**CHEMISTRY**

**Majors:**
- Bachelor of Arts, Chemistry (p. 1)
- Bachelor of Science, Biochemistry (p. 2)
- Bachelor of Science, Chemistry (p. 4)
- Bachelor of Science, Medicinal-Pharmaceutical Chemistry (p. 5)

**Minor:**
- Chemistry (p. 7)

The B.S. in Chemistry (BS-CHM) program is approved by the American Chemical Society for the training of professional chemists, and provides students with the opportunity to perform an original research project under the direction of a faculty mentor. BS-CHM majors electing to perform research typically select their faculty mentor and project during the first term of their junior year. The research project may be conducted over the entire senior year, but is more commonly conducted over a ten-week period during the summer following the junior year. In either case, the project culminates in the senior year with enrollment in CHM 498, the submission of an acceptable thesis, and the presentation of a seminar in CHM 490. Additional research work to a maximum total of six semester hours may be elected provided the work extends beyond two semesters.

The B.S. in Biochemistry (BCM) program prepares students for careers in the biochemical and life sciences. BCM majors may elect to conduct an original research project in biochemistry or a related chemical subdiscipline. In all other respects these biochemically-related research projects are identical to those detailed for the BS-CHM program above.

The B.S. in Medicinal-Pharmaceutical Chemistry (MCM) program is designed for students pursuing careers in medicine, pharmacy or forensic chemistry, and provides a focused preparation in the analysis and synthesis of compounds of pharmacological significance. MCM majors may elect to conduct an original research project, typically in synthetic or analytical chemistry. In all other respects these research projects are identical to those detailed for the BS-CHM program above.

The B.A. in Chemistry (BA-CHM) program prepares students for a wide range of interdisciplinary professions, and consists of a curriculum in which the traditional B.S. curriculum has been modified, most notably in mathematics, physics, and advanced chemistry. The BA-CHM program is accordingly somewhat flexible, and affords students a wide selection of courses in the humanities and social sciences. BA-CHM majors are free to choose courses which prepare them for careers in medicine, dentistry, optometry, veterinary medicine, biochemistry, education, law, and other professions which require a science background.

A minor in chemistry consists of twenty semester hours. Typically these consist of 8 credit hours of general chemistry (CHM 123, 123L, 124, 124L), 8 credit hours of organic chemistry (CHM 313, 313L, 314, 314L), 3 credit hours of physical chemistry (CHM 302, 303 or 304), and one credit hour in basic molecular spectroscopy (CHM 317). Of these, the physical chemistry course is the only requirement.

**Faculty**
Garry Crosson, Chairperson

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**Common Academic Program (CAP)**

**First-Year Humanities Commons**
- HST 103 Introduction to Global Historical Studies (12 cr.
- REL 103 Introduction to Religious and Theological Studies (3 cr.
- PHL 103 Introduction to Philosophy (3 cr.

**Second-Year Writing Seminar**
- ENG 200 Writing Seminar II (3 cr.

**Oral Communication**
- CMM 100 Principles of Oral Communication (3 cr.

**Mathematics**
- 3 cr.

**Social Science**
- 3 cr.

**Natural Sciences**
- 7 cr.

**Faith Traditions**
- Practical Ethical Action
- Inquiry
- Integrative
Advanced Study

- Philosophy and/or Religious Studies (6 cr. hrs.)
- Historical Studies (3 cr. hrs.)

Diversity and Social Justice

- 3 cr. hrs.

Major Capstone

- 0-6 cr. hrs.

The credit hours listed reflect what is needed to complete each CAP component. However, they should not be viewed as a cumulative addition to a student's degree requirements because many CAP courses are designed to satisfy more than one CAP component (e.g., Crossing Boundaries and Advanced Studies) and may also satisfy requirements in the student's major.

May be completed with ASI 110 and ASI 120 through the Core Program.

May be completed with ENG 100A and ENG 100B, by placement.

May be completed with ENG 114 or ENG 198 or ASI 120.

Must include two different disciplines and at least one accompanying lab.

U.S. History AP and CLEP credit will not satisfy this requirement.

May not double count with First-Year Humanities Commons, Second-Year Writing, Oral Communication, Social Science, Arts, or Natural Sciences CAP components, but may double count with courses taken to satisfy other CAP components and/or courses taken in the student's major.

The course or experience is designed by faculty in each major; it may, or may not, be assigned credit hours.

Liberal Studies Curriculum

Creative and Performing Arts (May include CAP Arts)

- 3 cr.

L2 Proficiency (Proficiency in a language other than English)

- 0-11 cr.

Literature (May include CAP Components)

- 3 cr.

Mathematics (Satisfies CAP Mathematics)

- 9 cr.

MTH 148 - Introductory Calculus I
& MTH 149 - and Introductory Calculus II

MTH 367 - Statistical Methods I

Natural Sciences (Applies to CAP Natural Science)

- 8 cr.

PHY 201 - College Physics I
& 201L - and College Physics Laboratory I

PHY 202 - College Physics II
& 202L - and General Physics Laboratory

SOC 150 - Social Sciences (Includes CAP Social Science)

- 12 cr.

Major Requirements

CHM 123 - 4 cr.
& 123L - General Chemistry
& 123L - and General Chemistry Laboratory

CHM 124 - 4 cr.
& 124L - General Chemistry
& 124L - and General Chemistry Laboratory

CHM 201 - 4 cr.
& 201L - Quantitative Analysis
& 201L - and Quantitative Analysis Laboratory

CHM 302 - 3-6 cr.
or CHM 303 - Physical Chemistry
& CHM 304 - and Physical Chemistry

CHM 480 - 1 cr.
& CHM 498 - Professional Practices Seminar

CHM 499 - 1 cr.
& CHM 498 - Seminar IV (Satisfies CAP Major Capstone)

Select four courses from:

