# University Core and Graduation Requirements

## University Core Requirements:

### Religion Cornerstones
- Teachings and Doctrine of The Book of Mormon
- Jesus Christ and the Everlasting Gospel
- Foundations of the Restoration
- The Eternal Family

### American Heritage
- Classes: 1
- Hours: 2.0
- REL A 275

### Foundations of the Restoration
- Classes: 1
- Hours: 2.0
- REL A 250

### The Eternal Family
- Classes: 1
- Hours: 2.0
- REL C 225

### Global and Cultural Awareness
- Classes: 1
- Hours: 3.0
- from approved list

### Arts, Letters, and Sciences
- Classes: 1
- Hours: 3.0
- from approved list

### Civilizations
- Classes: 1
- Hours: 3.0
- from approved list

### Biological Science
- Classes: 1-2
- Hours: 3-4.0
- from approved list

### Physical Science
- Classes: 1
- Hours: 3.0
- CHEM 105*, PHSCS 101*

## Skills

### First Year Writing
- Classes: 1
- Hours: 3.0
- from approved list

### Advanced Written and Oral Communications
- Classes: 1
- Hours: 3.0
- WRTG 316 recommended

### Quantitative Reasoning
- Classes: 1
- Hours: 3-4.0
- from approved list

### Languages of Learning (Math or Language)
- Classes: 1
- Hours: 3-4.0
- MATH 112*, 119*, or STAT 121*

### Core Enrichment: Electives

#### Religion Electives
- Classes: 3-4
- Hours: 6.0
- from approved list

#### Open Electives
- Classes: 1
- Hours: 3.0
- Variable

*THESE CLASSES FILL BOTH UNIVERSITY CORE AND PROGRAM REQUIREMENTS (16 hours overlap)

## Graduation Requirements:

- Minimum residence hours required: 30.0
- Minimum hours needed to graduate: 120.0

## Suggested Sequence of Courses

### FRESHMAN YEAR

<table>
<thead>
<tr>
<th>1st Semester</th>
<th>Hours</th>
<th>Classes</th>
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</thead>
<tbody>
<tr>
<td>First-year Writing or American Heritage*</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>REL A 275</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>MMbio 122 or BIO 130 or PDBIO 120</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>CHEM 105</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>Open electives</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td><strong>Total Hours</strong></td>
<td><strong>15-16.0</strong></td>
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<table>
<thead>
<tr>
<th>2nd Semester</th>
<th>Hours</th>
<th>Classes</th>
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<tbody>
<tr>
<td>First-year Writing or American Heritage*</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>REL A 250</td>
<td>2.0</td>
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</tr>
<tr>
<td>MMbio 240</td>
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</tr>
<tr>
<td>MMbio 241</td>
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</tr>
<tr>
<td>CHEM 106</td>
<td>3.0</td>
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</tr>
<tr>
<td>CHEM 107</td>
<td>1.0</td>
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<tr>
<td>Open elective</td>
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<tr>
<td><strong>Total Hours</strong></td>
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### SOPHOMORE YEAR

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<tr>
<th>3rd Semester</th>
<th>Hours</th>
<th>Classes</th>
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<tbody>
<tr>
<td>BIO 165</td>
<td>3.0</td>
<td></td>
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<tr>
<td>BIO 250</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>MMbio 112 or STAT 121</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>PHCS 105</td>
<td>3.0</td>
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</tr>
<tr>
<td>Civilization 2 elective</td>
<td>3.0</td>
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<tr>
<td><strong>Total Hours</strong></td>
<td><strong>14.0-15.0</strong></td>
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<tr>
<th>4th Semester</th>
<th>Hours</th>
<th>Classes</th>
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<tbody>
<tr>
<td>PWs 340</td>
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<tr>
<td>Requirement 7 choice</td>
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<tr>
<td>Open elective</td>
<td>3.0</td>
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<tr>
<td>REL C 200</td>
<td>2.0</td>
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</tr>
<tr>
<td>Civilization 2 elective*</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>Social Science elective*</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td><strong>Total Hours</strong></td>
<td><strong>16.0</strong></td>
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### JUNIOR YEAR

