HOS 6236 Molecular Marker Assisted Plant Breeding
Graduate Level – 3 credit hours
Fall 2017

Instructors: Dr. Patricio R. Munoz
2211 Fifield Hall
352-273-4837
p.munoz@ufl.edu
Office Hours by appointment

Dr. Marcio F. Resende
2135 Fifield Hall
352-273-4772
mresende@ufl.edu
Office Hours by appointment

Dr. Kevin Folta
2239 Fifield Hall
352-273-4812
kfolta@ufl.edu
Office Hours by appointment

Teaching Assistant: Ivone de Bem Oliveira
idebem.oliveira@ufl.edu
352-273-4836
Office Hours by appointment

Location and time: Tuesday period 2 (8:30-9:20), Fifield 2316
Thursday periods 2-3 (8:30-10:20), Fifield 2316

Prerequisite STA6166 or ALS5932 or equivalent, and AGR5321 or equivalent. Basic understanding of the software R.

Course Description
This course provides theory, methods and procedures required to apply molecular information in plant breeding programs. The course will be based on lectures and multiple hands-on activities that apply what is learned. Frequent evaluations will occur during the semester by topic (see below).

Intended Audience
The course is designed for graduate students working in plant breeding (e.g. agronomy, horticulture, environmental horticulture, and forestry), or any student in biological science who wants to deepen his/her knowledge about the theory and application of molecular breeding.

Course Objectives
The course goal is to familiarize students with the application of molecular information to plant breeding. By the end of the semester students should be able to describe current methods for mapping quantitative trait loci (QTL), Genome-wide association (GWAS), marker-assisted selection (MAS), and Genomic Selection (GS). The course will also review the applications of biotechnology to breeding programs. Students should be able to describe the advantages and disadvantages of the different methods covered in the course. Students should also be able to list the biotechnology methods applied to plant breeding. Ultimately, students should be able to identify what method and what strategy should be applied depending on the species, the breeding goals, the population and the timeframe.
Evaluation

<table>
<thead>
<tr>
<th>Points</th>
<th>Type</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>05</td>
<td>Quizzes</td>
<td>Plant Breeding and Molecular Markers</td>
</tr>
<tr>
<td>05</td>
<td>Quizzes</td>
<td>QTL Analysis</td>
</tr>
<tr>
<td>05</td>
<td>Paper Discussion</td>
<td>QTL Analysis</td>
</tr>
<tr>
<td>10</td>
<td>Partial Project</td>
<td>QTL Analysis</td>
</tr>
<tr>
<td>05</td>
<td>Quizzes</td>
<td>GWAS</td>
</tr>
<tr>
<td>05</td>
<td>Paper Discussion</td>
<td>GWAS</td>
</tr>
<tr>
<td>10</td>
<td>Partial Project</td>
<td>GWAS</td>
</tr>
<tr>
<td>05</td>
<td>Quizzes</td>
<td>MAS</td>
</tr>
<tr>
<td>15</td>
<td>Take-Home Exam</td>
<td>MAS</td>
</tr>
<tr>
<td>05</td>
<td>Quizzes</td>
<td>GS</td>
</tr>
<tr>
<td>05</td>
<td>Paper Discussion</td>
<td>GS</td>
</tr>
<tr>
<td>10</td>
<td>Partial Project</td>
<td>GS</td>
</tr>
<tr>
<td>05</td>
<td>Quizzes</td>
<td>Genetic Engineering in Breeding</td>
</tr>
<tr>
<td>10</td>
<td>Take-Home Exam</td>
<td>Genetic Engineering in Breeding</td>
</tr>
<tr>
<td>100</td>
<td>TOTAL</td>
<td></td>
</tr>
</tbody>
</table>

Letter Grade
A >90  B+ 85 to 89  B 80 to 84  C+ 75 to 79  C 70 to 74  D+ 65 to 69  D 60 to 64  E < 60

UF grading policies: https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Evaluation Description

Quizzes
Quizzes will happen in the first 5 minutes of the class. There will be no notice of when quizzes are happening and there is no make up of quizzes, so be on time for class.

