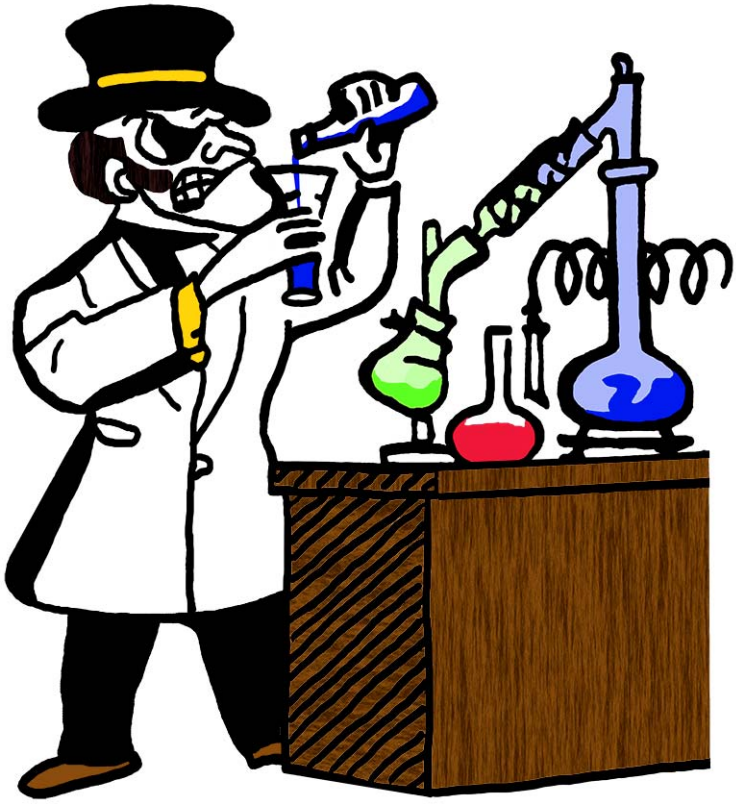

Handbook For Undergraduate

Chemistry Majors

2008-2009

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For more information email chemug@wfu.edu or see the Department of Chemistry web site at http://www.wfu.edu/academics/chemistry

Chemistry Majors at Wake Forest University

The Chemistry Department has a long tradition of strength in undergraduate instruction. The Department graduates an average of about 20 majors per year, with half of these going on to graduate or professional schools (20% in chemistry). Students taking the American Chemical Society standardized exam in various areas of chemistry have scored in the upper percentiles nationwide: analytical chemistry, 60th percentile; organic chemistry, 75th percentile; inorganic chemistry 79th percentile. Over 220 undergraduate students have conducted summer research in chemistry at Wake Forest over the last fifteen years. During the last 7 years over 42 undergraduates have been co-authors on research publications and 41 on presentations at professional meetings.

Awards and scholarships won by Wake Forest University undergraduate chemistry majors include:

- Two recipients of **The Barry M. Goldwater Scholarship** – awarded to undergraduates showing promise for a research career in physical sciences.
- Five **NSF Pre-doctoral Fellowships** - financial support for students pursuing doctoral degrees in chemistry.
- A **Rhodes Scholarship** - financial support for students studying at Oxford University
- **ACS Organic Division Fellowships** – prestigious awards to support graduate pre-doctoral study for two years.
- Three **ACS travel awards** – provide funds for travel to present research results at professional meetings.
- Seven awards for presentations at the N.C. Academy of Science
- Three **Glaxo-Wellcome Undergraduate Fellowships** – financial support for students conducting summer research in organic or analytical chemistry
- A **National Research Award of Iota Sigma Pi** – a cash prize to acknowledge outstanding research by undergraduate women
- Two **Eastern Analytical Symposium Student Awards** – a travel award based on student research accomplishments
- A **Sigma Xi Student Poster Award** - for an outstanding poster presentation of research

Statistics.

