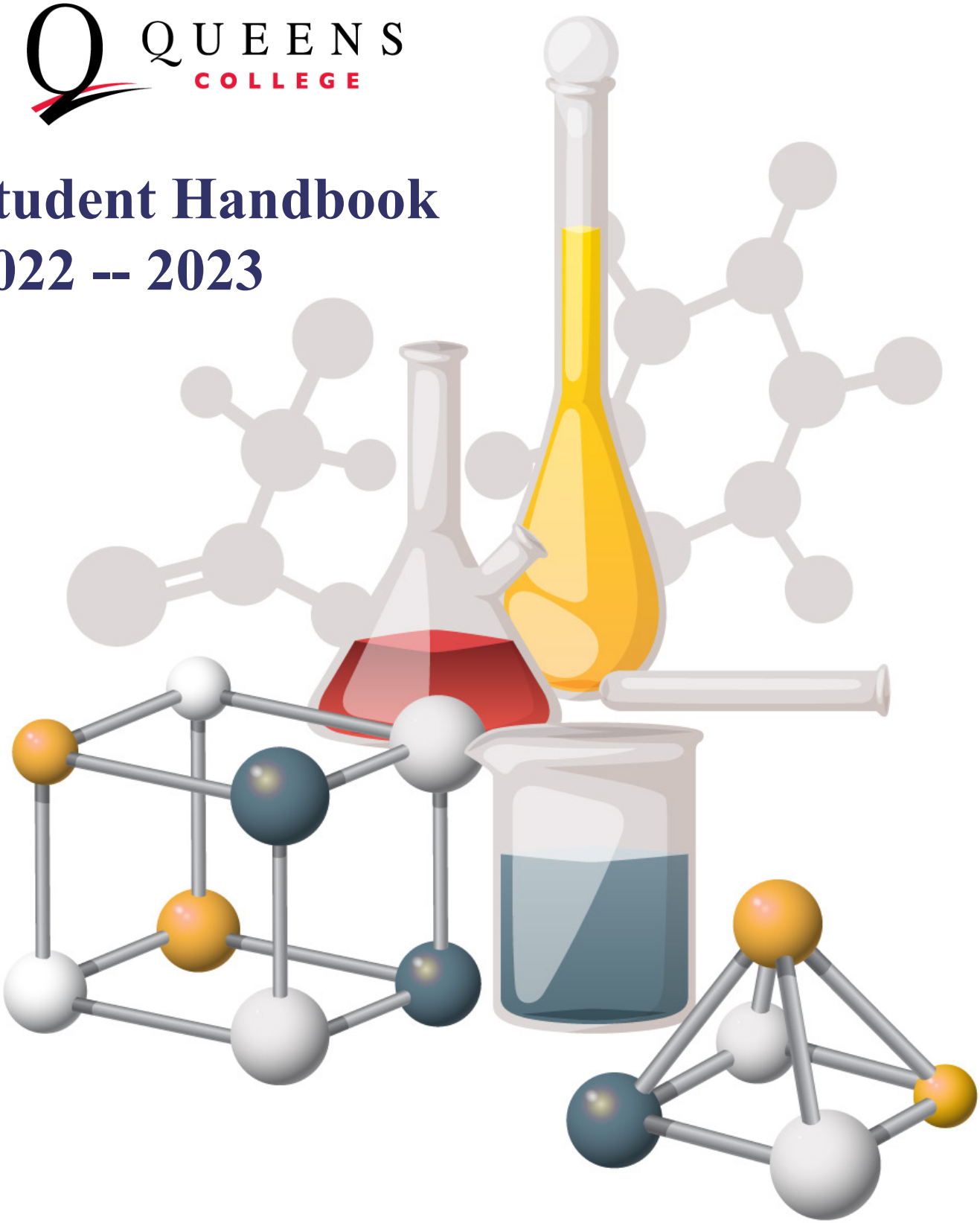
QUEENS COLLEGE

Student Handbook
2022 -- 2023



CHEMISTRY

Welcome to the Department of Chemistry and Biochemistry

The Queens College Department of Chemistry and Biochemistry offers American Chemical Society certified degree programs in Chemistry, Biochemistry, and Chemical Education. Our degree programs include:

- Bachelor of Arts degrees in Chemistry with specializations in chemistry and in biochemistry
- Dual Bachelor of Arts degrees in Chemical Education and Secondary Education and Youth Services
- Dual Bachelor/Master of Arts degrees in Chemistry with specializations in chemistry and in biochemistry
- Acceleratored Master of the Arts degree in Chemistry with specializations in chemistry and in biochemistry
- Masters of the Arts degree in Chemistry with specialization in chemistry and in biochemistry

We strive to offer an integrated, broad-based, challenging educational experience to imbue students with the intellectual, experimental, and online interactive skills necessary to perform effectively in any field related to the chemical and biochemistry sciences. The educational goals and pre-professional training of our programs are designed to deepen a student's molecular perspective of the natural world with modern, quantitative and mechanism-based approaches, and to equip the student with the skills needed to thrive in any workplace.

Department Information

Department Chair: Dr. Jianbo Liu (see picture above)

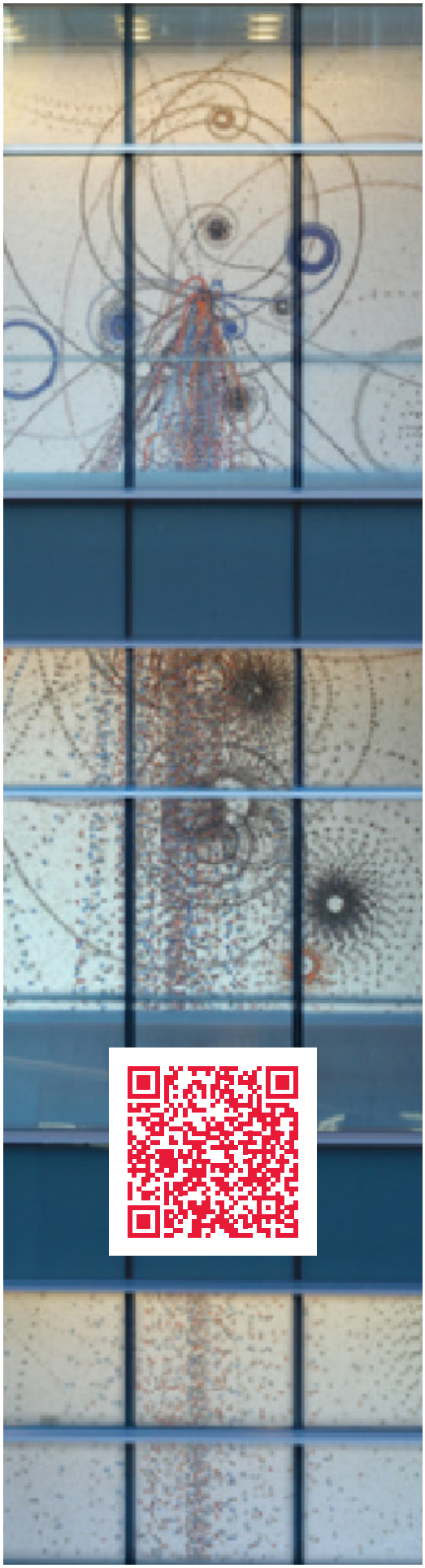
Deputy Chair: Dr. Seogjoo Jang

Associate Chair: Dr. Sanjai Pathak

Administrative Assistants: Ms. Elizabeth Zoiner (Secretary)
Ms. Kelly Barth (Office Assistant)

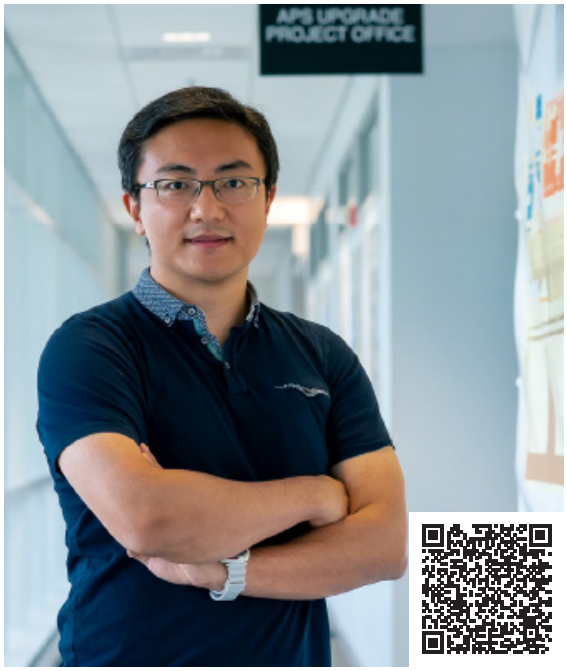
Department Office: Remsen 206

Phone: (718) 997-4100 or (718) 997-4482



Career Paths

Many students think that chemistry and/or biochemistry degrees lead to jobs in pharmaceuticals or in quality control or in synthesis or consider these degrees as stepping stones to post-graduate studies in the basic medical sciences (i.e., medicine, dental, veterinary, pharmacy, etc). While these are all valid career paths, students from Queens College have pursued a variety of careers. The selected short biographies below illustrate the diversity of Queens College chemistry program alumni.



Dr. Xianbo Shi (upper right corner) completed his PhD in Chemistry under Dr. Cherice M. Evans. Now, he is the optics specialist for the Argonne National Laboratory Advanced Photon Source upgrade.

