

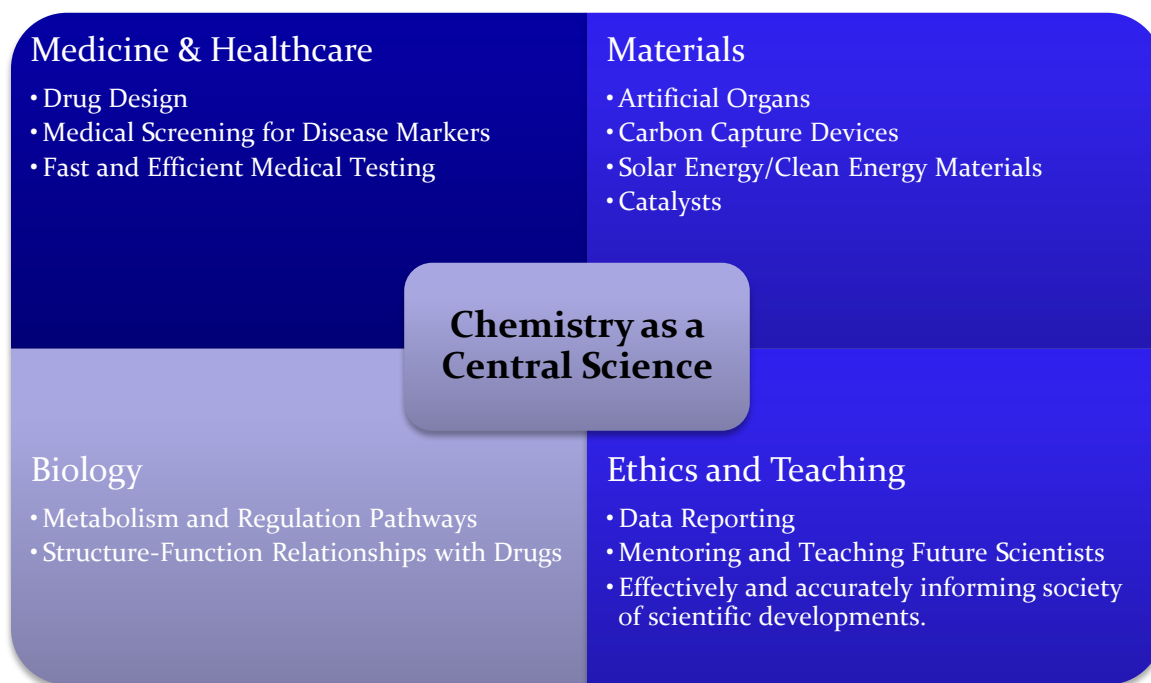
DUKE UNIVERSITY

DEPARTMENT OF CHEMISTRY – STUDENT HANDBOOK 2022-2023

INFORMATION FOR STUDENTS

We are excited to share information about our undergraduate program. The handbook is designed to provide an overview of the chemistry tracks and concentrations for prospective majors. We hope to provide key information to aid students in making an informed decision regarding whether to major in chemistry. For our current majors, the handbook provides checklists and key information regarding mapping out pathways toward graduation.

Chemistry is often referred to as the central science because many domains draw upon chemical concepts and related laboratory techniques. Chemists are addressing a multitude of issues ranging from energy, climate change, drug design, medical testing, synthesizing new materials, developing ethical standards, and teaching future doctors and leaders in STEM. The following chart illustrates the applications of chemistry across several domains. Note that many domains such as materials and medicine also connect.



Here are some statistics that paint a picture of our chemistry majors:

On average, about 40 majors have graduated each of the past five years with degrees in chemistry. Of these, 65% earned BS degrees, about 30% completed a biochemistry concentration, 25% completed a pharmacology concentration, and 9% received ACS certified degrees. In terms of academic achievements, almost 50% earned Graduation with Distinction honors, 10% were elected to Phi Beta Kappa, and 40% earned Latin Honors.

Regarding post-graduate plans, roughly 40% will enroll in medical school, 25% in graduate school in chemistry or a related area, and most of the rest are employed in a wide range of jobs or internships. A number of those with jobs will go on to graduate or professional training within 2 years of their graduation.

Students who have not declared a major and have questions about the chemistry major should feel free to contact the Director of Undergraduate Studies Group (Charlie Cox) at dus@chem.duke.edu. Students who have declared a chemistry major will be assigned a faculty adviser in the department who is available for consultation at any time during the academic year, or they may also contact the DUS group at the above e-mail address.

On behalf of our Chair, Professor Katherine Franz, and our faculty colleagues in the Department, we invite you to consider one of the degree programs described here.

Sincerely,
The DUS Group
Charlie Cox, French Family Science
Center 1222
Meg Avery, French Family Science Center
1216

CHEMISTRY FACULTY

Chair: Franz

Associate Chair: Hong

Director of Undergraduate Studies: Cox

Director of Graduate Studies: Fitzgerald

Diversity and Inclusion Committee Chair: Hargrove

Professors: Baldwin, Becker, Beratan, Craig, Fitzgerald, Franklin, Franz, Hong, Liu, McCafferty, Rubenstein, Therien, Warren, Widenhoefer, Vo-Dinh, Wiley, and Yang
Associate Professors: Charbonneau, Derbyshire, Hargrove, Malcolmson, Wang, and Welsher

Assistant Professors: Moreno-Hernandez

Associate Professors of the Practice: Canelas, Cox, Haas, and Parise

Research Professor of Chemistry: Fischer

Associate Research Professor of Chemistry: Zhang

Instructors: Kersey and Shorb

Secondary Appointments in Chemistry: Brown, Chilkoti, Donald, Lefkowitz, Modrich, Oas, Payne, and West

Emeritus Faculty: Chestnut, Crumbliss, MacPhail, McPhail, Palmer, Quin, Shaw and Toone

CHEMISTRY MINOR

Requirements. CHEM 101DL or CHEM 110DL or CHEM 021; plus four additional courses selected from the following: CHEM 180, 201DL, 202D, 210D, or 020; Chemistry courses numbered above 210; BIOCHEM 301, 302; BIOLOGY 372A; ENVIRON 540, 542; PHARM 350, 360, 533. Substitutions may be made in certain cases with the permission of the Director of Undergraduate Studies.

MAJORS & CONCENTRATIONS

1. AB Chemistry (no concentration)

The A.B. degree program allows greater flexibility than the B.S. program in scheduling and course selection, while still maintaining the integrity of the chemistry major. Students with interests in a second major or in advanced work in a professional school (e.g. medical, dental, veterinary, business, or law) following graduation should consider the A.B. program. Students with an interest in employment in the chemical or a related industry, or in advanced study in chemistry or a related science (e.g. biochemistry or pharmacology) may also consider this program, although they are encouraged to augment their program with additional upper-level chemistry courses. An A.B. degree would also enable a student to delve more deeply into a specific area of chemistry (for example organic synthesis or theoretical chemistry), but students considering such plans should meet with Dr. Cox to develop a coherent set of courses appropriate for their post-Duke plans.

2. BS Chemistry (no concentration)

The B.S. degree program is recommended for students planning to pursue graduate study in Chemistry or a related science (e.g. Biochemistry or Pharmacology) or for those contemplating employment in the chemical industry following graduation.

3. AB or BS Chemistry with a concentration in one of the following:

- a. Biochemistry
- b. Pharmacology
- c. Chemical Biology
- d. Environmental Science

The Concentration in Biochemistry

In cooperation with the Department of Biochemistry, in the School of Medicine, the Chemistry Department offers both an A.B. and a B.S. degree in chemistry with concentration in biochemistry. Certification of this concentration is designated on the

official transcript.

The Concentration in Pharmacology

In conjunction with the Department of Pharmacology in the Duke Medical Center, the Chemistry Department offers both an A.B. and a B.S. degree in chemistry with a Concentration in Pharmacology. Certification of the concentration is designated on the official transcript.

Pharmacology is more than the study of the mode of action of drugs. It is a science which uses the basic concepts of biology and chemistry to determine how drugs affect the organism; it gives a unique perspective in understanding how cells, organ systems, and organisms' function. Unlike other basic science fields, pharmacology combines many disciplines so that one can investigate systematically the mechanisms underlying a biological event—from the molecular level to the whole animal. Pharmacology also allows us to study how biological systems fail, providing information on the etiology of disease and on the mechanisms underlying toxic reactions. Pharmacologic research is essential for the development, testing and use of drugs and other bioactive molecules such as pesticides or industrial chemicals.

The objective of pharmacology concentration for chemistry majors is to provide students with knowledge of the basic principles underlying the design and actions of drugs and toxic substances. In addition, it provides the opportunity to apply these principles in a research setting. Ultimately, an introduction of pharmacology to undergraduates will encourage interested students to consider graduate study in the fields of pharmacology and/or medicinal chemistry, leading to a career in academic research, in governmental regulatory agencies, or in industry.

The Concentration in Chemical Biology

The Department of Chemistry is pleased to offer both A.B. and B.S. degrees in chemistry with a Concentration in Chemical Biology. Certification of the concentration is designated on the official transcript.

Chemical Biology is a relatively new scientific area that explores the chemical nature of life. For decades the traditional disciplines of chemistry - synthetic, physical and theoretical chemistry - have been mapped onto the task of understanding discrete biological entities, from proteins to nucleic acids to lipids. In contrast, Chemical Biology focuses on studying biological *processes* on the molecular level with a chemical approach and on developing molecular tools to both explore and manipulate biological processes. Chemical Biology is highly interdisciplinary, and overlaps with many other areas, including molecular biology, structural biology, bioinformatics, proteomics, organic chemistry, pharmacology, and medicinal chemistry. The field is primarily concerned with research at the chemistry-biology interface but is in practice largely focused on small molecules as research tools and potential therapeutics. Because chemical biology uses small molecules to probe and manipulate biology, the pharmacological treatment of human disease is a natural outgrowth of the discipline.

The Concentration in Environmental Chemistry

In conjunction with the Nicholas School of the Environment, the Chemistry Department is pleased to offer both an A.B. and a B.S. degree in Chemistry with Concentration in Environmental Chemistry. Official recognition of the completion of the requirements given below will appear on the permanent transcript of a major.