- Total number of students graduating in chemistry, (1986-2005): 391
- Male/female ratio (1986-2005): 223/168
- Minority (1991-2006, only records available): 24
- Students entering medical school, (1986-2004): 124, 67% success rate
- Students entering graduate school in health related sciences, Ph.D. (1986-2005): 26
- Students entering graduate school in chemistry, Ph.D. (1986-2005): 67

Department Web Page: http://www.wfu.edu/academics/chemistry

Department Chair: Dr. Christa Colyer, Salem 207C, 336-758-4936, colyercl@wfu.edu

The Chemistry Program at Wake Forest University

The department offers BA and BS degrees in chemistry. Students seeking further specialization can elect to take the BS degree with a concentration in either Biochemistry or Materials Chemistry, or the BA with a concentration in Biochemistry and Biophysics. A chemistry minor is available also. The BS degree is certified by the American Chemical Society. All chemistry courses and required physics/math courses are open to chemistry majors on a letter-grade basis only. A minimum GPA of 2.0 in the first two years of chemistry is required to declare a chemistry major. Admission to any class is contingent upon satisfactory grades in prerequisite courses, and registration for advanced courses must be approved by the department. Candidates for either degree with a major in chemistry must have a minimum GPA of 2.0 in their chemistry courses numbered 200 or above.

Note: It is recommended that chemistry majors and pre-med students take more than one lab class each semester. Changes to the chemistry curriculum have made it easy for B.A. majors to study abroad in either semester of their junior year without taking more than the normal load of chemistry courses!

Chemistry Courses for Science Majors/Pre-Health Professions

***111. College Chemistry I.** (3h) Fundamental chemical principles. C—CHM 111L. (D, QR)
***111L. College Chemistry I Lab.** (1h) Laboratory covers experimental aspects of basic concepts. Lab—three hours. C—CHM 111.
120. Physics and Chemistry of the Environment. (4h) Covers the basic physical and chemical processes in the earth's atmosphere, biosphere and the oceans. It consists of two parts: 1) chemical processes in the environment such as element cycles and the chemistry of the pollutants in air and water and, 2) physical aspects of the environment such as solar energy and the atmosphere, and the physics of weather and climate. Lab—three hours. Also listed as PHY 120. (D, QR)
***122. Organic Chemistry I.** (3h) Principles and reactions of organic chemistry. Students may not receive credit for both CHM 122 and CHM 123. P—CHM 111. C—CHM 122L. (D)
***122L. Organic Chemistry I Lab.** (1h) Lab—four hours. P—CHM 111. C—CHM 122.
***123. Organic Chemistry I Honors.** (3h) Principles and reactions of organic chemistry. Freshmen only, by invitation. P—CHM 111. C—CHM 123L. (D)
***123L. Organic Chemistry I Honors Lab.** (1h) Lab—four hours. P—CHM 111. C—CHM 123.
***223. Organic Chemistry II.** (3h) Principles and reactions of organic chemistry and introductory biochemistry. P—CHM 122. C—CHM 223L.
***223L. Organic Chemistry II Lab.** (1h) Lab—four hours. P—CHM 122. C—CHM 223.
280. College Chemistry II. (3h) Advanced study of fundamental chemical principles. P—CHM 111.
280L. Theory and Methods of Quantitative Analysis Lab. (1h) Laboratory emphasizes technique development for accuracy and precision. Lab—four hours. C or P—CHM 280.
301, 302. Elective Research. (0h, 0h) P—POI.
334. Chemical Analysis. (4h) Theoretical and practical applications of modern methods of chemical analysis. Lab—four hours (CHM 334L). P—CHM 341, 341L, or POI.
***341. Physical Chemistry I.** (3h) Fundamentals of thermodynamics and phenomenological kinetics, and introductory computational methods. Also listed as PHY 341. P—CHM 260, PHY 111 or 113, and 114. P or C —MTH 112. C—CHM 341L (PHY 113, with POI).
***341L. Physical Chemistry I Lab.** (1h) Lab—four hours. P—CHM 260, MTH 111, PHY 113-114. C—CHM 341, MTH 112.
***342. Physical Chemistry IIA.** (3h) Fundamentals of quantum mechanics, statistical thermodynamics, and introductory computational methods. P—CHM 341, MTH 111-112, PHY 113-114. C—CHM 342L, (PHY 114, with POI).
***342L. Physical Chemistry IIA Lab.** (1h) Lab—four hours. P—CHM 341, MTH 111-112, PHY 113-114. C—CHM 342 or 344.