Dr. Jasmine Hatcher Lamarre (middle right pictured with Secretary of Energy Rick Perry) came to Queens College as a transfer student from Queensborough Community College. She worked with Dr. Robert Engel on ionic liquids before working as a laboratory technician at Brookhaven National Laboratory. She then matriculated into the PhD program at The Graduate Center -- CUNY and studied nuclear chemistry at Hunter College. Now, she is developing a new method for producing Ac-225 at Brookhaven National Laboratory.

Dr. Gina Moriarty and **Dr. Luxi Li** (bottom right) both started as undergraduate chemistry students at Queens College. Gina Moriarty obtained a M.A. degree at QC before matriculating into the PhD program in biochemistry at Rutgers University. Luxi Li matriculated into the PhD program in chemistry at The Graduate Center -- CUNY. Today, Dr. Moriarty is an Associaate Scientific Director at Alligent Group (a company that she joined as a medical writer), while Dr. Li is an Assistant Physist at Argonne National Laboratory Advanced Photon Source.

Dr. Wenchao Lu (bottom left) completed his PhD in chemistry under Dr. Jianbo Liu. Now he is a postdoctoral fellow at Lawrence Berkley

National Laboratory investigating polycyclic hydrocarbon formation in stars using hot nozzle chemical reactors and mass spectroscopy.

Ms Antoaneta Tarpanova completed her biochemistry BA/MA as a mentee of Dr. Sanjai Kumar. Ms. Tarpanova was a second degree student as she had a LLM (Master of Laws) from Benjamin N. Cardozo School of Law She is now an associate of Gallet Dreyer & Berkey LLP and uses her knowledge of chemistry to prepare and prosecute patent and trademark applications.

Careers in Basic Medical Sciences

Many of our recent graduates are excelling in more traditional chemistry career paths as well. For example, **Mr. Alan Finkelstein** is pursuing a MD/PhD at the University of Rochester School of Medicine and Dentistiry and is a candidate for the PhD in multimodal neuroimaging and machine learning in neuropathology. (Mr. Finkelstein completed the BA/MA in biochemistry under the mentorship of Dr. Sanjai Pathak.) **Dr. Iosif Davidov**, also a mentee of Dr. Sanjai Pathak, completed his studies in chemistry at Queens College before matriculating into the medical school at Hofstra and now is a resident physician at Northwell Health. **Mr. Eli Perl**, a mentee of Dr. Yu Chen, completed a BA/MA in chemistry before entering the MD/PhD program at University of Cincinnati College of Medicine. Recently, he was selected to attend the 2020 Nobel Laureate Meeting in Germany (cf. QR code above).

Post-graduate Studies and Work

Dr. Mena Youssef, who completed an undergraduate degree at Queens College as a mentee of Dr. Jianbo Liu before matriculating in the PhD program at New York University, now is an assistant professor of chemistry at New York Institute of Technology. **Mr. Kamil (Krynski) Sklodowski** completed dual BA/MA degrees in chemistry and physics at Queens College before matriculating into the physics PhD program at University of California, Los Angeles. He is studying experimental plasma physics as a mentee of Dr. Troy Carter and Dr. Shreekrishna Tripathi. **Mr. Shuai Ma** transferred into Queens College from Queensborough Community College. After completing a BA and MA at Queens College, he has matriculated into the PhD program at The Graduate Center -- CUNY and is working under Dr. Jun Yong Choi. **Dr. Zhiwei Chen** completed a BA in Chemistry at Queens College as a mentee of Dr. Yu Chen before matriculating into a PhD program in Organic Chemistry at the University of California, Irvine. He is now a senior scientist at Merck. **Ms. Sara Burgdorf** was a mentee of Dr. William Hersh while completing her BA and MA degrees in chemistry at QC. She is now a research and development associate scientist at PepsiCo.

Are you interested?

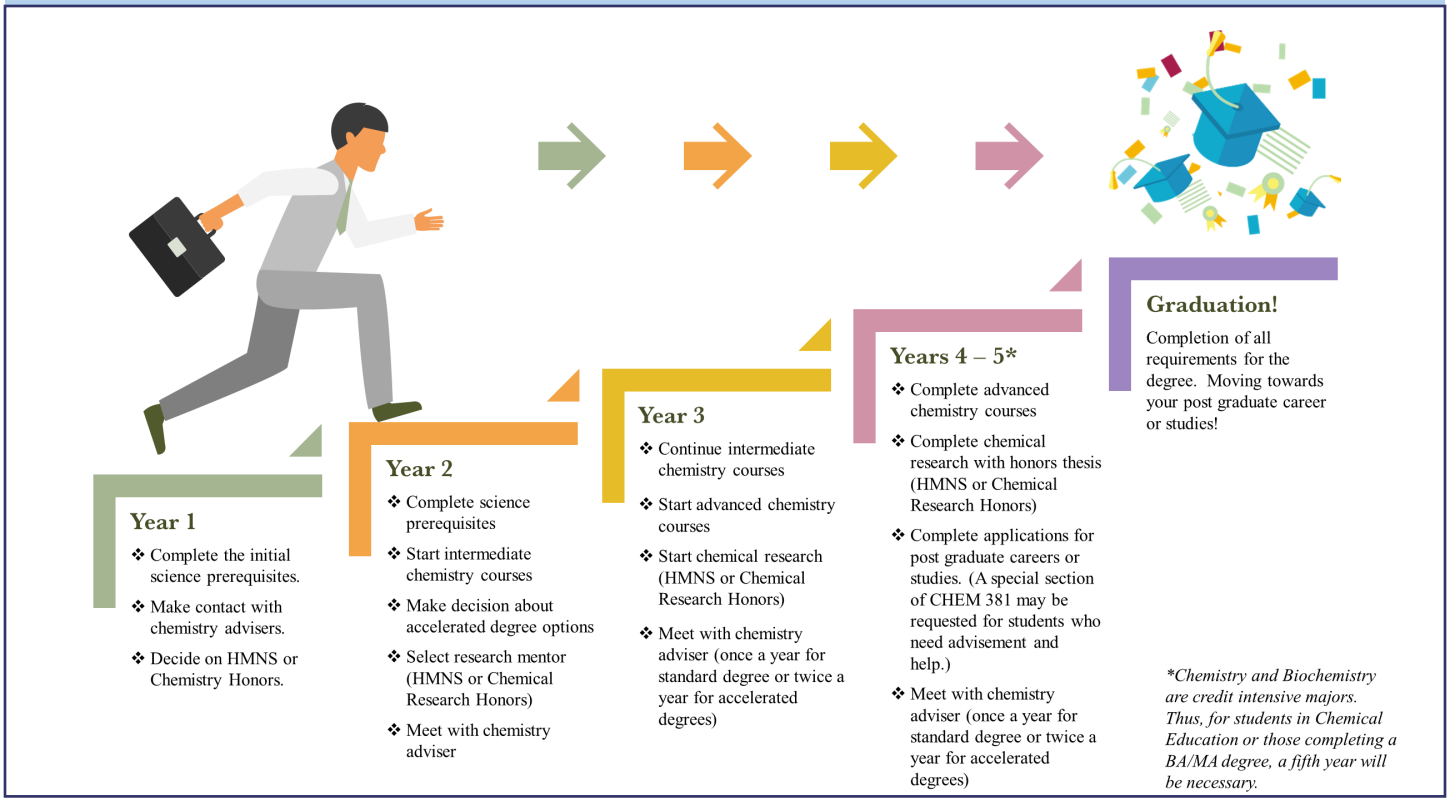
The short biographies presented above are just a small handful of the Queens College chemistry and biochemistry BA, MA and PhD students who are succeeding in the workforce of today. You can see by the list that a chemistry degree opens one up to a wide variety of career opportunities. More information about these opportunities can be obtained from the American Chemical Society website.

Degree Programs

The alumni highlighted in the previous section graduated in one of the many degree programs offered at or through Queens College -- CUNY. These programs are detailed in this section.

Steps to Degree

We should note here that a semester credit hour is an academic unit earned for fifteen 50-minute sessions of classroom instruction with a normal expectation of two hours of outside study for each class session. (Thus, a three credit hour course would expect 150 minutes of classroom instruction and 6 hours of outside study.) For group activities, such as laboratory courses, a semester credit hour is awarded for the equivalent of fifteen periods of 150 to 200 minutes in duration with little outside preparation expected.



Year 1. Science Prerequisites (22 crs; 20 hrs/week minimum external study)

These Year 1 Prerequisites are constant across Bachelors degrees unless otherwise noted.

CHEM 113.4. General Chemistry I (4 cr; *weekly: 50 min rec, 150 min lec, 8 hr study*)
CHEM 113.1. Introduction to Laboratory Techniques (1 cr; *weekly: 150 min lab, 1 hr prep*)
MATH 122. Pre-calculus (4 cr; *weekly: 200 min lec, 8 hr study*)

CHEM 114.4. General Chemistry II (4 cr; *weekly: 50 min rec, 150 min lec, 8 hr study*)
CHEM 114.1. Quantitative and Qualitative Analysis (1 cr; *weekly: 150 min lab, 1 hr prep*)
BIOL 105. General Biology: Physiology and Cell Biology (4 cr; *weekly: 150 min lec, 6 hr study, 150 min lab, 1 hr prep*)
MATH 141 Calculus IA (3 cr; *weekly: 150 min lec, 6 hr study*)
– May be replaced with MATH 151. Calculus I or MATH 157. Honors Calculus I
CHEM 291. Tools for Chemical Research (1 cr; *weekly: 50 min lec, 2 hr prep*)
– May be replaced with HMNS 100 or HMNS 101. Not required but highly recommended.