- CHM 317 - Spectroscopic Identification of Organic Compounds
- CHM 341 - Environmental Chemistry
- CHM 404 - Special Topics in Physical Chemistry
- CHM 412 - Intermediate Organic Chemistry
- CHM 415 - Analytical Chemistry
- CHM 415L - Analytical Chemistry Laboratory
- CHM 417 - Inorganic Chemistry Laboratory
- CHM 418L - Inorganic Chemistry Laboratory
- CHM 420 - Biochemistry
- CHM 426 - Biosynthetic Organic Chemistry
- CHM 427 - Medicinal Chemistry
- CHM 451 - General Biochemistry I
- CHM 452 - General Biochemistry II
- CHM 462L - Biochemistry Laboratory
- CHM 477 - Honors Thesis Project
& CHM 478 - and Honors Thesis Project
- CHM 497 - Research Seminar
& CHM 498 - and Research & Thesis

Bachelor of Science, Biochemistry (BCM) minimum 120 hours

The Common Academic Program (CAP) is an innovative curriculum that is the foundation of a University of Dayton education. It is a learning experience that is shared in common among all undergraduate students, regardless of their major. Some CAP requirements must be fulfilled by courses taken at UD (e.g., Capstone and Diversity and Social Justice). Some major requirements must also be fulfilled by courses taken at UD. Students should consult with their advisor regarding applicability of transfer credit to fulfill CAP and major program requirements.

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May be completed with ASI 110 and ASI 120 through the Core Program.

May be completed with ENG 100A and ENG 100B, by placement.

May be completed with ENG 114 or ENG 198 or ASI 120.

Must include two different disciplines and at least one accompanying lab.

U.S. History AP and CLEP credit will not satisfy this requirement.

May not double count with First-Year Humanities Commons, Second-Year Writing, Oral Communication, Social Science, Arts, or Natural Sciences CAP components, but may double count with courses taken to satisfy other CAP components and/or courses taken in the student's major.

The course or experience is designed by faculty in each major; it may, or may not, be assigned credit hours.

Liberal Studies Curriculum

Creative and Performing Arts (May include CAP Arts)

- 3 cr.

L2 Proficiency (Proficiency in a language other than English)

- 0-11 cr.

Literature (May include CAP Components)

- 3 cr.

Mathematics (Satisfies CAP Mathematics)

- 9 cr.

MTH 148 - Introductory Calculus I
& MTH 149 - and Introductory Calculus II

MTH 367 - Statistical Methods I

Natural Sciences (Applies to CAP Natural Science)

- 8 cr.

PHY 201 - College Physics I
& 201L - and College Physics Laboratory I

PHY 202 - College Physics II
& 202L - and General Physics Laboratory

SOC 150 - Social Sciences (Includes CAP Social Science)

- 12 cr.

Major Requirements

CHM 123 - 4 cr.
& 123L - General Chemistry
& 123L - and General Chemistry Laboratory

CHM 124 - 4 cr.
& 124L - General Chemistry
& 124L - and General Chemistry Laboratory

CHM 201 - 4 cr.
& 201L - Quantitative Analysis
& 201L - and Quantitative Analysis Laboratory

CHM 302 - 3-6 cr.
or CHM 303 - Physical Chemistry
& CHM 304 - and Physical Chemistry

CHM 480 - 1 cr.
& CHM 498 - Professional Practices Seminar

CHM 499 - 1 cr.
& CHM 498 - Seminar IV (Satisfies CAP Major Capstone)

Select four courses from:

- CHM 317 - Spectroscopic Identification of Organic Compounds
- CHM 341 - Environmental Chemistry
- CHM 404 - Special Topics in Physical Chemistry
- CHM 412 - Intermediate Organic Chemistry
- CHM 415 - Analytical Chemistry
- CHM 415L - Analytical Chemistry Laboratory
- CHM 417 - Inorganic Chemistry Laboratory
- CHM 418L - Inorganic Chemistry Laboratory
- CHM 420 - Biochemistry
- CHM 426 - Biosynthetic Organic Chemistry
- CHM 427 - Medicinal Chemistry
- CHM 451 - General Biochemistry I
- CHM 452 - General Biochemistry II
- CHM 462L - Biochemistry Laboratory
- CHM 477 - Honors Thesis Project
& CHM 478 - and Honors Thesis Project
- CHM 497 - Research Seminar
& CHM 498 - and Research & Thesis

Bachelor of Science, Biochemistry (BCM) minimum 120 hours

The Common Academic Program (CAP) is an innovative curriculum that is the foundation of a University of Dayton education. It is a learning experience that is shared in common among all undergraduate students, regardless of their major. Some CAP requirements must be fulfilled by courses taken at UD (e.g., Capstone and Diversity and Social Justice). Some major requirements must also be fulfilled by courses taken at UD. Students should consult with their advisor regarding applicability of transfer credit to fulfill CAP and major program requirements.
Second-Year Writing Seminar 4

ENG 200  Writing Seminar II  3 cr.

Oral Communication

CMM 100  Principles of Oral Communication  3 cr.

Mathematics

Social Science

SSC 200  Social Science Integrated  3 cr.

Arts

Natural Sciences 5

Crossing Boundaries  up to 12 cr.

Faith Traditions

Practical Ethical Action

Inquiry 6

Integrative

Advanced Study

Philosophy and/or Religious Studies (6 cr. hrs.)

Historical Studies (3 cr. hrs.) 7

Diversity and Social Justice 8

Major Capstone 9

1 The credit hours listed reflect what is needed to complete each CAP component. However, they should not be viewed as a cumulative addition to a student’s degree requirements because many CAP courses are designed to satisfy more than one CAP component (e.g., Crossing Boundaries and Advanced Studies) and may also satisfy requirements in the student’s major.

2 May be completed with ASI 110 and ASI 120 through the Core Program.

3 May be completed with ENG 100A and ENG 100B, by placement.

4 May be completed with ENG 114 or ENG 198 or ASI 120.

5 Must include two different disciplines and at least one accompanying lab.

6 U.S. History AP and CLEP credit will not satisfy this requirement.

7 May be completed with ASI 110 and ASI 120 through the Core Program.

8 U.S. History AP and CLEP credit will not satisfy this requirement.

9 May not double count with First-Year Humanities Commons, Second-Year Writing, Oral Communication, Social Science, Arts, or Natural Sciences CAP components, but may double count with courses taken to satisfy other CAP components and/or courses taken in the student’s major.

