MARB 6590.003 – DNA Sequencing Informatics  
Department of Life Sciences  
Fall 2018

A. COURSE INFORMATION

Course number/section: MARB 6590.003  
Class meeting time: MW 9:00 – 10:20am  
Class location: ECMS-207  
Course Website: https://bb9.tamucc.edu

B. INSTRUCTOR INFORMATION

Instructor: Dr. Jeffrey Turner  
Office location: Science Lab 1, Room 104  
Office hours: MTW 3:00 – 5:00pm  
Telephone: 361-825-6206  
e-mail: jeffrey.turner@tamucc.edu  
Appointments: please email

C. COURSE DESCRIPTION

Genome sequencing is the process that determines the complete DNA sequence of an organism’s genome. Today, a human genome can be sequenced in hours, and a microbial genome can be sequencing in minutes. However, making sense of genomic data goes beyond an understanding of the Central Dogma, necessitating sophisticated tools and high-level programming skills. In this course, students will explore DNA Sequencing Informatics through participation in lectures, discussion of peer-reviewed literature and hands-on exercises. The course will be centered on three general aspects of DNA Sequencing Informatics: genome sequencing, assembly, and analysis. For this purpose, student will analyze authentic datasets provided by the student and/or the instructor. These authentic datasets will be the centerpiece in a semester long project that will culminate with student submission/authorship to a peer-reviewed journal. Students can expect to walk away with 1) a working knowledge of genome sequencing technologies and comparative genomics, and 2) a greater understanding of marine ecology as it relates to their authentic dataset. Importantly, these techniques and tools provided by this class can be applied to answer “omics” questions across all three domains of life.

D. PREREQUISITES AND COREQUISITES

Prerequisites: Microbiology (BIOL-2421) and Genetics (BIOL-2416) or equivalent. This course is intended for graduate students with a background in microbiology, genetics, biological sciences, and/or computer science. Familiarity with high-performance computing (HPC) is not a prerequisite, but previous HPC experience is preferred. It is ideally suited for graduate students in the MARB, FAMA, CMSS, BIOL and ESCI MS and PhD programs.
Corequisites: None.

E. REQUIRED TEXTBOOK(S), READINGS AND SUPPLIES

Required Textbook(s): A textbook is not required. Lectures and primary literature will be made available on Blackboard https://bb9.tamucc.edu prior to class.

Other Resources: Analysis of next-generation sequence data necessitates that you’re familiar with the Unix shell. Software Carpentry (http://software-carpentry.org/) can help. To start, review the lesson entitled The Unix Shell. Also, when working with sequencing data, you will encounter questions that are beyond your level of experience. When this happens, online forums devoted to bioinformatics are a great place to find answers. I encourage you to sign up with https://www.biostars.org/ and http://seqanswers.com/.

Supplies: You must have access to a computer and the internet. Although some coursework can be completed on a personal computer, much of the coursework will be completed on TAMUCC’s high performance computer (HPC). You can learn more about the HPC here http://hpc.tamucc.edu/. On the 1st day of class, I’ll provide instructions that detail how to access and submit jobs to the HPC. For the transfer of files to and from your computer and the HPC, I recommend https://cyberduck.io/ which is a free graphical user interface (GUI) that allows you to drag-n-drop files via a FTP or SFTP connection.

F. STUDENT LEARNING OUTCOMES AND ASSESSMENT

Assessment is a process used by instructors to help improve learning. Assessment is essential for effective learning because it provides feedback to both students and instructors. A critical step in this process is making clear the course’s student learning outcomes that describe what students are expected to learn to be successful in the course. The student learning outcomes for this course are listed below. By collecting data and sharing it with students on how well they are accomplishing these learning outcomes students can more efficiently and effectively focus their learning efforts. This information can also help instructors identify challenging areas for students and adjust their teaching approach to facilitate learning. By the end of this course, students should be able to:

1. Describe the history of DNA sequencing and the paradigm shifts that have resulted from innovations in sequencing.
2. Understand different methods of whole-genome sequencing and make logical decisions about what method of sequencing best fits a given research question.
3. Evaluate the quality of raw sequence reads and filter sequences based on low quality and contamination.
4. Understand a variety of methods for assembling genomes and make empirical decisions about what method best fits a particular genome.
5. Understand different methods of genome annotation and choose a method that best fits a
particular genome.

6. Configure and submit raw sequence data and assembled genomes to GenBank.

7. Understand the principles of multiple sequence alignment (MSA) and how MSA relates to the study of genes and genomes.

8. Detect ecotype-specific genes and SNPs within a population of genomes.


10. Author a draft manuscript for peer-review publication.

G. INSTRUCTIONAL METHODS AND ACTIVITIES

Each week, topics will be covered in lecture on Day 1 followed by open discussion of relevant primary literature on Day 2. Lectures and primary literature will be posted to Blackboard https://bb9.tamucc.edu at least one week prior to class.

