

## MICROBIOLOGY MAJOR INFORMATION

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| <p><b>Coordinating Advisor:</b><br/>           Matt DeBlieck<br/>           320 BioSci. Bldg.<br/>           614-292-6961 (ASC Advising phone #)<br/>           Deblieck.2@osu.edu</p> | <p><b>Coordinator Undergraduate Research:</b><br/>           Dr. Jesse Kwiek<br/>           476 BioSci. Bldg.<br/>           614-292-3256<br/>           Kwiek.2@osu.edu</p> |

### Required Prerequisites\* to the Major

Credits from these courses do not count toward the 30 hours required to complete the Major; however, some are prerequisites for required major courses. All Prerequisites must be completed prior to graduation.

|  |          |
|--|----------|
| Biology 1113, 1114   | 8 hr.    |
| Mathematics 1156 or 1151 and one of the following:<br>Mathematics 1152 or 1157, or Statistics 1450, 2450 or 2480 | 8-10 hr. |
| Chemistry 1210, 1220   | 10 hr.   |
| Chemistry 2510, 2520, 2540   | 10 hr.   |
| Physics 1200 and 1201 or 1250 and 1251   | 10 hr.   |

\*Honors courses can substitute where available.

***Additional organic chemistry courses may be required or suggested for pre-professional students.***

### Microbiology Major Courses—General Information

The Microbiology Major consists of a minimum of 30 semester hours. Required Core courses make up 21 of these 30 hours. All students must complete the six Core Courses and nine (9) hours of elective courses (outlined below).

The elective courses are divided into two groups: Group 1 and Group 2. Students must take at least three (3) hours of Group 1 courses and may take all nine (9) elective hours from Group 1. Students are not required to take any Group 2 courses but may have up to six (6) hours from this group count as elective hours. Students are encouraged to discuss with their microbiology major advisor any courses that are not listed in Group 2 that would be suitable to include in the Microbiology Major.

A total of three (3) semester hours graded S/U may be counted toward the Microbiology Major. These are usually earned through Individual Study, Undergraduate Research or Honors Research (Microbiology 4193, 4998, 4998H, 4999 or 4999H). Individual Study courses may be arranged by contacting any faculty member in the department. You may also discuss your research options with the Coordinator of Undergraduate Research.

*Students must receive a C- or better in Microbiology courses to use them as prerequisites for other courses. Students must earn a grade of C- or higher for a course to transfer to Ohio State. The only exception to this is courses transferred from a public institution in Ohio since 2006. In these cases, credit for courses with grades of D and D+ will transfer to Ohio State. This rule cannot be appealed.*

**Microbiology Major Required Core Courses, 21 Hours**

| Department #      | Credit Hours | Course Title (Semester taught)                    | Prerequisites*   |
|-------------------|--------------|---|--|
| Biochemistry 4511 | 4            | Introduction to Biological Chemistry (Au, Sp, Su) | Chemistry 2310 or 2510 and one semester of Biological Sciences, or permission of instructor      |
| Microbiology 4100 | 5            | General Microbiology (Au, Sp, Su)                 | Biology 1113, Chemistry 2510 or concurrent   |
| Microbiology 4110 | 3            | Pathogenesis and Immunobiology (Au, Sp)           | Microbiology 4100 (C- or better)   |
| Microbiology 4120 | 3            | Microbial Physiology and Diversity (Au, Sp)       | Microbiology 4100 (C- or better), Biochem 4511 or concurrently.                                  |
| Microbiology 4130 | 3            | Microbial Genetics (Au, Sp)                       | Microbiology 4100 (C- or better) or Molecular Genetics 4500 or 4606                              |
| Microbiology 4140 | 3            | Molecular Microbiology Laboratory (Au, Sp)        | Microbiology 4100 (C- or better), Microbiology 4130 or concurrently, or permission of instructor |

