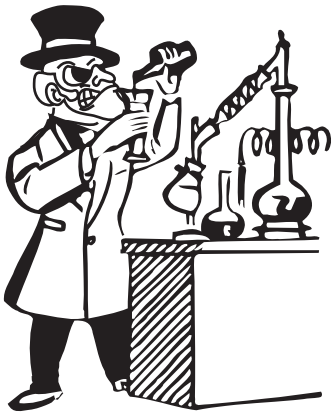

Handbook For Undergraduate

Chemistry Majors

2006-2007

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For more information email chemug@wfu.edu or see the Department of Chemistry web page 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 22 majors per year and about half go 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
- The **Eastern Analytical Symposium Student Award** – 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. Brad Jones (jonesbt@wfu.edu)

The Chemistry Program at Wake Forest University

The department offers BA and BS degrees in chemistry. Students can elect to take the BS degree with a concentration in Biochemistry or the BA with 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 either semester of their junior year without taking more than the normal load of chemistry courses!

Descriptions of Chemistry Courses for Science Majors/Pre-Health Professions

- *111/*111L. College Chemistry and Lab. Fundamental chemical principles and experimental aspects of basic concepts.
- 120. Physics and Chemistry of the Environment. The course covers the basic physical and chemical processes in the earth's atmosphere, biosphere and the oceans.
- *122/*122L. Introduction to Organic Chemistry. Principles and reactions of organic chemistry.
- *223/*223L. Organic Chemistry II. Principles and reactions of organic chemistry and introductory biochemistry.
- 230. Analytical Biochemistry. Survey of laboratory methods used to determine the composition of biological samples. 7 weeks.
- 260. Introduction to Inorganic Chemistry. Introductory thermodynamics; descriptive inorganic and bio-inorganic chemistry. 7 weeks.
- 301, 302. Elective Research. Permission of instructor. Summers only.
- *334/*334L. Chemical Analysis. Theoretical and practical applications of modern methods of chemical analysis. Seven weeks each.
- *341/*341L. Physical Chemistry I. Fundamentals of equilibrium thermodynamics and electrochemistry, phenomenological kinetics, and introductory computational methods.
- *342/*342L. Physical Chemistry IIA. Fundamentals of quantum mechanics, statistical thermodynamics, and introductory computational methods.
- *344. Physical Chemistry IIB. Fundamentals of quantum mechanics, statistical thermodynamics, and introductory computational methods. 342L is a co-requisite.
- 356, 357. Chemical Spectroscopy. Fundamental aspects of the theory and application of chemical spectroscopy, as found in the areas of analytical, inorganic, organic, and physical chemistry. Emphasis will vary. Seven-week courses.
- *361/*361L. Inorganic Chemistry. Principles and reactions of inorganic chemistry.
- 370. Biochemistry. Macromolecules and Metabolism. Introduction to the principles of biochemistry. Structure, function, and biosynthesis of biological molecules, analysis of enzyme function and activity, bioenergetics, and regulation of metabolic pathways. P-BIO 214 and either CHM 223 or 230, or POI. (Also listed as Biology 370).
- *371 Biochemistry. Macromolecules and Metabolism. Principles of biochemistry, emphasis on structure, function, and biosynthesis of biological molecules, analysis of enzyme function and activity, bioenergetics, and regulation of metabolic pathways; includes laboratory with emphasis on approaches for isolation and analysis of proteins and enzymes
- 372. Biochemistry. Protein and Nucleic Acid Structure and Function. Continuation of 370/371 with emphasis on how chemical properties dictate structure and function of proteins and nucleic acids.

- 381, 382. Chemistry Seminar. Discussions of contemporary research. Attendance required of BS chemistry majors in the junior and senior years.
- 383. Chemical Literature. Introduction to the chemical literature and searching techniques for the acquisition of chemical information.
- 391, 392. Undergraduate Research.

*The lecture and corresponding lab are strict co-requisites of each other.
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.

Recommended schedule for a *Bachelor of Science Degree*: Requires 37.5 (or 38) hours (out of 120 required for graduation). B.S. majors must engage in at least 1.5 hours of undergraduate research, an 8 hr/wk lab commitment for one semester.

First Year:	CHM 111, 111L, 122, 122L, MTH 111, 112
Sophomore:	CHM 223, 223L, 230, 260, PHY 113, 114, MTH 113 (or 301)
Junior:	CHM 341, 341L, 344, 342L, 381, 382, 383, 391 (or 392), MTH 113 (or 301)
Senior:	CHM 334, 361, 361L, 381, 382, 300-level elective

Recommended schedule for a *Bachelor of Arts Degree*: Requires 28 (or 28.5) hours (out of 120 required for graduation). B.A. majors are encouraged to participate in undergraduate research. For the BA major, the following schedule of chemistry and related courses is typical:

First Year:	CHM 111 , 111L, 122, 122L, MTH 111, 112
Sophomore:	CHM 230, 260, PHY 113, 114 (note that CHM 223, 223L can count as an elective towards the degree)
Junior:	CHM 341, 341L, one upper level elective
Senior:	Two upper level electives and either 381, 382, 383, 391, or 392

Recommended schedule for a Bachelor of Science Degree with concentration in Biochemistry: Requires 37.5 hours in chemistry and 1.5 hours of undergraduate research as above.

