CELLULAR AND MOLECULAR BIOLOGY, PH.D.

Graduate study in cellular and molecular biology at the University of Wisconsin—Madison is a research-oriented interdisciplinary program leading to the Ph.D. degree. Students are not admitted to the master’s degree program. The university has one of the largest and most prestigious biology facilities in the world, well-noted for its cooperation and collaboration across department boundaries. The Cellular and Molecular Biology Program (CMB) is an important part of that interdepartmental strength, providing students with the opportunity to work with more than 190 faculty members in 40 departments.

A major strength of the program is that it provides the opportunity for groups of investigators to work together on research topics of common interest. Research topic areas, identified as focus groups, are composed of faculty and students studying common research areas. Each group is held together by participation of both students and faculty at regular research presentations and by the participation of faculty on thesis committees of many students in the group. Because of the diverse nature of most research areas and the cross-fertilization among focus groups, many faculty and students participate in the activities of multiple focus groups.

The focus groups are: cancer biology; cell adhesion and cytoskeleton; cellular and molecular metabolism; developmental biology and regenerative medicine; immunology; membrane biology and protein trafficking; molecular and genome biology of microbes; plant biology; RNA; systems biology; transcriptional mechanisms; and virology. For a complete listing of each faculty member associated with each focus group and the corresponding research, see the CMB website (http://www.cmb.wisc.edu).

The CMB program encourages each student to develop an independent and creative approach to science. These skills can be gained through the program requirements, which include course work and research in the student’s specific area of interest. All CMB students are required to obtain 10 credits in the CMB core curriculum, which consists of both cellular and molecular biology course work, in addition to a 1-credit ethics requirement. Students also take courses and seminars, and participate in journal clubs related to their specific areas of expertise. Research experience is an integral part of the program while completing these requirements. The combination of coursework and research experience allows students to obtain a solid foundation in cellular and molecular biology that is also tailored to the professional objectives of each student. Specific core curriculum requirements can be found at the CMB website (http://www.cmb.wisc.edu).

ADMISSIONS

Admission to the program is highly competitive. Admission is based on demonstrated ability and interest in mathematics, the physical sciences, chemistry, and biology; three letters of recommendation; the personal statement; and Graduate Record Exam (GRE) scores. Previous research experience is required. Applicants are required to take the GRE general test. The GRE subject test in biology, chemistry, biochemistry, and molecular biology is recommended but not required. The application deadline for fall admission is December 1. All application materials must be received by this date in order to be reviewed by the CMB Admissions Committee. We do not offer spring or summer admission.

GRADUATE SCHOOL ADMISSIONS

Graduate admissions is a two-step process between academic degree programs and the Graduate School. Applicants must meet requirements of both the program(s) and the Graduate School. Once you have researched the graduate program(s) you are interested in, apply online (https://grad.wisc.edu/admissions).

FUNDING

GRADUATE SCHOOL RESOURCES

Resources to help you afford graduate study might include assistantships, fellowships, traineeships, and financial aid. Further funding information (https://grad.wisc.edu/funding) is available from the Graduate School. Be sure to check with your program for individual policies and processes related to funding.

PROGRAM RESOURCES

Initially, all students accepted into the Ph.D. degree program receive financial support from Graduate School fellowships, interdepartmental training grants, and/or research assistantships. The program strives to maintain a nationally competitive stipend. Students are guaranteed a stipend of $28,000 for 2018–19; tuition is remitted. After a student has chosen a thesis advisor, support is obtained either by the thesis advisor or by a previously named source. Graduate students are also eligible for comprehensive health insurance; individual or family coverage is available at a minimal cost. Students are strongly encouraged to apply for a National Science Foundation Graduate Fellowship, at the time of application to graduate school or during the first semester on campus.

REQUIREMENTS

MINIMUM GRADUATE SCHOOL REQUIREMENTS

Review the Graduate School minimum academic progress and degree requirements (http://guide.wisc.edu/graduate/#policiesandrequirementstext), in addition to the program requirements listed below.