***344. Physical Chemistry IIB.** (3h) Fundamentals of quantum mechanics, statistical thermodynamics, and introductory computational methods. Lab—four hours. P—CHM 341, MTH 111-112 and 205; and PHY 113-114. C—CHM 342L, (PHY 114, MTH 205 with POI).
356, 357. Chemical Spectroscopy. (1.5h, 1.5h) Fundamental aspects of the theory and application of chemical spectroscopy, as found in the areas of analytical, inorganic, organic, physical, and biological chemistry. Emphasis varies. Seven-week courses. May be repeated for credit. P—CHM 342 or 344, or POI.
***361. Inorganic Chemistry.** (3h) Principles and reactions of inorganic chemistry. P—CHM 341. C—CHM 361L or POI.
***361L. Inorganic Chemistry Lab.** (1h) Lab—four hours. P—CHM 341. C—CHM 361.
364. Materials Chemistry. (3h) A survey of inorganic-, organic-, bio-, and nano-materials, including hybrid materials and applications. P—CHM 341 or POI.
364L. Materials Chemistry Lab. (1h) Synthesis of inorganic and organic based materials and their characterization. Lab—four hours. P or C—CHM 364.
370. Biochemistry: Macromolecules and Metabolism. (3h) Lecture course introducing the principles of biochemistry including structure, function, and biosynthesis of biological molecules, analysis of enzyme function and activity, bioenergetics, and regulation of metabolic pathways. Also listed as BIO 370. P—two of CHM 223, CHM 280, and BIO 214; or POI.
370L. Biochemistry: Macromolecules and Metabolism Lab. (1h) Laboratory emphasizes approaches for isolation and analysis of proteins and enzymes. Also listed as BIO 370L. P—two of CHM 223, CHM 280, and BIO 214; or POI. C or P—CHM 370.
372. Biochemistry: Protein and Nucleic Acid Structure and Function. (3h) 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 223 and 370 (or BIO 370).
381, 382. Chemistry Seminar and Literature. (.5h, .5h) Discussions of contemporary research and introduction to the chemical literature and acquisition of chemical information. P—CHM 122 or 123.
391, 392. Undergraduate Research. (1.5h, 1.5h) Undergraduate research. Lab—eight hours. May be repeated for credit.

* The lecture and corresponding lab are strict corequisites of each other. A student must register for both during the same semester. (However, either can be repeated independently if the student wishes.)

The department will accept transfer courses taken at four year colleges and universities that offer a major in chemistry. These courses must be equivalent in content and level to courses offered at WFU (as judged by a departmental curriculum committee). Courses taken in summer school elsewhere, or in WFU study abroad programs, must meet these same criteria and receive pre-approval. Advanced courses are typically not transferable.

Degree Requirements: The core and basic requirements (including divisionals) that are stated in the Bulletin of Wake Forest University corresponding to your year of entry are in effect for your graduation. However, the requirements for the major are those specified in the Bulletin corresponding to the year in which you declare your major (the 2008/2009 Bulletin for those students who declare their major during the Spring 2009 declaration period).

Typical schedules for Chemistry Majors

The Bachelor of Science Degree requires 40.5 hours in chemistry and includes at least 1.5 hours of undergraduate research, an 8 hr/wk lab commitment for one semester:

First Year:	CHM 111, 111L, 122, 122L (or 123, 123L); MTH 111, 112
Sophomore:	CHM 223, 223L, 280, 280L; MTH 205; PHY 111 or 113, 114
Junior:	CHM 341, 341L, 344, 342L, 381, 382, 391 (or 392)
Senior:	CHM 334, 334L, 361, 361L, 370, 300-level elective

The Bachelor of Science Degree with concentration in Biochemistry requires 37.5 hours in chemistry and includes 1.5 hours of undergraduate research, an 8 hr/wk lab commitment for one semester:

First Year:	BIO 112; CHM 111, 111L, 122, 122L (or 123, 123L); MTH 111, 112
Sophomore:	BIO 213, 214; CHM 223, 223L, 280, 280L; PHY 111 or 113, 114
Junior:	CHM 341, 341L, 370, 370L, 381, 382, 391 (or 392)
Senior:	CHM 334, 334L, 361, 361L, 372, 300-level elective in biology or chemistry

The Bachelor of Science Degree with concentration in Materials Chemistry requires 41.5 hours in chemistry and includes at least 1.5 hours of undergraduate research, an 8 hr/wk lab commitment for one semester:

First Year:	CHM 111, 111L, 122, 122L (or 123, 123L); MTH 111, 112
Sophomore:	CHM 223, 223L, 280, 280L; MTH 205; PHY 111 or 113, 114
Junior:	CHM 341, 341L, 342, 342L, 364, 364L, 381, 382, 391 (or 392)
Senior:	CHM 334, 334L, 361, 361L, 370, 300-level elective in physics or chemistry

The Bachelor of Arts Degree requires at least 28.5 hours in Chemistry. B.A. majors are encouraged to participate in undergraduate research.

