

MMBB 488/ 588: Genetic Engineering

Organization and goals of this course

This course is intended for students who have completed one semester of genetics, or one semester of microbiology and biochemistry. Genetic engineering in one form or another is an integral part of nearly all experimentally-based research in biology today. This course will cover the building blocks upon which current work is based. During the semester, we will discuss basic topics such as gene regulation, codon usage, and DNA replication as each pertains either to gene modification, or gene isolation. Special attention will be given to the use of gene knock-outs and replacements in both prokaryotes and eukaryotes to further our understanding of Downs Syndrome, aging, cystic fibrosis, and disease-resistance in plants. The last few weeks will detail some of the unexpected problems that been revealed by studies of transgenic organisms. We will pay special attention to how studies of unintended gene silencing have led to the development of RNAi techniques.

This course is intended to prepare you for future careers in science, medicine, and in allied fields. If there are specific topics that you feel will prepare you for your chosen future, or complete what you have learned in other courses, I will be glad to modify the lectures to teach those.

At least one lecture will be devoted towards discussing different approaches to reading, analyzing, and assessing scientific papers. Most of the lecture will come from research material published in various journals. If you are interested in going to the original articles, please contact me.

The following pages include a course outline, and a statement of course requirements and grading procedures.

Disability Support Services Reasonable Accommodations Statement:

Reasonable accommodations are available for students who have documented temporary or permanent disabilities. Please notify your instructor(s) during the first week of class regarding accommodation(s) needed for the course. All accommodations must be approved through Disability Support Services located in the Idaho Commons Building, Room 306.

885-6307

email at dss@uidaho.edu

website at <www.access.uidaho.edu> or www.webs.uidaho.edu/taap

Please note. I am required by the university to inform you of the following policy:

1. Unexcused absence from exams or failure to turn in an assignment at the specified time will be dealt with according to University of Idaho General Catalog section M of General requirements and Academic Procedures.

2. Acts of cheating or plagiarism in MMBB 488 can result in an automatic 0 pts for that exam or assignment. A zero on any exam or assignment will result in an automatic F as a final grade in the course. All parties involved in cheating or plagiarism are responsible and may be treated equally. Cheating is defined as acquisition of answers to test questions or assigned materials in a dishonest fashion. Plagiarism is defined as 1) using or substituting another student's writing in place of your own and/or using published material without providing corresponding citations. Plagiarism includes copying or paraphrasing another person's writing without significant changes in wording. You will be presented with information in three forms. The first comes from lectures, the second from text and handout readings, and the third from the primary literature. The book is meant to provide you with background, the handouts with basic principles and convenient reference tables, and the papers with the heart and soul of the field. The lectures are distilled from the papers. Each source may complement the others, but will not substitute for the others. You should attempt to pursue each source of information and integrate it with the rest.

Times and places; papers and tests.

MMBB 488/ 588 Genetic Engineering

Genetics is an analysis of the blueprints that shape and form every virus, cell, and organism. This course will present you with an introduction to how this knowledge is being applied to reveal, and in some cases alter, these blueprints.

The course will follow the outline I am giving below; it will not follow the chapters in the book. In order to prepare yourself for each lecture you will need to become familiar with the handouts that I give you and with the notes of previous classes. I will specify chapters of Primrose and Twyman (Principles of Gene Manipulation and Genomics 7th edition) so that you may obtain a brief overview of the methods and goals of genetic engineering. This book was chosen to bring us to a common ground. A number of topics in genetics, biology, and biotechnology that are reviewed in the text will not be reviewed in the lectures because you have had them in earlier courses. Since I will expect you to use those concepts in the course, you are still welcome to ask me in lecture to explain them to you, but the **decision to ask is yours**.

TOOLS AND TERMS

Week of 25 August

Section 1 (defining goals; model systems; basic function, properties, and organization of the gene; some characteristic differences between organisms; useful properties of bacteriophages, restriction enzymes, nucleic acid purification)

READ HANDOUTS AND Primrose and Twyman pp. 1-24; 36-61

WEEKS OF 1-8 SEPTEMBER:

Section 2 (transformation of bacterial cells; selectable vs. screenable markers; plasmids; vectors and cosmids; genomic libraries) Primrose and Twyman pp. 24-26; 61--87; 96-99.

