

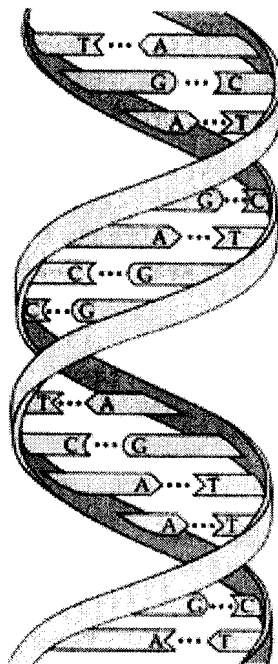
# **NATURAL SCIENCE II: HUMAN GENETICS**

V55.0303  
Autumn 2006

Mondays and Wednesdays  
9:30 AM – 10:45 AM  
Room 207 Silver

## **Professor Stephen Small**

Department of Biology  
10<sup>th</sup> floor Brown Building  
Phone: 998-8244  
E-mail: [sjs1@nyu.edu](mailto:sjs1@nyu.edu)  
Office Hours: By email appointment



## **1. Course Description**

We are witnessing a revolution in human genetics, where the ability to scrutinize and manipulate DNA has allowed scientists to gain unprecedented insights into the role of heredity. This course explores the foundations and frontiers of modern human genetics, with an emphasis on understanding the latest discoveries in this rapidly changing field of research. The course begins with an overview of cell structure and cellular processes. We then examine the principles of heredity, where simple Mendelian inheritance is contrasted with the effect of multiple genes and the environment that influence complex physical or behavioral traits. Descending to the molecular level, we investigate how genetic information is encoded in DNA, and how this information is unfolded during the process of development. We also examine how mutations affect gene functions, and cause birth defects, diseases, and cancers. Finally, we will cover new techniques that permit profound manipulations of the genetic material. These molecular foundations are used to explore the science and social impact of modern genetic technology, including topics such as cloning, genetic testing, and the new map of the human genome. The laboratory projects throughout the semester are designed to introduce students to techniques currently used by scientists, ranging from diagnosing inherited traits using family pedigrees to hands-on explorations of modern methods of genetic testing.

## **2. Course Objectives**

- To acquire a foundation of knowledge of the biological mechanisms of inheritance.
- To understand the technological advances that will shape the future of our world.
- To develop skills in problem solving and interpreting scientific information.
- To engage in various methods of scientific investigation in the laboratory.
- To critically evaluate popular media reports on the latest developments in genetics research.
- To address the complex ethical, social and legal consequences of genetic information.

## **3. Course Texts and Readings**

### **Required Texts:**

Ricki Lewis, *Human Genetics: Concepts and Applications, 7<sup>th</sup> Edition* (McGraw Hill, 2005).

Gilbert, Tyler, and Zacklin, *Bioethics and the New Embryology* (Sinauer, 2005).

*Human Genetics Laboratory Manual* (NYU – Autumn 2006)

### **News Articles:**

A few articles about recent discoveries in genetics from *The New York Times* or other sources will be assigned throughout the semester as part of the required readings.

## 4. Lecture, Reading, and Laboratory Schedule

Readings from Lewis, *Human Genetics*:

“L” followed by the chapter or page numbers.

Readings from Gilbert et al:

“G” followed by the chapter or page numbers.

<u>Date</u>	<u>Lecture/Laboratory</u>	<u>Reading</u>
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#1	W Sept. 6	Introduction and Course Overview	
No labs this week			

### Module 1: Cells, Chromosomes, and Genes

#2	M Sept. 11	Basic Cell Biology	L 21-33;
#3	W Sept. 13	Structure and Replication of DNA	L 3; 5-6; 171-182 PDF -Rosalind Franklin

Sept. 11, 12 Lab 1: Microscopy of cells

#4	M Sept. 18	Chromosomes and Mitosis	L 33-37; 241-250
#5	W Sept. 20	What is a Gene?	L 185-197
<u>Sept. 18, 19</u> Lab 5: Isolation of DNA			****(Media Project groups assigned here)

