UR Chemistry

The Undergraduate's

Insider's Guide

2022-2023

Contents

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Introduction

What is this booklet about?

This booklet was designed as an informal guide for undergraduates considering a chemistry major at the University of Rochester. The material and comments are from chemistry majors and our faculty advisors. We believe the Chemistry Department at the University of Rochester is exceptional and wish to share this information with students who have an aptitude and interest in the chemical sciences.

This Insider's Guide is filled with the insights of students who have "been there." This booklet is revised yearly as other students (possibly you) provide insights and ideas to be shared with others.

In short, we hope you will join us and be part of one of the best departments on campus! We hope you will accept this booklet in the spirit it was written in and share our enthusiasm for the opportunities available. Most of all, we welcome your comments.

Please submit
comments or recommendations
for this booklet to:

Elaine Maholick
Administrative Assistant
Undergraduate Program
& Development Office
Department of Chemistry
Hutchison Hall, Room 404D
Email: ugradadm@chem.rochester.edu

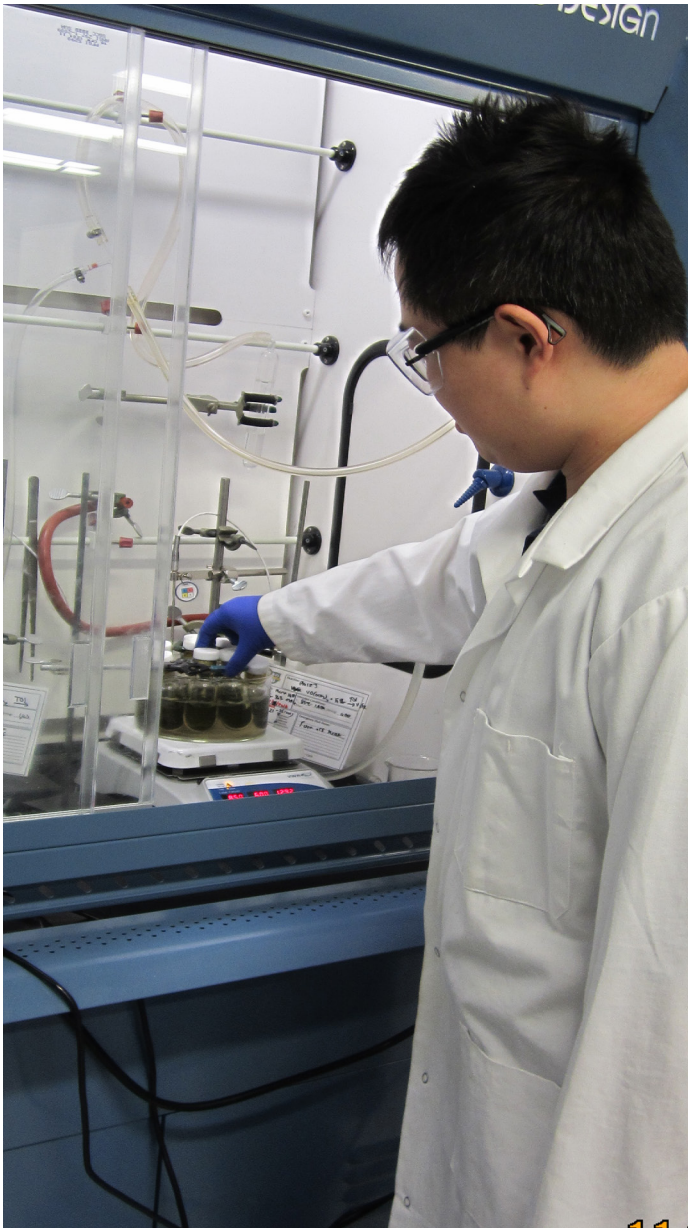
A Word About the UCC...

The ***Undergraduate Chemistry Council*** is a student-run group of chemistry enthusiasts that aims to bridge the gap between students and faculty, while fostering a love of chemistry. We have monthly lunches with professors, conduct exciting (and oftentimes explosive) demonstrations to local K-12 students, and host peer research talks, just to name a few. We are an active chapter of the American Chemical Society Student Affiliates. This club is free to join and open to new members of any class year and experience level.

Join us on CCC (ccc.rochester.edu/ucc/home), and catch us on Facebook (www.facebook.com/RocChemCouncil) for updates on current happenings!

IS CHEMISTRY FOR ME?

For a student fresh out of high school, where most of the course selection was done for you, the difficult decisions involved in choosing a major, picking enjoyable elective courses, and putting together a program to suit your needs and interests can be a bit unnerving. The only basis you have for your decisions may be one or two high school courses in each science subject. Fortunately, the first two years of college are quite flexible and it is possible to take courses in a variety of fields before choosing a major.



A quick glance at the course requirements for majors in chemistry, biology, biochemistry, and chemical engineering will reveal similar course requirements for all, at least during the first two years. All of the aforementioned majors require at least two semesters each of mathematics and physics and four semesters of chemistry courses. Physics and mathematics majors can follow this general format as well. Thus, one plan of action may be to take courses in most of the previously mentioned fields and let the decision of choosing a major sit on the back burner until you have explored all of the options. A few hours spent with the course requirements for all science degrees will convince you of the common requirements and will hopefully relieve some of the anxiety associated with choosing a major.

If you are reading this as a sophomore or a junior and want to become a chemistry major, please see one of the undergraduate chemistry advisors (page 3). They can help you decide how to best arrange your schedule to fulfill the laboratory requirements and continue on as a chemistry major. Another option is to minor in chemistry. The requirements (see the official Undergraduate Bulletin (www.rochester.edu/bulletin) are identical to those for anyone pursuing any biology or chemical engineering degree, supplemented with two upper-level chemistry courses.

Your chemistry professors are perhaps your most indispensable resource for information about chemistry as a profession and the Undergraduate Chemistry Program at the University of Rochester. Talk to them. A member of the Undergraduate Studies Committee is a good start (p. 3), but also feel free to speak with other professors. Peer advisors, graduate students and postdoctoral students may also provide information and invaluable guidance about future careers. Planning a course load that does not cut off your options for majors, as well as discussing your interests and goals with your professors, will undoubtedly make your educational experience at the University of Rochester both enjoyable and profitable.

Undergraduate Studies committee

The Chemistry Undergraduate Studies Committee (USC) serve as academic advisors and handle undergraduate student concerns including declaration of a major or minor, petitions for waiver or substitution of program requirements, and other curriculum or program questions. Faculty listed below have primary responsibilities for undergraduate studies. All USC committee members are "authorized signatures" for required paperwork to declare a major or minor in chemistry. Petitions for transfer of credit (Course Approval Forms) should be directed to the Undergraduate Program Coordinator.

In addition to the USC committee members, students may contact any of our other faculty or a Peer Advisor with questions. We also welcome you to stop by and visit the Undergraduate Studies Office (Hutch 404D) anytime during normal business hours.