MAJOR REQUIREMENTS

MODE OF INSTRUCTION

<table>
<thead>
<tr>
<th>Mode of Instruction Definitions</th>
<th>Face to Face</th>
<th>Evening/Weekend</th>
<th>Online</th>
<th>Hybrid</th>
<th>Accelerated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evening/Weekend: These programs are offered in an evening and/or weekend format to accommodate working schedules. Enjoy the advantages of on-campus courses and personal connections, while keeping your day job. For more information about the meeting schedule of a specific program, contact the program.</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Online: These programs are offered primarily online. Many available online programs can be completed almost entirely online with all online programs offering at least 50 percent or more of the program work online. Some online programs have an on-campus component that is often designed to accommodate working schedules.</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
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</table>
Take advantage of the convenience of online learning while participating in a rich, interactive learning environment. For more information about the online nature of a specific program, contact the program.

**Hybrid:** These programs have innovative curricula that combine on-campus and online formats. Most hybrid programs are completed on-campus with a partial or completely online semester. For more information about the hybrid schedule of a specific program, contact the program.

**Accelerated:** These on-campus programs are offered in an accelerated format that allows you to complete your program in a condensed time-frame. Enjoy the advantages of on-campus courses with minimal disruption to your career. For more information about the accelerated nature of a specific program, contact the program.

### CURRICULAR REQUIREMENTS

<table>
<thead>
<tr>
<th>Minimum Credit Requirement</th>
<th>51 credits</th>
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<tbody>
<tr>
<td>Minimum Residence Credit Requirement</td>
<td>32 credits</td>
</tr>
<tr>
<td>Minimum Graduate Coursework Requirement</td>
<td>Half of degree coursework (26 credits out of 51 total credits) must be completed graduate-level coursework; courses with the Graduate Level Coursework attribute are identified and searchable in the university’s Course Guide.</td>
</tr>
<tr>
<td>Overall Graduate GPA Requirement</td>
<td>3.00 GPA required.</td>
</tr>
<tr>
<td>Other Grade Requirements</td>
<td>The Graduate School requires an average grade of B or better in all coursework (300 or above, not including research credits) taken as a graduate student unless conditions for probationary status require higher grades. Grades of Incomplete are considered to be unsatisfactory if they are not removed during the next enrolled semester.</td>
</tr>
<tr>
<td>Assessments and Examinations</td>
<td>Doctoral students are required to take a comprehensive preliminary/oral examination at the end of their second year. In order to complete their preliminary exam, students must have cleared their record of all Incomplete and Progress grades (other than research and thesis). Deposit of the doctoral dissertation in the Graduate School is required.</td>
</tr>
<tr>
<td>Language Requirements</td>
<td>Contact the program for information on any language requirements.</td>
</tr>
<tr>
<td>Doctoral Minor/ Breadth Requirements</td>
<td>Doctoral students in the CMB program are not required to complete a minor, but may choose to.</td>
</tr>
</tbody>
</table>

### REQUIRED COURSES

Eleven credits of coursework, not including 990 research credits, are required to complete the CMB course requirements. One course must be taken from the "core" list of molecular biology courses and one course must be taken from the "core" list of cell biology courses. The remaining credits can come from either the "core" or "elective" list of classes to bring the total number of credits to ten. In addition, one credit must be fulfilled through the required ethics course. All CMB course requirements must be completed by the end of the student’s second year, before completing the preliminary exam and obtaining dissertator status.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>Course Requirements</td>
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### Molecular Biology Core

Choose one of the following:

- BIOCHEM/GENETICS/MD GENET 620 Eukaryotic Molecular Biology
- BIOCHEM/GENETICS/MICROBIO 612 Prokaryotic Molecular Biology
- MICROBIO/ONCOLOGY/PL PATH 640 General Virology-Multiplication of Viruses

### Cell Biology Core

Choose one of the following:

- BOTANY 860 Plant Cell Biology
- ZOOLOGY/ANATOMY/NTP 765 Developmental Neuroscience
- PATH 750 Cellular and Molecular Biology/Pathology
- ONCOLOGY 703 Carcinogenesis and Tumor Cell Biology

