Chemistry at Dartmouth

Welcome to Burke Laboratory
Home of the Dartmouth
Department of Chemistry

A Guide for the Prospective Chemistry Major

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Introduction

Chemistry is the science of molecules. Chemists synthesize new drugs; they develop new polymeric, composite, and ceramic materials; they help in understanding and ameliorating environmental problems; and they work to understand the complex mechanisms of biological macromolecules to better understand and treat human diseases. More fundamentally, chemists want to know everything about molecules and their interactions with each other. Even when one looks outside of chemistry *per se* to the spectrum of forefront scientific research, including areas such as molecular genetics, alternative energy development, molecular biology, neurophysiology, molecular electronics, nutrition, and pharmacology, it is astonishing to see how much modern science depends on our ability to understand and manipulate molecules and their structures. Chemistry is an ancient discipline that evolved out of alchemy and natural philosophy, but it is still at the center of most attempts to understand ourselves and our surroundings.

Chemistry majors and non-majors alike have opportunities at Dartmouth that are rarely found at other colleges and universities. Excellent teaching, close faculty-student relationships, and internationally recognized research programs characterize the department. A small but highly regarded Ph.D. program and several post-doctoral research associates help to ensure a stimulating scientific atmosphere supported by modern research instruments that are accessible to undergraduates. Most of such facilities are housed in Burke Laboratory.

The First Two Years

During the first and second years, all prospective chemistry majors should complete a common set of courses in chemistry, which includes a general chemistry sequence (either Chem 5 and 6, or Chem 11) and an organic chemistry sequence (Chem 51 and 52). Chem 5 and 6 provide a thorough two-term introduction to the foundational concepts in chemistry for students with less prior exposure to chemistry. Chem 11 provides a one-term approach to the foundational concepts in chemistry for students with significant prior exposure to chemistry. Chemistry majors will also need to complete a set of physics, mathematics, and possibly biology courses, which can also be completed during their first two years. All chemistry majors will need to take Mathematics 3 and 8 (or 9), and those electing the plan A major will need to take Mathematics 13 (or 11) as well. All chemistry majors are required to take an introductory physics sequence (13 and 14, or 3 and 4, or 15 and 16), with Physics 13 and 14 strongly preferred. Students in the Biological Chemistry major are required to take Biology 12 and Biology 13, which are also *recommended* for those in the Biophysical Chemistry major. While mathematics, physics and biology courses do not need to be completed during a student's first two years at Dartmouth it is often highly advantageous given that some upper-level chemistry courses require these other courses as prerequisites.

A prospective chemistry major should begin with a general chemistry course that is appropriate for their background and knowledge in chemistry. Students with scores of 4 or 5 on the Advanced Placement (AP) Chemistry exam, 6 or 7 on the International Baccalaureate (IB) higher level Chemistry exam, or A on the British A-level Chemistry exam, are placed into Chem 11. All other students who are interested in Chem 11 should take an on-line Chemistry Placement Test, to determine if they are placed into Chem 5 or Chem 11. Students who are not placed into Chem 11 should begin with Chem 5. **Both Chem 5 and Chem 11 have a prerequisite of Math 3** (or higher-level mathematics course), which must be taken before beginning the study of chemistry, often in the fall before taking Chem 5 in the winter or Chem 11

in the spring. Chem 5 and 6, or Chem 11 introduce modern chemical knowledge and physical concepts that are used in its interpretation and serve as prerequisites for higher-level chemistry courses. The laboratory work emphasizes quantitative techniques and introduces the student to chemical instrumentation.

In the second year, the prospective chemistry major begins the study of organic chemistry with Chem 51 and 52. These courses cover both a theoretical approach to the subject as well as synthetic methods and mechanisms of organic reactions. In the organic chemistry laboratory, students have the opportunity to use equipment of research quality while learning the techniques of experimental organic chemistry.

Declaring a Major

The formal election of a major comes during the winter or spring term of the second year. At that time, a detailed plan for a student's third and fourth years at Dartmouth is made in consultation between the student and a faculty member of the Undergraduate Advising Committee (UAC). More information can be found on the Chemistry Department's website. UAC is always available to help you find the major path that is best suited for you. It is especially important to consult UAC when deciding which term to be away from campus during a student's sophomore or junior year. The choice of a major will be the primary factor in dictating what courses are to be completed during a student's last two years at Dartmouth. The four different chemistry majors, described in detail below, are:

Plan A: The student who is interested in a career in chemical science will usually elect the Plan A major with its three physical chemistry courses, Chem 75 (*Physical Chemistry I*), Chem 76 (*Physical Chemistry II*) and Chem 96 (*Special Topics in Physical Chemistry*).