First Year:	CHM 111, 111L, 122, 122L (or 123, 123L); MTH 111, 112
Sophomore:	CHM 280, 280L; one upper-level CHM elective with lab; PHY 111 or 113, 114
Junior:	CHM 341, 341L, and one upper-level CHM elective with lab
Senior:	Either CHM 381, 382, 391, or 392 and one upper-level CHM elective with lab

The Bachelor of Arts Degree with concentration in Biochemistry and Biophysics requires 32.5-33.5 hours in chemistry, 15 hours in physics, and 1.5 hours of undergraduate research, an 8 hr/wk lab commitment for one semester. Total hours including all required courses: 57.5-60.5.

First Year:	CHM 111, 111L, 122, 122L (or 123, 123L); MTH 111, 112
Sophomore:	One BIO elective; CHM 223, 223L, 280, 280L; PHY 111 or 113, 114
Junior:	One BIO elective; CHM 341, 341L, 370, 370L, 391 or 392 (or substitute); PHY 215
Senior:	Two upper-level CHM electives and one PHY elective

Variations in the above schedules are possible to accommodate study abroad and other special circumstances, in which case the student should consult the advisor and the **Center for International Studies** at **http://www.wfu.edu/cis/**

Minor. A minor in chemistry requires nineteen hours in chemistry and must include at least one of the following courses: 334/334L, 341/341L, 356/357, 361/361L, 364, or 370. The department will not accept courses taken pass/fail to count toward the minor.

The Health Professions Program at Wake Forest recommends that students take the following chemistry courses and their corequisite labs before the end of the third year: 111, 122 or 123, 223, and 280. Students interested in this track should see the Health Professions Program advisor for more information.

Honors in Chemistry

Qualified majors are considered for honors in chemistry. To be graduated with the designation "Honors in Chemistry," a student must have a minimum grade point average in chemistry courses of 3.3 and a minimum overall grade point average of 3.0. In addition, the honors candidate must satisfactorily complete an approved research project, prepare a paper describing the project, and present results at a seminar for departmental approval. For additional information, members of the departmental faculty should be consulted.

Departmental Requirements for Honors in Chemistry

- Students must have a 3.30 GPA in chemistry and a 3.00 GPA overall.
- A written thesis must be submitted.
- The thesis will be read by the advisor and two other faculty members. This group will constitute the student's committee and will be appointed as early as possible but no later than the beginning of the student's final semester.
- The thesis must be presented to the department and defended. After a successful defense, the committee will sign the thesis.
- The student will provide three copies of the thesis for binding- one for the department, one for the advisor, and one for her/himself.
- Students may carry out their honors work outside the department only if a departmental faculty member is intimately involved and serves as the student's advisor. The committee may include the outside advisor, but must include another faculty member in the Department of Chemistry.

Timetable

- Students should indicate their intention to carry out honors work with their current or potential research advisors as early as possible. They should then inform the Honors Coordinator of the tentative title of the research project, the names of committee members, and the name of the advisor. The Honors Coordinator will keep records of Honors Students and will schedule their defense times. Honors work can be started as late as two semesters before graduation but cannot be started in the last semester before graduation.
- The defense will be scheduled for the annual Honors Symposium held in the Spring. The date will be announced early each spring semester.
- The thesis must be submitted to the advisor one week before it can be presented to the full committee. The committee must then have an additional week to read the thesis before the defense.

Undergraduate students completing chemistry lab coursework.

Undergraduate Research in Chemistry

Students are encouraged to participate in the Department of Chemistry's highly productive research programs. Many of our students publish scientific papers in professional journals, give presentations at national meetings, obtain summer research internships, and win national awards based on their research.

