

# CELLULAR AND MOLECULAR BIOLOGY (BS)

## Program Description

The Cellular and Molecular Biology program is intended for students interested in pursuing a career or postgraduate training in cellular biology, developmental biology, genetics, microbiology or molecular biology. This major prepares you for careers such as biomedical or cellular molecular biology research, clinical microbiology, medical or agricultural biotechnology, medicine or genetic counseling.

## Entering and Completing the Major

In order to earn a degree, you must complete at least one academic major. SPU encourages students to explore various academic paths, so if you change your mind about a major, or want to include an additional program, you are able to do so, as outlined below.

Note that the University encourages you to enter your chosen major(s) as soon as you have determined it and are eligible to join it, especially by the start of your junior year. Students who transfer as juniors and seniors should enter a major within their first two quarters at SPU.

- If this is your first quarter at SPU and you identified a major in this department as your first choice on your application for admission to the University, you have gained entry to the major. To change or add a major, follow these instructions (<https://spu.atlassian.net/l/cp/a3th1keb/>).
- If you are an SPU student with an SPU cumulative GPA of 2.0 or better, follow these instructions (<https://spu.atlassian.net/l/cp/a3th1keb/>) to enter a major in this department.
- The University requires a grade of C- or better in all classes that apply to a major; however, programs may require higher minimum grades in specific courses. You may repeat an SPU course only once for a higher grade.
- To advance in this program, meet with your faculty advisor regularly to discuss your grades, course progression, and other indicators of satisfactory academic progress. If your grades or other factors indicate that you may not be able to successfully complete the major or minor, your faculty advisor can work with you to explore options, which may include choosing a different major.
- You must complete the major requirements that are in effect in the SPU Undergraduate Catalog for the year you enter the major.

## Cellular and Molecular Biology (BS)

97 Credits Minimum, Including 26 Upper Division (UD)

Code	Title	Credits
<b>General Core Requirements</b>		
BIO 2101	General Biology	5
BIO 2102	General Biology	5
BIO 2103	General Biology	5
BIO 3325	Genetics	5
BIO 3899	Scientific Literature	1
BIO 3351	General Microbiology <sup>1</sup>	5
or BIO 4419	Medical Virology	
BIO 4325	Molecular Biology	5

BIO 4352	Cell Biology	5
Section Credits Required		36

### Biology Electives

Select ten credits of the following:<sup>2</sup> 10

BIO 3000	Introduction to Biological Anthropology	
BIO 3350	Immunology	
BIO 3432	Biodiversity: Vertebrate Biology	
BIO 4256	Environmental Physiology	
BIO 4320	Principles of Development	
BIO 4330	Evolutionary Mechanisms	
BIO 4410	Human Physiology	
BIO 4413	Animal Physiology	
BIO 4415	Plant Physiology	
BIO 4418	Neurobiology	
BIO 4435	Biodiversity: Parasites and Pests	
BIO 4744	Marine Botany	
BIO 4840	Chemical Ecology	

Section Credits Required 10

### Required Supporting Courses

BIO 4360	Biostatistics	5
CHM 1211	General Chemistry I	5
CHM 1212	General Chemistry II	5
CHM 1213	General Chemistry III	3
CHM 3371	Organic Chemistry I	5
CHM 3372	Organic Chemistry II	5
CHM 3373	Organic Chemistry III	5
CHM 4361	Biochemistry	5
CHM 4362	Biochemistry	5
MAT 2360	Introduction to Statistics for the Sciences	5

Section Credits Required 48

### Capstone Experience

Select one of the following Groups: 3

Group A:

BIO 4615	Bioethics	
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Group B:

BIO 4978	Biological Research Proposal	
BIO 4979	Biological Research	

Section Credits Required 3

### Recommended Courses

CHM 2213	Inorganic Qualitative Analysis	
MAT 1221	Survey of Calculus	
or MAT 1234	Calculus I	
MAT 1235	Calculus II	

Select one of the following Groups:

Group A:

PHY 1101	General Physics	
PHY 1102	General Physics	
PHY 1103	General Physics	

Group B:

PHY 1121	Physics for Science and Engineering	
PHY 1122	Physics for Science and Engineering	
PHY 1123	Physics for Science and Engineering	

Section Credits Required	0
<b>Total Credits</b>	<b>97</b>

<sup>1</sup> BIO 3351 General Microbiology or BIO 4419 Medical Virology may count as Biology Elective if not used in Core.