Plan B: Those with career goals outside chemical science *may* elect the Plan A major but often prefer the Plan B major. *Either* plan permits up to two advanced level courses from other science departments to be included in the eight courses of the major.

Biophysical Chemistry: This major is available for those students who are interested in biochemistry but would like additional emphasis on physical chemistry. This program is intended to prepare students for admission to top graduate programs in fields with a variety of disciplinary titles, such as chemistry, biochemistry, molecular biology, biophysics, and structural biology. Finally, it is important to note that all three majors have required courses that are offered in the winter and spring terms. The Plan A and Biophysical Chemistry majors require that at least one major course be taken in each of the winter and spring terms of the third year, and students should plan to be in residence these terms, in addition to their fourth year. Although, the Plan B major is more flexible, scheduling of major courses will be easier if two major courses are selected in the third year.

Biological Chemistry: This major is designed for students interested in applications of chemistry to fundamental biological processes, similar to the biophysical chemistry option, but without as much emphasis on physical chemistry. The Biological Chemistry major requires that both Chem 40 and 41 be completed by the end of the junior year, so that Chem 42 can be taken in senior fall. In addition to excellent preparation for premedical students, it provides the framework for further graduate study in all areas of biological chemistry and biomedical science.

Plan A Major

The Plan A curriculum requires Chem 51 and 52 *(Organic Chemistry),* Chem 64 (*Inorganic Chemistry*), Chem 75 (*Physical Chemistry I*), Chem 76 (*Physical Chemistry II*), and Chem 96 (*Special Topics in Physical Chemistry*, a special topics course with offerings once or twice a year from among Quantum Chemistry, Statistical Thermodynamics, Molecular Spectroscopy, Physical Chemistry of Polymers, Computational Chemistry, Materials Science, and Chemical Kinetics. Chem 75 and 76 provide a strong curriculum that covers all major aspects of thermodynamics, kinetics, transport processes, quantum mechanics, and molecular spectroscopy. A study of advanced topics in the above areas, and/or additional topics, is provided in Chem 96. Chem 75 and 76 are taken in the winter and spring terms, respectively, of the third year, and Chem 96 is elected in the senior year. Chem 64, which is offered in the winter term and has Chem 51 as prerequisite, may be taken in the second, third or fourth year.

Laboratory work in Chem 64 emphasizes the synthesis, characterization, and spectroscopy of inorganic molecules. Laboratory work in Chem 75 and 76 illustrates concepts covered in the classroom and makes extensive use of instrumental techniques. Chem 76 also involves a computational laboratory.

Plan B Major

The core curriculum of the somewhat more flexible Plan B major requires Chem 51 and 52 (*Organic Chemistry*), Chem 64 (*Inorganic Chemistry*), Chem 75 (*Physical Chemistry I*, and Chem 76 (*Physical Chemistry II*). Chem 64, which is offered in the winter term, and has Chem 51 as prerequisite, may be taken in the second, third or fourth year. Chem 75 (offered in the winter term) and Chem 76 (offered in the spring term) may be taken in either the third or fourth year. This two-term physical chemistry sequence covers the major topics of thermodynamics, kinetics, transport processes, quantum mechanics and molecular spectroscopy.

Biophysical Chemistry Major

The core curriculum of the Biophysical Chemistry major requires Chem 51 and 52 *(Organic Chemistry),* Chem 41 *(Biological Chemistry I),* Chem 64 *(Inorganic Chemistry),* Chem 75 *(Physical Chemistry I)*, Chem 76 *(Physical Chemistry II)*, and one offering of Chem 95 (*Topics in Advanced Biophysical Chemistry)*, a special topics course that is offered once or twice a year from among Membrane Biophysics, Biomolecular Simulations, Biomolecular NMR, Structure and Dynamics of Biomolecules, Protein Crystallography, and Enzymology. Chem 75 and 76 is taken in the winter and spring terms, respectively, of the third year, and Chem 95 is taken in the senior year. Chem 64, which is offered in the winter term, and has Chem 51 as prerequisite, may be taken in the second, third or fourth year. The one-term introduction to biochemistry, Chem 41, is taken either in the spring term of the second year, right after completion of organic chemistry (Chem 52), or in the spring term of the third year along with Chem 76. An additional elective course offered in this area is Chem 42 (*Biological Chemistry II*) in the fall.