10 The course or experience is designed by faculty in each major; it may, or may not, be assigned credit hours.

Science Breadth Requirements

MTH 168  Analytic Geometry & Calculus I

MTH 169  Analytic Geometry & Calculus II

MTH 218  Analytic Geometry & Calculus III

MTH 219  Applied Differential Equations

or MTH 367  Statistical Methods I

PHY 206  General Physics I - Mechanics

PHY 207  General Physics II - Electricity & Magnetism

PHY 210L  General Physics Laboratory I

Select courses from:

CHM 319L  Advanced Organic Synthesis Laboratory

BIO 312  General Genetics

BIO 314  Plant Biology

BIO 403  Physiology I

BIO 404  Physiology II

BIO 411  General Microbiology

BIO 427  Immunology

BIO 440  Cell Biology

BIO 462  Molecular Biology

BIO 466  Biology of Infectious Disease

CHM 404  Special Topics in Physical Chemistry

CHM 412  Intermediate Organic Chemistry

CHM 415  Analytical Chemistry & 415L and Analytical Chemistry Laboratory

CHM 417  Inorganic Chemistry

CHM 418L  Inorganic Chemistry Laboratory

CHM 426  Biosynthetic Organic Chemistry

CHM 427  Medicinal Chemistry

CHM 438  Sustainability and Chemistry

CHM 454  Rational Drug Design

CHM 458  Metabolism and Human Disease

CHM 477  Honors Thesis Project

CHM 478  Honors Thesis Project

CHM 497 & CHM 498  Research Seminar & Research & Thesis

CHM 498  Research & Thesis

CHM 499  Research & Thesis

Major Requirements 1

Year 1

BIO 151 & 151L  Concepts of Biology I: Cellular & Molecular Biology and Concepts of Biology Laboratory I: Cellular & Molecular Biology

BIO 152  Concepts of Biology II: Evolution & Ecology

CHM 123 & 123L  General Chemistry and General Chemistry Laboratory

CHM 124 & 124L  General Chemistry and General Chemistry Laboratory

CHM 190  Seminar I

47
Bachelor of Science, Chemistry (CHM) minimum 120 hours

The Common Academic Program (CAP) is an innovative curriculum that is the foundation of a University of Dayton education. It is a learning experience that is shared in common among all undergraduate students, regardless of their major. Some CAP requirements must be fulfilled by courses taken at UD (e.g., Capstone and Diversity and Social Justice). Some major requirements must also be fulfilled by courses taken at UD. Students should consult with their advisor regarding applicability of transfer credit to fulfill CAP and major program requirements.

Common Academic Program (CAP) 1

<table>
<thead>
<tr>
<th>Component</th>
<th>Credits</th>
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<tbody>
<tr>
<td>First-Year Humanities Commons 2</td>
<td>12 cr. hrs.</td>
</tr>
<tr>
<td>HST 103 Introduction to Global Historical Studies</td>
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</tr>
<tr>
<td>REL 103 Introduction to Religious and Theological Studies</td>
<td></td>
</tr>
<tr>
<td>PHL 103 Introduction to Philosophy</td>
<td></td>
</tr>
<tr>
<td>ENG 100 Writing Seminar I 3</td>
<td></td>
</tr>
<tr>
<td>Second-Year Writing Seminar 4</td>
<td>0-3 cr. hrs.</td>
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<tr>
<td>ENG 200 Writing Seminar II</td>
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</tr>
<tr>
<td>Oral Communication</td>
<td>3 cr. hrs.</td>
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<tr>
<td>CMM 100 Principles of Oral Communication</td>
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Mathematics

<table>
<thead>
<tr>
<th>Courses</th>
<th>Credits</th>
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<tbody>
<tr>
<td>MTH 168 Analytic Geometry &amp; Calculus I</td>
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</tr>
<tr>
<td>MTH 169 Analytic Geometry &amp; Calculus II</td>
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Social Science

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<tr>
<th>Courses</th>
<th>Credits</th>
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<td>MTH 168 Analytic Geometry &amp; Calculus I</td>
<td></td>
</tr>
<tr>
<td>MTH 169 Analytic Geometry &amp; Calculus II</td>
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</tr>
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</table>

Social Science

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<tr>
<th>Courses</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTH 168 Analytic Geometry &amp; Calculus I</td>
<td></td>
</tr>
<tr>
<td>MTH 169 Analytic Geometry &amp; Calculus II</td>
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</table>

Science Breadth Requirements

<table>
<thead>
<tr>
<th>Mathematics, Computer Sciences 1</th>
<th>15</th>
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<tbody>
<tr>
<td>MTH 168 Analytic Geometry &amp; Calculus I</td>
<td></td>
</tr>
<tr>
<td>MTH 169 Analytic Geometry &amp; Calculus II</td>
<td></td>
</tr>
</tbody>
</table>

The credit hours listed reflect what is needed to complete each CAP component. However, they should not be viewed as a cumulative addition to a student’s degree requirements because many CAP courses are designed to satisfy more than one CAP component (e.g., Crossing Boundaries and Advanced Studies) and may also satisfy requirements in the student’s major.

