Chemistry and Biochemistry

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The Department of Chemistry and Biochemistry offers bachelor of arts and bachelor of science degrees with majors in chemistry or biochemistry. The department enjoys a strong national reputation.

The curriculum in chemistry provides broad knowledge of the field as a part of the liberal education offered by the College of Arts and Sciences. Chemistry course work is a sound foundation for students interested in advanced work in chemistry or related sciences, particularly such fields as biochemistry, geochemistry, materials science, and molecular biology.

Faculty

Shannon W. Boettcher, associate professor (inorganic, materials science). BA, 2003, Oregon; PhD, 2008, California, Santa Barbara. (2010)

Jeffrey A. Cina, professor (physical). BS, 1979, Wisconsin, Madison; PhD, 1985, California, Berkeley. (1995)

Victoria J. De Rose, professor (bioinorganic). BA, 1983, Chicago; PhD, 1990, California, Berkeley. (2006)

Kenneth M. Doxsee, professor (organic, materials science). BS, 1978, MS, 1979, Stanford; PhD, 1983, California Institute of Technology. (1989)

Deborah B. Exton, senior instructor. BS, 1987, Metropolitan State College of Denver; PhD, 1992, Denver. (1993)

Marina G. Guenza, professor (physical). Laurea, 1985, Università degli Studi di Genova; PhD, 1989, degree granted by consortium of universities of Torino, Genova, and Pavia. (1998)

Julie A. Haack, senior instructor. BS, 1986, Oregon; PhD, 1991, Utah. (2000)

Michael M. Haley, Richard M. and Patricia H. Noyes Professor in Chemistry (organic, materials science). BA, 1987, PhD, 1991, Rice. (1993)

Diane K. Hawley, professor (biochemistry). BA, 1976, Kansas; PhD, 1982, Harvard. (1986)

James E. Hutchison, professor (organic, materials science); Lokey-Harrington Chair in the Department of Chemistry. BS, 1986, Oregon; PhD, 1991, Stanford. (1994)

Darren W. Johnson, professor (organic). BS, 1996, Texas, Austin; PhD, 2000, California, Berkeley. (2003)

David C. Johnson, professor (inorganic, materials science); Rosaria P. Haugland Foundation Chair in Pure and Applied Chemistry. BA, 1978, Rutgers; MS, 1980, PhD, 1983, Cornell. (1986)

Michael E. Kellman, professor (physical). BS, 1971, California, Berkeley; PhD, 1977, Chicago. (1989)

Michael Koscho, senior instructor (organic). BS, 1993, Purdue; PhD, 1999, Illinois, Urbana-Champaign. (2006)

Mark Lonergan, professor (physical, materials science); director, Materials Science Institute. BS, 1990, Oregon; PhD, 1994, Northwestern. (1996)

Andrew H. Marcus, professor (physical, materials science). BA, 1987, California, San Diego; PhD, 1993, Stanford. (1996)

George V. Nazin, associate professor (physical). MS, 1999, Moscow Institute of Physics and Technology; PhD, 2007, California, Irvine. (2010)

Brad J. Nolen, associate professor (biochemistry). BA, 1997, Missouri State; PhD, 2003, California, San Diego. (2008)

Catherine J. Page, associate professor (inorganic, materials science). BA, 1980, Oberlin; PhD, 1984, Cornell. (1986)

Michael D. Pluth, associate professor (organic). BS, 2004, Oregon; PhD, 2008, California, Berkeley. (2011)

Kenneth E. Prehoda, professor (biochemistry). BA, 1991, California State, Sacramento; PhD, 1997, Wisconsin, Madison. (2001)

James Prell, assistant professor (physical). BA, 2005, Washington (St. Louis); PhD, 2011, California, Berkeley. (2014)

Geraldine L. Richmond, professor (physical, materials science); Presidential Chair. BS, 1975, Kansas State; PhD, 1980, California, Berkeley. (1985)

Tom H. Stevens, Philip H. Knight Professor (biochemistry). BA, 1974, MS, 1976, San Francisco State; PhD, 1980, California Institute of Technology. (1982)

David R. "Randy" Sullivan, senior instructor. BS, 1982, MS, 1989, North Texas. (2001)

David R. Tyler, Charles J. and M. Monteith Jacobs Professor in Chemistry (inorganic, materials science). BS, 1975, Purdue; PhD, 1979, California Institute of Technology. (1985)

Gregory M. Williams, senior professor. BS, 1977, California, Los Angeles; PhD, 1981, Princeton. (2001)

Cathy Wong, assistant professor (physical). BSc, 2004, McMaster; PhD, 2011, Toronto. (2015)

Special Staff

John Hardwick, courtesy senior instructor and senior research associate (molecular physics). AB, 1966, Princeton; PhD, 1972, Georgia Institute of Technology. (1985)

Emeriti

Ralph J. Barnhard, senior instructor emeritus. BS, 1959, Otterbein; MS, 1965, Oregon. (1966)

Bruce P. Branchaud, professor emeritus. BS, 1976, Massachusetts; MA, 1981, Dartmouth; PhD, 1981, Harvard. (1983)

Frederick W. Dahlquist, professor emeritus. BA, 1964, Wabash; PhD, 1969, California Institute of Technology. (1971)

Thomas R. Dyke, professor emeritus. BA, 1966, Wooster; PhD, 1972, Harvard. (1974)

O. Hayes Griffith, professor emeritus. AB, 1960, California, Riverside; PhD, 1964, California Institute of Technology. (1965)

David R. Herrick, professor emeritus. BS, 1969, Rochester; MS, 1971, PhD, 1973, Yale. (1975)

John F. W. Keana, professor emeritus. BA, 1961, Kalamazoo; PhD, 1965, Stanford. (1965)

James W. Long, senior instructor emeritus. BS, 1965, Washington (Seattle); PhD, 1969, California, Berkeley. (1978)

Robert M. Mazo, professor emeritus. AB, 1952, Harvard; MS, 1953, PhD, 1955, Yale. (1962)

Peter H. von Hippel, professor emeritus. BS, 1952, MS, 1953, PhD, 1955, Massachusetts Institute of Technology. (1967)

The date in parentheses at the end of each entry is the first year on the University of Oregon faculty.

- **Bachelor of Arts in Chemistry**
- **Bachelor of Arts in Biochemistry**
- **Bachelor of Science in Chemistry**
- **Bachelor of Science in Biochemistry**
- **Chemistry Minor**
- **Biochemistry Minor**

Undergraduate Studies

One strength of the program is the opportunity undergraduates have to participate in the activities of a dynamic research group that considers problems extending well beyond textbook instruction. Major and nonmajor students alike can enjoy this experience of scientific inquiry. One to two years of preparatory course work typically precede the research experience. The department enrolls twenty to thirty undergraduate students each term in CH 401 Research: [Topic].

Preparation

The high school preparation of a prospective chemistry major should include chemistry, physics, and a minimum of three years of mathematics. Those interested in biochemistry would also profit from biology courses in high school.

Two-year college students planning to transfer to the university to major in chemistry should prepare by taking courses equivalent to those outlined for the freshman and sophomore years.

The department offers two general-chemistry sequences, both of which lead to organic chemistry, the second-year sequence in chemistry.

