

State University of New York at Stony Brook

Biological Chemistry

**Bachelor of Science
in Chemistry Option**

Department of Chemistry

Department of Chemistry
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Biological Chemistry

The Biological Chemistry Option of the Bachelor of Science Degree in Chemistry is designed to provide students with a basic understanding of the chemical principles underlying chemical and biological processes.

The program emphasizes chemistry infused with an orientation towards the biological sciences. Its central theme is a chemistry core strengthened by biology and biochemistry courses. The choice of suitable electives will help the student to prepare for work or advanced study in areas such as chemistry, biochemistry, biotechnology, pharmacology, medicinal chemistry, medicine and other health sciences.

What is Biological Chemistry? Chemists who use the basic techniques of computational, inorganic, physical, and organic chemistry to study biological molecules often call themselves biological chemists. This is a wide-ranging and ever-changing definition. Biological Chemistry is at the core a fundamental and rigorously molecular study of synthesis, mechanism, and structure of the macromolecules and miniomolecules of life. As one focuses still further on how ensembles of these biomolecules interact to make a living cell, one enters into the realm of Biochemistry. Many students trained as chemists successfully move into advanced research in the fields of Biological Chemistry and Biochemistry; in contrast, students trained as Biochemists rarely move into the more fundamental studies of Biological Chemistry.

Declaring the Major. The Biological Chemistry Option of the Chemistry Major is open to all Stony Brook undergraduates. Perhaps the ideal time to declare the major is at the beginning of a student's sophomore year. It is usually unwise to postpone the declaration past the beginning of the student's junior year. Students who wish to elect this major should speak to the Director of Undergraduate Studies.

Plan of Study. Freshman students usually begin their studies toward the major by completing their introductory studies in chemistry and mathematics. In the sophomore year studies in biology and organic chemistry are combined with mathematics and physics courses. In the junior and senior years, physical and inorganic chemistry courses are completed as well as a series of advanced organic and biochemistry courses.

Research. Biological Chemistry is based upon research. This is why students in the major have so many laboratory courses required for their degree. However structured instructional laboratories can not truly introduce students to independent research. For this experience the student must seek out independent research opportunities. The faculty of the Department of Chemistry welcome qualified undergraduate students into their research laboratories. These opportunities are especially suitable for students in their junior and senior years of study. Interested students should review the research interests of the various faculty members and then discuss the possibilities for independent study or research with the individual faculty members who have the research programs of greatest interest. Each summer there are numerous special research programs available at Stony Brook, at nearby Brookhaven Laboratory and at universities across the country, open to qualified students. Interested students should talk to the Director of Undergraduate Studies several months in advance.

Careers. Students who have completed the Biological Chemistry Option are well prepared for entry level positions in many different industries. Such students are particularly attractive to the chemical industry, the pharmaceutical industry, the biotechnology industry and the various health care industries. The best jobs go to students with good records and with lots of laboratory experience, including research. Students who earn a degree certified by the American Chemical Society may have an edge (see next section). Many students choose to pursue graduate study in such fields as Chemistry, Biochemistry, Pharmacology or Health Science, at various universities around the nation. Masters degrees are usually obtainable after one and a half to two years additional study. Ph.D. degrees usually require four-five years study beyond the Bachelor of Science Degree. Graduate students usually receive substantial stipends throughout their period of graduate study.

Health Professions. The Biological Chemistry Option is an excellent choice for students preparing for a career in medicine, dentistry or the other health professions. The courses required for the major include most of the courses requested for admission to the major medical schools. Students who are interested in preparing for health professions programs should consult with advisors in the Center for Academic Advising in the Office of Undergraduate Advising. They will give you advice in regards to necessary course preparation, establishing a reference file, and participation in recommended extracurricular and volunteer activities. When you are ready to apply for admission to the health professional schools of your choice, the Faculty Committee on Health Professions will assist you in preparing your application. There are many criteria used for selecting students for admission, but all schools will look for students who have achieved superior

academic records in a strong program of demanding courses throughout their undergraduate years.

Internships. Special internships are available for qualified undergraduate students majoring in the chemical sciences. These programs allow students to combine work in an industrial setting with their academic studies. Students in the program work in an industrial laboratory one or two days a week. In return they receive a salary from the company and academic credit from Stony Brook. Interested students should talk to the Student Affairs Coordinator several months in advance.