1 Advanced placement is permitted.
<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>MTH 218</td>
<td>Analytic Geometry &amp; Calculus III</td>
<td>3</td>
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<tr>
<td>MTH 219</td>
<td>Applied Differential Equations</td>
<td></td>
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<tr>
<td>MTH 367</td>
<td>Statistical Methods I</td>
<td>3</td>
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<tr>
<td>PHY 206</td>
<td>General Physics I - Mechanics</td>
<td>3</td>
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<td>PHY 207</td>
<td>General Physics II - Electricity &amp; Magnetism</td>
<td>3</td>
</tr>
<tr>
<td>PHY 208</td>
<td>General Physics III- Thermodynamics, Waves, and Fluids</td>
<td>3</td>
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<tr>
<td>PHY 210L</td>
<td>General Physics Laboratory I</td>
<td>1</td>
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<tr>
<td>CHM 319L</td>
<td>Advanced Organic Synthesis Laboratory</td>
<td>1</td>
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</tbody>
</table>

**Major Requirements**

**Year 1**
- CHM 123 & 123L: General Chemistry and General Chemistry Laboratory (4 credits)
- CHM 124 & 124L: General Chemistry and General Chemistry Laboratory (4 credits)
- CHM 190: Seminar I (0 credits)

**Year 2**
- CHM 201 & 201L: Quantitative Analysis and Quantitative Analysis Laboratory (4 credits)
- CHM 313 & 313L: Organic Chemistry and Organic Chemistry Laboratory (4 credits)
- CHM 314 & 314L: Organic Chemistry and Organic Chemistry Laboratory (4 credits)
- CHM 290: Seminar II (0 credits)

**Year 3**
- CHM 303 & 303L: Physical Chemistry and Physical Chemistry Laboratory (4 credits)
- CHM 304 & 304L: Physical Chemistry and Physical Chemistry Laboratory (4 credits)
- CHM 317: Spectroscopic Identification of Organic Compounds (1 credit)
- CHM 390: Seminar III (0 credits)

**Year 4**
- CHM 415 & 415L: Analytical Chemistry and Analytical Chemistry Laboratory (4 credits)
- CHM 417: Inorganic Chemistry (3 credits)
- CHM 418L: Inorganic Chemistry Laboratory (1 credit)
- CHM 420: Biochemistry (3 credits)
- CHM 450: Advanced Organic Synthesis (3 credits)
- CHM 451: General Biochemistry I (3 credits)
- CHM 452: General Biochemistry II (3 credits)
- CHM 454: Rational Drug Design (3 credits)
- CHM 455: Metabolism and Human Disease (3 credits)
- CHM 456: Biochemistry Laboratory (3 credits)
- CHM 457: Honors Thesis Project (3 credits)
- CHM 478: Honors Thesis Project (3 credits)
- CHM 498: Research & Thesis (3 credits)
- CHM 499: Research & Thesis (3 credits)

**Bachelor of Science, Medicinal-Pharmaceutical Chemistry (MCM)**

The Common Academic Program (CAP) is an innovative curriculum that is the foundation of a University of Dayton education. It is a learning experience that is shared in common among all undergraduate students, regardless of their major. Some CAP requirements must be fulfilled by courses taken at UD (e.g., Capstone and Diversity and Social Justice). Some major requirements must also be fulfilled by courses taken at UD. Students should consult with their advisor regarding applicability of transfer credit to fulfill CAP and major program requirements.

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
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<tbody>
<tr>
<td>First-Year Humanities Commons</td>
<td>12 cr.</td>
</tr>
<tr>
<td>HST 103: Introduction to Global Historical Studies</td>
<td>3 cr.</td>
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<tr>
<td>REL 103: Introduction to Religious and Theological Studies</td>
<td>3 cr.</td>
</tr>
<tr>
<td>PHL 103: Introduction to Philosophy</td>
<td>3 cr.</td>
</tr>
<tr>
<td>ENG 100: Writing Seminar I</td>
<td>0-3 cr.</td>
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<tr>
<td>Second-Year Writing Seminar I</td>
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<tr>
<td>Oral Communication</td>
<td>3 cr.</td>
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<tr>
<td>CMM 100: Principles of Oral Communication</td>
<td>3 cr.</td>
</tr>
<tr>
<td>Mathematics</td>
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</tr>
<tr>
<td>Social Science</td>
<td>3 cr.</td>
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<td>Course Code</td>
<td>Course Title</td>
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</tr>
<tr>
<td>SSC 200</td>
<td>Social Science Integrated Arts</td>
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<tr>
<td><strong>Natural Sciences</strong></td>
<td>7 cr. hrs.</td>
</tr>
<tr>
<td><strong>Crossing Boundaries</strong></td>
<td>up to 12 cr. hrs.</td>
</tr>
<tr>
<td><strong>Faith Traditions</strong></td>
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<tr>
<td><strong>Practical Ethical Action Inquiry</strong></td>
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<tr>
<td><strong>Integrative Advanced Study</strong></td>
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</tr>
<tr>
<td>Philosophy and/or Religious Studies (6 cr. hrs.)</td>
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<tr>
<td>Historical Studies (3 cr. hrs.)</td>
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<tr>
<td><strong>Diversity and Social Justice</strong></td>
<td>3 cr. hrs.</td>
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<td><strong>Major Capstone</strong></td>
<td>0-6 cr. hrs.</td>
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<tr>
<td><strong>Science Breadth Requirements</strong></td>
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<tr>
<td>Satisfies CAP Mathematics and CAP Natural Science</td>
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<tr>
<td>BIO 151 &amp; 151L</td>
<td>Concepts of Biology I: Cellular &amp; Molecular Biology and Concepts of Biology Laboratory I: Cellular &amp; Molecular Biology</td>
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<tr>
<td>BIO 152 &amp; 152L</td>
<td>Concepts of Biology II: Evolution &amp; Ecology and Concepts of Biology Laboratory II: Evolution &amp; Ecology</td>
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<td>MTH 148 &amp; MTH 149</td>
<td>Introductory Calculus I and Introductory Calculus II</td>
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<td>MTH 367</td>
<td>Statistical Methods I</td>
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<td>PHY 201 &amp; 201L</td>
<td>College Physics I and College Physics Laboratory I</td>
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<td>PHY 202 &amp; 202L</td>
<td>College Physics II and General Physics Laboratory</td>
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<td><strong>Major Requirements</strong></td>
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<td><strong>Year 1</strong></td>
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<tr>
<td>CHM 123 &amp; 123L</td>
<td>General Chemistry and General Chemistry Laboratory</td>
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<td>CHM 124 &amp; 124L</td>
<td>General Chemistry and General Chemistry Laboratory</td>
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<td>CHM 190</td>
<td>Seminar I</td>
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<td><strong>Year 2</strong></td>
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<td>CHM 201 &amp; 201L</td>
<td>Quantitative Analysis and Quantitative Analysis Laboratory</td>
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<td>CHM 290</td>
<td>Seminar II</td>
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<td>CHM 313 &amp; 313L</td>
<td>Organic Chemistry and Organic Chemistry Laboratory</td>
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<td>CHM 314 &amp; 314L</td>
<td>Organic Chemistry and Organic Chemistry Laboratory</td>
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<td><strong>Year 3</strong></td>
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<tr>
<td>CHM 302 &amp; 302L</td>
<td>Physical Chemistry and Physical Chemistry Laboratory</td>
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<td>CHM 317</td>
<td>Spectroscopic Identification of Organic Compounds</td>
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<td>CHM 390</td>
<td>Seminar III</td>
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<td>CHM 420</td>
<td>Biochemistry</td>
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<td>CHM 420L</td>
<td>Biochemistry Lab for the Medical Sciences</td>
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<td><strong>Year 4</strong></td>
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<tr>
<td>CHM 319L</td>
<td>Advanced Organic Synthesis Laboratory</td>
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<td>CHM 426</td>
<td>Biosynthetic Organic Chemistry</td>
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<td>CHM 427</td>
<td>Medicinal Chemistry</td>
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<td>CHM 454</td>
<td>Rational Drug Design</td>
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<td>CHM 463L</td>
<td>Bioanalytical Chemistry Laboratory</td>
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<td>CHM 480</td>
<td>Professional Practices Seminar</td>
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<td>CHM 490</td>
<td>Seminar IV (Satisfies CAP Major Capstone)</td>
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<td><strong>Science Requirements</strong></td>
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<td>Select six semester hours from:</td>
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<td>CHM 412</td>
<td>Intermediate Organic Chemistry</td>
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<td>CHM 415 &amp; 415L</td>
<td>Analytical Chemistry and Analytical Chemistry Laboratory</td>
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<td>CHM 417</td>
<td>Inorganic Chemistry</td>
</tr>
<tr>
<td>CHM 418L</td>
<td>Inorganic Chemistry Laboratory</td>
</tr>
<tr>
<td>CHM 497 &amp; 498</td>
<td>Research Seminar and Research &amp; Thesis</td>
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<td>Select two lecture courses and one laboratory from:</td>
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<tr>
<td>BIO 403 &amp; 403L</td>
<td>Physiology I and Physiology Laboratory I</td>
</tr>
<tr>
<td>BIO 411 &amp; 411L</td>
<td>General Microbiology and General Microbiology Laboratory</td>
</tr>
<tr>
<td>BIO 440 &amp; 440L</td>
<td>Cell Biology and Cell Biology Laboratory</td>
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</table>
Minors in Chemistry (CHM)