A short (500 word) summary of each reading assignment will be due on Day 2, accounting for 20% of the student’s final grade. Participation in weekly discussions will contribute significantly (20%) to the student’s final grade.

Students will be required to work as a team to analyze an authentic genomic dataset over the long-semester. Students will also be required to work collectively to author a manuscript for peer-reviewed submission. For fall 2018, we will analyze a collection of bacterial genomes isolated from the hypersaline Laguna Salada. As students learn to work with the data, the instructor will set deadlines for Data Deliverables, when the student will be required to complete a specific task. For instance, the preprocessing of raw reads for quality will be a Data Deliverable. The completion of a genome assembly is another example of a Data Deliverable. In total, these will account for 20% of the student’s final grade.

Students will be required to share a 15-minute PowerPoint presentation/tutorial on the proper use of a genomic tool or a suite or genomic tools (given at the end of the semester), accounting for 20% of the student’s final grade. The presentation should include significant background information, a detailed description of methods, and a hands-on tutorial. Student will also be required to co-author a research paper in the style of an appropriate peer-reviewed journal, accounting for 20% of the student’s final grade. I and my co-instructor (Mr. Lee Pinnell) will help to synthesize the writing, creating a single manuscript for submission to a peer-reviewed journal. All participating students will be given co-authorship.

H. MAJOR COURSE REQUIREMENTS AND GRADING

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>% of FINAL GRADE</th>
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<tbody>
<tr>
<td>Written Summary of Papers</td>
<td>20</td>
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<tr>
<td>Participation in Discussions</td>
<td>20</td>
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<tr>
<td>Data Deliverables</td>
<td>20</td>
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Grades will be based on the following:
A. 90.0% – 100.0% Excellent
B. 80.0% – 89.9% Good
C. 70.0% – 79.9% Satisfactory
D. 60.0% – 69.9% Passing
E. 0.0% – 59.9% Failing

I. **COURSE CONTENT/SCHEDULE**

General themes listed below are organized by week. Unless otherwise noted, topics will be covered in lecture on Day 1 followed by open discussion of primary literature on Day 2.

<table>
<thead>
<tr>
<th>Week 1</th>
<th>Course introduction, History of DNA sequencing</th>
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<tr>
<td>Week 2</td>
<td>Best practices in scientific presentation and writing</td>
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<td>Week 3</td>
<td>Methods of DNA sequencing</td>
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<td>Week 4</td>
<td>Designing a genome sequencing experiment</td>
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<td>Week 5</td>
<td>Visualizing and understanding sequence data</td>
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<td>Week 6</td>
<td>Quality control and data preprocessing</td>
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<td>Week 7</td>
<td>Methods of genome assembly</td>
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<td>Week 8</td>
<td>Genome annotations</td>
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<td>Week 9</td>
<td>Submission of sequence data and genome assemblies to GenBank</td>
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<td>Week 10</td>
<td>Multiple sequence alignments and whole-genome alignments</td>
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<td>Week 11</td>
<td>Multilocus and whole-genome phylogenetics</td>
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<tr>
<td>Week 12</td>
<td>Detecting ecotype-specific genes</td>
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<tr>
<td>Week 13</td>
<td>Detecting ecotype-specific single nucleotide polymorphisms (SNPs)</td>
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Note: Changes in this course schedule may be necessary and will be announced to the class by the instructor. The assignments and exams shown are directly related to the Student Learning Outcomes described in Section F.

### J. COURSE POLICIES

**Deadline for Dropping a Course with a Grade of W (University)**
I hope that you never find it necessary to drop this or any other class. However, events can sometimes occur that make dropping a course necessary or wise. **Please consult with your academic advisor, the Financial Aid Office, and me, before you decide to drop this course.** Should dropping the course be the best course of action, **you must initiate the process to drop the course by going to the Student Services Center and filling out a course drop form.** Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. Please consult the Academic Calendar ([http://www.tamucc.edu/academics/calendar/](http://www.tamucc.edu/academics/calendar/)) for the last day to drop a course.

**Attendance/Tardiness**
Attendance is mandatory. Attendance will be recorded using a sign-in sheet prior to every class. Exceptions will be granted in the event of illness, death in the family, university sponsored event and military deployment. Other conflicts such as attendance of professional symposia or the need to conduct field research will be considered on a case-by-case basis. In the event of an absence, it is the student’s responsibility to find out what you missed, get notes, learn about changes in the syllabus, etc. An unexcused absence will result in a score of ‘0’ for that day. Students with a university approved scheduled absence (athletics, military duty, etc.) or other conflict must contact the instructor well in advance of the anticipated absence.

**Late Work**
Assignment will be accepted late in the event of a university approved absence. Otherwise, a letter grade will be deducted per day for all late assignments.

**Cell Phone Use**
Students are required to put their cell phones to silent mode during class. Taking pictures and sending text messages during class are not allowed.
Computer Use
Computer use is encouraged as it is essential to the trial and completion of computational jobs on the HPC. Students may also use computers for class-related activities such as taking notes, looking at the PowerPoint lectures and study guides.