General Chemistry Sequence Options		
CH 221–223	General Chemistry	12
CH 224H–226H	Honors General Chemistry	12

Each sequence covers the fundamentals of chemistry but uses a different approach and a textbook tailored to suit a student's background in high school chemistry and mathematics.

Careers

Career opportunities for chemists are available in education, government, and industry (see the annual October issue of *Chemical and Engineering News*). A bachelor's degree in chemistry provides a good background for advanced study in such fields as

- atmospheric science
- biochemistry
- biology
- environmental sciences
- forensic science
- geochemistry
- geological sciences
- pharmacy
- pharmacology
- physiology
- materials science
- medicine
- medicinal chemistry
- metallurgy
- molecular biology
- neuroscience
- oceanography

Chemists also find jobs in science writing, public relations, personnel, plant production, sales, management, safety management, market research, patent law, and financial analysis. The alumni newsletter, *Chemistry News*, has examples of careers UO majors have chosen. Follow the links on the department's website.

Chemistry Major

The program described below is the recommended curriculum for chemistry majors. It includes courses in chemistry and related fields. Courses taken to satisfy major requirements must be passed with grades of C– or better. Variations in courses and order may be worked out in consultation with an advisor. Advisors can also provide lists of substitute courses and courses that are recommended but not required.

Students are encouraged to participate in CH 401 Research: [Topic].

Bachelor of Arts Degree Requirements in Chemistry

Code	Title	Credits
CH 224H–226H	Honors General Chemistry	12
or CH 221–223	General Chemistry	
CH 227–229	General Chemistry Laboratory	6
or CH 237–239	Advanced General Chemistry Laboratory	
CH 341–343	Majors Track Organic Chemistry I-III	12
CH 337	Organic Chemistry Laboratory	3
CH 348–349	Organic Chemistry Lab for Majors	8
CH 411–413	Physical Chemistry	12
CH 417–419	Physical Chemistry Laboratory	12

Advanced Electives (see Advanced Electives table)		9-12
CH 429	Instrumental Analysis	5
Total Credits		**79-82**

Related Science Requirements

Code	Title	Credits
MATH 251–253	Calculus I-III	12
MATH 256 & MATH 281	Introduction to Differential Equations and Several-Variable Calculus I	8
PHYS 251–253	Foundations of Physics I	12
or PHYS 201–203	General Physics	
PHYS 290	Foundations of Physics Laboratory (three terms)	3-6
or PHYS 204–206	Introductory Physics Laboratory	
Total Credits		**35-38**

Advanced Electives

Code	Title	Credits
Advanced electives (e.g., three courses or 9 credits of research or one course and 6 credits of research) chosen from the following: [1]		9-12
CH 401	Research: [Topic]	
CH 420	Physical Organic Chemistry I	
CH 421	Physical Organic Chemistry II	
CH 431	Inorganic Chemistry	
CH 432	Inorganic Chemistry	
CH 433	Inorganic Chemistry	
CH 441	Quantum Chemistry	
CH 442	Quantum Chemistry and Spectroscopy	
CH 443	Quantum Chemistry and Spectroscopy	
CH 444	Chemical Thermodynamics	
CH 445	Statistical Mechanics	
CH 446	Chemical Kinetics: [Topic]	
CH 447	Computational Chemistry	
CH 451	Advanced Organic-Inorganic Chemistry	
CH 452	Advanced Organic Chemistry—Stereochemistry and Reactions	
CH 454	Advanced Electrochemistry	
CH 461	Biochemistry	
CH 462	Biochemistry	
CH 463	Biochemistry	
CH 464	RNA Biochemistry	
CH 465	Physical Biochemistry	
CH 466	Structural Biochemistry	
CH 467	Biochemistry Laboratory	
GEOL 471	Thermodynamic Geochemistry	
GEOL 472	Aqueous-Mineral-Gas Equilibria	
GEOL 473	Isotope Geochemistry	
PHYS 411–413	Mechanics, Electricity, and Magnetism	
PHYS 414–415	Quantum Physics	
Total Credits		**9-12**

[1] Other courses may be included with advisor approval.

Sample Program for Chemistry Majors

First Year		Credits
CH 224H–226H or 221-223	Honors General Chemistry	12
CH 227–229 or 237-239	General Chemistry Laboratory	6
MATH 251–253	Calculus I-III	12
Select one of the following:		8
WR 121 & WR 122	College Composition I	8
WR 121 & WR 123	College Composition I	8
Electives (general-education, group-satisfying courses)		8-12
Second Year		
CH 341–343	Majors Track Organic Chemistry I-III	12
CH 337	Organic Chemistry Laboratory	3
CH 348	Organic Chemistry Laboratory for Majors	4
CH 349	Organic Chemistry Lab for Majors	4
MATH 256	Introduction to Differential Equations	4
MATH 281	Several-Variable Calculus I	4
PHYS 251–253 or 201-203	Foundations of Physics I	12
PHYS 290 or 204-206	Foundations of Physics Laboratory	3-6
Electives (general-education, group-satisfying courses)		8-12
Third Year		
Advanced electives (see above) and/or CH 401 Research: [Topic]		8-12
CH 411–413	Physical Chemistry	12
CH 417–419	Physical Chemistry Laboratory	12
Electives		8-12
Fourth Year		
Advanced electives (see above) and/or CH 401 Research: [Topic]		8-12
CH 429	Instrumental Analysis	5

Electives		18
	Total Credits:	**171-194**

Bachelor of Science Degree Requirements in Chemistry

Code	Title	Credits
CH 224H–226H	Honors General Chemistry	12
or CH 221–223	General Chemistry	
CH 227–229	General Chemistry Laboratory	6
or CH 237–239	Advanced General Chemistry Laboratory	
CH 341–343	Majors Track Organic Chemistry I-III	12
CH 337	Organic Chemistry Laboratory	3
CH 348–349	Organic Chemistry Lab for Majors	8
CH 411–413	Physical Chemistry	12
CH 417–419	Physical Chemistry Laboratory	12
Advanced Electives (see Advanced Electives table)		9-12
CH 429	Instrumental Analysis	5
Total Credits		**79-82**

Related Science Requirements

Code	Title	Credits
MATH 251–253	Calculus I-III	12
MATH 256 & MATH 281	Introduction to Differential Equations and Several-Variable Calculus I	8
PHYS 251–253	Foundations of Physics I	12
or PHYS 201–203	General Physics	
PHYS 290	Foundations of Physics Laboratory (three terms)	3-6
or PHYS 204–206	Introductory Physics Laboratory	
Total Credits		**35-38**

Advanced Electives

Code	Title	Credits
Advanced electives (e.g., three courses or 9 credits of research or one course and 6 credits of research) chosen from the following: [1]		9-12
CH 401	Research: [Topic]	
CH 420	Physical Organic Chemistry I	
CH 421	Physical Organic Chemistry II	
CH 431	Inorganic Chemistry	
CH 432	Inorganic Chemistry	
CH 433	Inorganic Chemistry	
CH 441	Quantum Chemistry	
CH 442	Quantum Chemistry and Spectroscopy	
CH 443	Quantum Chemistry and Spectroscopy	
CH 444	Chemical Thermodynamics	
CH 445	Statistical Mechanics	
CH 446	Chemical Kinetics: [Topic]	
CH 447	Computational Chemistry	
CH 451	Advanced Organic-Inorganic Chemistry	
CH 452	Advanced Organic Chemistry—Stereochemistry and Reactions	
CH 454	Advanced Electrochemistry	
CH 461	Biochemistry	
CH 462	Biochemistry	
CH 463	Biochemistry	
CH 464	RNA Biochemistry	
CH 465	Physical Biochemistry	
CH 466	Structural Biochemistry	
CH 467	Biochemistry Laboratory	
GEOL 471	Thermodynamic Geochemistry	
GEOL 472	Aqueous-Mineral-Gas Equilibria	
GEOL 473	Isotope Geochemistry	
PHYS 411–413	Mechanics, Electricity, and Magnetism	
PHYS 414–415	Quantum Physics	
Total Credits		**9-12**

[1] Other courses may be included with advisor approval.