Chemistry

CHM 123  General Chemistry  4
& 123L  and General Chemistry Laboratory  4
CHM 124  General Chemistry  4
& 124L  and General Chemistry Laboratory  4
CHM 302  Physical Chemistry  3
or CHM 303  Physical Chemistry  3
Select three CHM courses (300/400 level) 1  9

1 In consultation with the chairperson.

- Bachelor of Arts, Chemistry (p. 1)
- Bachelor of Science, Medicinal-Pharmaceutical Chemistry (p. 7)
- Bachelor of Science, Biochemistry (p. 8)
- Bachelor of Science, Chemistry (p. 4)

Bachelor of Arts, Chemistry

First Year

Fall  Hours  Spring  Hours
CHM 123 & 123L  4  CHM 124 & 124L  4
MTH 148 (Satisfies CAP Mathematics)  3  MTH 149  3
REL 103, PHL 103, or HST 103 (CAP Humanities Commons)  3
PHL 103  3  HST 103  3
Social Science - intro level  3  Language 141  3
ASI 150  1  CHM 290  0

Second Year

Fall  Hours  Spring  Hours
CHM 313 & 313L  4  CHM 201 & 201L  4
MTH 367  3  MTH 202L  1
ENG 200 (CAP Writing Seminar)  3  CAP Faith Traditions  3
CHM 390  0

Third Year

Fall  Hours  Spring  Hours
CHM 302  3  CHM elective  3
PHY 201 & 201L (CAP Natural Science)  4  PHY 202  3
CHM elective  3  PHY 202L  1
CAP Faith Traditions  3  CAP Arts / Creative and Performing
Social Science - elective  3  CAP Advanced Philosophy/Religious Studies
CHM 480  1

Fourth Year

Fall  Hours  Spring  Hours
CHM elective  3  CHM elective  3
CAP Inquiry  3  CAP Integrative
CAP Advanced Philosophy/Religious Studies  3  CAP Practical Ethical Action
CAP Advanced Historical Studies  3  CAP Diversity and Social Justice
General Elective  3  General Elective (optional)
CHM 480  1  CHM 490 (Satisfies CAP Major Capstone)

Total credit hours: 132

Bachelor of Science, Medicinal-Pharmaceutical Chemistry

First Year

Fall  Hours  Spring  Hours
CHM 123 & 123L  4  CHM 124 & 124L  4
BIO 151 & 151L (CAP Natural Science)  4  CAP Inquiry  3
BIO 152 & 152L  4
MTH 148 (Satisfies CAP Mathematics)  3  CAP Advanced Historical Studies  3
ENG 100 (CAP Humanities Commons)  3

Second Year

Fall  Hours  Spring  Hours
CHM 313 & 313L  4  CHM 201 & 201L  4
MTH 367  3  MTH 202L  1
ENG 200 (CAP Writing Seminar)  3  CAP Faith Traditions  3
CHM 390  0

Third Year

Fall  Hours  Spring  Hours
CHM 302  3  CHM elective  3
PHY 201 & 201L (CAP Natural Science)  4  PHY 202  3
CHM elective  3  PHY 202L  1
CAP Faith Traditions  3  CAP Arts / Creative and Performing
Social Science - elective  3  CAP Advanced Philosophy/Religious Studies
CHM 480  1

