

UN1130, Genes and Development

Tuesdays and Thursdays, 2:40-3:55

Uris 331

Syllabus

Spring, 2023

Instructor:

Professor Tulle Hazelrigg

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Office hours: Fridays, 11:00 AM-12:00 PM by Zoom (and by appointment)

Graduate Teaching Assistant:

Ben Wesley

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Office hours: Tuesdays, 6:00-7:00 PM, Fairchild Conference Room 607 (and by appointment)

Required Text, available on reserve and as an e-book at the Columbia library:

** - Julia E. Richards and R. Scott Hawley. The Human Genome, A User's Guide, 3rd Edition. Academic Press/Elsevier, 2011. (Listed as "Richards" in Readings.) Note: the library has 2 e-book editions - be sure to use the 3rd edition. The library also has 2 copies of the print version on reserve at the Science and Engineering Library.

Additional books, on reserve at the Columbia Science and Engineering Library:

- Scott F. Gilbert, Anna L. Tyler, Emily J. Zackin. Bioethics and the New Embryology: Springboards for Debate. Sinauer Associates, 2005. (Listed as "Gilbert *et al*" in Readings.)

- Anthony J.F Griffiths *et al.*, Introduction to Genetic Analysis, 11th edition, W. H. Freeman and Company, 2015.

- Philip Kitcher, The Lives to Come: The Genetic Revolution and Human Possibilities. Simon and Schuster, 1996.

- Alice Wexler, Mapping Fate: A Memoir of Family, Risk and Genetic Research. University of California Press, 1996.

Scott Gilbert, Developmental Biology 10th edition Sinauer Associates, 2014.

Ricki Lewis, Human Genetics: Concept and Applications, 12th edition. McGraw Hill Education, 2018.

Readings:

The **main readings** listed in the syllabus are from the Richards and Hawley textbook. The library has 2 copies on reserve, and you also have access to the library's e-Book copy (be sure to access the 3d edition e-book, not the earlier edition). There are some recommended readings in Gilbert *et al* and Griffiths (in parentheses) and one assigned reading in Gilbert *et al*. I may add assigned readings in other books that are on reserve. Note that Gilbert *et al* (Bioethics and the New Embryology) also has very useful chapters on several of the topics that we address in the ethics and societal issues workshops.

On Courseworks, I will provide you with PDFs of scanned copies of any required readings listed in the syllabus that are not in the Richards book. I will also assign additional articles and other readings as the semester progresses. These are required reading. Please

check Courseworks regularly, as I will post these readings in the Files or Assignment sections. When time permits, class discussions will address these articles.

Students are strongly encouraged to scour the news media on a daily basis for articles that are relevant to the topics being discussed in class. Please feel free to share interesting news articles with the class - send them to me, and I will post them on Courseworks.

Workshops

There are five student-run workshops devoted to the analysis and discussion of societal and ethical implications of selected topics. Each workshop is preceded by lectures that cover the relevant biology. It is my goal that each workshop will be strongly influenced by the science, but that students will find new and interesting perspectives on these topics.

Early in the semester I will hand out a workshop preferences form, which you should fill out from 1 (most preferred workshop) to 5 (least preferred). Please turn in the form to Prof. Hazelrigg in the next class. I will try to match everyone with one of their top choices.

Each workshop will consist of a presentation by 4-6 **workshop presenters** followed by a discussion of news articles. The workshop presenters will be expected to each research a topic they choose, and work together to prepare and coordinate a PowerPoint presentation, formulate and present questions to stimulate discussion, and select and agree upon two news articles to assign for class discussion during the workshop. These articles must be emailed to Prof. Hazelrigg and Ben Wesley, our graduate student TA, at least 2 days before the workshop so that they can be posted on Courseworks for students to read before class.

Your PowerPoint presentation should include references on the slides to indicate the source of any figures and information. It is important that you coordinate the presentations so that everyone in the workshop gets equal time to present, and also so enough time is left for discussion at the end.

Ben Wesley will meet with each group of presenters no later than the week preceding their workshop, to go over the plans for the workshop. This meeting is required, and Ben will email you to arrange a time. Bring an outline for your workshop to this meeting, a draft of PowerPoint slides you have made, and a list of possible articles to assign. In addition, you can arrange to meet with him before this to discuss your ideas about possible topics for your workshop.