### Ethics Core

- ONCOLOGY 715 Ethics in Science

### Elective Courses

- BIOCHEM 601 Protein and Enzyme Structure and Function
- BIOCHEM/BOTANY 621 Plant Biochemistry
- BIOCHEM/PHMCOL-M/ZOOLOGY 630 Cellular Signal Transduction Mechanisms
- B M E/CBE 510 Introduction to Tissue Engineering
- B M E 545 Engineering Extracellular Matrices
- B M E 556 Systems Biology: Mammalian Signaling Networks
- B M I 826 Special Topics in Biostatistics and Biomedical Informatics
- B M I/STAT 877 Statistical Methods for Molecular Biology
- BOTANY/BIOCHEM/GENETICS 840 Regulatory Mechanisms in Plant Development
- CRB 610 Fundamentals of Mammalian Embryology
- CRB 640 Fundamentals of Stem Cell and Regenerative Biology
- CRB 650 Molecular and Cellular Organogenesis
- CRB/MEDICINE 701 Cell Signaling and Human Disease
- CBE/B M E 520 Stem Cell Bioengineering
- CBE/B M E 783 Design of Biological Molecules
CHEM/BIOCHEM 665  Biophysics Chemistry
GENETICS 631  Plant Genetics
GENETICS/BOTANY/M M & I/MICROBIO/PL PATH 655  Biology and Genetics of Fungi
GENETICS 885  Advanced Genomic and Proteomic Analysis
GENETICS/M D GENET 677  Advanced Topics in Genetics
GENETICS/HORT 550  Molecular Approaches for Potential Crop Improvement
M M & I 555  Vaccines: Practical Issues for a Global Society
M M & I/MICROBIO 740  Mechanisms of Microbial Pathogenesis
M M & I/PATH-BIO 750  Host-Parasite Relationships in Vertebrate Viral Disease
GENETICS/MICROBIO 607  Advanced Microbial Genetics
MICROBIO 625  Advanced Microbial Physiology
MICROBIO/BMOLCHEM 668  Microbiology at Atomic Resolution
NTP/NEURODPT 610  Cellular and Molecular Neuroscience
NUTR SCI/BIOCHEM 619  Advanced Nutrition: Intermediary Metabolism of Macronutrients
ONCOLOGY 675  Advanced or Special Topics in Cancer Research
PATH-BIO 675  Special Topics
PATH 751  Cell and Molecular Biology of Aging
PATH 803  Pathogenesis of Major Human Diseases
PL PATH/BOTANY/ENTOM 505  Plant-Microbe Interactions: Molecular and Ecological Aspects
STAT/F&W ECOL/HORT 571  Statistical Methods for Bioscience I
ZOOLOGY 604  Computer-based Gene and Disease/Disorder Research Lab

Research Credits
A minimum of 51 credits taken in graduate level courses are required: the 11 above, and the remaining credits can be 990 research credits.

Total Credits 51

1 EXCEPTION: M.D./Ph.D. students are only required to take 3 credits from the Core Curriculum or the Elective Courses list.
2 EXCEPTION: M.D./Ph.D. students are not required to take an ethics course because they received this training in their M.D. courses.

Policies

GRADUATE SCHOOL POLICIES
The Graduate School’s Academic Policies and Procedures (https://grad.wisc.edu/acadpolicy) provide essential information regarding general university policies. Program authority to set degree policies beyond the minimum required by the Graduate School lies with the degree program faculty. Policies set by the academic degree program can be found below.

MAJOR-SPECIFIC POLICIES

GRADUATE PROGRAM HANDBOOK
The Graduate Program Handbook (http://www.cmb.wisc.edu/handbook) is the repository for all of the program’s policies and requirements.

PRIOR COURSEWORK

Graduate Work from Other Institutions
Does not appear on UW–Madison transcript or count toward graduate GPA. The minimum residence requirement can be satisfied only with courses taken as a graduate student at UW–Madison, with the exception being graduate-level work taken as a CIC traveling scholar. These requests evaluated on case-by-case basis.

UW–Madison Undergraduate
The program may decide to accept up to seven credits numbered 300 or above of required or elective courses from undergraduate work completed at UW–Madison toward fulfillment of minimum degree requirements. This is not allowed to count toward the 50% graduate coursework minimum unless taken at the 700 level or above. Work will not appear on the graduate career portion of UW–Madison transcript or count toward GPA. Minimum residence credit requirement can be satisfied only with courses taken as a graduate student at UW–Madison. All requests evaluated on case-by-case basis.

