

## GENETICS 320, Genetics, Agriculture and Biotechnology Fall 2008

**All students are required to read the entire syllabus during the first week of classes.**

**Brief Description of Course:** (3 credits)

Introduction to transmission, molecular, population and quantitative genetics, and cytogenetics.

**Instructor:** Dr. Michael Lee, [mlee@iastate.edu](mailto:mlee@iastate.edu), 294-7951 (1553 Agronomy).

**Teaching Assistant:** Pedro Gonzalez, 294-3517; 1555 Agronomy. Pedro will help prepare and grade the problem sets and exams and help with review sessions. **Please contact us by email** (not via webmail from WebCTgold).

**Lectures:** Tuesday and Thursday, 11:00-12:15, room 2050 of Agronomy Hall.

**Review Sessions:** Initially, Weds, 10:00-11:00, room G541 of Agronomy Hall. During the first week of classes, the class will be surveyed to identify better days and times for regular review sessions. Review of suggested problems for the previous week(s), problems sets and exam questions as per the requests of the students at the session and the discretion of the instructor.

**Questions from students are vital to the review sessions.** Such questions help the teachers to understand the degree and nature of the students' interpretation of a topic and to modify presentations of concepts and methods. Individual tutoring sessions are not available on a weekly basis.

**Office Hours:** 1553 Agronomy Hall, immediately after lecture, at a review session, or by an appointment by email with the instructor. **All visits during office hours** should be preceded by a brief email to the instructor that indicates the preferred time and the topics to be discussed.

**Exam times:** Except for the final exam, the three other exams have been scheduled for September 18, October 16 and November 13 from 11:00 a.m. to 12:15 p.m., in Agronomy 2050.

**Required Text:** *Essential iGenetics*, Peter J. Russell, 2003

**Optional Text:** *Study Guide and Solutions Manual for Essential iGenetics* by Bruce A. Chase

**Text web site:** [www.geneticsplace.com](http://www.geneticsplace.com)

Click on the *Essential iGenetics* text icon.

If you have purchased a new text you can click on "Register" under "First Time User?" and follow the instructions.

If you have purchased a used copy of the text you will need to buy online access, so click on "Buy Now" under "First Time User?" and follow the instructions.

**WebCT Site:** Click on WebCT (Gold) on the ISU homepage and follow the instructions.

All course materials will be posted on WebCT including the syllabus, problem sets, keys for exams and problem sets, and class/lecture notes and textbook supplements. An on-line grade book will be maintained.

## STUDENT OUTCOMES ASSESSMENT

**At the completion of this course students should meet the following instructional objectives:**

### **A. Learning as Knowledge:**

The student will be able to understand and describe:

1. mitosis, meiosis, and gamete formation and how these processes relate to inheritance.
2. Mendel's Principles of Inheritance and give examples.
3. examples of non-Mendelian inheritance.
4. the chromosomal basis of heredity.
5. genetic mapping in both eukaryotes and prokaryotes.
6. evidence that DNA is the genetic material.
7. the structures of DNA, RNA, and protein.
8. the processes of DNA replication, transcription of RNA, and translation of protein.
9. gene regulation in prokaryotes using the *lac* operon as an example.
10. key aspects of gene regulation in eukaryotes.
11. the processes of gene mutation and DNA repair.
12. principles of population genetics, selection, and genetic drift.
13. common procedures used in DNA cloning, sequencing and genome analysis.
14. examples of applications of genetic principles and methods.

### **B. Learning as Process:**

The student will be able to:

1. Solve problems involving monohybrid and dihybrid crosses.
2. Analyze data using appropriate statistical tests.
3. Create a genetic map for 2 or more linked genes.
4. Solve problems using the Hardy-Weinberg Law.

### **C. Learning as Attitude:**

The student will be able to:

1. Describe how genetics relates to other areas of biology.
2. Undertake further studies in genetics, cell biology, developmental biology, biochemistry, and molecular biology.
3. Understand some basic principles of the roles of genetic information in understanding nature, planning research, product development, medicine, law, commerce and other activities.
4. Develop questions that facilitate additional learning and understanding.

## GENERAL CONSIDERATIONS

As this may be your first course in genetics, and for many, the only genetics course you will take, we plan to cover nearly all of the subjects in genetics. Each subject will be discussed in sufficient depth to enable you to search and understand more detail for your own interests. This should also be good preparation for those of you who will take more advanced courses in genetics and related areas.

Genetics is a **problem-solving science** and working through problems is fundamental for learning and understanding the material and underlying concepts. So, each student is strongly advised to do the **suggested problems** on the course schedule. There will be problems to work on all exams. In addition, there will be take-home problem sets due on each Thursday that an exam is not scheduled.

It is also essential that you **learn the vocabulary** of genetics. Each test will have vocabulary assessment in one form or another, so you need to have a working knowledge of the language of genetics. Most of the important vocabulary terms are highlighted **in bold text or in italics in the book**. To help students' focus, a list of vocabulary words for each chapter will be posted on the course homepage. List of other terms are provided with the "Textbook Supplements".