Biological Chemistry Major

The core curriculum of the Biological Chemistry major requires Chem 51 and 52 *(Organic Chemistry),* Chem 64 *(Inorganic Chemistry),* Chem 40 *(Physical Chemistry of Biochemical Processes),* Chem 41 and

42 *(Biological Chemistry).* Additional courses to complete the requisite eight are listed in the ORC or on the Chemistry Department website. *At least one of the two additional courses must have a biochemical focus*.

Specialized Courses

Chemistry faculty also teach a number of graduate courses that are available to qualified undergraduates and allow a specialized, advanced curriculum, once the required major courses are completed. Examples of such courses include Chem 91 (*Organometallic Chemistry and Catalysis*), Chem 92 (*Inorganic Biochemistry*), Chem 93 (*Physical Organic Chemistry*), Chem 95 (*Topics in Advanced Biophysical Chemistry*, including *Membrane Biophysics, Biomolecular Simulations, Biomolecular NMR, Structure and Dynamics of Biomolecules, Protein Crystallography, and Enzymology*), Chem 96 (*Special Topics in Physical Chemistry*, including *Quantum Chemistry, Statistical Thermodynamics, Molecular Spectroscopy, Physical Chemistry of Polymers, Materials Science, and Chemical Kinetics*), Chem 152 (*Advanced Organic Synthesis and Mechanisms*), Chem 153 (*Chemistry of Natural Products*), and Chem 159 (*Chemistry of Heterocyclic Compounds*). See the ORC for a complete list of upper-level courses that are offered.

Culminating Experience

Dartmouth requires that all majors must complete a substantial, graded culminating experience in their major. Many Plan A, Plan B, Biophysical, or Biological chemistry majors will satisfy this requirement by participating in undergraduate research by registering for Chem 80, Chem 87.01 or Chem 87.02. Often such students will be enrolled in the Chemistry Honors Program as well. Please note that Dartmouth's minimum requirement for admission to the Honors Program is a grade point average of 3.0 in the major and a 3.0 general GPA average at the beginning of the senior year or at any other time that an application for admission is made.

Other chemistry majors will satisfy the requirement for a culminating experience by including in their major programs one of the following course groups, each of which provides an integrated presentation of an important area of modern chemical sciences: *Biophysical Chemistry*: Chem 75, 76 and 95; *Biological Chemistry:* Chem 40, 41 and *42; Physical Chemistry*: Chem 75, 76 and 96; or *Chemical Applications, Synthesis and Characterization:* Chem 63, 64, and one course from among Chem 91, 92, and 93. Note that for Biological Chemistry majors, Chem 40, 41 and 42 is a required sequence.

Students must be prepared to discuss their plans for satisfying the requirement for the culminating or integrating experience at the time they enroll in the major. Since a student may not enroll in Chem 80, 87.01 or 87.02 until after they have been accepted into the Chemistry Research Program, the initial declaration of a major will satisfy the culminating experience requirement using one of the three-course groups mentioned above. In addition, they must confirm their major plans at the beginning of the fall term of the fourth year.

The four-term, year-round operation of Dartmouth requires careful planning of the major program in consultation with a faculty member of UAC but permits some flexibility in the individual curricular plan and residence pattern. Vacation or leave term opportunities may include research assistantships

at Dartmouth or elsewhere, and industrial or government jobs or internships. Information and assistance are available through the Department and the Office of Career and Employment Services. The Department also hires many of its majors for part- time positions such as a laboratory teaching assistant.

Minor in Chemistry

The Chemistry Department offers a single minor program. The minimum prerequisites for the minor are Mathematics 3 (or the equivalent) and two terms of introductory chemistry, with Chem 5 and 6, *or* 11 suitable for this purpose. Four additional courses are required for the minor and must include Chem 51 (*Organic Chemistry*) and Chem 64 (*Inorganic Chemistry*). The remaining two courses may be selected from other chemistry courses numbered 40 or higher. The NRO option is not allowed for courses taken to fulfill the chemistry minor.

