Biology 562: Ecological metagenomics

Syllabus

Times Monday 10 – 11:40 lecture
Monday 1- 3:40 Lab Section 1
Wednesday 10 – 12:40 Lab Section 2
Location – NLS 324

Class Syllabus

Instructor: Dr. Elizabeth Dinsdale
Office, phone: LS 308, 594-5623
Email: dinsdale@sciences.sdsu.edu
Office hours: By appointment

Course Goals

Ecological studies of microbes have traditionally been hindered with technical limitations on identifying community members and determining their metabolic and ecological roles in the community. Ecological metagenomics focuses on training students in next generation DNA sequencing technology to describe the ecological roles of microbial communities in different environments. Student-generated data will include a description of how the metabolic functions, taxonomic distribution, diversity, evenness and species richness of microbial communities varies across environments. The microbial communities that can be analyzed with these methods can be natural or experimentally manipulated, including those that have not been studied previously. For example, students may describe how the functions of the microbial communities associated with kelp forests change with increases in carbon dioxide, or whether the microbial taxonomic composition on sea urchins is unique or reflects sea water microbes from the environment in which the sea urchins live.

Learning Outcomes:
Students will:
1. use metagenomic data to describe the taxonomic make-up, functional potential and ecological processes of microbial communities from a range of environments
2. apply next generation sequencing technology to ecologically relevant projects
3. assemble and annotate genomes by identifying genes and describing the function of each gene
4. record data in a lab book and use these data to troubleshoot the DNA extraction process
5. extract DNA and analyze its quality
6. prepare DNA libraries
7. conduct an run on a sequencing instrument
8. writing up findings in a scientific style reports

Texts
Written material for this course is made up of primary literature and lab manual which is made up of manufacturers’ protocols, and is available on the SDSU Blackboard website.

Prerequisites
Credit or concurrent registration in both BIOL 354 and BIOL 366 are required. Students that are enrolled for the course but do not have the appropriate prerequisites will be dropped by the instructor.
Biology 562: Ecological metagenomics  
Syllabus

Adds/drops
Crashers will only be considered if the course is not full. After the first three weeks of the semester (exact date is in the class schedule handbook) it is very difficult to drop any course at SDSU. All requests after that date are reviewed by the University’s Registrar’s office or an Assistant Dean, not by the instructors of the course. Please see your department’s academic advisor if you have serious problems requiring withdrawing from your courses.

Class conduct
Students are expected to be ON TIME and PREPARED for lecture and laboratories. The use of cell phones in any way (including text messaging) is distracting to other students and the instructor. TURN OFF CELL PHONES prior to lecture. The use of all electronic devices except calculators is strictly prohibited during quizzes. This includes cell phones and PDAs. Put a calculator in your backpack and leave it there, so you will have it for quizzes and calculations during the class.

Class web site
All class material will be posted on Blackboard (https://blackboard.sdsu.edu). This will include outlines, protocols, primary literature, and grades. The web site is likely to be updated at least weekly.

Grading summary
Participation – 10%
Quizzes – 15%
Report 1 comparison between sequencers – 10%
Report 2 – either Metagenomic, bacterial genomics, eukaryotic genomics or transcriptomics -10%  
Lab book and practical tasks – 20%
Presentation – 15%
Final report – analysis of your data – 20%
Standard grade distributions will apply: 90-100% = A, 80-89% = B, 70-79% = C, 60-69% = D, <60% = F. Students receiving less than 60 % of the total points will still be given a grade of F for the semester in all cases.

