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BIOH 191.01: GLI - Human Genetics and Personalized Medicine

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Human Genetics and Personalized Medicine

3 credits

Fall 2014

Instructor: Dr. Sarah Certel
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Office Hours: T (3:30-5), F (10-11)

Lectures: TTH, 2:10-3:30

Location: LA 337

Textbooks: Human Genetics: Concepts and Applications by Lewis, 10th Edition.

Resources: The publisher provides online resources for students who purchase the 10th edition. Go to the provided link and set up your account.

Web Page: Additional reading assignments will be provided as PDF documents posted on the class Moodle page and/or electronically distributed to students' University e-mail accounts.

Course Description:

This course will address two fundamental biological and societal questions; how do genes direct and/or influence our health and how do economic, ethical, and political issues affect the implementation of personalized medicine. In the first unit, the material covered will give students a practical knowledge of the principles of human genetics, which will serve as a foundation to understand inherited diseases and the application of genetic testing information. This unit will cover the basics of heredity namely what is a gene and the patterns of gene inheritance. We will also address how individual gene variation affects health risks, the interpretation of genetic tests, and how we as a society view genetic differences.

In the second part of the course, students will learn how a broad range of issues impact the application of personalized medicine. Personalized medicine is the customization of healthcare - with medical decisions, practices, and/or products being tailored to the individual patient. Advances in medical genetics are enabling individualized medicine to be practiced in a reactive measure, i.e. treatment after the signs and symptoms appear, as well as tailor preventative treatments by assessing the genetic risk factors associated with an individual's genomic sequence. In this new era of genomic technologies, we will explore Hippocrates quote, "It is far more important to know what person the disease has than what disease the person has." We will view the movie GATTACA and discuss whether we are more or less than our genetic diagnosis and how this information could change the way we assess ourselves. Additional topics covered in this section include: pharmacogenetics, the use of personal genetic information in clinical medicine, and ethical, legal, and social issues concerned with genetic testing. Finally, we will discuss how governmental policies affect the safety of genetic testing and the security of genetic databases.

This course will:

- Provide sufficient background to understand the biology of genes and genetic issues as they relate to family inheritance, genetic test results, and various disease conditions.

- Give students a solid foundation in genetic terminology and concept. This knowledge may be applicable to current health situations in students' lives or can be built upon to understand future health challenges and participate knowledgeably in political discussions.
- Enable students to discuss how our genetic variations affect how we describe what makes us the same and what makes us different as human beings.
- Promote an understanding of the impact of human genetics on individuals and society.

Students will be able to: (Learning outcomes):

- Understand what a gene is, the information in a pedigree, and describe methods of inheritance.
- Describe the contribution genes make to the development of a specific disease or disorder.
- Describe the contribution genes, chromosomes, and transposable elements make to a unique individual.
- Analyze the purpose, strengths and limitations of current and emerging genome technologies.
- Contribute to a discussion on "race" as a social category vs. a biological category

Course Format and Grading: This course will 1) utilize a lecture format to teach core concepts, 2) case study examples to demonstrate and apply the core concepts, and 3) animations and videos to complement the lecture and textbook content. The first segment of each class period will be given in a lecture format while the second segment will be a discussion of the topic covered with an emphasis on personal experiences and practical implementations. Student led discussions of a NY Times article will also take place during the second half of the class period.

Exams will include multiple choice questions and short essays.

Exams will cover at least these three components:

Exam I: Students will define critical genetic terms, describe the basic methods of inheritance, and discuss genetic variation.

Exam II: Students will be required to describe the principles of genomic testing and how our genetic variation can affect an individual's health.

Comprehensive Exam: Comprehensive questions and a short essay on the global economic and ethical implications regarding how our genetic differences and similarities affect the world and potential curing of genetic-based diseases.