American Chemical Society (ACS) certification is available with any of the BS programs in chemistry. Additional coursework is required to achieve ACS certification.

UNDERGRADUATE AND GRADUATE COURSE OFFERINGS (2022-2023)

CHEM 020 - General Chemistry Credit. Pre-matriculation credit awarded for a score of 4 on the College Board AP chemistry examination (or the equivalent). Recommended placement is CHEM 110DL, but a student may choose to take CHEM 101DL without loss of credit. One course.

CHEM 021 - General Chemistry Credit. Pre-matriculation credit awarded for a score of 5 on the College Board AP chemistry examination (or the equivalent). Recommended placement is CHEM 201DL, but a student may choose to take CHEM 110DL without loss of credit. One course.

CHEM 091 - Chemistry, Technology, and Society. NS, STS Science, the scientific method, and background topics from chemistry, biochemistry, and environmental chemistry that enable citizens to utilize the inductive-deductive methodology of science to better evaluate the potential benefits and risks associated with selected existing and proposed technologies. Intended primarily for nonmajors. One course. C-L: Energy and the Environment. Offered: Fall Semester

CHEM 099D - Introduction to Chemistry and Chemical Problem Solving. NS Introductory course for students with limited background in chemistry emphasizing chemical problem solving. Topics include atoms, molecules, ions, compounds, and the periodic table, stoichiometry and chemical reactions, reactions in solution, and an introduction to chemical bonding, thermochemistry, and gas laws. To be followed by CHEM 101DL. Not open to students who have credit for CHEM 020, 021 or 101DL. One course. Offered Fall Semester

CHEM 101DL - Core Concepts in Chemistry. NS Emphasizes core concepts required for organic chemistry, including atomic and molecular structure, chemical equilibrium with applications to acids and bases, thermodynamics, chemical kinetics, and reaction mechanisms. Relevance and integrated nature of these

concepts illustrated through applications to a modern theme in chemistry, e.g. in biological, materials, or environmental chemistry. Laboratory illustrates experimental applications of these core concepts. One course. Offered: Fall and Spring Semester.

CHEM 110DL - Honors Chemistry: Core Concepts in Context. NS Emphasizes core concepts required for organic chemistry, including atomic and molecular structure, chemical equilibrium with applications to acids and bases, thermodynamics, chemical kinetics, and reaction mechanisms. Strong emphasis on applications of these concepts in context of large, interdisciplinary scientific challenge, e.g. in cancer biology or nanoscience. Laboratory illustrates experimental applications of these core concepts. Students may not receive credit for both CHEM 101DL and CHEM 110DL. One course. Offered: Fall Semester.

CHEM 201DL - Organic Chemistry I. NS, STS The structures and reactions of the compounds of carbon and the impact of selected organic compounds on society. Laboratory: techniques of separation, organic reactions and preparations, and systematic identification of compounds by their spectral and chemical properties. Prerequisite: CHEM 101DL, or CHEM 110DL, or CHEM 021. One course. Offered: Fall and Spring Semester

CHEM 202D - Organic Chemistry II. NS, STS Continuation of CHEM 201DL. Prerequisite: CHEM 201DL. One course. Offered: Fall and Spring Semester

CHEM 202L - Organic Chemistry II. Laboratory accompanying Chem 202 lecture. Prerequisite: CHEM 201DL. One-quarter course. Offered: Fall and Spring Semester.

CHEM 210D - Modern Applications of Chemical Principles. NS Modern applications of chemistry in context of larger scientific theme, e.g. in biology, materials science, or environmental chemistry. Revisits core concepts from CHEM 101DL or CHEM 110DL, incorporating additional topics including intermolecular interactions, phases of matter, solutions, quantitative treatment of aqueous equilibria, electron transfer reactions, and inorganic and coordination chemistry. Prerequisite: CHEM 101DL or CHEM 110DL. One course. Offered: Fall and Spring Semester

CHEM 210L - Modern Applications Laboratory Laboratory accompanying Chem 210 lecture. Laboratory illustrates experimental approaches to modern problems in biological, materials, and environmental chemistry, as well as analytical and synthetic techniques. Prerequisite: 101DL or 110DL. One-quarter course. Offered: Fall and Spring Semester

CHEM 295 - Introduction to Research Independent Study. NS, W Includes

research methodology, retrieval techniques for, and use of, the chemical literature, safety in the research laboratory, and the ethical conduct of research, and writing a research proposal. Registration recommended concurrently with first course in research independent study in chemistry (CHEM 393) or a related area. Lecture/discussion. Half course. Offered: Fall and Spring Semester

CHEM 301 - Elements of Physical Chemistry. NS Survey of physical chemistry including quantum chemistry, molecular structure, molecular spectroscopy, thermodynamics, and kinetics. Prerequisites: CHEM 210DL; or CHEM 020 plus CHEM 101DL; or CHEM 020 plus CHEM 110DL; or CHEM 021; MATH 112L, and PHYSICS 142L or PHYSICS 152L or PHYSICS 162L or consent of instructor. One course. Offered: Fall Semester

CHEM 301L - Physical Chemistry Laboratory. NS, W Laboratory experiments designed to accompany CHEM 301. Includes instruction and practice in writing the laboratory notebook and formal laboratory reports. Prerequisite: (or corequisite) CHEM 301. Half course. Offered: Spring Semester

CHEM 302 - Biophysical Chemistry. NS An introduction to biophysical chemistry and molecular biophysics. Explores principles that underpin biological structure and function through such topics as: how the structure and function of biomolecules can be studied at the level of single molecules; how biomolecular machines capture energy and do work; how biomolecules function within networks to convey signals, act cooperatively, and form patterns. Pre-requisite: CHEM 301 or CHEM 311 or consent of instructor. One course. Offered: Spring Semester

CHEM 310 - Physical Chemistry I. NS Fundamentals of physical chemistry. Emphasizes quantum chemistry, molecular structure, and molecular spectroscopy. CHEM 310L should be taken concurrently with CHEM 310. Prerequisites: CHEM 210DL; or CHEM 020 plus CHEM 101DL; or CHEM 020 plus CHEM 110DL; or CHEM 021; PHYSICS 142L or PHYSICS 152L or PHYSICS 162L; MATH 212 or consent of the instructor. One course. Offered: Fall Semester

CHEM 310L - Physical Chemistry I Laboratory. NS, W Laboratory experiments designed to accompany CHEM 310. Includes instruction and practice in writing the laboratory notebook and formal laboratory reports. Prerequisite: (or corequisite) CHEM 310. Half course. Offered: Fall Semester

CHEM 311 - Physical Chemistry II. NS Continuation of CHEM 310. Fundamentals of physical chemistry. Emphasizes thermodynamics and kinetics. CHEM 311L should be taken concurrently with CHEM 311. Prerequisite: CHEM 310 or consent of instructor. One course. Offered: Spring Semester

CHEM 311L - Physical Chemistry II Laboratory. NS, W Laboratory experiments designed to accompany CHEM 311. Prerequisite: (or corequisite). CHEM 311 or consent of instructor. Half course. Offered: Spring Semester

CHEM 393 - Research Independent Study. R Individual research in a field of special interest under the supervision of a faculty member, the central goal of which is a substantive paper or written report containing significant analysis and interpretation of a previously approved topic. Consent of instructor and director of undergraduate studies required. One course.

CHEM 394 - Research Independent Study. R Second semester of independent study. See CHEM 393. Consent of instructor and director of undergraduate studies required. One course.

CHEM 401 - Analytical Chemistry. NS Fundamentals of qualitative and quantitative measurement with emphasis on chemometrics, quantitative spectrometry, electrochemical methods, and common separation techniques. This course corresponds with the lab CHEM 401L. Prerequisite: CHEM 301L or CHEM 310L. One course. Offered: Fall Semester

CHEM 401L - Analytical Chemistry Laboratory. NS Laboratory experiments designed to accompany CHEM 401. Corequisite: CHEM 401. Half course. Offered: Fall and Spring Semester

CHEM 410 - Inorganic Chemistry. NS Bonding, structures, and reactions of inorganic compounds studied through physical chemical concepts. Prerequisite: CHEM 301 or CHEM 311. One course. Offered: Spring Semester

CHEM 420L - Advanced Laboratory Techniques. NS Techniques for synthesis include the use of high or low pressure, microwave synthesis, and/or inert atmospheres. Techniques for characterization of synthetic products include electrical conductance, optical rotation, NMR, UV-VIS, IR, and/or mass spectra. Prerequisite: (or corequisite) CHEM 410. Half course. Offered: Spring Semester

CHEM 493 - Research Independent Study. R Third semester of independent study. See CHEM 393. Consent of instructor and director of undergraduate studies required. One course.

CHEM 494 - Research Independent Study. R Fourth semester of independent study. See CHEM 393. Consent of instructor and director of undergraduate studies required. One course.

CHEM 496 - Graduation with Distinction in Chemistry. Course for majors who are candidates for graduation with distinction in chemistry. Includes preparation of the research thesis, preparation and presentation of a poster describing student's research, and oral defense of the research thesis. Pre- or co-requisite: two semesters of research independent study. Lecture/ discussion. Satisfactory/Unsatisfactory grading only. Half course. Offered: Spring Semester

CHEM 506 - Biomolecular Mass Spectrometry. Advanced topics in the mass spectral characterization of biopolymers with an emphasis on protein and DNA analysis. Fundamental and practical aspects of the ionization processes and the instrumentation associated with MALDI- and ESI-mass spectrometry will be discussed along with applications of these techniques to structural problems in chemistry and biochemistry. Prerequisite: CHEM 501 or permission of instructor. Half course.

CHEM 511 - Chemistry of Biomolecular Interactions. Chemistry of the noncovalent interactions governing biological systems. Topics include: review of biomacromolecules; chemical principles of non-covalent interactions and the use of model systems; experimental methods to determine binding interactions; interactions responsible for molecular recognition in biological systems; and applications in signal regulation. Recommended precursor to Chemistry 518. One course.