Paper discussion
There will be one paper assigned every two weeks. One student chosen at random at the beginning of the class will lead the paper discussion, this student will randomly chose as many students as figures appear in the paper to be explained and discussed. All students will have a chance to lead the discussion.

Partial Projects
Partial project will be developed while the class is covering the topic and is due by 5 PM the last day the topic is covered. The project will start during class for every topic. The due day will be communicated the day the data is given to students. For example; the QTL analysis will involve creating a linkage map, mapping the QTLs, and presenting a report of the work. Similar projects will be given to the topics GWAS, and GS.

Take-Home Exam
Take home exam will be due one days after is given to students. These exams will involve developing strategies for application of the methods and techniques under different scenarios.

Hands-on Activities
Every week during the second period on Thursday students will be handling data to apply what was learn during the week. This means students are required to participate in this activities.

Software
You will need to bring your own laptop. The main software used will be the statistical software R which can be downloaded from www.r-project.org, and R-studio http://www.rstudio.com/. It is your responsibility to make sure that your computer has the latest version of R. Prior to the first day of class, please make sure you have removed all old versions of R, and have the most recent version installed.
There are numerous online resources available for R; however, if you would like a traditional textbook, The R Book, is widely available and comprehensive.
Required and Recommended Literature
This course does not have a required but a recommended textbook, and a series of scientific manuscript that will be assigned for reading and discussion. Additional literature, to deepen student understanding, can also be found below.


Course Schedule and Topics (Tentative).

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wk 1</td>
<td>Plant Breeding Review</td>
</tr>
<tr>
<td>Wk 2</td>
<td>Molecular Markers Review</td>
</tr>
<tr>
<td>Wk 3</td>
<td>Linkage Mapping</td>
</tr>
<tr>
<td>Wk 4</td>
<td>Quantitative Trait Loci (QTL) Analysis I</td>
</tr>
<tr>
<td>Wk 5</td>
<td>Quantitative Trait Loci (QTL) Analysis II</td>
</tr>
<tr>
<td>Wk 6</td>
<td>Genome-Wide Analysis (GWAS) I</td>
</tr>
<tr>
<td>Wk 7</td>
<td>Genome-Wide Analysis (GWAS) II</td>
</tr>
<tr>
<td>Wk 8</td>
<td>Genome-Wide Analysis (GWAS) III</td>
</tr>
<tr>
<td>Wk 9</td>
<td>Marker-Assisted Selection (MAS): Traditional Methods I</td>
</tr>
<tr>
<td>Wk 10</td>
<td>Marker-Assisted Selection (MAS): Traditional Methods II</td>
</tr>
<tr>
<td>Wk 11</td>
<td>Genomic Selection (GS) I</td>
</tr>
<tr>
<td>Wk 12</td>
<td>Genomic Selection (GS) II</td>
</tr>
<tr>
<td>Wk 13</td>
<td>Genomic Selection (GS) III</td>
</tr>
<tr>
<td>Wk 14</td>
<td>Genomic Selection (GS) IV</td>
</tr>
<tr>
<td>Wk 15</td>
<td>Genetic Engineering in Plant Breeding: Traditional Methods</td>
</tr>
<tr>
<td>Wk 16</td>
<td>Genetic Engineering in Plant Breeding: Gene-Editing tools</td>
</tr>
</tbody>
</table>

**Attendance and Make-Up Work**

“Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at:
https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx”

**Online Course Evaluation Process**

“Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at https://evaluations.ufl.edu. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at https://evaluations.ufl.edu/results/”

**Academic Honesty**

“UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (http://www.dso.ufl.edu/scr/process/student-conduct-honor-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.”
Software Use:
All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate.

Services for Students with Disabilities
“Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, www.dso.ufl.edu/drc/) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.”

Campus Helping Resources
Health and Wellness:
U Matter, We Care: If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.

Counseling and Wellness Center: http://www.counseling.ufl.edu/cwc/Default.aspx, 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Assault Recovery Services (SARS) Student Health Care Center, 392-1161. University Police Department, 392-1111 (or 9-1-1 for emergencies). http://www.police.ufl.edu/