CATALOG TERM: 2019-2020  TOTAL UNITS REQUIRED = 120

**BIOLOGICAL SCIENCES**

- This worksheet is intended for supplemental use only. The University will use your Academic Requirements Report (ARR) to track your graduation requirements, including those for your major. Please continue to check your ARR for accuracy.
- If your ARR requires a correction, please submit an ARR Correction Form at [www.csusm.edu/academicadvising](http://www.csusm.edu/academicadvising).
- Your [Degree Planner](http://my.csusm.edu) will display the following requirements in the University's recommended sequence.
- All courses used for the major and preparation for the major must be completed with a grade of C (2.0) or higher.
- All non-articulated courses MUST be reviewed and approved by a faculty advisor.
- A minimum of 18 units must be completed at CSUSM.
- No more than a total of 8 units of any combination of BIOL 488 (4 units only), BIOL 489 (4 units only), BIOL 495 (3 units only), BIOL 496 (2 units only), BIOL 498 (2 units only), and BIOL 499 (2 units only) may be applied toward the major.
- Students who plan on applying to graduate or professional school are strongly recommended to take MATH 162 as an elective.

**PREPARATION FOR THE MAJOR**

**Lower-division Biology Courses (15 units):**

<table>
<thead>
<tr>
<th>Need</th>
<th>Course</th>
<th>Units</th>
<th>Sem</th>
<th>Grade</th>
</tr>
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<tbody>
<tr>
<td>✔</td>
<td>BIOL 210: Introduction to Cellular and Molecular Biology (*CHEM 150)</td>
<td>4</td>
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<tr>
<td>✔</td>
<td>BIOL 211: Introduction to Organismal &amp; Population Biology (*BIOL 210)</td>
<td>4</td>
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<tr>
<td>✔</td>
<td>BIOL 212: Evolution (*BIOL 210)</td>
<td>3</td>
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<tr>
<td>✔</td>
<td>BIOL 215: Experimental Design &amp; Statistical Analysis</td>
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**Non-Biology Supporting Courses (26 units):**

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<thead>
<tr>
<th>Need</th>
<th>Course</th>
<th>Units</th>
<th>Sem</th>
<th>Grade</th>
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<tbody>
<tr>
<td>✔</td>
<td>CHEM 150: General Chemistry (<em>CPE</em>, CHEM 101 or 105 and MATH 101, 105 or MATH Category 1 or 2)</td>
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<tr>
<td>✔</td>
<td>CHEM 150L: General Chemistry Lab (*CHEM 150)</td>
<td>1</td>
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<tr>
<td>✔</td>
<td>CHEM 160: General Chemistry II (*CHEM 150/150L, *MATH 125 or 132)</td>
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<tr>
<td>✔</td>
<td>CHEM 201: Organic Chemistry I (*CHEM 160)</td>
<td>3</td>
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<tr>
<td>✔</td>
<td>CHEM 201L: Organic Chemistry I Lab (*CHEM 201)</td>
<td>2</td>
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<tr>
<td>✔</td>
<td>MATH 160: Calculus with Applications, I (*MATH 125, 126 or pass MATH 160 Placement Test)</td>
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Complete **one pair of Physics courses:**

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<tr>
<td>✔</td>
<td>PHYS 101: Introduction to Physics I (*B4)</td>
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<tr>
<td>✔</td>
<td>PHYS 102: Introduction to Physics II (*PHYS 101)</td>
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**OR**

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<th>Units</th>
<th>Sem</th>
<th>Grade</th>
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<tr>
<td>✔</td>
<td>PHYS 205: Physics for the Biological Sciences I (*MATH 132 or 160)</td>
<td>4</td>
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<tr>
<td>✔</td>
<td>PHYS 206: Physics for the Biological Sciences II (*PHYS 205)</td>
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*prerequisite; *pre-/co-requisite; *instructor consent required

Score above 50% on the Chemistry Placement Exam
CATALOG TERM: 2019-2020
TOTAL UNITS REQUIRED = 120

