Biology 13 SYLLABUS

Biology 13
Gene Expression and Inheritance

Professor
Prof. Tom Jack LSC 331 Office Hours: Tu 10-11:30, W 4-5, Th 1:30-3

Instructor
Therese Kinemund LSC 123 Office Hours: Th and Sunday, 7-9PM in 113 Silsby

Graduate Teaching Assistants

Laboratory Instructors
Nick Sylvain (Laboratory Director)
Cori Anderson

Prerequisites
There are no enforced prerequisites for Biology 13. However, Biology 11 or a strong prior preparation in biology is recommended. The details of Biology Department's recommendations for entry into Biology 13, for those that have not taken Biology 11, can be found at https://canvas.dartmouth.edu/courses/5105/pages/how-to-interpret-the-score-on-the-placement-slash-advisory-test.

Textbook

Course Goals
At the end of the course, students will:

- understand the "central dogma" of molecular biology, i.e. the key gene products and molecular mechanisms responsible for the transfer of genetic information from DNA to RNA to protein and ultimately to the expression of a phenotype
- understand how genetic information is recombined and transmitted from one generation to the next
- understand the fundamental concepts that underlie the regulation of the expression of genetic information
- be familiar with specific foundational experiments and well-studied examples in molecular genetics
- be able to think critically and solve problems in genetics and molecular genetics
- be capable of analyzing different types of data (from genetic crosses or genomic analysis) to determine genetic linkage and to create a genetic map
- be able to investigate a current problem in genetics and effectively communicate key scientific information to others

Office hours
Both Therese and I will be having several hours of office hours per week. We have tried to schedule office hours at different times of day and different days of the week to accommodate varying student schedules.

Special appointments
If you have particular concerns, difficulties or interests that you would like to discuss individually, email to set up an appointment.
Biology 13 SYLLABUS

Study groups
We encourage students to form their own study groups. The Academic Skills Center will be organizing study groups for Bio 13, led by a student who has previous taken Biology 13. The sign up for study groups will be during the second week of the course.

Canvas
Course materials for Biology 13 will be available in Canvas. The syllabus, announcements, reading assignments, Powerpoint class presentations, pre-lecture screencasts, solutions to problem sets and exams, information about the laboratory etc. will be posted in Canvas.

Interactive Technology
We will use an interactive technology, called “Lecture Tools”, that will allow you to respond to a variety of different types of questions posed in class. To take best advantage of Lecture Tools, you should bring your computer or iPad to class. When the class responds to one of the interactive questions, we can immediately see the results for the entire class. Class participation using Lecture Tools will count for a small percentage of your overall grade. With the Lecture Tools questions, the key is to participate; your participation grade is not dependent on answering questions correctly. To get full credit for Lecture Tools participation, you need to respond to questions in 85% of the class periods, and complete 85% of the pre-class exercises. In other words, if you forget your computer, or are sick and have to miss a class, or are too busy to complete the pre-class exercises, you will not be penalized until you have missed more than 15% of classes (>5 classes) or failed to complete more than 15% of the pre-class exercises (>5 assignments).

Assessment of your academic performance

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>First Exam</td>
<td>10%</td>
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<tr>
<td>Second Exam</td>
<td>10%</td>
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<tr>
<td>Third Exam</td>
<td>15%</td>
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<td>Fourth Exam</td>
<td>15%</td>
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<tr>
<td>Final Exam</td>
<td>20%</td>
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<tr>
<td>Project</td>
<td>5%</td>
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<tr>
<td>Participation (pre-lecture and in-class)</td>
<td>5%</td>
</tr>
<tr>
<td>Laboratory</td>
<td>20%</td>
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We will have four exams during the term, roughly every two weeks, and in total, these exams will count for 50% of your grade. The final exam will cover all topic areas (i.e. it is cumulative), and will count for 20% of your final grade. In general, the final exam will be less detailed than the mid term exams, and will emphasize major concepts, integration and synthesis. 5% of your grade will be based on a project that we will undertake in the last week of the course. This project will involve reading and presenting a paper from the primary literature. 5% of your grade will be for participation, both for completing the pre-class material and being prepared for and participating in class discussions, problem sessions, and in-class interactive questions. The remaining 20% will be based on performance in the laboratory component of the course.