Elaine Maholick
Administrative Assistant
Undergraduate Program & Development
(585) 276-3663
ugradadm@chem.rochester.edu
Hutchison 404D

Faculty Advisors

Prof. Alison Frontier
Chair, Undergraduate Studies Committee
(585) 275-2568
alison.frontier@rochester.edu
Hutchison 414
Interests: Synthetic organic chemistry; synthesis of bioactive natural products; pericyclic reactions; asymmetric catalysis; cationic cascades

Prof. Ignacio Franco
(585) 275-8209
ignacio.franco@rochester.edu
Hutchison 454
Interests: Physical and Theoretical Chemistry

Prof. Joseph Dinnocenzo
(585) 275-8351
Hutchison 463
jpd@chem.rochester.edu
Interests: Mechanistic and physical organic chemistry

Dr. Ben Hafensteiner
(585) 275-1936
benjamin.hafensteiner@rochester.edu
Hutchison 124
Interests: Chemical education; total synthesis of natural products; organic synthesis; reaction invention and investigation; cascade reactions

Prof. David McCamant
(585) 276-3122
david.mccamant@rochester.edu
Hutchison B30
Interests: Ultrafast spectroscopy of molecular dynamics in photochemistry; mechanisms of vibrational relaxation

Prof. John-Carl Olsen
(585) 275-8308
john-carl.olsen@rochester.edu
Hutchison 112B
Interests: Chemical education; topologically non-trivial molecules and metal-ligand assemblies; nanoparticles for drug delivery; total synthesis

Prof. Wolf-Udo Schröder
(585) 275-8263
w.udo.schroeder@rochester.edu
Hutchison 466
Interests: Dynamics of Complex Nuclear Reactions at intermediate and high energies

Prof. Courtney Stanford
(585) 273-4988
courtney.stanford@rochester.edu
Hutchison B19, 112A/114A
Interests: Chemistry Education, Lab Development, Active Learning Pedagogy

Peer Advisors

In addition to our Undergraduate Studies Committee, students our encouraged to consult with one of our Chemistry Peer Advisors. Our current Peer Advisors are chemistry majors in their senior year and have gone through training with the College Center for Advising Services. They can help students with planning their program of study, or to make connections with faculty, review research opportunities, explore study abroad options as well as independent and interdisciplinary study. If they can't answer your question, they are happy to point you in the right direction. You may also want to contact the College Center for Advising Services directly with any general questions at cascas@mail.rochester.edu.

Elise Gendrich

Email: egendric@u.rochester.edu

Major: Chemistry (BA)

Research Experience: I do electrochemistry and photochemistry in the Bren Group; specifically, I do nitrate/nitrite reduction using an iron-containing small molecule catalyst

Activities: Workshop leader for CHEM 203 and 132, member of Hillel, Off Broadway On Campus (OBOC), and The Opposite of People (TOOP), secretary of Undergraduate Chemistry Society (UCS)

Aidan Kropiwnick

Email: akropiwn@u.rochester.edu

Major: Chemistry (BS) & Environmental Science (BA)

Research Experience: I've been working on expanding the methodology for palladium catalysis with Dr. Paradine in her lab since the beginning of last Summer (so just over one year!) and plan to continue this research all through my senior year. I'm majoring in environmental science as well as chemistry, but haven't pursued any research in that field

Activities: I'm a member of the Track & Field team here at Rochester, and I lifeguard at the GAC on weekends

Choosing a degree

Choice of Undergraduate Degrees: B.A. and B.S.

Many students are concerned about the relative advantages of the Bachelor of Science and Bachelor of Arts degrees. The Undergraduate Bulletin (www.rochester.edu/bulletin) suggests that a B.S. is the way to go for those who wish to pursue a career in chemistry, and that the B.A. is appropriate for people considering a career in medicine or dentistry, for example. This is not always true. The B.A. requirements, when prudently supplemented, can also prepare one very adequately for graduate study in chemistry.

The simplest way to sort out which degree is best for you is to think about your career and educational goals. If your ambition is to attend medical, dental or law school, the B.A. degree will offer more flexibility in choosing other premedical/pre-dental courses. However, the B.A. can also be supplemented with senior research and perhaps a graduate course in chemistry and can adequately prepare one for a career in chemistry.

The B.A. is also more appropriate when a student desires to have a double major, for example. The B.A. is constructed to encourage interdisciplinary studies. If you desire to get a job or attend a graduate program in chemistry immediately after college in the chemical industry, a B.S. program will suit your needs. Our B.S. degree program has additional requirements in chemistry and supporting sciences. It is also an American Chemical Society (ACS) approved program, which may provide some advantage in terms of employment.

The B.A. and the B.S. degree programs share a common curriculum for the first three semesters, and normally students declare by the end of their sophomore year. There's more information regarding declaring a major online at: www.rochester.edu/college/sophomores/declare/artsandsciences.html.

Double Major/Double Degree Programs

Students who are interested in pursuing a double major or double degree are advised to consult the College website where it outlines course overlap rules and additional credit requirements.

- College Center for Advising Services (CCAS) Major Advising Information:
www.rochester.edu/college/ccas/handbook/Majors.html

- Double Majors:
www.rochester.edu/college/ccas/undergraduate/curriculum/majors.html#doublemajor

- Overlap Policies:
www.rochester.edu/college/ccas/handbook/overlap.html

In addition, we strongly suggest you speak to one of our Chemistry Faculty Advisors.

B.A. REQUIREMENTS

The B.A. program makes fewer specifications at the advanced level than the B.S. degree and encourages a wider range of elective courses. It is particularly suitable for students with interdisciplinary scientific interests in the health professions, biology, physics, geological sciences, engineering or education. B.A. students may elect advanced courses in chemistry, including independent research, and can, thereby, create a curriculum best suited to their individual interests.

REQUIREMENTS

Student are required to take at least 39 credit-hours in chemistry, and at least 59 credit-hours overall.

- General Chemistry (4 credits)
  - CHEM 131: General Concepts I (or equivalent AP)

- Organic Chemistry (9 credits)

Standard Sequence
- CHEM 203 - Organic Chem. I
- CHEM 204 - Organic Chem. II
- CHEM 207 - O. Chem. Lab II (1 credit)

OR

Freshman Organic Sequence
- CHEM 171 - Freshman Organic Chem. I
- CHEM 172 - Freshman Organic Chem. II
- CHEM 173 - Freshman Organic Chem. Lab II

- All of the following theory courses (12 credits)
  - CHEM 132: Chemical Concepts II
  - CHEM 211: Inorganic Chemistry
  - CHEM 251: Physical Chemistry I
  - CHEM 252: Physical Chemistry II

- Two of the following laboratory courses (6-8 credits)
  - CHEM 210W: Organic Chemistry Lab II (2 credits)
  - CHEM 231W: Chemical Instrumentation (4 credits)
  - CHEM 232: Molecular Spectroscopy (4 credits)
  - CHEM 234: Advanced Laboratory Techniques (4 credits)
  - CHEM 244W: ANSEL (Advanced Nuclear Science Education Laboratory) (4 credits)
- Two additional 200-level (or higher) chemistry courses or other science courses approved by USC
- Satisfaction of the upper-level writing requirement
- Mathematics Coursework (12-16 credits)