<sup>2</sup> At least 5 cr. must include lab/field.

## Additional Requirements and Information

- Max 6 credits from BIO 4900-4999 may be applied to major.

## Suggested Course Sequence

*This suggested course sequence is a potential plan for how to complete the major within four years. Please consult with a departmental faculty advisor for course advisement.*

- Students should take the Chemistry Placement test (available in Canvas) prior to New Student Advising.
  - A Chemistry Placement score  $\geq 35$  is a pre-requisite for BIO 2101 General Biology and CHM 1211 General Chemistry I.
  - Students who score  $< 35$  on the Chemistry Placement test, or who would benefit from an introduction to Chemistry, should take CHM 1000 Preparation for General Chemistry in Autumn quarter, then take BIO 2101 General Biology and CHM 1211 General Chemistry I in Winter quarter.
- Students interested in careers in the health sciences should take PPHS 1200 Introduction to the Health Professions and PPHS 3400 Application Workshop. See Pre-Professional Health Sciences program (<https://catalog.spu.edu/undergraduate/interdisciplinary-programs/pre-professional-health-sciences/>) website for more information.

## Four-Year Plan: $>35$ on Chemistry Placement Test

Course	Title	Credits
<b>Freshman</b>		
<b>Autumn</b>		
CHM 1211	General Chemistry I	5
UCOL 1000	University Colloquium	1
<b>Credits</b>		<b>6</b>
<b>Winter</b>		
BIO 2101	General Biology <sup>1</sup>	5
CHM 1212	General Chemistry II	5
PPHS 1200	Introduction to the Health Professions	1
<b>Credits</b>		<b>11</b>
<b>Spring</b>		
BIO 2102	General Biology	5
CHM 1213	General Chemistry III	3
CHM 2213	Inorganic Qualitative Analysis <sup>2</sup>	2
<b>Credits</b>		<b>10</b>
<b>Any Quarter</b>		
WRI 1000	Academic Inquiry and Writing Seminar	5
WRI 1100	Disciplinary Research and Writing Seminar	5
UFDN 1000	The Christian Faith	5
<b>Credits</b>		<b>15</b>
<b>Sophomore</b>		
<b>Autumn</b>		
BIO 2103	General Biology	5
CHM 3371	Organic Chemistry I	5

PHY 1101/1121	General Physics	5
<b>Credits</b>		<b>15</b>
<b>Winter</b>		
CHM 3372	Organic Chemistry II	5
PHY 1102/1122	General Physics	5
<b>Credits</b>		<b>10</b>
<b>Spring</b>		
CHM 3373	Organic Chemistry III	5
PHY 1103/1123	General Physics	5
<b>Credits</b>		<b>10</b>
<b>Any Quarter</b>		
MAT 2360	Introduction to Statistics for the Sciences	5
MAT 1221	Survey of Calculus <sup>3</sup>	5
or MAT 1234	or Calculus I	
BIO 4978 & BIO 4979	Biological Research Proposal and Biological Research (in years 2 - 4) <sup>4</sup>	3
<b>Credits</b>		<b>13</b>
<b>Junior</b>		
<b>Autumn</b>		
CHM 4361	Biochemistry	5
<b>Credits</b>		<b>5</b>
<b>Autumn or Winter</b>		
BIO 3325	Genetics	5
<b>Credits</b>		<b>5</b>
<b>Winter</b>		
CHM 4362	Biochemistry	5
BIO 4360	Biostatistics	5
<b>Credits</b>		<b>10</b>
<b>Spring</b>		
BIO 3351	General Microbiology <sup>5</sup>	5
or BIO 4419	or Medical Virology	
Apply to graduate!		
<b>Credits</b>		<b>5</b>
<b>Any Quarter</b>		
BIO 3899	Scientific Literature	1
Select five credits of elective courses from the following: (in years 3 - 4)		
BIO 3000	Introduction to Biological Anthropology	
BIO 3350	Immunology	
BIO 3432	Biodiversity: Vertebrate Biology	
BIO 4256	Environmental Physiology	
BIO 4320	Principles of Development	
BIO 4330	Evolutionary Mechanisms	
BIO 4410	Human Physiology	
BIO 4413	Animal Physiology	
BIO 4415	Plant Physiology	
BIO 4418	Neurobiology	
BIO 4419	Medical Virology <sup>5</sup>	
BIO 4435	Biodiversity: Parasites and Pests	
BIO 4744	Marine Botany	
BIO 4840	Chemical Ecology	
<b>Credits</b>		<b>6</b>
<b>Senior</b>		
<b>Autumn</b>		
BIO 4615	Bioethics <sup>4</sup>	3
<b>Credits</b>		<b>3</b>
<b>Winter</b>		
BIO 4325	Molecular Biology	5
<b>Credits</b>		<b>5</b>