CHEM 517 - Molecules in Life and Disease. **NS** Molecules are an essential component of life as they dictate our development, enable adaptation to our environment, and carry our thoughts. This course explores the roles of molecules in normal physiological functions and disease states ranging from genetic disorders to those caused by deadly toxins, such as anthraxin toxin. Case studies on bacterial pathogenesis, drug resistance and modern drug development are among the topics that will be discussed. Prerequisites: Organic Chemistry and introductory Biology or consent of instructor. One course.

CHEM 518 - Chemical Biology. The application of chemical concepts and methods to solving problems in molecular and cell biology, with emphasis on the use of small molecules to elucidate and control information transfer in biological systems. Provides relevant background on both useful chemical tools and new biological targets. One course.

CHEM 521 - Inorganic Chemistry. Bonding and spectroscopy, reactions, transition metal chemistry, main group chemistry, organometallics/catalysis, and solid state. One course.

CHEM 531 - Organic Chemistry. Bonding and structure, stereochemistry, conformational analysis, substitution, addition, and elimination reactions, carbon reactive intermediates, concerted reactions, photochemistry, carbon alkylation, carbonyl addition, nucleophilic substitution, electrophilic additions, reduction, cycloadditions, rearrangements, main group organometallics, oxidation. One course.

CHEM 532 - Organic Reactions. Highlights strategic operations that enable selective synthesis of small molecules, including organic ligands, natural products, and molecular probes. Topics include chemical synthesis and retrosynthetic analysis; arrow-pushing mechanisms of polar, radical, transition metal-mediated and pericyclic reactions; protecting groups, oxidation, reduction, enolate reactivity; stereoselective reactions and conformational analysis; cross-coupling transformations. One course.

CHEM 533 - Nuclear Magnetic Resonance. Structural elucidation of organic and inorganic compounds by NMR. Fundamentals of data acquisition (pulse sequences, detection), multidimensional techniques, study of dynamic processes and their application to the determination of structure. Variable credit.

CHEM 535 - Organic Synthesis. NS Application of organic reactions to the synthesis of structurally and biologically interesting compounds. Topics include synthetic design, retrosynthetic analysis, synthetic methods, and total syntheses of natural products. Prerequisite: Chemistry 532 or consent of instructor. One course.

CHEM 538 - Organometallic Chemistry and Catalysis. Introduction to the structure and bonding of organometallic and coordination complexes, stressing the origin of metal-ligand interactions from a molecular orbital theory perspective. Elementary reactions of transition metal complexes and their application to organic synthesis, with special emphasis on catalytic reactions. General concepts of catalysis and the advantages and benefits of catalytic systems. One course.

CHEM 542 - Quantum Mechanics. Special emphasis on chemical applications. Topics include: linear algebra, the uncertainty relations, angular momentum, perturbation theory, time-dependent phenomena, molecules in electromagnetic fields, group theory, and electron correlation. Prerequisite: Chemistry 541 or consent of instructor. One course.

CHEM 543 - Statistical Thermodynamics. Introduction to statistical thermodynamics, with an emphasis on ideal systems and selected model approaches to more complex systems, e.g. lattice models. Half course.

CHEM 544 - Statistical Mechanics. Fundamentals of quantum and classical statistical mechanics using the ensemble approach. Introduction of modern

techniques and applications including the renormalization group treatment of phase transitions and linear response theory of time-dependent statistical mechanics. Prerequisite: CHEM 543 or consent of instructor. One course.

CHEM 548 – Solid-State and Materials Chemistry. Introduction to the structure, physical, and electronic properties of solid-state materials. One course.

CHEM 590 – Special Topics in Chemistry. Special topics in chemistry and chemistry-related areas. Content varies by instructor. One course.

CHEM 601 - Biosensors. Theory and applications of biosensors. Basic principles of interactions between analytes and bioreceptors and various transduction techniques: optical, electrochemical, ion-selective electrode-based, voltametric, conductometric, and mass-sensitive techniques as well as novel nanotechnology-based biosensing systems including nanosensors, plasmonic nanoprobe, quantum dots, carbon nanotubes, molecular beacons, and molecular sentinel systems. Applications in chemical, environmental, biological and medical sensing. Paired with Biomedical Engineering 567. One course.

CHEM 611 – Foundations of Nanoscale Science and Technology. One course. C-L: see NANOSCI/ECE 511.

CHEM 630 – Advances in Photonics. One course. C-L: see Biomedical Engineering 555

REQUIRED COURSES FOR AB/BS PROGRAMS

For all chemistry majors, the following courses are required for all majors and concentrations. Except for Chem 401 (Analytical Chemistry), all other courses below are offered in both fall & spring. All courses for the major must be taken for a letter grade.

Math 111L¹ – Laboratory Calculus I

Math 112L – Laboratory Calculus II

Physics 141L^{2,3} – Physics I

Physics 142L – Physics II

Chem 21/101DL/110DL – Core Concepts in Chemistry

Chem 201DL – Organic Chemistry I

Chem 202D – Organic Chemistry II

Chem 202L – Organic Chemistry Laboratory

Chem 20/21/210D – Modern Applications of Chemistry

Chem 20/21/210L – Modern Applications Laboratory

Chem 401 – Analytical Chemistry

Chem 401L – Analytical Chemistry Laboratory

¹ Math 105L/106L are equivalent to Math 111L. Students who take 105L and 106L will also need to take 112L to satisfy the graduation requirements.

²Students can complete the physics requirements using 141L/142L, 151L/152L, and 161L/162L. Students are encouraged to identify one sequence (141/142, etc.) and remain with that sequence to satisfy the graduation requirements.

³PHYSICS 100 may be substituted for required physics courses: PHYSICS 141L-142L, PHYSICS 151L-152L; or 161L-162L, in either the A.B. or B.S. chemistry major, provided the physics course(s) are (1) calculus-based, (2) taken at an institution that is accredited by the American Chemical Society, and (3) are the courses that are required for an ACS-certified degree at that institution.

PHYSICAL CHEMISTRY SEQUENCE

There are two physical chemistry sequences. The sequences should be completed during students' junior year. Either sequence serves as prerequisites for the upper division (400-level) chemistry courses, which are taken during students' senior year.

CHEM 301-302-301L

CHEM 310-310L-311 and 311L for ACS Accreditation

The 301-302-301L sequence will cover the frameworks of physical chemistry using a less rigorous mathematical approach. Math 112L and physics 142L (or equivalent) should be completed prior to enrolling in Chem 301.

The 310-310L-311 sequence will cover the frameworks of physical chemistry using a more rigorous mathematical approach. Students must complete Math 212 and physics 142L (or equivalent) before enrolling in Chem 310. The second physical chemistry laboratory is not required unless students are seeking ACS accreditation.

Students who are interested in going to graduate school for chemistry are encouraged to take the Chem 310-310L-311 sequence.

INDEPENDENT STUDY

Two semesters of independent study are required for all majors and concentrations except for the AB major with no concentration. Two semesters of independent study are also required for Graduation with Distinction.

Time Commitment

CHEM 393, 394, 493, and 494 are graded courses and that will require 10 to 15 scheduled hours per week in the laboratory at times mutually agreed upon by the supervising faculty PI.

The faculty mentor may also be referred to as: Research Director, Supervising Faculty, PI (Principle Investigator), Research Supervisor, Research Advisor and Research Mentor.

ENROLLING IN FIRST SEMESTER OF INDEPENDENT STUDY

When you have found a research director, view the independent study form linked below:

https://chem.duke.edu/sites/chem.duke.edu/files/documents/ISForm_2022.pdf

To request enrollment, contact the Director of Undergraduate Studies at dus@chem.duke.edu providing your name, email address and your PI's name and email address. The form linked above will be sent to both you and your PI via AdobeSign. Once the AdobeSign document is completed and signed by both you and your PI, it is routed to the Director of Undergraduate Studies. After review and approval, a permission number will be issued. This is required for all students who are enrolling in independent study for the first time. PLEASE BEGIN PROCESS AT LEAST TWO WEEKS PRIOR TO WHEN DROP|ADD ENDS. All permission numbers for 393 must be provided by the DUS. For subsequent semesters of independent study, the form linked above is not required unless the project and/or PI changes. For 394, 493, and 494, permission numbers can be assigned by your PI or the DUS.

Chemistry Independent Study is based on the Trinity Requirement for Independent Study with some deviation specific to our department:

<https://trinity.duke.edu/undergraduate/academic-policies/independent-study>

CHEM 295 is a co-requisite taken concurrently with CHEM 393 or prior to starting independent study.

If your independent study is outside the chemistry department, the DUS will review your form to determine if the project is sufficiently chemical/molecular oriented to count toward chemistry major requirements and requirements for Graduation with Distinction in Chemistry. When the project has been approved, you need to obtain a permission number in order to register. Students doing research with faculty members outside of chemistry will sign up for independent study with the Chemistry DUS and not the home department of the PI.

FINDING A RESEARCH GROUP

Participation in independent study requires identifying a faculty member who agrees to mentor you. Students are permitted to work broadly in the molecular sciences, and the mentor need not be a Chemistry faculty member. The Chemistry DUS office must approve the planned research. Majors who would like assistance in finding a research mentor may see the DUS in 1222 French Family Science Center (Suite 1219) or information found here: <https://chem.duke.edu/undergraduate/independent-study/find-director>

In addition, Duke now has a web site called [MUSER](#) to advertise undergraduate research positions. MUSER provides a central web-based location for Duke faculty, postdoctoral researchers, lab managers, and graduate students to advertise undergraduate research positions.

FIRST SEMESTER OF INDEPENDENT STUDY

General Safety Training Required by the University

Prior to beginning laboratory work in the first semester of Independent Study, all majors participating in Independent Study must complete the university's general on-line safety training. Later the major is expected to receive specific safety instruction from the department in which the major is carrying out his/her research project. The following link takes you to the general on-line training area of the [OESO website](#).

1. From there, select the tab: "Training and Reports"
2. On the next page, select "Online Training"
3. Once logged in, you need to read and complete the brief quiz at the end of the following three selections: "General Chemical Safety Orientation", "Fire/Life Safety Orientation", "Laboratory Safety Orientation"
4. If you will be working with or around lasers, then you should also complete the selection on "Laser Safety (non-clinical)".