One of the most important experiences for undergraduate science majors is the ability to participate in original research programs. Over 200 undergraduate students have conducted summer research in chemistry at Wake Forest since 1985, funded through research grants, Wake Forest Research Fellowships and an NSF-Research Experience for Undergraduates program. Over the last 15 years, 75 undergraduates co-authored research publications originating from the chemistry department. The success of WFU undergraduate researchers is reflected in the careers paths of chemistry majors:

- Since 1986, Wake Forest chemistry majors have had a 67% success rate applying to medical schools and have gone to schools such as Penn, Georgetown, UVa, Johns Hopkins, Emory, Rutgers, Duke, UNC-Chapel Hill, Northwestern, and Wake Forest University.
- Chemistry majors entering industry have gained employment at companies such as GSK, Pfizer, Boston Scientific Corp., Union Carbide, RTI, and the National Cancer Institute.
- Students entering graduate programs have gone to schools such as Penn, MIT, Harvard, Vanderbilt, UC-Berkeley, Oxford, Yale, UNC-Chapel Hill, UCLA, Duke, Cornell, Wisconsin, Scripps Research Institute, U. of Texas, U of Maryland, Virginia Commonwealth, and Emory to study the core disciplines in chemistry as well as disciplines as diverse as Environmental Chemistry, Pharmacology, Chemical Engineering, Environmental Engineering, Biology, and Toxicology.

Students may receive academic credit (CHM 391 or CHM 392) or scholarships and financial incentives for research projects. Research may be conducted during the summer or the academic year. If you are interested in beginning a research project in chemistry, consult the list of chemistry faculty below. Read their research descriptions and look for areas that match your interests. Individually contact those professors whose work you find intriguing and ask for more information on available research projects.

Note that many national scholarships and awards, for both undergraduate and graduate students, are given based on past research accomplishments. The earlier in your college career you begin participating in research, the more you will learn and the stronger your application for such awards will be.

Examples of research labs where undergraduate students conduct independent research.

Chemistry Faculty Members and Their Research Interests

Rebecca Alexander Our research interests are centered on understanding protein-nucleic acid interactions, using protein engineering, spectroscopy, binding analyses, and kinetic studies. We are particularly interested in how macromolecules change structure when they form biologically relevant complexes, and how conformational change can contribute to catalysis and other cellular functions.

Ulrich Bierbach Research in this lab explores the mechanism of action of DNA-targeted small-molecule drugs. Transition metal compounds are developed for therapeutic applications (anticancer, antimetastatic agents). The interaction of these structurally novel drugs with potential biomolecular targets (DNA, DNA-processing enzymes) in cell-free media is studied using LC/MS, optical and magnetic resonance spectroscopies, molecular modeling, and molecular biology methods. Biological activity studies are carried out *in vitro* and *in vivo* by collaborators at the Comprehensive Cancer Center of Wake Forest University.

Christa L. Colyer The Colyer lab is interested in bioanalytical chemistry, with a specific focus on the development of protein separation methods using capillary electrophoresis with laser-induced fluorescence detection. Understanding the role of organic dyes as protein probes for trace-level detection is another important aspect of our work. Applications of our work are found in areas as varied as oceanographic science, homeland security, and clinical chemistry.

Lindsay Comstock Research in our laboratory lies at the chemistry-biology interface and seeks to gain a deeper understanding of the role of post-translational modifications in the dynamic regulation of cellular function and how alterations in these modification states correlate to disease. The combination of organic chemistry, biochemistry, and molecular biology is utilized in developing small-molecule tools to not only identify where substrates are modified, but to investigate the physiological effect of such modifications in vivo.

Patricia Dos Santos Our lab is interested in an essential biochemical pathway in which metals play an essential role. The project aims to understand the mechanisms of Fe-S cluster formation in Gram-positive bacteria, through molecular biology, biochemical, and genetic approaches. The work in this lab involves various aspects of biochemistry including recombinant DNA techniques, protein expression and purification, enzymology, and development of strategies for gene knockout in *Bacillus subtilis*.

Willie L. Hinze Analytical Chemistry. Exploitation of organized media (surfactant micelles, cyclodextrins & related materials) to enhance analytical methodology including their utilization in spectroscopic measurements (ultraviolet-visible absorption, fluorescence, and chemiluminescence methods) and chemical separations (extractions and chromatography) for analytes of clinical, environmental, and biological concern.

Bradley T. Jones Analytical Chemistry-Determination of toxic heavy metals in environmental and clinical samples. Development of novel atomic spectrometers particularly for portable applications. Sample introduction techniques for Inductively Coupled Plasma spectrometry including electrothermal vaporization and liquid chromatography interfaces.