MATH 140 Sequence (12 cr)
- MATH 141, MATH 142, and MATH 143 (Calculus I, II, & III)

OR

MATH 160 Sequence (8 cr)
- MATH 161, and MATH 162 (Calculus IA & IIA)

Plus one of the following:
- MATH 163, 165, STT 201, 211, 212, CSC 161, 171

- Physics Coursework (8 credits)

PHYS 113-114 Sequence
- PHYS 113 and PHYS 114 (General Physics I & II)

OR

PHYS 121-123 Sequence
- PHYS 121, PHYS 122, and PHYS 123 (Mechanics and Electricity & Magnetism)

OR

PHYS 141–142 Sequence
The Honors Sequence of Mechanics and Electricity & Magnetism

B.A. SAMPLE PROGRAM OF STUDY

Regular Sequence

First Year

Fall	Spring
• CHEM 131	• CHEM 132
• MATH 141/161	• MATH 142/162
• Elective	• Elective
• Elective	• Elective

Second Year

Fall	Spring
• CHEM 203	• CHEM 204
• MATH 207 (1 cr)	• MATH 210W
• PHYS 113	• PHYS 114
• MATH 143 or Elective	• MATH 163/165

Third Year

Fall	Spring
• CHEM 211	• CHEM 232
• MATH 251	• CHEM 252
• Elective	• Elective
• Elective	• Elective

Fourth Year

Fall	Spring
• CHEM 231	• CHEM 234 (or CHEM 2XX)
• 200 level Sci	• Elective
• Elective	• Elective
• Elective	• Elective

Freshman Organic Sequence

First Year

Fall	Spring
• CHEM 171	• CHEM 172
• CHEM 173 (1 cr)	• CHEM 210W
• MATH 161	• MATH 162
• Elective	• PHYS 121
• Elective	• Elective

Second Year

Fall	Spring
• CHEM 211/132	• CHEM 234/244W
• PHYS 122/113	• PHYS 123/114
• MATH 163/165	• MATH/CSC/STT
• Elective	• Elective

Third Year

Fall	Spring
• CHEM 232	• CHEM 232
• MATH 251	• CHEM 252
• Elective	• Elective
• Elective	• Elective

Fourth Year

Fall	Spring
• CHEM 393	• CHEM 393
• CHEM 400 level	• CHEM 262/BIOL 250
• Elective	• Elective
• Elective	• Elective

Notes:

- Total: at least 39 credit-hours in chemistry, and at least 59 credit-hours overall
- The Freshman Organic sequence is designed for first year students with good preparation in chemistry (e.g., two years of general chemistry and an Advanced Placement score 4 or 5, or equivalent preparation). This sequence fast tracks students to more advanced chemistry courses and the fulfillment of degree requirements in other disciplines.
- B.A. candidates considering employment in the chemical profession or graduate work in chemistry should include: CHEM 210, 211, 231, 232, 251, and 252 in their curriculum.
- Approved 200-Level Courses for the Chemistry Program that will satisfy the requirement of Two additional 200-level (or higher) chemistry courses (8 credits) are listed online at: www.chem.rochester.edu/undergrad/200lvl.php.
- Students should speak with a chemistry advisor to tailor their programs specifically to their career goals. Particular electives that are not included in the chemistry curriculum may be required for some graduate programs.
- Students who are interested in pursuing a double major or double degree, are advised to consult the College website which outlines the course overlap rules and additional credit requirements.

B.S. REQUIREMENTS

The B.S. program is designed primarily for students who anticipate professional careers in chemistry and related sciences. The program provides the range of knowledge, skills, and experience required for work as a professional chemist or for entry into graduate studies in chemistry. The fundamental work is completed by the end of the third year, leaving the senior year free for graduate-level coursework and a full year of independent research with one of the department faculty. **The B.S. program that includes a biochemistry course meets all of the requirements for an American Chemical Society approved degree.**

REQUIREMENTS

Student are required to take at least 55 credit-hours in chemistry, and at least 85 credit-hours overall.

- One General and Organic Chemistry Sequence (Standard or Freshman Organic Sequence - 16-21 credits)

Standard Sequence

- CHEM 131 - Chemical Concepts I (or AP equiv.)
- CHEM 132 - Chemical Concepts II
- CHEM 203 - Organic Chem. I
- CHEM 204 - Organic Chem. II
- CHEM 207: Organic Chemistry Lab I (1 credit)
- CHEM 210W: Organic Chemistry Lab II (2 credits)

OR

Freshman Organic Sequence

- CHEM 131 - Chemical Concepts I (or AP equiv.)
- CHEM 171 - Freshman Organic Chem. I
- CHEM 172 - Freshman Organic Chem. II
- CHEM 173: First-Year Organic Chem. Lab I (1 credit)
- CHEM 210W: Organic Chemistry Lab II (2 credits)

- All of the following theory courses (20 credits)
  - CHEM 211: Inorganic Chemistry
  - CHEM 251: Physical Chemistry I
  - CHEM 252: Physical Chemistry II
  - CHEM 262/BIOL 250/BIOL 252: Biochemistry

- All of the following laboratory courses (12 credits)
  - CHEM 231W: Chemical Instrumentation
  - CHEM 232: Molecular Spectroscopy
  - CHEM 234: Advanced Laboratory Techniques*

  **CHEM 234 may be replaced by CHEM 244W (ANSEL) or an Approved Laboratory Course in another science department.*

- 400-Level/Graduate Level Chemistry Course (4 credits)
- Senior Thesis Research CHEM 393 (8 credits)
- Satisfaction of the upper-level writing requirement
- Mathematics Coursework (16-20 credits)

MATH 140 Sequence (12 cr)

- MATH 141, MATH 142, and MATH 143 (Calculus I, II, & III)

OR

MATH 160 Sequence (8 cr)

- MATH 161, and MATH 162 (Calculus IA & IIA)

Plus one of the following:

- MATH 165, 163

Plus one of the following:

- MATH 164, STT 201, 211, 212, CSC 161, 171, Any 200 level math course

- Physics Coursework (8 credits)

PHYS 113-114 Sequence

- PHYS 113 and PHYS 114 (General Physics I & II)

OR

PHYS 121-123 Sequence*

- PHYS 121, PHYS 122, and PHYS 123 (Mechanics and Electricity & Magnetism)

OR

PHYS 141–142 Sequence

The Honors Sequence of Mechanics and Electricity & Magnetism

*We recommend students take the PHYS 121–123 series. The sequence begins in the spring with PHYS 121.