#6	M Sept. 25	Mutations and What Causes Them	L 217-232
#7	W Sept. 27	Mutations and What Causes Them II	
<u>Sept. 25, 26</u> Lab 2: Mitosis			****(Homework 1 due here)

### Module 2: Mendel and Meiosis

#8	M Oct. 2	Mendel's Laws	L 75-91
#9	W Oct. 4	Meiosis	L 49-53; 251-257

Oct. 2, 3 Lab Session: Review for Exam I

	M Oct. 9	No Class (Columbus Day)	
	W Oct. 11	Midterm Exam I (up to Lecture 8)	
<u>Oct. 9, 10</u> No labs (Columbus Day)			

#10	M Oct. 16	Sex-linked Traits	L 121-128
#11	W Oct. 18	Exceptions to Mendel	L 64; 95-98; 100; 101-106 G Chapter 14
<u>Oct. 16, 17</u> Lab 3: Fly lab			****(Homework 2 due here)

#12	M Oct. 23	Multifactorial Traits	L 9-10, 135-151
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### **Module 3: Human Variation**

#13	W Oct. 25	Population genetics What is normal?	L 267-272 G Chapter 13
<u>Oct. 23, 24      Lab 4: Human Genetic Traits</u>			
#14	M Oct. 30	DNA Sequencing, Genomics	L 433-441
#15	W Nov. 1	DNA as an Identifier I	L 180-181; 267-279; 379-380
<u>Oct. 30, 31      Lab 6: Sickle Cell Anemia</u>			****(Media Project proposals due here)
#16	M Nov. 6	DNA as an Identifier II	PDF: John Doe Warrants
#17	W Nov. 8	Sex Determination	L 113-120 G Chapter 5+6
<u>Nov. 6, 7      Lab Session: Review for Midterm Exam II</u>			****(Homework 3 due here)
<b>M Nov. 13      Midterm Exam II (up to Lecture 16)</b>			
#18	W Nov. 15	Genetics of Behavior	L 155-167 PDF –Girl feels no pain
<u>Nov. 13, 14      Lab 7: DNA Fingerprinting</u>			

### **Module 4: Reproduction and Development**

#19	M Nov. 20	Reproductive Biology	L 53-55; 417-429 G Chapter 3+4
W Nov. 22      No Class –Thanksgiving			
<u>Nov. 20, 21      No Labs -Thanksgiving</u>			
#20	M Nov. 27	Introduction to Development	L 56-62 G Chapter 1+2
#21	W Nov. 29	Stem Cells I	L 39-43; L 385
<u>Nov 27, 28      Lab Session: Student Presentations I</u>			****(Homework 4 due here)
#22	M Dec. 4	Stem Cells II	G Chapter 9+10

### **Module 5: Genetic Engineering**

#23	W Dec. 6	Cloning by Nuclear Transfer	L 58-59 G Chapter 7+8
<u>Dec. 4, 5      Lab Session Student Presentations II</u>			
#24	M Dec. 11	Gene Therapy	L 397-414 G Chapter 11+12
#25	W Dec. 13	Our wonderful future	L 67-70; 322-325
<u>Dec. 11, 12      Lab session: Review for Final Exam</u>			
<b>W Dec. 20      Final Examination      8:00 AM – 9:50 AM in 207 Silver</b>			

## 5. Grades

Midterm Exam 1	15 %	Wednesday, October 11, 9:30 AM– 10:45 AM
Midterm Exam 2	15 %	Wednesday, November 13, 9:30 AM – 10:45 AM
Final Exam	25 %	Wednesday, December 20, 8:00 AM – 9:50 AM
Laboratory	25 %	
Homework	10 %	
Media Report	10 %	

