PLANT BREEDING AND PLANT GENETICS, M.S.

The program leading to the Master of Science in Plant Breeding and Plant Genetics provides a broad exposure in the various disciplines involved with plant improvement. The program is truly interdisciplinary with faculty participants from agronomy, biochemistry, botany, entomology, genetics, horticulture, plant pathology, and statistics. Research areas include biochemical and molecular genetics, bioinformatics, biometry, cytogenetics and cytology, genecology, genetics, plant breeding, and quantitative genetics.

The Plant Breeding and Plant Genetics Program has been designated a UW System Center of Excellence. The 50–60 students majoring in the program come from throughout the United States and all over the world. Faculty have included members of the National Academy of Sciences, endowed chair professors, and recipients of the National Council of Plant Breeders "Genetic and Plant Breeding Award." The University of Wisconsin leads the nation in the diversity of plant breeding programs and number of graduate students trained. Graduates are found in responsible positions with academic institutions, research institutions, and private companies involved in molecular to cultivar development work.

ADMISSIONS

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).

Requirements

<table>
<thead>
<tr>
<th>Detail</th>
<th>Fall Deadline</th>
<th>Spring Deadline</th>
<th>Summer Deadline</th>
<th>GRE (Graduate Record Examinations)</th>
<th>English Proficiency Test</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>December 1</td>
<td>September 1</td>
<td>December 1</td>
<td>May be required in certain cases; consult program.</td>
<td>Every applicant whose native language is not English or whose undergraduate instruction was not in English must provide an English proficiency test score and meet the Graduate School minimum requirements (<a href="https://grad.wisc.edu/apply/requirements/#english-proficiency">https://grad.wisc.edu/apply/requirements/#english-proficiency</a>).</td>
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<td>n/a</td>
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Other Test(s) (e.g., GMAT, MCAT) | n/a

Letters of Recommendation Required

Satisfactory preparation for graduate study in plant breeding and plant genetics includes undergraduate coursework in mathematics through differential and integral calculus, general chemistry and organic chemistry, physics, and a comprehensive biology sequence that covers both plant and animal biology and includes labs. Some of this preparatory coursework may be completed during the first year of graduate study. Normally, applicants will have had undergraduate training in the biological or agricultural sciences. All applicants must fulfill the minimum entrance requirements of the Graduate School.

Application Checklist

A complete application should include the following items:

1. Graduate School Application: We only accept applications submitted online through the Graduate School.
2. Supplementary Application: The supplementary application will appear as a part of the Graduate School’s electronic application once the applicant selects plant breeding and plant genetics.
3. Application Fee: Instructions for paying the application fee are available through the Graduate School’s online application form.
4. Statement of Purpose: Your essay should be a concise description of your reasons for choosing to study plant breeding and plant genetics at the University of Wisconsin. Please include your research interests and career goals as well as a description of your preparation for graduate study including relevant coursework, related employment, research experience, publications, presentations, awards, and honors. The essay may be submitted electronically through the Graduate School’s online application.
5. Transcripts: We require all applicants to submit an unofficial transcript in PDF format to their online application. If an applicant is recommended for admission, then they will be required to submit their official transcript to the Graduate School. International academic records must be submitted in the original language and accompanied by an official English translation. Documents must be issued by the institution with an official seal/stamp and an official signature.
6. Three Letters of Recommendation
7. GRE Scores: Graduates of U.S. institutions must submit scores from the Graduate Record Exam (GRE). The GRE General Test is required and measures verbal reasoning, quantitative reasoning, critical thinking, and analytical writing skills. GRE Subject Tests are not required, but applicants are encouraged to take either the Biochemistry, Cell and Molecular Biology test or the Biology test. Students should contact the Educational Testing Service for the exact time and location of the examination and general information on this procedure. Results of the examination must be sent to the Graduate School. Our institution code is 1846. There is no department code. At the option of the major professor, graduates of foreign institutions may be required to submit GRE scores in order to qualify for graduate research assistantships. Any student interested in competing for fellowships or scholarships from UW-Madison or the PBPG program must submit GRE scores.
8. Proof of English Proficiency - Applicants, whose native language is not English, or whose undergraduate instruction was not in English, must follow the Graduate School’s guidelines for proof of English proficiency.

Application Process

Applications for graduate study in plant breeding and plant genetics must be submitted using the Graduate School’s online application. If you are applying to multiple programs at the University of Wisconsin, make sure you send application materials to each program.

