

**BIOL 312 Online – Bioinformatics  
Western Kentucky University  
Syllabus and Course Information Sheet  
Summer 2019**

**INSTRUCTOR:** Dr. Chandra Emani  
Associate Professor  
Room EBS3123 Ph: 270-745-2104

**Class Schedule:**

Blackboard site Monday through Thursday – Video Lecture followed by Lab assignments  
Fridays – Graded Reflective Assignments

**E-mail:** [chandrankanth.emani@wku.edu](mailto:chandrankanth.emani@wku.edu)

**WELCOME TO BIO 312**

Congratulations to you all for joining the Western Kentucky University academic family and a warm welcome to our Bioinformatics community. I am all excited and looking forward to exploring with you all the LANGUAGE OF LIFE through the fascinating world of Bioinformatics or computation biology. This course will be a memorable journey of a new area of biology you have never encountered. If you know how to operate a computer with mouse, and know how to browse the internet, I will open a new door into an exciting world of understanding LIFE

My teaching methodology is based on the principle of “deep learning”. Briefly, deep learning is a process where the student learns with understanding as opposed to rote or surface learning where he/she just collects innumerable unrelated facts. My personal definition of a great teacher is “an *individual who promotes a classroom environment, where learning is a continuous and stimulatory process aimed at analysis, assimilation and application.*” That said, I look forward to a fulfilling experience in our classes, where we will work together and through the fascinating world of bioinformatics, create a pathway to a greater understanding of ourselves and the life around us just by flicking fingers on a computer keyboard. The rest of the course information sheet will help you to understand the objectives we will achieve through this course, the methods used to measure and gauge your progress throughout the course, and the WKU academic policies and rules.

**COURSE DESCRIPTION**

Biology 312 is an introductory survey of computational biology that includes an introduction to basic concepts of how computers, information technology and computer software are used to understand and analyze the genes that govern life processes, specific methodologies involved to analyze, DNA, RNA, proteins and metabolic pathways of life, and the understanding of principles involved in basic molecular biology, genetics, biotechnology, and the principles of evolution through computers. The course consists of four class hours of interactive lecture and lab sessions per week with the instructor guiding the students through the computer operations.

## **COURSE OBJECTIVES AND STUDENT LEARNING OUTCOMES**

After successfully completing Biology 312, the student will have a working knowledge of:

1. The scientific process of how computers have a role in biology.
2. The basics of molecular biology to understand the language of life.
3. Using the databases available on the internet to retrieve scientific literature and to analyze the DNA, RNA and protein sequences.
4. Comparing DNA and protein sequences to understand the sequence related functions.
5. Building multiple sequence alignments and phylogenetic tree construction to understand the evolution of biomolecules.
6. Analysis of the 3D structures of proteins and RNA to understand their function.
7. The do's and don't's of using bioinformatics servers and the internet biology world.

## **EXPANDED COURSE DESCRIPTION**

Please refer to the lecture schedule at the end of this document

## **REQUIRED TEXTBOOK**

Understanding Bioinformatics by Marketa Zvelebil & Jeremy O. Baum, ISBN 0-8153-4024-9

**OTHER CLASSROOM MATERIAL:** Handouts and instructions posted on Blackboard

## **CLASS POLICIES**

**Course Design:** Each day the class meets online for 2 hours to go over lectures that will be used for interactive concept introduction. This will be followed by online lab sessions that will take 2 hours each day with the goal of learning to analyze and annotate an assigned gene for each student that is related to cancer genomics and molecular biology. Students will regularly present their results to the class via the discussion board and final presentation will be made online during the scheduled final exam period. The hourly sessions indicated are for effective time management. Sessions are prerecorded video lectures or instructions posted on the blackboard course site that are open throughout the duration of the course.

**Attendance/participation:** WKU believes that regular class attendance is a crucial component for student success. Every class lecture is a vital foundation for subsequent class meetings. Without full participation and regular class attendance, students will be at a severe disadvantage for achieving success at college. Every online class session has an assignment that will be started in class and maybe completed and turned in at the beginning of following class period. In an online class, students will have the flexibility to plan their sessions as most assignments will open throughout semester, but proper time management in a short summer session is crucial. When a student has 5 days unexcused absences, I will record the student's unexcused absences. The student will receive an emailed warning from me that upon one more day of unexcused absence, the student will be dropped from all classes in which the unexcused absences are reported. Some of the

forms of absence that can be considered officially excused are: (1) Sick and medical emergencies (2) Representing WKU at an official institutional function. Other excuses will be considered, at my discretion, with documentation.