5. If you are doing only computational work rather than work in a lab with chemicals, you can omit the "General Chemical Safety Orientation" unless the computer is located in or adjacent to a working chemical lab.
6. A permanent record is created when you pass the quizzes and are complete.

CHEM 295, Introduction to Independent Study, 0.5 cc, is open to all Chemistry majors, but is recommended for Chemistry majors who are enrolling in their first semester of independent study in chemistry; CHEM 393 or in a related area, and who intend to pursue graduation with distinction in chemistry, or who intend to pursue a BS degree that is certified by ACS. Majors may take CHEM 295 for Satisfactory/Unsatisfactory or regular letter grades depending on their needs. Those taking it for letter grades will also earn 0.5 cc toward the writing requirement (W). The writing component (see information that follows) will focus on writing a research proposal and on writing progress reports for the major's project. The course is recommended for all majors.

INDEPENDENT STUDY EVALUATION

When considering a research group, students and supervising faculty should communicate about the requirements to receive course credit for independent study. Factors that may contribute to the final grade include: ability of the student to maintain the work schedule to which s/he committed, maintaining a research notebook in the style requested by the research director, ability to function as a productive member of a research group, ability of student to carry out research safely and ethically, progress toward becoming an independent researcher as demonstrated by ability to apply some variation of the scientific method to solve research problems systematically, and being able to locate, retrieve, evaluate, and apply information from the literature of the field that is relevant to the research problem, and overall progress toward resolving the assigned research problem.

WRITING CURRICULUM CODE FOR INDEPENDENT STUDY

Students who are completing Chem 496 and independent study concurrently are encouraged to request a writing credit for independent study. Students who have completed one semester of independent study, and are not currently completing Chem 496, may also request a writing credit upon consultation with the DUS. A writing credit can be requested for only one independent study. The procedure for W-credit for Independent Study is as follows. Prior to the end of Drop/Add of your final semester of participation in independent study, review the information and complete the required form at:

<https://trinity.duke.edu/undergraduate/academic-policies/research-independent-study-w-code>

The form needs to be signed by the PI and DUS.

COMPLETING INDEPENDENT STUDY RESEARCH

Requirements for Completing Independent Study Requirements for the final semester of independent study include a poster session and a scholarly research report. The easiest way to meet these requirements is to take CHEM 496, Graduation with Distinction in Chemistry. Whether a major takes CHEM 496 or not, s/he must fulfill the following two requirements in order for independent study to count toward fulfilling requirements for a degree in chemistry:

Research Report (senior thesis). A final research report will be required of all students, with copies to be given to the Coordinator of Independent Study (Instructor of CHEM 496) and to the student's research director. The rough draft of the paper, in the style of a technical paper in the scientific literature, will be due to the research director at a predesignated time prior to the Poster Session. The final copy, which must be approved well in advance of submission by the faculty mentor, will be due at a predesignated time following the Poster Session. *Note: this report is both a department and university requirement and cannot be waived by the research director.*

ACS CERTIFICATION COURSEWORK

To earn a B.S. degree in Chemistry that is certified by the American Chemical Society requires:

Math 212 (Fall and Spring)
CHEM 295 (Fall and Spring)
CHEM 310 (Fall)
CHEM 310L (Fall)
CHEM 311 (Spring)
CHEM 311L (Spring)
CHEM 410 (Spring)
CHEM 420L (Spring)

AB DEGREE (NO CONCENTRATION)

Prerequisites: [CHEM 101DL or CHEM 110DL, or CHEM 021]; [MATH 111L & MATH 112L, or MATH 122L]; [PHYSICS 141L & PHYSICS 142L or PHYSICS 151L & PHYSICS 152L or PHYSICS 161L & PHYSICS 162L].

Major Requirements: CHEM 201DL, CHEM 202D & CHEM 202L, [CHEM 210D & CHEM 210L or CHEM 020 or CHEM 021], [CHEM 301 & CHEM 301L or CHEM 310 & CHEM 310L & CHEM 311]; CHEM 401 & CHEM 401L; plus one of the following three options:

Option 1. Three of the following: CHEM 302, CHEM 410; BIOCHEM 301, BIOCHEM 302; any CHEM courses at or above the 500 level.

Option 2. One of the following: CHEM 302, CHEM 410, BIOCHEM 301, any CHEM course at or above the 500 level; plus CHEM 393 & CHEM 394 or the equivalent in an approved chemistry-related discipline.

Option 3. One of the following emphases:

Physics Emphasis: [CHEM 302 or CHEM 311] plus any 2 of the following:

PHYSICS 264L Optics and Modern Physics

PHYSICS 361 Intermediate Mechanics

PHYSICS 362 Electricity and Magnetism

Mathematics Emphasis: [CHEM 302 or CHEM 311] plus either of the following pairs of courses:

[MATH 221 and MATH 356] or [MATH 216 and MATH 353]. Course titles:

MATH 221 Linear Algebra and Application

MATH 356 Elementary Differential Equations

MATH 216 Linear Algebra and Differential Equations

MATH 353 Ordinary and Partial Differential Equations

Biology Emphasis BIOCHEM 301 plus any 2 of the following:

BIOLOGY 201L Gateway to Biology or BIOLOGY 203L

BIOLOGY 220 Cellular and Developmental Biology

BIOLOGY 223 Cellular and Molecular Neurobiology

BIOLOGY 329D or 329L Principles of Animal Physiology

BIOLOGY 515 Principles of Immunology

BIOLOGY 520S Biopolymers to Disease

Substitution may be made in certain cases with the permission of the Director of Undergraduate Studies.

SEQUENCE OF CORE COURSES FOR THE A.B. DEGREE IN CHEMISTRY

The following is a typical schedule for the core and prerequisite courses for students who are seeking an A.B. degree and do not have CHEM or MATH advanced placement credits. The additional advanced course requirements to satisfy the specific options (1 – 3 noted above) are generally taken in the junior or senior year. These courses are not listed in the planner below, but careful planning is suggested, because these courses may only be offered once a year and/or have specific prerequisites that should be completed during the freshman or sophomore year. Courses listed in brackets [] can be scheduled in other semesters or have equivalent courses that can be scheduled in other semesters.

	<u>Fall</u>	<u>Spring</u>
Fr	CHEM 101DL [MATH 111L]	CHEM 201DL [MATH 112L]
So	CHEM 202D CHEM 202L [PHYSICS 141L]*	CHEM 210D CHEM 210L [PHYSICS 142L]*
Jr	CHEM 301	CHEM 301L
Sr	CHEM 401 [CHEM 401L]	[CHEM 401L]

Note: CHEM 301/301L is a prerequisite for most upper level chemistry courses and usually taken in the fall semester of junior year. Since PHYSICS 142L (or 152L or 162L) is a prerequisite for CHEM 301, physics courses are normally taken in the sophomore year. Likewise, MATH 111L and 112L are taken freshman year to satisfy the prerequisites for introductory Physics courses.

AB Degree (2021 Revision)

Check all course completed using AP credit, transfer credit, or completed at Duke.

MATH 111L <input type="checkbox"/>	OR	MATH 122L <input type="checkbox"/>	OR	MATH 21 <input type="checkbox"/>		
MATH 112L <input type="checkbox"/>				MATH 22 <input type="checkbox"/>		
PHYS 141L <input type="checkbox"/>	OR	PHYS 151L <input type="checkbox"/>	OR	PHYS 161L <input type="checkbox"/>	OR	PHYS 25 <input type="checkbox"/>
PHYS 142L <input type="checkbox"/>		PHYS 152L <input type="checkbox"/>		PHYS 162L <input type="checkbox"/>		PHYS 26 <input type="checkbox"/>
CHEM 101DL <input type="checkbox"/>	OR	CHEM 110DL <input type="checkbox"/>	OR	CHEM 21 <input type="checkbox"/>		
Advanced Courses						
CHEM 201DL <input type="checkbox"/>						
CHEM 202D <input type="checkbox"/>						
CHEM 202L <input type="checkbox"/>						
CHEM 210D <input type="checkbox"/>	OR	CHEM 20 <input type="checkbox"/>	OR	CHEM 21 <input type="checkbox"/>		
CHEM 210L <input type="checkbox"/>						
CHEM 301 <input type="checkbox"/>	OR	CHEM 310 ¹ <input type="checkbox"/>				
CHEM 301L <input type="checkbox"/>		CHEM 310L <input type="checkbox"/>				
		CHEM 311 <input type="checkbox"/>				
CHEM 401 <input type="checkbox"/>						
CHEM 401L <input type="checkbox"/>						
Options (the option being pursued is circled)						
Option 1 <i>Any 3:</i> CHEM 302 <input type="checkbox"/> CHEM 410 <input type="checkbox"/> BIOCHEM 301 <input type="checkbox"/> BIOCHEM 302 <input type="checkbox"/> CHEM 500+ <input type="checkbox"/> CHEM 393 <input type="checkbox"/> CHEM 394 <input type="checkbox"/>	OR	Option 2 is to add an "Emphasis" in PHYS, MATH, or BIO. See below for course sets that constitute an "Emphasis". The choice of "Emphasis" is not listed on the transcript.				
Option 2.1: PHYS CHEM 302 <input type="checkbox"/> OR CHEM 311 <input type="checkbox"/> AND ANY TWO: PHYSICS 264L <input type="checkbox"/> PHYSICS 361 <input type="checkbox"/> PHYSICS 362 <input type="checkbox"/>		Option 2.2: MATH CHEM 302 <input type="checkbox"/> OR CHEM 311 <input type="checkbox"/> AND either pair: MATH 221/356 <input type="checkbox"/> MATH 216/353 <input type="checkbox"/>		Option 2.3 BIO BIOCHEM 301 <input type="checkbox"/> AND ANY TWO: BIOL 201 or 203 <input type="checkbox"/> BIOL 220 <input type="checkbox"/> BIOL 223 <input type="checkbox"/> BIOL 329D or L <input type="checkbox"/> BIOL 515 <input type="checkbox"/> BIOL 520S <input type="checkbox"/>		

1. CHEM 310 has a MATH 212 prerequisite: MATH 212
2. Research courses taken outside the chemistry department require approval in order to count toward chemistry major requirements and requirements for Graduation with Distinction in Chemistry.