\*or honors equivalent

**ELECTIVE COURSES, GROUP 1: Take 3-9 hr. from this group**

| Micro. Course No. | Credit Hours             | Course Title (Semester taught)                               | Prerequisites  |
|-------------------|--------------------------|--|--|
| 2000              | 1.5                      | Introduction to Microbiology Research (Au)                   | Biology 1113(H)  |
| 3704              | 3                        | HIV: From Microbiology to Macrohistory (Sp)                  | English 1110.xx, or permission of instructor. Not open to students with credit for History 3704  |
| 4193              | 1-3<br><i>Graded S/U</i> | Individual Studies (Au, Sp, Su)                              | Permission of instructor. Maximum of 3 credit hours can be counted toward the Major  |
| 4591S             | 1<br><i>Graded S/U</i>   | DNA Fingerprinting; Service learning course (Sp)             | Students present workshops at Columbus Public High Schools.  |
| 5122              | 3                        | Immunobiology (Au)   | C- or better in either Microbiology 4000 or 4100   |
| 5129              | 3                        | Cellular and Molecular Biology of Pathogenic Eukaryotes (Sp) | Microbiology 4100 or permission of instructor  |
| 5147              | 3                        | Eukaryotic Pathogens (Au)                                    | Microbiology 4100 (C- or better)   |
| 5149              | 3                        | Introductory Virology (Sp)                                   | Microbiology 4100 (C- or better)   |
| 5150              | 3                        | Microbial Ecology (TBD)                                      | C- or better in Microbiology 4000 or equivalent  |
| 5155              | 3                        | Environmental Microbiology (Au)                              | C- or better in Microbiology 4000 or equivalent  |
| 5160              | 3                        | Geomicrobiology (Sp)   | Sr or Grad standing in School of Earth Sciences, Department of Microbiology, Department of Civil, Environmental, and Geodetic Engineering, or School of Environment and Natural Resources. |

|                               |                   |   |   |
|-------------------------------|-------------------|---|---|
| 5161                          | 3                 | Bioinformatics and Molecular Microbiology (Sp)                                    | Microbiology 4130 or Molecular Genetics 4500; Biochemistry 4511; or permission of instructor  |
| 5169                          | 3                 | Microbial Evolution (Au)  | 6 semester hours of biological sciences course work   |
| 5270                          | 3                 | Microbial Natural Products: Discovery, Biosynthesis, and Antibiotic Activity (Sp) | C- or better in Microbiology 4120; or C- or better in Biochemistry 5614; or Graduate student standing (with equivalent background); or consent of the instructor. |
| 5536                          | 3                 | Food Microbiology Lecture (Au)  | C- or better in either Microbiology 4000 or 4100  |
| 5546                          | 3                 | Food Microbiology Laboratory (Sp)   | Microbiology 5536   |
| 5800                          | 2                 | Organelle Biology (Au)  | Molecular Genetics 4500 or permission of instructor   |
| <b>Undergraduate Research</b> |                   |   |   |
| 4998/4998H                    | 1-5               | Undergraduate Research in Microbiology (Au, Sp, Su)                               | Permission of instructor. Maximum of 3 credit hours for any combination of these courses can be counted toward the Major.   |
| 4999/4999H                    | <i>Graded S/U</i> | Undergraduate Research in Microbiology—Thesis (Au, Sp, Su)                        | Thesis requires a minimum of 4 cumulative credit hours and final thesis examination. Check with your advisor for details.   |

Students must meet with an advisor to have coursework pre-approved for Study at a Foreign Institution or a Domestic Study Tour. Credit (S/U) may be applicable to the Microbiology Major.