In addition, the Chemistry Department, together with Physics and Engineering, jointly sponsors a minor in Material Science. This minor program is coordinated through the Center for Nanomaterials Research at Dartmouth.

Modified Majors

For individuals with special interests, modified majors in which chemistry is combined with such disciplines as biology, earth sciences, mathematics, physics, or environmental studies can be arranged. At Dartmouth, the course requirements for a modified major are proposed by the student and, subject to institutional guidelines, approved by the departments or programs involved. In addition to modified majors with chemistry and a second science, recent examples of creative curriculum planning have included modified majors in chemistry and psychology, chemistry and religion, and chemistry and economics. Dartmouth's guiding principle is that a modified major, however diverse, must constitute a "unified and coherent whole." As part of the application process, each student must submit a written statement documenting why he or she believes the proposed modified major meets that requirement.

Research

Chemistry majors can also complete one their major by participating in undergraduate research and electing Chem 80, Chem 87.01 or Chem 87.02, as discussed in more detail below.

Possible paths through the chemistry major

Plan A and Plan B

For students without credit on entrance for Math 3 and who are not placed into Chem 11.

Year/Term	Fall	Winter	Spring	Summer
One	Math 3	Chem 5	Chem 6	
Two	Math 8	Phys 13	Chem 51, Phys 14	Chem 52 and 63
Three		Chem 75	Chem 76	
Four	(Chem 93), (Chem 96.X)	Chem 64	(Chem 41), (Chem91)	

Two of the four chemistry courses shown in parentheses would be required for the minimum of 8 courses. The culminating experience course options are 63, 64, and 91 or 93 (Plan B); or 75, 76, 96.X (Plan A). The Plan A major would also require Math 13.

For students with credit on entrance for Math 3 and who are not placed into Chem 11.

Year/Term	Fall	Winter	Spring	Summer
One	Chem 5	Chem 6	Math 8	
Two	Phys 13	Chem 51, Phys 14	Chem 52	Chem 63
Three		Chem 75	Chem 41 and 76	
Four	(Chem93), (Chem 96.X)	Chem 64	(Chem 91) or (Chem 92)	

One of the four courses shown in parentheses would be required for the minimum of 8 courses. The culminating experience course options are 63, 64, and one of 91, 92 or 93 (Plan B); or 75, 76, 96.X (Plan A). The Plan A major would also require Math 13.

For students with credit on entrance for Math 3 and who are placed into Chem 11.

Year/Term	Fall	Winter	Spring	Summer
One	Chem 11		Math 8	
Two	Chem 51	Chem 52, Phys 13	Phys 14	Chem 63
Three		Chem 64	Chem 41	
Four	(Chem 93)	Chem 75	Chem 76, (Chem 91) or (Chem 92)	

Suitable for Plan B. One of the three courses shown in parentheses would be required for the minimum of 8 courses. The culminating experience options are 63, 64, and one of 91, 92 or 93. The Plan A major would also require Math 13.

For students without credit on entrance for Math 3 and who are placed into Chem 11.

Year/Term	Fall	Winter	Spring	Summer
One	Math 3	Math 8	Chem 11	
Two	Phys 13	Phys 14	Chem 51	Chem 52 and Chem 63
Three		Chem 75	Chem 76	
Four	(Chem 93)	Chem 64	Chem 41, (Chem 91), (Chem 92)	

Suitable for Plan B. One of the three courses shown in parentheses would be required for the minimum of 8 courses. The culminating experience options are 63, 64, and one of 91, 92 or 93. The Plan A major would also require Math 13.

Biophysical Chemistry

For students without credit on entrance for Math 3 and who are not placed into Chem 11.

Year/Term	Fall	Winter	Spring	Summer
One	Math 3	Chem 5	Chem 6, Math 8	
Two	Chem 51	Chem 52, Phys 13	Chem 41, Phys 14	(Chem 63)
Three		Chem 64 and Chem 75	Chem 76	
Four	Chem 95.X, (Chem 42), (Chem 93)		(Chem 91), (Chem92)	

Only one of the four courses shown in parentheses would be required for the minimum of 8 courses. The culminating experience course options are 75, 76, 95.X; or 63, 64, and one of 91, 92 or 93.