Sample Program for Chemistry Majors

First Year		Credits
CH 224H–226H or 221-223	Honors General Chemistry	12
CH 227–229 or 237-239	General Chemistry Laboratory	6
MATH 251–253	Calculus I-III	12
Select one of the following:		8
WR 121 & WR 122	College Composition I	8
WR 121 & WR 123	College Composition I	8
Electives (general-education, group-satisfying courses)		8-12
Second Year		
CH 341–343	Majors Track Organic Chemistry I-III	12
CH 337	Organic Chemistry Laboratory	3
CH 348	Organic Chemistry Laboratory for Majors	4
CH 349	Organic Chemistry Lab for Majors	4
MATH 256	Introduction to Differential Equations	4
MATH 281	Several-Variable Calculus I	4
PHYS 251–253 or 201-203	Foundations of Physics I	12
PHYS 290 or 204-206	Foundations of Physics Laboratory	3-6
Electives (general-education, group-satisfying courses)		8-12

Third Year		
Advanced electives (see above) and/or CH 401 Research: [Topic]		8-12
CH 411–413	Physical Chemistry	12
CH 417–419	Physical Chemistry Laboratory	12
Electives		8-12
Fourth Year		
Advanced electives (see above) and/or CH 401 Research: [Topic]		8-12
CH 429	Instrumental Analysis	5
Electives		18
	Total Credits:	**171-194**

Biochemistry Major

Many undergraduate students who are interested in advanced study using molecular approaches to biological problems (e.g., biochemistry, molecular biology, neurochemistry, physical biochemistry, or perhaps medical research) may want to include courses in biologically based subjects. For these students, the Department of Chemistry offers a biochemistry major.

Courses taken to satisfy major requirements must be passed with grades of C– or better. Variations in courses and order may be worked out in consultation with an advisor.

Students who plan to attend graduate school should include research in their advanced work. If chemical research is included as part of the advanced work, at least 6 credits of CH 401 Research: [Topic] must be completed. Students who plan to apply to medical schools should investigate the need for a physics laboratory course that is not included in this curriculum.

Bachelor of Arts Degree Requirements in Biochemistry

Code	Title	Credits
CH 224H–226H	Honors General Chemistry	12
or CH 221–223	General Chemistry	
CH 227–229	General Chemistry Laboratory	6
or CH 237–239	Advanced General Chemistry Laboratory	
CH 337	Organic Chemistry Laboratory	3
CH 341–343	Majors Track Organic Chemistry I-III	12
CH 348	Organic Chemistry Laboratory for Majors	4
CH 411–412	Physical Chemistry	8
CH 461–463	Biochemistry	12
CH 467	Biochemistry Laboratory	4
Advanced electives (see Advanced Electives table below)		21-21
Total Credits		**81-82**

Related Science Requirements

Code	Title	Credits
MATH 251–253	Calculus I-III	12
PHYS 201–203	General Physics	12
or PHYS 251–253	Foundations of Physics I	
BI 281H–282H	Honors Biology I-II	10
BI 320	Molecular Genetics	4
Total Credits		**38**

Physical Laboratory Requirement

Code	Title	Credits
Select one of the following:		3-8
PHYS 204–206	Introductory Physics Laboratory	
PHYS 290	Foundations of Physics Laboratory (three terms)	
CH 417	Physical Chemistry Laboratory	
CH 418	Physical Chemistry Laboratory	
CH 419	Physical Chemistry Laboratory	
Total Credits		**3-8**

Advanced Laboratory Requirements

Code	Title	Credits
Select one of the following:		4-6
Any 400-level chemistry laboratory course		
CH 401	Research: [Topic] (three terms) [1]	
Total Credits		**4-6**

Advanced Electives

Code	Title	Credits
Five approved 400-level courses in chemistry, biology, and physics. Students may use one approved 300-level biology course (BI 321, 322, 328, or 360) as one of the five advanced electives. [2]		21-21
CH 413	Physical Chemistry	
CH 417	Physical Chemistry Laboratory	
CH 418	Physical Chemistry Laboratory	
CH 419	Physical Chemistry Laboratory	
CH 420	Physical Organic Chemistry I	
CH 421	Physical Organic Chemistry II	
CH 429	Instrumental Analysis	
CH 431	Inorganic Chemistry	
CH 432	Inorganic Chemistry	
CH 433	Inorganic Chemistry	
CH 441	Quantum Chemistry	
CH 442	Quantum Chemistry and Spectroscopy	
CH 443	Quantum Chemistry and Spectroscopy	
CH 444	Chemical Thermodynamics	
CH 445	Statistical Mechanics	
CH 446	Chemical Kinetics: [Topic]	
CH 447	Computational Chemistry	
CH 451	Advanced Organic-Inorganic Chemistry	

CH 452	Advanced Organic Chemistry—Stereochemistry and Reactions	
CH 464	RNA Biochemistry	
CH 465	Physical Biochemistry	
CH 466	Structural Biochemistry	
BI 322	Cell Biology	
BI 328	Developmental Biology	
BI 360	Neurobiology	
BI 421	Advanced Molecular Genetics Research Laboratory	
BI 422	Protein Toxins in Cell Biology	
BI 423	Human Molecular Genetics	
BI 424	Advanced Molecular Genetics	
BI 425	Advanced Molecular Biology Research Laboratory	
BI 426	Genetics of Cancer	
BI 428	Developmental Genetics	
BI 433	Bacterial-Host Interactions	
BI 461	Systems Neuroscience	
BI 463	Cellular Neuroscience	
BI 466	Developmental Neurobiology	
BI 484	Molecular Evolution	
BI 487		
BI 493	Genomic Approaches and Analysis	
Total Credits		**20-21**

1 Advisor approval and a written report are required for Research.

2 See advisor for complete list. Courses used to satisfy the physical and advanced laboratory requirements cannot also be used as an advanced elective.