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<tr>
<th>5th Semester</th>
<th>Hours</th>
<th>Classes</th>
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<tbody>
<tr>
<td>CHEM 351 or CHEM 285</td>
<td>3.0</td>
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<tr>
<td>FSBIO 360</td>
<td>3.0</td>
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<tr>
<td>MMbio 494R</td>
<td>1.0</td>
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</tr>
<tr>
<td>Religion elective*</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>Letters elective*</td>
<td>3.0</td>
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<tr>
<td>Arts elective*</td>
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<tr>
<td><strong>Total Hours</strong></td>
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<th>6th Semester</th>
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<th>Classes</th>
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<tbody>
<tr>
<td>MMbio 390R</td>
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<tr>
<td>MMbio 490R</td>
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<tr>
<td>Major electives</td>
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<tr>
<td>REL C 225</td>
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</tr>
<tr>
<td>Open electives</td>
<td>6.0</td>
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<tr>
<td><strong>Total Hours</strong></td>
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### SENIOR YEAR

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<th>7th Semester</th>
<th>Hours</th>
<th>Classes</th>
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<tr>
<td>MMbio 441</td>
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</tr>
<tr>
<td>MMbio 442</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>Major electives</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>Religion elective</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>Global &amp; Cultural Awareness elective*</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td><strong>Total Hours</strong></td>
<td><strong>16.0</strong></td>
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<thead>
<tr>
<th>8th Semester</th>
<th>Hours</th>
<th>Classes</th>
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<tr>
<td>Religion Elective</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>MMbio 468</td>
<td>3.0</td>
<td></td>
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<tr>
<td>Adv. Written &amp; Oral Communication (WRTG 316 recommended)</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>Open electives</td>
<td>3.6</td>
<td></td>
</tr>
<tr>
<td><strong>Total Hours</strong></td>
<td><strong>11-14.0</strong></td>
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Note: Quantitative Reasoning elective fulfilled by Math 112 or Math 119. Note: Students are encouraged to complete an average of 15 credit hours each semester or 30 credit hours each year, which could include spring and/or summer terms. Taking fewer credits substantially increases the cost and the number of semesters to graduate.

Note: Quantitative Reasoning can be fulfilled by ACT Math subscore of 22 or higher.

*Double counting options available for some GE courses
## BS in Molecular Biology (285125)
### 2020-2021 Program Requirements (57 - 60 Credit Hours)

### REQUIREMENT 1: Complete 1 course
### INTRODUCTORY CORE COURSES:
- "BIO 130 - Biology" 4.0
- MMBio 121 - General Biology: Health and Disease 3.0
- *PDBIO 120 - Science of Biology* 3.0

### REQUIREMENT 2: Complete 3 courses
### INTRODUCTORY CORE COURSES:
- MMBio 240 - Molecular Biology 3.0
- MMBio 241 - Molecular and Cellular Biology Laboratory 1.0
- PDBIO 360 - Cell Biology 3.0

### REQUIREMENT 3: Complete 7 courses
### MOLECULAR BIOLOGY COURSES:
- BIO 165 - Introduction to Bioinformatics 3.0
- BIO 250 - Evolutionary Medicine 2.0
- MMBio 390R - Readings in Molecular Biology 1.0
- MMBio 441 - Advanced Molecular Biology 3.0
- MMBio 468 - (MMBio-Bio-PWS) Genomics 3.0
- MMBio 490R - Molecular Biology Seminar 1.0

### REQUIREMENT 4: Complete 4 courses
### PHYSICAL SCIENCE COURSES:
- *CHEM 105 - General College Chemistry 1 with Lab (Integrated)* 4.0
- CHEM 106 - General College Chemistry 2 3.0
- CHEM 107 - General College Chemistry Laboratory 1.0
- *PHSCS 105 - General Physics 1* 3.0

### REQUIREMENT 5: Complete 1 course
### FOR SOME MEDICAL SCHOOLS AND SOME GRADUATE SCHOOLS, CHEM 351, 352, 353, AND 481 ARE REQUIRED CLASSES. THESE CLASSES MAY BE USED AS ELECTIVES FOR THE MOLECULAR BIOLOGY PROGRAM (SEE BELOW). IF CHEM 285 IS USED TO FULFILL REQUIREMENT 5, CHEM 351 MAY BE USED AS AN ELECTIVE FOR REQUIREMENT 8. (CHEM 351 WILL NOT DOUBLE COUNT BETWEEN REQUIREMENTS 5 AND 8.)
- CHEM 285 - Introductory Bio-organic Chemistry 4.0
- CHEM 351 - Organic Chemistry 1 3.0