Spring		
BIO 4352	Cell Biology	5
<b>Credits</b>		<b>5</b>
<b>Total Credits</b>		<b>134</b>

<sup>1</sup> Students who test at Math Placement Level B and who either score  $\geq$  on the Chemistry Placement Test or transfer in the complete General Chemistry sequence may take BIO 2103 General Biology in Autumn 2024.

<sup>2</sup> CHM 2213 Inorganic Qualitative Analysis may be required by some graduate programs.

<sup>3</sup> Take Calculus Placement Test in Canvas first. MAT 1221 Survey of Calculus or MAT 1234 Calculus I are typically required by many graduate programs. MAT 1235 Calculus II may be required by some graduate programs.

<sup>4</sup> Research (BIO 4978 Biological Research Proposal & BIO 4979 Biological Research) or BIO 4615 Bioethics will satisfy the Capstone Experience requirement.

<sup>5</sup> BIO 4419 Medical Virology is typically offered in winter quarter; it may not count for both the General Core and Biology Electives categories.

## Freshman Notes

- Take Math Placement Test (in Canvas) if you are at Math Level 0 or A at time of admission.
  - Math Level B is a prerequisite for BIO 2102 General Biology, BIO 2103 General Biology, CHM 1212 General Chemistry II and MAT 2360 Introduction to Statistics for the Sciences.
- Students who test into Level 0 or A should plan to take MAT 0144 College Readiness Math I and/or MAT 0145 College Readiness Math II to achieve Math Level B.

## Sophomore Notes

- MAT 2360 Introduction to Statistics for the Sciences is a pre-requisite for BIO 3325 Genetics and BIO 4360 Biostatistics.
- Physics (either 110x series or 112x series) is recommended for most graduate programs.

## Junior Notes

- BIO 3325 Genetics is offered both Autumn and Winter. It is a pre-requisite for BIO 4325 Molecular Biology (only offered in Winter) and BIO 4352 Cell Biology (only offered in Spring).

## Senior Notes

- Check the time schedule, as most upper division courses are offered only in certain quarters.

## Four-Year Plan: <35 on Chemistry Placement Test

Course	Title	Credits
<b>Freshman</b>		
<b>Autumn</b>		
CHM 1000	Preparation for General Chemistry	2
UCOL 1000	University Colloquium	1
<b>Credits</b>		<b>3</b>
<b>Winter</b>		
BIO 2101	General Biology	5
CHM 1211	General Chemistry I	5
PPHS 1200	Introduction to the Health Professions	1
<b>Credits</b>		<b>11</b>

Spring		
BIO 2102	General Biology	5
CHM 1212	General Chemistry II	5
<b>Credits</b>		<b>10</b>

Any Quarter		
WRI 1000	Academic Inquiry and Writing Seminar	5
WRI 1100	Disciplinary Research and Writing Seminar	5
UFDN 1000	The Christian Faith	5
<b>Credits</b>		<b>15</b>

Sophomore		
<b>Autumn</b>		
BIO 2103	General Biology	5
PHY 1101/1121	General Physics	5
<b>Credits</b>		<b>10</b>

