

## MOLECULAR, CELL & DEVELOPMENTAL BIOLOGY MAJOR 2024 – 2025

| Preparation for the Major |  |           |                                      |
|---------------------------|--|-----------|--------------------------------------|
|                           | Life Science Series  |           | Physical Science Series              |
| <b>Chemistry</b>          | 14A or 14AE, 14B or 14BE, 14BL, 14C, 14CL*, 14D                  | <b>OR</b> | 20A, 20B, 20L, 30A, 30AL, 30B, 30BL* |
| <b>Math</b>               | 3A, 3B, 3C <u>or</u><br>LIFESCI 30A, 30B, STATS 13 or LIFESCI 40 |           | 31A, 31B, 32A                        |
| <b>Physics</b>            | 5A, 5B, 5C   |           | 1A, 1B, 1C, 4AL, 4BL                 |
| <b>Life Science</b>       | 7A, 7B, 7C, 7L (Formerly 23L)                                    |           |                                      |

### IMPORTANT NOTES – Preparation for the Major

Students must earn a grade of C- or better in each prep course and achieve an overall GPA of 2.0 in the major prep. Students receiving grades of below C- in two prep courses, either separate courses or repetitions of the same course, are subject to dismissal from the major.

- Students who complete Chem 20A can move to the 14 series starting with 14B, or after taking 20A, 20B, students can take 14BL, 14C, 14CL\*, 14D or after taking 20A, 20B, 20L may take 14C, 14CL\*, 14D. Students who transfer chemistry credit from another school for 20A, 20L can take 14B, 14C, 14CL\*, 14D.
- The Chemistry 14 series is unique to UCLA – there are no equivalents at other schools and must be taken in its entirety at UCLA.

\*Chem 14CL and Chem 30BL are not required for the major, but most professional schools and possibly some graduate schools require an organic chemistry lab.

### UPPER DIVISION MAJOR REQUIREMENTS

| Upper-Division Core Requirements |  |
|----------------------------------|--|
| <b>Biochemistry</b>              | <b>CHEM 153A</b> – Biochemistry: Intro to Structure, Enzymes, and Metabolism (4 units) |
| <b>Genetics</b>                  | <b>LIFESCI 107</b> – Genetics (5 units)  |
| <b>Cell Biology</b>              | <b>MCDB 165A</b> – Biology of Cells (5 units)  |
| <b>Developmental Biology</b>     | <b>MCDB 138</b> – Developmental Biology (5 units)                                      |
| <b>Molecular Biology</b>         | <b>MCDB 144</b> – Molecular Biology of Cellular Processes (5 units)                    |

#### Laboratory Requirement (Choose one from #1 – 6)

|           |   |
|-----------|---|
| <b>1.</b> | <b>MCDB 104AL</b> – Research Immersion Lab in Developmental Biology (5 units)   |
| <b>2.</b> | <b>MCDB 187AL</b> – Research Immersion Lab in Genomic Biology (5 units)   |
| <b>3.</b> | <b>MCDB 150AL</b> – Research Immersion Lab in Plant-Microbe Ecology (5 units)   |
| <b>4.</b> | <b>MCDB 196B</b> – Research Apprenticeship II in MCDB (4 units) <ul style="list-style-type: none"> <li>• Must be taken concurrently with <b>MCDB 180B</b> – Scientific Analysis and Communication II (2 units) to fulfill Lab Requirement</li> <li>• <b>MCDB 196A</b> – Research Apprenticeship I in MCDB (4 units) and <b>MCDB 180A</b> – Scientific Analysis and Communication I (2 units) are prerequisites for MCDB 196B and MCDB 180B</li> </ul> |
| <b>5.</b> | <b>MCDB 198C</b> – Honors Research in MCDB (4 units) <ul style="list-style-type: none"> <li>• Limited to students completing the Biomedical Research Minor</li> </ul>   |
| <b>6.</b> | <b>MCDB 196B, 198B/C, or 199B/C</b> (4 units) <ul style="list-style-type: none"> <li>• Must be taken concurrently with <b>MCDB 145</b> – Appreciation and Critical Review of Biomedical Research (4 units) to fulfill Lab Requirement</li> </ul>  |

#### Upper-Division Elective Requirement for the Major

|   |  |
|---|--|
| <b>20 units of upper-division electives</b><br>List of approved electives on page 3 | 5 units must be taken from Category 1          |
|   | 5 units may be taken from Category 1 or 2      |
|   | 10 units may be taken from Category 1, 2, or 3 |

See the next page for important notes about course restrictions and how courses apply towards major requirements.

