Biology 423L Syllabus 2015
Laboratory Experiments in Genetics

Lecture: Monday at 12:20 in Wilson Hall 128

Laboratories:  
Section 001: Tuesday at 2:00 p.m. in Wilson room 242  
Section 002: Wednesday at 2:00 p.m. in Wilson room 242

Course materials available on Sakai

Text book: Genetic Analysis by Sanders and Bowman. I strongly recommend buying the text but one copy will be at the reserve circulation desk in the undergraduate library available for two hours at a time.

There is no course pack. All lab protocols, reading lists and most reading materials will be available on Sakai. A new version of the protocol will be available one week before each lab. Print out the protocol, read it carefully and bring it to class.

Instructor: Sarah Grant  
Email: sgrant@email.unc.edu  
Telephone: 919 962-4470  
Office hours: by appointment (email me if you want to set up a meeting). Friday afternoons are optimal.

TA: Susie Harris  
Email: slharrs@email.unc.edu  
Office hours: TBA

Reports: Due in laboratory period 2 weeks after exercise finished. Penalty for handing in late: 50% off if handed in by 5:00 Wednesday for Section 001 and Thursday for section 002. Otherwise your report will not be graded and your grade will be recorded as 0 points. Exceptions can be made in unusual circumstances by arrangement (email to TA or instructor, preferably before due date)

Reports will be handed back one week after being turned in. Lab reports will make up 50% of the final grade. They will be graded out of 25 points: 5 for participation, 5 for abstract and introduction, 10 for methods and results and 5 for discussion.

See Course Information on web site for instructions on how to prepare lab reports.

Regrade requests:  
Lab reports: Submit graded pdf with grader’s comments to Dr. Grant. Explain your complaint in writing. You can submit the complaint by email with the graded PDF attached. I reserve the right to regrade the entire paper, not just evaluate your complaint.

Midterms: Submit your correction in writing to Dr Grant’s mailbox with the exam. I reserve the right to regrade the entire test, Email
Dr. Grant to make sure she looks in her mailbox for your request. If the problem is incorrect addition of marks, discuss that directly with Dr. Grant (after class is fine).

Exams etc: Homework quizzes and in-class quizzes: 5% of final grade. 2 midterms for 10% of final grade each. Final exam: 25% of final grade Lab reports for a total of 50% of the grade.

Syllabus

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
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<tbody>
<tr>
<td>August 18/19</td>
<td>First meeting: Plant fast plant seeds for two experiments</td>
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<td>August 24</td>
<td>First Lecture: Mendelian Genetics</td>
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<td><strong>Readings for class:</strong></td>
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<td>Sanders and Bowman: Read Chapter 2 for a review of the principles</td>
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<td>relevant to this week's lab. Focus on dihybrid cross: section 2.2 and 2.3</td>
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<td>pp. 30-38 and Chi-square test: section 2.5 pp. 47-50.</td>
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<td>Review epistasis: Section 4.3 pp. 122-133 and complementation test</td>
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<td>section 4.4 pp. 133-135.</td>
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<td>FAST PLANTS: Williams et al. (1986) Vol. 232 pp. 1385-1389. PDF</td>
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<td>available on web site;</td>
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<td>You can find more information at the home page for Wisconsin Fast</td>
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<td>Aug 25/26</td>
<td>Mendelian Genetics: fast plants and corn kernel color</td>
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<td>August 31</td>
<td>Complementation test and Mutagenesis of yeast</td>
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<td><strong>Readings:</strong> Review of mutation: Sanders and Bowman section 12.2-12.4</td>
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<td>See Sakai Resources site for the following PDFs from A Classroom</td>
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<td>Guide to Yeast Experiments: Manney, T., Davis, L. Johnson, B.,</td>
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<td>Manney, M., Montelone, B., Weaver, L. and Williamson, B. 1996. A</td>
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<td>Classroom guide to yeast genetics. Carolina Biologica. Burlington,</td>
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<td>North Carolina.</td>
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<td>Sept 1/2</td>
<td>A. Complementation of alleles</td>
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<td>B. Mating for transposon mutagenesis.</td>
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<td>You will need to come back on day 2 and 3 after the lab to finish the</td>
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<td>experiments.</td>
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<td><strong>Readings:</strong> Yeast complementation: Sanders and Bowman Section 4.4 pp.</td>
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<td>133-136, Section 5.18 p. 170.</td>
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See Sakai Resources site for the following PDFs from A Classroom Guide to Yeast Experiments:
Genetics of Baker’s Yeast.
Baker’s Yeast and its Life Cycle
A Closer Look at Adenine-requiring Mutants in Yeast-

**Conjugation in bacteria:** review Bacterial conjugation: Sanders and Bowman Section 6.1 pp. 185-193.

**Transposons and transposon mutagenesis:** Sanders and Bowman Section 13.5 pp. 444-449 and p. 550.

Optional reading available as Pdfs on Sakai site Resources:
Erin Garcia research: Anderson et al 2012 Plos Genetics e1002877. doi:10.1371/journal.pgen.1002877

Report on yeast complementation due Sept. 15/16.


