Capstone Seminar: BIOL 475-[Removed] - Biotechnology & Human Disease
Spring 2019

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Meeting Times: [Removed]
CRN: [Removed]

Subject:
Biotechnology is a term that essentially refers to any technology that is based on biology or biological processes. On the "simple" end of things, this includes making use of yeast or bacteria (and their metabolic processes) to produce alcoholic beverages or modified dairy products such as cheese or yoghurt, as well as using bacteria for bioremediation after an oil spill or selectively breeding plants and animals for agriculture.

More modern uses of biotechnology include the production of renewable biofuels, the design of genetically modified crops to feed the growing world population, and – the focus of this seminar – the application of technology to improve our understanding of human disease with the goal of achieving early, accurate diagnoses and successful treatments. Examples of this include:

- Bioinformatics/ computational biology: the use of computers to analyze large data sets to identify disease markers or evaluate susceptibility to a disease
- Biopharmaceutics: genetically engineering microorganisms to produce antibiotics or other useful products (ex: insulin)
- Pharmacogenomics: analyzing the genome to correlate individual differences with the response to a drug, including the likelihood of side effects
- Genetic testing/screening for disease markers
- Gene therapy is still in the early stages, but refers to changing a person's genome to modify disease risk or severity, or to cure an existing condition

Format of the course – a "Journal Club":
Because biotechnology is a rapidly evolving field, it is not ideally suited for textbook-based learning. By the time a new technique makes its way into a book, it is often already being replaced by a newer version that is faster, cheaper and more precise. Therefore, the reading materials for this class will be based entirely on current research articles, which students will present to the class. Students are expected to read all articles, not only the one(s) they are presenting, as each presentation will be followed by a class discussion.

The papers you select, from whatever journal, must be **primary research** papers; that is, they present experiments the authors have done themselves, and include a *Materials and Methods* section detailing the experimental methods, a *Results* section describing the data, as well as *Introduction* and *Discussion* sections – just like a lab report (which is why we structure lab reports the way we do). If the paper you find doesn't have such sections and is a summary of the work of many different groups, it is a **review** paper. Journals often print two or three-page "mini reviews" which may be very useful to provide background for your paper, and they often relate to one or more primary papers in the same issue of the journal, which can be very convenient. However, the reviews are not themselves what you present in class – the primary research paper is, with the review and other papers acting to provide the necessary background information.

Resources:

Due to the rapid progress in the field of biotechnology, current research articles often utilize methods that have not yet made their way into a textbook. Therefore, if you are trying to learn about a particular technique, you will often need to find it online. However, you must be very careful to use only credible, scientific sources! Examples of some good sources are listed below.

- DNA Learning Center at Cold Spring Harbor Laboratories:
https://www.dnalc.org/
The first page is a listing of current news and one of the selected resources; click "resources" button to view all the available resources at the site. These include simulated experiments and excellent tutorials. The level is very basic.

- National Center for Biotechnology Information – National Library of Medicine/National Institutes of Health:
http://www.ncbi.nlm.nih.gov/
This site provides access to **PubMed** as well as many other resources. It will probably be the most useful place to look for an article.

- Kits:
Increasingly the materials and methods section of papers reports the use of commercial kits to do fairly complex procedures (and fails to explain how the kits work). Fortunately, the kit manufacturers (specified in parentheses after the kit is named) almost invariably have websites with a great deal of information about the kits and what they do.

Sequence of the course:

We will have one student presentation per meeting, lasting 20-25 minutes, followed by questions and a thorough class discussion of the article. Discussion will focus on the significance of the work in the context of research and medicine, the appropriateness of the methods used and the general experimental design, and significant details of the techniques used. We can also speculate on how the paper's technique will impact other areas of Biology.

Prior to starting the presentations there will be an informal class meeting (a "workshop") to help you find and choose a paper. You will need to bring a laptop or other internet-enabled device on this day.

All articles must be submitted to me via email and approved by me no later than ***[Removed]*** I will then post the articles to Blackboard so that all students have access to them ahead of individual presentations. *Failure to submit your article on time will result in the loss of 2 points per day after [Removed]* from your presentation grade, not to exceed 10 points total. If your article is not submitted at least a week before your presentation you cannot present and will not pass the class.
In addition, you must submit your presentation to me (via email) *at least 3 business days prior to presenting (this will always be on a Tuesday)*. Failure to do so will result in a loss of 3 points per day.

Presentations:

Do not cut your preparation time short on presentations – you cannot do passing work by reading the paper the night before. You will discover that any paper you select will require you to read several other papers (cited in it) in order to understand it well enough to present it, and this will take some time. Allow for this. Get to know your paper; highlight important passages, write in the margins, underline, write out questions.

You will probably want to use Power Point to show the figures in your article; aside from these, you may use any format you prefer. You are not expected to make a fancy presentation, but rather to convey the information in the paper in a clear, understandable way. This will often require you to introduce a technique that the class may not be

familiar with; in this case, you may need to include diagrams from sources other than your paper, or you may draw something on the board.