### IMPORTANT NOTES – Major Requirements

Students must receive a grade of C or better in each required Core course (LIFESCI 107, CHEM 153A, MCDB 138, 144, 165A) and must achieve a minimum overall GPA of 2.0 in the major. Students receiving grades below C in two required core courses, either in separate courses or repetitions of the same course, are subject to dismissal from the major.

- Any single course can be used in only one category on the major.
- Courses applied toward the prep and major requirements must be taken for a letter grade.
- Any upper-division MCDB course will be accepted as an MCDB elective, *excluding* MCDB 100, 104AL, 138, 144, 150AL, 165A, 187AL, 187C, 187D, 190A-C, 192A, 192B, 193, 194A, and 199.
- A maximum of 4 units of approved seminar courses may be applied to the upper-division elective requirement for the major (e.g., MCDB 145, 180A, 180B, 191).
- Elective credit is granted for either BIostat 100A or STATS 100A, but not both.
- The MCDB department does not approve Biochemistry/MCDB or MIMG/MCDB double major petitions.

### IMPORTANT NOTES – Applying Independent Research towards MCDB Major Requirements

- To enroll in MCDB 196A-B, 198A-D, or 199A-D, students must be conducting research in an MCDB-approved lab. The list of approved faculty research mentors is available on our website: <https://www.mcdb.ucla.edu/undergraduate-research/>.
- A maximum of 12 units of MCDB research (MCDB 196A-B, MCDB 199A-C, MCDB 198A-C) may be applied towards major requirements.
- **Applying Independent Research towards the Lab Requirement**
  - **MCDB 196A/B and MCDB 180A/B**
    - Students may apply for these courses during their third or fourth year. Application instructions can be found here: <https://www.mcdb.ucla.edu/mcdb-196a-and-196b/>.
    - MCDB 196B fulfills the Lab Requirement. MCDB 196A, 180A, and 180B (total 8 units) apply towards the 20 units of upper-division electives required for the major.
  - **MCDB 196B, 198B/C, or 199B/C and MCDB 145**
    - MCDB 145 is only offered in Spring quarter. Students must apply for the course in Winter quarter.
    - MCDB 145 must be taken concurrently with an MCDB upper-division research course. The research course fulfills the Lab Requirement. MCDB 145 (4 units) applies towards the 20 units of upper-division electives required for the major.
- If you take MCDB 104AL, 187AL, or 150AL to fulfill the Lab Requirement, up to 12 units of MCDB research (MCDB 198A-C or MCDB 199A-C) apply towards the 20 units of upper-division electives required for the major.

Requirements for the B.S. degree established by the College of Letters & Science are listed in the UCLA General Catalog. A total of 180 quarter-units are required for the degree. 60 of the 180 units must be upper division (courses numbered 100-199). Please note that the MCDB major requirements satisfy 49 upper-division units.

## APPROVED LIST OF UPPER-DIVISION ELECTIVES FOR THE MCDB MAJOR

The categories below correspond to the categories on your Degree Audit Report.