Winter		
PHY 1102/1122	General Physics	5
<b>Credits</b>		<b>5</b>

Spring		
CHM 1213	General Chemistry III	3
CHM 2213	Inorganic Qualitative Analysis <sup>1</sup>	2
PHY 1103/1123	General Physics	5
<b>Credits</b>		<b>10</b>

Any Quarter		
MAT 2360	Introduction to Statistics for the Sciences	5
MAT 1221 or MAT 1234	Survey of Calculus <sup>2</sup> or Calculus I	5
BIO 4978 & BIO 4979	Biological Research Proposal and Biological Research (in years 2 - 4) <sup>3</sup>	3
<b>Credits</b>		<b>13</b>

Junior		
<b>Autumn</b>		
CHM 3371	Organic Chemistry I	5
<b>Credits</b>		<b>5</b>

Autumn or Winter		
BIO 3325	Genetics	5
<b>Credits</b>		<b>5</b>

Winter		
CHM 3372	Organic Chemistry II	5
BIO 4360	Biostatistics	5
<b>Credits</b>		<b>10</b>

Spring		
BIO 3351 or BIO 4419	General Microbiology <sup>4</sup> or Medical Virology	5
CHM 3373	Organic Chemistry III	5
Apply to graduate!		
<b>Credits</b>		<b>10</b>

Any Quarter		
BIO 3899	Scientific Literature	1
Select 5 credits of elective courses from the following: (in years 3 - 4)		
BIO 3000	Introduction to Biological Anthropology	
BIO 3350	Immunology	
BIO 3432	Biodiversity: Vertebrate Biology	
BIO 4256	Environmental Physiology	
BIO 4320	Principles of Development	
BIO 4330	Evolutionary Mechanisms	
BIO 4410	Human Physiology	
BIO 4413	Animal Physiology	
BIO 4415	Plant Physiology	
BIO 4418	Neurobiology	
BIO 4419	Medical Virology <sup>4</sup>	
BIO 4435	Biodiversity: Parasites and Pests	
BIO 4744	Marine Botany	

BIO 4840	Chemical Ecology	
<b>Credits</b>		<b>6</b>
<b>Senior</b>		
<b>Autumn</b>		
CHM 4361	Biochemistry	5
BIO 4615	Bioethics <sup>3</sup>	3
<b>Credits</b>		<b>8</b>
<b>Winter</b>		
BIO 4325	Molecular Biology	5
CHM 4362	Biochemistry	5
<b>Credits</b>		<b>10</b>
<b>Spring</b>		
BIO 4352	Cell Biology	5
<b>Credits</b>		<b>5</b>
<b>Total Credits</b>		<b>136</b>

<sup>1</sup> CHM 2213 Inorganic Qualitative Analysis may be recommended by some graduate programs.

<sup>2</sup> Take Calculus Placement Test in Canvas first. MAT 1221 Survey of Calculus or MAT 1234 Calculus I are typically required by many graduate programs. MAT 1235 Calculus II may be required by some graduate programs.

<sup>3</sup> Research (BIO 4978 Biological Research Proposal & BIO 4979 Biological Research) or BIO 4615 Bioethics will satisfy the Capstone Experience Requirement.

<sup>4</sup> BIO 4419 Medical Virology is typically offered in winter quarter; it may not count for both the General Core and Biology Electives categories.

## Freshman Notes

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  - Math Level B is a prerequisite for BIO 2102 General Biology, BIO 2103 General Biology, CHM 1212 General Chemistry II and MAT 2360 Introduction to Statistics for the Sciences.
  - Students who test into Level 0 or A should plan to take MAT 0144 College Readiness Math I and/or MAT 0145 College Readiness Math II to achieve Math Level B.
- BIO 2102 General Biology and BIO 2103 General Biology can be taken in either order.

## Sophomore Notes

- MAT 2360 Introduction to Statistics for the Sciences is a pre-requisite for BIO 3325 Genetics and BIO 4360 Biostatistics.
- Physics (either 110x series or 112x series) is recommended for most graduate programs.

## Junior Notes

- BIO 3325 Genetics is offered both Autumn and Winter. It is a pre-requisite for BIO 4325 Molecular Biology (only offered in Winter) and BIO 4352 Cell Biology (only offered in Spring).
- Check the time schedule, as most upper division courses are offered only in certain quarters.