

**University of Jordan Dept. Horticulture & Crop Science**

**Faculty of Agriculture 2016/2017 Semester:**

**Bioinformatics** (0601782)

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| **Credit hours** | 3 | **Level** | M.Sc. | **Pre-requisite** |  |
| **Lecturer** | Dr. Monther Sadder | **Office #** | 212 | **Office phone** |  |
| **Course website** |  | **E-mail** | sadderm@ju.edu.jo | **Place** |  |

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| --- | --- | --- | --- | --- | --- |
| **Office hours** | | | | | |
| **Day/Time** | **Sunday** | **Monday** | **Tuesday** | **Wednesday** | **Thursday** |
|  | 1-2 p.m. | 11-12 a.m. | 1-2 p.m. | 11-12 a.m. |  |

**Course Description:**

This course covers the computational tools for classifying sequences, large databases of biological information, computationally intensive methods, new algorithms, machine learning unite to extract new concepts, new sophisticated DNA, RNA and protein sequence analysis. Pattern recognition and DNA computing, and traditional mathematical modelings. Analysis of macromolecular sequences, tri-dimensional structures, phylogenic relationships, and genomic and proteomic data.

**Learning Objectives:**

The course is designed to expose students to the following fields in biotechnology:

1. Introduction and review for Genetics.
2. Computational tools for classifying sequences, large data bases of biological information, computationally intensive methods, new algorithms, and machine learning unite to extract new concepts.
3. Bioinformatics includes new sophisticated DNA, RNA and protein sequence analysis and pattern recognition and DNA computing, but also more traditional mathematical modeling.
4. Bioinformatics covers many subjects, among the most important of which are the analysis of macromolecular sequences, the analysis of tri-dimensional structures, the analysis of phylogenic relationships, and the analysis of genomics and proteomic data.

**Intended Learning Outcomes:**

1. **knowledge and understanding:** Student is expected to

A1. Review of the basic controlling levels of traits and their feedbacks (DNA 🡪 mRNA 🡪 protein🡪 metabolites).

A2. Understand DNA sequence and analysis.

A3. Understand protein sequence and analysis.

A3. Acquire sequence similarity analysis tools.

A4. Gain whole genome and transcriptome data interpretation.

A5. Understand phylogenetic tools.

1. **Intellectual analytical and cognitive skills:** Student is expected to

B1. Understand the direct information flow from DNA to mRNA to Proteins.

B2. Cope with GO terms and protein families.

B3. Know basic bioinformatics scripts and file formats.

B4. Reasonable solutions for retrieving and analyzing bioinformatics data .

1. **Subject-specific skills:** Student is expected to

C1. Show high concentration and fine hand work dedicated to the scope of implementing bioinformatics techniques.

C2. Understand pair-wise alignment.

C3. Understand multiple sequence alignment.

C4. Be aware of bioinformatics databases and software.

1. **Transferable key skills:** Student is expected to know

D1. Lab practical work, precession and time management

D2. Drawing and illustrations of solid data into elastic easy to follow scheme

D3. Data analysis and interpretation

D4. Reporting data in a proper way and writing scientific articles

**ILOs Learning and Evaluation Methods**

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| **ILO/s** | **Learning Methods** | **Evaluation Methods** |
| A1-A5 | Lectures and Discussions | Quiz, Exam |
| B1-B4 | Lectures and Discussions  Presentation | Quiz, Exam, Assignment |
| C1-C3 | Lectures and Discussions  Project | Quiz, Exam, Assignment |
| D1-D4 | Lectures and Discussions | Quiz, Exam, Assignment |

**Course Contents**

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| **Content** | **Reference** | **Weeks** | **ILOs** |
| Organization and expression of genes | Lectures | 1/2 | A1-A5, B1-B4 |
| Sequence and other biological information | Lectures | 1/2 | A1-A5, B1-B4 |
| Basic sequence manipulation | Lectures | 1 | A1-A5, B1-B4 |
| Gene identification | Lectures | 1 | A1-A5, B1-B4, C1-C3 |
| Homology searching | Lectures | 1 | A1-A5, B1-B4, C1-C3 |
| Pairwise sequence alignment | Article, Assignment | 1 | A1-A5, B1-B4 |
| BLAST: Basic local alignment  search tool | Article, Assignment | 1 | A1-A5, B1-B4 |
| Advanced Database Searching | Article, Assignment | 1 | A1-A5, B1-B4 |
| Multiple sequence alignment | Article, Assignment | 1 | A1-A5, B1-B4 |
| Molecular Phylogeny and Evolution | Article, Assignment | 1 | C1-C3, D1-D4 |
| Gene expression: Microarray data analysis | Lectures | 1 | C1-C3, D1-D4 |
| Gene expression: RNAseq data analysis | Lectures | 1 | C1-C3, D1-D4 |
| Protein analysis and proteomics | Article, Assignment | 1 | C1-C3, D1-D4 |
| Introduction to Genomics and the Tree of Life | Lectures | 1 | C1-C3, D1-D4 |
| Viral and Prokaryotes Genomics | Lectures | 1 | C1-C3, D1-D4 |
| Eukaryotes Genomics | Article | 2 | C1-C3, D1-D4 |

**Learning Methodology**

## This course will be structured in

## Lectures and discussions,

## Presentations of recent articles

## Lab project

# Evaluation

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| **Evaluation** | **Point %** | **Date** |
| **Midterm Exam** | 30 | After 10 weeks |
| **Project & Quizes** | 20 | After 4, 6 and 12 weeks |
| **Presentation** | 10 | As indicated in table above |
| **Final Exam** | 40 | Determined by Registration Dept. |

**References**

1. Griffiths, A.J.F et al (2012) Introduction to Genetic Analysis. Freeman, USA.
2. Mount, D. (2001) Bioinformatics: Sequence and Genome Analysis. CSHL Press, New York.
3. Claerie, J-M and Notredame, C. (2007) Bioinformatics for Dummies. 2nd ed. Wiley Publishing, Inc. Indiana.
4. [Genebank] <<http://www.ncbi.nlm.nih.gov>>.
5. [The Arabidopsis Information Resources] <<http://www.arabidopsis.org>>.
6. Other bioinofrmatics sites:

* <http://www.lecb.ncifcrf.gov/~pnh/papers/poster/ucb.htm>
* <http://www.wright.edu/~michael.raymer/courses/cs790/current/syllabus/syllabus.html>
* <http://bioinf.uta.fi/courses/presentation/>
* <http://bio.fsu.edu/~stevet/modules.html>
* <http://bioinformatics.rit.edu/SIGCSE2005/>
* <http://home.cc.umanitoba.ca/%7Eumbagher/39.769/39.769.html>
* <http://www.ist.temple.edu/~vucetic/cis595spring2005.htm>
* <http://www.staff.ncl.ac.uk/n.j.morris/nano/>
* <http://cmgm.stanford.edu/classes/csuh/>
* <http://www.bioinfo.rpi.edu/~bystrc/courses/biol4540.html>