BA – Biochemistry

Year 2 (27 crs; 20 hrs/week minimum external study)

CHEM 2514. Organic Chemistry I (4 cr; *weekly: 50 min rec, 150 min lec, 8 hr study*)
CHEM 2511. Organic Chemistry I Laboratory (1 cr; *weekly: 200 min lab, 2 hr prep*)
BIOL 106. General Biology: Life Forms and Ecosystems (4 cr; *weekly: 150 min lec, 6 hr study, 150 min lab, 1 hr prep*)
– Not a required course, but suggested for basic medical science and/or biology minor.
MATH 142. Calculus IB (3 cr; *weekly: 150 min lec, 6 hr study*)
– May be replaced with MATH 152. Calculus II or MATH 158. Honors Calculus II
CHEM 291. Introduction to Chemical Research (1 cr; *weekly: 150 min lab, 2 hr prep*)
– Not required but highly recommended. May be replaced with HMNS 102.

CHEM 2524. Organic Chemistry II (4 cr; *weekly: 50 min rec, 150 min lec, 8 hr study*)
CHEM 2521. Organic Chemistry II Laboratory (1 cr; *weekly: 200 min lab, 2 hr prep*)
CHEM 3911. Chemical Research (1 cr; *weekly: 200 min lab, 2 hr prep*)
– Not required but highly recommended. May be replaced with HMNS 291.
MATH 143. Calculus II (3 cr; *weekly: 150 min lec, 6 hr study*)
– Only if students took MATH 141 and 142
PHYS 1214. General Physics I (4 cr; *weekly: 200 min lec, 8 hr study*)
PHYS 1211. General Physics I Laboratory (1 cr; *weekly: 100 min lab, 2 hr prep*)
– May be replaced with PHYS 1454 and 1451. Principles of Physics.

Year 3 (27 crs; 25 hrs/week minimum external study)

CHEM 211. Statistical Thermodynamics and Kinetics (4 cr; *weekly: 50 min rec, 150 min lec, 8 hr study*)
CHEM 371. Biochemistry I (4 cr; *weekly: 200 min lec, 8 hr prep*)
CHEM 3912. Chemical Research (2 cr; *weekly: 400 min lab, 2 hr prep*)
– May be replaced with HMNS 291. Not required but highly recommended.
PHYS 1224. General Physics II (4 cr; *weekly: 200 min lec, 8 hr study*)
PHYS 1221. General Physics II Laboratory (1 cr; *weekly: 100 min lab, 2 hr prep*)
– May be replaced with PHYS 1464 and 1461. Principles of Physics.

CHEM 372. Biochemistry II (4 cr; *weekly: 200 min lec, 8 hr prep*)
CHEM 376. Biochemistry Laboratory (2 cr; *weekly: 50 min rec, 200 min lab, 2 hr prep*)
CHEM 378. Physical Biochemistry (4 cr; *weekly: 200 min lec, 8 hr prep*)
CHEM 3912. Chemical Research (2 cr; *weekly: 400 min lab, 2 hr prep*)
– May be replaced with HMNS 391. Not required but highly recommended.

Year 4 (17 crs; 20 hrs/week minimum study)

CHEM 3313. Inorganic Chemistry (3 cr; *weekly: 150 min lec, 6 hr study*)
CHEM 3311. Physical Inorganic Chemistry Laboratory (1 cr; *weekly: 200 min lab, 2 hr prep*)
CHEM 3413. Instrumental Analysis (3 cr; *weekly: 150 min lec, 6 hr study*)
CHEM 3411. Instrumental Methods Laboratory (1 cr; *weekly: 200 min lab, 2 hr prep*)
CHEM 3912. Chemical Research (2 cr; *weekly: 300 min lab, 3 hr prep*)
– Students who do not complete at least 2 credits of chemical research will need to take CHEM 388 (2 cr) in Spring.

CHEM 352. Physical Methods of Structure Determination (4 cr; *weekly: 200 min lec, 6 hr study*)
– Not required but recommended for students interested in graduate work/industrial work in biochemistry
CHEM 395. Honors Thesis (3 cr; *weekly: 50 min lec, 2 hr writing, 6 hr prep*)
– Course is not required except for students pursuing Chemical Research Honors

Notes

Basic Medical Sciences:

Students with an interest in biochemistry as a pathway towards post-graduate studies in the basic medical sciences will need to complete SOC 101 (General Introduction to Sociology, 3 cr), PSYCH 101 (General Psychology, 4 cr), PSYCH 1073 (Statistical Methods, 3 cr), and PSYCH 1071 (Statisitcal Methods Lab, 1 cr) during the first three years in order to prepare for entrance examinations.

Past experience has indicated that the biochemistry track prepares students well for the science portion of entrance examinations for basic medical science studies. However, stuents seem to be poorly prepared for the liberal arts portions of these exams. We strongly recommend that students focus on honors and/or writing intensive versions of the liberal arts courses, when available along with an emphasis on comparitive courses (i.e., philosophy, comparative literature, etc). The Health Professions Advisory Services committee has compiled a list of suggested courses (cf. right QR code).

Students within the biochemistry track with an interest in the basic medical sciences would do better considering a Biology minor or Anthropology minor (either Health & Culture or Human Ecology) instead of the Health Sciences minor.

Biology Minor

The biology minor would require an additional 9 credits of biology courses if students complete the sequence above. Suggested courses for such a minor are BIOL 201 (General Microbiology, 2 lec, 1 rec, 3 lab; 4 cr), BIOL 285 (Principles of Genetics, 3 lec, 1 rec; 4 cr), BIOL 286 (Principles of Cell Biology, 3 lec, 3 cr); BIOL 362 (Laboratory Techniques in Molecular Biology, 2 rec, 3 lab; 3 cr), and/or BIOL 363 (Laboratory Techniques in Cell Biology, 2 rec, 3 lab; 3 cr).

Anthropology Minors

The anthropology minors in Health & Culture and in Human Ecology are newly approved. More information can be found on page 13 of the document linked to the QR code provided on the right.

BA – Chemistry*

The sequence presented below is ideal for students with an interest in* **synthetic chemistry. *An alternative sequence for those with interest in analytical and physical chemistry uses a slightly different Year 1 (cf. Page 13) and an interdisciplinary sequence (cf. Page 15) for those with an interest in material science and chemical engineering are presented on other pages.*

Year 2 (27 crs; 20 hrs/week minimum external study)

CHEM 2514. Organic Chemistry I (4 cr; *weekly: 50 min rec, 150 min lec, 8 hr study*)
CHEM 2511. Organic Chemistry I Laboratory (1 cr; *weekly: 200 min lab, 2 hr prep*)
MATH 142. Calculus IB (3 cr; *weekly: 150 min lec, 6 hr study*)
– May be replaced with MATH 152. Calculus II or MATH 158. Honors Calculus II
CHEM 291. Introduction to Chemical Research (1 cr; *weekly: 150 min lab, 2 hr prep*)
– Not required but highly recommended. May be replaced with HMNS 102.

CHEM 2524. Organic Chemistry II (4 cr; *weekly: 50 min rec, 150 min lec, 8 hr study*)
CHEM 2521. Organic Chemistry II Laboratory (1 cr; *weekly: 200 min lab, 2 hr prep*)
CHEM 3911. Chemical Research (1 cr; *weekly: 200 min lab, 2 hr prep*)
– Not required but highly recommended. May be replaced with HMNS 291.
MATH 143. Calculus II (3 cr; *weekly: 150 min lec, 6 hr study*)
– Only if students took MATH 141 and 142
PHYS 1214. General Physics I (4 cr; *weekly: 200 min lec, 8 hr study*)
PHYS 1211. General Physics I Laboratory (1 cr; *weekly: 100 min lab, 2 hr prep*)
– May be replaced with PHYS 1454 and 1451. Principles of Physics.

Year 3 (27 crs; 25 hrs/week minimum external study)

CHEM 211. Statistical Thermodynamics and Kinetics (4 cr; *weekly: 50 min rec, 150 min lec, 8 hr study*)
CHEM 351. Advanced Organic Chemistry (4 cr; *weekly: 200 min lec, 8 hr study*)
CHEM 3912. Chemical Research (2 cr; *weekly: 400 min lab, 2 hr prep*)
– May be replaced with HMNS 291. Not required but highly recommended.
PHYS 1224. General Physics II (4 cr; *weekly: 200 min lec, 8 hr study*)
PHYS 1221. General Physics II Laboratory (1 cr; *weekly: 100 min lab, 2 hr prep*)
– May be replaced with PHYS 1464 and 1461. Principles of Physics.

CHEM 212. Quantum Mechanics and Spectroscopy (4 cr; *weekly: 50 min rec, 150 min lec, 8 hr study*)
CHEM 352. Physical Methods of Structure Determination (4 cr; *weekly: 200 min lec, 8 hr study*)
CHEM 3912. Chemical Research (2 cr; *weekly: 400 min lab, 2 hr prep*)
– May be replaced with HMNS 391. Not required but highly recommended.

Year 4 (17 crs; 20 hrs/week minimum study)

CHEM 3313. Inorganic Chemistry (3 cr; *weekly: 150 min lec, 6 hr study*)
CHEM 3311. Physical Inorganic Chemistry Laboratory (1 cr; *weekly: 200 min lab, 2 hr prep*)
CHEM 3413. Instrumental Analysis (3 cr; *weekly: 150 min lec, 6 hr study*)
CHEM 3411. Instrumental Methods Laboratory (1 cr; *weekly: 200 min lab, 2 hr prep*)
CHEM 3912. Chemical Research (2 cr; *weekly: 400 min lab, 3 hr prep*)
– Students who do not complete at least 2 credits of chemical research will need to take CHEM 387 (2 cr) in Spring.