B.S. SAMPLE PROGRAM OF STUDY

Regular Sequence

First Year

Fall	Spring
• CHEM 131	• CHEM 132
• MATH 161	• MATH 162
• Elective	• PHYS 121
• Elective	• Elective

Second Year

Fall	Spring
• CHEM 203	• CHEM 204
• MATH 207 (1 cr)	• MATH 210W
• MATH 163/165	• MATH/CSC/STT
• PHYS 122/113	• PHYS 123/114
• Elective	• Elective

Third Year

Fall	Spring
• CHEM 211	• CHEM 232
• MATH 231	• CHEM 234/244W
• MATH 251	• CHEM 252
• Elective	• Elective

Fourth Year

Fall	Spring
• CHEM 393	• CHEM 393
• CHEM 400 level	• CHEM 262/BIOL 250
• Elective	• Elective
• Elective	• Elective

Freshman Organic Sequence

First Year

Fall	Spring
• CHEM 171	• CHEM 172
• CHEM 173 (1 cr)	• CHEM 210W
• MATH 161	• MATH 162
• Elective	• PHYS 121
• Elective	• Elective

Second Year

Fall	Spring
• CHEM 211/132	• CHEM 234/244W
• PHYS 122/113	• PHYS 123/114
• MATH 163/165	• MATH/CSC/STT
• Elective	• Elective

Third Year

Fall	Spring
• CHEM 232	• CHEM 232
• MATH 251	• CHEM 252
• Elective	• Elective
• Elective	• Elective

Fourth Year

Fall	Spring
• CHEM 393	• CHEM 393
• CHEM 400 level	• CHEM 262/BIOL 250
• Elective	• Elective
• Elective	• Elective

Notes:

- Total: at least 55 credit-hours in chemistry and at least 85 credit-hours overall
- The Freshman Organic sequence is designed for first year students with good preparation in chemistry (e.g., two years of general chemistry and an Advanced Placement score 4 or 5, or equivalent preparation). This sequence fast tracks students to more advanced chemistry courses and the fulfillment of degree requirements in other disciplines.
- CHEM 234 may be replaced by CHEM 244W (ANSEL) or an Approved Laboratory Course in another science department, listed at: http://www.chem.rochester.edu/undergrad/200lvl.php.
- We recommend students take the PHYS 121–123 series. The sequence begins in the spring with PHYS 121.
- BS Students must prepare a senior research thesis, and have the thesis read and approved by the research adviser and a second faculty member in Chemistry.
- At least four credits of a 400-level chemistry course may be taken anytime during the junior or senior year.
- Students should speak with a chemistry advisor to tailor their programs specifically to their career goals. Particular electives that are not included in the chemistry curriculum may be required for some graduate programs.
- Students who are interested in pursuing a double major or double degree, are advised to consult the College website which outlines the course overlap rules and additional credit requirements.

Undergraduate Research Emphasis

The Chemistry Department provides a variety of opportunities for undergraduates to participate in research programs during the academic year and the summer. Faculty members welcome undergraduates in their research groups and usually arrange a close collaboration with graduate students and postdoctoral fellows. These symbiotic interactions provide opportunities for students to work with the latest equipment and ideas in modern chemical science, in an environment that provides close mentoring and support.

Senior Research (CHEM 393), can be the most rewarding and fulfilling course that you take at the University of Rochester. It is required for the B.S. degree and optional for the B.A. degree. Although two semesters of CHEM 393 are specified as being Senior Research, any undergraduate may work with a professor as part of his/her research team during their Freshman, Sophomore, or Junior years. Often this is done as Independent Research (CHEM 395).

To start, you need to find out what kind of chemistry appeals to you. Then, speak directly with the professor who does that kind of research to ask if there are openings. Showing an interest in the group's work helps a lot! To find out the areas in which professors are working, it is helpful to see the research and teaching interests pages located in this document, and on our website at www.sas.rochester.edu/chm/people/faculty/index.html.
Once you have narrowed your field of interest, the next step is to talk with the professors. They can give you a better idea of what they are doing and what you may be able to do. They may suggest that you attend one of their "group meetings" to find out what their group is about. If you decide that you like the area of research, you and the professor can devise an individual research plan and you can begin your work.

A semester of research is worth four credits, whether registered as CHEM 395, Independent Study, or CHEM 393, Senior Research. You should plan on spending at least the equivalent of two afternoons (eight hours) a week in the lab. Most people find themselves spending far more time than this, because the work is fun and the atmosphere is stimulating. The basis for determining your grade for the research course is worked out between the student and the professor as part of registration for independent study or senior research.

The actual research can be both rewarding and frustrating. Sometimes it is exciting, and other times it will drive you crazy; but at all times it teaches you to work independently and gives you an excellent idea of what academic research is all about. Currently, many Chemistry seniors, both B.S. and B.A. candidates, are conducting research with professors. It is extremely easy to do research at the University of Rochester, but you must make the first move.

Summer research

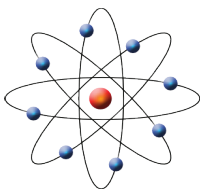
The Chemistry Department also provides support for undergraduate students from Rochester and other institutions during the summer, using funds from a variety of sources. Rochester is a **National Science Foundation (NSF) Research Experience for Undergraduates (REU)** site, providing funding for eight students per summer from other institutions along with funding for University of Rochester students. UR students are also supported by REACH funds from the Career Center and by research grants to faculty.

In 2015, the Department also inaugurated an **International Summer Fellowship Program** designed to provide outstanding undergraduates in Chemistry from all over the world the opportunity to conduct first class summer research at the University of Rochester.

Summer research students have their own research projects, a specific faculty advisor and a specific day-to-day graduate student or postdoctoral mentor. Everybody participates in a weekly group meeting, reporting to each other on their research projects and results in oral, poster, and written form. Discussions of careers, graduate work, and scientific ethics are also part of the experience.

Research projects are available across the broad landscape of contemporary chemical research: structure, mechanism, dynamics, synthesis, spectroscopy and theory; inorganic, organic, organometallic, physical, biological, polymer, nuclear and environmental chemistry. In addition, there are special research lectures by scientists from the University and industry.

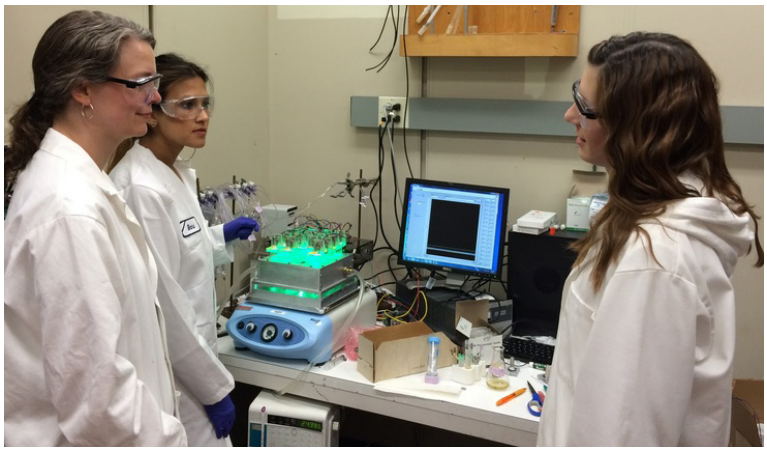
For more information on the **summer undergraduate research programs**, as well as application forms and deadline dates, please see our website at: www.sas.rochester.edu/chm/undergraduate/summer-programs.html, or email URchemREU@chem.rochester.edu.