BS DEGREE (NO CONCENTRATION)

The B.S. degree program is recommended for students planning to pursue graduate study in Chemistry or a related science (e.g. Biochemistry or Pharmacology) or for those contemplating employment in the chemical industry following graduation.

For the B.S. Degree

Prerequisites. [CHEM 101DL or CHEM 110DL or CHEM 021]; [MATH 111L & MATH 112L, or MATH 122L]; [PHYSICS 141L & PHYSICS 142L or PHYSICS 151L & PHYSICS 152L or PHYSICS 161L & PHYSICS 162L].

Major Requirements. CHEM 201DL, CHEM 202D & CHEM 202L, [CHEM 210D & CHEM 210L or CHEM 020 or CHEM 021], CHEM 310, CHEM 310L, CHEM 311, CHEM 311L, CHEM 393 (or its equivalent in a chemistry-related area), CHEM 401, CHEM 401L, CHEM 410, CHEM 420L, plus two additional courses selected from the following: BIOCHEM 301*, CHEM 302, CHEM 394 (or its equivalent in a chemistry-related discipline)

Certification of the BS degree by the American Chemical Society requires selection of BIOCHEM 301 and CHEM 394 (or its equivalent in a chemistry related discipline) plus CHEM 295.

SEQUENCE OF CORE COURSES FOR THE B.S. DEGREE IN CHEMISTRY

The following is a typical schedule for the core and prerequisite courses for students who are seeking an B.S. degree and do not have CHEM or MATH advanced placement credits. Courses listed in brackets [] can be scheduled in other semesters or have equivalent courses that can be scheduled in other semesters.

	<u>Fall</u>	<u>Spring</u>
Fr	CHEM 101DL [MATH 111L]	CHEM 201DL [MATH 112L]
So	CHEM 202D CHEM 202L [PHY 141L]* [MATH 212]	CHEM 210D CHEM 210L [PHY 142L]*
Jr	CHEM 310/310L	CHEM 311/311L
Sr	CHEM 401/401L	CHEM 410 CHEM 420L

* PHYSICS 141L (Fall) – PHYSICS 142L (Spring) may be replaced by PHYSICS 161L (Fall) – PHYSICS 162L (spring) or PHYSICS 151L (Spring) – PHYSICS 152L (Fall).

Note: CHEM 310/310L is a prerequisite for most upper level chemistry courses and is usually taken in the fall semester of junior year. Since PHYSICS 142L (or 152L or 162L) is a prerequisite for CHEM 310, physics courses are normally taken in the sophomore year. Likewise, MATH 111L and 112L are taken freshman year to satisfy the prerequisites for introductory Physics courses. Additionally, MATH 212 is a prerequisite for CHEM 310, it needs to be taken in sophomore year. Physics and Math courses may be taken in other semesters, but only with considerable loss of flexibility in scheduling

BS Degree (2021 Revision)

Check all course completed using AP credit, transfer credit, or completed at Duke.

Prerequisite Courses						
MATH 111L <input type="checkbox"/>	OR	MATH 122L <input type="checkbox"/>	OR	MATH 21 <input type="checkbox"/>		
MATH 112L <input type="checkbox"/>				MATH 22 <input type="checkbox"/>		
MATH 212 <input type="checkbox"/>	OR		OR			
PHYS 141L <input type="checkbox"/>	OR	PHYS 151L <input type="checkbox"/>	OR	PHYS 161D/164L <input type="checkbox"/>	OR	PHYS 25 <input type="checkbox"/>
PHYS 142L <input type="checkbox"/>		PHYS 152L <input type="checkbox"/>		PHYS 162D/165L <input type="checkbox"/>		PHYS 26 <input type="checkbox"/>
CHEM 101DL <input type="checkbox"/>	OR	CHEM 110DL <input type="checkbox"/>	OR	CHEM 21 <input type="checkbox"/>		
Advanced Courses						
CHEM 201DL <input type="checkbox"/>						
CHEM 202D <input type="checkbox"/>						
CHEM 202L <input type="checkbox"/>						
CHEM 210D <input type="checkbox"/>	OR	CHEM 20 <input type="checkbox"/>	OR	CHEM 21 <input type="checkbox"/>		
CHEM 210L <input type="checkbox"/>						
CHEM 310 ¹ <input type="checkbox"/>						
CHEM 310L <input type="checkbox"/>						
CHEM 311 <input type="checkbox"/>						
CHEM 311L <input type="checkbox"/>						
CHEM 401 <input type="checkbox"/>						
CHEM 401L <input type="checkbox"/>						
CHEM 410 <input type="checkbox"/>						
CHEM 420L <input type="checkbox"/>						
CHEM 393 ² <input type="checkbox"/>						
CHEM 394 <input type="checkbox"/>						
One of the following:						
BIOL 201 <input type="checkbox"/>						
BIOCHEM 301 <input type="checkbox"/>						
CHEM 500+ <input type="checkbox"/>						
Options						
ACS-certified degree requires BIOCHEM 301 and CHEM 295						

1. CHEM 310 has a MATH 212 prerequisite: MATH 212
2. Research courses taken outside the chemistry department require approval in order to count toward chemistry major requirements and requirements for Graduation with Distinction in Chemistry.

DEGREES WITH CONCENTRATIONS IN BIOCHEMISTRY

THE A.B. DEGREE WITH CONCENTRATION IN BIOCHEMISTRY

Prerequisites. CHEM 101DL or CHEM 110DL or CHEM 021; [MATH 111L & MATH 112L, or MATH 122L]; [PHYSICS 141L & PHYSICS 142L or PHYSICS 151L & PHYSICS 152L or PHYSICS 161D/164L & PHYSICS 162D/165L]; BIOLOGY 201L or BIOLOGY 203L.

Major Requirements. CHEM 201DL, CHEM 202D & CHEM 202L, [CHEM 210D & CHEM 210L or CHEM 020 or CHEM 021], [CHEM 301 & CHEM 301L or CHEM 310 & CHEM 310L & CHEM 311], CHEM 401 & CHEM 401L; BIOCHEM 301, BIOCHEM 302; plus one of the following: [CHEM 393 & CHEM 394], [BIOLOGY 293 & BIOLOGY 294], or [BIOCHEM 593 & BIOCHEM 594].

THE B.S. DEGREE WITH CONCENTRATION IN BIOCHEMISTRY

Prerequisites. CHEM 101DL or CHEM 110DL or CHEM 021; [MATH 111L & MATH 112L, or MATH 122L]; [PHYSICS 141L & PHYSICS 142L or PHYSICS 151L & PHYSICS 152L or PHYSICS 161L/161D/164L & PHYSICS 162L/162D/165L]; BIOLOGY 201L or BIOLOGY 203L.

Major Requirements. CHEM 201DL, CHEM 202D & CHEM 202L, [CHEM 210D & CHEM 210L or CHEM 020 or CHEM 021], [CHEM 301 & CHEM 301L & CHEM 302, or CHEM 310 & CHEM 301L & CHEM 311], CHEM 401 & CHEM 401L, CHEM 410; BIOCHEM 301, BIOCHEM 302; plus one of the following: CHEM 393, BIOLOGY 293, or BIOCHEM 593.

***TO EARN A B.S. DEGREE IN CHEMISTRY THAT IS CERTIFIED BY THE AMERICAN CHEMICAL SOCIETY REQUIRES CHEM 295, CHEM 310 (WHICH HAS A MATH 212 PREREQUISITE), CHEM 310L, CHEM 311, CHEM 311L, CHEM 410, AND CHEM 420L**

Sample Course Sequences

Sample –AB with Concentration in Biochemistry

	Fall Semester	Spring Semester
First Year	CHEM 101DL or 110DL MATH 111L	CHEM 201DL MATH 112L BIOLOGY 201L
Second Year	CHEM 202D CHEM 202L PHYSICS 141L	CHEM 210D CHEM 210L PHYSICS 142L
Third Year	CHEM 295 CHEM 301 CHEM 393	CHEM 302 CHEM 394 CHEM 301L
Fourth Year	CHEM 401 BIOCHEM 301	CHEM 401L BIOCHEM 302

Sample – ACS Certified BS with Concentration in Biochemistry(w/GwD)

	Fall Semester	Spring Semester
First Year	CHEM 101DL or 110DL MATH 111L	CHEM 201DL MATH 112L BIOLOGY 201L
Second Year	CHEM 202D CHEM 202L PHYSICS 141L MATH 212	CHEM 210D CHEM 210L PHYSICS 142L
Third Year	CHEM 310/310L CHEM 295 CHEM 393	CHEM 311/311L CHEM 394
Fourth Year	CHEM 401 BIOCHEM 301	BIOCHEM 302 CHEM 401L CHEM 410 CHEM 420L* CHEM 496**

*not needed if not ACS certified degree

**not needed if not Graduating with Distinction (GwD)

AB Degree Concentration in Biochemistry. (2021 Revision)

Check all course completed using AP credit, transfer credit, or completed at Duke.

Prerequisite Courses					
MATH 111L <input type="checkbox"/>	OR	MATH 122L <input type="checkbox"/>	OR	MATH 21 <input type="checkbox"/>	
MATH 112L <input type="checkbox"/>				MATH 22 <input type="checkbox"/>	
PHYS 141L <input type="checkbox"/>	OR	PHYS 151L <input type="checkbox"/>	OR	PHYS 161D/164L <input type="checkbox"/>	OR
PHYS 142L <input type="checkbox"/>		PHYS 152L <input type="checkbox"/>		PHYS 162-D/165L <input type="checkbox"/>	PHYS 25 <input type="checkbox"/>
					PHYS 26 <input type="checkbox"/>
BIOL 201L <input type="checkbox"/>	OR	BIOL 203L <input type="checkbox"/>			
CHEM 101DL <input type="checkbox"/>	OR	CHEM 110DL <input type="checkbox"/>	OR	CHEM 21 <input type="checkbox"/>	
Advanced Courses					
CHEM 201DL <input type="checkbox"/>					
CHEM 202D <input type="checkbox"/>					
CHEM 202L <input type="checkbox"/>					
CHEM 210D <input type="checkbox"/>	OR	CHEM 20 <input type="checkbox"/>	OR	CHEM 21 <input type="checkbox"/>	
CHEM 210L <input type="checkbox"/>					
CHEM 301 <input type="checkbox"/>	OR	CHEM 310 ¹ <input type="checkbox"/>			
CHEM 301L <input type="checkbox"/>		CHEM 310L <input type="checkbox"/>			
		CHEM 311 <input type="checkbox"/>			
CHEM 401 <input type="checkbox"/>					
CHEM 401L <input type="checkbox"/>					
BIOCHEM 301 <input type="checkbox"/>					
BIOCHEM 302 <input type="checkbox"/>					
CHEM 393 ² <input type="checkbox"/>	OR	BIOL 293 ² <input type="checkbox"/>	OR	BIOCHEM 593 ² <input type="checkbox"/>	
CHEM 394 <input type="checkbox"/>		BIOL 294 <input type="checkbox"/>		BIOCHEM 594 <input type="checkbox"/>	

1. CHEM 310 has a MATH 212 prerequisite: MATH 212
2. Research courses taken outside the chemistry department require approval in order to count toward chemistry major requirements and requirements for Graduation with Distinction in Chemistry.