| CATEGORY 1   |  |       |
|--|--|-------|
| Five Units of MCD Biology Upper Division Electives |  |       |
| Course #   | Course Name  | Units |
| MCDB 104BL   | Advanced Research Analysis in Developmental Biology                                      | 4     |
| MCDB 120   | Reproductive Science and Health  | 5     |
| MCDB M130  | Fundamentals of Digital Imaging and Image Processing                                     | 5     |
| MCDB M140  | Cancer Cell Biology  | 5     |
| MCDB C141  | Molecular Basis of Plant Differentiation and Development                                 | 5     |
| MCDB 142   | Design Principles of Biological Circuits   | 5     |
| MCDB 145   | Appreciation and Critical Review of Biomedical Research                                  | 4     |
| MCDB 146   | Metabolism and Disease   | 5     |
| MCDB C150  | Plant Communication  | 4     |
| MCDB CM156   | Human Genetics and Genomics  | 5     |
| MCDB 160   | Principles of Light Microscopy   | 4     |
| MCDB 167   | Genetic Engineering: History, Science, and Applications in Medicine, Agriculture and Law | 6     |
| MCDB 168   | Stem Cell Biology  | 5     |
| MCDB M175A   | Neuroscience: From Molecules to Mind – Cellular and Systems Neuroscience                 | 5     |
| MCDB M175B   | Neuroscience: From Molecules to Mind – Molecular and Developmental Neuroscience          | 5     |
| MCDB M175C   | Neuroscience: From Molecules to Mind – Behavioral and Cognitive Neuroscience             | 5     |
| MCDB 180A  | Scientific Analysis and Communications I   | 2     |
| MCDB 180B  | Scientific Analysis and Communications II  | 2     |
| MCDB 191   | Variable Topics in Molecular, Cell, and Developmental Biology                            | 2     |
| MCDB 196A  | Research Apprenticeship I  | 4     |
| MCDB 198A-C  | Honors Research in MCDB  | 4/qtr |
| MCDB 199A-C  | Directed Research in MCDB  | 4/qtr |

| CATEGORY 2   |  |       |
|--|--|-------|
| Five Units of Upper Division Electives from MCD Biology and Acceptable List of Outside Electives |  |       |
| Select from any Category 1 courses listed above or acceptable outside electives listed below.    |  |       |
| Course #   | Course Name  | Units |
| <b>Chemistry and Biochemistry</b>  |  |       |
| CHEM C100  | Genomics and Computational Biology   | 5     |
| CHEM 153B  | <b>NOT ACCEPTED ON THE MAJOR – DO NOT TAKE THIS COURSE</b>                 |       |
| CHEM 153C  | Biochemistry: Biosynthetic & Energy Metabolism & Its Regulation            | 4     |
| CHEM 153L  | Biochemistry Laboratory  | 4     |
| CHEM C159  | Mechanisms in the Regulation of Transcription                              | 4     |
| <b>Computer Science/Computational and Systems Biology</b>  |  |       |
| COM SCI C121   | Probabilistic Models in Computational Genomics                             | 4     |
| COM SCI C124   | Machine Learning Applications in Genetics                                  | 4     |
| COM SCI CM186  | Computational Systems Biology: Modeling & Simulation of Biological Systems | 5     |

| Course #   | Course Name   | Units |
|--|---|-------|
| <b>Ecology &amp; Evolutionary Biology</b>                |   |       |
| EE BIOL 184  | Evolution, Development, and Disease                     | 4     |
| <b>Microbiology, Immunology &amp; Molecular Genetics</b> |   |       |
| MIMG 100L  | Microbiology Lab for Professional Schools               | 3     |
| MIMG 101   | Introductory Microbiology                               | 4     |
| MIMG 102   | Virology  | 4     |
| MIMG 105   | Biological Microscopy                                   | 4     |
| MIMG 132   | <b>NOT ACCEPTED ON THE MCDB MAJOR</b>                   |       |
| MIMG 158   | Microbial Genomics                                      | 4     |
| MIMG 168   | Molecular Parasitology                                  | 4     |
| MIMG 170   | Cell and Gene Therapy                                   | 4     |
| MIMG M178  | Quantitative Regulatory Biology and Signal Transduction | 4     |
| MIMG C185A   | Immunology  | 5     |
| <b>Physiological Sciences</b>                            |   |       |
| PHY SCI 121  | Disease Mechanisms and Therapies                        | 5     |
| PHY SCI 125  | Molecular Systems Biology                               | 5     |
| PHY SCI C130   | Sex Differences in Physiology and Disease               | 4     |
| PHY SCI 174  | Cell Biophysics in Physiology and Disease               | 5     |