Faculty research & teaching interests

Barnett, Brandon, Assistant Professor of Chemistry; Ph.D. 2016, University of California, San Diego. Organometallic chemistry, porous materials, molecular separations, catalysis.

Bren, Kara L., Richard S. Eisenberg Professor in Chemistry; Ph.D. 1996, California Institute of Technology. Bioinorganic and biophysical chemistry: engineered metalloprotein and metallopeptide analysis for solar fuels, biological and nanotechnological systems for solar energy conversion, heme protein structure and function, protein dynamics.



Dinnocenzo, Joseph P., Professor; Ph.D. 1983, Cornell University. Chemistry of organic ion radicals; mechanistic and physical organic chemistry; design and testing of new photoresponsive polymeric materials.

Fasan, Rudi, Andrew S. Kende Professor; PhD. 2005, University of Zurich. Bioorganic chemistry and chemical biology; biomolecular engineering; chemoenzymatic synthesis. Current interests include development of chemo-biosynthetic strategies to construct and evolve macrocyclic compounds for modulating protein-protein interactions and asymmetric catalysis, and development of enzyme engineering and chemoenzymatic methods for functionalization of aliphatic C-H bonds in complex molecules.

Franco, Ignacio, Associate Professor; Ph.D. 2007, University of Toronto. Physical and Theoretical Chemistry. Theory and computation as applies to dynamical processes occurring at the nanoscale; Control over the behavior of matter by means of external stimuli; Laser control of electronic properties and dynamics; Electronic decoherence in molecules; Theory and simulation of single-molecule pulling processes; Novel spectroscopies and control in single-molecule junctions.

Frontier, Alison J., Professor, PhD. 1999, Columbia University. Synthetic organic chemistry; synthesis of bioactive natural products; pericyclic reactions; asymmetric catalysis; cationic cascades.

Hafensteiner, Benjamin, Faculty lecturer; Ph.D. 2008, The Scripps Research Institute. Chemical education; total synthesis of natural products; organic synthesis; reaction invention and investigation; cascade reactions.

Huo, Pengfei, Associate Professor; Ph.D. 2011, Boston University. Physical and Theoretical Chemistry, Ab-initio dynamics for understanding chemistry and photo physics of solar energy conversion.

Jones, William D., C.F. Houghton Professor; Ph.D. 1979, California Institute of Technology. Mechanisms of reactions of transition metal organometallic compounds; activation of carbon-hydrogen, carbon-carbon, and carbon-fluorine bonds by transition metal complexes; transition metals as catalysts for the desulfurization of thiophenes in oil.

Kennedy, C. Rose, Assistant Professor; Ph.D. 2017, Harvard University. Catalysis & Synthetic Methods, Organometallic Chemistry, Mechanistic & Physical Organic Chemistry. Research is directed toward the development of sustainable chemo-, regio-, and stereoselective catalytic methods for the valorization of chemical feedstock (ranging from petrochemicals to biomass to anthropogenic waste) to produce useful building blocks and materials for applications in chemical synthesis.

Knowles, Kathryn, Assistant Professor; Ph.D. 2013, Northwestern University. Inorganic materials chemistry; synthesis and characterization of colloidal nanocrystals and nanostructured thin films; investigation of structure-function relationships between surface chemistries/morphologies and photoelectrochemical behavior. Techniques include spectroelectrochemistry, photoconductivity, and time-resolved optical spectroscopy.

Faculty research & teaching interests

Krauss, Todd D., Professor; Ph.D. 1998, Cornell University. Physical chemistry; synthesis and characterization of nanometer scale materials and devices, and mechanisms of protein folding, studied with single molecule photoluminescence spectroscopy, atomic force microscopy, ultrafast and nonlinear optical spectroscopy. Nanotechnological approaches to solar energy conversion and solar fuels production.

Matson, Ellen, Associate Professor; Ph.D. 2013, Purdue University. Inorganic and Organometallic Chemistry. Probing cooperative reactivity between non-traditional ligand platforms and first-row transition metals, specifically their ability to facilitate chemical transformations of industrial, environmental and biological significance.

McCamant, David W., Associate Professor, Ph.D. 2004, University of California, Berkeley. Ultrafast vibrational spectroscopy of structural dynamics in photochemistry, vibrational coupling and relaxation; structural rearrangements and relaxation mechanisms in photo-excited nucleic acids; Ultrafast energy and electron transfer processes relevant for solar energy systems.

Neidig, Michael, Marshall D. Gates, Jr. Professor of Chemistry; Ph.D. 2007, Stanford University. Physical-inorganic chemistry and catalysis; elucidation of structure and bonding in non-precious metal catalysts through inorganic spectroscopic methods; studies of reaction intermediates and mechanisms of transition metal catalysis; non-precious metal organo-metallic, biological and heterogeneous catalysis.

Nilsson, Bradley L., Professor; Ph.D. 2003, University of Wisconsin. Bioorganic chemistry and chemical biology; study of pathogenic amyloid self-assembly in processes relevant to Alzheimer's disease and HIV infection; design and synthesis of novel self-assembled peptides as materials for biological applications.

Olsen, John-Carl, Assistant Professor of Teaching; Ph.D. 2010, UCLA. Chemical education; topologically non-trivial molecules and metal-ligand assemblies; nanoparticles for drug delivery; total synthesis.

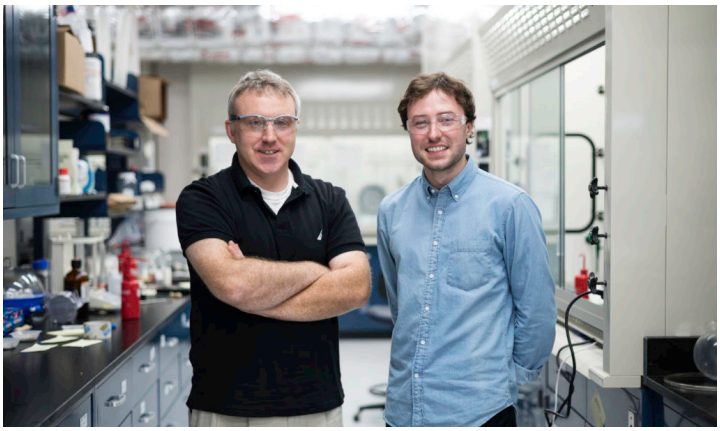
Paradine, Shauna, Assistant Professor of Chemistry; Ph.D. 2015, University of Illinois at Urbana-Champaign. Organic Chemistry and Organometallic Chemistry.

Partridge, Benjamin, E., Assistant Professor of Chemistry; Ph.D. 2018, University of Pennsylvania. Supramolecular chemistry; Bioinspired materials; Self-assembly in water; Protein engineering

Rothberg, Lewis, Professor; Ph.D. 1983, Harvard University. Physical chemistry: Photophysics relevant to function of organic electronic devices, metal nanoparticle-enhanced molecular spectroscopy, biomolecular sensing.