BS Degree Concentration in Biochemistry (2021 Revision)

Check all course completed using AP credit, transfer credit, or completed at Duke.

Prerequisite Courses					
MATH 111L <input type="checkbox"/>	OR	MATH 122L <input type="checkbox"/>	OR	MATH 21 <input type="checkbox"/>	
MATH 112L <input type="checkbox"/>				MATH 22 <input type="checkbox"/>	
PHYS 141L <input type="checkbox"/>	OR	PHYS 151L <input type="checkbox"/>	OR	PHYS 161D/164L <input type="checkbox"/>	PHYS 25 <input type="checkbox"/>
PHYS 142L <input type="checkbox"/>		PHYS 152L <input type="checkbox"/>		PHYS 162D/165L <input type="checkbox"/>	PHYS 26 <input type="checkbox"/>
BIOL 201L <input type="checkbox"/>	OR	BIOL 203L <input type="checkbox"/>			
CHEM 101DL <input type="checkbox"/>	OR	CHEM 110DL <input type="checkbox"/>	OR	CHEM 21 <input type="checkbox"/>	
Advanced Courses					
CHEM 201DL <input type="checkbox"/>					
CHEM 202D <input type="checkbox"/>					
CHEM 202L <input type="checkbox"/>					
CHEM 210D <input type="checkbox"/>	OR	CHEM 20 <input type="checkbox"/>	OR	CHEM 21 <input type="checkbox"/>	
CHEM 210L <input type="checkbox"/>					
CHEM 301 <input type="checkbox"/>		CHEM 310 ¹ <input type="checkbox"/>			
CHEM 301L <input type="checkbox"/>	OR	CHEM 310L <input type="checkbox"/>			
CHEM 302 <input type="checkbox"/>		CHEM 311 <input type="checkbox"/>			
CHEM 401 <input type="checkbox"/>					
CHEM 401L <input type="checkbox"/>					
CHEM 410 <input type="checkbox"/>					
BIOCHEM 301 <input type="checkbox"/>					
BIOCHEM 302 <input type="checkbox"/>					
CHEM 393 ² <input type="checkbox"/>	OR	BIOL 293 ² <input type="checkbox"/>	OR	BIOCHEM 593 ² <input type="checkbox"/>	
CHEM 394 <input type="checkbox"/>		BIOL 294 <input type="checkbox"/>		BIOCHEM 594 <input type="checkbox"/>	

1. CHEM 310 has a MATH 212 prerequisite: MATH 212

2. Research courses taken outside the chemistry department require approval in order to count toward chemistry major requirements and requirements for Graduation with Distinction in Chemistry.

Degrees with Concentrations in Chemical Biology

A.B. DEGREE WITH CHEMICAL BIOLOGY CONCENTRATION

Prerequisites: CHEM 101DL or CHEM 110DL or CHEM 021; [MATH 111L & MATH 112L, or MATH 122L]; [PHYSICS 141L & PHYSICS 142L or PHYSICS 151L & PHYSICS 152L or PHYSICS 161L & PHYSICS 162L]; BIOLOGY 201L or BIOLOGY 203L.

Major requirements: CHEM 201DL, CHEM 202D & CHEM 202L, [CHEM 210D & CHEM 210L or CHEM 020 or CHEM 021], [CHEM 301 & CHEM 301L or CHEM 310 & CHEM 310L & CHEM 311], CHEM 401 & CHEM 401L;; Two courses chosen from (CHEM 511, CHEM 517, CHEM 518, or CHEM 536); plus 2 semesters of independent study involving some aspect of chemical biology (CHEM 393 & 394, or two appropriate independent study courses in another department).

B.S. DEGREE WITH CHEMICAL BIOLOGY CONCENTRATION

Prerequisites: CHEM 101DL or CHEM 110DL or CHEM 021; [MATH 111L & MATH 112L, or MATH 122L]; [PHYSICS 141L & PHYSICS 142L or PHYSICS 151L & PHYSICS 152L or PHYSICS 161L & PHYSICS 162L]; BIOLOGY 201L or BIOLOGY 203L.

Major Requirements: CHEM 201DL, CHEM 202D & CHEM 202L, [CHEM 210D & CHEM 210L or CHEM 020 or CHEM 021], [CHEM 301 & CHEM 301L & CHEM 302, or CHEM 310 & CHEM 310L & CHEM 311], CHEM 401 & CHEM 401L, CHEM 410; Two courses chosen from (CHEM 511, CHEM 517, CHEM 518, or CHEM 536) plus 2 semesters of independent study involving some aspect of chemical biology (CHEM 393 & 394, or two appropriate independent study courses in another department).

*TO EARN A B.S. DEGREE IN CHEMISTRY THAT IS CERTIFIED BY THE AMERICAN CHEMICAL SOCIETY REQUIRES CHEM 295, CHEM 310 (WHICH HAS A MATH 212 PREREQUISITE), CHEM 310L, CHEM 311, CHEM 311L, CHEM 410, AND CHEM 420L

AB Degree Concentration in Chemical Biology (2021 Revision)

Check all course completed using AP credit, transfer credit, or completed at Duke.

Prerequisite Courses						
MATH 111L <input type="checkbox"/>	OR	MATH 122L <input type="checkbox"/>	OR	MATH 21 <input type="checkbox"/>		
MATH 112L <input type="checkbox"/>				MATH 22 <input type="checkbox"/>		
PHYS 141L <input type="checkbox"/>	OR	PHYS 151L <input type="checkbox"/>	OR	PHYS 161L <input type="checkbox"/>	OR	PHYS 25 <input type="checkbox"/>
PHYS 142L <input type="checkbox"/>		PHYS 152L <input type="checkbox"/>		PHYS 162L <input type="checkbox"/>		PHYS 26 <input type="checkbox"/>
BIOL 201L <input type="checkbox"/>	OR	BIOL 203L <input type="checkbox"/>	OR	BIOCHEM 301 <input type="checkbox"/>		
CHEM 101DL <input type="checkbox"/>	OR	CHEM 110DL <input type="checkbox"/>	OR	CHEM 21 <input type="checkbox"/>		
Advanced Courses						
CHEM 201DL <input type="checkbox"/>						
CHEM 202D <input type="checkbox"/>						
CHEM 202L <input type="checkbox"/>						
CHEM 210D <input type="checkbox"/>	OR	CHEM 20 <input type="checkbox"/>	OR	CHEM 21 <input type="checkbox"/>		
CHEM 210L <input type="checkbox"/>						
CHEM 301 <input type="checkbox"/>	OR	CHEM 310 ¹ <input type="checkbox"/>				
CHEM 301L <input type="checkbox"/>		CHEM 310L <input type="checkbox"/>				
		CHEM 311 <input type="checkbox"/>				
CHEM 401 <input type="checkbox"/>						
CHEM 401L <input type="checkbox"/>						
PICK TWO:						
CHEM 511 <input type="checkbox"/>						
CHEM 517 <input type="checkbox"/>						
CHEM 518 <input type="checkbox"/>						
CHEM 536 <input type="checkbox"/>						
CHEM 393 ² <input type="checkbox"/>						
CHEM 394 <input type="checkbox"/>						

1. CHEM 310 has a MATH 212 prerequisite: MATH 212
2. Research courses taken outside the chemistry department require approval in order to count toward chemistry major requirements and requirements for Graduation with Distinction in Chemistry.

BS Degree Concentration in Chemical Biology (2021 Revision)

Check all course completed using AP credit, transfer credit, or completed at Duke.

Prerequisite Courses						
MATH 111L <input type="checkbox"/>	OR	MATH 122L <input type="checkbox"/>	OR	MATH 21 <input type="checkbox"/>		
MATH 112L <input type="checkbox"/>				MATH 22 <input type="checkbox"/>		
PHYS 141L <input type="checkbox"/>	OR	PHYS 151L <input type="checkbox"/>	OR	PHYS 161L <input type="checkbox"/>	OR	PHYS 25 <input type="checkbox"/>
PHYS 142L <input type="checkbox"/>		PHYS 152L <input type="checkbox"/>		PHYS 162L <input type="checkbox"/>		PHYS 26 <input type="checkbox"/>
BIOL 201L <input type="checkbox"/>	OR	BIOL 203L <input type="checkbox"/>	OR	BIOCHEM 301 <input type="checkbox"/>		
CHEM 101DL <input type="checkbox"/>	OR	CHEM 110DL <input type="checkbox"/>	OR	CHEM 21 <input type="checkbox"/>		
Advanced Courses						
CHEM 201DL <input type="checkbox"/>						
CHEM 202D <input type="checkbox"/>						
CHEM 202L <input type="checkbox"/>						
CHEM 210D <input type="checkbox"/>	OR	CHEM 20 <input type="checkbox"/>	OR	CHEM 21 <input type="checkbox"/>		
CHEM 210L <input type="checkbox"/>						
CHEM 301 <input type="checkbox"/>	OR	CHEM 310 ¹ <input type="checkbox"/>				
CHEM 301L <input type="checkbox"/>		CHEM 310L <input type="checkbox"/>				
CHEM 302 <input type="checkbox"/>		CHEM 311 <input type="checkbox"/>				
CHEM 401 <input type="checkbox"/>						
CHEM 401L <input type="checkbox"/>						
CHEM 410 <input type="checkbox"/>						
PICK TWO:						
CHEM 511 <input type="checkbox"/>						
CHEM 517 <input type="checkbox"/>						
CHEM 518 <input type="checkbox"/>						
CHEM 536 <input type="checkbox"/>						
CHEM 393 ² <input type="checkbox"/>						
CHEM 394 <input type="checkbox"/>						

1. CHEM 310 has a MATH 212 prerequisite: MATH 212
2. Research courses taken outside the chemistry department require approval in order to count toward chemistry major requirements and requirements for Graduation with Distinction in Chemistry.