### ELECTIVE COURSES, GROUP 2: Take 0-6 hr. from this group

| Course No.              | Credit Hours | Course Title (Semester taught)                                       | Prerequisites  |
|-------------------------|--------------|--|--|
| Microbiology 2200       | 1            | Genome Biology (Sp)  | Biology 1113(H)  |
| Microbiology 3798.05    | 4            | HIV in Context: East Africa (Su) [Study Abroad]                      | English 1110.xx, or instructor permission. Not open to students with credit for History 3798.05. |
| Biochemistry 5621       | 4            | Introduction to Biological Chemistry Laboratory (Au, Sp)             | Biochemistry 4511 or 5613 or equivalent  |
| CBE 5765                | 3            | Principles of Biochemical Engineering (Sp)                           | CBE 2523 or 3610, or Graduate standing or permission of instructor.                              |
| ENVENG 5120             | 3            | Bioremediation of Groundwater and Soil (Sp 2015, 2017)               | EnvEng 5110 and a class in Microbiology; Graduate Standing or permission of instructor.          |
| ENR 5263                | 3            | Biology of Soil Ecosystems (Sp)                                      | ENR 3000 or Grad Standing  |
| ENR 5266                | 3            | Field Soil Investigation: Soil Chemistry, Fertility and Biology (Su) | Not open to students with credit for 7740  |
| Molecular Genetics 4500 | 3            | General Genetics (Au, Sp, Su)  | Biology 1101, 113, or 1113H, and 3 additional semester credit hours in Biological Sciences       |
| Molecular Genetics 4501 | 1            | General Genetics Laboratory (Au)                                     | Molecular Genetics 4500 or permission of instructor  |
| Molecular Genetics 4606 | 4            | Molecular Genetics (Au, Sp)  | Biology 1113, 1113H, 1114, 1114H, or Chem 1220 or equiv.   |
| Plant Pathology 5010    | 2            | Phytobacteriology (Au)   | Plant Pathology 3002 or Microbiology 4100, or permission of instructor                           |
| Plant Pathology 5020    | 2            | Introduction to Plant Virology                                       | Plant Pathology 3001, Biochemistry 4511, or Microbiology 4000 or permission of instructor        |
| Plant Pathology 5040    | 3            | Science of Fungi: Mycology (Au)                                      | Biology 1114 or Plant Pathology 3001   |