Schröder, Wolf-Udo, Professor, Ph.D. 1971, Technical University of Darmstadt, Germany. Basic and applied nuclear science: Transport and relaxation processes in nuclear reactions, thermodynamics of hot atomic nuclei. Laser induced ion acceleration and thermo-nuclear reactions. Radio-tracers in tritium transport and nuclear forensics. Radiation detector instrumentation.

Stanford, Courtney, Assistant Professor of Teaching; Ph.D. 2016, University of Iowa. Chemistry Education: focus on the teaching and learning of chemistry by developing inquiry based laboratory experiments, examining student and instructor interaction in active learning pedagogies, and building connections between the macroscopic, submicroscopic, and symbolic levels of chemistry.



Turner, Douglas H., Professor; Ph.D. 1972, Columbia University. Biophysical chemistry: nucleic acid structure and function, prediction of RNA structure from sequence, RNA folding, influenza RNA and therapeutics to target RNA.

Teaching & employment

Teaching Opportunities

There are several ways for you to become actively involved in the teaching programs in the department as a recitation or laboratory teaching assistant or as a Workshop leader. These positions offer you opportunities to put your knowledge to work to help others learn, to develop new communication and leadership skills, and to test out your interest in teaching. In addition you will find that you develop new relationships with the faculty, the department, and the College. These are paying jobs, so you can start to get some financial rewards from your studies.

The Chemistry Department is the leader in the College supported Workshop Program. There are opportunities to lead workshops in general chemistry, organic chemistry, and in some advanced courses. Most Workshop leaders also earn credit in CAS 352, Issues in Group Leadership, and CAS 355 Group Leadership Seminar. Teaching Assistantships and Workshop leader positions are available in both semesters and in the summer. Applications are available in the department office. Workshop leader positions are by invitation, but you should not hesitate to make your interests known to faculty teaching workshop courses.

Considering a career in teaching? The University of Rochester now offers the Robert Noyce Scholarship Program for Math & Science Teachers through our Warner School of Education. Noyce scholars participate in high-quality programs leading to a master's degree and New York State certification to teach in mathematics, biology, chemistry, physics, and earth science in grades 7-12. The program can be completed in 15 months by full-time students who start in the summer. The Warner School also offers a Fifth Year in Teaching Scholarship for University of Rochester undergraduates, which enables a master's degree with only one extra year of study. For more information on both of these innovative programs, visit www.warner.rochester.edu.

Undergraduate Employment Opportunities

There are a number of employment opportunities for undergraduates within the Chemistry Department. These positions are not only modestly financially rewarding but are also educational and provide good work experience. Positions are available year-round for those with an inclination to work and the initiative to ask. Both clerical and technical positions are available.

The most common type of employment offered by the Chemistry Department is the job of Teaching Assistant as mentioned above. Undergraduates serve as TA's in recitations, workshops, and laboratories. Applications for TA jobs can be obtained from Donna Dolan, in Hutchison Hall 404C, the semester before the course you want to TA is scheduled. Fill out the application and return it to her. If you are selected, you will be contacted. Chemistry courses are also taught in the summer, so a few TA's are needed during this time.

The chemistry library

The Carlson Science and Engineering Library is located in the Computer Studies Building and is attached to Hutchison Hall. It includes most chemistry books and older journals, as well as books in related subjects such as biology, computer sciences, and engineering. During the school year the Library is open Monday-Thursday 8:00 a.m. - 2:00 a.m., Friday 8:00 a.m. - midnight, Saturday 10:00 a.m. - midnight and Sunday 11:00 a.m. - 2:00 a.m.. Up-to-date information about the Library and the hours the reference disk is staffed is available at: library.rochester.edu/spaces/carlson

The Chemistry Librarian, Sue Cardinal, and other library staff are dedicated to working closely with students and faculty to create an outstanding educational experience. Electronic and print versions of books, journals, and search engines required for chemistry courses and research are actively purchased or subscribed to. If the Library does not have immediate access to a needed journal or book, copies can be obtained very quickly through interlibrary loan at no cost to the student. Students are welcome to suggest books and journals for the Librarian to purchase or subscribe to.

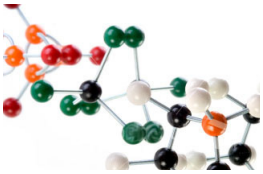
Sue Cardinal collaborates with faculty when courses have assignments that require information searching and management. She posts a list of useful library resources for each course to libguides.lib.rochester.edu/ChemistryList. Beginning in the student's first year, she teaches students about relevant resources and information seeking skills in their classes. She makes appointments to assist individuals with library research. Students learn which reference books and websites to use to answer specific questions and learn the optimum strategies for finding properties (melting point, spectra, dielectric constants, etc.), syntheses, and other information needed to plan experiments. This includes learning to search for substances that exactly match a drawn structure or that contain a specified subset of bonds and atoms, as well as finding these substances as part of reactions. Students learn to use databases including SciFinder (Chemical Abstracts), Reaxys, Science Citation Index Expanded, Medline, and resources on the internet. Students are well prepared for their professional careers as a result of four years of working closely with the Chemistry Librarian and the excellent access to books, journals, and relevant web resources. Chemistry graduates also gain top-notch information searching skills. The Library staff is friendly, knowledgeable, and enjoys working with students and faculty. Each librarian specializes in a specific science subject and several have science degrees.

Current text books are often kept "on reserve" at the Library's circulation and Reserve Desk on the 2nd floor. Some "reserve" items such as problem sets or practice exams are available online and easily obtained from any University computer. Photocopiers are located on the 1st and 2nd floors. Computers are available on all three floors. The reference desk is located on the 1st floor, along with the reference books, and is the best place to ask questions. Students can also ask questions via a chat box on the Library's web page.

Seminars & awards

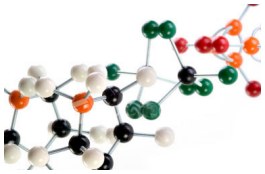
Seminars

Interested students are encouraged to attend departmental seminars which are given by faculty, graduate students and outside speakers. These seminars are on topics not directly covered in undergraduate courses. Although the topics are quite advanced, the seminars can be instrumental in providing opportunities for undergraduates to meet professors and non-faculty scientists. In addition, students can develop a feel for modern chemistry research and terminology. These seminars can be great experience for an undergraduate. To find out the date, time, and subject of the department seminars check the weekly announcement bulletins on the fourth floor and the Chemistry web site. Scheduling of seminars loosely follows this pattern:



Monday, 4:00 p.m.
Wednesday, 12:00 p.m.
Friday, 9:30 a.m.

Physical/Inorganic Chemistry
Chemistry Colloquium
Organic Chemistry



Undergraduate Chemistry Awards

While the main reason for studying chemistry is for insight and understanding, distinctions are awarded to those students who have demonstrated exceptional potential for a contribution to chemistry. The awards are presented by both the Department of Chemistry and the College of Arts and Sciences at the end of each year at graduation or in the fall at the first chemistry department get together. Along with the award, there is generally included some type of prize, either cash, book, a journal subscription, or a membership in a chemistry organization.

