Plant Science 3213/Animal Science 3213  
Genetics of Agricultural Plants and Animals

M, T, W, R, F 8:00 – 8:50 am  
S147 ASRC  
3 credits – 9 weeks

I n s t r u c t o r s  
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Telephone  
E-mail
Anne McKendry  106 Curtis Hall  882-7708  mckendrya@missouri.edu  
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Bill Lamberson  159 ASRC  882-8234  lambersonw@missouri.edu

T e a c h i n g   A s s i s t a n t s  
Office  
Telephone  
E-mail

Generally there are 2-3 teaching assistants

T e x t:  Benjamin Pierce – *Genetics: A Conceptual Approach* - Text is required.

T o p i c s  
Instructor
Material Basis of Genetics  Gavin Conant
Mendelian Genetics  Anne McKendry
Genetic Mapping  Anne McKendry
Cytogenetics  Anne McKendry
Population and Quantitative Genetics  Bill Lamberson

N o t e: detailed syllabus on pages 3 and 4.

Coverage of each topic will consist of a series of lectures and readings, assignments of homework problems or questions (25 points), and an exam (100 points). This results in a total of 625 points for the course. No makeup homework or exams will be given. Your grade on an optional comprehensive final will replace your lowest exam score (if better than the lowest score). There will be no curve on exams or the final grade.

E x t r a  c r e d i t:  
Opportunities for extra credit are provided. Four genetics-related books have been selected for optional outside reading. They are: *Voyage of the Beagle* by Charles Darwin, *Genome* by Matt Ridley, *The Beak of the Finch* by Jonathan Weiner, and *The Double Helix* by James Watson. Twenty points extra credit can be earned by reading and satisfactorily demonstrating knowledge and understanding of critical issues covered by the respective books during a discussion with Dr. Lamberson. There will be no partial credit. Up to three books can be read for a total of up to 60 points extra credit. Several copies of these books are available for checkout from the instructors (See Cinda Hudlow in 159 ASRC), they may be available from the university or a public library, or used copies can be purchased at a reasonable cost through ABE.com. The last day to schedule a discussion is April 30. To receive credit for reading more than one book, the first discussion must be completed before spring break.
Grading Scale:

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<td>A+</td>
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**Academic integrity** is fundamental to the activities and principles of a university. All members of the academic community must be confident that each person's work has been responsibly and honorably acquired, developed, and presented. Any effort to gain an advantage not given to all students is dishonest whether or not the effort is successful. The academic community regards breaches of the academic integrity rules as extremely serious matters. Sanctions for such a breach may include academic sanctions from the instructor, including failing the course for any violation, to disciplinary sanctions ranging from probation to expulsion. When in doubt about plagiarism, paraphrasing, quoting, collaboration, or any other form of cheating, consult the course instructor.

If you need accommodations because of a **disability**, if you have emergency medical information to share with me, or if you need special arrangements in case the building must be evacuated, please inform me immediately. Please see me privately after class, or at my office. To request academic accommodations (for example, a note taker), students must also register with the Office of Disability Services, [http://disabilityservices.missouri.edu](http://disabilityservices.missouri.edu), S5 Memorial Union, 882-4696. It is the campus office responsible for reviewing documentation provided by students requesting academic accommodations, and for accommodations planning in cooperation with students and instructors, as needed and consistent with course requirements. For other MU resources for students with disabilities, click on "Disability Resources" on the MU homepage.

The University community welcomes **intellectual diversity** and respects student rights. Students who have questions concerning the quality of instruction in this class may address concerns to either the Departmental Chair or Divisional leader or Director of the Office of Students Rights and Responsibilities [http://osrr.missouri.edu/](http://osrr.missouri.edu/). All students will have the opportunity to submit an anonymous evaluation of the instructor(s) at the end of the course.

If you have any questions about academic integrity or intellectual pluralism, please feel free to contact Associate Vice Provost Michael Prewitt (882-1422) who oversees the Office of Student Rights and Responsibilities [http://osrr.missouri.edu/](http://osrr.missouri.edu/). For questions about ADA classroom accommodations, please contact the Office of Disability Services at 882-4696.
Detailed Syllabus:

Week 1: Molecular Genetics (5 lectures) (Dr. Gavin Conant)

a. The Chemical composition and structure of DNA and RNA
b. Structure of eukaryotic chromosomes
c. DNA synthesis and replication
d. Cell Replication, mitosis and meiosis
e. The anatomy of a gene
f. Transcription and translation
g. The anatomy of proteins

Exam

Week 2: Mendelian Genetics (3 lectures) (Dr. Anne McKendry)

a. Branches of Genetics
b. Genetic Research
c. The Scientific Method
d. Organisms of Genetic Study
e. Phenotype, genotype and their interrelationship
f. Monohybrid and dihybrid crosses: the principles of uniformity of the F1; segregation; independent assortment
g. The Chi-square Test

Week 2-3: Extensions and Modifications of Mendelian Genetics (4 lectures) (Dr. Anne McKendry)

a. Modifications of dominance relationships
b. Multiple alleles
c. Gene interactions and modified Mendelian ratios
d. Penetrance and Expressivity
e. The impact of the environment; e.g. the Himalayan trait
f. Cytoplasmic and maternal inheritance

Week 3: Sex-determination and sex-linked traits (2 lectures) (Dr. Anne McKendry)

a. Sex determination
b. Autosomes versus sex chromosomes
c. Sex-linked inheritance
d. Inactivation of the X chromosome
e. Examples of sex-linked traits

Week 3: Pedigree Analysis (1 lecture) (Dr. Anne McKendry)

a. Pedigree analyses of autosomal dominant and recessive traits
b. Pedigree analyses of sex-linked dominant and recessive traits
c. Genetic counseling

Exam
Week 4-5: Linkage Recombination and Mapping (9 lectures) (Dr. Anne McKendry)

- Discovery of linkage (Thomas Hunt Morgan)
- Linked genes and linkage groups
- Crossing over and recombination
- Map distance
- Coupling, repulsion and predicting the outcomes of crosses involving linked genes
- The concept of the genetic map
- Constructing genetic maps from recombinant data; two-point and three-point test crosses
- Interference and coincidence
- Molecular markers – an alternative approach
- Types of molecular markers
- Polymerase chain reaction (PCR)
- Mapping genes to chromosomes using markers
- Other applications

Exam

Weeks 5-6: Cytogenetics (6 lectures) (Dr. Anne McKendry)

- Identification of chromosomes; the euploid genome
- Chromosome mutations: duplications, deletions, inversions, translocations
- Phenotypic effects of chromosome rearrangements
- Aneuploids
- Polyploidy
- Gene mutations: Somatic versus germ-line mutations
- Types of gene mutations
- Causes of gene mutations
- DNA Repair

Exam

Weeks 7-8: Population Genetics (Dr. Bill Lamberson)

- Genotypic frequencies
- Allelic frequencies
- Hardy-Weinberg Law
- Changes in allele Frequency: migration, mutation, selection, and drift
- Genetic variation: how does it arise and how is it maintained
- Evolution

Week 9 Quantitative Genetics (Dr. Bill Lamberson)

- Quantitative traits and quantitative genetic variation
- Statistics of quantitative traits
- Genetic variation: additive and dominance variation
- Heritability: broad sense, narrow sense, and repeatability
- Estimating heritability: regression methods, correlation methods
- Inbreeding depression and heterosis
- Genomics

Exam