Fourth Year

Fall  Hours  Spring  Hours
CHM elective  3  CHM elective  3
CAP Inquiry  3  CAP Integrative
CAP Advanced Philosophy/Religious Studies  3  CAP Practical Ethical Action
CAP Advanced Historical Studies  3  CAP Diversity and Social Justice
General Elective  3  General Elective (optional)
CHM 480  1  CHM 490 (Satisfies CAP Major Capstone)

Total credit hours: 132
### Second Year

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Total credit hours: 132

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**Bachelor of Science, Biochemistry**

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### Bachelor of Science, Chemistry

**First Year**

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**Total credit hours: 132**

### Courses

**CHM 101. Introductory General, Organic, and Biochemistry I. 3 Hours**
The first semester of a two-semester course covering fundamentals of general, organic and biochemistry as they relate to the health sciences, human medicine, or science education. The topics include states of matter, scientific measurements, balancing chemical equations, acid-base properties of aqueous reactions, pH-scale, buffers, and intramolecular and intermolecular chemical bonding. Foundational general chemistry topics essential to understanding biological systems and health sciences are emphasized.

**CHM 101L. Introductory General, Organic, and Biochemistry Laboratory I. 1 Hour**
Laboratory course to complement CHM 101. Laboratory procedures reinforce concepts covered in lecture with an emphasis on relating chemistry to the health sciences and human medicine. One three-hour laboratory session each week. Corequisite(s): CHM 101.

**CHM 102. Introductory General, Organic, and Biochemistry II. 3 Hours**
The second part of a two-semester course that covers the fundamentals of general, organic and biochemistry subject areas. Topics include an introduction to chemical nomenclature, structure, and function of biologically relevant organic compounds including function and reactivity of chemical groups commonly encountered in living systems. This course will also cover fundamental components of cell structure, transcription and translation, and metabolism as it relates to chemical principles and reactivity. Several aspects of organic chemistry relevant to living organisms will be emphasized. Prerequisite(s): CHM 101.

**CHM 102L. Introductory General, Organic, and Biochemistry Laboratory II. 1 Hour**
Laboratory course to complement CHM 102, a lecture course which covers the fundamentals of general, organic and biochemistry as it relates to the health sciences or human medicine. One three-hour laboratory session each week. Prerequisites: CHM 101L. Corequisites: CHM 102.

**CHM 115. College Preparatory Chemistry. 3 Hours**
One-term course for students desiring to enter a science or engineering program but whose background is insufficient for CHM 123 and CHM 124. Unacceptable for credit toward chemistry requirements in any chemistry program.

**CHM 115L. College Preparatory Chemistry Laboratory. 1 Hour**
Course to accompany CHM 115 or to be elected by students in CHM 200 who lack previous chemistry laboratory experience. One three-hour laboratory each week.
CHM 123. General Chemistry. 3 Hours
Comprehensive treatment of the fundamentals of general chemistry. Prerequisite(s): One year of high school chemistry or equivalent.

CHM 123L. General Chemistry Laboratory. 1 Hour
Laboratory course to complement CHM 123. One three-hour laboratory session each week. Corequisite(s): CHM 123.

CHM 124. General Chemistry. 3 Hours
Comprehensive treatment of the fundamentals of general chemistry. Prerequisite(s): CHM 123.

CHM 124L. General Chemistry Laboratory. 1 Hour
Laboratory course to complement CHM 124. One three-hour laboratory session each week. Prerequisites: CHM 123L and CHM 123 and CHM 124 (can be taken concurrently).

CHM 190. Seminar I. 0 Hours
Overview of methods of scientific oral presentation and formal conversation within the molecular sciences professional community.

CHM 200. Chemistry & Society. 3 Hours
Examination of issues such as environmental quality, disease, hunger, synthetic materials, and law enforcement by the application of chemical principles. Course is for non-science majors. Depending upon background and experience, a student needing a laboratory course may enroll in SCI 220L. Prerequisite(s): One year of high school chemistry or equivalent.

CHM 201. Quantitative Analysis. 3 Hours
Application of the principles of chemical equilibrium to the theory and techniques of gravimetric, volumetric, spectrophotometric, and electroanalytical methods of chemical analysis. Prerequisite(s): CHM 124, CHM 124L.

CHM 201L. Quantitative Analysis Laboratory. 1 Hour
Course to accompany CHM 201. One three-hour laboratory period each week.

CHM 234. Energy Resources. 3 Hours
The chemical and geological aspects of formation, production, and benefits/costs (including environmental impacts) of energy derived from fossil fuels (coal and hydrocarbons), biofuels (e.g., ethanol production), radioactive materials (nuclear power), and renewable sources (e.g., geothermal, hydro, wind, and solar power). Prerequisite(s): CHM 123, CHM 124. Corequisite(s): GEO 208.

CHM 290. Seminar II. 0 Hours
Overview of methods of scientific oral presentation and formal conversation within the molecular sciences professional community.

CHM 302. Physical Chemistry. 3 Hours
Essential elements of thermodynamics, chemical kinetics, equilibria, and electrochemistry for those with a primary interest in the life sciences. For B.A. chemistry majors and premedical, predental, and biology majors. Prerequisite(s): CHM 124.

CHM 302L. Physical Chemistry Laboratory. 1 Hour
Course to accompany CHM 302. One three-hour laboratory each week. Prerequisite(s): CHM 201, CHM 201L. Corequisite(s): CHM 302.

CHM 303. Physical Chemistry. 3 Hours
Fundamentals of thermodynamics, chemical kinetics, electrochemistry, and spectroscopy with a mathematics format. For B.S. chemistry and biochemistry majors and chemical engineers. Prerequisite(s): CHM 201 or equivalent. Corequisite(s): MTH 218.

CHM 303L. Physical Chemistry Laboratory. 1 Hour
Course to accompany CHM 303. One three-hour laboratory each week. Prerequisite(s): MTH 218.