Among the awards presented by the Chemistry Department are the ACS Division of Inorganic Chemistry (presented to a sophomore, junior, or senior) and the Carl A. Whiteman Teaching Awards (given to seniors and juniors). Among the awards presented to seniors only are the Dr. E.W. and Maude V. Flagg Awards, John McCreary Memorial Prize, ACS Rochester Section Award, and Chemistry Department Awards. The Department's Undergraduate Studies Committee chooses the recipients of these awards from individuals nominated by individual faculty members and then approved by the entire faculty.

There are also two college-wide awards that could be given to Chemistry majors who are female. The Janet Howell Clark Prize is presented to a senior while the Catherine Block Memorial Fund Prize is awarded to a junior. Both prizes are awarded to women who show promise and potential for achievement in the natural or physical sciences.

None of these awards require applications, interviews, or the like. They are presented to individuals who show extraordinary effort and achievement in their work in chemistry. The only way to win such an award is to keep a standard of academic excellence, a high degree of intellectual curiosity, and, above all, to get the most enjoyment you can from the challenge of studying chemistry. For a complete listing of Undergraduate awards and recipients, please see our website listing at: www.sas.rochester.edu/chm/news-events/awards.html.

Transfer credit & petitions

Requesting Transfer Credit

Elective credit can usually be granted by the College Center for Advising Services. To request equivalent transfer credit for chemistry courses, students should provide the course description from either the course catalog or website (preferred) of the course they plan to take, or have already taken elsewhere, to the chemistry Undergraduate Studies Coordinator (ugradadm@chem.rochester.edu), or to the chemistry faculty member assigned to handle "Approval of Transfer Credit" as listed on the departmental Undergraduate Studies Committee web page (www.sas.rochester.edu/chm/undergraduate/usc.html). The syllabus may also be requested. Please see our general policies regarding General Chemistry and Organic Chemistry transfer credit (www.sas.rochester.edu/chm/undergraduate/policies.html). It is recommended that students obtain approval of transfer credit before taking a course elsewhere when possible.

Students must also complete a Course Approval Form, which needs to include the course number and title of the other school's course, and indicate which corresponding course at the University of Rochester transfer credit is being sought for. Course Approval Forms are available at the College Center for Advising Services counter outside Lattimore 312. Upon completion of the course(s), students need to request that the Registrar at the other school send an official transcript to the College Center for Advising Services.

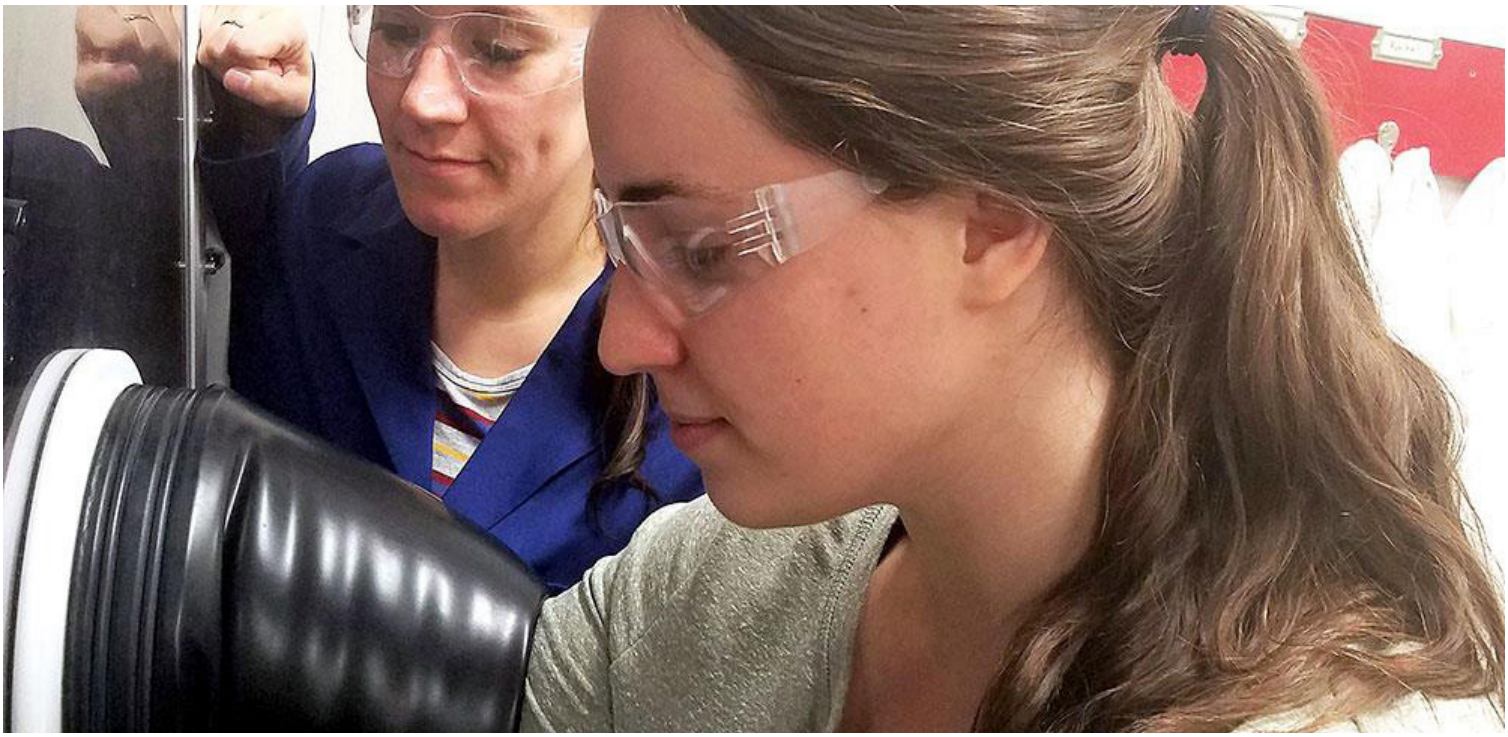
Further information regarding university transfer credit policy is available at: www.rochester.edu/college/CCAS/AdviserHandbook/TransferCrdt.html.

Petitions

Requirements for the Bachelor of Arts and the Bachelor of Science degrees in Chemistry appear in the Undergraduate Bulletin (www.rochester.edu/bulletin), and the most up-to-date listings can be found on the Chemistry Department web site (www.sas.rochester.edu/chm/). Although these requirements may appear to be set in stone with little room for compromise, a Chemistry major may petition the Undergraduate Studies Committee for a course waiver or a course substitution. One can petition for substitution of a laboratory course in another science for a chemistry laboratory course or for a waiver of a course that covers material already learned in another course. A petition should explain the proposed deviation from the requirements and the reason for it. Your petition should be sent by e-mail to the Chair of the Undergraduate Studies Committee (page 3). The petition will be circulated to the committee, and the committee will decide whether or not to grant the request. The petitioner will receive notification of the decision by return e-mail.