WEEK OF 15 SEPTEMBER:

Section 3 (simple screening techniques; cDNA synthesis; gene isolation in bacteria)

READ HANDOUTS AND Primrose and Twyman pp. 75-90; 96-125; 323-332.

WEEK OF 22 SEPTEMBER :

Section 4 (DNA transfer to eukaryotic cells; development of simple cloning vehicles for yeast, animals, and plants; fate of DNA that has been introduced into cells.)

READ HANDOUTS AND Primrose and Twyman pp. 201-212.

GENE ISOLATION AND EDITING

Week of 29 September:

Section 5 (Science and the analysis of scientific papers).

READ HANDOUTS AND ESPECIALLY BE SURE TO READ PAPERS INDICATED DURING CLASS

WEEKS OF 6-13 OCTOBER:

Section 6 (Sophisticated screening techniques: gene isolation through chromosome walking, transposons, subtractive libraries)

WEEK OF 20 OCTOBER:

section 7 (Exploiting the genetic code, value of introns in maximizing gene expression, optimizing conditions for translation,)

READ HANDOUTS, INDICATED PAPERS.

WEEK OF 27 OCTOBER:

section 8 (protein targeting,)

READ HANDOUTS AND INDICATED PAPERS.

APPLIED GENETICS

WEEK OF 3 NOVEMBER

Section 9 (protein folding and stability; using chaperones to prevent aggregation)

READ HANDOUTS, INDICATED PAPERS, AND Primrose and Twyman pp.540-546.

WEEK OF 10 NOVEMBER

section 10 (protein folding and stability; using chaperones to prevent aggregation)

READ HANDOUTS, INDICATED PAPERS, AND Primrose and Twyman pp.540-546.

WEEK OF 17 NOVEMBER:

Section 11 (The effects of gene addition)

PAPERS DUE BY END OF WEEK FROM ALL STUDENTS IN 588 AND ALL 488 STUDENTS WHO ELECTED TO WRITE ONE.

READ HANDOUTS AND INDICATED PAPERS Primrose and Twyman pp.387-393.

Week of 24 November:

Fall Break

WEEK OF 1 DECEMBER:

sections 12-13 (The effects of gene removal; targeted recombination; sense and antisense; ribozymes)

READ HANDOUTS AND INDICATED PAPERS Primrose and Twyman pp.250-272; 306-319.

WEEK OF 8 DECEMBER:

section 14 (Understanding the unexpected: methylation, position effects, and transcriptional interference)

READ HANDOUTS AND INDICATED PAPERS Primrose and Twyman pp.338-349; 353-36; 404-406.

Class this year will be held in Life Science 163 Mondays and Wednesdays from 3:30-5:00.

Evaluation process

Students in **488/ 588** will be graded according to 4 criteria:

- The sum of the points earned from the 5-7 quizzes that will be given to you over the course of the semester,

The quizzes will be closed book. Each will be based either on the handouts and the text readings, or on 1-2 papers that will be given out previously. I will be testing you on either the reason certain controls or experiments were done, or on the conclusions of the paper. Questions will emphasize *the reasons things are done and the factors that determine success or failure* rather than specific details concerning the amounts of the materials used.

- The points earned from a closed book exam to be given on **19 September**,
- The points earned from a cumulative, open book final,

This will be “open book” meaning you can bring and use your notes, text, and any papers you feel would help you.

- **Students taking 588 will also submit a paper (see below) that will be due by 16 November**

(yeah-that is not a class day. I will accept papers anytime before the Thanksgiving break.)

Students taking 488 can choose to submit a paper *or instead* take a **second exam** to be given some time between **24 October** and **7 November**.

- If you choose the exam, and there are no unexpected disruptions of the schedule, then you will be given in the preceding week a series of papers and/ or questions to prepare at home. The exam will then ask you to discuss and analyze some of those questions and/ or papers.

Every quiz and exam will include additional questions that must be answered by students in **588**.

At the end of the course, all earned points will be summed and scaled. 488 and 588 students will be scaled independently.

I have office hours following each class, but you are welcome to come by to talk with me about this or about the course any time. My office and lab are in rm 164b/ 161 Life Science Bldg. Early mornings are the best time to catch me.