BACHELOR OF SCIENCE IN BIOCHEMISTRY 4+1 MS CHEMISTRY TRACK

The Bachelor of Science degree in Biochemistry is recommended for those students interested in integrating the subjects of biology and chemistry. The cross-disciplinary nature of the degree provides students with a good foundation for careers in research and development in the private sector and in academia. Many will continue their education in graduate schools or in health related fields such as medicine, dentistry, or pharmacy.

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 with MATH in major)		
Some couses 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)		
This requirement is met through courses in the major		
Social Science (6 s.h.)		6
General Education Electives (9 s.h.)		
CMST 1545	Communication Foundations	3
Any 2 Gen Ed Courses		6
The following CHEM core courses are required:		
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 3739	Physical Chemistry 1	3
CHEM 3739L	Physical Chemistry 1 Laboratory	1
CHEM 3785	Biochemistry 1	3
CHEM 3785L	Biochemistry Laboratory	1
CHEM 3786	Biochemistry 2	3
CHEM 4850	Chemistry Research	1
CHEM 4851	Chemistry Research Project	2
CHEM 5876	Enzyme Analysis	2
Dual Credit Requirements		
Select 9 s.h. in upper-level CHEM electives from the list below. At least one elective must be a laboratory course or include a laboratory component:		9
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	
The following BIOL core courses are required (14 s.h.):		
BIOL 2601 & 2601L	General Biology 1: Molecules and Cells and General Biology I: Molecules and Cells Laboratory	4
BIOL 3702 & 3702L	Microbiology and Microbiology Laboratory	4
BIOL 3711	Cell Biology: Fine Structure	3
BIOL 3721	Genetics	3
At least 3 s.h. in upper-level BIOL courses required from the list below; 6 s.h. recommended if needed to attain 120 s.h. required for graduation.		**6**
BIOL 4800 & 4800L	Bioinformatics and Bioinformatics Laboratory	
BIOL 4801 & 4801L	Environmental Microbiology and Environmental Microbiology Laboratory	
BIOL 4829	Microbial Physiology	
BIOL 4890 & 4890L	Molecular Genetics and Molecular Genetics Laboratory	
BIOL 5840	Advanced Microbiology	
The following support courses are required (22 s.h.):		
MATH 1571	Calculus 1	4
MATH 1572	Calculus 2	4
STAT 3717	Statistical Methods	4
or STAT 3743	Probability and Statistics	
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
Total Semester Hours		**120-122**

Dual Credit Requirements

Accelerated 4+1 Program

Undergraduate Biochemistry 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		
Fall		**S.H.**
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
BIOL 2601	General Biology 1: Molecules and Cells	3
BIOL 2601L	General Biology I: Molecules and Cells Laboratory	1
	Semester Hours	**16**
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
STAT 3717 or STAT 3743	Statistical Methods or Probability and Statistics	4
	Semester Hours	**14**
Year 3		
Fall		
CHEM 3785	Biochemistry 1	3
CHEM 3785L	Biochemistry Laboratory	1
CHEM 3739	Physical Chemistry 1	3
CHEM 3739L	Physical Chemistry 1 Laboratory	1
BIOL 3721	Genetics	3
GER		6
	Semester Hours	**17**
Spring		
CHEM 3786	Biochemistry 2	3
CHEM 5876	Enzyme Analysis	2
BIOL 3711	Cell Biology: Fine Structure	3
BIOL 3702 & 3702L	Microbiology and Microbiology Laboratory	4
GER		3
	Semester Hours	**15**
Year 4		
Fall		
CHEM 4850	Chemistry Research	1
CHEM Upper-Level Elective		6
CHEM 4851	Chemistry Research Project	2
CMST 1545	Communication Foundations	3
GER		3
	Semester Hours	**15**
Spring		
CHEM Upper-Level Elective		4
BIOL Upper-Level Elective		5
GER		6
	Semester Hours	**15**
	Total Semester Hours	**120-122**

Learning Outcomes

The undergraduate student learning outcomes for the major in biochemistry are as follows:

- Undergraduate students will demonstrate an understanding of the fundamentals of chemistry and biochemistry.
- Undergraduate students will demonstrate independent and critical thinking.
- Undergraduate students will demonstrate an understanding of the fundamentals of modern chemical instrumentation.
- Undergraduate students will be able to interpret experimental data.
- Undergraduate students will effectively communicate their ideas both orally and in writing.