Sample Program for Biochemistry Majors

First Year		**Credits**
CH 224H–226H or 221-223	Honors General Chemistry	12
CH 227–229 or 237-239	General Chemistry Laboratory	6
WR 121 & WR 123	College Composition I	8
MATH 251–253	Calculus I-III	12
Electives (general-education, group-satisfying courses)		8-12
Second Year		
BI 281H–282H	Honors Biology I-II	10
BI 320	Molecular Genetics	4
CH 341–343	Majors Track Organic Chemistry I-III	12
CH 337	Organic Chemistry Laboratory	3
CH 348	Organic Chemistry Laboratory for Majors	4
Electives (general-education, group-satisfying courses)		8-12
Third Year		
CH 461–463	Biochemistry	12
CH 467	Biochemistry Laboratory	4
PHYS 201–203	General Physics	12
PHYS 204–206	Introductory Physics Laboratory	6
Electives (general-education and advanced chemistry-biology courses)		8-12
Fourth Year		
CH 411–412	Physical Chemistry	8
CH 401	Research: [Topic] (or advanced laboratory)	4-6
Electives (general-education and advanced chemistry-biology courses)		21-28
	Total Credits:	**162-183**

Bachelor of Science Degree Requirements in Biochemistry

Code	**Title**	**Credits**
CH 224H–226H	Honors General Chemistry	12
or CH 221–223	General Chemistry	
CH 227–229	General Chemistry Laboratory	6
or CH 237–239	Advanced General Chemistry Laboratory	
CH 337	Organic Chemistry Laboratory	3
CH 341–343	Majors Track Organic Chemistry I-III	12
CH 348	Organic Chemistry Laboratory for Majors	4
CH 411–412	Physical Chemistry	8
CH 461–463	Biochemistry	12
CH 467	Biochemistry Laboratory	4
Advanced electives (see Advanced Electives table below)		21-21
Total Credits		**81-82**

Related Science Requirements

Code	**Title**	**Credits**
MATH 251–253	Calculus I-III	12
PHYS 201–203	General Physics	12
or PHYS 251–253	Foundations of Physics I	
BI 281H–282H	Honors Biology I-II	10
BI 320	Molecular Genetics	4
Total Credits		**38**

Physical Laboratory Requirement

Code	Title	Credits
Select one of the following:		3-8
PHYS 204–206	Introductory Physics Laboratory	
PHYS 290	Foundations of Physics Laboratory (three terms)	
CH 417	Physical Chemistry Laboratory	
CH 418	Physical Chemistry Laboratory	
CH 419	Physical Chemistry Laboratory	
Total Credits		**3-8**

Advanced Laboratory Requirements

Code	Title	Credits
Select one of the following:		4-6
Any 400-level chemistry laboratory course		
CH 401	Research: [Topic] (three terms) [1]	
Total Credits		**4-6**

Advanced Electives

Code	Title	Credits
Five approved 400-level courses in chemistry, biology, and physics. Students may use one approved 300-level biology course (BI 321, 322, 328, or 360) as one of the five advanced electives. [2]		21-21
CH 413	Physical Chemistry	
CH 417	Physical Chemistry Laboratory	
CH 418	Physical Chemistry Laboratory	
CH 419	Physical Chemistry Laboratory	
CH 420	Physical Organic Chemistry I	
CH 421	Physical Organic Chemistry II	
CH 429	Instrumental Analysis	
CH 431	Inorganic Chemistry	
CH 432	Inorganic Chemistry	
CH 433	Inorganic Chemistry	
CH 441	Quantum Chemistry	
CH 442	Quantum Chemistry and Spectroscopy	
CH 443	Quantum Chemistry and Spectroscopy	
CH 444	Chemical Thermodynamics	
CH 445	Statistical Mechanics	
CH 446	Chemical Kinetics: [Topic]	
CH 447	Computational Chemistry	
CH 451	Advanced Organic-Inorganic Chemistry	
CH 452	Advanced Organic Chemistry—Stereochemistry and Reactions	
CH 464	RNA Biochemistry	
CH 465	Physical Biochemistry	
CH 466	Structural Biochemistry	
BI 322	Cell Biology	
BI 328	Developmental Biology	
BI 360	Neurobiology	
BI 421	Advanced Molecular Genetics Research Laboratory	
BI 422	Protein Toxins in Cell Biology	
BI 423	Human Molecular Genetics	
BI 424	Advanced Molecular Genetics	
BI 425	Advanced Molecular Biology Research Laboratory	
BI 426	Genetics of Cancer	
BI 428	Developmental Genetics	
BI 433	Bacterial-Host Interactions	
BI 461	Systems Neuroscience	
BI 463	Cellular Neuroscience	
BI 466	Developmental Neurobiology	
BI 484	Molecular Evolution	
BI 487		
BI 493	Genomic Approaches and Analysis	
Total Credits		**20-21**

[1] Advisor approval and a written report are required for Research.

[2] See advisor for complete list. Courses used to satisfy the physical and advanced laboratory requirements cannot also be used as an advanced elective.

Sample Program for Biochemistry Majors

First Year		Credits
CH 224H–226H or 221-223	Honors General Chemistry	12
CH 227–229 or 237-239	General Chemistry Laboratory	6
WR 121 & WR 123	College Composition I	8
MATH 251–253	Calculus I-III	12
Electives (general-education, group-satisfying courses)		8-12
Second Year		
BI 281H–282H	Honors Biology I-II	10
BI 320	Molecular Genetics	4
CH 341–343	Majors Track Organic Chemistry I-III	12
CH 337	Organic Chemistry Laboratory	3
CH 348	Organic Chemistry Laboratory for Majors	4
Electives (general-education, group-satisfying courses)		8-12
Third Year		
CH 461–463	Biochemistry	12
CH 467	Biochemistry Laboratory	4
PHYS 201–203	General Physics	12
PHYS 204–206	Introductory Physics Laboratory	6

Electives (general-education and advanced chemistry-biology courses)		8-12
Fourth Year		
CH 411–412	Physical Chemistry	8
CH 401	Research: [Topic] (or advanced laboratory)	4-6
Electives (general-education and advanced chemistry-biology courses)		21-28
	Total Credits:	**162-183**

Honors Program

The criteria used for the selection of students who graduate with departmental honors in chemistry or biochemistry are as follows:

1. Grade point average (GPA) of at least 3.50 in all graded courses
2. Suitable accomplishment in undergraduate chemical or related research. Specifically, the student must pursue a research problem for one academic year or longer and be recommended as worthy of honors by the faculty supervisor. Positive accomplishment and publishable results are expected but not required
3. Endorsement for a major with honors by a member of the university faculty
4. Completion of all course requirements for the BS degree in chemistry. Waivers or substitutions allowed with the chemistry faculty's approval

Chemistry Minor

A minor in chemistry may be designed from course work in general chemistry, including the laboratory sequence, and at least four additional upper-division courses. University requirements for the minor include a total of 24 credits in chemistry, 15 of which must be in upper-division courses and 12 of which must be completed at the University of Oregon. All courses for the minor must be completed with grades of C– or better. Credits earned in CH 407 Seminar: [Topic], CH 405 Reading and Conference: [Topic], and CH 409 Special Laboratory Problems may not be applied as required course work for the minor.

Biochemistry Minor

Lower Division		
General chemistry sequence		12
General chemistry laboratories		6
Upper Division		
CH 331 & CH 335	Organic Chemistry I and Organic Chemistry II	8
CH 461 & CH 462	Biochemistry and Biochemistry	8
CH 463	Biochemistry	4
or CH 467	Biochemistry Laboratory	
Total Credits		**38**

Other courses may be submitted for consideration and approval by the department. At least 12 credits for the biochemistry minor must be completed at the University of Oregon. All courses applied to the minor must be completed with grades of C– or better. Credits earned in CH 407 Seminar: [Topic], CH 405 Reading and Conference: [Topic], and CH 409 Special Laboratory Problems may not be applied to required course work for the biochemistry minor.