First Year:	CHM 111, 111L, 122, 122L, BIO 112, MTH 111, 112
Sophomore:	CHM 223, 223L, 230, 260, PHY 113, 114, BIO 213, 214
Junior:	CHM 341, 341L, 371, 372, 391 (or 392)
Senior:	CHM 334, 361, 361L, 381, 382, 300-level elective in BIO or CHM.

Recommended schedule for a 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 as above. Total hours including all required courses: 57.5-60.5.

First Year:	CHM 111, 111L, 122, 122L, BIO 112 or 213, MTH 111, 112
Sophomore:	CHM 223, 223L, 230, 260, PHY 113, 114, BIO 213 or 214
Junior:	CHM 341, 341L, 371, 391 (or 392), PHY 141
Senior:	2 of the following courses (and corequisite labs, if applicable): CHM 334, 361, or 372; 1 of the following courses: PHY 307/325 or 320/323.

Minor. A minor in chemistry requires nineteen hours in chemistry and must include at least one of the following courses: 334, 341 and 341L, 356 and 357, 361 and 361L, or 371. The department will not accept courses taken pass/fail to count toward the minor.

Graduating with Honors. To graduate with "Honors in Chemistry", a qualified major must have a minimum GPA in chemistry courses of 3.3 and a minimum overall GPA of 3.0. 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.

Independent Research. 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.

Undergraduate students completing chemistry lab coursework.

Undergraduate Research in Chemistry at Wake Forest University

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, and the Scripps Research Institute 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 available on page 6. 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 in Salem Hall, 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.

Bernie Brown Our laboratory investigates the chemical, physical, and structural properties of proteins and nucleic acids using a variety of spectroscopic and biochemical techniques, in addition to x-ray crystallography. We are interested in exploring how the structure and specific intermolecular interactions of macromolecules affects their biochemical activities. These insights

may help us to develop pharmalogical compounds which may be used to modulate specific interactions or functions in an effort to combat a variety of health problems.

Karen Buchmueller My research program is focused on understanding and utilizing the chemistry of nucleic acids. DNA plays an integral role in basic bioprocesses and its chemical and physical properties can be exploited to develop selective therapeutics, biosensors and even robust catalysts. I am starting a new lab and am looking for energetic and hard working students who want to delve into the science of DNA.

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.

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 occuring photoactive molecules and photochemistry in nonconventional 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.

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.

Suzanne Tobey Our research pursuits encompass the fields of molecular recognition and synthetic organic chemistry. Broadly defined, we seek to use molecular recognition techniques to explore physical organic problems. As a complement to the physical organic studies, we seek to identify and develop new synthetic methodologies as tools for the assembly of amine containing natural products that demonstrate biological activity.

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) has shown increased vigor during the 2000-2004 school years. The group of enthusiastic and motivated students organized a wide variety of activities during the year. The chapter was awarded an Honorable Mention by the National ACS for their efforts. The continued increase in membership has allowed the students to become even more active. Students meet biweekly to coordinate projects, socialize, and participate in discussions with faculty. 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 – A one-day Saturday event is 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 interaction at a local elementary school – The WFU ACS SA is developing a mentoring relationship with a local elementary school. Each year, the students will select a topic to introduce to elementary students who are underrepresented in the sciences (specifically minorities). The student affiliates will travel to the school every few weeks to work on an on-going project that relates chemistry to everyday activities. In 2001, the chapter was awarded a grant by the ACS to begin this project.

- Meeting in Miniature – The WFU ACS SA hosts an annual research conference specifically for undergraduates. Students from colleges and universities in central and western North Carolina present their research orally or as posters.

For more information, please see the WFU ACS SA web site www.wfu.edu/Student-organizations/acs or contact 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 $3,000 taxable stipend and free campus housing. Applicants must have a cumulative 3.0 GPA at the time of application and 29 completed credits before undertaking research in this program.

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 http://www.nsf.gov/home/crssprgm/reu/reulist.htm

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.

Excerpts concerning a Pre-med Chemistry Major from the Freshman Orientation prepared by Hugo C. Lane D.Sc.

Health Professions Advisor (lane@wfu.edu)

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 (Chem 370 or 371. Biochemistry). Bio 370 has a prerequisite of Bio 214 (Cell and Molecular Biology).

Prospective Pre-med Chemistry majors (BA) schedule

	FALL		SPRING	
Freshman	Math 111	Other	Math 112	Other
	Chem 111	Other	Chem 122	Other
Sophomore	Chem Elect	Other	Chem 230/260	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 me 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.