**Microbiology Faculty (<https://microbiology.osu.edu/directory>)**

| <b>Name</b>                       | <b>Scientific Focus</b>   | <b>@osu.edu</b>                |
|-----------------------------------|---|--------------------------------|
| Stephen Abedon                    | <a href="#">Bacteriophage ecology; phage therapy (OSU-Mansfield)</a>                                  | <a href="#">abedon.1</a>       |
| Brian Ahmer                       | <a href="#">Detection of microbes and host environment by Salmonella</a>                              | <a href="#">ahmer.1</a>        |
| Birgit Alber                      | <a href="#">Biochemistry of central carbon metabolism</a>   | <a href="#">alber.8</a>        |
| Juan Alfonzo                      | <a href="#">tRNA in mitochondrial bio-genesis and disease</a>   | <a href="#">alfonzo.1</a>      |
| Amal Amer                         | <a href="#">Innate immunity against Legionella and Burkholderia</a>                                   | <a href="#">amer.13</a>        |
| Matthew Anderson                  | <a href="#">Phenotypic consequences of genomic variation</a>  | <a href="#">anderson.3196</a>  |
| Irina Artsimovitch                | <a href="#">Regulation of transcription</a>   | <a href="#">artsimovitch.1</a> |
| Charles Bell                      | <a href="#">Molecular and cellular biochemistry</a>   | <a href="#">bell.489</a>       |
| Tammy Bullwinkle                  | <a href="#">tRNA biology</a>  | <a href="#">bullwinkle.1</a>   |
| Ross Dalbey                       | <a href="#">Membrane protein assembly; proteases; biophysics</a>                                      | <a href="#">dalbey.1</a>       |
| Charles Daniels                   | <a href="#">Molecular biology of the archaea; archaeal SNO-RNAs</a>                                   | <a href="#">daniels.7</a>      |
| Rajendar Deora                    | <a href="#">Molecular determinants of pathogenesis and biofilm development</a>                        | <a href="#">deora.6</a>        |
| Kurt Fredrick                     | <a href="#">Mechanistic studies of protein biosynthesis</a>   | <a href="#">fredrick.5</a>     |
| Venkat Gopalan                    | <a href="#">Protein-aided RNA catalysis</a>   | <a href="#">gopalan.5</a>      |
| John Gunn                         | <a href="#">Salmonella and Francisella host-pathogen interactions</a>                                 | <a href="#">gunn.43</a>        |
| Patrice Hamel                     | <a href="#">Mitochondria and chloroplast membrane biogenesis</a>                                      | <a href="#">hamel.16</a>       |
| Tina Henkin                       | <a href="#">Transcription termination control in Gram positive bacteria; RNA structure/function</a>   | <a href="#">henkin.3</a>       |
| Mette Ibba                        | <a href="#">General microbiology</a>  | <a href="#">ibba.2</a>         |
| Michael Ibba                      | <a href="#">Translation of the genetic code; tRNA biology</a>   | <a href="#">ibba.1</a>         |
| Igor Jouline                      | <a href="#">Computational biology, evolutionary genomics, signal transduction</a>                     | <a href="#">jouline.1</a>      |
| Kou-San Ju                        | <a href="#">Natural products; microbial metabolism; biocatalysis</a>                                  | <a href="#">ju.109</a>         |
| Pravin Kaumaya                    | <a href="#">Peptide and protein design and folding; antigenic determinants</a>                        | <a href="#">kaumaya.1</a>      |
| Joseph Krzycki                    | <a href="#">Biochemistry and molecular biology of methanogenic archaea</a>                            | <a href="#">krzycki.1</a>      |
| Jesse Kwiek                       | <a href="#">HIV pathogenesis and public health</a>  | <a href="#">kwiek.2</a>        |
| Shan-Lu Liu                       | <a href="#">Host restriction to viral infection; innate immunity to viruses; viral oncogenesis</a>    | <a href="#">liu.6244</a>       |
| Thomas Magliery                   | <a href="#">Combination and statistical approaches to protein stability</a>                           | <a href="#">magliery.1</a>     |
| Madhura Pradhan                   | <a href="#">Microbial pathogenesis and immunology</a>   | <a href="#">pradhan.2</a>      |
| Chad Rappleye                     | <a href="#">Molecular mechanisms of fungal virulence</a>  | <a href="#">rappleye.1</a>     |
| John Reeve ( <i>Emeritus</i> )    | <a href="#">Molecular biology of archaea; molecular adaptations to extreme environments</a>           | <a href="#">reeve.2</a>        |
| Virginia Rich                     | <a href="#">Global change microbiology; microbial meta-omics; Genes-to-Ecosystems inquiry</a>         | <a href="#">rich.270</a>       |
| Yasuko Rikihisa                   | <a href="#">Obligatory intracellular bacteria; Anaplasma, Ehrlichia, and Neorickettsia</a>            | <a href="#">rikihisa.1</a>     |
| Natividad Ruiz                    | <a href="#">Envelope biogenesis in Gram-negative bacteria</a>   | <a href="#">ruiz.82</a>        |
| Zakee Sabree                      | <a href="#">Insect microbe interactions; nutrient cycling; microbial evolution and ecology</a>        | <a href="#">sabree.8</a>       |
| Abhay Satoskar                    | <a href="#">Immune mechanisms</a>   | <a href="#">satoskar.2</a>     |
| Stephanie Seveau                  | <a href="#">Bacterial toxins and infectious diseases</a>  | <a href="#">seveau.1</a>       |
| Paul Stoodley                     | <a href="#">Biofilm development and dynamics</a>  | <a href="#">stoodley.4</a>     |
| Matthew Sullivan                  | <a href="#">Phage ecology, evolution, host interaction, and discovery through (meta)genomics</a>      | <a href="#">sullivan.948</a>   |
| Robert Tabita                     | <a href="#">Microbial physiology; carbon sequestration; bioenergy/biofuel production</a>              | <a href="#">tabita.1</a>       |
| Olli Tuovinen ( <i>Emeritus</i> ) | <a href="#">Environmental and industrial microbiology</a>   | <a href="#">tuovinen.1</a>     |
| Hua Wang                          | <a href="#">Biofilm formation involving food-borne pathogens</a>                                      | <a href="#">wang.707</a>       |
| Marshall Williams                 | <a href="#">Deoxyuridine metabolism in eukaryotic systems; DNA repair and replication</a>             | <a href="#">williams.70</a>    |
| David Wood                        | <a href="#">Applied protein engineering for biotechnology development</a>                             | <a href="#">wood.750</a>       |
| Daniel Wozniak                    | <a href="#">Bacterial pathogenesis; gene regulation</a>   | <a href="#">wozniak.1</a>      |
| Jacob Yount                       | <a href="#">Post-translational modifications; protein fatty-acylation; innate immunity to viruses</a> | <a href="#">yount.37</a>       |
| Ahmed Yousef                      | <a href="#">Microbial safety of food; foodborne pathogens; preservation technologies</a>              | <a href="#">yousef.1</a>       |