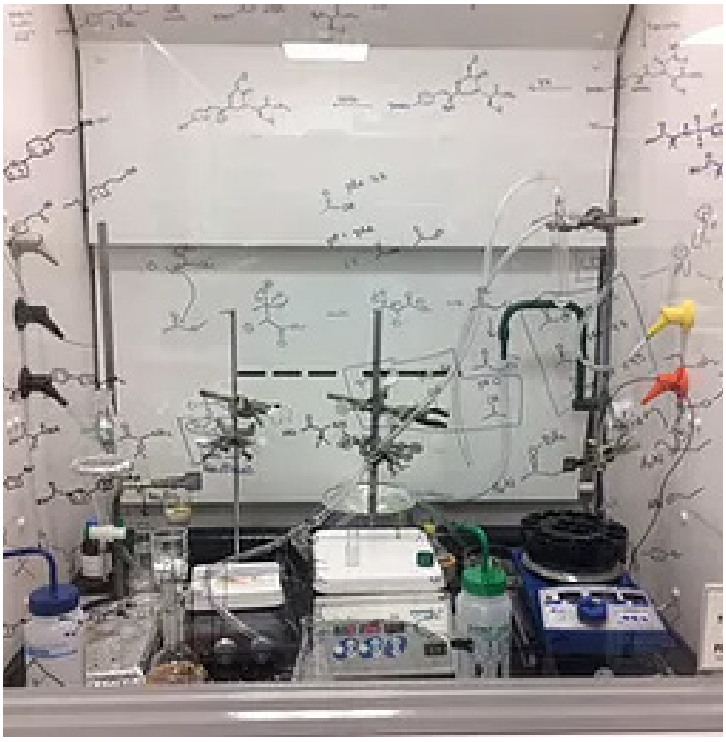
CHEM 371. Biochemistry I (4 cr; *weekly: 200 min lec, 8 hr study*)
CHEM 395. Honors Thesis (3 cr; *weekly: 50 min lec, 2 hr writing, 6 hr prep*)
– Course is not required except for students pursuing Chemical Research Honors

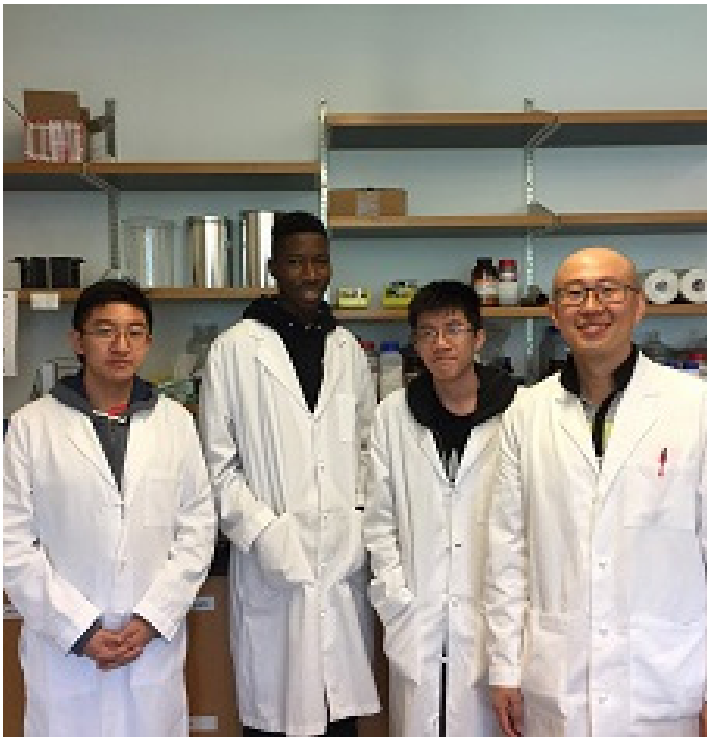
Notes

The sequence given above contains one additional lecture course than required by the major, since is suggests both CHEM 351 and CHEM 352. However, students with an interest in synthetic chemistry will need both the advanced organic course and the structure determination course in terms of future career plans (whether those plans are industry or post-graduate work). This sequence is NOT designed for students with an interest in basic medical sciences, because Biochemistry is completed in the last semester instead of earlier in the sequence.

Research in Chemistry

Students with an interest in synthetic chemistry should focus on research in organic chemistry or inorganic chemistry. Thus, Dr. William Hersh, Dr. Sanjai Pathak, Dr. Yu Chen, Dr. Jun Yong Choi, and Dr. Chen Wang are the best potential mentors for students in this career path. (See Research section of this handbook for more information.)





BA – Chemical Education

Advisor: Dr. Gopal Subramaniam (gopal.subramaniam@qc.cuny.edu)

This program results in a double major, namely one in Chemistry 7-12 (Chemical Education) and one in Secondary Education and Youth Services. This degree takes five years to complete because of the student teaching requirements coupled with the advanced chemistry requirements. Students can opt to complete the accelerated MA in Secondary Education with the BA in Chemical Education. If time permits, students should consider a minor in another science, such a biology, mathematics, environmental science, or physics as this will allow students to obtain supplementary certification in the second science upon graduation. **Students must maintain a minimum GPA of 2.75 in the courses required for the major.**

Year 2 (22 crs; 20 hrs/week minimum external study)

CHEM 2514. Organic Chemistry I (4 cr; *weekly: 50 min rec, 150 min lec, 8 hr study*)
CHEM 2511. Organic Chemistry I Laboratory (1 cr; *weekly: 200 min lab, 2 hr prep*)
MATH 142. Calculus IB (3 cr; *weekly: 150 min lec, 6 hr study*)
SEYS 201W. Historical, Social, and Philosophical Foundations of Education (3 cr; *20 hr field work, weekly: 150 min lec, 4 hr prep)*
CHEM 3211. Chemical Education Practicum (1 cr; *weekly: 200 min lab, 2 hr prep*)

CHEM 2524. Organic Chemistry II (4 cr; *weekly: 50 min rec, 150 min lec, 8 hr study*)
CHEM 2521. Organic Chemistry II Laboratory (1 cr; *weekly: 200 min lab, 2 hr prep*)
CHEM 3212. Chemical Education Practicum (2 cr; *weekly: 400 min lab, 2 hr prep*)
MATH 143. Calculus II (3 cr; *weekly: 150 min lec, 6 hr study*)
SEYS 221. Development and Learning in Middle Childhood and Adolescence (3 cr; *20 hr field work, weekly: 150 min, 4 hr prep*)

Year 3 (27 crs; 25 hrs/week minimum external study)

CHEM 211. Statistical Thermodynamics and Kinetics (4 cr; *weekly: 50 min rec, 150 min lec, 8 hr study*)
CHEM 3212. Chemical Education Practicum (2 cr; *weekly: 400 min lab, 2 hr prep*)
PHYS 1214. General Physics I (4 cr; *weekly: 200 min lec, 8 hr study*)
PHYS 1211. General Physics I Laboratory (1 cr; *weekly: 100 min lab, 2 hr prep*)
SEYS 340. Language, Literacy, and Culture in Education (3 cr; *20 hr field work, weekly: 150 min lec*)

PHYS 1224. General Physics II (4 cr; *weekly: 200 min lec, 8 hr study*)
PHYS 1221. General Physics II Laboratory (1 cr; *weekly: 100 min lab, 2 hr prep*)
CHEM 3212. Chemical Education Practicum (2 cr; *weekly: 400 min lab, 2 hr prep*)
SEYS 362. Methods of Teaching Science in Middle and High School (3 cr; *20 hr field work, weekly: 150 min lec, 4 hr prep*)

Year 4 (18 crs; 20 hrs/week minimum study)

CHEM 3313. Inorganic Chemistry (3 cr; *weekly: 150 min lec, 6 hr study*)
CHEM 3311. Physical Inorganic Chemistry Laboratory (1 cr; *weekly: 200 min lab, 2 hr prep*)
CHEM 3413. Instrumental Methods (3 cr; *weekly: 150 min lec, 6 hr study*)
CHEM 3411. Instrumental Methods Laboratory (1 cr; *weekly: 200 min lab, 3 hr prep*)
CHEM 3212. Chemical Education Practicum (2 cr; *weekly: 400 min lab, 2 hr prep*)

CHEM 371. Biochemistry I (4 cr; *weekly: 200 min lec, 8 hr study*)
CHEM 395. Honors Thesis (3 cr; *weekly: 50 min lec, 2 hr writing, 6 hr prep*)
– Course is not required except for students pursuing Chemical Research Honors

This year completes all of the requirements for the Chemical Education major. However, this is a good year for students wanting to complete a second STEM minor to add additional science courses.

Year 5 (Student Teaching)

This year is focused on student teaching and, therefore, is an intense and busy year. Students should not add significant STEM coursework during this year because study time will be an issue.