Academic Minors for Chemistry Majors

A carefully chosen minor can complement and enhance undergraduate study in chemistry. Following is a selection of academic minors that chemistry majors might want to consider:

- biology
- business administration
- computer and information science
- economics
- environmental studies
- geological sciences
- human physiology
- mathematics
- physics

Kindergarten through Secondary Teaching Careers

Students who complete the BA or BS degree with a major in chemistry or biochemistry are eligible to apply for the College of Education's fifth-year licensure program in middle-secondary teaching or the fifth-year licensure program to become an elementary teacher. More information is available from the department's K–12 education advisors, Catherine Page and Julie Haack; see also the **College of Education** section of this catalog.

Four-Year Degree Plan

The degree plan shown is only a sample of how students may complete their degrees in four years. There are alternative ways. Students should consult their advisor to determine the best path for them.

- **Chemistry**
- **Biochemistry**

Bachelor of Arts in Chemistry

Course	Title	Credits	Milestones
First Year			
Fall			
CH 221 or CH 224H	General Chemistry I or Honors General Chemistry	Course must be graded and passed with a C– or better	4
CH 227 or CH 237	General Chemistry Laboratory or Advanced General Chemistry Laboratory	Course must be graded and passed with a C– or better	2

WR 121	College Composition I		4
MATH 111	College Algebra		4
	Credits		**14**
Winter			
CH 222 or CH 225H	General Chemistry II or Honors General Chemistry	Course must be graded and passed with a C– or better	4
CH 228 or CH 226H	General Chemistry Laboratory or Honors General Chemistry	Course must be graded and passed with a C– or better	2
WR 123 or WR 122	College Composition III or College Composition II		4
MATH 112	Elementary Functions		4
	Credits		**14**
Spring			
CH 223 or CH 226H	General Chemistry III or Honors General Chemistry	Course must be graded and passed with a C– or better	4
CH 229 or CH 239	General Chemistry Laboratory or Advanced General Chemistry Laboratory	Course must be graded and passed with a C– or better	2
MATH 251	Calculus I	Course must be graded and passed with a C– or better	4
General education course in arts and letters			4
	Credits		**14**
	Total Credits		**42**

Course	Title		Credits	Milestones
Second Year				
Fall				
CH 341	Majors Track Organic Chemistry I	Course must be graded and passed with a C– or better	4	
CH 337	Organic Chemistry Laboratory	Course must be graded and passed with a C– or better	3	
PHYS 201 or PHYS 251	General Physics or Foundations of Physics I	Course must be graded and passed with a C– or better	4	
PHYS 204 or PHYS 290	Introductory Physics Laboratory or Foundations of Physics Laboratory	Course must be graded and passed with a C– or better	2	
MATH 252	Calculus II	Course must be graded and passed with a C– or better	4	
	Credits		**17**	
Winter				
CH 342	Majors Track Organic Chemistry II	Course must be graded and passed with a C– or better	4	
CH 348	Organic Chemistry Laboratory for Majors	Course must be graded and passed with a C– or better	4	
PHYS 202 or PHYS 252	General Physics or Foundations of Physics I	Course must be graded and passed with a C– or better	4	
PHYS 205 or PHYS 290	Introductory Physics Laboratory or Foundations of Physics Laboratory	Course must be graded and passed with a C– or better	2	

MATH 253	Calculus III	Course must be graded and passed with a C– or better	4
	Credits		**18**
Spring			
CH 343	Majors Track Organic Chemistry III	Course must be graded and passed with a C– or better	4
CH 349	Organic Chemistry Lab for Majors	Course must be graded and passed with a C– or better	4
PHYS 203 or PHYS 253	General Physics or Foundations of Physics I	Course must be graded and passed with a C– or better	4
PHYS 206 or PHYS 290	Introductory Physics Laboratory or Foundations of Physics Laboratory	Course must be graded and passed with a C– or better	2
General education course in social science			4
	Credits		**18**
	Total Credits		**53**

Course	Title		Credits	Milestones
Third Year				
Fall				
CH 411	Physical Chemistry	Course must be graded and passed with a C– or better	4	
CH 417	Physical Chemistry Laboratory	Course must be graded and passed with a C– or better	4	
MATH 256	Introduction to Differential Equations	Course must be graded and passed with a C– or better	4	
First term of first-year second-language sequence (BA only)		Begin Foreign Language Requireme	5	
	Credits		**17**	
Winter				
CH 412	Physical Chemistry	Course must be graded and passed with a C– or better	4	
CH 418	Physical Chemistry Laboratory	Course must be graded and passed with a C– or better	4	
MATH 281	Several-Variable Calculus I	Course must be graded and passed with a C– or better	4	
Second term of first-year second-language sequence (BA only)			5	
	Credits		**17**	
Spring				
CH 413	Physical Chemistry	Course must be graded and passed with a C– or better	4	
CH 419	Physical Chemistry Laboratory	Course must be graded and passed with a C– or better	4	
Third term of first-year second-language sequence (BA only)			5	
General education course in social science			4	
	Credits		**17**	
	Total Credits		**51**	

Course	Title		Credits	Milestones
Fourth Year				
Fall				
400-level course in chemistry, earth sciences, or physics		Approved elective course; must be graded and passed with a C– or better	4	
First term of second-year second-language sequence (BA only)			4	
General education course in arts and letters that also satisfies multicultural requirement			4	
General education course in social science			4	
	Credits		**16**	
Winter				
400-level course in chemistry, earth sciences, or physics		Approved elective course; must be graded and passed with a C– or better	4	
Second term of second-year second-language sequence (BA only)			4	
General education course in arts and letters that also satisfies multicultural requirement			4	
General education course in arts and letters			4	
	Credits		**16**	
Spring				
CH 429	Instrumental Analysis	Course must be graded and passed with a C- or better	5	
400-level course in chemistry, earth sciences, or physics		Approved elective course; must be graded and passed with a C– or better	4	
Third term of second-year second-language sequence (BA only)			4	
General education course in arts and letters		Apply for degree in DuckWeb by end of fourth week of spring term	4	
	Credits		**17**	
	Total Credits		**49**	

Bachelor of Science in Chemistry

Course	Title		Credits	Milestones
First Year				
Fall				
CH 221 or CH 224H	General Chemistry I or Honors General Chemistry	Course must be graded and passed with a C– or better	4	
CH 227 or CH 237	General Chemistry Laboratory or Advanced General Chemistry Laboratory	Course must be graded and passed with a C– or better	2	
WR 121	College Composition I		4	
MATH 111	College Algebra		4	
	Credits		**14**	
Winter				
CH 222 or CH 225H	General Chemistry II or Honors General Chemistry	Course must be graded and passed with a C– or better	4	
CH 228 or CH 238	General Chemistry Laboratory or Advanced General Chemistry Laboratory	Course must be graded and passed with a C– or better	2	
WR 123 or WR 122	College Composition III or College Composition II		4	
MATH 112	Elementary Functions		4	
	Credits		**14**	

Spring			
CH 223 or CH 226H	General Chemistry III or Honors General Chemistry	Course must be graded and passed with a C– or better	4
CH 229 or CH 239	General Chemistry Laboratory or Advanced General Chemistry Laboratory	Course must be graded and passed with a C– or better	2
MATH 251	Calculus I	Course must be graded and passed with a C– or better	4
General education course in arts and letters			4
	Credits		**14**
	Total Credits		**42**