## Sample Curriculum for a Microbiology B.S.

| Sample 1  |                      |            |                          |   |              |                          |                |
|---|----------------------|------------|--------------------------|---|--------------|--------------------------|----------------|
| Year  | Autumn               | Credit Hrs | Comment*                 | Spring  | Credit Hrs   | Comment                  | Year Total     |
| 1   | Gen Chem 1210        | 5          | GE-Nat Sci/Micro-PreRec  | Gen Chem 1220   | 5            | GE-Nat Sci/Micro-PreRec  |                |
|   | Math 1151 or 1156    | 5          | GE-Math/Micro-PreRec     | Math 1152 (2) or<br>Math 1157 (3) or<br>Stats 1450(3) or<br>Stats 2450 (3) or<br>Stats 2480 (3) | 3 - 5        | Micro-PreRec             |                |
|   | Bio 1113             | 4          | GE-Nat Sci/Micro-PreRec  | Bio 1114  | 4            | GE-Open Opt/Micro-PreRec |                |
|   | Freshman Survey      | 1          | GE                       | GE Comp I   | 3            | GE                       |                |
|   | <b>Semester Sum</b>  | <b>15</b>  |                          | <b>Semester Sum</b>   | <b>15-17</b> |                          | <b>30 - 32</b> |
| Year  | Autumn               | Credit Hrs | Comment*                 | Spring  | Credit Hrs   | Comment                  | Year Total     |
| 2   | Org Chem 2510        | 4          | Micro-PreRec             | Org Chem 2520   | 4            | Micro-PreRec             |                |
|   | Physics 1200         | 5          | GE-Open Opt/Micro-PreRec | Org Chem Lab 2540   | 2            | Micro-PreRec             |                |
|   | GE: F.L. 1           | 4          | GE                       | Physics 1201  | 5            | Micro-PreRec             |                |
|   | GE: Comp II          | 3          | GE                       | GE: F.L. 2  | 4            | GE                       |                |
|   | <b>Semester Sum</b>  | <b>16</b>  |                          | <b>Semester Sum</b>   | <b>15</b>    |                          | <b>31</b>      |
| Year  | Autumn               | Credit Hrs | Comment*                 | Spring  | Credit Hrs   | Comment                  | Year Total     |
| 3   | Micro 4100           | 5          | Micro-Core               | Micro 4110  | 3            | Micro-Core               |                |
|   | BioChem 4511         | 4          | Micro-Core               | Micro 4130  | 3            | Micro-Core               |                |
|   | GE: F.L. 3           | 4          | GE                       | #Micro Elective 1   | 3            | Micro-Required           |                |
|   | GE: Soc. Sci. I      | 3          | GE                       | GE: Soc. Sci. 2   | 3            | GE                       |                |
|   |                      |            |                          | GE: Literature  | 3            | GE                       |                |
|   | <b>Semester Sum</b>  | <b>16</b>  |                          | <b>Semester Sum</b>   | <b>15</b>    |                          | <b>31</b>      |
| Year  | Autumn               | Credit Hrs | Comment*                 | Spring  | Credit Hrs   | Comment                  | Year Total     |
| 4   | Micro 4120           | 3          | Micro-Core               | Micro 4140  | 3            | Micro-Core               |                |
|   | Micro Elective 2     | 3          | Micro-Required           | Micro Elective 3  | 3            | Micro-Required           |                |
|   | GE: Visual Art       | 3          | GE                       | GE: Cult. & Ideas   | 3            | GE                       |                |
|   | GE: Historical Study | 3          | GE                       | Electives   | 4 - 6        | Free elective            |                |
|   | Electives            | 2          | Free elective            |   |              |                          |                |
|   | <b>Semester Sum</b>  | <b>14</b>  |                          | <b>Semester Sum</b>   | <b>13-15</b> |                          | <b>27 - 29</b> |
|   |                      |            |                          |   |              | <b>Total Hrs.</b>        | <b>121</b>     |
| * Placement of specific GE courses will vary depending on the student's individual requirements and preferences. Where available, honors courses can substitute   |                      |            |                          |   |              |                          |                |
| # Micro electives include 3-9 hours from Group 1 and 00-6 hours from Group 2 courses. Up to 3 hrs of S/U graded courses, including independent research (Micro 4998), can be counted toward the elective requirement. |                      |            |                          |   |              |                          |                |