The best method to prepare for class and to understand genetics is to **read the material in the text prior to the class** in which it will be discussed. This will help you to get the most out of the time in class. Any unclear points may be addressed during or after the class session or at another session and further explored by reading the text more carefully after the class discussion. There is much valuable information in the text that we will not cover in depth during class periods. Summaries and Analytical Approaches for Solving Genetics Problems at the end of each chapter are quite helpful.

### **Attendance and Seating Policies**

Class attendance is very important. There will be four or more in-class assignments. Class is also a time to ask questions and clarify concepts. We will do our best to address the questions during or after the class session. You will also be asked questions during class. We avoid the need for assigned seats.

**Please be respectful of others during the lectures, exams and review sessions** (e.g. turn off cell phones or similar devices and keep your private conversations under control **or** move them to another room). Thanks.

### **Accommodation**

Iowa State University complies with the American with Disabilities Act and Section 504 of the Rehabilitation Act. Any student who may require an accommodation under such provisions should contact the instructor privately as soon as possible and no later than the end of the first week of class and provide a brief written summary of the requested accommodation. No retroactive accommodations will be provided in this class. **To obtain an authentic and valid accommodation, the student needs to contact Student Disability Resources, room 1076 of the Student Services Building, 294-7220.**

## GRADING

The grade for this course will be based on a possible maximum total of 600 points. Those 600 points come from ten problem sets (200 points), four in-class assignments (40 points), three 75-minute exams (240 points), and a two-hour final (120 points).

Individual assignments for “extra credit” are **not offered** but it is possible to earn extra points throughout the semester by providing correct answers to bonus questions on problem sets and exams. Also, at the discretion of the instructor, “exam rehabilitations” may be scheduled for a lecture or review session in order to provide all members of our class a chance to repeat exam questions chosen by the instructor. **So, these extra points that may be earned from bonus questions and exam rehabilitations are a form of extra credit** and a “curve” that provide each student with other opportunities to gain points used to establish their final grade according to the table in “Grading System and Grading Scale”.

### Policies for Exams, Problems Sets, In-Class Assignments and Exam Rehabilitations:

- All students will take the final exam on the date and time assigned by ISU.
- A missed or late problem set will result in "0" points. **“Make-up” problem sets will not be given.**
- Make-up exams, in-class assignments and exam rehabilitations are given only as a result of an acceptable and verifiable excuse. **The student must provide a printed version of a typed or written document that describes why the student could not attend the scheduled course activity. The document must be signed by another person who can verify the reasons for each absence and it must contain a telephone number and address of the person who signed the document** (e.g. a note from major advisor, medical professional, parent, personnel at ISU Student Health clinic, etc.). The instructor will determine the acceptability of the document and the excuse.
- Limit of two excused “make-ups” (with approved note) per person.
- **Requests for make-ups sent by email or phone will not be accepted.**
- When field trips, judging trips, or other official university activities conflict with an exam, arrangements, as requested in a written note from the student, must be made **prior to** the official university activity so the exam can be taken at another time. **For such activities, written, excused absences from an exam must be agreed upon prior to the exam.**
- **When an absence has received approval, the missed exam, in-class assignment and exam rehabilitation must be completed no later than six days after the originally scheduled date** (sooner for exam #4, the final exam) and they may have a different composition than that presented on the date in the syllabus.
- If you have a question regarding an assessment of your answer on an exam or assignment, you must **review the answer key prior to requesting another assessment and bring a printed copy of the key** when you meet with the instructor.
- Comments concerning question clarity must be asked during the exam, not after.

**Calendar of Assessment Activities: Exams, Problem Sets, In-Class Assignments and Exam Rehabilitations.**

**EXAMS: 360 points**

**Exam 1 on September 18** (80 points);

**Exam 2 on October 16** (80 points);

**Exam 3 on November 13** (80 points);

**Exam 4 during December 15-19**, (120 points); new material will be 80 points; old material will be 40 points.

As genetics builds on concepts learned throughout the semester, all exams have the feature of being somewhat comprehensive. **Exams** will emphasize the content for a given set of dates listed in the syllabus (i.e., text, lecture files, required reading, suggested problems, problem sets and textbook supplements). Exam questions will be short answer, multiple choice, vocabulary words, diagrams, and problem solving. **Always bring a calculator and pencil to exams (other electronic devices are not allowed).**

**PROBLEM SETS: 200 points (20 points each)**

Ten problem sets will be posted on WebCTgold one week prior to their due date **and will be collected near the beginning of class, in room 2050 Agronomy Hall. Electronic submissions are not accepted.** The **due dates** for problems sets are listed **in the schedule.**

**IN-CLASS ASSIGNMENTS: minimum of 40 points**

These will be four or more in-class assignments (e.g. assess understanding of the previous or current lecture, repeat questions from exams and problem sets). Each activity will be worth 10 points and students may work together on some assignments. The dates of the in-class assignments are determined by unpredictable events such as results on exams and problem sets and questions from students. Therefore, it is not possible to put the dates of such assignments on the schedule.

**EXAM REHABILITATIONS: minimum of 30 points.**

At the discretion of the instructor, "exam rehabilitations" will be **scheduled for a lecture session or a review session** in order to provide all members of our class a chance to repeat exam questions chosen by the instructor. The **exam rehabs will be scheduled for the weeks of September 28, October 26 and November 30** so that students have time to review the exam key and related sections in the text.