### REQUIREMENT 6: Complete 1 course
### QUANTITATIVE COURSES (NOTE: MATH 119 IS OFFERED THROUGH BYU INDEPENDENT STUDY):
- "MATH 112 - Calculus 1" 4.0
- MATH 119 - Introduction to Calculus 4.0

### REQUIREMENT 7: Complete 2.0 hours from the following course(s)
#### COMPLETE TWO HOURS FROM THE FOLLOWING 400 LEVEL LAB(S):
- MMBio 442 - Advanced Molecular Biology Laboratory 2.0
- MMBIO 494R - Advanced Mentored Research 3.0

You may take up to 3 credit hours.

### REQUIREMENT 8: Complete 12.0 hours from the following option(s)
#### ELECTIVES:
**OPTION 8.1** Complete up to 12.0 hours from the following course(s)
- BIO 350 - Ecology 3.0
- BIO 463 - Genetics of Human Disease 3.0
- BIO 465 - Capstone in Bioinformatics 3.0
- CHEM 351 - Organic Chemistry 1 3.0
- CHEM 352 - Organic Chemistry 2 3.0
- CHEM 353 - Organic Chemistry Laboratory—Nonmajors 2.0
- CHEM 481 - Biochemistry 3.0
- CHEM 482 - Mechanisms of Molecular Biology 3.0
- MMBIO 110R - Extremophiles: Life in Extreme Environments 1.0
- MMBIO 122 - General Biology: Health and Disease Laboratory 1.0
- MMBIO 151 - Introduction to Microbiology 4.0
- MMBIO 162R - Careers in Biomedical Sciences 1.0
- MMBIO 261 - Infection and Immunity 3.0
- MMBIO 350 - Genetic Counseling 3.0
- MMBIO 360 - Microbial Genetics 4.0
- MMBIO 363 - Microbial Ecology 2.0
- MMBIO 364 - Bacterial Pathogenesis 3.0
- MMBIO 365 - Bacterial Pathogenesis Laboratory 1.0
- MMBIO 366 - Microbial Ecology Laboratory 1.0
- MMBIO 409 - Hematology 3.0
- MMBIO 411 - Molecular Diagnostics 3.0
- MMBIO 418 - Medical Parasitology 2.0
- MMBIO 463 - Immunology 3.0
- MMBIO 465 - Virology 3.0
- MMBIO 466 - Virology Laboratory 1.0
- MMBIO 467 - Immunology Lab 1.0
- MMBIO 471 - Applied and Industrial Microbiology 2.0
- MMBIO 493R - Curriculum and Instruction Practicum 2.0
- MMBIO 510 - History and Philosophy of Microbiology and Molecular Bio 2.0
- MMBIO 512 - Gene Regulation 2.0
- MMBIO 514 - Advanced Immunology 2.0
- MMBIO 516 - Bacteria-Host Interactions 2.0
- MMBIO 518 - Select Pathogens 2.0
- MMBIO 520 - Molecular Virology 2.0
- MMBIO 522 - Flow Cytometry 2.0
- MMBIO 528R - Current Topics in Pathogenesis 1.0
- PDBIO 220 - Human Anatomy (with lab) 4.0
- PDBIO 305 - Human Physiology 4.0
- PDBIO 325 - Tissue Biology (with lab) 3.0
- PDBIO 362 - Advanced Physiology 3.0
- PDBIO 363 - Advanced Physiology Laboratory 1.0
- PDBIO 382 - Developmental Biology 3.0
- PDBIO 444 - Bio-Innovation and Entrepreneurship 1 2.0
- PDBIO 445 - Bio-Innovation and Entrepreneurship 2 2.0
- PDBIO 582 - Developmental Genetics 3.0
- PHSCS 106 - General Physics 2 3.0
- WPS 470 - Analysis of Genetic and Genomic Data 3.0