| <b>CATEGORY 3</b>   |                                    |       |
|---|------------------------------------|-------|
| <b>TEN UNITS OF UPPER DIVISION ELECTIVES FROM MCD BIOLOGY AND ACCEPTABLE LIST OF ADDITIONAL OUTSIDE COURSES</b> |                                    |       |
| Select from any Category 1 or 2 courses listed above or additional outside electives listed below.              |                                    |       |
| Course #  | Course Name                        | Units |
| <b>Biostatistics</b>  |                                    |       |
| BIOSTAT 100A  | Intro to Biostatistics             | 4     |
| <b>Ecology &amp; Evolutionary Biology</b>   |                                    |       |
| EEB 110   | Vertebrate Morphology              | 6     |
| EEB 121   | Molecular Biology and Evolution    | 4     |
| EEB C146  | Conservation Genetics              | 4     |
| EEB 162   | Plant Physiology                   | 4     |
| <b>Human Genetics</b>   |                                    |       |
| HUM GEN C144  | Genomic Technology                 | 4     |
| <b>Physiological Sciences</b>   |                                    |       |
| PHY SCI 166   | Animal Physiology                  | 6     |
| <b>Statistics</b>   |                                    |       |
| STATS 100A  | Introduction to Probability Theory | 4     |

#### Course Number Designations

- **C** = Course is offered concurrently to undergraduate and graduate students in the same class.
- **M** = Course is listed under multiple departments (and may have different course numbers in each department).

**SCHEDULING TIPS**

- Not all electives are offered every year. Please consult the Schedule of Classes or the appropriate department.
- When planning your classes, please make sure you have accounted for all prerequisites for any upper-division class in which you plan to enroll. Courses may even have upper-division prerequisites.
- Some electives are restricted to the department's own majors during first pass enrollment appointments. For example, you must wait until your second pass to enroll in MIMG 101, because it is restricted to MIMG majors during first pass.

| Fall | Units | Winter | Units | Spring | Units |
|------|-------|--------|-------|--------|-------|
|      |       |        |       |        |       |
|      |       |        |       |        |       |
|      |       |        |       |        |       |

| Fall | Units | Winter | Units | Spring | Units |
|------|-------|--------|-------|--------|-------|
|      |       |        |       |        |       |
|      |       |        |       |        |       |
|      |       |        |       |        |       |

| Fall | Units | Winter | Units | Spring | Units |
|------|-------|--------|-------|--------|-------|
|      |       |        |       |        |       |
|      |       |        |       |        |       |
|      |       |        |       |        |       |

## COMPUTING SPECIALIZATION IN MCDB

MCDB majors may receive a Specialization in Computing by:

1. Satisfying all requirements for a bachelor's degree in the MCDB major and;
2. Completing the following course requirements:

| Course Requirements   |
|---|
| 1. <b>COMPTNG 10A</b> – Introduction to Programming (5 units)   |
| 2. <b>COMPTNG 10B</b> – Intermediate Programming (5 units)  |
| 3. <b>COMPTNG 10C</b> – Advanced Programming (5 units)  |
| 4. <b>COMPTNG 16A</b> – Python with Applications I (5 units)  |
| 5. <b>STATS 13</b> – Introduction to Statistical Methods for Life and Health Sciences<br>OR<br><b>LIFESCI 40</b> – Statistics of Biological Systems (5 units) |
| 6. One upper-division course from the approved list below.  |

| APPROVED UPPER-DIVISION COURSES |  |       |
|---------------------------------|--|-------|
| Course #                        | Course Name  | Units |
| <b>CHEM C100</b>                | Genomics and Computational Biology   | 5     |
| <b>COM SCI C121</b>             | Probabilistic Models in Computational Genomics                             | 4     |
| <b>COM SCI C124</b>             | Machine Learning Applications in Genetics                                  | 4     |
| <b>COM SCI CM186</b>            | Computational Systems Biology: Modeling & Simulation of Biological Systems | 5     |
| <b>MCDB M130</b>                | Fundamentals of Digital Imaging and Image Processing                       | 5     |
| <b>MCDB 142</b>                 | Design Principles of Biological Circuits                                   | 5     |
| <b>MCDB 187AL*</b>              | Research Immersion Lab in Genomic Biology                                  | 5     |
| <b>MIMG M178</b>                | Quantitative Regulatory Biology and Signal Transduction                    | 4     |
| <b>PHYSICI 125</b>              | Molecular Systems Biology  | 5     |

### IMPORTANT NOTES – Computing Specialization

**Students must earn a letter grade of C or better in each required course for the Computing Specialization and a combined GPA of at least 2.0 in these courses to graduate with the Specialization in Computing.**

- Students may overlap the upper-division course for the Specialization with an elective or Lab Requirement for the major.

\*Space in MCDB 187AL is limited and students are not guaranteed a space in MCDB 187AL simply because they are pursuing the Computing Specialization.