

BACHELOR OF SCIENCE IN CHEMISTRY 4+1 MS CHEMISTRY TRACK

The Division of Chemistry within the Department of Chemical and Biological Sciences is comprised of 14 full-time faculty, 10 adjunct & part time faculty, 3 staff members, nearly 100 majors in its BS & BA Chemistry and BS Biochemistry programs, and an active MS program. The division is exceptionally well-equipped in research instrumentation, and offers a rich, hands-on 'learning through research' experience for its students. State-of-the-art laboratory facilities include NMR, X-ray diffraction (powder and single crystal), electron microscopy (scanning & transmission), and a variety of analytical instrumentation. As part of the College of STEM, the division also participates in the YSU Ph.D. program in Materials Science and Engineering.

Our BS Chemistry program is accredited by the American Chemical Society (ACS), one of the largest scientific societies in the world. Students completing an accredited program are considered to be especially well-trained for the chemistry profession, thus the BS degree is recommended for those students who plan to make a career in industrial chemistry or pursue a graduate degree in chemistry. The BA degree is recommended for those who plan to go into a medical, pharmacy, or dental field and for those who plan to enter business or secondary education careers related to chemistry. The BS Biochemistry degree integrates the chemical and biological sciences for students interested in developing a deep understanding of the molecular and chemical processes of living organisms. Students completing this program will be especially well-prepared for further studies in medicine or graduate school programs in biochemistry, or for related careers in the chemical industry.

Each student majoring in chemistry or biochemistry will be assigned a faculty advisor by the department. The advisor will discuss the overall curriculum necessary for your degree program and will assist you in the preparation of a suitable course sequence and choice of a minor or minors if applicable.

| COURSE | TITLE | S.H. |
|--|---|------|
| FIRST YEAR REQUIREMENT -STUDENT SUCCESS | | |
| YSU 1500 | Success Seminar | 1-2 |
| or YSU 1500S | Youngstown State University Success Seminar | |
| or HONR 1500 | Intro to Honors | |
| General Education Requirements | | |
| ENGL 1550 | Writing 1 | 3-4 |
| or ENGL 1549 | Writing 1 with Support | |
| ENGL 1551 | Writing 2 | 3 |
| Mathematics requirement (met through MATH in major) | | |
| Some courses are categorized in more than one Knowledge Domain. Courses can only be used once within the GE model. | | |
| Arts and Humanities (6 s.h.) | | 6 |
| Natural Sciences (2 courses, 1 with lab) (6-7 s.h.) | | |
| Requirement is met through science courses in the major | | |
| Social Science (6 s.h.) | | 6 |
| Gen Ed Electives (9 s.h.) | | |
| CMST 1545 | Communication Foundations | 3 |
| Two Gen Ed Courses Met with Courses in Major | | 0 |
| The following CHEM core courses are required (40 s.h.) | | |
| Grade of "C" or better is required. Courses cannot be taken "CR/NC" | | |
| CHEM 1515 | General Chemistry 1 | 3 |
| CHEM 1515L | General Chemistry 1 Laboratory | 1 |
| CHEM 1515R | Recitation for General Chemistry 1 | 1 |
| CHEM 1516 | General Chemistry 2 | 3 |
| CHEM 1516L | General Chemistry 2 Laboratory | 1 |

| | | |
|-------------------|--|---|
| CHEM 1516R | Recitation for General Chemistry 2 | 1 |
| CHEM 2604 & 2604L | Quantitative Analysis and Quantitative Analysis Laboratory | 5 |
| CHEM 3719 | Organic Chemistry 1 | 3 |
| CHEM 3719L | Organic Chemistry 1 Laboratory | 1 |
| CHEM 3719R | Organic Chemistry Recitation 1 | 1 |
| CHEM 3720 | Organic Chemistry 2 | 3 |
| CHEM 3720L | Organic Chemistry 2 Laboratory | 1 |
| CHEM 3720R | Organic Chemistry Recitation 2 | 1 |
| CHEM 3729 | Inorganic Chemistry | 3 |
| CHEM 3739 | Physical Chemistry 1 | 3 |
| CHEM 3739L | Physical Chemistry 1 Laboratory | 1 |
| CHEM 3740 | Physical Chemistry 2 | 3 |
| CHEM 3740L | Physical Chemistry 2 Laboratory | 1 |
| CHEM 3761 | Introduction to Polymer Chemistry | 1 |
| CHEM 3785 | Biochemistry 1 | 3 |

The following capstone is required (3 s.h.)

| | | |
|-----------|----------------------------|---|
| CHEM 4850 | Chemistry Research | 1 |
| CHEM 4851 | Chemistry Research Project | 2 |

The following non-CHEM courses are required (22 s.h.)

| | | |
|------------|------------------------------|---|
| MATH 1571 | Calculus 1 | 4 |
| MATH 1572 | Calculus 2 | 4 |
| MATH 2673 | Calculus 3 | 4 |
| PHYS 2610 | General Physics 1 | 4 |
| PHYS 2610L | General Physics Laboratory 1 | 1 |
| PHYS 2611 | General Physics 2 | 4 |
| PHYS 2611L | General Physics laboratory 2 | 1 |

Dual Credit Requirements

Select 9 hours of upper-division chemistry electives (from the list below) 4 9 hours of which must be in upper-division laboratory.

| | | |
|-------------------|--|--|
| CHEM 5822 & 5822L | Advanced Organic Laboratory and Advanced Organic Laboratory | |
| CHEM 5804 & 5804L | Chemical Instrumentation and Chemical Instrumentation Laboratory | |
| CHEM 6911 | Advanced Analytical Chemistry 1 | |
| CHEM 6912 | Advanced Analytical Chemistry 2 | |
| CHEM 6921 | Advanced Biochemistry 1 | |
| CHEM 6941 | Advanced Organic Chemistry 1 | |
| CHEM 6980 | Introduction to Chemical Research | |
| CHEM 6991K | Special Topics Organometallics | |
| CHEM 6991Q | Special Topics Quantum Chemistry | |

24 s.h. of additional hours required. These electives could include courses 24 needed to fulfill requirements of the minor.