Paul B. Jones Photochemistry and bio-organic chemistry. The Jones group is interested in how photochemistry can be used to control or activate molecules with either synthetic or biological utility. This involves the development of new photolabile protecting groups and the subsequent investigation of the PPG's photochemical behavior and, finally, use of the PPG in the synthetic or biochemical process it was designed for. The group also studies naturally occurring photoactive molecules and photochemistry in unconventional media.

Angela G. King Efforts are directed towards increasing the retention of under-represented groups in science and improving the conceptual understanding and performance in general and organic chemistry with technological avenues, peer-instruction and use of case studies. Science outreach efforts are focused on providing middle and high school teachers with updated content knowledge and hands-on activity procedures as well as science enrichment programs both after school and in the summer.

S. Bruce King Dr. King's research group uses synthetic organic chemistry and biochemistry to prepare and evaluate new molecules capable of releasing the biologically important molecule nitric oxide (NO). Such compounds may ultimately be useful for the treatment of heart attack, stroke and various vascular diseases such as sickle cell disease.

Dilip K. Kondepudi Fundamental study of spontaneous generation and propagation of chiral asymmetry from molecules to the macromolecular structures and crystals. Experimental studies in crystallization and other processes are supported through computer modeling. Thermodynamics and kinetics of inter-metallic compounds in high temperature nano-systems.

Abdessadek Lachgar Rational design and self-assembly of cluster-based hybrid inorganic/organic materials. Solvothermal synthesis of porous and low dimensional metal phosphates/oxalates.

Ronald E. Noftle Synthesis and properties of novel materials containing thiophenes and pyrroles and their complexes with biologically important metals. Coupling of thiophene-containing substances with nanoparticles to produce new nanomaterials. These materials have applications in color displays, drug-delivery systems, sensors, biochemically active membranes, charge-storage devices, light-emitting diodes, and artificial muscle. Research may involve synthesis, spectroscopy (NMR, IR, MS) and electrochemistry.

Al Rives I am involved in the development of instructional methods, demonstrations, and laboratory experiments that can enhance student understanding in General, Analytical, Inorganic, and Physical Chemistry courses. I have recently been examining the correlation between learning styles and the effectiveness of different orders of presentation of topics in General chemistry.

Akbar Salam Theoretical Chemistry: Quantum mechanical theories of electronic structure are being developed and applied to study the properties of molecules, their interaction with each other, and their interaction with light. Techniques employed include formal analytical methods and state of the art quantum chemical software packages. Current and future research areas of interest include long-range intermolecular forces, single- and multi-photon absorption and emission processes, molecular handedness, tautomerism in cyclic conjugated ketones, and molecular clusters.

Robert L. Swofford Tunable lasers are used to study the visible spectra of vibrational overtones (Δv=5,6,7,etc.) in molecules with X-H bonds (X=C,N,O,S, etc.). The high overtones absorb only weakly, and the powerful light of the laser is needed for these studies. The overtone energies are sensitive to the local environment, and electronic interactions cause measurable shifts in the absorption energies. This sensitivity to the local environment allows overtone spectroscopy to probe directly the bond strength, thus providing a link between molecular structure and chemical reactivity. We also use computational quantum mechanics as an aid in understanding the measurements.

Mark E. Welker We make new molecules containing carbon, hydrogen, oxygen, sulfur, and nitrogen. We make some new molecules that also contain metal-carbon bonds. If you like to cook you might like to work in our lab. What kinds of new molecules do we make or new reactions do we develop? The National Cancer Institute of NIH supports one project where we make new molecules that induce the production of enzymes which humans use to detoxify carcinogens. The National Science Foundation supports a second project where we develop new ways for making molecules which possess a fundamental property known as chirality. Things which are chiral have nonsuperimposable mirror images (i.e. your hands, your feet, your ears, etc.).

Some molecules also have this property, and we develop reactions which can be used to selectively make one of the two possible mirror images. While the bulk of the new chemistry proposed above centers on new diastereo- and enantioselective reaction development, this methodology can access biologically significant core structures in the *cis* clerodane terpenes. These compounds have biological activities ranging from insect antifeedants to biomedical science applications.