## Sample 2

| Year | Autumn  | Credit Hrs   | Comment*                 | Spring              | Credit Hrs   | Comment                 | Year Total     |
|------|---|--------------|--------------------------|---------------------|--------------|-------------------------|----------------|
| 1    | Gen Chem 1210   | 5            | GE-Nat Sci/Micro-PreRec  | Gen Chem 1220       | 5            | GE-Nat Sci/Micro-PreRec |                |
|      | Math 1151 or 1156   | 5            | GE-Math/Micro-PreRec     | Bio 1113            | 4            | GE-Nat Sci/Micro-PreRec |                |
|      | *GE: F.L. 1   | 4            | GE                       | GE: F.L. 2          | 4            | GE                      |                |
|      | Arts Sci 1100.07  | 1            | GE                       | GE: Comp 1          | 3            | GE                      |                |
|      | <b>Semester Sum</b>   | <b>15</b>    |                          | <b>Semester Sum</b> | <b>16</b>    |                         | <b>31</b>      |
| 2    | Org Chem 2510   | 4            | Micro-PreRec             | Org Chem 2520       | 4            | Micro-PreRec            |                |
|      | Bio 1114  | 4            | GE-Open Opt/Micro-PreRec | Org Chem Lab 2540   | 2            | Micro-PreRec            |                |
|      | GE: F.L. 3  | 4            | GE                       | Micro 4100          | 5            | Micro-Core              |                |
|      | Math 1152 (2) or<br>Math 1157 (3) or<br>Stats 1450(3) or<br>Stats 2450 (3) or<br>Stats 2480 (3) | 3 - 5        | Micro-PreRec             | GE: Comp 2          | 3            | GE                      |                |
|      | <b>Semester Sum</b>   | <b>15-17</b> |                          | <b>Semester Sum</b> | <b>14</b>    |                         | <b>29 - 31</b> |
| 3    | Physics 1200  | 5            | GE-Open Opt/Micro-PreRec | Physics 1201        | 5            | Micro-PreRec            |                |
|      | BioChem 4511  | 4            | Micro-Core               | Micro 4110          | 3            | Micro-Core              |                |
|      | GE: Soc. Sci 1  | 3            | GE                       | Micro 4130          | 3            | Micro-Core              |                |
|      | GE: Literature  | 3            | GE                       | GE: Soc. Sci 2      | 3            | GE                      |                |
|      | <b>Semester Sum</b>   | <b>15</b>    |                          | <b>Semester Sum</b> | <b>15</b>    |                         | <b>30</b>      |
| 4    | Micro 4120  | 3            | Micro-Core               | Micro 4140          | 3            | Micro-Core              |                |
|      | #Micro Elective 1   | 3            | Micro-Required           | Micro Elective 3    | 3            | Micro-Required          |                |
|      | Micro Elective 2  | 3            | Micro-Required           | GE: Cult & Ideas    | 3            | GE                      |                |
|      | GE: Visual Art  | 3            | GE                       | Electives           | 5 - 7        | Free elective           |                |
|      | GE: Historical Study  | 3            | GE                       |                     |              |                         |                |
|      | <b>Semester Sum</b>   | <b>15</b>    |                          | <b>Semester Sum</b> | <b>14-16</b> |                         | <b>29 - 31</b> |
|      |   |              |                          |                     |              | <b>Total Hrs.</b>       | <b>121</b>     |

\* Placement of specific GE courses will vary depending on the student's individual requirements and preferences. Where available, honors courses can substitute  
# Micro electives include 3-9 hours from Group 1 and 00-6 hours from Group 2 courses. Up to 3 hrs of S/U graded courses, including independent research (Micro 4998), can be counted toward the elective requirement.