Workshop questions. 1) Each class member must submit two questions, one on each of the assigned articles, to be handed in at the beginning of each workshop. Please be sure to put your name on these, as they are scored and count towards your final grade. These questions are intended to stimulate discussion, so they will not be accepted after the beginning of class. 2) The workshop presenters must also include a slide in their PowerPoint presentation with a list of the questions that they pose for class discussion.

Please submit the Powerpoint file of your presentation (with every presenters' slides in it) in the assignments section of Courseworks by 5:00 PM the day before the workshop. The very latest you can submit your PowerPoint is noon the day of the workshop, but it is much preferable to submit it by 5 PM the day before. Choose one member of your group to do this. In your Powerpoint, please indicate which sections were prepared by which person. In addition, please email a copy of your powerpoint presentation to Professor Hazelrigg as a backup, so we can be sure to show it in class the next day.

Exams and Grades

There are 4 exams: 3 during the semester, and one cumulative exam during finals week. All 4 exams have the same weight (each is worth 25 points). You will be allowed to drop one exam, so that the highest 3/4 exams will count for your final grade; thus each will equal 25% of your grade (75% total for exams). If you are sick for an exam, or absent for another reason, you can count that as your one dropped exam. (But if you have a doctor's excuse, and want to do a makeup for a missed exam, please talk to me.) If you are satisfied with your grades on the first 3 exams, you do not need to take the final.

Performance in workshops will count for 25 points, and thus constitutes 25% of your grade: 21 points for the presentation and questions you pose in your workshop, and 4 points for the questions that you hand in as a workshop audience member at the other 4 workshops.

Disability Accommodations:

In order to receive disability-related academic accommodations for this course, students must first be registered with their school Disability Services (DS) office. Detailed information is available online: Columbia - <https://health.columbia.edu/content/disability-services>; Barnard - <https://barnard.edu/disabilityservices>.

Class Schedule

Date

Reading

1/17 **Course Overview; Model Organisms**

1/19 **Mendelian Genetics**

Richards ch 1, 3-15

1/24 **Chromosome Theory of Inheritance; Inheritance Patterns**

Richards ch 2, 57-67; ch 1, 15-25 and 34-39; ch 7, 262-268

1/26 **DNA: Structure and Function**

Richards ch 2, 41-56

1/31 **Analysis of DNA**

Richards ch 2, 71-77; ch 5, 153-159

2/2 **Gene Expression I: Transcription**

Richards ch 3, 83-102; (Gilbert *et al*, ch 11, 179-191)

2/7 **Gene Expression II: Translation, The Code, RNA Processing**

Richards ch 4

2/9 **EXAM 1 (7 lectures, 1/17--2/7)**

2/14 **Workshop: Uses and Misuses of DNA Information**

2/16 **Mutations I**

Richards ch 5, 143-153, 159-192

2/21 **Mutations II**

2/23 **Transposable Elements**

(Griffiths et al, ch 15)

- 2/28 **Recombinant DNA and Genetic Engineering I** Richards ch 2, 67-71
 3/2 **Recombinant DNA and Genetic Engineering II** TBA
- 3/7 **Gene Therapy** Richards ch 14
 3/9 ***Workshop: Genetically Modified Organisms***
- 3/13 - 3/17 **SPRING BREAK!**
- 3/21 **Mitosis, Meiosis, and Aneuploidy** Richards ch 6, 199-230, 236-245
 3/23 ***EXAM 2 (6 lectures + 2 workshops, 2/14 - 3/9, NOT including 3/21 lecture)***
- 3/28 **Germ Cells, Fertilization, and Artificial Reproductive Technologies (ART)** Richards, ch 13, (Gilbert *et al* ch 3)
 3/30 **Steroid Hormones and Gene Expression** Richards ch 3, 102-104
- 4/4 ***Workshop: Artificial Reproductive Technologies***
 4/6 **Sex Determination** Richards ch 8, 273-287, (Gilbert *et al*, ch 5)
- 4/11 ***Workshop: Uses and Abuses of Steroids***
 4/13 **Reproductive Cloning** Gilbert *et al* ch 7
- 4/18 **Epigenetics** Richards ch 3, 104-106; ch 7, 247-259
 4/20 ***Workshop: Reproductive Cloning***
- 4/25 **Lessons From a Shameful Past: the Case of Eugenics** Richards ch 15
 4/27 **Exam 3 (7 lectures + 3 workshops, 3/21 - 4/25)**
- 5/1 **Monday - last day of classes**
 5/2-5/4 **Reading Period**
- 5/5-5/12 **Final Exams**