Participation: A subjective evaluation of your lab work will be made and a maximum of 10 % will go toward your overall grade. The subjective grade will be based on factors such as contribution to group effort, leadership, enthusiasm, precision in executing exercises, following lab rules and safety precautions, clean-up, attendance, and preparation for each lab session.
Quizzes: A brief quiz that covers preparation for the daily lab exercise will be given at the start of class, during random classes throughout the semester.
**Biology 562: Ecological metagenomics**

*Syllabus*

**Lab Book:** The course objective is to describe the ecology of an entire microbial population, which will only work if the students can achieve a sequencing run. Because problems are likely to be encountered during the process, students will keep a lab book with clearly described protocol to aid in troubleshooting. The lab book will be handed in three times during the course, after week 3, and 12. The lab book is a working document for the students to describe the steps they have taken and observations they have made throughout the process. Therefore, the most important criteria of the lab book is that it contains a complete and accurate account of the process. Grammar and spelling are secondary considerations for the lab book (but not absent). To conduct any research records have to be accurately kept and information in the lab book will be drawn upon by the students in their presentations and report. Practical tasks include bioanalyzer score, bead retention etc.

**Presentations:** Students will present a paper from the reading list or from their own research during the scheduled class. These papers are chosen to help with the written assignments. They provide information on how genomic information is annotated and what the data tells us about the organism. Oral presentations will be conducted with the aid of PowerPoint or a similar computer program. In presentations it is important to provide key points on the slides, but do not copy text verbatim. You need to present your data in a way in which people can understand it – do not read you notes. These presentations will cover the main theme of the papers and have 4 discussion questions ready at the end for the whole class to discuss. 10% of the mark will be given for the presentation and 5 % for the questions for the discussion.

**Written Reports:**

Report 1 and 2 will be a review style document. Read some reviews from either Trends in Ecology and Evolution or Trends in Microbiology to see how they are written. The first assignment will cover a review of DNA sequencing technology, why it is important and how it will be used in the future. Will sequencing technology affect you? The second assignment will review major findings in one of the fields of eukaryotic or microbial genomics, metagenomic, metatranscriptomics or viromics in the last 6 years. Both of these reports will need an abstract, introduction, headings of key sections and you have to take a position and defend that position. Correct citations will be used and at least 15 references will be needed in each. All reports will be given though turnitin. These reports will be 6-10 pages double spaced with 12 point font.

**The final written report** is a formal discussion of the sequenced genome or metagenomes. The body of the report should identify genes which are present and those which are missing, and discuss the ecological relevance of this variation. It should also describe how the metabolic function, taxonomic distribution, and diversity change with environment parameters or experimental manipulation, and how changes in the microbial community may affect the ecology of the ecosystem by comparing metagenomes/genomes collected from different environments. The final report will emulate a scientific paper in journal format, requiring abstract, introductions, methods, results and discussion. The report will be marked on content and presentation including, spelling, grammar, and correct referencing.
Biology 562: Ecological metagenomics

Syllabus

Make up for illness
This is a lab orientated course. Missing large sections of the course will result in students having difficulty completing the work. Make-up assignments may be given at the instructor’s discretion. If students are going to miss a class:
1. Prior notice must be given to the instructor if at all possible.
2. If last-minute severe illness or exceptional personal problems prevent a student from presenting results, the instructor should be notified by email (preferable) or phone as soon as possible, and definitely before class. Documentation will be requested.
3. Consideration will not be given for traffic delays, work-related conflicts or personal out-of-town travel.
4. Unavoidable conflicts with major sporting events for student-athletes, or academic activities should be kept to a minimum and documented by the appropriate university office. Documentation should be presented to the instructor during the first two weeks of class.

Posting grades
All grades will be posted on the Blackboard web site as soon as they are available. University rules prohibit grades to be emailed to students or posted in hallways.

Class requirements

Computers: Students will be required to record the steps they conduct in a webbased interface, therefore they will need to bring a laptop computer to class

Lab books: Students need to have an opening folder to place lab protocols in. 9 3/4 by 7 ½ inches preferred.

Students must wear closed-toe shoes to lab. SDSU policy states that students wear appropriate clothing in laboratory settings.

Academic dishonesty
I have a zero-tolerance policy for cheating of any sort. If you are caught cheating on an exam or report you will receive a grade of zero on that exercise. The incident will be reported to the campus judicial officer and may lead to disciplinary action by the University.