Food
Please eat your meals before or after class.

Participation
Participation during discussions is mandatory.

K. COLLEGE AND UNIVERSITY POLICIES

• Academic Integrity (University)
University students are expected to conduct themselves in accordance with the highest standards of academic honesty. Academic misconduct for which a student is subject to penalty includes all forms of cheating, such as illicit possession of examinations or examination materials, falsification, forgery, complicity or plagiarism. (Plagiarism is the presentation of the work of another as one’s own work.) In this class, academic misconduct or complicity in an act of academic misconduct on an assignment or test will result in a failing grade.

• Classroom/Professional Behavior
Texas A&M University-Corpus Christi, as an academic community, requires that each individual respect the needs of others to study and learn in a peaceful atmosphere. Under Article III of the Student Code of Conduct, classroom behavior that interferes with either (a) the instructor’s ability to conduct the class or (b) the ability of other students to profit from the instructional program may be considered a breach of the peace and is subject to disciplinary sanction outlined in article VII of the Student Code of Conduct. Students engaging in unacceptable behavior may be instructed to leave the classroom. This prohibition applies to all instructional forums, including classrooms, electronic classrooms, labs, discussion groups, field trips, etc.

• Statement of Civility
Texas A&M University-Corpus Christi has a diverse student population that represents the population of the state. Our goal is to provide you with a high quality educational experience that is free from repression. You are responsible for following the rules of the University, city, state and federal government. We expect that you will behave in a manner that is dignified, respectful and courteous to all people, regardless of sex, ethnic/racial origin, religious background, sexual orientation or disability. Behaviors that infringe on the rights of another individual will not be tolerated.

• Deadline for Dropping a Course with a Grade of W (University)
The grade of W will be assigned to any student officially dropping a course. Please consult with the instructor before you decide to drop to be sure it is the best thing to do.
Just stopping attendance and participation WILL NOT automatically result in your being dropped from the class. Should dropping the course be the best course of action, visit the Office of the University Registrar for the Course Drop Form that must submitted. No student is eligible to receive a W without completing the official drop process by this deadline. Last day to drop the class is November 11, 2016. Last day to withdraw from the University, is December 05, 2016.

• **Grade Appeals (College of Science and Engineering)**

As stated in University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures, a student who believes that he or she has not been held to appropriate academic standards as outlined in the class syllabus, equitable evaluation procedures, or appropriate grading, may appeal the final grade given in the course. The burden of proof is upon the student to demonstrate the appropriateness of the appeal. A student with a complaint about a grade is encouraged to first discuss the matter with the instructor. For complete details, including the responsibilities of the parties involved in the process and the number of days allowed for completing the steps in the process, see University Procedure 13.02.99.C2.01, Student Grade Appeal Procedures. These documents are accessible through the University Rules website at [http://www.tamucc.edu/provost/university_rules/index.html](http://www.tamucc.edu/provost/university_rules/index.html), and the College of Science and Engineering Grade Appeals webpage at [http://sci.tamucc.edu/students/GradeAppeal.html](http://sci.tamucc.edu/students/GradeAppeal.html). For assistance and/or guidance in the grade appeal process, students may contact the chair or director of the appropriate department or school, the Office of the College of Science and Engineering Dean, or the Office of the Provost.

• **Disability Services**

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please call (361) 825-5816 or visit Disability Services in Corpus Christi Hall 116.

If you are a returning veteran and are experiencing cognitive and/or physical access issues in the classroom or on campus, please contact the Disability Services office for assistance at (361) 825-5816.

[http://disabilityservices.tamucc.edu/](http://disabilityservices.tamucc.edu/)

• **Statement of Academic Continuity**

In the event of an unforeseen adverse event, such as a major hurricane and classes could not be held on the campus of Texas A&M University–Corpus Christi; this course would continue through the use of Blackboard and/or email. In addition, the syllabus and class activities may be modified to allow continuation of the course. Ideally, University facilities (i.e., emails, web sites, and Blackboard) will be
operational within two days of the closing of the physical campus. However, students need to make certain that the course instructor has a primary and a secondary means of contacting each student.

L. OTHER INFORMATION

- **Academic Advising**
  The College of Science & Engineering requires that students meet with an Academic Advisor as soon as they are ready to declare a major. The Academic Advisor will set up a degree plan, which must be signed by the student, a faculty mentor, and the department chair. Meetings are by appointment only; advisors do not take walk-ins. Please call or stop by the Advising Center to check availability and schedule an appointment. The College’s Academic Advising Center is located in Center for Instruction 350 or can be reached at (361) 825-3928.

M. GENERAL DISCLAIMER

- **Changes to the Syllabus**
  I reserve the right to modify the information, schedule, assignments, deadlines, and course policies in this syllabus if and when necessary. I will announce such changes in a timely manner during regularly scheduled lecture periods.