## Sample 3

| Year                | Autumn               | Credit Hrs | Comment*                 | Spring  | Credit Hrs   | Comment                   | Year Total   |
|---------------------|----------------------|------------|--------------------------|---|--------------|---------------------------|--------------|
| 1                   | Math 1148            | 4          | GE-Math                  | Math 1149   | 3            | GE-Math                   |              |
|                     | GE: Cult. & Ideas    | 3          | GE                       | Gen Chem 1210   | 5            | GE: Nat. Sci/Micro-PreRec |              |
|                     | GE: Soc. Sci. 1      | 3          | GE                       | Bio 1113  | 4            | GE-Nat Sci/Micro-PreRec   |              |
|                     | GE: Visual Art       | 3          | GE                       | GE: Comp I  | 3            | GE                        |              |
|                     | ArtsSci 1100.07      | 1          | GE                       |   |              |                           |              |
| <b>Semester Sum</b> | <b>14</b>            |            | <b>Semester Sum</b>      | <b>15</b>   |              | <b>29</b>                 |              |
| 2                   | Gen Chem 1220        | 5          | GE-Nat Sci/Micro-PreRec  | Org Chem 2510   | 4            | Micro-PreRec              |              |
|                     | Bio 1114             | 4          | GE-Open Opt/Micro-PreRec | Org Chem Lab 2540   | 2            | Micro-PreRec              |              |
|                     | GE: Comp II          | 3          | GE                       | GE: F.L. 1  | 4            | GE                        |              |
|                     | Math 1151 or 1156    | 5          | GE-Math/Micro-PreRec     | Math 1152 (2) or<br>Math 1157 (3) or<br>Stats 1450(3) or<br>Stats 2450 (3) or<br>Stats 2480 (3) | 3 - 5        | Micro-PreRec              |              |
|                     | <b>Semester Sum</b>  | <b>17</b>  |                          | <b>Semester Sum</b>   | <b>13-15</b> |                           | <b>30-32</b> |
| 3                   | GE: F.L. 2           | 4          | GE                       | GE: F.L. 3  | 4            | GE                        |              |
|                     | Org Chem 2520        | 4          | Micro-PreRec             | Micro 4110  | 3            | Micro-Core                |              |
|                     | Micro 4100           | 5          | Micro-Core               | #Micro Elective 1   | 3            | Micro-Required            |              |
|                     | GE: Historical Study | 3          | GE                       | BioChem 4511  | 4            | Micro-Core                |              |
|                     | <b>Semester Sum</b>  | <b>16</b>  |                          | <b>Semester Sum</b>   | <b>14</b>    |                           | <b>30</b>    |
| 4                   | Micro 4120           | 3          | Micro-Core               | Micro 4140  | 3            | Micro-Core                |              |
|                     | Micro 4130           | 3          | Micro-Core               | Micro Elective 3  | 3            | Micro-Required            |              |
|                     | Micro Elective 2     | 3          | Micro-Required           | Physics 1201  | 5            | Micro-PreRec              |              |
|                     | Physics 1200         | 5          | GE-Open Opt/Micro-PreRec | GE: Literature  | 3            | GE                        |              |
|                     |                      |            |                          | Electives   | 1-3          | Free Electives            |              |
|                     | <b>Semester Sum</b>  | <b>15</b>  |                          | <b>Semester Sum</b>   | <b>15-17</b> |                           | <b>30-32</b> |
|                     |                      |            |                          |   |              | <b>Total Hrs.</b>         | <b>121</b>   |

\* Placement of specific GE courses will vary depending on the student's individual requirements and preferences. Where available, honors courses can substitute  
# Micro electives include 3-9 hours from Group 1 and 00-6 hours from Group 2 courses. Up to 3 hrs of S/U graded courses, including independent research (Micro 4998), can be counted toward the elective requirement.