SEYS 350. Cognition, Technology and Instruction for Diverse Learners (3 cr; *150 min lec, 4 hr prep*)
SEYS 3722. Student Teaching I. Initial Clinical Experience (3 cr; *100 – 150 hours in clinical practice, 6 hr prep*)
SEYS 382. Standards-Based Curriculum and Assessment in Teaching Science (3 cr; *weekly: 150 min lec, 4 hr prep*)

SEYS 3724. Student Teaching Science in Middle or High School (3 cr; *190 – 240 hours in clinical practice, daily work in a secondary school, 6 hr prep*)

BA – Chemistry*

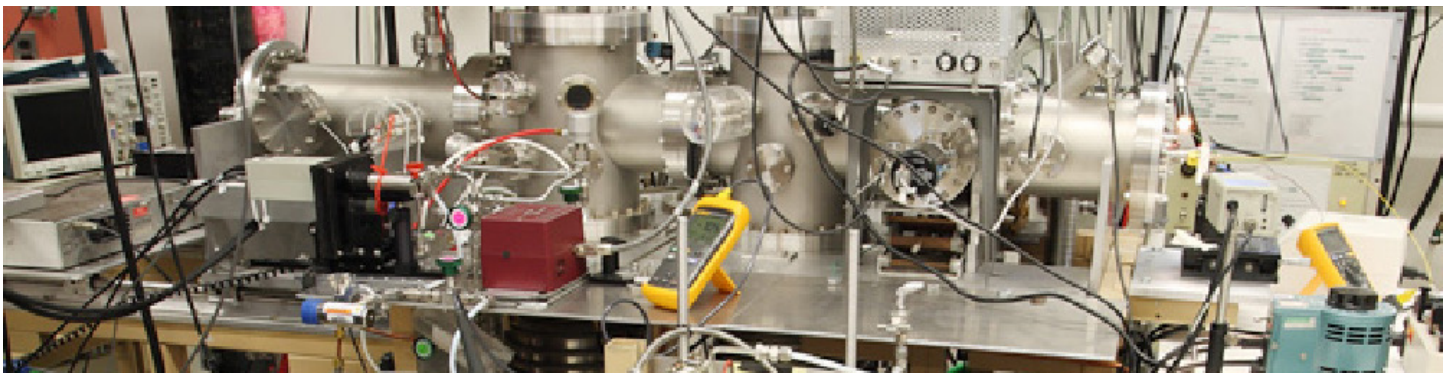
The sequence presented below is designed for students with an interest in* **analytical and physical chemistry. *An alternative sequence for those with interest in synthetic chemistry and an interdisciplinary sequence for those with an interest in material science and chemical engineering are presented on other pages.*

Year 1 (27 crs; 20 hrs/week minimum external study)

MATH 122.	Precalculus (4 cr; 200 min lec, 8 hr study)
CHEM 1134.	General Chemistry I (4 cr; *200 min lec, 8 hr study*)
CHEM 1131.	Introduction to Laboratory Techniques (1 cr; *150 min lab, 1 hr prep*)
MATH 151.	Calculus I (4 cr; *200 min lec, 8 hr study*)
	-- May be replaced with MATH 157 (Honors Calculus)
CHEM 1144.	General Chemistry II (4 cr; *200 min lec, 8 hr study*)
CHEM 1141.	Quantitative and Qualitative Chemical Analysis (1 cr; *150 min lab, 1 hr prep*)
CHEM 291.	Tools in Chemical Research (1 cr; *50 min lec, 2 hr prep*)
	– May be replaced with HMNS 100 or HMNS 101. Not required but highly recommended.

Year 2 (27 crs; 20 hrs/week minimum external study)

MATH 152.	Calculus II -- May be replaced with MATH 158 (Honors Calculus)
PHYS 1454.	Principles of Physics I
PHYS 1451.	Principles of Physics Laboratory I
CHEM 291.	Introduction to Chemical Research
MATH 201§.	Advanced Calculus
PHYS 1464.	Principles of Physics II
PHYS 1461.	Principles of Physics Laboratory II
CHEM 212.	Quantum Chemistry and Spectroscopy
CHEM 3911.	Chemical Research



Year 3 (27 crs; 25 hrs/week minimum external study)

CHEM 211. Statistical Thermodynamics and Kinetics (4 cr; *weekly: 50 min rec, 150 min lec, 8 hr study*)
CHEM 3413. Instrumental Analysis (3 cr; *weekly: 150 min lec, 6 hr study*)
CHEM 3411. Instrumental Methods Laboratory (1 cr; *weekly: 200 min lab, 2 hr prep*)
CHEM 3912. Chemical Research (2 cr; *weekly: 400 min lab, 2 hr prep*)
– May be replaced with HMNS 291. Not required but highly recommended.
CSCI 111[§]. Introduction to Algorithmic Problem Solving (3 cr; *weekly: 150 min lec, 6 hr study*)
or PHYS 270[§]. Physics Applications of Machine Learning and Data Science (4 cr; *weekly: 100 min lec, 6 hr lab, 8 hr study*)

CHEM 2514. Organic Chemistry I (4 cr; *weekly: 200 min lec, 8 hr study*)
CHEM 2511. Organic Chemistry Laboratory I (1 cr; *weekly: 200 min lab, 1 hr prep*)
BIOL 105. General Biology: Physiology and Cell Biology (4 cr; *weekly: 150 min lec, 6 hr study, 150 min lab, 1 hr prep*)
CHEM LEC. Advanced Chemistry Lecture (suggestions given below)
– CHEM 385. Special Topics in Chemistry (4 cr; weekly: 200 min lec, 8 hr study)
: Computational Chemistry
: Solid State Chemistry
: Engineering Thermodynamics
: Mass and Energy Transfer
– CHEM 7901. Basic Laboratory Techniques in Analytical and Physical Chemistry (4 cr; 100 min lec, 6 hr lab, 8 hr study)
– PHYS 233. Intermediate Methods of Mathematical Physics (3 cr; weekly: 150 min lec, 6 hr study)
– PHYS 275. Introduction to Scientific Computing (4 cr; weekly: 200 min lec, 8 hr study)

Year 4 (18 crs; 20 hrs/week minimum study)

CHEM 2524. Organic Chemistry II (4 cr; *weekly: 200 min lec, 8 hr study*)
CHEM 2521. Organic Chemistry II Laboratory (1 cr; *weekly: 200 min lab, 2 hr prep*)
CHEM 3313. Inorganic Chemistry (3 cr; *weekly: 150 min lec, 6 hr study*)
CHEM 3311. Physical Inorganic Chemistry Laboratory (1 cr; *weekly: 200 min lab, 2 hr prep*)
CHEM 3912. Chemical Research (2 cr; *weekly: 400 min lab, 3 hr prep*)
– Students who do not complete at least 2 credits of chemical research will need to take CHEM 388 (2 cr) in Spring.

CHEM 371. Biochemistry I (4 cr; *weekly: 200 min lec, 8 hr study*)
CHEM 395. Honors Thesis (3 cr; *weekly: 50 min lec, 2 hr writing, 6 hr prep*)
– Course is not required except for students pursuing Chemical Research Honors

Notes

[§]The sequence given above contains a computer science/physics course and MATH 201 (Advanced Calculus) which are not required courses for a chemistry major, but are courses that will benefit students with an interest in analytical chemisry, physical chemistry, or nanochemistry.

BA – Interdisciplinary

This program is designed for students interested in graduate studies in chemical engineering, material science or biomedical engineering. The department should note here that if enough students expres an interest in this interdisciplinary major (that can be ACS certified), then the department will consider creating a separate track based on this program. Students must contact the adviser for the program (Dr. Cherice Evans) before submitting the interdisciplinary major form to Dr. Alicia Alvero, Associate Provost for Research and Faculty Affairs.

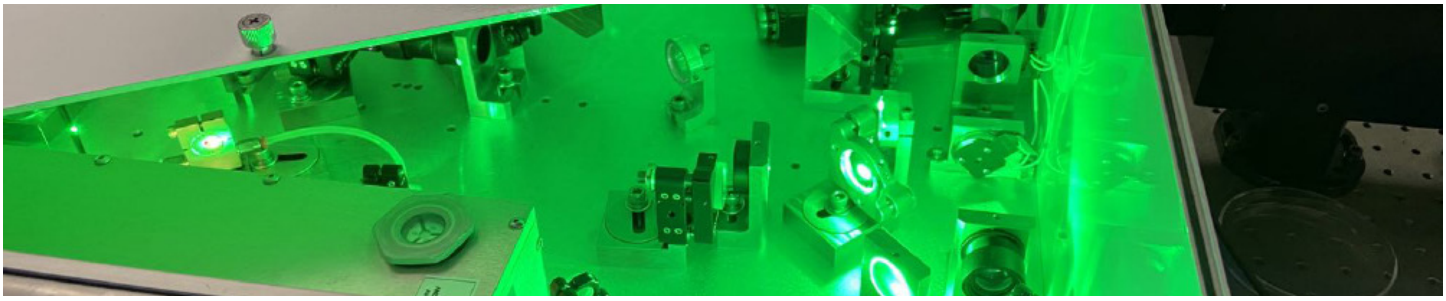
Year 1 (22 crs; 20 hrs/week minimum external study)

Students must complete the Year 1 requirements with no grade lower than a B to be considered for this interdisciplinary program and must maintain a GPA of 3.0 throughout the program.

MATH 151.	Calculus I (4 cr; 200 min lec, 8 hr study)
CHEM 1134.	General Chemistry I (4 cr; *200 min lec, 8 hr study*)
CHEM 1131.	Introduction to Laboratory Techniques (1 cr; *150 min lab, 1 hr prep*)
CSCI 111.	Introduction to Algorithmic Problem Solving (3 cr; 150 min lec, 6 hr study)
MATH 152.	Calculus II (4 cr; *200 min lec, 8 hr study*)
CHEM 1144.	General Chemistry II (4 cr; *200 min lec, 8 hr study*)
CHEM 1141.	Quantitative and Qualitative Chemical Analysis (1 cr; *150 min lab, 1 hr prep*)
CHEM 291.	Tools in Chemical Research (1 cr; *50 min lec, 2 hr prep*)

Years 2 – 4 (20 crs/year; 25 hrs/week minimum external study)

The courses for the remaining years will be determined in consultation with the adviser for the program and with your interest in mind. The courses will be a blend of mathematics, physics, chemistry, and computer science courses slanted to prepare each student for post-graduate work in material science, chemical engineering, environmental engineering, or biomedical engineering. Since all graduate programs in these areas have a minimium admission requirement of a B in all STEM courses taken during undergraduate work, this requirement will be maintained during the interdisciplinary program. Students will be required to meet with the program adviser once a semester before registering for courses.