BIOLOGICAL SCIENCES

UPPER-DIVISION CORE REQUIREMENTS (20 UNITS)

<table>
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<th>Need</th>
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<tbody>
<tr>
<td></td>
<td>BIOL 351: Molecular Cell Biology (*BIOL 210, 211, 215)</td>
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<td></td>
<td>BIOL 352: Genetics (*BIOL 210, 211, 212, 215)</td>
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<td></td>
<td>BIOL 353: Comparative Animal Physiology (*BIOL 210, 211, 215)</td>
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UPPER-DIVISION CONCENTRATION AND SCIENCE ELECTIVES (19 UNITS TOTAL)

Courses taken for Area A (Concentration Requirements) and Area B (Science Electives) MUST total a minimum of 19 units.

**Area A: Concentration Requirements (10-12 units)**

Select a concentration for course requirements. Course options for each concentration are located on the Biological Sciences Concentration Courses on page 3 of this document.

- **Ecology Concentration:**
  - Select 3 Ecology courses. One course must have a lecture + lab.

- **General Concentration:**
  - Select 1 course each from Ecology, Molecular and Cellular Biology, and Physiology.
  - One course must have a lecture + lab.

- **Molecular and Cellular Biology Concentration:**
  - Select 3 Molecular and Cellular Biology courses. One course must have a lecture + lab.

- **Physiology Concentration:**
  - Select 3 Physiology courses. One course must have a lecture + lab.

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**Area B: Science Electives (7-9 units)**

Select from any Biology courses numbered 355-599. In addition, with consent of advisor, may include PSYC 461 or 1 course from the following list: CS 305, 311; CHEM 341, 351, 401, 402, 404; PHYS 440; MATH 362, 374, 441, 448, 464. Other courses may be approved with faculty consent.

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Units from **Area A (Concentration Requirements)** + **Area B (Science Electives)** must total a minimum of 19 units: 19 units

*prerequisite; *pre-/co-requisite; "instructor consent required

Score above 50% on the Chemistry Placement Exam
BIOLOGICAL SCIENCES CONCENTRATION COURSES

*BIOL 210 and BIOL 211 are prerequisites for each of the courses below. Some courses may have additional prerequisites.

ECOLOGY COURSES:

- BIOL 379: Invertebrate Biology (4)
- BIOL 380: Comparative Animal Behavior (3) + BIOL 380L: Animal Behavior Laboratory and Field Methods (1) (*BIOL 215 for lab)
- BIOL 381: Plant Diversity (3) + BIOL 381L: Plant Diversity Laboratory (1)
- BIOL 382: Biogeography (3)
- BIOL 383: Tropical Ecology (3) (*BIOL 212)
- BIOL 384: Natural History of Southern California (4)
- BIOL 385: Terrestrial Ecology (3) + BIOL 386L: Terrestrial Ecology Laboratory (1)
- BIOL 387: Ecological Processes in Aquatic Systems (3) + BIOL 387L: Aquatic Ecology Laboratory (1)
- BIOL 388: Marine Communities (3)
- BIOL 389: Freshwater Biology (3)
- BIOL 390: Terrestrial Plant Ecology (3) + BIOL 390L: Terrestrial Plant Ecology Laboratory (1)
- BIOL 400: Vertebrate Biology (3) + BIOL 400L: Vertebrate Biology Laboratory (1) (*BIOL 212)
- BIOL 401: Comparative Vertebrate Anatomy (4) (*BIOL 212)
- BIOL 420: Ecological Monitoring (4) (*BIOL 215, 354)
- BIOL 463: Principles of Conservation Biology (3) (*BIOL 354)
- BIOL 502*: Population Genetics (4) (*BIOL 352)
- BIOL 505*: Physiological Ecology (3) (*BIOL 353)
- BIOL 513: Ecology of Parasitism (3) (*BIOL 354)
- BIOL 533*: Geographic Information Systems Applications in Landscape Ecology (4) (*BIOL 354)
- BIOL 535*: Ecological Modeling (3) (*BIOL 354)
- BIOL 536*: Biogeochemical Cycles and Global Change (3) (*BIOL 354)
- BIOL 540: Molecular Methods in Ecology and Evolution (3) (*BIOL 352)