Course	Title		Credits	Milestones
Second Year				
Fall				
CH 341	Majors Track Organic Chemistry I	Course must be graded and passed with a C– or better	4	
CH 337	Organic Chemistry Laboratory	Course must be graded and passed with a C– or better	3	
PHYS 201 or PHYS 251	General Physics or Foundations of Physics I	Course must be graded and passed with a C– or better	4	
PHYS 204 or PHYS 290	Introductory Physics Laboratory or Foundations of Physics Laboratory	Course must be graded and passed with a C– or better	2	
MATH 252	Calculus II	Course must be graded and passed with a C– or better	4	
	Credits		**17**	
Winter				
CH 342	Majors Track Organic Chemistry II	Course must be graded and passed with a C– or better	4	
CH 348	Organic Chemistry Laboratory for Majors	Course must be graded and passed with a C– or better	4	
PHYS 202 or PHYS 252	General Physics or Foundations of Physics I	Course must be graded and passed with a C– or better	4	
PHYS 205 or PHYS 290	Introductory Physics Laboratory or Foundations of Physics Laboratory	Course must be graded and passed with a C– or better	2	
MATH 253	Calculus III	Course must be graded and passed with a C– or better	4	
	Credits		**18**	
Spring				
CH 343	Majors Track Organic Chemistry III	Course must be graded and passed with a C– or better	4	

CH 349	Organic Chemistry Lab for Majors	Course must be graded and passed with a C– or better	4
PHYS 203 or PHYS 253	General Physics or Foundations of Physics I	Course must be graded and passed with a C– or better	4
PHYS 206 or PHYS 290	Introductory Physics Laboratory or Foundations of Physics Laboratory	Course must be graded and passed with a C– or better	2
General education course in social science			4
	Credits		**18**
	Total Credits		**53**

Course	Title		Credits	Milestones
Third Year				
Fall				
CH 411	Physical Chemistry	Course must be graded and passed with a C– or better	4	
CH 417	Physical Chemistry Laboratory	Course must be graded and passed with a C– or better	4	
MATH 256	Introduction to Differential Equations	Course must be graded and passed with a C– or better	4	
General education course in arts and letters			4	
	Credits		**16**	
Winter				
CH 412	Physical Chemistry	Course must be graded and passed with a C– or better	4	
CH 418	Physical Chemistry Laboratory	Course must be graded and passed with a C– or better	4	
MATH 281	Several-Variable Calculus I	Course must be graded and passed with a C– or better	4	
General education course in social science			4	
	Credits		**16**	
Spring				
CH 413	Physical Chemistry	Course must be graded and passed with a C– or better	4	
CH 419	Physical Chemistry Laboratory	Course must be graded and passed with a C– or better	4	
CH 429	Instrumental Analysis	Course must be graded and passed with a C– or better	5	
General education course in social science			4	
	Credits		**17**	
	Total Credits		**49**	

Course	Title		Credits	Milestones
Fourth Year				
Fall				
400-level course in chemistry, earth sciences, or physics		Approved elective course; must be graded and passed with a C– or better	4	

CH 401	Research: [Topic]	Advanced elective: 6 credits of undergradu research; must be graded and passed with a C– or better	2
General education course that also satisfies multicultural requirement			4
General education course in arts and letters			4
	Credits		**14**
Winter			
CH 401	Research: [Topic]	Advanced elective: 6 credits of undergradu research; must be graded and passed with a C– or better	2
General education course that also satisfies multicultural requirement			4
General education course in social science			4
Elective			4
	Credits		**14**
Spring			
CH 401	Research: [Topic]	Advanced elective: 6 credits of undergraduate research; must be graded and passed with a C– or better	2
General education course in arts and letters			4
Elective			4
Elective		Apply for degree in DuckWeb by end of week 4, Spring Term	4
	Credits		**14**
	Total Credits		**42**

Bachelor of Arts in Biochemistry

Course	Title		Credits Milestones
First Year			
Fall			
CH 221 or CH 224H	General Chemistry I or Honors General Chemistry	Course must be graded and passed with a C– or better	4
CH 227 or CH 237	General Chemistry Laboratory or Advanced General Chemistry Laboratory	Course must be graded and passed with a C– or better	2
WR 121	College Composition I		4
MATH 111	College Algebra	BI 281H must be graded and passed with a B– or better	4
	Credits		**14**
Winter			
CH 222 or CH 225H	General Chemistry II or Honors General Chemistry	Course must be graded and passed with a C– or better	4
CH 228 or CH 238	General Chemistry Laboratory or Advanced General Chemistry Laboratory	Course must be graded and passed with a C– or better	2
WR 123 or WR 122	College Composition III or College Composition II		4
MATH 112	Elementary Functions		4
	Credits		**14**
Spring			
CH 223 or CH 226H	General Chemistry III or Honors General Chemistry	Course must be graded and passed with a B- or better for BI 281H	4

CH 229 or CH 239	General Chemistry Laboratory or Advanced General Chemistry Laboratory	Course must be graded and passed with a C– or better	2
MATH 251	Calculus I	Course must be graded and passed with a C- or better	4
General education course in social science that also satisfies multicultural requirement			4
	Credits		**14**
	Total Credits		**42**

Course	Title		Credits	Milestones
Second Year				
Fall				
CH 341	Majors Track Organic Chemistry I	Course must be graded and passed with a C– or better	4	
CH 337	Organic Chemistry Laboratory	Course must be graded and passed with a C– or better	3	
BI 281H	Honors Biology I: Cells, Biochemistry and Physiology	Prereqs: B– or better in MATH 111 and CH 223 or 224H; course must be graded and passed with C– or better	5	
MATH 252	Calculus II	Course must be graded and passed with a C– or better	4	
	Credits		**16**	
Winter				
CH 342	Majors Track Organic Chemistry II	Course must be graded and passed with a C– or better	4	
CH 348	Organic Chemistry Laboratory for Majors	Course must be graded and passed with a C– or better	4	
BI 282H	Honors Biology II: Genetics and Molecular Biology	Course must be graded and passed with a C– or better	5	
MATH 253	Calculus III	Course must be graded and passed with a C– or better	4	
	Credits		**17**	
Spring				
CH 343	Majors Track Organic Chemistry III	Course must be graded and passed with a C– or better	4	
BI 320	Molecular Genetics	Course must be graded and passed with a C– or better	4	
General education course in arts and letters that also satisfies multicultural requirement			4	
General education course in social science			4	
	Credits		**16**	
	Total Credits		**49**	