The goal of each presentation should be to provide a clear, organized overview of what the paper was about, *with particular focus on the methods used by the authors.* You don't have to go into detail explaining every single method used (though you should be able to answer questions about them if they come up), but rather, focus on the biotechnology aspect and how it is being applied in this case.

Some points that should be addressed include: What question were the researchers asking? Why is this an important question? *How did the technology used in the paper help them to answer this question*? Were these methods suitable, in your opinion? Why or why not? Were they able to answer their question conclusively? How do the results (figures!) answer the question? Do you agree with the conclusions the authors drew from the results? Could the results be interpreted differently? How is this work important to the field?
In a way, you are not just presenting the paper, but critiquing it as well (which will further continue in the general class discussion). If the authors did a poor job somewhere, whether with methods, results or conclusions- point it out! This is not your work; you are not expected to defend it. Simply present what is in the paper, and be prepared to participate in a discussion about the strong and weak points of the study.

Evaluation of Presentations:

What am I looking for in these presentations? First, of course, that you truly understood the paper you presented. This will involve your reading and understanding of some of the background material, not just the paper. When there is some fairly obvious question – such as "what kind of organism is this thing they're working with?" or "their data were all collected using a 'Schnellberg assay' – what's that?" - it's a very poor answer for the presenter to say "They didn't explain that." Due to page charges, research papers *never* explain everything but they do reference everything, so to get a fuller understanding you are going to have to follow up some references – that's the main job of the presenter, in fact. There may be times, it's true, when you are really stuck, but even then you can usually arrive at an educated guess with enough outside reading and help. Don't be a presenter and make it sound as if you only read the paper itself and nothing else.

In addition to understanding the paper, you will be evaluated on how well you convey this information to the class. Was the presentation well-organized, did you speak clearly and to the audience, were your visuals appropriate, etc.? Did you address a new biology-based technology, and explain it to the class?

Your participation at other people's presentations – by way of intelligent discussion – is also a significant factor in your grade. You are expected to have read the papers that will be presented ahead of time, and have a reasonable understanding of what the papers were all about. If you have questions, the discussion is a great time to ask these. *Sitting politely and silently through the whole class but only speaking when you have a presentation will result in at least a letter grade off on your final grade.* Absences mean, of course, that you can't participate at all and will affect your grade accordingly.

Midterm and Final exams:

The midterm and final exams in this course will each consist of two papers from the current literature. These will be included in the exam packet, together with a series of questions to be addressed about each paper. These papers will be selected to use some of the methods that you've been hearing about most during the semester and will allow you to demonstrate what you've learned about analyzing and interpreting papers in the field of biotechnology. Both are take-home exams, and you are permitted to use your notes, any textbooks you might find useful, and yes, the internet. *However, any instances of plagiarism (especially direct copying from websites) will be considered cheating and result in a zero on the exam*. Use the internet to help you understand the paper, if you wish (e.g. look up a specific method), but don't try to use it to answer the questions themselves.
You are NOT permitted to discuss the midterm or final exam with any other students in the class, or with any professor (Biology or otherwise) until after they have all been turned in.

Grading:

Your final grade in this course will be based on:
25% - participation in discussions*
40% - presentation
15% - midterm exam
20% - final exam

The grading scale is shown below and is the same scale used throughout VCU.
*Remember: if you are not present, you can't participate. This is a discussion-based class, and attendance is absolutely required. There are only 14 class meetings in total. While one or two absences for valid, documented reasons will not have a devastating impact on your grade, missing more than 3 class meetings will significantly lower your grade in this course.

Grading Scale:

90-100% A

80-89% B

70-79% C

60-69% D

Below 60%: F

Decimals will be rounded up or down based on universal math conventions (.4 and below rounds down, .5 and above rounds up).

Class schedule: (will be posted to Blackboard with names after the first class)

Date	**Class**
[Removed]	Introductions, Syllabus, Organization
[Removed]	Introduction to reading and presenting scientific articles **Workshop**: bring a laptop/iPad to class!
[Removed]	***Deadline to submit articles for presentations.***
[Removed]	*NO CLASS – SPRING BREAK*
[Removed]	***Midterm exams due by NOON.*** Last Day to withdraw with a "W" is [Removed]
[Removed]	No Class ***FINAL EXAM DUE***

Midterm: Posted to Blackboard [Removed] **Due [Removed]**
Final Exam: Posted [Removed] **Due [Removed]**

University Policies:

The required syllabus statements originally included here are maintained by the Office of the Provost and are regularly updated. To prevent the dissemination of information which may no longer be accurate or complete, the full text of the required syllabus statements have been removed from this document.

Students should visit http://go.vcu.edu/syllabus and review all syllabus statement information. The full university syllabus statement includes information on safety, registration, the VCU Honor Code, student conduct, withdrawal and more.