

Fall, 2009

PBIO/BIOL 3020 – Genomic Biology

The term ‘Genomics’ covers the advances that have been made in the development of tools and technologies that allow high-throughput mapping, sequencing and functional analysis of genes. The era of genomics started with the sequencing of the human genome and currently, the full genomic sequence of several eukaryotic organisms is available. The course will cover tools, applications and ethical concerns related to genomics. It will provide students with an insight into cutting edge technologies and how they are used to enhance our understanding of how genes function. The course is intended for students that have had a modern introduction to biology. We will make every attempt to accommodate students with different backgrounds, although the course will remain rigorous.

All academic work must meet the standards contained in ‘A Culture of Honesty’. Students are responsible for informing themselves about those standards before performing any academic work.

The link to more detailed information about academic honesty can be found at:

<http://www.uga.edu/ovpi/honesty/acadhon.htm>

Instructors

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Office hours: Please make an appointment with the instructor; Drop-in’s will be accommodated whenever possible.

Miscellaneous

When: Tuesday – Thursday, 2.00 – 3.15 pm

Where: Miller Plant Sciences Bldg. Room 1503

Final exam: Friday 11th December 3.30 – 6.30 pm

Textbook

There is currently not a single handbook that covers the materials taught in PBIO 3020. Some materials are taken from the textbook ‘**Genomics**’ by **Phillip N. Benfey and Alexander D. Protopapas**. This book provides slides and some text, but no background information. Some teaching materials are also taken from ‘**Modern Genetic Analysis: Integrating Genes and Genomes**’ by **Anthony J.F. Griffiths, William M. Gelbart, Jeffrey H. Miller and Richard C. Lewontin**, which is a standard-form textbook. I would recommend this book in particular for students without a genetics background. The slides for each class will be posted on WebCT.

Every attempt will be made to post the slides 24 hrs before each class. For a few classes, you may be asked to search the ‘popular press’ – newspapers, magazines, etc. for articles related to some of the genomics issues discussed in class. These articles will provide supplemental material that will help us explore the ramifications of a genomic perspective on biology. For the ethics classes, students are asked to work in small groups to find information on a given ethic-related topic, present the material to the class and lead a discussion on the topic.

Attendance

Class attendance will not be taken. It is the responsibility of the student to ensure that he/she is up-to-date with course materials. Please note that, although the slides presented in each class will be available on-line, both written and verbally covered materials are required knowledge for the exams. Please take copious notes. Furthermore, in-class/home exercises and quizzes will be given to help students understand the materials and link different parts of the syllabus. No prior notification will be given of quiz and exercise dates. Students are therefore strongly advised to attend all classes. Please arrive on time and avoid leaving early.

Cell phones

Please turn off cell phones before entering the class room. Using your cell phone (for talking, sending text messages, playing games, etc.) during class will not be tolerated.

Computers

Computers are to be used for taking notes only and not for playing games or surfing the web. If a student is caught using a computer in class for non-class related activities, he/she will be banned from using a computer in the class room.

Grading

The class includes three midterm exams, each of which will account for 15% of the total grade. During some classes, exercises and/or quizzes will be given. Turning in a completed exercise will yield 1 point. Answering 3 out of 4 questions on a quiz correctly will also yield 1 point. A bonus of 3% will be given to students that have answered 75% of all questions (totaled over all exercises and quizzes) correctly. The total amount of points that can be gained from home exercises and quizzes is thus 15, that is 15% of the total grade. Home exercises need to be handed in at the start of the next class. The ethics presentations will account for 10% of the final grade. The final exam will account for 30% of the grade (5% on the last series of classes and 25% cumulative).

3 midterm exams (@15% each): 45%

Home/Class assignments: 15%

Ethics presentations: 10%

Final exam: 30%

Tentative Syllabus

This syllabus is 'tentative' because it will no doubt require fine-tuning as we proceed. Some material may require more time and some less than originally anticipated. *Your feedback and suggestions will be essential to arriving at a syllabus that is both rigorous and stimulating.*