Double Majors. Highly motivated students often choose to complete the requirements for two majors. Students choosing to major in chemistry may wish to consider a second major in such fields as engineering chemistry, physics, mathematics or biology. Students electing the Biological Chemistry Option will find it particularly easy to complete a second major in biochemistry. This requires only a few additional courses, BIO 151, BIO 220, BIO 362 (an option in the CHE requirements), BIO 365 and one additional BIO elective. Students completing a double major will have an extra credential when looking for a job or when applying for graduate study. However a double major is certainly not a good idea for everyone. Often a better approach is to choose particular advanced courses as electives, matching one's own interests and abilities. And in all cases students should consider the importance of research and additional laboratory courses.

American Chemical Society Certification. The American Chemical Society is the national organization for chemists in the United States. The Society publishes the most prestigious journals, hosts the major national chemistry conferences, and influences chemical education in the country. The Society sets standards for the undergraduate chemistry programs at American universities. As part of this program the American Chemical Society's Committee on Professional Training has defined a minimum set of courses that they consider necessary for a student to achieve the skills needed for entry into the chemistry profession. Students who complete these requirements have their degrees certified by the Society. Students receiving certified degrees are eligible for immediate entry into the Society upon graduation. Certification requires the completion of a small number of courses in addition to those required for the major.

Biological Chemistry Option

Major Requirements for the Bachelor of Science Degree:

Candidates for the Bachelors of Science Degree in Chemistry who elect the Biological Chemistry option must complete the Chemistry Core Requirements of basic chemistry, mathematics and physics courses, plus a series of area requirements unique to the Biological Chemistry Option. In addition all students must fulfill the Upper-Division Writing Requirement.

All required courses must be taken for a letter grade; P/NC grades are not acceptable. All chemistry courses must be passed with a grade of C or higher with the exception of three courses for which the grade may be C-. No transferred course with a grade lower than C may be used to fulfill any major requirement.

Completion of the major requirements entails approximately 67 to 69 credits.

A. Core Requirements

- _____ CHE 129/130 or 131, 132 or 141, 142 General or Honors Chemistry
- _____ CHE 133, 134 or 143, 144 General or Honors Chemistry Laboratory
- _____ CHE 301, 302 Physical Chemistry I, II
- _____ CHE 303 Solution Chemistry Laboratory
- _____ CHE 321 and 326 Organic Chemistry I, IIB
- _____ CHE 375 Inorganic Chemistry
- _____ CHE 383 Introductory Synthetic and Spectroscopic Laboratory Techniques
- _____ CHE 385 Tools of Chemistry
- _____ MAT 131, 132 Calculus I, II (Substitutions are possible, see note 1)
- _____ MAT 211 or AMS 210 Linear Algebra
- _____ PHY 131, 132 Classical Physics I, II or PHY 141,142 Classical Physics I, II Honors; (PHY 121, 122 acceptable with permission)

B. Area Requirements for Biological Chemistry Option

- _____ CHE 384 Intermediate Synthetic and Spectroscopic Laboratory Techniques
- _____ One organic or inorganic chemistry elective: CHE 345, 346, 376, 487, or 496
- _____ BIO 202 Fundamentals of Biology: Cell and Molecular Biology
- _____ BIO 361 Biochemistry I
- _____ BIO 310 Cell Biology or BIO 362 Biochemistry II

C. Upper-Division Writing Requirement

Successful completion of CHE 385.

Notes:

1. Alternate Mathematics Sequences

The following alternate sequences may be substituted for major requirements or prerequisites: MAT 125, 126, 127 or 141, 142 for 131, 132. MAT 203 or MAT 205 for AMS 210 or MAT 211.

2. Transfer Credit

At least twelve credits of upper-division work in chemistry must be taken at Stony Brook; these must be taken in at least two of the major subdisciplines (inorganic, physical, and organic chemistry).

3. American Chemical Society Certification

The American Chemical Society's Committee on Professional Training has set nationally recognized standards for professional preparation in chemistry. The Chemistry faculty recommends that students intending to pursue careers in the Chemical Sciences secure ACS certification along with their Bachelor of Science in Chemistry degree.

For ACS certification, students electing the Biological Chemistry Option need to complete the following courses:

- _____ CHE 304 Chemical Instrumentation Laboratory
- _____ CHE 357 Molecular Structure and Spectroscopy Laboratory
- _____ CHE 487 or 496 Senior Laboratory Projects in Chemistry or Senior Research
- _____ Elective in chemistry or related area

**Sample Course Sequence for Students
Electing Biological Chemistry Option
With ACS Certification**

Required Courses:

(major)	Required for CHE Major: Biological Chemistry Option
(DEC)	Diversified Education Curriculum
(ACS)	Required for American Chemical Society Certified Degree (These courses are not required for the CHE degree, but are required for ACS certification.)