Academic Honesty
Academic honesty is essential. The following is quoted directly from the Dartmouth College Student Handbook: "Students who submit work that is not their own or who commit other acts of academic dishonesty forfeit the opportunity to continue at Dartmouth." The complete text of the Academic Honor Principle is available at [http://www.dartmouth.edu/~uja/honor/](http://www.dartmouth.edu/~uja/honor/). Please read it carefully; you are responsible for it. In Bio 13, where assessment is based on in-class exams and a final exam, the application of the Honor Principle is quite simple; all your quiz and exam work must be 100% your own, and you may not use any unauthorized notes, textbook, electronic resources (smart phones, iPads, laptops, internet) or other resources during the quizzes and exam. Any violations of the Honor Principle within the context of Biology 13 will be referred to the Undergraduate Judicial Affairs Office.
and can result in a hearing before the Committee on Standards and can result in your suspension for multiple terms or, in the most extreme cases, separation from the College.

There are a number of situations in which a student in Biology 13 might be tempted to violate the Academic Honor Principle. These situations include (but are not limited to) the following:

a) Examinations must be completed without reference to unauthorized written materials or electronically accessed materials other than those provided with the exam paper and must be completed without communication with anyone else (the only permissible exception is that students may request clarification of any exam question from the course faculty and staff who are present expressly for that purpose). The answers that you provide must be entirely your own work.

b) We allow re-submission of exams for potential re-grading by the professor. Any alteration of the answers between the time when the graded papers were returned to the student and the time when the paper was submitted for re-grading constitutes a breach of the Academic Honor Principle. To deter this practice, we routinely photocopy exams after grading them.

c) Some laboratory exercises are performed in small groups, and we encourage collaborative analysis of the data. However, any work submitted for grading must represent the original words of the student submitting that report. Do not share computer files of work (including text, graphs, tables, etc.) to be submitted for grading! The student misrepresenting the work of another as his or her own is in violation of the Academic Honor Principle and it is quite possible that the Committee on Standards might find the student providing the original file also to be in violation. Honesty is the foundation of the academic pursuit of knowledge. In recognition of this, the faculty of Biology 13 will not overlook any violations of the Academic Honor Principle. Indeed, the Faculty Handbook of Dartmouth College states explicitly that College Faculty members are obligated to report potential violations of the Academic Honor Principle to the Dartmouth College Committee on Standards. Should the Committee on Standards find the student to be in violation of the Academic Honor Principle, punishments usually involve suspension for multiple terms or separation of the student from the College.

Disabilities
We encourage students with disabilities, who may need disability-related classroom accommodations, to make an appointment to see one of the professors as soon as possible, preferably before the end of the second week of the term. All discussions will remain confidential, although the Student Accessibility Services office may be consulted to discuss appropriate implementation of any accommodation requested.

Religious observances
Some students may wish to take part in religious observances that occur during this academic term. If you have a religious observance that conflicts with your participation in the course, please meet with the professor before the end of the second week of the term to discuss appropriate accommodations.
Lab Syllabus

The Bio13 laboratory will utilize the fruit fly *Drosophila melanogaster* to understand a system used during development. The system centers around a protein found in all complex organisms called Notch, which controls cell fate decisions. During the course of the term we will do the following:

a) Look at the phenotypes of flies carrying mutations in the Notch gene and other genes in the Notch system.

b) Look at the genetic interactions between different mutations in this system.

c) Determine the molecular nature of the mutations we are studying by PCR and DNA sequence analysis.

d) Using the yeast-2-hybrid system, examine the interactions between proteins in this system.

e) Examine the expression of genes downstream of Notch signaling using green-fluorescence protein assays.

This document contains general information about the lab, important dates and laboratory policies, and a lab exercise on pipette operation that you will be doing at the first lab meeting.