For students with credit on entrance for Math 3 and who are not placed into Chem 11.

Year/Term	Fall	Winter	Spring	Summer
One	Chem 5	Chem 6	Math 8	
Two	Chem 51	Chem 52, Phys 13	Phys 14	(Chem 63)
Three		Chem 64 and Chem 75	Chem 41 and Chem 76	
Four	Chem 95.X, (Chem 42), (Chem 93)		(Chem 91), (Chem 92)	

Only one of the four courses shown in parentheses would be required for the minimum of 8 courses. The culminating experience course options are 75, 76, 95.X; or 63, 64, and one of 91, 92 or 93.

For students with credit on entrance for Math 3 and who are placed into Chem 11.

Year/Term	Fall	Winter	Spring	Summer
One	Chem 11		Math 8	
Two	Phys 13	Chem 51, Phys 14	Chem 52	(Chem 63)
Three		Chem 64 and Chem 75	Chem 41 and Chem 76	
Four	Chem 95.X, (Chem 42), (Chem 93)		(Chem 91), (Chem 92)	

Only one of the four courses shown in parentheses would be required for the minimum of 8 courses. The culminating experience course options are 75, 76, 95.X; or 63, 64, and one of 91, 92 or 93.

For students without credit on entrance for Math 3 and who are placed into Chem 11.

Year/Term	Fall	Winter	Spring	Summer
One	Math 3	Math 8	Chem 11	
Two	Phys 13	Phys 14	Chem 51	Chem 52 (Chem 63)
Three		Chem 75	Chem 76 and Chem42	
Four	Chem 95.X, (Chem 42), (Chem 93)	Chem 64	(Chem 91), (Chem 92)	

Only one of the four courses shown in parentheses would be required for the minimum of 8 courses. The culminating experience course options are 75, 76, 95.X; or 63, 64, and one of 91, 92 or 93.

Biological Chemistry

For students without credit on entrance for Math 3 and who are not placed into Chem 11.

Year/Term	Fall	Winter	Spring	Summer
One	Math 3	Chem 5, Math 8	Chem 6, Biol 12	
Two	Chem 51, Phys 13	Chem 52	Phys 14	Biol 13, (Chem 63)
Three		Chem 40, Chem 64	Chem 41	
Four	Chem 42 (Chem 95.X)		(Chem 92)	

Only two of the courses shown in parentheses would be required for the minimum of 8 courses. Students may wish to take Biol 11 before taking Biol 12.

For students with credit on entrance for Math 3 and who are not placed into Chem 11.

Year/Term	Fall	Winter	Spring	Summer
One	Chem 5	Chem 6, Math 8	Biol 12	
Two	Chem 51, Phys 13	Chem 52	Phys 14	Biol 13, (Chem 63)
Three		Chem 40 Chem 64	Chem 41	
Four	Chem 42 (Chem 95.X)		(Chem 92)	

Only two of the courses shown in parentheses would be required for the minimum of 8 courses. Students may wish to take Biol 11 before taking Biol 12.

For students with credit on entrance for Math 3 and who are placed into Chem 11.

Year/Term	Fall	Winter	Spring	Summer
One	Chem 11 Math 8 or 11	Phys 13	Bio 12 Phys 14	
Two	Chem 51	Chem 52 Biol 13	Chem 41	(Chem 63)
Three		Chem 40 Chem 64		
Four	Chem 42 (Chem 95.X)		(Chem 92)	

Only two of the courses shown in parentheses would be required for the minimum of 8 courses. Students may wish to take Biol 11 before taking Biol 12.

Undergraduate Research

Upper class students who are interested in research may take Chem 80 (*Independent Study in Chemistry*), Chem 87.01 or Chem 87.02 (*Undergraduate Investigation in Chemistry*), courses for individual investigation under the supervision of a faculty member. These include an initial literature study of the problem, the experimental, computational or theoretical research, and a detailed report upon completion of the project. Chem 80 is appropriate for a one-term project and Chem 87, which can be elected up to two times (87.01 and 87.02), is normally elected for a project that extends more than one term, although it counts only once toward the eight-course major requirement; however, each election of Chem 87 counts towards Dartmouth's graduation requirement. Faculty advisors are often able to offer extra-curricular opportunities to do research, and undergraduates may be able to work full-time on a research project during leave or vacation terms. The Department offers Zabriskie Leave Term Fellowships to help with living and research expenses while students are engaged in full-time research. Moreover, sometimes faculty members can provide financial support from research grants.