Course	Title		Credits	Milestones
Third Year				
Fall				
CH 461	Biochemistry	Course must be graded and passed with a C– or better	4	
CH 467	Biochemistry Laboratory	Course must be graded and passed with a C– or better	4	
PHYS 201 or PHYS 251	General Physics or Foundations of Physics I	Course must be graded and passed with a C– or better	4	
PHYS 204 or PHYS 290	Introductory Physics Laboratory or Foundations of Physics Laboratory	Course must be graded and passed with a C– or better	2	
First term of first-year second-language requirement (BA only)			5	
	Credits		**19**	
Winter				
CH 462	Biochemistry	Course must be graded and passed with a C– or better	4	
PHYS 202 or PHYS 252	General Physics or Foundations of Physics I	Course must be graded and passed with a C– or better	4	
PHYS 205 or PHYS 290	Introductory Physics Laboratory or Foundations of Physics Laboratory	Course must be graded and passed with a C– or better	2	
Second term of first-year second-language requirement (BA only)			5	
General education course in social science			4	
	Credits		**19**	
Spring				
CH 463	Biochemistry		4	
400-level course in chemistry or biology		Approved elective course; must be graded and passed with a C– or better	4	
PHYS 203 or PHYS 253	General Physics or Foundations of Physics I	Course must be graded and passed with a C– or better	4	
PHYS 206 or PHYS 290	Introductory Physics Laboratory or Foundations of Physics Laboratory	Course must be graded and passed with a C– or better	2	
Third term of first-year second-language requirement (BA only)			5	
	Credits		**19**	
	Total Credits		**57**	

Course	Title		Credits	Milestones
Fourth Year				
Fall				
CH 411	Physical Chemistry	Course must be graded and passed with a C– or better	4	
CH 417	Physical Chemistry Laboratory	Course must be graded and passed with a C– or better	4	
400-level course in chemistry or biology		Approved elective course; must be graded and passed with a C– or better	4	

First term of second-year second-language requirement (BA only)			4
General education course in arts and letters			4
	Credits		**20**
Winter			
CH 412	Physical Chemistry	Course must be graded and passed with a C– or better	4
400-level courses in chemistry or biology		Approved elective course; must be graded and passed with a C– or better	8
Second term of second-year second-language requirement (BA only)			4
General education course in arts and letters			4
	Credits		**20**
Spring			
400-level course in chemistry or biology		Approved elective course; must be graded and passed with a C– or better	4
Third term of second-year second-language requirement (BA only)			4
General education course in social science			4
General education course in arts and letters		Apply for degree in DuckWeb by end of fourth week of spring term	4
	Credits		**16**
	Total Credits		**56**

Bachelor of Science in Biochemistry

Course	Title		Credits	Milestones
First Year				
Fall				
CH 221 or CH 224H	General Chemistry I or Honors General Chemistry	Course must be graded and passed with a C– or better	4	
CH 227 or CH 237	General Chemistry Laboratory or Advanced General Chemistry Laboratory	Course must be graded and passed with a C– or better	2	
WR 121	College Composition I		4	
MATH 111	College Algebra	Course must be graded and passed with a B– or better	4	
	Credits		**14**	
Winter				
CH 222 or CH 225H	General Chemistry II or Honors General Chemistry	Course must be graded and passed with a C– or better	4	
CH 228 or CH 238	General Chemistry Laboratory or Advanced General Chemistry Laboratory	Course must be graded and passed with a C– or better	2	
WR 123 or WR 122	College Composition III or College Composition II		4	
MATH 112	Elementary Functions		4	
	Credits		**14**	
Spring				
CH 223 or CH 226H	General Chemistry III or Honors General Chemistry	Course must be graded and passed with a B– or better	4	
CH 229 or CH 239	General Chemistry Laboratory or Advanced General Chemistry Laboratory	Course must be graded and passed with a C– or better	2	
MATH 251	Calculus I	Course must be graded and passed with a C– or better	4	

General education course in arts and letters			4
	Credits		**14**
	Total Credits		**42**

Course	Title	Credits	Milestones
Second Year			
Fall			
CH 341	Majors Track Organic Chemistry I	Course must be graded and passed with a C– or better	4
CH 337	Organic Chemistry Laboratory	Course must be graded and passed with a C– or better	3
BI 281H	Honors Biology I: Cells, Biochemistry and Physiology	Prereqs: B– or better in MATH 111 and CH 223 or 224H; course must be graded and passed with C– or better	5
MATH 252	Calculus II	Course must be graded and passed with a C– or better	4
	Credits		**16**
Winter			
CH 342	Majors Track Organic Chemistry II	Course must be graded and passed with a C– or better	4
CH 348	Organic Chemistry Laboratory for Majors	Course must be graded and passed with a C– or better	4
BI 282H	Honors Biology II: Genetics and Molecular Biology	Course must be graded and passed with a C– or better	5
MATH 253	Calculus III	Course must be graded and passed with a C– or better	4
	Credits		**17**
Spring			
CH 343	Majors Track Organic Chemistry III	Course must be graded and passed with a C– or better	4
BI 320	Molecular Genetics	Course must be graded and passed with a C– or better	4
General education course in arts and letters			4
General education course in social science			4
	Credits		**16**
	Total Credits		**49**

Course	Title	Credits	Milestones
Third Year			
Fall			
CH 461	Biochemistry	Course must be graded and passed with a C– or better	4
CH 467	Biochemistry Laboratory	Course must be graded and passed with a C– or better	4
PHYS 201 or PHYS 251	General Physics or Foundations of Physics I	Course must be graded and passed with a C– or better	4

PHYS 204 or PHYS 290	Introductory Physics Laboratory or Foundations of Physics Laboratory	Course must be graded and passed with a C– or better	2
	Credits		**14**
Winter			
CH 462	Biochemistry	Course must be graded and passed with a C– or better	4
PHYS 202 or PHYS 252	General Physics or Foundations of Physics I	Course must be graded and passed with a C– or better	4
PHYS 205 or PHYS 290	Introductory Physics Laboratory or Foundations of Physics Laboratory	Course must be graded and passed with a C– or better	2
CH 401	Research: [Topic]	Advanced lab requirement (one year undergraduate research with written report)	2
General education course in social science			4
	Credits		**16**
Spring			
CH 463	Biochemistry	Course must be graded and passed with a C– or better	4
PHYS 203 or PHYS 253	General Physics or Foundations of Physics I	Course must be graded and passed with a C– or better	4
PHYS 206 or PHYS 290	Introductory Physics Laboratory or Foundations of Physics Laboratory	Course must be graded and passed with a C– or better	2
CH 401	Research: [Topic]	Advanced lab requirement (one year undergraduate research with written report)	2
General education course in arts and letters			4
	Credits		**16**
	Total Credits		**46**

Course	Title	Credits	Milestones
Fourth Year			
Fall			
CH 411	Physical Chemistry	Course must be graded and passed with a C– or better	4
400-level courses in chemistry or biology		Approved elective course; must be graded and passed with a C– or better	8
CH 401	Research: [Topic]	Advanced lab requirement (one year undergraduate research; submit written report)	2
General education course in arts and letters			4
	Credits		**18**
Winter			
CH 412	Physical Chemistry	Course must be graded and passed with a C– or better	4

400-level courses in chemistry or biology	Approved elective course; must be graded and passed with a C– or better	8
General education course in social science		4
Credits		**16**
Spring		
400-level course in chemistry or biology	Approved elective course; must be graded and passed with a C– or better	4
General education course in social science		4
General education courses that also satisfy multicultural requirement	Apply for degree in DuckWeb by end of fourth week of spring term	8
Credits		**16**
Total Credits		**50**

Graduate Studies

Graduate work in chemistry is a research-oriented PhD program with options in

- biochemistry and molecular biology
- biophysics
- bioorganic and medicinal chemistry
- environmental chemistry
- inorganic and organometallic chemistry
- materials chemistry
- optics and spectroscopy
- organic synthesis
- polymer chemistry
- physical chemistry
- solid-state chemistry
- statistical mechanics of liquids and complex fluids
- surfaces and interfaces
- theoretical chemical physics

Master of science (MS) and master of arts (MA) degrees are also offered.