Grading:

Points will be assigned as follows:

<i>Exam 1</i>	80 pts
<i>Exam 2</i>	80 pts
<i>Comprehensive Exam</i>	100 pts
<i>Pre Test</i>	10 pts
<i>Post Test</i>	10 pts
<i>Case Studies (3/20 pts)</i>	60 pts
<i>Newspaper article Comments (2/20)</i>	40 pts
<i>Group presentation on Personalized Medicine Issue</i>	60 pts

Writing Essay 60 pts
500 pts

Lecture and Discussion Schedule:

	<i>Instructor</i>	<i>Ch.</i>	<i>Topic</i>
Section 1: What makes us genetically the same? What makes us genetically different?			
August 26	Certel	1	What is Genetics?
August 28	Certel	1,13	Genes and Chromosomes I
Sept 2	Certel	1,13	Genes and Chromosomes II (Mosaicism)
Sept 4	Certel	19.1,11	The Human Genome: who owns our DNA sequences
Sept 9	Certel	12	Genes: what are mutations, polymorphisms?
Sept 11	Certel	10	Genes: what are they good for? (Protein)
Sept 16	Certel	2	Individual Genomes: copy number variants
Sept 18	Certel	11	Individual Genomes: Transposable Elements,
Sept 23	Certel	4,6	Gene Relationships: Understanding Pedigrees
Sept 25	Certel	4,6	Understanding Crosses and Pedigrees II, Review
Sept 30	Exam I – Genes, Mutations, and Inheritance		
Section 2: How does what makes us genetically different affect our health?			
October 2	Certel	6	Gene expression: epigenetics
October 7	Certel	8, AR	Gene expression: epigenetics & behavior
October 9	Certel	6	Gene expression: Sex Chromosomes
October 14	Certel	7.4	Principles of genomic technologies (GWAS), Direct-to-Consumer applications
October 16	Woodahl (BMED)		Gene Variation and Drug Response
October 21	Certel		Disease Transmission: prions
October 23	Wetzel (BIOL)		Pesticides and Risk Factors
October 28	Certel	20	Genetic information regulation, Cost of Gene testing, Genetic engineering
October 30	Exam II – Genes, Genetic Testing, and Disease		
Section 3: How do our genetic differences and similarities affect the world?			
Nov 4 and 11 (No class – Election Day and Veterans Day)			
Nov 6	Certel		Movie Gattaca
Nov 13	Certel		Movie Gattaca; Discussion
Nov 18	McCaffrey (Writing Ctr)		Writing Center: Essay on Ethical Issue
Nov 20	Certel		How do we assess ourselves genetically/How do we assess others; health care, group assignments

Dec 2	Jeanne Loftus/Group Presentations	Global Issues
Dec 4	Group Presentations	Global Issues

Comprehensive Exam: Ethical and Societal Implications of Genetic Engineering & Testing

GLI Students must attend **TWO lectures selected from the list below.**

News in the Age of Snowden: What investigations of leaks to reporters tell us about the World

William Glaberson, former New York Times reporter
Monday, September 29 at 7pm in the UC Theater

It's the Oil, Stupid: The Oily Aspects of the Current Wars in Iraq, Syria and Other Hot Spots on Five Continents

Michael Schwartz, founding director, College of Global Studies, Stony Brook University (SUNY)
Wednesday, October 22 at 8pm in the Dennison Theatre

First-Year Reading Experience Book, "The Things They Carried"

Tim O'Brien, author
Tuesday, October 28 at 8pm in the Dennison Theatre

Do Words Kill? Hate Speech, Propaganda and Incitement to Genocide

Elizabeth White, Research Director of the Center for the Prevention of Genocide
Wednesday, November 5 at 7pm in the UC Theater

The Riddle of Sustainability: A Surprisingly Short History of the Future

William Cronon, Professor of History, Geography, and Environmental Studies, University of Wisconsin-Madison
Monday, November 17 at 8pm in the Dennison Theatre

Ukraine, Russia and the West: Crisis, Causes and Consequences

Robert D. English, Professor and Director, School of International Relations, University of Southern California
Monday, December 1 at 8pm in the Dennison Theatre

In the Pavilion of Snow Oxen — Big Animals in an Increasingly Peopled World

Joel Berger, Professor of Wildlife Conservation
Tuesday, December 2 at 6pm in the UC North Ballroom