Listed below are brief descriptions of the research interests of the faculty:

Ivan Aprahamian: Organic and materials chemistry: self-assembly; supramolecular interactions; molecular switches and machines; nanotechnology

David S. Glueck: Organic, organometallic and inorganic chemistry: homogeneous catalysis, asymmetric synthesis, chiral phosphines, sustainable energy

Miguel Gonzalez: Inorganic, organic, materials, synthesis, catalysis, advanced crystallography, spectroscopy, photochemistry

Jon Kull: Biophysical chemistry: X-ray crystallographic, biophysical, and kinetic characterization of molecular motors, cytoskeletal-associated nucleotide hydrolases, and structural proteins; force generation in biological systems; enzyme kinetics; protein engineering

Jane E. G. Lipson: Theory and computation are combined with experimental data from collaborators to test explanations and predictions about material properties; applications include modeling and predicting the behavior of complex materials and how that changes with temperature and pressure; explaining important differences between thin films and bulk; predicting how differences in physical properties will affect ability to mix

Charles R. Midgett: Biophysical chemistry of virulence regulation in bacterial pathogens

Dale F. Mierke: Biophysical chemistry: structural basis of the biological function of peptide hormones and regulation/trafficking of their receptors; structure-based rational drug design employing experimental (NMR, fluorescence, circular dichroism) and theoretical (molecular dynamics, docking) methods

Katherine A. Mirica: Materials chemistry: design and synthesis of selective gas sensors

Maria Pellegrini: Biophysical chemistry: modulation of protein-protein interactions through structure-

based methods (NMR, X-ray crystallography) and NMR-based screening, with a focus on the NF-kB pathway

Ekaterina Pletneva: Bioinorganic and biophysical chemistry: redox reactions, structure, and conformational dynamics of heme proteins; roles of these processes in energy conversion and human disease

Xin Qi: Computational materials and biophysical chemistry: molecular modeling of organic-inorganic hybrid nanomaterials; solid-state nanomaterial growth and assembly; computational design for protein and biomimetic molecules

Michael Ragusa: Biophysical chemistry: protein crystallography, small angle x-ray scattering, peripheral membrane proteins, autophagy

Paul J. Robustelli: Computational biophysics and biophysical chemistry: molecular simulations and NMR spectroscopy to study dynamic and disordered proteins in atomic-detail, design and characterization of small molecule drugs that inhibit disordered proteins

Mahima Sneha: Physical chemistry: Transient vibrational and electronic absorption spectroscopies, vibrational sum frequency generation spectroscopy, reaction mechanisms in photocatalysis, solution phase and interfacial chemistry

Dean E. Wilcox: Inorganic and bioinorganic chemistry: coordination chemistry of proteins and peptides; thermodynamics of metal ions binding to biological macromolecules

Jimmy Wu: Organic chemistry: reaction methodology, alkaloid synthesis, heterocyclic chemistry

Wenlin Zhang: Computational and theoretical material chemistry: multi-scale simulations and theories for predicting phase behaviors, assembly and material properties of soft matter

Listed below are students who have completed a recent honors thesis, the title of their thesis and their research advisor:

Caleb Liu ‘25	Atomistic and Coarse-Grained Simulations of Polyethylene Nanodroplets (Wenlin Zhang)
Colby Lish ‘25	Optimization of the Purification of Variant Toxsp for use in a Fluorenscence Anisotropy Binding Assay with Toxsp (F. Jon Kull)
Eleanor F. Chase ‘25	Hydrothermal deposition of Ni3(HHTP)2 MOF on conductive threads for electrochemical sensing (Katherine Mirica)
Jack Ranani ‘25	Development of a Modular Sythesis of Bifunctional Phosphorus (V)/Boronic Acid Compounds (Christopher Sandford)