A strength of the University of Oregon program is its interdisciplinary approach to research and teaching. Many important advances in chemistry occur at the junctions of classically defined divisions of science. Collaborative interaction between these divisions is fostered through interdisciplinary research institutes. Chemical scientists may be interested in the Institute of Molecular Biology, the Institute of Theoretical Science, the Materials Science Institute, the Oregon Center for Optics, and the programs in cell biology and in molecular synthesis, structure, and dynamics.

First-year students are offered financial assistance through graduate teaching fellowships (GTFs). Research assistantships are typically available for students with advanced standing. These research appointments are funded through grants to the university by federal agencies and private (industrial) sources for support of the basic research programs in the department. Students are selected for these positions based on their interest in a particular research area and by mutual agreement of the student and the faculty member directing the work.

An illustrated publication, *University of Oregon Doctoral Program in Chemistry*, may be requested from the department. The booklet presents information about the program, facilities, financial support, faculty members and their individual research interests, housing, and the local environment. People who request the booklet also receive information about admission and application forms for admission and graduate teaching fellowships.

Biochemistry, Molecular Biology, Cell Biology

One of the most active areas of research is the study of the molecular bases of cell function, including synthesis of macromolecules, regulation of gene expression, development, cell movement, and the structure and function of biological membranes. Research in these areas has been fostered by close collaboration among biologists, chemists, and physicists. The interdisciplinary nature of these programs has been greatly strengthened by the Institute of Molecular Biology and the program in cell biology. Eight members of the chemistry department are affiliated with these programs. Entering graduate students are in an excellent position to take advantage of the molecular-oriented avenues to study biological problems.

Biophysical Chemistry

Biophysical chemistry provides close collaboration and educational interaction among faculty members and students. Research groups that are developing and applying physical methods work closely with molecular and cellular biologists, neurobiologists, biochemists, and synthetic organic chemists. Most of the research programs in biophysical chemistry are interdisciplinary.

Another area of general interest is the nature of the excited electronic states of biopolymer components. This includes the use of the optical properties of biopolymers, such as their circular dichroism, as a probe of their conformational state; the relationship of excited state conformation changes to their resonance Raman spectra; and a fundamental interest in the nature of excited states.

Materials Science

The discipline of materials science seeks to understand the structures, properties, and structure-property relationships of condensed phase materials. It is by nature interdisciplinary, combining expertise from the fields of chemistry, physics, geology, and molecular biology. Most areas of chemistry can make an important contribution to materials science in the synthesis and characterization of various materials. Here the word materials generally means bulk crystalline solids but also includes low-

dimensional materials such as thin solid films or nanoscopic "wires" as well as amorphous solids and some aspects of liquids. Much of the excitement of the research in this area derives from the discovery and the improved understanding of new materials that have potential technological applications.

The Materials Science Institute was created to foster collaboration among the materials-oriented research groups at the University of Oregon. Members of the institute are active in the study of the structure, reactivity, and thermodynamics of materials in addition to the characterization of their electronic, magnetic, and optical properties. The chemistry and physics departments, dominant members of the institute, offer courses and seminars on the chemistry and physics of materials to foster the educational and research aspects of materials science. The list of active research topics includes the application of novel synthetic strategies toward the preparation of metastable phases (including the use of thin-film superlattice composites, sol-gel synthesis, self-assembly, and electron beam lithography), ultra-high vacuum surface science, laser-induced dynamics at surfaces, nonlinear optics of interfaces, characterization of electronic materials and devices, studies on the properties of amorphous and glassy materials, quantum size effects and fundamental limits of microelectronic devices, scanning force and scanning tunneling microscopy of modified surfaces and biological molecules, and electron transport across protein assemblies and biotechnological materials. Sharing of facilities and expertise among the various research groups is an important and valued aspect of the Materials Science Institute. Collaboration between institute members and industrial and national research laboratories is also an important dimension of the program. See also Materials Science Institute in the **Research Institutes and Centers** section of this catalog.

Organic, Bioorganic, Inorganic, Organometallic, and Materials Chemistry

The synthesis of new chemical substances and the study of their fundamental chemical and physical properties is at the heart of organic, bioorganic, organometallic, inorganic, and materials chemistry. Research and teaching in these traditionally distinct subareas is unified through a single, cohesive organic-inorganic area in the chemistry department.

Undergraduate students, graduate students, and postdoctoral researchers in organic-inorganic chemistry enjoy an especially broad education emphasizing the fundamental aspects of chemical synthesis, structural characterization, and mechanisms of chemical reactions and processes. Formal course work is organized around these interdisciplinary themes. Many research projects are interdisciplinary.

Weekly organic-inorganic seminars cover recent advances in organic, organometallic, inorganic, and materials research. Of foremost importance is the contiguous location of research laboratories. This proximity results in an open and active atmosphere that encourages spontaneous discussions of day-to-day research activities and problems, providing a chemical education unsurpassed by any textbook or formal course.

Organic-inorganic researchers have direct access to state-of-the-art instrumentation in the shared organic-inorganic instrumentation facility adjoining the research laboratories. Most faculty members in this area have varied research interests and expertise. Collaboration with researchers working in physics, materials science, biochemistry, and medicinal chemistry enhances the program.

Physical Chemistry

Physical chemistry focuses on understanding the physical basis of chemical phenomena. This goal is pursued through the concerted efforts of experimentalists and theorists. While experimentalists design and carry out laboratory investigations of chemical systems, theorists conceive and develop theoretical tools to explain and predict system properties. Ultimately, physical chemistry is about understanding the mysteries of chemical phenomena at a deep, fundamental level. The discipline draws from and contributes to many areas of chemistry, physics, biology, materials science, engineering, and mathematics.

At the University of Oregon, research in physical chemistry focuses on a variety of topics.

Experimental spectroscopy includes pulsed laser techniques to probe the molecular structure at wet interfaces; the development of new optical techniques to study the motions of intracellular species and macromolecules in liquids; and novel ultrafast, nonlinear spectroscopic methods to study the dynamics of excited states in molecules.

On the theoretical front, topics of interest include dynamics of highly excited molecules using quantum and semiclassical techniques, the development of a formal description of wave-packet interferometry, elucidation of molecular structure through theoretical studies of electronic potential energy surfaces, and theoretical statistical mechanics and simulation.

Much work at Oregon combines frontier experimental and theoretical approaches in tandem on particular topics. Theoretical and experimental studies in statistical mechanics concentrate on soft condensed matter and complex fluids. Another focus is quantum control using coherent and ultrafast laser pulses, pursued along both experimental and theoretical lines.

The physics of chemical systems at interfaces includes spectroscopic studies of organic, inorganic, and biomolecules at surfaces and interfaces as well as electrochemical and electrical investigations of charge transfer at molecular or nanoparticle-based semiconducting interfaces.

The research on semiconductor interfaces aims at identifying and controlling novel systems that enhance or mimic the behavior of conventional semiconductor interfaces.

Industrial Internships for Master’s Degrees in Chemistry

These internships, sponsored by the Materials Science Institute, are described in the Research Centers and Institutes (http://catalog.uoregon.edu/archive/2017-2018/research) section of this catalog. Information and application materials are available through the institute.