CHM 304. Physical Chemistry. 3 Hours
Fundamentals of thermodynamics, chemical kinetics, electrochemistry, and spectroscopy with a mathematics format. For B.S. chemistry and biochemistry majors and chemical engineers.

CHM 304L. Physical Chemistry Laboratory. 1 Hour
Course to accompany CHM 304. One three-hour laboratory each week. Corequisite(s): MTH 218.

CHM 313. Organic Chemistry. 3 Hours
Major topics in organic chemistry including synthesis, mechanisms, stereochemistry, and spectroscopy. Required of all chemistry majors and students in the life sciences. Prerequisite(s): CHM 124.

CHM 313L. Organic Chemistry Laboratory. 1 Hour
Common separation, purification, and analytical techniques including chromatography and spectroscopy. One three-hour laboratory each week. Prerequisite(s): CHM 124, 124L Corequisite(s): CHM 313.

CHM 314. Organic Chemistry. 3 Hours
Major topics in organic chemistry including synthesis, mechanisms, stereochemistry, and spectroscopy. Required of all chemistry majors and students in the life sciences. Prerequisite(s): CHM 313L.

CHM 314L. Organic Chemistry Laboratory. 1 Hour
Synthesis and characterization of organic materials utilizing skills from CHM 313L. One three-hour laboratory each week. Prerequisite(s): CHM 313L. Corequisite(s): CHM 314.

CHM 317. Spectroscopic Identification of Organic Compounds. 1 Hour
The use of nuclear magnetic resonance, infrared, and mass spectrometry in elucidating structures. Emphasis on interpretation and integration of spectral data in problem solving. Prerequisite(s): (CHM 314, CHM 314L) or equivalent.

CHM 319L. Advanced Organic Synthesis Laboratory. 1 Hour
Preparation of organic compounds by single and multi-step synthetic sequences. Basic techniques in synthesis including use of organometallics, inert atmosphere, temperature control, extraction, vacuum distillation, column chromatography, recrystallization, and spectroscopic characterization methods. One four-hour laboratory each week. Prerequisite(s): CHM 314, CHM 314L.

CHM 341. Environmental Chemistry. 3 Hours
An introduction to the chemical processes in the environment. Topics include chemical equilibrium in aqueous solution, reaction mechanisms as applied to atmospheric chemistry, and analytical methods commonly applied to environmental samples. Prerequisite(s): CHM 314 or permission of instructor.

CHM 341L. Environmental Chemistry Laboratory. 1 Hour
Laboratory course to accompany CHM 341. Corequisite(s): CHM 341.

CHM 390. Seminar III. 0 Hours
Overview of methods of scientific oral presentation and formal conversation within the molecular sciences professional community.

CHM 404. Special Topics in Physical Chemistry. 3 Hours
Thorough treatment of topics such as electrochemistry, macromolecules, photochemistry, or spectroscopy. May be repeated as topics change. Prerequisite(s): CHM 302 or CHM 303.

CHM 412. Intermediate Organic Chemistry. 3 Hours
Modern theory and practice of organic chemistry. May include structure-reactivity relationships, reaction mechanism, and synthetic topics not normally treated in introductory courses. Prerequisite(s): CHM 302 or equivalent; CHM 313, CHM 314; senior standing.
CHM 415. Analytical Chemistry. 2 Hours
Chemical analysis based on modern instrumentation. Chromatographic, electrochemical, and spectroscopic methods. Prerequisite(s): CHM 201, CHM 201L; (CHM 302 or CHM 304).

CHM 415L. Analytical Chemistry Laboratory. 2 Hours
Course to accompany CHM 415. Two three-hour laboratory sessions each week. Prerequisite(s): CHM 201L; CHM 302 or equivalent.

CHM 417. Inorganic Chemistry. 3 Hours
An advanced course in modern inorganic chemistry. Atomic structure, principles of bonding and structure, acid-base chemistry, periodicity, coordination compounds, nonaqueous solvents, electrochemistry, molecular symmetry, organometallic compounds, and the chemistry of selected representative elements. Prerequisite(s): CHM 314. Corequisite(s): CHM 302 or CHM 304.

CHM 418L. Inorganic Chemistry Laboratory. 1 Hour
Laboratory course dealing with the synthesis and characterization of inorganic and organometallic compounds. Topics include vacuum and inert atmosphere techniques, separation and purification, spectroscopic characterization, X-ray diffraction, magnetic moment, and conductance measurements. Prerequisite(s): CHM 201L, CHM 314L. Corequisite(s): CHM 417.

CHM 420. Biochemistry. 3 Hours
The fundamental aspects of the chemistry and biochemistry of carbohydrates, lipids, proteins, and nucleic acids. Enzymology, protein purification, bioenergetics, metabolism of carbohydrates, lipids, amino acids, nucleotides and nucleic acids, elementary molecular biology, and control processes are described. Acceptable preparation for medical school. Prerequisite(s): CHM 314.

CHM 420L. Biochemistry Lab for the Medical Sciences. 1 Hour
A laboratory course to accompany CHM420, biochemistry. Prerequisite(s): CHM314, CHM314L. Corequisite(s): CHM420.

CHM 426. Biosynthetic Organic Chemistry. 3 Hours
Mechanistic fundamentals of the biosynthesis and transformation of organic natural products, with special emphasis on medicinal compounds, toxins, pheromones and other secondary metabolite structures. Prerequisite(s): (CHM 314, CHM 314L) or equivalent.

CHM 427. Medicinal Chemistry. 3 Hours
The chemical mechanisms of action of the major drug classes will be surveyed with particular emphasis on the facets of organic chemistry that control drug-receptor interactions, metabolism and mechanisms of toxicity and resistance. First term. Prerequisite(s): CHM 314; (CHM 420 or CHM 451).

CHM 428. Rational Drug Design. 3 Hours
Introduction to drug target selection, lead compound discovery, and application of structure-activity relationships and computational chemistry towards refinement and optimization of lead compounds and their derivatives. Use of molecular graphics software and publicly available macromolecular structure databases will provide the foundation for evaluating macromolecular models of drug targets and allow a hands-on exploration of the structure/function relationships of proteins that have been successful targets of rational drug design. Prerequisite(s): (CHM 420 or CHM 452) or equivalent.