At this time, the graduate program in plant breeding and plant genetics does not support lab rotations. Applicants are admitted directly into a specific research program with one major professor. Admissions decisions are contingent upon the acceptance of an applicant by a
faculty mentor. Because we receive many more applications from qualified applicants than we are able to admit, we highly recommend that applicants directly contact any faculty members with whom they are interested in working.

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

Financial support may be available through research assistantships (RAs) or fellowships. Fellowships are granted to students with very outstanding academic records. We recommend that your application be complete by the application deadlines in order to be considered for funding. Research assistantships are awarded by individual professors through funds available to their research programs.

Please be advised that you do not need to make a separate application for financial support as your admission application will also serve as an application for assistantships and fellowships.

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>Face to Face</th>
<th>Evening/Weekend</th>
<th>Online</th>
<th>Hybrid</th>
<th>Accelerated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Mode of Instruction Definitions

- **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.
- **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. 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>Requirements Detail</th>
<th>Credit</th>
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<tbody>
<tr>
<td><strong>Minimum Credit Requirement</strong></td>
<td>30 credits</td>
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<tr>
<td><strong>Minimum Residence Credit Requirement</strong></td>
<td>16 credits</td>
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<tr>
<td><strong>Minimum Graduate Coursework Requirement</strong></td>
<td>Half of degree coursework (15 credits out of 30 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 (<a href="https://registrar.wisc.edu/course-guide/">https://registrar.wisc.edu/course-guide/</a>).</td>
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<tr>
<td><strong>Overall Graduate GPA Requirement</strong></td>
<td>3.00 GPA required</td>
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<tr>
<td><strong>Other Grade Requirements</strong></td>
<td>Students must earn a B or above in all core curriculum coursework.</td>
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<tr>
<td><strong>Assessments</strong></td>
<td>A formal M.S. thesis is required.</td>
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<tr>
<td><strong>Examinations</strong></td>
<td>and</td>
</tr>
<tr>
<td><strong>Language</strong></td>
<td>No language requirements.</td>
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</table>

REQUIRED COURSES

The specific program of study toward a master’s degree is developed by the student and their major professor. Considerable flexibility in the selection of courses is permitted to meet the needs and interests of the candidate. Of the 30 credits required, students must complete a minimum of 12 credits of coursework (not research credit) and at least 9 credits must come from the Core Curriculum, including at least 2 credits in Section A, and 2 credits in Section B or C. Students must also complete 2 credits of Plant Breeding seminar (HORT/AGRONOMY/GENETICS 957 Seminar-Plant Breeding).

Core Curriculum

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>A. Plant Breeding</td>
<td></td>
<td></td>
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<tr>
<td>HORT/AGRONOMY 501</td>
<td>Principles of Plant Breeding</td>
<td></td>
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<tr>
<td>HORT/AGRONOMY 502</td>
<td>Techniques of Plant Breeding</td>
<td></td>
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<tr>
<td>HORT/AGRONOMY 812</td>
<td>Selection Theory for Quantitative Traits in Plants</td>
<td></td>
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<tr>
<td>B. Genetics</td>
<td></td>
<td></td>
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<tr>
<td>HORT/GENETICS 550</td>
<td>Molecular Approaches for Potential Crop Improvement</td>
<td></td>
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<tr>
<td>GENETICS 631</td>
<td>Plant Genetics</td>
<td></td>
</tr>
<tr>
<td>GENETICS 701</td>
<td>Advanced Genetics</td>
<td></td>
</tr>
<tr>
<td>GENETICS/BIOCHEM/BOTANY 840</td>
<td>Regulatory Mechanisms in Plant Development</td>
<td></td>
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</tbody>
</table>
HORT 875  Special Topics (Polyploid Genetics; Genetic Analysis with R)

C. Quantitative Genetics and Biometry
HORT/F&W ECOL/  Statistical Methods for Bioscience II
STAT  572
HORT/  Biometrical Procedures in Plant Breeding
AGRONOMY 811
AGRONOMY 771  Experimental Designs
& AGRONOMY 772 and Applications in ANOVA

D. Additional Core Courses
BIOCHEM/  Plant Biochemistry
BOTANY  621
PL PATH/  Plant-Microbe Interactions: Molecular and Ecological Aspects
BOTANY/  ENTOM  505
PL PATH 517  Plant Disease Resistance
GENETICS 633  Population Genetics
BOTANY  500  Plant Physiology

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://plantbreeding.wisc.edu/current-students/program-requirements) is the repository for all of the program’s policies and requirements.