Only the minimum number of required credits are listed. Good students will elect to take additional courses in both the major and other areas. Suggested electives include research and additional specialized courses.

Fall - Freshman year

MAT 131	4	(major)
CHE 141 or 131 or 129/130	4	(major)
CHE 143 or 133	1	(major)
WRT 102	3	(DEC)
DEC course	3	(DEC)

Total	15	credits

Spring - Freshman year

CHE 142 or 132	4	(major)
CHE 144 or 134	1	(major)
MAT 132	4	(major)
DEC courses	6	(DEC)

Total	15	credits

Fall - Sophomore year

CHE 321	4	(major)
CHE 383	2	(major)
MAT 211	3	(major)
PHY 131 or 141	4	(major)
DEC course	3	(DEC)

Total	16	credits

Spring - Sophomore year

CHE 326	4	(major)
CHE 384	3	(major)
CHE 385	1	(major)
PHY 132 or 142	4	(major)
BIO 202	4	(major)

Total	16	credits

Fall - Junior year

CHE 301	4	(major)
CHE 303	2	(major)
BIO 361	3	(major)
DEC courses	6	(DEC)

Total	15	credits

Spring - Junior year

CHE 302	4	(major)
CHE 304	2	(ACS)
DEC courses	6	(DEC)
BIO 310 or 362	3	(major)

Total	15	credits

Fall - Senior year

CHE 375	3	(major)
CHE 357	2	(ACS)
CHE 345	3	(major* and/or ACS)
CHE 346	3	(major*)
CHE 495	3	(major* and/or ACS)
Open electives	3	

Total	17	credits

Spring - Senior year

CHE 496	3	(major* and/or ACS)
Open Electives	6	
DEC courses	6	(DEC)

Total	15	credits

Grand Total 123 credits

* Only one of the selections marked with an asterisk is required for the major, but all would help meet the requirements for ACS certification.

Chemistry at Stony Brook

The Department of Chemistry offers a variety of degree opportunities for undergraduates.

The Bachelor of Science in Chemistry Degree

Students who wish to complete the B.S. degree in Chemistry must elect one of the following options. All the options feature a common core of basic introductory chemistry, physics and mathematics courses combined with additional courses unique to each option. A separate brochure is available describing the features of each option.

Chemical Science

This option is the most traditional path with a greatest emphasis given to courses in the Chemistry Department. Students electing this option will acquire a considerable amount of laboratory experience. This option is an excellent one for students who wish to seek employment as a chemist or who wish to go to graduate school in chemistry.

Biological Chemistry

Students choosing this option take a variety of courses in the biological sciences in addition to advanced courses in chemistry. The program prepares students for work or further study in such fields as chemistry, biochemistry, biotechnology, pharmacology, medicinal chemistry, medicine or other health sciences.

Chemical Physics

The Chemical Physics option is for students who wish to combine their studies in chemistry with additional courses in Physics and Mathematics. The program is strongly recommended for students who have an interest in the more physical aspects of chemistry. Students who complete the program are well trained for employment in chemistry and well prepared for graduate studies in chemical physics or physical chemistry.

Environmental Chemistry

This option is a unique one that combines traditional studies in chemistry with additional work in biology and environmental science. Student completing the program are well prepared for employment as chemists and for graduate studies in chemistry as well as various environmental specialties.

The Bachelor of Arts in Chemistry Degree

Students who wish to complete the B.A. degree in Chemistry must complete a set of requirements somewhat less lengthy than those required for the B.S. degree. The B.A. degree may be a good choice for students seeking further professional training or those who wish to combine their major in chemistry with a second major in some other department.

The Bachelor of Science in Engineering Chemistry Degree

The Engineering Chemistry Program is an interdisciplinary program sponsored by the Department of Chemistry and the Department of Materials Science and Engineering. The program is designed to provide students with a basic understanding of the chemical principles and materials technology underlying modern materials technology. Students take a core of courses in chemistry, physics and mathematics combined with a set of courses offered by the Materials Science and Engineering Department. Students completing the program are well trained for employment in the materials field or for graduate study in solid state chemistry or materials science.