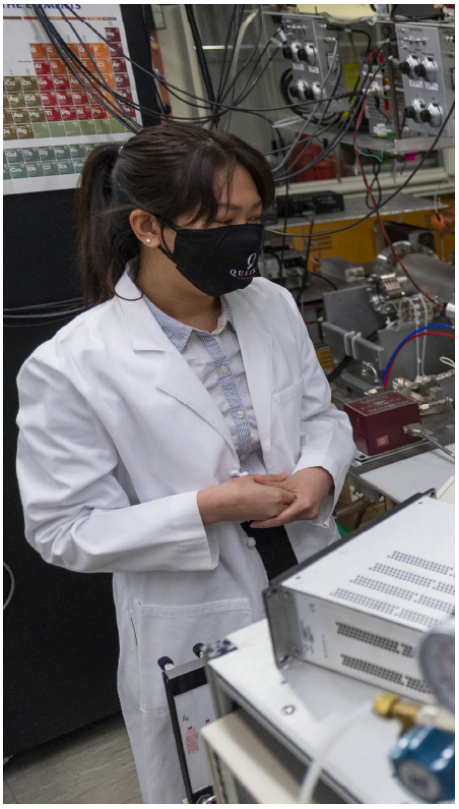
Accelerated Degrees

There are two different accelerated degrees that lead to graduation with a MA in Chemistry (or Biochemistry):

- BA/MA degree
- Accelerated MA degree

BA/MA Degree

The BA/MA degree is a four to five year degree program that assumes you will complete 30 credits of MA courses as part of the requirements for the BA degree. In this program, you graduate with the BA and the MA at the same graduation ceremony. A minimum grade of B must be maintained for all graduate courses completed. However, the disadvantage is that you must pay graduate tuition for ANY credits over 120 credit hours (including 100-level liberal art course requirements). Students interested in this program should make a decision about this program and apply in his/her/their third semester with the goal of being accepted in the fourth semester and beginning graduate course work in the junior year.



Accelerated MA Degree

The accelerated MA degree is designed for students who are planning a slack year between undergraduate work and post-graduate studies (such as medical school) or for those pursuing advanced certification for high school chemistry education. We should note here that a MA is NOT required to enter a PhD program in chemistry or in biochemistry. In this program, students are allowed to complete 12 credits of graduate course work while being an undergraduate student and are guaranteed admission into the MA program upon graduation. The advantages to this program – in comparison to the BA/MA degree – are that students receive the BA degree before officially matriculating into the MA degree. This allows such students to apply for teaching positions in the department to help fund their graduate studies. Chemical Education students should apply for the program at the end of their sophomore year (i.e., fourth semester), while chemistry and biochemistry students should apply for the program at the beginning of their junior year (i.e., fifth semester) with the goal of being accepted in the sixth semester and beginning graduate course work in the senior year. Once accepted into the program, students should meet with the program adviser to setup the graduate courses for their program of study.

We added a new biochemistry minor effective Fall 2022. This may be more appropriate for biology majors and students with an interest in basic medical sciences. The Biochem Minor consists of CHEM 113.4, 113.1, 114.4, 114.1, 251.4, 251.1, 252.4, 252.1, one biochem course (371 or 372 or 378) and 2 credits of lab (376 or any combination of chem 291, 391, or HMNS lab course credits)

The basic chemistry minor is very flexible. It consists of CHEM 113.4, 113.1, 114.4, 114.1, and 10 credits of elective 200 level and 300 level courses. This change is effective Fall 2022 onwards. See some of the suggestions listed below based on academic interest. Talk to a chemistry advisor for more details.

For STEM education majors with an interest in a minor in chemistry:

CHEM 113.4, 113.1, 114.4, 114.1, 102.3, 102.1, 103.3, 103.1, 211, 291-1 (Tools for Chemistry Research), and 3212.

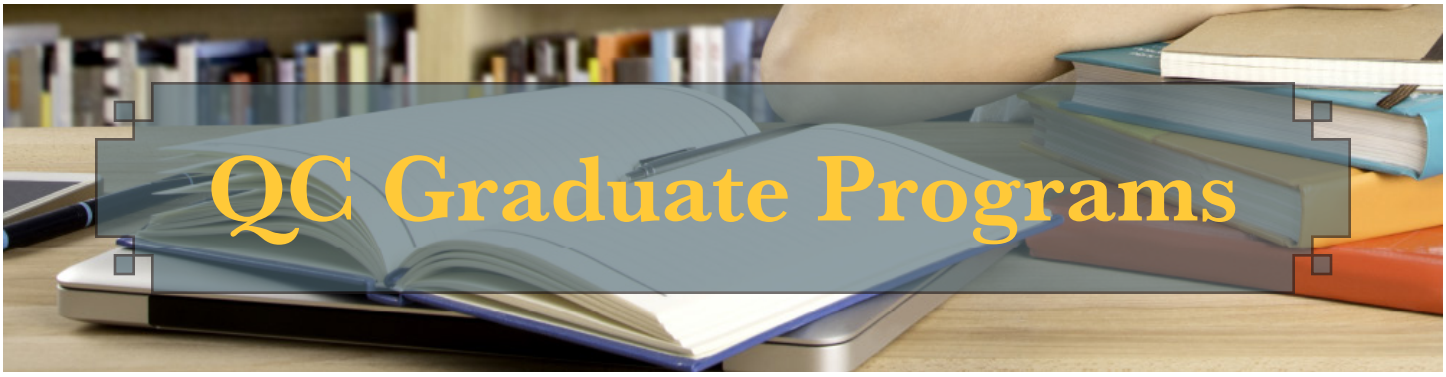
For physics majors with an interest in a minor in chemistry:

CHEM 113.4, 113.1, 114.4, 114.1, 102.3, 102.1, 211, 212 and either 341.3 and 341.1 or 331.3 and 331.1.

For environmental science and/or geology majors with an interest in a minor in chemistry:

CHEM 113.4, 113.1, 114.4, 114.1, 102.3, 102.1, 211, 331.3, 331.1, 341.3, and 341.1.

Students in one of these other majors with an interest in the other listed pathways towards a minor in chemistry should talk to a chemistry advisor, namely Dr. Gopal Subramaniam or Dr. Cherice M. Evans.



QC Graduate Programs

Application Process

If you are an undergradaute student at Queens College, you should consider the accelerated MA degree or the BA/MA degree. However, if you have decided to return to QC to improve GPA requirements for post graduate studies or are using the MA to decide what direction you wish your career to take, then the MA program is a suitable option.

Students should have a Bachelor's degree in chemistry, biochemistry or related field (i.e., molecular biology, chemisty, etc) with an nimimum academic average of B in the undergraduate course work considered by the department and the Office of Graduate Studies to be relevant to the proposed area of study. If ten years have elapsed since completion of undergraduate work, additional courses may be required as a condition of admission.

Fall Priority Deadline:	April 1
Spring Priority Deadline:	November1
Accepts non-matriculated students:	Yes

Application Requirements

- Essay explaining the objective for graduate study (maximum of 500 words).
- One full year of general chemistry.
- One full year of organic chemistry and/or physical chemistry. Deficiencies may be removed by coursework or individual study.
- Mathematics through integral calculus and one year of physics.
- For biochemistry track: one year of biology and one semester of biochemistry (lecture and laboratory).
- Three written recommendations from undergraduate chemistry instructors, with a preference for instructors who have taught the applicant during the junior and senior year and for research mentors and/or industry supervisors.
- An interview with a member of the Chemistry and Biochemistry Graduate Committee may be requested. The committee decides on deficiencies, conditions, exceptions, and special permissions.

Examinations	Minimum Scores
TOEFL (IBT):	61
IELTS:	5
PTE:	44
GRE:	Not required
GMAT:	Not required

Ready to apply?

Application site can be found by following the QR Code to the right!

MA – Chemistry

CHEM 710.	Advanced Inorganic Chemistry (3 cr)
CHEM 750.	Advanced Organic Chemistry I (3 cr)
CHEM 760.	Introductory Quantum Chemistry (3 cr)
CHEM 780.	Advanced Seminar I (2 cr)
CHEM 781.	Advanced Seminar II (2 cr)
CHEM 7901.	Basic Laboratory Techniques (4 cr)

Advisors

Dr. Uri Samuni
uri.samuni@qc.cuny.edu

Dr. Sanjai Pathak
sanjai.pathak@qc.cuny.edu

Advanced electives: A minimum of one advanced lecture course (3 – 4 cr)

Students can fll the remaining 6 to 7 required credits with research or with additional advanced lecture courses. Students who chose to count 6 credits of research towards the MA degree must write a Thesis and defend this to the department during seminar day.

MA – Biochemistry

BIOCHEM 710.	Advanced Biochemistry (3 cr)
CHEM 750.	Advanced Organic Chemistry I (3 cr)
CHEM 780.	Advanced Seminar I (2 cr)
CHEM 781.	Advanced Seminar II (2 cr)
CHEM 7901.	Basic Laboratory Techniques in Chemistry (4 cr)

Advisors

Dr. Uri Samuni
uri.samuni@qc.cuny.edu

Dr. Sanjai Pathak
sanjai.pathak@qc.cuny.edu

Advanced elective: One course in physical chemistry selected from CHEM 760 (Quantum Chemistry) or CHEM 770 (Chemical Thermodynamics and Kinetics) or BIOCHEM 770 (Physical Biochemistry)

Students can fll the remaining 13 required credits with research or with additional advanced lecture courses. Students who chose to count 6 or more credits of research towards the MA degree must write a Thesis and defend this thesis to the department during seminar day.

