**The University of Jordan**

**Faculty of Agriculture Dept. Horticulture & Crop Science**

**Master: Biotechnology 2017/2018 Semester**

**Molecular Plant Breeding (**0601784**)**

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| **Credit hours** | **3** | **Level** | **2nd year** | **Pre-requisite** | **Non** |
| **Coordinator/ Lecturer** | **Prof. Mahmud Duwayri**  **Dr. Muhanad Akash** | **Office number** | **214**  **290** | **Office phone** | **22331**  **22340** |
| **Course website** | **http://elearning.ju.edu.jo/** | **E-mail** | **duwayri@ju.edu.jo**  **makash@ju.edu.jo** | **Place** |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Office hours** | | | | | |
| **Day/Time** | **Sunday** | **Monday** | **Tuesday** | **Wednesday** | **Thursday** |
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**Course Description**

Review of basic genetics, inheritance of unlinked and linked traits, and recombination, genetic recombination as a tool for genetic map construction, theory and application of DNA markers for mapping and selection, including pros, cons, and their special characteristics, DNA markers (RFLP, RAPD, AFLP, SSR, EST, STS, SNP), marker assisted selection in various breeding systems, and quantitative trait loci (QTL) concept and its application in plant breeding programs.

**Learning Objectives**

The course is designed to expose graduate students to the following fields in molecular plant breeding:

1. Overview of plant breeding and the molecular techniques
2. Explore molecular techniques as tools for conventional plant breeding
3. Explore case studies on practical applications and impacts of molecular breeding tools in crop improvement programs
4. Learn how to use molecular techniques data analysis software including mapping software programs

**Intended Learning Outcomes (ILOs):**

Successful completion of the course should lead to the following outcomes:

**A. Knowledge and Understanding:** Student is expected to

**A1-**Know various molecular techniques in plants

**A2-**Understand practical applications and impacts of molecular breeding tools in crop improvement programs

**A3**-Use of statistical and other molecular data analysis software packages

**B. Intellectual Analytical and Cognitive Skills:** Student is expected to

**B1**-Practice to read and use literature with critical understanding of molecular breeding related papers

**B2**- Go through step by step understanding and applying protocols of molecular techniques analysis and applications

**C. Subject- Specific Skills:** Students is expected to

**C1**- Utilize data analysis software packages

**C2**- Utilize practical molecular technique ideas

**D. Transferable Key Skills:** Students is expected to

**D1**-Draw and illustrate solid data into elastic easy to follow scheme

**D2**-Use scientific software

**D3**-Use internet for data mining

**D4**-Practice data analysis and interpretation

# ILOs: Learning and Evaluation Methods

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| **ILO/s** | **Learning Methods** | **Evaluation Methods** |
| A. Knowledge and Understanding (A1-A3) | Lectures and Discussions | Exam, assignments |
| B. Intellectual Analytical and Cognitive Skills (B1-B2) | Lectures, Homework and Assignments | Exam, assignments |
| C. Subject Specific Skills (C1-C2) | Lectures, Homework | Exam , assignments |
| D.Transferable Key Skills (D1-D4) | Lectures, Assignments | Projects, presentation |

**Course Contents**

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| --- | --- | --- | --- |
| **Content** | **Reference** | **Week** | **ILO/s** |
| Overview of plant breeding and the molecular techniques | Phillips and Vasil (1994)  Vienne (2003)  Srivastava (2005) | 1-2 | A1 |
| Molecular markers as tools for conventional plant breeding (including RFLP, RAPD, SCAR, AFLP, SSR, various ISSR, SNPs, DArT, CAPs, SSCP, TRAP, SRAP, and other markers) | Caetano-Anollés, and Gresshoff (1997) | 3-5 | A2 |
| Developing molecular techniques for traits of interest; Qualitative traits vs. Quantitative traits | Kang (2002) | 6-8 | C2 |
| Case studies on practical applications and impacts of molecular breeding tools in crop improvement programs:   * Overview of methods for the identification of markers linked to interesting agricultural traits * QTL-analysis * From DNA-marker to gene: map-based cloning * Marker assisted selection programs | Caetano-Anollés, and Gresshoff (1997)  Nagata et al. (2005)  Selected papers | 9-13 | B1, B2, C2, D1, D2 |
| Molecular techniques data analysis software. | Kang (2003) | 14-16 | A3, C1, D2, D3, D4 |

**Learning Methodology**

1. **Lectures**: 2 per week (including one 2-hour exam)
2. **Duration:** 16 weeks, 48 hours in total
3. **Assignments:** to be notified

# Evaluation

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| **Evaluation** | **Point %** | **Date** |
| **Midterm Exam** | 30 |  |
| **Project** | 10 |  |
| **Assignments** | 10 |  |
| **Homework** | 10 |  |
| **Final Exam** | 40 |  |

**Main Reference/s:**

* Caetano-Anollés, G., and Gresshoff, P.M. (1997) DNA Markers: Protocols, Applications, and Overviews. Wiley-Liss.
* Phillips, R.L. and Vasil, I.K. (1994) DNA-based markers in plants. Kluwer Academic Publishers, London.
* Vienne, D. (2003) Molecular Markers in Plant Genetics and Biotechnology. Science Publishers, Inc. USA

# References:

* Nagata, T., Loِrz, H. and Widholm, J. M. (2005) Molecular Marker Systems in Plant Breeding and Crop Improvement. Springer-Verlag Berlin, Germany.
* Kang, M. S. (2002) Quantitative Genetics, genomics, and Plant Breeding. CABI, USA.
* Srivastava, P.S., Narula A., Srivastava Sh. (2005). Plant biotechnology and molecular markers. Anamaya Publishers, New Delhi, India.
* Kang MS. (2003). Handbook of Formulas and Software for Plant Geneticists and Breeders. Haworth Press Inc, New York, USA
* Selected papers.

**Notes:**

* Concerns or complaints should be expressed in the first instance to the module lecturer; if no resolution is forthcoming, then the issue should be brought to the attention of the module coordinator (for multiple sections) who will take the concerns to the module representative meeting. Thereafter, problems are dealt with by the Department Chair and if still unresolved the Dean and then ultimately the Vice President. For final complaints, there will be a committee to review grading the final exam.
* For more details on University regulations please visit:

<http://www.ju.edu.jo/rules/index.htm>