**Dropping:** If a student chooses to drop the course, it is that student's responsibility to ensure proper documentation with WKU. Failure to do so could result in a grade of F in the course. If you wish to withdraw from the course you should do so by the dates mandated by the University. Be sure you are aware of these dates because credit for the course will not be changed after the university's designated time. You also cannot drop the class or Withdraw after the designated time.

**Disabilities:** "Students with disabilities who require accommodations (academic adjustments and/or auxiliary aids or services) for this course must contact the Office for Student Disability Services at (270) 745-5004. Please DO NOT request accommodations directly from the professor or instructor without a letter of accommodation from the Office for Student Disability Services."

**Dishonesty Statement:** WKU does not tolerate cheating, plagiarism or other acts of dishonesty. Definitions of these acts and procedures for dealing with them are described in the WKU standards of professional conduct on the university website and in the student handbook.

**Civility Statement:** Members of the WKU community, which includes faculty, staff and students, are expected to act responsibly in classroom and campus. WKU holds all members accountable for their actions and words. Therefore, all members should commit themselves to behave in a manner befitting a responsible College and Civilian community. In the online discussion forums, avoid personal comments, political statements and focus the postings on science. Responsible College and Civil behavior in an online environment applies to language and decorum during discussions.

## **COURSE REQUIREMENTS AND CRITERIA FOR GRADING**

**Lab assignments:** There will be regular daily lab assignments that need to be turned in during the semester. A late submission will be considered by excused absences include those officially recognized by WKU, plus a death in the family, or an illness with doctor's certification. **An unexcused absence from turning in a lab assignment will result in a grade of zero.**

**Graded assignments:** There will be three graded assignments on every Friday of the course period excluding the last Friday.

**Final Project:** The final project will be an individual research project in the form of an online poster for each student. The project will be based on what's learned in the class and will be designed by each individual student in consultation with the instructor. The format will be a virtual poster conference that includes peer-review of each other's work.

**Bonus activities:** As assigned by the instructor will be tuned to attending the class regularly.

**Point Distribution:**

Graded Assignments (3 x 100 points each)	300 points
Online lab assignments (10 x 50 points)	500 points
Final Project	<u>200 points</u>
	1000 points

## CLASS SCHEDULE

- JULY 8 – INTRODUCTION: What is bioinformatics and what does it do for you?  
9 – Lecture 1: The LANGUAGE OF LIFE (or GOD?) (Chapters 1 and 2)  
Lab 1: Introduction to your genes  
10 – Lecture 2: Walking through the NCBI - Pubmed and Medline (Chapter 3)  
Lab 2: History and Science of your assigned genes  
11 – Lecture 3: Working with protein sequences (Chapter 4, 5)  
Lab 3: Starting to work with protein sequences – ExPASy and BLAST

### 12 – Reflective Assignment 1

- 15 – Lecture 4: Understanding Protein alignments (Chapter 6)  
Lab 4: Working with your (cancer) genes – PSI-BLAST  
16 – Lecture 5: Molecular evolution (Chapter 7)  
Lab 5: Collecting the ancestral sequences of your gene of interest  
17 – Lecture 6: Molecular evolution continued (Chapter 7)  
Lab 6: Selecting the significant sequences of your gene of interest  
18 – Lab 7: Building phylogenetic trees (Chapter 8)  
Lab 7: Identifying the distant ancestors of your gene sequence

### 19 – Reflective Assignment 2

- 22 – Lecture 8: DNA, RNA and genomes (Chapter 9 and 10)  
Lab 8: Working with DNA – designing PCR primers  
23 – Lecture 9: Understanding protein structure (Chapter 11 and 12)  
Lab 9: Biochemistry on a computer – PROSITE  
24 – Lecture 10: The 3D structures of proteins (Chapter 13 and 14)  
Lab 10: Biochemistry on a computer – InterProScan and Motif Scan  
25 – Lecture 11: Bioinformatics and Biotechnology (Chapter 15 and 16)  
Lab 11: Fishing out protein domains - TCOFFEE

### 26 – Reflective Assignment 3

- 29 – Lecture 12: Systems Biology – The Web of Life (Chapter 17)  
30 – Lab 11 (contd) - TCOFFEE continued  
31 – Lab 12: The Phylogenetic tree of your gene – Tree of Life

- AUG 1 – Preparing for the virtual poster conference  
2 – **Final project**