Jake E. Patterson ‘25	Synthesis and Characterization of MOC/MXene Hybrid Nanoarchitectures for Electrocatalytic Hydrogen Production (Miguel Gonzalez)
Maria Beatriz Hidalgo Quinana ‘25	In Silico and In Vitro Screening of Small Molecules as Inhibitors of the NEMO/IKKβ Interaction (Dale Mierke)
Mariana I. Cepeda Quintero ‘25	Developing a High Throughput Method to Measure Rns Protein Interactions with DNA (F. Jon Kull)
Anjali Dhar ‘24	Ensemble-based molecular docking of small molecule ligands on the disordered protein α-synuclein (Paul Robustelli)
Daniel Chen ‘24	Expression and Purification of the Selective Autophagy Adaptor Protein Bph1 in *Saccharomyces cerevisiae* and Progress Towards Structural Analysis (Michael Ragusa)
Emma Cool ‘24	Characterization of evolutionary changes in the redox properties of cytochrome c4 proteins (Ekaterina Pletneva)
Ericka Asmus ‘24	Scavenging of Toxic Arsenic Oxo-Ions Using Two-Dimensional Triphenylene-Based Metal Organic Frameworks (Katherine Mirica)
Julia Binder ‘24	Characterization and Disruption of N-Glycosylation Sites on Adam10a (Dionna Kasper)
Julia Patterson ‘24	In pursuit of understanding the physiological mechanism of the novel tumor suppressor LactB (Henry Higgs)
Lynne Li ‘24	Fabrication and Characterization of 3D Printable Ceramic Resins for Tissue Engineering (Katherine Hixon)
Vaishnavi Katragadda ‘24	Probing the Binding Mechanism of a Small Molecule Drug to the Disordered Domain of the Androgen Receptor (Paul Robustelli)
Yingze (Mary) Ma ‘24	Optimizing Nanostructured Platinum Catalysts for Polymer Upcycling (Xin Qi)
Ava Neijna ‘23	Evaluating AggR Expression and Purification Methods for Crystallization Trials (Jon Kull)
Andrew Sasser ‘23	Design and Synthesis of Pt Catalysts for Enantioselective Hydration of Racemic Nitriles (David Glueck)
Lewis MacMillan ‘23	Power or Prediction: Applying Data Techniques to understand Organic Charge Transfer Complexes (Jacquelyne Read)

Samantha Hedley ‘23	Progress Towards the Transmembrane Domain Structures of Mitophagy Proteins Atg32 and Atg33 in Saccharomyces cerevisiae (Michael Ragusa)
Theodore Press ‘23	Towards an Understanding of the Thermodynamics of Zinc and Copper Binding to Human Superoxide Dismutase 1 (SOD1) Using Isothermal Titration Calorimetry (ITC) (Dean Wilcox)
Albert Chen ’22	Towards the Development of New Methods for Crosslinking Porous Molecular Crystals (Chenfeng Ke)
Anna Kolln ‘22	An Electrochemical Assessment of Conductive Metal-Organic Frameworks as Electrode Materials for the Detection of Neurochemicals (Katherine Mirica)
Sophia Miller ‘22	Towards Arrays of Metal-Organic Frameworks for the Detection of Ovarian Cancer from Exhaled Air (Katherine Mirica)

Honors Program

The Chemistry Honors Program involves the writing of a thesis based on original experimental, computational or theoretical research. Students whose grades meet the minimum Dartmouth GPA requirement for honors work (3.0 in the major and a 3.0 general GPA average) may arrange with a faculty member to undertake a project under their supervision and apply for admission to the program. The Chemistry Honors Program may include electing Chemistry 87 (*Undergraduate Investigation in Chemistry)* for academic credit up to two times (87.01 and 87.02) but must involve a cumulative research effort that is equivalent to *three* terms of Chemistry 87. Such an effort often involves a combination of Chemistry 87, Chemistry 80, research during a leave term, and part-time research while enrolled in other courses. Upon completion of the work, the student writes a thesis and takes an oral examination. The program is open to qualified seniors and advanced juniors.

Integrated 4+1 AB/MS Programs in Biophysical Chemistry and in Chemistry

The Department offers a 4+1 program to provide Dartmouth undergraduate students with an opportunity to acquire a broader and deeper education in modern techniques of biophysical chemistry through a combination of coursework and independent research under the direction of one of the program faculty. By integrating undergraduate courses and a substantial independent research effort during the senior year, the MS can be obtained in one year directly after completing the AB degree (generally in Biophysical Chemistry). Interested students should contact Professor Dale Mierke no later than the beginning of winter term of the junior year.