Research Facilities

The Department of Chemistry is fully equipped with the instrumentation and equipment required for cutting edge research. This translates into less time waiting for instrumentation and more time carrying out research. Standard instrumentation for research is available and includes a staffed high field NMR facility (Bruker Avance 300 MHz and 500 MHz NMR instruments), electron paramagnetic resonance spectrometer, GC/mass spectrometer, LC/mass spectrometer, FT-Infrared, Raman, UV-visible, Circular Dichroism, and Fluorescence spectrometers, a staffed single crystal X-ray and structure determination facility, powder X-ray diffractometer, gas and high performance liquid chromatographic systems, atomic absorption and ICP spectrometers, gel and capillary electrophoretic systems, double manifold vacuum lines, inert atmosphere glove-boxes, and electrochemical and polarographic systems. Additional instrumentation is available at the School of Medicine. Computational facilities include a 128 node Linux Beowulf cluster comprising dual processor Intel Xeon x335 CPU's. Software includes Gaussian 03 and GAMESS electronic structure packages, extensive mathematical libraries and Fortran, C/C++ compilers.

The library contains over 225 current journal subscriptions in chemistry and physics and holds complete runs in most chemistry titles. The chemistry collection is housed mainly in Salem Hall and is available to students. On-line computer searching of over 200 databases is available.

Undergraduate teaching laboratories in Salem Hall used for chemistry lab classes.

American Chemical Society Student Affiliates

The American Chemical Society is a self-governed individual membership organization consisting of 163,000 members at all degree levels and in all fields of chemistry. The organization provides a broad range of opportunities for peer interaction and career development, regardless of professional or scientific interests. The programs and activities conducted by ACS today are the products of a tradition of excellence that dates from the Society's founding in 1876.

The Student Affiliates program gives undergraduate students studying the chemical sciences the opportunity to participate in the ACS. In addition to fostering social interactions among students, the Student Affiliates program gives you the professional edge, lets you network with top professionals, and provides you with scientific meetings and direct access to research. Joining ACS entitles student affiliates to substantial discounts on ACS journals, 17 issues of Chemical & Engineering News, four issues of the undergraduate career magazine *in Chemistry*, career and employment services, and the Directory of Experience Opportunities listing co-ops, internships, and summer jobs for undergraduate chemical science students. There are ACS Student Affiliates chapters at over 900 colleges and universities in the United States.

The Wake Forest University American Chemical Society Student Affiliates (WFU ACS SA) is a group of enthusiastic and motivated students who organize a wide variety of activities during the year. The chapter was awarded an Honorable Mention by the National ACS for their efforts. Students meet regularly to coordinate projects, socialize, and participate in discussions with faculty and graduate students. Because of their participation in this organization, the students are able to develop closer relationships with the chemistry faculty and with each other.

Annual activities of the WFU ACS SA include:

- Community outreach during National Chemistry Week –Events are held to provide hands-on activities for children using the theme provided by the ACS to introduce students in grades K – 5 to chemistry. In 2001, the chapter was awarded a grant by the ACS to support this project.
- Participation in Project Pumpkin – Underprivileged children are brought to the Wake Forest campus prior to Halloween for a day of fun, including a Mad Scientist Show co-sponsored by the ACS SA and the Physics Department.
- Community outreach through education – The WFU ACS SA is actively involved in outreach activities for elementary school-age children, both on our campus and in the community. Family science nights, science shows and demonstrations, and judging science fairs are some examples of these activities.
- Meeting in Miniature or Research Mixer – The WFU ACS SA hosts an annual research meeting for undergraduates and graduates.

For more information, please see the WFU ACS SA web site
http://www.wfu.edu/academics/chemistry/acs/index.html
or contact the faculty advisor Dr. Paul Jones (jonespb@wfu.edu)

Scholarships and Awards Available to Wake Forest University Chemistry Majors

Wake Forest Research Fellowship Program The Wake Forest Research Fellowship Program is designed to encourage individual undergraduate students to collaborate with professors on scholarly research projects. Summer awards include a $4,000 taxable stipend and free campus housing. Applicants must have a cumulative 3.0 GPA at the time of application and sophomore standing (23/25 or more hours passed) before undertaking research in this program. More information is available at http://www.wfu.edu/undergraduate_college/research-fellowship/

The Barry M. Goldwater Scholarship and Excellence in Education Program The purpose is to provide a continuing source of highly qualified individuals in the sciences or mathematics and provides funds for academic study and research. Students who plan to study medicine are eligible for a Goldwater Scholarship only if they plan a research career rather than a career as a medical doctor in a private practice. For more information see http://www.act.org/goldwater/

Blackbyrd Scholarship (in Chemistry) Award Presented annually to an outstanding rising junior BS chemistry major.