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| Tue 18 th Aug.
KMD | 1. Review: Genomes, DNA and Genes |
| Thu 20 th Aug.
KMD | 2. Definition and technical foundations of genomics <ul style="list-style-type: none">- What is genomics?- Recombinant DNA technology- Library construction and screening |
| Tue 25 th Aug.
XZ | 2. Definition and technical foundations of genomics (cont.) <ul style="list-style-type: none">- DNA sequencing- Polymerase chain reaction |
| Thu 27 th Aug.
XZ | 3. The structure of genomes <ul style="list-style-type: none">- Genome size and C-value paradox- Classes of repetitive DNA |
| Tue 1 st Sept.
XZ | 4. Sequencing <ul style="list-style-type: none">- Whole genome sequencing- Physical mapping- BAC by BAC sequencing approach- Whole genome shotgun sequencing |
| Thu 3 rd Sept.
XZ | 4. Sequencing (cont.) <ul style="list-style-type: none">- Sequencing the gene space- Expressed sequenced tags- Other gene-enrichment techniques |
| Tue 8 th Sept.
XZ | 4. Sequencing (cont.) <ul style="list-style-type: none">- Second generation sequencing methodologies<ul style="list-style-type: none">- 454, Solexa, SOLiD- Third generation sequencing technologies<ul style="list-style-type: none">- Real-time sequencing of single DNA molecules |
| Thu 10 th Sept.
KMD/XZ | Exam 1 |
| Tue 15 th Sept.
KMD | 5. Bioinformatics <ul style="list-style-type: none">- Sequence databases: entries and access |

Thu 17 th Sept. KMD	5. Bioinformatics (cont.) <ul style="list-style-type: none"> - Sequence alignments <ul style="list-style-type: none"> - Global and local alignments - Alignment methods (dot matrix, blast, blat) - Genome annotation KMD/XZ
Tue 22 nd Sept. KMD	6. Mapping <ul style="list-style-type: none"> - Why is mapping important - Markers
Thu 24 th Sept. KMD	6. Mapping (cont.) <ul style="list-style-type: none"> - Review of Mendelian Genetics
Tue 29 th Sept. KMD	6. Mapping (cont.) <ul style="list-style-type: none"> - Genetic map construction - Map-based gene cloning
Thu 1 st Oct. KMD	6. Mapping (cont.) <ul style="list-style-type: none"> - Class exercises
Tue 6 th Oct. XZ	7. Expression Analysis <ul style="list-style-type: none"> - Individual Genes <ul style="list-style-type: none"> - Northern Analysis - Real-time PCR
Thu 8 th Oct. XZ	7. Expression Analysis (cont.) <ul style="list-style-type: none"> - Genome-wide analysis <ul style="list-style-type: none"> - Microarrays
Tue 13 th Oct. KMD/XZ	Exam 2
Thu 15 th Oct. XZ	8. Comparative Genomics <ul style="list-style-type: none"> - Aims of comparative studies
Tue 20 th Oct. XZ	8. Comparative Genomics <ul style="list-style-type: none"> - Applications
Thu 22 nd Oct. XZ	8. Comparative Genomics (cont.) <ul style="list-style-type: none"> - Techniques
Tue 27 th Oct. XZ	9. High-throughput genetics <ul style="list-style-type: none"> - Forward genetics
Thu 29 th Oct. XZ	9. High-throughput genetics (cont.) <ul style="list-style-type: none"> - Forward genetics (cont.) - Reverse genetics

Tue 3 rd Nov. XZ	9. High-throughput genetics (cont.) - Reverse genetics (cont.)
Thu 5 th Nov. XZ	Exam 3
Tue 10 th Nov. KMD	10. Genomics Applications (cont.) - Genomics and medicine
Thu 12 th Nov. KMD	10. Genomics Applications (cont.) - Pharmacogenomics
Tue 17 th Nov. KMD	10. Genomics Applications (cont.) - Genomics in agriculture
Thu 19 th Nov. KMD	11. Ethical issues of genomics - Student presentations & discussion
Tue 24 th Nov.	<i>Thanksgiving holiday</i>
Thu 26 th Nov.	<i>Thanksgiving holiday</i>
Tue 1 st Dec. KMD	11. Ethical issues of genomics (cont.) - Student presentations & discussion
Thu 3 rd Dec. KMD	11. Ethical issues of genomics (cont.) - Student presentations & discussion - Question time: time for students to ask questions/clarifications on course topics
Tue 8 th Dec.	<i>No class (Friday class schedule on December 8th)</i>
Fri 11 th Dec. 3.30 – 6.30 pm	Final Exam