Degrees with Concentrations in Pharmacology

The pharmacology concentration requires that students take specific courses in biological sciences and chemistry in addition to pharmacology, and two semesters of research in Pharmacology. The required course BIOLOGY 201L (or BIOLOGY 203L) which provides the necessary biological background for Chemistry majors to proceed with studies in Pharmacology. The two semesters of pharmacology courses are: PHARM 350, which deals with drug actions and reactions, and PHARM 360, which deals with Drugs, Brain and Behavior. Students will also spend two semesters of independent study doing research from a list of approved pharmacology faculty. Pharmacology course is PHARM 554, Mammalian Toxicology is recommended.

THE A.B. DEGREE WITH CONCENTRATION IN PHARMACOLOGY

Prerequisites. CHEM 101DL or CHEM 110DL or CHEM 021; [MATH 111L & MATH 112L, or MATH 122L]; [PHYSICS 141L & PHYSICS 142L or PHYSICS 151L & PHYSICS 152L or PHYSICS 161D/164L & PHYSICS 162D/165L]; BIOLOGY 201L or BIOLOGY 203L.

Major requirements: CHEM 201DL, CHEM 202D & CHEM 202L, [CHEM 210D & CHEM 210L or CHEM 020 or CHEM 021], [CHEM 301 & CHEM 301L or CHEM 310 & CHEM 310L & CHEM 311], CHEM 401 & CHEM 401L; PHARM 350** & PHARM 360**; plus 2 semesters of independent study involving some aspect of pharmacology (CHEM 393 & 394 or PHARM 393 & 394).

THE B.S. DEGREE WITH CONCENTRATION IN PHARMACOLOGY

Prerequisites. CHEM 101DL or CHEM 110DL or CHEM 021; [MATH 111L & MATH 112L, or MATH 122L]; [PHYSICS 141L & PHYSICS 142L or PHYSICS 151L & PHYSICS 152L or PHYSICS 161D/164L & PHYSICS 162D/165L]; BIOLOGY 201L or BIOLOGY 203L.

Major Requirements: CHEM 201DL, CHEM 202D & CHEM 202L, [CHEM 210D & CHEM 210L or CHEM 020 or CHEM 021], [CHEM 301 & CHEM 301L & CHEM 302, or CHEM 310 & CHEM 310L & CHEM 311], CHEM 401 & CHEM 401L, CHEM 410; PHARM 350** & PHARM 360**; plus 2 semesters of independent study involving some aspect of pharmacology (CHEM 393 & 394 or PHARM 393 & 394).

TO EARN A B.S. DEGREE IN CHEMISTRY THAT IS CERTIFIED BY THE AMERICAN CHEMICAL SOCIETY REQUIRES CHEM 295, CHEM 310 (WHICH HAS A MATH 212 PREREQUISITE), CHEM 310L, CHEM 311, CHEM 311L, CHEM 410, AND CHEM 420L

AB Degree Concentration in Pharmacology (2021 Revision)

Check all course completed using AP credit, transfer credit, or completed at Duke.

Prerequisite Courses						
MATH 111L <input type="checkbox"/>			MATH 122L <input type="checkbox"/>			MATH 21 <input type="checkbox"/>
MATH 112L <input type="checkbox"/>	OR		MATH 22 <input type="checkbox"/>	OR		
PHYS 141L <input type="checkbox"/>			PHYS 151L <input type="checkbox"/>			PHYS 161D/164L <input type="checkbox"/>
PHYS 142L <input type="checkbox"/>	OR		PHYS 152L <input type="checkbox"/>	OR		PHYS 162D/165L <input type="checkbox"/>
PHYS 25 <input type="checkbox"/>	OR		PHYS 26 <input type="checkbox"/>			
BIOL 201L <input type="checkbox"/>	OR		BIOL 203L <input type="checkbox"/>			
CHEM 101DL <input type="checkbox"/>	OR		CHEM 110DL <input type="checkbox"/>	OR		CHEM 21 <input type="checkbox"/>
Advanced Courses						
CHEM 201DL <input type="checkbox"/>						
CHEM 202D <input type="checkbox"/>						
CHEM 202L <input type="checkbox"/>						
CHEM 210D <input type="checkbox"/>			CHEM 20 <input type="checkbox"/>	OR		CHEM 21 <input type="checkbox"/>
CHEM 210L <input type="checkbox"/>	OR					
CHEM 301 <input type="checkbox"/>			CHEM 310 ¹ <input type="checkbox"/>			
CHEM 301L <input type="checkbox"/>	OR		CHEM 310L <input type="checkbox"/>			
			CHEM 311 <input type="checkbox"/>			
CHEM 401 <input type="checkbox"/>						
CHEM 401L <input type="checkbox"/>						
PHARM 350 <input type="checkbox"/>						
PHARM 360 <input type="checkbox"/>						
CHEM 393 ² <input type="checkbox"/>			PHARM 393 ² <input type="checkbox"/>			
CHEM 394 <input type="checkbox"/>	OR		PHARM 394 <input type="checkbox"/>			

1. CHEM 310 has a MATH 212 prerequisite: MATH 212
2. Research courses taken outside the chemistry department require approval in order to count toward chemistry major requirements and requirements for Graduation with Distinction in Chemistry.

BS Degree Concentration in Pharmacology (2021 Revision)

Check all course completed using AP credit, transfer credit, or completed at Duke.

Prerequisite Courses					
MATH 111L <input type="checkbox"/>	OR	MATH 122L <input type="checkbox"/>	OR	MATH 21 <input type="checkbox"/>	
MATH 112L <input type="checkbox"/>				MATH 22 <input type="checkbox"/>	
PHYS 141L <input type="checkbox"/>	OR	PHYS 151L <input type="checkbox"/>	OR	PHYS 161D/164L <input type="checkbox"/>	OR
PHYS 142L <input type="checkbox"/>		PHYS 152L <input type="checkbox"/>		PHYS 162D/165L <input type="checkbox"/>	PHYS 25 <input type="checkbox"/>
					PHYS 26 <input type="checkbox"/>
BIOL 201L <input type="checkbox"/>	OR	BIOL 203L <input type="checkbox"/>			
CHEM 101DL <input type="checkbox"/>	OR	CHEM 110DL <input type="checkbox"/>	OR	CHEM 21 <input type="checkbox"/>	
Advanced Courses					
CHEM 201DL <input type="checkbox"/>					
CHEM 202D <input type="checkbox"/>					
CHEM 202L <input type="checkbox"/>					
CHEM 210D <input type="checkbox"/>	OR	CHEM 20 <input type="checkbox"/>	OR	CHEM 21 <input type="checkbox"/>	
CHEM 210L <input type="checkbox"/>					
CHEM 301 <input type="checkbox"/>	OR	CHEM 310 ¹ <input type="checkbox"/>			
CHEM 301L <input type="checkbox"/>		CHEM 310L <input type="checkbox"/>			
CHEM 302 <input type="checkbox"/>		CHEM 311 <input type="checkbox"/>			
CHEM 401 <input type="checkbox"/>					
CHEM 401L <input type="checkbox"/>					
CHEM 410 <input type="checkbox"/>					
PHARM 350 <input type="checkbox"/>					
PHARM 360 <input type="checkbox"/>					
CHEM 393 ² <input type="checkbox"/>	OR	PHARM 393 ² <input type="checkbox"/>			
CHEM 394 <input type="checkbox"/>		PHARM 394 <input type="checkbox"/>			

1. CHEM 310 has a MATH 212 prerequisite: MATH 212

2. Research courses taken outside the chemistry department require approval in order to count toward chemistry major requirements and requirements for Graduation with Distinction in Chemistry.

Degrees with Concentrations in Environmental Science

A. B. DEGREE WITH ENVIRONMENTAL CHEMISTRY CONCENTRATION

Prerequisites: CHEM 101DL or CHEM 110DL or CHEM 021; [MATH 111L & MATH 112L, or MATH 122L]; [PHYSICS 141L & PHYSICS 142L or PHYSICS 151L & PHYSICS 152L or PHYSICS 161L & PHYSICS 162L]; BIOLOGY 201L or BIOLOGY 203L.

Major Requirements: CHEM 201DL, CHEM 202D & CHEM 202L, [CHEM 210D & CHEM 210L or CHEM 020 or CHEM 021], CHEM 301 & CHEM 301L, or CHEM 310 & CHEM 310L & CHEM 311, CHEM 401 & CHEM 401L; ENVIRON 360; plus one of the following: ENVIRON 239, ENVIRON 540, ENVIRON 542L, CEE 565, CEE 667; plus one of the following: [CHEM 393 & CHEM 394] or [ENVIRON 393 & ENVIRON 394] or [CEE 393 & CEE 394].

B.S. DEGREE WITH ENVIRONMENTAL CHEMISTRY CONCENTRATION

Prerequisites: CHEM 101DL or CHEM 110DL or CHEM 021; [MATH 111L & MATH 112L, or MATH 122L]; [PHYSICS 141L & PHYSICS 142L or PHYSICS 151L & PHYSICS 152L or PHYSICS 161L & PHYSICS 162L]; BIOLOGY 201L or BIOLOGY 203L.

Major Requirements: CHEM 201DL, CHEM 202D & CHEM 202L, [CHEM 210D & CHEM 210L or CHEM 210DL or CHEM 020 or CHEM 021], [CHEM 301 & CHEM 301L & CHEM 302, or CHEM 310 & CHEM 310L & CHEM 311], CHEM 401 & CHEM 401L, CHEM 410; ENV 360; plus one of the following: ENVIRON 239, ENVIRON 540, ENVIRON 542L, CEE 565, CEE 667; plus one of the following: [CHEM 393 & CHEM 394] or [ENVIRON 393 & 394] OR [CEE 393 & CEE 394].