Prior Coursework
Graduate Work from Other Institutions
With program approval, students are allowed to count no more than 9 credits of graduate coursework from other institutions. coursework earned five or more years prior to admission to a master’s degree is not allowed to satisfy requirements.

UW–Madison Undergraduate
No credits from a UW–Madison undergraduate degree are allowed to count toward the degree.

UW–Madison University Special
With program approval, students are allowed to count no more than 9 credits of coursework numbered 300 or above taken as a UW–Madison University Special student. Coursework earned five or more years prior to admission to a master’s degree is not allowed to satisfy requirements.

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.

1. Good standing (progressing according to standards; any funding guarantee remains in place).
2. Probation (not progressing according to standards but permitted to enroll; loss of funding guarantee; specific plan with dates and deadlines in place in regard to removal of probationary status).
3. Unsatisfactory progress (not progressing according to standards; not permitted to enroll, dismissal, leave of absence or change of advisor or program).

Advisor / Committee
Every graduate student must have a faculty advisor (Major Professor) who is a member of the PBPG faculty. The Major Professor advises the student about course work and supervises the student’s research. The major professor must approve the student’s coursework and research direction.

A Master’s Committee is composed of at least three current UW–Madison faculty members, including the major professor. The Master’s Committee is empowered by the Program to advise the student regarding coursework and thesis content, and conduct the final master’s oral examination. Prior to the end of the first year of graduate study the student, in consultation with their major professor, should select two members of the UW–Madison faculty to serve on their Master’s Committee. It is the student’s responsibility to seek and obtain (verbal) approval from the faculty selected to serve on this committee.

Credits Per Term Allowed
15 credits

Time Constraints
Master’s degree students who have been absent for five 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.

Other
Financial support may be available through research assistantships (RAs) or fellowships. Fellowships are granted to students with very outstanding academic records. We recommend that your application be complete by the application deadlines in order to be considered for funding. Research assistantships are awarded by individual professors through funds available to their research programs.

Professional Development

Graduate School Resources
Take advantage of the Graduate School’s professional development resources (https://grad.wisc.edu/pd) to build skills, thrive academically, and launch your career.
PROGRAM RESOURCES

Close working relationships between plant breeding and plant genetics (PBPG) students and faculty with companies, commodity groups, and NGOs allow for exposure to various work environments and potential employers. Opportunities exist for students to complete short-term internships with companies depending on research interests and progress towards the graduate degrees. The Plant Science Graduate Student Council (PSGSC) (http://psgsc.wisc.edu) fosters communication and social interactions among the graduate students in the plant sciences.

LEARNING OUTCOMES

1. Articulates the theories, research methods, and approaches to inquiry in the field of plant breeding and plant genetics.
2. Identifies sources and assembles evidence pertaining to questions in the field of plant breeding and plant genetics.
3. Demonstrates understanding of the primary field of study in a global context.
4. Selects and utilizes the most appropriate methodologies and practices.
5. Synthesizes information pertaining to questions in the field of plant breeding and plant genetics.
6. Communicates clearly in ways appropriate to the field of plant breeding and plant genetics.
7. Recognizes and applies principles of ethical and professional conduct.

PEOPLE

FACULTY

_Agronomy_
Jean-Michel Ane
Natalia De Leon (program chair)
Lucia Gutierrez
Heidi Kaeppler
Shawn Kaeppler
Bill Tracy

_Biochemistry_
Rick Amasino
Sebastian Bednarek

_Botany_
Hiroshi Maeda
Edgar Spalding
Donald M. Waller

_Entomology_
Johanne Brunet

_Genetics_
Patrick Masson
Xuehua Zhong

_Horticulture_
John Bamberg
Paul Bethke
Julie Dawson

Jeff Endelman
Irwin Goldman
Michael Havey
Shelley Jansky
Patrick Krystan
Jim Nienhuis
Jiwan Palta
Sara Patterson
Phillip Simon
David Spooner
Yiqun Weng
Juan Zalapa

_Plant Pathology_
Andrew Bent
Doug Rouse

_Statistics_
Karl Broman
Brian Yandell