## **Grading System and Grading Scale**

The following grade categories and points will be used to determine your course grade.

With the extra points available from Exam Rehabilitations and Bonus Questions, it is possible for someone to exceed 600 points for the course. Those extra points are available to all members of our class and may be earned throughout the semester: they are a type of “curve”.

<u>GRADE</u>	<u>MINIMUM POINTS</u>	<u>PERCENTAGE</u>
A	558	93
A-	540	90
B+	522	87
B	498	83
B-	480	80
C+	462	77
C	438	73
C-	420	70
D+	402	67
D	378	63
D-	360	60
F	Below 360	Below 60

### GENETICS 320 SCHEDULE FOR FALL 2008

DATE	TOPICS	CHAPTER	SUGGESTED PROBLEMS
T Aug 26	Introductions and survey; The molecular basis of heredity and variation	1	1-5, 7
Th Aug 28	Cellular reproduction in eukaryotes	1 & 2	Chapter 1: 10-14, 17-20
T Sept 2	Transmission genetics & Mendelian inheritance	2	1, 4, 7-10, 13
Th Sept 4	Mendelian inheritance & Extensions of Mendelian Genetics <b>(Problem Set 1 due)</b>	2 & 4	2,3,6,12,14,16, 19-23, 26-27. Chap 4: 1,2, 4, 5, 9-12.
T Sept 9	Extensions of Mendelian Genetics & Quantitative Genetics	4 & 23	Chapter 4: 18-20, 22-23 Chapter 23: 6, 7, 9,10
Th Sept 11	Quantitative Genetics <b>(Problem Set 2 due)</b>	23	18-19, 25
T Sept 16	Population genetics	22	3-6, 8
<b>Th Sept 18</b>	<b>EXAM 1 (80 POINTS): CHAPTERS 1 UP TO PAGES COVERED THROUGH SEPT. 11.</b>		
T Sept 23	Population Genetics; Chromosomal basis of inheritance and sex linkage	22 & 3	Ch 3: 1-2, 6-7, 9.
Th Sept 25	Linkage and gene mapping <b>(Problem Set 3 due)</b>	3 & 5	Chapter 5: 1-2, 6-7
T Sept 30	Linkage and gene mapping; Association Mapping Lecture Supplement	5	3-5, 11
Th Oct 2	Genetics of bacteria and bacteriophages <b>(PS 4 due)</b>	6	1-3
T Oct 7	Genetics of bacteria and bacteriophages	6	4, 6-8
Th Oct 9	Extranuclear inheritance; DNA the genetic material <b>(Problem Set 5 due)</b>	7 & 8	7.1-3, 5-7, 12, 14; 8. 1-4
T Oct 14	DNA the genetic material	8	6-9, 22-24, 26, 28
<b>Th Oct 16</b>	<b>EXAM 2 (80 POINTS): TEXT PAGES FROM SEPT 16 THROUGH OCT. 9.</b>		
T Oct 21	Gene control of proteins; Transcription	10 & 11	10.2-4, 7; 11.1-2, 17, 21
Th Oct 23	Transcription; RNA Silencing Lecture Supplement <b>(Problem Set 6 due)</b>	11	11.1-2, 17, 21
T Oct 28	Translation	12	1, 4, 11a, 14, 17
Th Oct 30	Regulation of Gene Expression in Bacteria <b>(PS 7 due)</b>	16	16.1,3,6,7, 9-10
T Nov 4	Regulation of Gene Expression in Eukaryotes	17	17.1, 6, 7, 13
Th Nov 6	Gene mutation and repair <b>(Problem Set 8 due)</b>	19	19.1-4, 8, 14,15
T Nov 11	Gene mutation and repair; Transposable elements	20	20.1, 2, 20.4
<b>Th Nov 13</b>	<b>EXAM 3 (80 POINTS): TEXT PAGES FROM OCTOBER 14 THROUGH NOV. 6.</b>		
T Nov 18	Variation in chromosome structure	21	1-2, 4, 7-8, 10
Th Nov 20	Variation in chromosome number <b>(PS 9 due)</b>	21	14-25
<b>Nov 24-28</b>	<b>ISU Holiday &amp; No classes.</b>		
T Dec 2	DNA cloning and analysis	13	1, 5, 7
Th Dec 4	DNA cloning and analysis; Applications	13 & 14	14.4, 8-9
T Dec 9	DNA cloning and analysis; Applications <b>(PS 10 due)</b>	13 & 14	14.4, 8-9
Th Dec 11	Genome Analysis	15	15.1,4,8,13
<b>Dec 15-19 = Finals Week</b>	<b>FINAL EXAM (120 POINTS) = TEXT PAGES FROM NOVEMBER 11 THROUGH DECEMBER 11 (80 POINTS) AND REVIEW OF MATERIAL FROM TEXT PAGES COVERED AUGUST 26 THROUGH NOVEMBER 6 (40 POINTS; MATERIAL FROM EXAMS 1, 2 AND 3).</b>		