**OPTION 8.2** Complete up to 6.0 hours from the following course(s)

- MMBIO 294R - Mentored Research 3.0
- MMBIO 399R - Academic Internship 3.0
- MMBIO 494R - Advanced Mentored Research 3.0
- MMBIO 495R - Independent Research 3.0
- MMBIO 521 - Molecular Genetics 3.0
- MMBIO 522 - Molecular Genetics Laboratory 3.0
- MMBIO 527 - Human Genetics 3.0
- MMBIO 528 - Current Topics in Pathogenesis 1.0
- MMBIO 528R - Current Topics in Pathogenesis 1.0
- MMBIO 541 - Bacterial Pathogenesis 1.0
- MMBIO 551 - Virology Laboratory 3.0
- MMBIO 553 - Virology Laboratory 3.0
- MMBIO 554 - Virology Laboratory 4.0
- MMBIO 555 - Virology Laboratory 1.0
- MMBIO 556 - Virology Laboratory 2.0
- PDBIO 201 - Histology (with lab) 3.0
- PDBIO 202 - Histology (with lab) 3.0
- PDBIO 203 - Histology (with lab) 3.0
- PDBIO 305 - Human Physiology 3.0
- PDBIO 307 - Human Physiology 3.0
- PDBIO 325 - Tissue Biology (with lab) 3.0
- PDBIO 331 - Developmental Biology 3.0
- PDBIO 382 - Developmental Biology 3.0
- PDBIO 444 - Bio-Innovation and Entrepreneurship 1 2.0
- PDBIO 445 - Bio-Innovation and Entrepreneurship 2 2.0
- PDBIO 582 - Developmental Genetics 3.0
- PHSCS 106 - General Physics 2 3.0
- WPS 470 - Analysis of Genetic and Genomic Data 3.0

### REQUIREMENT 9
Pass the Biology Major Field Exam.

### REQUIREMENT 10
Complete an exit interview.

### RECOMMENDED Complete 4 courses
### ALTHOUGH NOT REQUIRED, THE FOLLOWING COURSES ARE RECOMMENDED:
- PHSCS 107 - General Physics Lab 1 1.0
- PHSCS 108 - General Physics Lab 2 1.0
- STAT 121 - Principles of Statistics 3.0
- WRTG 316 - Writing for Science and Engineering 3.0
THE DISCIPLINE:
Molecular biology is the basic science that has as its goal an explanation of life processes at the subcellular and molecular level. Recent years have seen explosive advances in the study of DNA and molecular genetics, including gene cloning, sequencing, and mapping. Developments in molecular biology have opened new areas of study and provided powerful techniques that are revolutionizing the pharmaceutical, health, and agricultural industries. They have spawned new industries in biotechnology, and opened avenues for answering basic and applied questions in all of the life sciences.

PROGRAM OBJECTIVES:
The objectives of the molecular biology major are to provide a conceptual knowledge base and critical thinking skills related to the following areas:

• Molecular biology
• Cell biology
• Integrating themes (biochemistry, evolution, and diversity)

At the completion of the program, the student will be able to:

1. Possess basic knowledge and demonstrate critical thinking in molecular biology, cell biology, and evaluate literature in related areas.

2. Demonstrate basic laboratory skills including laboratory safety and basic molecular biology techniques.

3. Demonstrate laboratory thinking skills including cognitive processes, analytical skills, communication skills, and interpersonal and citizenry skills.

4. Demonstrate basic research skills to include formulating a clear, answerable question, developing a testable hypothesis, predicting expected results, developing, modifying, and/or following an experimental protocol, collecting and organizing data in a systematic fashion, presenting data in an appropriate form, assessing the validity of the data and drawing appropriate conclusions based on the results.

CAREER OPPORTUNITIES:
Graduates are well prepared for continued study toward advanced degrees in agriculture, animal science biochemistry, biology, microbiology, molecular biology, medicine, and related fields or to enter the biotechnology work force. Molecular biology is an excellent pre-professional course of study for those interested in health professions, law, or business.

FINANCING:
Students may be employed either as research or teaching assistants. Several endowed scholarships are available.

MAP DISCLAIMER
While every reasonable effort is made to ensure accuracy, there are some student populations that could have exceptions to listed requirements. Please refer to the university catalog and your college advisement center/department for complete guidelines.

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lifesciences@byu.edu

BS in Molecular Biology (285125)
2020-2021