Sept. 7 Labor Day - No lecture

Sept. 8/9 Mutations in yeast and Transposon mutagenesis in *Burholderia*
You will need to come back every day this week to finish the experiments. Times will be worked out with the TA during the lab class.


Report on Mendelian Genetics due this week.

Sept. 14 Selection of insertion mutants Meet in lab classroom
Select candidate mutant bacteria in the lab class and prep cultures for DNA purification this week.

Sept. 15/16DNA purification - see week 3 for the protocol.

**Readings:** review of DNA structure and replication: Sanders and Bowman Section 7.2-7.4 pp. 228-245.
Qiagen DNA purification kit protocol- available on Sakai


Report on Yeast alleles due this week.

Sept. 21 PCR, Forensics and DNA markers

Sept. 22/23 Forensics Lab and PCR And Transformation of *Burholderia*,

**Readings:** PCR: Sanders and Bowman pp. 248-250, 256
VNTR Fig. 7.29 and 7.35. Animation Chapter 7 slide show #120.
Micro and Tiling arrays pp. 622-630.

**Reading for lab:** Nakamura et al., 1988. NAR 16:9364.

You will need to come back on day 2 and 3 to complete the experiments.

**Forensics lab short report due Oct. 6/7**

**Report on Yeast mutations due this week.**

**Sept. 28  Introduction to Mapping – Threepoint Cross**

**Readings:**  
Drosophila life cycle: Sanders and Bowman page 678 figure 20.4 (a)  
Sex-linked inheritance: Sanders and Bowman section 3.3 and 3.4 pp.81-98 (mostly for interest)  
Three point cross: Sanders and Bowman Chapter 5: pp. 143-167.  
Focus on sections 5.2, 5.3 and 5.5.  
Mapping in Humans: Sanders and Bowman Section 5.5 pp. 165-170.  
Positional cloning of Huntington syndrome gene Section 16.1 pp 555-557.

**Home work:** design PCR primers for tetracyclin resistance gene

**Sept. 29/30  Drosophila Three-point Cross Oct 13/14, Oct. 27/28.**  
Finish transposon mutagenesis up to Selection of mutants.  
**TA:** David

**Report on Transposon mutation work due Oct. 13/14.**

**Report on Drosophila 3 point cross due Nov. 17/18.**

**Oct. 5  Midterm 1**

**Oct. 6/7  Gateway Cloning Lab. Discuss design of PCR products**  
**Do BP reaction and E. coli transformation.**

**Readings:**  
Sanders and Bowman: PCR Section 7.5 pp. 248-250, p. 540  
Natural Bacterial transformation Section 6.4 pp. 201-203  
Recombinant DNA technology: Section 16.2-16.5 pp. 531-550.  
Gene libraries: Section 16.4 and 16.5 pp. 543-551

**Report on Gateway Cloning Lab due Oct. 27/28** (short report)

**PCR and Forensics lab report due this week.**

**Oct 12  University Day lecture cancelled**

Fall break: Thurs Oct. 15 and Friday Oct. 16

Report due Nov. 10/11.

Report on Transposon mutagenesis due this week.

Oct. 19  
C. elegans as a Model System and Epigenetics
Readings for class: Sanders and Bowman Section 15.3 pp. 512-517 and Section 17.3 pp. 586-588.
Required Reading: See Sakai Resources folder for a recent review of epigenetic gene regulation.

Oct. 20-26  
C. elegans Genetics and RNAi
You will need to come back on each day after the lab to continue experiments. Times for all returns will be organized by the TA during the lab period.


Report on Burkholderia transposon mutagenesis due this week.

Oct. 26  
Finish C. elegans lab. Meet in lab room (Wilson 242) open lab room at 11 and allow students to come late leaving room open until 1.

Oct 27/28  
Drosophila Three-point Cross - scoring test cross progeny.
TA: David


Report on Gateway Cloning due in lab this week.

Nov. 2  
Midterm 2

Nov. 3/4  
DNA analysis. Analysis of DNA of Transposon Insertions
Computer exercise
Readings: Sanders and Bowman: DNA sequencing: pp.250-256.
Animation in slide show Ch. 7 #127 and pp. 603-617.
Annotation pp. 620-622.

Report due at end of lab period.

Nov. 9  
Mapping in a Model Organism

Mapping in Humans: Sanders and Bowman Section 5.5 pp. 165-170.
Positional cloning of Huntington syndrome gene Section 16.1 pp 555-557.
Nov. 10/11  Mapping in Arabidopsis
Short report on Mapping in Arabidopsis due Nov. 24/25
Report on RNAi in C. elegans due this week.

Nov. 16 QTL and GWAS mapping
Reading: Sanders and Bowman: Ch. 21 pp. 708-730, 732.

Nov. 17/18. QTL mapping in mouse.
Report on mapping in mouse due Dec 1/2.
Report on Drosophila three-point cross due this week.

Nov. 23. QTL lab results. Mapping genes in Humans. GWAS

Reading: Sanders and Bowman pp. 730-731.
GWAS papers

No lab this week due to Thanksgiving Holiday
Report on Mapping in Arabidopsis due this week.

Nov. 30  Genetic engineering - CRISPR technology

Dec 11 12 noon-3 pm  Final Exam
128 Wilson Hall