## 6. Coursework and Policies

### Exams

- The exams will contain questions covering the **lectures, readings, and laboratory projects**. Study questions for the lecture topics will be distributed at least one week before each exam. The final exam will be **cumulative**, but will be more heavily focused on material covered after the second midterm. Homeworks provide practice with some types of questions that will appear on the exams.
- If you miss **one midterm exam** because of illness, you must contact Professor Small by e-mail **before** the start of the exam and provide a doctor's note explaining your absence. **No make-up exams will be given for the course**. Instead, the final exam will count as **40% of your course total**. Since the final is cumulative and the most difficult exam of the course, this option is not advisable unless extreme circumstances prevail. If you miss **two midterm exams** you will be required to withdraw from the course.
- A make-up will be given for the final exam only under **exceptional circumstances** that must be discussed with Professor Small **prior to the exam**. In this case a grade of **incomplete** will be given for the course and the make-up will be scheduled for the Spring 2007 semester. No alternative date for the final exam will be offered, so avoid making travel plans to leave NYU before 12/20/06.

### Homework

- Four homework assignments will be given during the course of the semester. Homeworks will be posted on Blackboard, and will be due in specific laboratory sessions according to the syllabus. They will contain questions that review the course material and/or questions that relate to the laboratory. Each assignment will contain several questions, of which **one will be graded**. Assignments are worth 5 points, with up to 3 points for the graded question and 2 points for completing all the questions. Homework must be submitted on time for full credit. Any late assignments will be penalized 1 point per day (excluding weekends).

### Media Project

As part of the course requirements, you will be assigned as part of a media project team of three students. This team will work collaboratively on selecting and evaluating a topic on modern genetics that appeals to your interests. The topic declaration for the project is due in the lab session on October 30 or 31. The team will then prepare an oral presentation that will be delivered in the laboratory sessions on November 27 or 28, or December 4 or 5. Further details about this Project will be provided early in the semester.

## 6. Laboratory Sessions

The laboratory sessions will be held in Silver 201. There will be no laboratory session during the first week of classes and the sessions will begin on September 11. The laboratories will be taught by three experienced instructors.

**James Kuehn**  
[jmk475@nyu.edu](mailto:jmk475@nyu.edu)

**Joyce Lee**  
[jsl413@nyu.edu](mailto:jsl413@nyu.edu)

**Shawn Lyons**  
[sml433@nyu.edu](mailto:sml433@nyu.edu)

### Laboratory Schedule:

<b>Section:</b>	<b>Time:</b>	<b>Teaching Assistant:</b>
002	Mondays @ 11:00 AM	James Kuehn
003	Mondays @ 1:00 PM	James Kuehn
004	Mondays @ 3:00 PM	Joyce Lee
005	Mondays @ 5:00 PM	Joyce Lee
006	Tuesdays @ 9:00 AM	Shawn Lyons
007	Tuesdays @ 11:00 AM	Shawn Lyons

### Laboratory Policies

- Each weekly lab session is worth **50 points**:

Attendance	10 points
Quiz	10 points
Lab Assignment	30 points

- You must be **registered in a laboratory section** in order to receive credit for the course. The sections have a capacity of **20 students**, which is determined by the availability and logistics of laboratory equipment. If you are not appropriately registered for a laboratory section by lab #2 you will be required to drop the course.
- You are expected to arrive punctually for the beginning of the lab session. Arriving more than **10 minutes late** will result in a loss of attendance credit for the session.
- Questions for the **laboratory quiz** will be based on the description of the experiment in the laboratory manual and may also include pertinent material from the lectures and readings. Arriving more than 10 minutes late for the lab will exclude you from taking the quiz.
- The **laboratory assignment** must be completed and submitted during the laboratory period by working collaboratively with your laboratory partners. Some laboratories may have a take-home component in addition to the in-lab exercises.
- If you cannot attend a lab session because of illness, notify your lab instructor **before** the start of the laboratory session and provide doctor's note within one week. If you will miss a lab session due to special circumstances, including observation of a religious holiday, notify your lab instructor **in advance**. Because of the logistics of using the laboratory room, it is not possible to attend another laboratory section other than your own or to perform make-up experiments.
- Missing **more than three** laboratory sessions for any reason will result in receiving a score of **zero** for the **entire** laboratory portion of the course.