The chemistry curriculum is designed to give a well-balanced undergraduate education in chemistry. Petitioning is a way to further optimize your education by allowing you to select special undergraduate courses.

Five-year M.S. program



The Chemistry Department offers a special research based Masters degree program, available only to UR students. By taking advantage of the intensive curriculum in the B.S. Chemistry program and by integrating B.S. and M.S. research, students can make efficient use of their time by accomplishing an M.S. degree with only one additional year beyond the B.S. program. Typically, enrollment in four or five graduate courses in chemistry is distributed over the fourth and fifth years of study. A research program is started in the fourth and continued in the fifth year. Both B.S. and M.S. theses are required. Most fifth year students will devote more than 50% of their time to research. When compared to more traditional course based M.S. programs in chemistry, the Rochester program reduces the time and tuition costs, while increasing the research experience of the graduates.

The five-year program makes no assumptions about the long-term goals of students. Some will choose to continue to study for a Ph.D. while others will choose to go to work as chemists. In either case, the program prepares students who are superbly educated for their subsequent choices. By providing an extended opportunity to pursue basic research, the program also promises to help students decide whether to pursue further study and independent research. Some students will find industrial employment in the summer between the fourth and fifth years of study, thereby acquiring a better understanding of employment opportunities.

Since the program is based on integration of the fourth and fifth years of study, careful planning is required. Students should begin to discuss this program with a faculty advisor when they begin to make decisions about senior research in the spring of their junior year. Formal application and admission to the program follows in fall of the senior year. Some tuition support for the fifth year of study is available; consideration for that support is concurrent with the review for admission.

For more information on the five year Masters program, please contact the Graduate Studies Coordinator at: gradrec@chem.rochester.edu

Applying to graduate school

The process of applying to chemistry graduate school is very similar to that for an undergraduate college but with a different timetable. Although many schools accept applications through February and later, it is wise to start early.

The way to begin is to decide what you want to get out of graduate school. What areas of research interest you the most? What would you like to do after graduate school? Why do you want a doctorate or a master's degree? How much money do you need for your upkeep while in graduate school? Honest answers to these types of questions can focus your search as you ascertain which graduate schools are right for you.

Next, you should look at graduate schools. There are a number of sources of information to be found on campus about graduate schools. In the Career Center Library (in Meliora) and in Rush Rhees one can find Peterson's Guide to Graduate Schools, a catalog listing graduate schools and how to write to them to obtain information such as application deadlines, etc. Graduate school catalogs, which can be found in Carlson, Rush Rhees on microfiche, or from the graduate school itself, are often helpful. Professors and graduate students, especially in your area of interest, can provide a great deal of information not found in the catalogs. Another good source of advice is seniors, who by the end of their senior year have already applied to and been accepted in a graduate program. Once you have narrowed your choices to a few good schools, a visit could be the deciding factor. Once there, talk with professors and graduate students, and look over the campus and surrounding area to see if the school meets your academic and personal expectations.

A few other things one should keep in mind when looking for a graduate school are:

1. What is the acceptance rate for new graduate students at that institution?
2. Are there at least three professors there who do research you are interested in?
3. Are there additional financial awards for outstanding students?
4. What are their program requirements?

Graduate school applications vary from institution to institution. Most, however, require you to take the Graduate Record Examinations (GRE). Some may require the General test (similar in concept to the SAT), while others ask that you take the General test and the Subject test in chemistry. Test dates vary from state to state, so plan carefully where and when you want to take the test. Both tests may be taken on the same day. It is advisable to take them early in your senior year. Lastly, take a look at national fellowships for graduate school. It is a big feather in your cap if you can win one of these (e.g. an NSF Graduate Fellowship). The Career Center can be of assistance if problems or questions arise in filling out graduate school applications. The best idea is to complete your applications in early fall of your senior year, for both schools and fellowships, since most schools and funding opportunities operate on a rolling admissions basis (first come, first served).

In summary:

1. Begin the researching process early in your senior year - maybe even the summer before
2. Take the GRE
3. Send out requests for applications in October - it may take you several weeks to receive them
4. Submit applications by January 1.

Our chemistry graduates

A chemistry degree from the University of Rochester is a valuable asset with regard to postgraduate opportunities. Degrees from the University of Rochester are highly regarded in the scientific community, and the University of Rochester chemistry graduates have traditionally gone on to study at distinguished research institutions. For example, during recent years University of Rochester graduates have been accepted at graduate schools such as:

- University of California-Berkeley
- University of California-Irvine
- University of California-Santa Cruz
- Massachusetts Institute of Technology
- University of Chicago
- Harvard University
- Northwestern University
- University of Michigan
- California Institute of Technology
- Columbia University

Just to name a few. Many graduates have gone on to medical or dental school; others have gone directly into private industry. Whatever your choice, you will discover that your University of Rochester degree is recognized and respected.

2018 Chemistry Graduates

University Resources

Admissions
- (585) 275-3221
- admit@admissions.rochester.edu
- enrollment.rochester.edu

- **Tours and Information:**
- enrollment.rochester.edu/on-campus-visits/

Bursar
- (585) 275-3931
- bursar@admin.rochester.edu
- rochester.edu/adminfinance/bursar

Center for Excellence in Teaching and Learning (CETL)
- (585) 275-9049
- cetl@rochester.edu
- rochester.edu/college/cetl

College Center for Advising Services (CCAS)
- (585) 275-2354
- cascas@mail.rochester.edu
- rochester.edu/college/CCAS

Dining Services
- dining.rochester.edu

- Meal Plans: (585) 275-8756
- mealplans@services.rochester.edu

- General Information: (585) 275-6265
- RCDining@services.rochester.edu

Office of Disability Resources
- (585) 276-5075
- disability@rochester.edu
- rochester.edu/college/disability

Health Professions:
- (585) 275-2366
- urhealthprofessions@ur.rochester.edu
- rochester.edu/college/health

Financial Aid Office (FAO)
- (585) 275-3226
- enrollment.rochester.edu/financial-aid

Department of Chemistry
Main Office
Hutchison Hall, Room 404C
(585) 275-4231
sas.rochester.edu/chm/

- **Undergraduate Studies**
Hutchison Hall, Room 404D
(585) 276-3663
ugradadm@chem.rochester.edu

- **Graduate Studies**
Hutchison Hall, Room 471
(585) 275-0635
gradrec@chem.rochester.edu

International Services Office (ISO)
- (585) 275-2866
- questions@iso.rochester.edu
- iso.rochester.edu

Information Technology Services (ITS)
- (585) 275-2000
- UnivITHelp@rochester.edu
- tech.rochester.edu

Registrar
- (585) 275-8131
- registrar@rochester.edu
- rochester.edu/registrar

Residential Life
- (585) 275-3166
- housing@reslife.rochester.edu
- rochester.edu/reslife

University Health Services (UHS)
- (585) 275-2662
- rochester.edu/uhs

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