CHM 438. Sustainability and Chemistry. 3 Hours
Chemical industrial practices drive many sustainability challenges in the near and long term. Many chemical technologies can address the sustainability of these practices as long as the costs (monetary and environmental) of such innovations are accurately presented and evaluated. Sustainability and Chemistry is an advanced 1 semester course describing chemical concepts and principles that underlie the foundations for a more sustainable world. This course analyzes the root chemical and societal causes of unsustainable practices in chemical transformations in our everyday life, and explores techniques to evaluate them. The core technologies discussed will be deeply integrated in the current environmental, economic, and social pillars of modern society. We will specifically address green chemistry principles with learning how to create and manage life cycle assessments (cradle to grave) with computational tools. We will also discuss molecular design to reduce hazards to the environment, and how we can establish practices to quantitatively evaluate the health and safety of core chemical technologies. Prerequisites: CHM 102 or CHM123 or any fundamental chemistry, sustainability, biology, or engineering courses that include sustainability ideas with permission.

CHM 450. Advanced Organic Synthesis. 3 Hours
Fundamentals of synthesis and transformations of organic compounds, with emphasis on mechanisms; pericyclic reactions; small and medium ring synthesis; chemoselectivity, regioselectivity, stereoselectivity, retrosynthesis, functional group transformations, carbon-carbon bond forming reactions, oxidations, reductions and protecting groups. Prerequisite: (CHM 314, CHM 314L) or equivalent.

CHM 451. General Biochemistry I. 3 Hours
Discussion of the chemistry and biochemistry of carbohydrates, amino acids, proteins, and nucleic acids, including health-science and methodologic aspects. Descriptions of enzymology, protein purification, and carbohydrate metabolism related to such topics as bioenergetics, membranes, and disease processes. Recommended for students desiring entry into graduate and professional schools. Prerequisite(s): CHM 201, CHM 314.

CHM 452. General Biochemistry II. 3 Hours
Discussion of selected topics in bioenergetics, and metabolism of lipids, amino acids, porphyrins, nucleic acids, and proteins. Current aspects of nutrition, biochemical genetics, endocrinology, regulation, and genetic engineering addressed and related to health-science topics as time permits. Suitable preparation for medical school. Prerequisite(s): CHM 451.

CHM 454. Metabolism and Human Disease. 3 Hours
This course examines the connections between metabolism, human disease and diet with an emphasis placed on current research related to these topics. Prerequisites: Undergraduate biochemistry course that covers metabolism CHM 420, CHM 452, HSS 307 or BIO 403.
CHM 462L. Biochemistry Laboratory. 1 Hour
Laboratory course to accompany biochemistry lecture courses. Spectrophotometry, pH and dissociation, enzymologic methodology and analytical techniques, chromatographic techniques. Corequisite(s): CHM 420 or CHM 451.

CHM 463L. Bioanalytical Chemistry Laboratory. 1 Hour
Introduction to analytical methods in current use in biochemistry. Course will focus on separations and spectroscopic methods for the analysis of biomolecules. Prerequisite(s): CHM 201, CHM 201L, CHM 302.

CHM 477. Honors Thesis Project. 3 Hours
First of two courses leading to the selection, design, investigation, and completion of an independent, original Honors Thesis project under the guidance of a faculty research advisor. Restricted to students in the University Honors Program with permission of the program director and department chairperson. Students pursuing an interdisciplinary thesis topic may register for three semester hours each in two separate disciplines in consultation with the department chairpersons. Prerequisite(s): Approval of University Honors Program.

CHM 478. Honors Thesis Project. 3 Hours
Second of two courses leading to the selection, design, investigation, and completion of an independent, original Honors Thesis project under the guidance of a faculty research advisor. Restricted to students in the University Honors Program with permission of the program director and department chairperson. Students pursuing an interdisciplinary thesis topic may register for three semester hours each in two separate disciplines in consultation with the department chairpersons. Prerequisite(s): Approved 477; approval of University Honors Program.

CHM 480. Professional Practices Seminar. 1 Hour
Practicum which culminates in the presentation of a technical talk on a topic in chemistry to peers and faculty members. Emphasis on the molecular scale of observation.

CHM 490. Seminar IV. 1 Hour
Presentation of a research topic during the weekly seminar series for the Department of Chemistry. Prerequisite(s): CHM 480.

CHM 495. Introduction to Research Seminar. 0 Hours
Research topics presented by visiting scientists and faculty, and the results of thesis research by senior students. Required of all junior chemistry and biochemistry majors in the B.S. programs. Grading Option two.

CHM 496. Professional Practices Seminar. 0 Hours
After discussions of the chemical literature and information retrieval, resumes, graduate education, and career opportunities, students present technical talks on topics with social, ethical, or historical implications. Required of all chemistry and biochemistry majors, both B.S. and B.A.

CHM 497. Research Seminar. 0 Hours
A series of seminars as described under CHM 495. Required of all senior chemistry and biochemistry majors in the B.S. programs.

CHM 498. Research & Thesis. 3 Hours
All students in the B.S. programs including co-op students are required to enroll for a minimum of three semester hours in a research course (CHM 498). Students may take additional research semester hours (CHM 499) if the work extends for more than two semesters. Successful completion of research courses requires the submission of a typewritten thesis and the presentation of a seminar. With the prior approval of the department chairperson, B.S. co-op students may substitute work experience for research. Prerequisite(s): CHM 498; permission of department chairperson.

CHM 499. Research & Thesis. 1-3 Hours
All students in the B.S. programs including co-op students are required to enroll for a minimum of three semester hours in a research course (CHM 498). Students may take additional research semester hours (CHM 499) if the work extends for more than two semesters. Successful completion of research courses requires the submission of a typewritten thesis and the presentation of a seminar. With the prior approval of the department chairperson, B.S. co-op students may substitute work experience for research. Prerequisite(s): CHM 498; permission of department chairperson.