UW–Madison University Special
The program may accept up to 15 University Special student credits as fulfillment of the minimum graduate residence, or graduate degree requirements on occasion. This work would not be allowed to count toward the 50% graduate coursework minimum unless taken at the 700 level or above. All requests evaluated on case-by-case basis.

PROBATION
The Graduate School regularly reviews the record of any student who earned grades of BC, C, D, F, or Incomplete in a graduate course (300 or above), or grade of U in research credits. This review could result in academic probation with a hold on future enrollment or in being suspended from the Graduate School.

ADVISOR / COMMITTEE
The thesis advisor will assist the graduate student throughout the duration of their Ph.D. studies. Upon choosing a thesis advisor, the student should formulate goals and expectations when starting in a permanent lab home. The student and thesis advisor should work together to ensure that mutual goals and expectations are met. The
thesis advisor will monitor and guide the student’s progress toward the Ph.D. degree, provide the student with advice about how and when to meet the degree requirements of the program, and help the student decide on appropriate coursework during Ph.D. studies.

After joining a thesis lab, students are required to form a thesis committee. The purpose of the thesis committee is to: guide the student through the process of earning the Ph.D. degree and meeting all CMB program requirements; assist the student in developing as an independent scientist in the student’s area of research; provide the student with an array of ideas and opportunities regarding the direction of the research and thesis project; and evaluate the student’s research proposal, attend curriculum certification, preliminary exam, annual progress report, and thesis defense.

The thesis committee consists of five faculty members, including the thesis advisor. All committee members must be readers when the student defends their dissertation. Three committee members, including the thesis advisor, must be faculty trainers in the CMB program. Two committee members must be outside the student’s direct area of expertise.

CREDITS PER TERM ALLOWED
15 credits

TIME CONSTRAINTS
Doctoral degree students who have been absent for ten or more consecutive years lose all credits that they have earned before their absence. Individual programs may count the coursework students completed prior to their absence for meeting program requirements; that coursework may not count toward Graduate School credit requirements.

A candidate for a doctoral degree who fails to take the final oral examination and deposit the dissertation within 5 years after passing the preliminary examination may require to take another preliminary examination and to be admitted to candidacy a second time.

OTHER
CMB students all earn a stipend that is set by the program each year, and tuition is covered. First year rotating students are funded through the CMB Program during the first semester. After the first semester, students are typically funded by their thesis advisor. In some cases, students earn individual fellowships or training grant slots and are funded through these mechanisms. Please contact the CMB Program for specific questions about stipend level, etc.

PROFESSIONAL DEVELOPMENT

LEARNING OUTCOMES

1. Gain a broad understanding of the cellular and molecular principles that underlie biological processes.
2. Develop proficiency in a chosen area of cellular and molecular biology.
3. Learn to think critically and problem solve to address research challenges using a broad range of theories, research methods, and approaches to scientific inquiry.
4. Create research and scholarship that makes a substantive contribution to the field of cellular and molecular biology.
5. Experience collaboration with scientists within the lab, the department, the program, the university, and beyond.
6. Clearly and effectively communicate scientific ideas and research to both scientists and non-scientists in written and oral forms.
7. Exhibit and foster ethical and professional conduct.
8. Gain exposure to potential career paths and develop leadership and professional skills that will prepare them for a successful and rewarding career.

PEOPLE

Faculty Chairs: David Wassarman (program chair), Kate O’Connor-Giles (admissions chair), Reid Alisch (recruiting chair), Curtis Brandt (advising and orientation chair), Donna Peters (curriculum chair), Caroline Alexander (awards chair), Tim Gomez (training grant liaison)

Focus Group Chairs: Caroline Alexander (Cancer Biology), Jill Wildonger (Cell Adhesion and Cytoskeleton), David Pagliarini (Cellular and Molecular Metabolism), Anne Griep (Developmental Biology and Regenerative Medicine), Jyoti Watters (Immunology), Guy Groblewski (Membrane Biology and Protein Trafficking), Robert Landick (Molecular and Genome Biology of Microbes), Sebastian Bednarek (Plant Biology), David Brow (RNA), Megan McClean (Systems Biology), Melissa Harrison (Transcriptional Mechanisms), Paul Ahlquist (Virology).

For a list of all participating faculty, see the program website (http://www.cmb.wisc.edu/).