* TO EARN A B.S. DEGREE IN CHEMISTRY THAT IS CERTIFIED BY THE AMERICAN CHEMICAL SOCIETY REQUIRES CHEM 295, CHEM 310 (WHICH HAS A MATH 212 PREREQUISITE), CHEM 310L, CHEM 311, CHEM 311L, CHEM 410, AND CHEM 420L

AB Degree Concentration in Environmental Chemistry (2021 Revision)

Check all course completed using AP credit, transfer credit, or completed at Duke.

Prerequisite Courses						
MATH 111L <input type="checkbox"/> MATH 112L <input type="checkbox"/>	OR	MATH 122L <input type="checkbox"/>	OR	MATH 21 <input type="checkbox"/> MATH 22 <input type="checkbox"/>		
PHYS 141L <input type="checkbox"/> PHYS 142L <input type="checkbox"/>	OR	PHYS 151L <input type="checkbox"/> PHYS 152L <input type="checkbox"/>	OR	PHYS 161L <input type="checkbox"/> PHYS 162L <input type="checkbox"/>	OR	PHYS 25 <input type="checkbox"/> PHYS 26 <input type="checkbox"/>
BIOL 201L <input type="checkbox"/>	OR	BIOL 203L <input type="checkbox"/>				
CHEM 101DL <input type="checkbox"/>	OR	CHEM 110DL <input type="checkbox"/>	OR	CHEM 21 <input type="checkbox"/>		
Advanced Courses						
CHEM 201DL <input type="checkbox"/> CHEM 202D <input type="checkbox"/> CHEM 202L <input type="checkbox"/>						
CHEM 210D <input type="checkbox"/> CHEM 210L <input type="checkbox"/>	OR	CHEM 20 <input type="checkbox"/>	OR	CHEM 21 <input type="checkbox"/>		
CHEM 301 <input type="checkbox"/> CHEM 301L <input type="checkbox"/>	OR	CHEM 310 ¹ <input type="checkbox"/> CHEM 310L <input type="checkbox"/> CHEM 311 <input type="checkbox"/>				
CHEM 401 <input type="checkbox"/> CHEM 401L <input type="checkbox"/>						
ENVIRON 360 <input type="checkbox"/>						
PICK ONE: ENVIRON 239 <input type="checkbox"/> ENVIRON 540 <input type="checkbox"/> ENVIRON 542 <input type="checkbox"/> CEE 565 <input type="checkbox"/> CEE 667 <input type="checkbox"/>						
CHEM 393 ² <input type="checkbox"/> CHEM 394 <input type="checkbox"/>	OR	ENVIRON 393 <input type="checkbox"/> ENVIRON 394 <input type="checkbox"/>	OR	CEE 393 <input type="checkbox"/> CEE 394 <input type="checkbox"/>		

1. CHEM 310 has a MATH 212 prerequisite: MATH 212
2. Research courses taken outside the chemistry department require approval in order to count toward chemistry major requirements and requirements for Graduation with Distinction in Chemistry.

BS Degree Concentration in Environmental Chemistry (2021 Revision)

Check all course completed using AP credit, transfer credit, or completed at Duke.

Prerequisite Courses						
MATH 111L <input type="checkbox"/>	OR	MATH 122L <input type="checkbox"/>	OR	MATH 21 <input type="checkbox"/>		
MATH 112L <input type="checkbox"/>				MATH 22 <input type="checkbox"/>		
PHYS 141L <input type="checkbox"/>	OR	PHYS 151L <input type="checkbox"/>	OR	PHYS 161L <input type="checkbox"/>	OR	PHYS 25 <input type="checkbox"/>
PHYS 142L <input type="checkbox"/>		PHYS 152L <input type="checkbox"/>		PHYS 162L <input type="checkbox"/>		PHYS 26 <input type="checkbox"/>
BIOL 201L <input type="checkbox"/>	OR	BIOL 203L <input type="checkbox"/>				
CHEM 101DL <input type="checkbox"/>	OR	CHEM 110DL <input type="checkbox"/>	OR	CHEM 21 <input type="checkbox"/>		
Advanced Courses						
CHEM 201DL <input type="checkbox"/>						
CHEM 202D <input type="checkbox"/>						
CHEM 202L <input type="checkbox"/>						
CHEM 210D <input type="checkbox"/>	OR	CHEM 20 <input type="checkbox"/>	OR	CHEM 21 <input type="checkbox"/>		
CHEM 210L <input type="checkbox"/>						
CHEM 301 <input type="checkbox"/>	OR	CHEM 310 ¹ <input type="checkbox"/>				
CHEM 301L <input type="checkbox"/>		CHEM 310L <input type="checkbox"/>				
CHEM 302 <input type="checkbox"/>		CHEM 311 <input type="checkbox"/>				
CHEM 401 <input type="checkbox"/>						
CHEM 401L <input type="checkbox"/>						
CHEM 410 <input type="checkbox"/>						
ENVIRON 360 <input type="checkbox"/>						
PICK ONE:						
ENVIRON 239 <input type="checkbox"/>						
ENVIRON 540 <input type="checkbox"/>						
ENVIRON 542 <input type="checkbox"/>						
CEE 565 <input type="checkbox"/>						
CEE 667 <input type="checkbox"/>						
CHEM 393 ² <input type="checkbox"/>	OR	ENVIRON 393 <input type="checkbox"/>	OR	CEE 393 <input type="checkbox"/>		
CHEM 394 <input type="checkbox"/>		ENVIRON 394 <input type="checkbox"/>		CEE 394 <input type="checkbox"/>		

1. CHEM 310 has a MATH 212 prerequisite: MATH 212
2. Research courses taken outside the chemistry department require approval in order to count toward chemistry major requirements and requirements for Graduation with Distinction in Chemistry.

Graduation with Distinction

Majors may be considered for Graduation with Distinction honors provided they have all of the following:

1. At least a B average in chemistry major courses is required at the time of application and at graduation.
2. Satisfactory completion of at least two semesters of independent study in chemistry or in an approved chemistry-related area.
3. Enrollment and participation in CHEM 295, Introduction to Research Independent Study, preferably concurrently with their enrollment in their first independent study course.
4. Enrollment and participation in CHEM 496, Graduation with Distinction in Chemistry, in the spring semester of the senior year. No formal declaration of candidacy is required. A major automatically becomes a candidate for GwD by enrolling in CHEM 496.
5. Submission of a high-quality research thesis based upon the results of independent study.
6. Formal nomination for GwD by the research advisor based on the completed research thesis.
7. Presentation of a poster based on the results of the independent study.
8. Oral defense of the research thesis, completed as part of CHEM 496. Suggestions for preparing and delivering oral reports are given at <http://www.chem.duke.edu/undergraduate/oral-reports>
9. Selection for the honor by the Chemistry Department Undergraduate Awards Committee.

The process for awarding Graduation with Distinction is as follows: The student's work is evaluated first by the supervising professor and then, upon his/her recommendation, by a committee of Chemistry faculty. Final decisions on Graduation with Distinction rest with the departmental awards committee. In recent years approximately 40% of majors have earned Graduation with Distinction.

Student Awards & Recognition

The following Awards and Honors are conferred each year and are recorded in the Special Prizes and Awards section of the annual Commencement Program in May.

The American Chemical Society Undergraduate Award in Analytical Chemistry is given annually to a rising junior or senior chemistry major. Selection by a faculty committee is based on an aptitude for analytical chemistry, including academic excellence and laboratory proficiency. The award consists of a

personalized certificate, as well as monthly highlights from the journal *Analytical Chemistry*, published by the American Chemical Society.

The American Chemical Society Undergraduate Award in Inorganic Chemistry is given annually to a graduating chemistry major. Selection by a faculty committee is based on demonstrated excellence in inorganic chemistry, including research experience, coursework and a desire to pursue a career in chemistry. The award consists of a personalized certificate and a letter of commendation from the American Chemical Society Division of Inorganic Chemistry.

The American Chemical Society Undergraduate Award in Organic Chemistry is given annually to a graduating chemistry major. Selection by a faculty committee is based on demonstrated excellence in organic chemistry, including research experience, coursework and a desire to pursue a career in chemistry. The award consists of a letter of recognition from the American Chemical Society Division of Organic Chemistry, an award certificate signed by the division chair, and a one-year membership to the Organic Division of the ACS.

The American Chemical Society Undergraduate Award in Physical Chemistry is given annually to a graduating chemistry major. Selection by a faculty committee is based on demonstrated excellence in physical chemistry, including research experience, coursework and a desire to pursue a career in chemistry. The award consists of a letter of recognition from the American Chemical Society Division of Physical Chemistry, an award certificate signed by the division chair, and a one-year membership to the Physical Division of the ACS.

The Chemistry Department Award is given annually to an outstanding senior B. S. chemistry major. Selection by a faculty committee is based on the student's independent research, scholastic achievement, and interest in pursuing graduate study in chemistry. The award consists of a one-year membership in the American Chemical Society and a one-year subscription to an appropriate journal.

ACS Student Club

The ACS Student Club in the Department of Chemistry allows undergraduate students with an interest in Chemical Sciences paired with faculty mentors the opportunity to conduct community outreach and gain professional development. This collaboration enhances the academic experience while simultaneously preparing students for successful careers.

Student Employment in the Department

Employment within the Department is an opportunity for the qualified student to gain valuable educational experience as a supplement to formal classroom instruction and at the same time to benefit financially. The following opportunities may be available.

- Undergraduate Teaching Assistantships or Undergraduate Prep Room Assistant positions are occasionally available in the Chemistry Department for **CHEMISTRY MAJORS ONLY**. These opportunities are communicated to eligible students by the DUS when available and interested students will need to apply to the position in [JobX](#) for consideration of employment.
- Undergraduate Research Assistantships are occasionally available in specific Chemistry labs. These opportunities are communicated by the PI directly to eligible students and interested students will need to apply to the position in [JobX](#) for consideration of employment.
- [Work Study](#)