Churchill Scholarships Awarded to graduating seniors in engineering, mathematics, physical and natural sciences. The scholarships enable Americans to pursue graduate studies and research at Churchill College, a constituent college of Cambridge University. Wake Forest University may nominate two students per year for these highly competitive scholarships.

Environmental Studies Grants Grants of up to $3000 from the Wake Forest Environmental Studies Program are available to support undergraduate students of ALL majors in environmental activities, including:

- Environmental work with non-profit, governmental, and industrial organizations,
- Environmental research of your own design,
- Environmental research with Wake Forest faculty or faculty at other institutions,
- Participation in programs with a significant environmental component.

American Institute of Chemists Foundation Outstanding Senior Award This award is given to a senior Wake Forest chemistry major each year, in recognition of a demonstrated record of ability, leadership and professional promise.

American Chemical Society Undergraduate Award in Analytical Chemistry Presented to a rising senior to recognize students who display an aptitude for a career in the field.

CRC Press Freshman Chemistry Achievement Award Presented to first year students based on outstanding academic achievement in chemistry classes.

National Science Foundation Research Experiences for Undergraduates (REU) Programs Programs consist of approximately 10 undergraduates from across the country, who work in research programs of the host institution. Each student is assigned a specific research project and works closely with the faculty advisor, and perhaps post-docs and graduate students. Students receive stipends and possibly assistance with housing and travel. For more information see listings on the bulletin board across from the stock room in Salem Hall.

Research Opportunities at the Wake Forest University School of Medicine The WFU School of Medicine offers a summer research experience where students learn basic research lab skills, techniques and technology used in biomedical research through an independent research project led by medical school faculty. Participants receive a stipend and free housing.

Chemistry Majors and the Health Professions

Prepared by Hugo C. Lane D.Sc., Health Professions Advisor (lane@wfu.edu)
http://www.wfu.edu/~lane/hpp/orientation.html

Below are grids representing possible scheduling of the courses needed to satisfy MCAT and medical school admissions. Please note that they are suggestions that seem to work well. No one should feel shackled to a given plan. However, two main comments must be made:

1: Whether you take one or two mathematics courses is based upon two facts: Some medical schools (about 40 of them) require some math (one or two semesters of calculus usually, although not exclusively), and others have no math requirement,

2: Increasing numbers of medical schools require or recommend, to varying degrees, a biochemistry course as a prerequisite to entering their program. At Wake Forest, biochemistry can be taken in the Biology Department (Bio 370. Biochemistry) or the Chemistry Department (CHM 370 Biochemistry). BIO and CHM 370 have a prerequisite of two of CHM 223, CHM 280 and BIO 214 .

Prospective Pre-med Chemistry majors (BA) schedule

	FALL		SPRING	
Freshman	Math 111	Other	Math 112	Other
	Chem 111	Other	Chem 122	Other
Sophomore	Chem 223	Other	Chem 280	Other
	Phy 113	Other	Phy 114	Other
Junior	Bio 111 or 112	Other	Bio 112 or 111	Other
	Chem 341/341L	Other	Chem Elect	Other/ **MCAT**
Senior	Bio 214	Other	Other	Other
	Chem Elect	Other	Other	Other

I offer the following comments about workload:

1. It may appear that taking two laboratory science/math courses a semester is too hard. However, please bear in mind that this pressure can be alleviated somewhat by matching these two with non-science courses with moderate homework. Most health professions students are capable of this effort. I feel that the work load of two laboratory courses is no more strenuous than taking two literature and history courses with their inherent demands for extra reading and writing assignments. Some students may be able to take only one science course the first semester of the freshman year and still remain on track. However, please note that although the basic Biology courses are offered each semester, the Chemistry courses are in a sequence and not taking the first course in the fall semester may mean waiting for the following fall to take the sequence. The same applies to the two Physics courses.

2. Medical schools are interested in students who excel in things academic under normal work loads. I think, as do other faculty in the sciences, that a normal work load would have two science courses. See Dr. Lane or Dr. Gary Miller if you need help in planning your schedule.

3. A student who does not, or is not able to, take two science courses may fall behind and will then have to take summer work in order to get back on schedule.