Research

Our department has research that represents both experimental and theoretical areas within all of the disciplines of chemical sciences. Most groups are working on multiple projects, thereby allowing students to integrate into a project involving an area of interest for each student. Many undergraduate students have participated in research throughout their career (i.e., from freshman to senior) and, because of their commitment, have become authors on papers published in peer-reviewed journals.

The disciplines represented within the department are:

- Analytical and and electrochemistry
- Biochemical sciences
- Chemical education
- Materials
- Organic chemistry
- Physical chemistry, chemical physics and/or chemical engineering
- Theoretical and computational chemistry

Analytical and Electrochemistry Research

Dr. Jianbo Liu

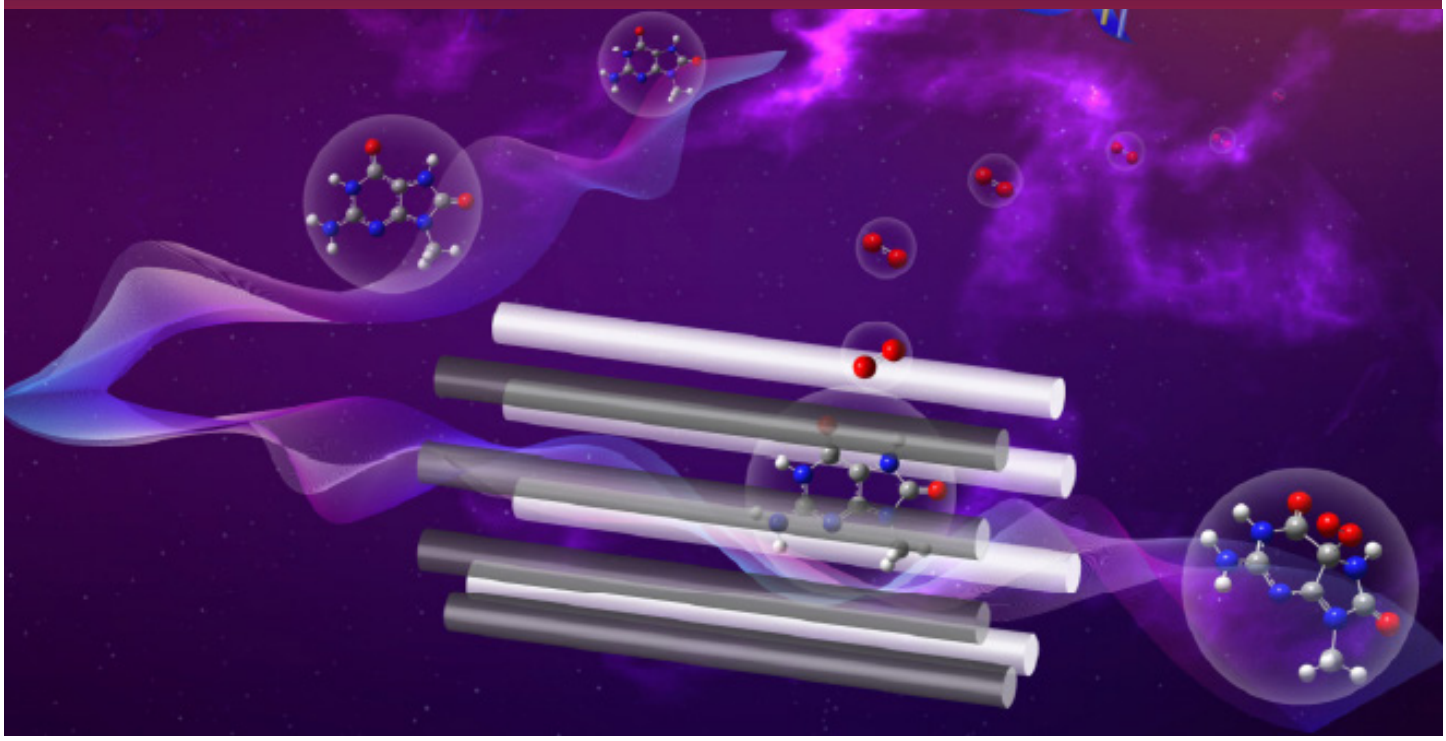
Research focuses on using mass spectrometry and ion-molecule reaction techniques to probe biologically relevant processes in a myraid of systems ranging from isolated biomolecules through micelles and aerosol droplets to biomolecule solutions.

Dr. Michael Mirken

Research is in the emergining field of nanoelectrochemistry. Our group develops nanometer-sized electrochemical probes to study a wide variety of systems, such as charge-transfer reaction, bioelectrochemistry, and transport processes in nanoconfined spaces.

Dr. Gopal Subramaniam

His research group develops new procedures for nuclear magnetic resonance (NMR) spectroscopy, and applies these procedures along with molecular modeling to the structure and dynamics of small and large molecules.



Biochemical Science Research

Dr. Junyong Choi

The main objective is to discover specific, target-directed therapeutics for human diseases. This research laboratory integrates organic synthesis, computer-aided drug design, and chemical biology to discover bioactive chemical probes and therapeutic candidates.

Dr. Sanjai Pathak

Design, synthesis and evaluation of tight binding inhibitors of clinically important enzyme targets using a combination of rational and combinatorial approaches, enzyme kinetics and molecular modeling.

Dr. Susan Rotenberg

Protein kinase C (PKC) is a vital component in various signaling pathways that govern proliferation, differentiation, and cell movement. In malignant cells, PKC promotes unregulated celluar growth and metastisis. This research laboratory investigates the intracellular substrates of specific PKC isoforms to help develop targeted chemotherapeutic agents.

Dr. Uri Samuni

Research focuses on the creation of sol-gel based matrices and nanoparticles to encapsulate proteins and other functionally important reagents. The focus is to fabricate and optimize hybrid nanogels containing cyclic nitroxide stable radicals to service as a nontoxic and safe alternative to gadolinium based MRI contrast agents.

Chemical Education Research

Dr. Sheila Sanders

Dr. Sanders – who is the coordinator for general chemistry laboratories – has helped to create and implement new project oriented and guided inquiry laboratories within the general chemistry sequence. Thus, her chemical education research involves design and testing of new guided inquiry laboratories for future use.

Dr. Gopal Subramaniam

In chemical education, the Subramaniam group has a focus on the use of demonstrations and project-based experimental methods to improve concept retention in basic and general chemistry courses. His group also is focused on redesigning gateway college chemistry courses to improve retention through sequences.

Dr. Stephen Farenga

The research interest of Dr. Farenga involve making science content accessible and comprehensible to the general public. In particular, his areas of specialization include cognition in science, the development of spatial thinking skills in STEM, neuroconstructivism, and the development of STEM-related dispositions. He is a professor of science education in SEYS at QC.

Dr. Cherice Evans

Dr. Evans chemical education research involves the quantification of success through the standard chemistry sequence of general chemistry and organic chemistry, along with the development of new techniques to improve student retention and success through this sequence.

Materials and Nanoscience Research

Dr. Guoxiang Hu

Dr. Hu is interested in using multiscale simulations and machine learning to solve important problems in three energy related applications, namely catalysis, neuromorphic computing, and solar harvesting. Current projects include modeling edges in 2D materials, understanding the mechanism of metal-insulator transitions, and developing metal nanoclusters with long carrier lifetimes for use in solar harvesting.

Dr. Chen Wang

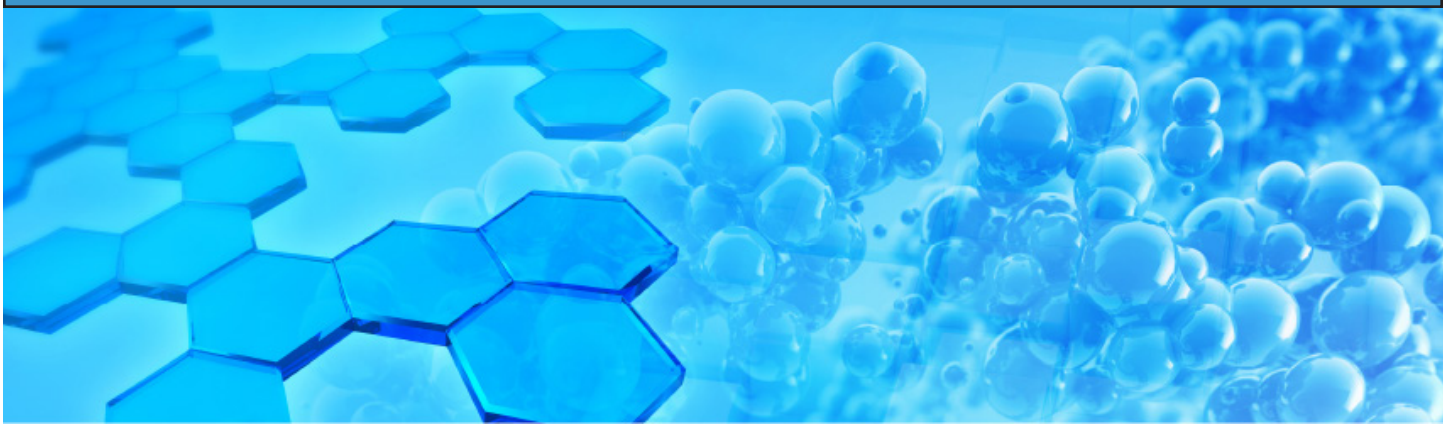
Research in Dr. Wang's laboratory involvesthe synthesis of nanoparticles with strong exciton and plasmonic transitions in order to investigate the dynamics of excitonic processes. The goal of this research is to manage the transportation, conversion, and release of exciton energy.