MOLECULAR AND CELLULAR BIOLOGY COURSES:

- BIOT 356: Cellular Biotechnology (4) (offered Spring semester only)
- BIOT 357: Foundations of Biotechnology (2)
- BIOT 420: Plant Biotechnology (3) (*BIOT 355 OR BIOL 351)
- BIOL 367: Biology of Microorganisms (4) (offered Fall semester only)
- BIOL 368: Developmental Biology (3) + BIOL 368L: Developmental Biology Laboratory (1)
- BIOL 370: Plant Physiology (3) + BIOL 370L: Plant Physiology Lab (1)
- BIOL 452: Medical Genetics (3) (*BIOL 212, 352)
- BIOL 456: Molecular Medicine and Mechanisms of Disease (3) (*BIOL 351, 352, 353, 477, or 504 or BIOL 355 or 356)
- BIOL 477: Immunology (3) + BIOL 477L: Immunology Lab (1) (*BIOL 351 or BIOT 355)
- BIOL 480: Bioinformatics (4) (*BIOL 351, 352 or BIOT 355)
- BIOL 502: Population Genetics (4) (*BIOL 352)
- BIOL 503: Modern Molecular Biology and Genomics (4) (*BIOL 351 or BIOT 355)
- BIOL 504*: Virology (3) (*BIOL 351 or BIOT 355)
- BIOL 520*: Advanced Molecular Cell Biology (3) (*BIOL 351, 352)
- BIOL 537*: Microbial Physiology (3) (*BIOL 351 or 367)
- BIOL 540*: Molecular Methods in Ecology and Evolution (3) (*BIOL 352)

PHYSIOLOGY COURSES:

- BIOL 368: Developmental Biology (3) + BIOL 368L: Developmental Biology Laboratory (1) (*BIOL 215 for lab)
- BIOL 370: Plant Physiology (3) + BIOL 370L: Plant Physiology Lab (1)
- BIOL 374: Exercise Physiology and Bioenergetics (3)
- BIOL 375: Endocrinology (3) (*CHEM 201)
- BIOL 380: Comparative Animal Behavior (3) + BIOL 380L: Animal Behavior Laboratory and Field Methods (1) (*BIOL 215 for lab)
- BIOL 401: Comparative Vertebrate Anatomy (4) (*BIOL 212)
- BIOL 404: Developmental Physiology (3) + BIOL 404L: Developmental Physiology Lab (1) (*BIOL 353)
- BIOL 411: Animal Reproductive Physiology (3) (*BIOL 212 and 353) + BIOL 411L: Animal Reproductive Physiology Laboratory (1)
- BIOL 423: Fish Physiology (3) + BIOL 423L: Fish Physiology (2) (*BIOL 353)
- BIOL 434: Human Cardiovascular Physiology (3) (*BIOL 353)
- BIOL 476: Neurobiology (3) (*BIOL 353)
- BIOL 505*: Physiological Ecology (3) (*BIOL 353)
- BIOL 512*: Physiology of Aging (3) + BIOL 512L*: Physiology of Aging Laboratory (1) (*BIOL 353)
- BIOL 514*: Physiology of Parasitism (3) + BIOL 514L*: Physiology of Parasitism Lab (1) (*BIOL 353)
- BIOL 515*: Medical Physiology (3) (*BIOL 353)
- BIOL 537*: Microbial Physiology (3) (*BIOL 351 or 367)
- BIOL 576*: Laboratory Experience in Neurobiology (1) (*BIOL 476)

ONE OF THE FOLLOWING MAY BE USED TO FULFILL A CONCENTRATION COURSE:

- BIOL 365: Computing Skills for Biologists (4) (*BIOL 215)
- BIOL 531: Biological Data Analysis I-Linear (3) (*BIOL 215)
- BIOL 532: Biological Data Analysis II-Multivariate (3) (*BIOL 215)