The Department also offers a 4+1 program to provide Dartmouth undergraduate students with an opportunity to acquire a broader and deeper education in modern techniques of chemistry through a combination of coursework and independent research under the direction of one of the program faculty. By integrating undergraduate courses and a substantial independent research effort during the senior year,

the MS can be obtained in one year directly after completing the AB degree in Chemistry. Interested students should contact Professor David Glueck no later than the beginning of winter term of the junior year.

Advising

The Department's Undergraduate Advising Committee (UAC), as well as other members of the Chemistry faculty, assists students in planning their major, selecting graduate schools and making other career choices. For those pursuing a career in medicine, a faculty member often writes a composite letter of recommendation for admission to medical school.

Career Opportunities

Students majoring in chemistry have a wide variety of careers available to them:

Chemistry. The Department receives information and advises students regarding graduate study in chemistry and jobs in industry or government upon graduation. A placement service is available to all students.

Medicine. Many students use a major in chemistry as a rigorous basis for medical studies leading to a career in medical practice or research. It should be noted, however, that medical schools do not require chemistry or another science major, and many future medical students complete a major outside of the sciences.

Biochemistry. Students interested in biochemistry can choose to major in Biological Chemistry or Biophysical Chemistry in the Chemistry Department or Biochemistry and Molecular Biology in the Biology Department. Both routes provide a suitable basis for graduate study in biochemistry or molecular biology.

Environmental Science. Majors can use courses from the Environmental Studies Program to relate chemistry and other sciences to environmental problems. Other environmental studies courses relate science to policy formulation, education, and public action. Students have used such backgrounds as preparation for graduate work in environment and natural resource programs, as well as for immediate employment with consulting companies and public interest organizations.

Secondary School Teaching. Students interested in a career in secondary school teaching will supplement or modify their major with suitable courses in education, including a term of practice teaching.

Engineering, Business, and Law. An occasional chemistry major goes on to graduate study in engineering or in fields outside of science, such as business administration or law, in which training in a scientific discipline can lead to special opportunities. Chemists sometimes serve as members of teams dedicated to research, planning, and services in many fields of human activity.

Chemical Engineering. Students who are interested in chemical engineering should consult at the earliest opportunity with members of the Chemistry and Thayer (engineering) faculties regarding suitable programs.

Facilities and Programs

The undergraduate major receives many benefits from our competitive graduate program and from initiatives in biochemistry (BioMolecular Targeting, bioMT) and material science (NH BioMade). Research in the general fields of inorganic, organic, physical, computational, theoretical, and biological chemistry is supported by modern instrumentation, computers and a first-rate library, including computer-assisted literature searches. Almost all the research laboratories are in a state-of-the-art chemistry facility, Burke Laboratory. All majors are welcome to attend the weekly departmental colloquium, which features speakers from other universities and from industry. Undergraduate research students also attend the meetings of their research group and graduate courses allow advanced undergraduates to pursue specific interests as these develop. The Chemistry faculty is committed to high quality teaching and mentoring of students from diverse backgrounds. We believe that we have one of the best undergraduate chemistry programs available at any college or university.

Some Statistics for the Department of Chemistry

Research and Teaching Faculty	17
Research Faculty	3
Adjunct Faculty	10
Lecturers	2
Research Scientists	4
Research Associates (Post-doctoral fellows)	16 (on average)
Staff	8
Chemistry Majors & Minors graduating each year	12 (on average)
Ph.D. degrees completed each year	8 (on average)

Major Research Equipment

(available for hands-on use by qualified undergraduates)

- Nuclear Magnetic Resonance (NMR) Spectrometers, 500 MHz and 600 MHz
- Electron Paramagnetic Resonance (EPR) Spectrometer
- Liquid Chromatography/Mass Spectrometers (LC-MS)
- Gas Chromatography/Mass Spectrometers (GC-MS)
- High Performance Liquid Chromatographs (HPLC)
- Gas Chromatographs (GC)
- UV/Visible/NIR Spectrophotometers
- Laser Transient Absorption Spectrophotometer
- Circular Dichroism (CD) Spectrophotometers
- Fourier Transform Infrared (FTIR) Spectrometers
- Atomic Force Microscope (AFM) – Raman Spectrometer
- Isothermal Titration Calorimeters (ITC)
- Differential Scanning Calorimeters (DSC)
- X-ray Diffractometers, single-crystal and powder

If you have any questions, please feel free to contact:

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