Dr. Cherice Evans

The nanomaterial project in Dr. Evans' group is the kinetics study of UV mediated nanoparticle growth, with a focus on developing mechanisms of growth along with rate constants. This project is open to students at the freshman level, but will require physical chemistry to fully understand the developing theory.

Dr. Seogjoo Jang

Dr. Jang's research combines theory development and computational modeling to investigate dynamical and kinetic processes in complex molecular environments. Students joining this group need to have a background in advanced mathematics and/or quantum mechanics, or be interested in developing such a background.



Dr. Jianbo Liu

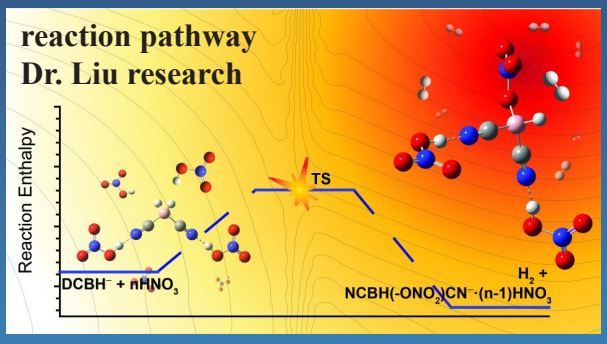
This research group designs, creates and uses gas phase reverse micelles as novel gas-phase nanoreactors. In turn, these nanoreactors are used to investigate biochemical processes in solution phase and/or heterogeneous environments. The complexity of these studies requires significant time dedication from all students – including undergraduate students – in the group.

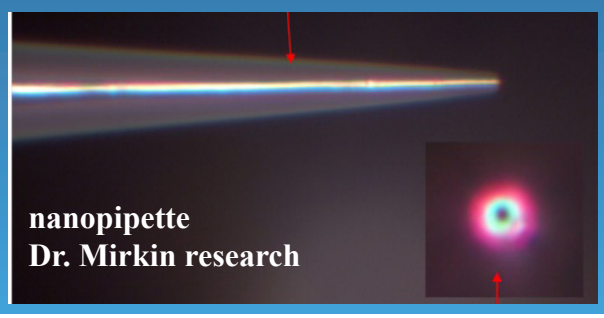
Dr. Michael Mirkin

With a focus on nanoelectrochemistry, Dr. Mirkin's research group has a myraid of projects involving nanomaterials. However, this group requires significant time dedicaton (i.e., a minimum of 16 hrs/week) from all students – including the rare undergraduate student – in the group.

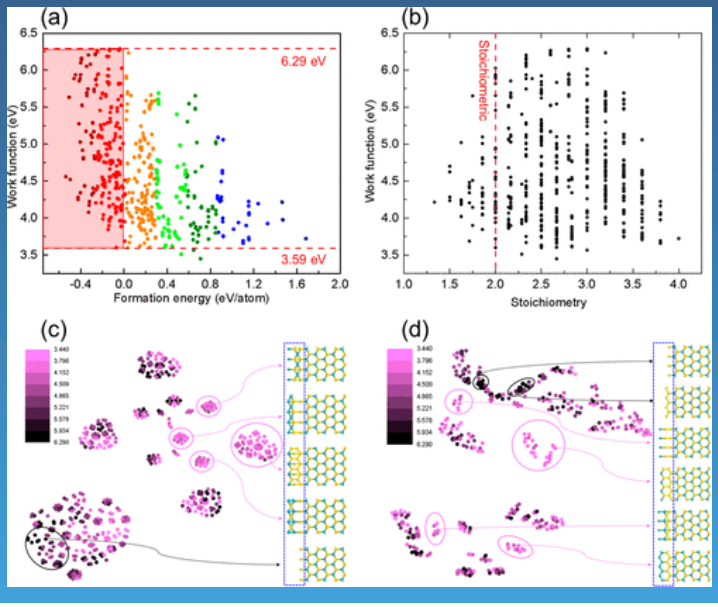
Dr. Uri Samuni

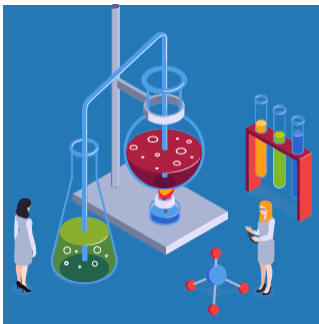
Research focuses on the development of protocols for nanogel fabrication and encapsulation within proteins and other functionally important species. The group characterizes and optimizes the hybrid nanogel size and stability to improve the stability and functionality of the encapsulated protein and/or functional species.





work function engineering – Dr. Hu research





Organic Chemistry Research

Dr. Yu Chen

Dr. Chen's research is in the development of new metal catalyzed reaction pathways. Recent work has been to develop an iron-catalyzed reductive ring-open mechanism and a palladium catalyzed cascade reaction. Undergraduate students interested in joining this group should have completed Organic Chemistry I.

Dr. Junyong Choi

The research within Dr. Choi's group is focused on the synthesis and study of therapeutic candidates and chemical probes for allosteric modulation of various kinases, selective MMP inhibitors, and isoform-specific kinase inhibitors. Undergraduate students interested in this group should be considering MD/PhD programs or PhD programs in chemistry and should have completed Organic Chemistry I.

Dr. William Hersh

The group of Dr. Hersh is focused on syntheses of chiral phosphites and disulfides with connections to oligonucleotide synthetic routes. The recent work in this group has been on the creation of sulfonylamino phosphines and the use of these materials in hydroformylation reactions. Students interested in this research should have completed Organic Chemistry I

Dr. Sanjai Pathak

Dr. Pathak's research involves the development and study of non-toxic drug-like inhibitors of Nek2 kinase as well as the creation of clickable and tagless inhibitory probes for various cysteine cathepsins.

Experimental Physical Chemistry Research

Dr. Cherice Evans

The primary project in the Evans' group is the investigation of dynamics and energetics of charged species in supercritical fluids. These studies soon will involve the creation of a new vacuum ultraviolet light source at QC, as well as the installation of a new high temperature high pressure fluid handling system and sample cell.

Dr. Chen Wang

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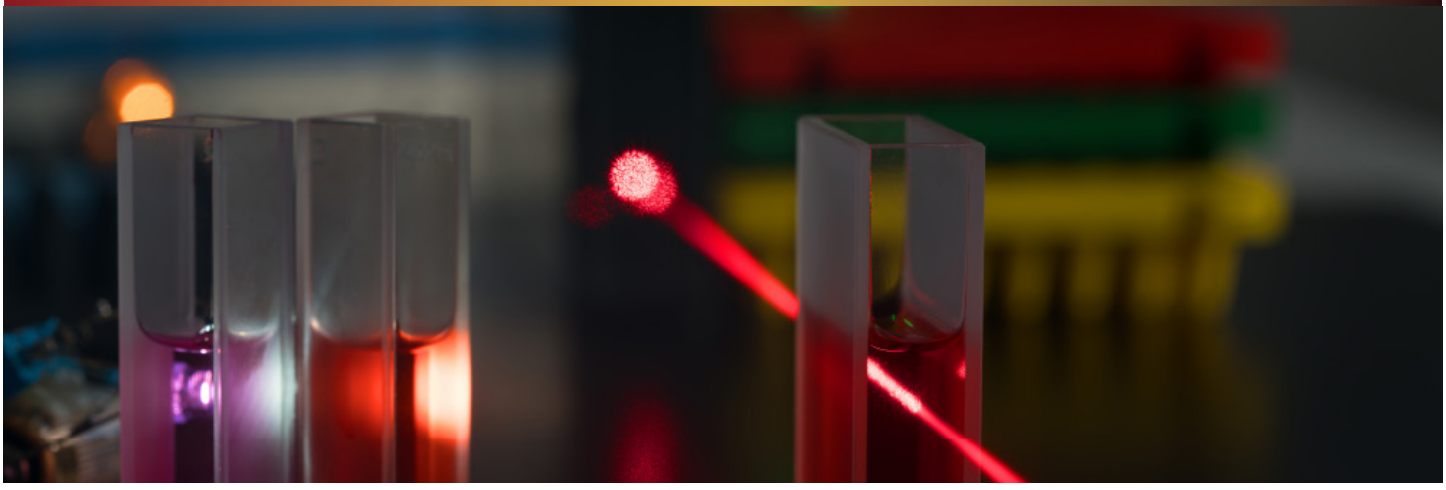

Computational and Theoretical Chemistry Research

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Dr. Guoxiang Hu

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Dr. Jianbo Liu

This research group uses ab-initio electronic structure calculations to map out reaction coordinates (i.e., intermediate complexes, transition states, products, etc). For systems with modest molecular weights, direct dynamics trajector simulations are completed to examine dynamical behavior for comparison with experiment.

Many of the other research groups in the chemistry department have computational aspects of their research programs. These include the organic groups of Dr. William Hersh (computational studies of NMR shifts and coupling constants) as well as both Dr. Junyong Choi and Dr. Sanjai Pathak, who use computational software to test and design small molecule inhibitors before the synthesis of these compounds. Dr. Cherice Evans uses integral methods and molecular dynamics to model ions in supercritical fluids as well as using computational software to probe UV/visible transitions of solvatochromic dyes. Thus, the groups highlight above are those whose primary research involves computation and/or theoretical problems.