Total Semester Hours **120-122**

Dual Credit Requirements

Accelerated 4+1 Program

Undergraduate Chemistry students can apply for admission into the accelerated 4+1 MS in Chemistry graduate program after completing 78 undergraduate semester hours with a GPA of 3.0 or higher. After being admitted to the accelerated 4+1 MS program, students will be allowed a maximum of nine semester hours of graduate coursework, specified as 5000 level or higher, to be double counted toward both a bachelor's and master's degrees. The courses chosen to count for both undergraduate and graduate coursework must be approved by the Graduate Program Director. An additional three hours of graduate coursework can be completed as an undergraduate and used exclusively for graduate credit. This allows the student to graduate with a master's degree with one year of additional full-time study beyond the

bachelor's degree, as the total hours counted towards the Master's degree is greater than or equal to 30 hours.

Courses Counting Towards Requirements

Select 3 of these courses, as only 3 can be double counted. Can select a 4th that would only count for the Master's degree.

| Year 1 | | S.H. |
|--|---|--------------|
| Fall | | |
| YSU 1500 or YSU 1500S or HONR 1500 | Success Seminar or Youngstown State University Success Seminar or Intro to Honors | 1-2 |
| CHEM 1515 | General Chemistry 1 | 3 |
| CHEM 1515L | General Chemistry 1 Laboratory | 1 |
| CHEM 1515R | Recitation for General Chemistry 1 | 1 |
| MATH 1571 | Calculus 1 | 4 |
| ENGL 1550 or ENGL 1549 | Writing 1 or Writing 1 with Support | 3-4 |
| Semester Hours | | 13-15 |
| Spring | | |
| CHEM 1516 | General Chemistry 2 | 3 |
| CHEM 1516L | General Chemistry 2 Laboratory | 1 |
| CHEM 1516R | Recitation for General Chemistry 2 | 1 |
| MATH 1572 | Calculus 2 | 4 |
| ENGL 1551 | Writing 2 | 3 |
| GER | | 3 |
| Semester Hours | | 15 |
| Year 2 | | |
| Fall | | |
| CHEM 3719 | Organic Chemistry 1 | 3 |
| CHEM 3719L | Organic Chemistry 1 Laboratory | 1 |
| CHEM 3719R | Organic Chemistry Recitation 1 | 1 |
| CHEM 2604 & 2604L | Quantitative Analysis and Quantitative Analysis Laboratory | 5 |
| PHYS 2610 | General Physics 1 | 4 |
| PHYS 2610L | General Physics Laboratory 1 | 1 |
| Semester Hours | | 15 |
| Spring | | |
| CHEM 3720 | Organic Chemistry 2 | 3 |
| CHEM 3720L | Organic Chemistry 2 Laboratory | 1 |
| CHEM 3720R | Organic Chemistry Recitation 2 | 1 |
| PHYS 2611 | General Physics 2 | 4 |
| PHYS 2611L | General Physics laboratory 2 | 1 |
| MATH 2673 | Calculus 3 | 4 |
| Semester Hours | | 14 |
| Year 3 | | |
| Fall | | |
| CHEM 3739 | Physical Chemistry 1 | 3 |
| CHEM 3739L | Physical Chemistry 1 Laboratory | 1 |
| CHEM 3729 | Inorganic Chemistry | 3 |
| Elective | | 3 |
| GER | | 6 |
| Semester Hours | | 16 |
| Spring | | |
| CHEM 3740 | Physical Chemistry 2 | 3 |
| CHEM 3740L | Physical Chemistry 2 Laboratory | 1 |
| CHEM 3761 | Introduction to Polymer Chemistry | 1 |

| | | |
|---------------------------------|----------------------------|----------------|
| Upper Level Chemistry Electives | 5 | |
| Elective | 3 | |
| GER | 3 | |
| Semester Hours | | 16 |
| Year 4 | | |
| Fall | | |
| CHEM 4850 | Chemistry Research | 1 |
| CHEM 4851 | Chemistry Research Project | 2 |
| CHEM 3785 | Biochemistry 1 | 3 |
| Upper Level Chemistry Elective | | 3 |
| GER Speech Communications | | 3 |
| GER | | 3 |
| Semester Hours | | 15 |
| Spring | | |
| Upper Level CHEM Elective | | 3 |
| Electives | | 10 |
| GER | | 3 |
| Semester Hours | | 16 |
| Total Semester Hours | | 120-122 |

Electives must include courses to fulfill the students chosen minor. Typically for Chemistry majors, the minor will be in Mathematics, Physics or Biology.

Learning Outcomes

- Undergraduate students will demonstrate an understanding of the basic principles of the chemical disciplines included in their curriculum.
- Undergraduate students will demonstrate independent and critical thinking.
- Undergraduate students will demonstrate an understanding of the fundamentals of modern chemical instrumentation.
- Undergraduate students will effectively communicate their ideas both orally and in writing.
- Undergraduate students will acquire basic research skills including planning and performing an experiment and analyzing the results.