CONTENTS

General Information………………………………………………………………………………..p2

Lab Schedule…………………………………………………………………………………..p5

Lab Safety……………………………………………………………………………………. p6

Pipette Operation………………………………………………………………………………p7
General Information

Laboratory Instructor
Dr. Nicholas Sylvain
Office: LSC236
Email: Nicholas.R.Sylvain@dartmouth.edu
Telephone number: 646-8841

Web Site
We have set up a web site for the course on Canvas. The site will contain class lecture notes, the lab manual and other useful items. The URL is: https://canvas.dartmouth.edu/

Laboratory Section Assignment
On the first day of class you will be directed to fill out an online survey to determine your lab section assignment based on your academic schedule. Conflicts of an academic nature will take priority, followed by work and extracurricular activities. Your lab section assignment will be the same for the entire term and it is your responsibility to ensure that you will be in attendance for all sessions. Be sure to check all exams and X-hours for your other classes this term. Lab sections will be offered at the following times:

Section 1: Tuesday morning 9:00am – 1:00pm
Section 2: Tuesday afternoon 1:30pm – 5:30pm
Section 3: Tuesday evening 6:00pm – 10:00pm
Section 4: Wednesday afternoon 1:30pm – 5:30pm

Lab Grade
The lab is worth 100 points which is 20% of the overall grade; it is broken down as follows:

- Prelab and postlab assignments 50 points
- Lab Summary #1 20 points
- Lab Summary #2 20 points
- Lab Practical 10 points

Expectations of students prior to coming to the lab
All laboratory work can be done more effectively and efficiently if the subject matter is understood before coming to the laboratory. To accomplish this, we expect that you will read the background material and the experimental protocol before arriving in the laboratory. Also, it may be helpful to read sections of the textbook that pertain to the experiment being performed. The more prepared you are, the more efficient you will be in successfully performing the experiments.

No one will be excused from the laboratory component of the class barring illness. Even so, we cannot offer make-up labs for missed lab sessions for any reason including illness.

All laboratory experiments will begin with a brief discussion by the graduate TA of the scientific basis for the experiment, the details of the experimental protocol, the location of
materials and other important information. Feel free to ask the graduate TA questions prior to the lab (e.g. via email) or any of the lab staff (e.g. graduate TAs, lab instructor, professors) during the lab.

**Weekly lab assignments**

Each week you will receive an assignment on Canvas that will be due at the beginning of your next lab section. The assignments must be submitted at the beginning of the lab period. Post-lab assignments will be handed out at the beginning of lab, they must be completed within the lab period and handed in to the graduate TAs before leaving lab. No credit will be given for assignments that are handed in late. That means that you must come to the lab on time and submit your post lab assignment before leaving the lab. The graduate TAs will grade the assignments and hand them back to you during the next lab period.

**Lab Summaries**

There will be two lab summaries submitted for this course:

- Lab Summary #1 - Lab Summary #1 is due Friday, July 31 at the start of class.
- Lab Summary #2 - Lab Summary #2 is due Monday, August 24 at the start of class.

The penalty for handing in lab summaries late will be minus 25% of the earned grade per day that the summary is late.

*Note: In order to pass the course, students must attend all labs and complete both lab summaries.*

**Lab Practical**

On August 21, 24, and 25 there will be a lab practical exam that will cover topics and techniques discussed in lab. You will sign up for a date and time to take the exam through Canvas. Since there are no labs the week of August 17, the TAs will be available in lab during the normally scheduled lab times to answer questions about the Lab Summary assignment or to help you practice for the lab practical exam.

**Lab Partners**

While performing the labs, you will work with a partner. The data generated in the labs should be shared between lab partners. Although you are to work closely with your lab partner while in the lab, the lab summaries and lab assignments are to be prepared independently. Failure to write the lab summaries/assignments independently will be considered a violation of the Dartmouth Honor Principle.

**Academic Honor Principle**

The Dartmouth College Student Handbook states “Fundamental to the principle of independent learning are the requirements of honesty and integrity in the performance of academic assignments, both in the classroom and outside. Dartmouth operates on the principle of academic honor, without proctoring of examinations. Students who submit
work which is not their own or who commit other acts of academic dishonesty forfeit the opportunity to continue at Dartmouth.”

**There are a number of situations in which a student in Biology 13 might be unsure about what constitutes a violation of the Academic Honor Principle. These situations include (but are not limited to) the following:**

a) Examinations must be completed without reference to written materials other than those provided with the exam paper and must be completed without communication with anyone else (the only permissible exception is that students may request clarification of any exam question from the course faculty and staff who are present expressly for that purpose). The answers that you provide must be entirely your own work.

b) Under certain circumstances, we may allow exams to be re-graded by the instructors. The deadline for submitting an assignment to be re-graded is one week from the date that the assignment was returned to you. Any alteration of the answers between the time when the graded papers were returned to the student and the time when the paper was submitted for re-grading constitutes a breach of the Academic Honor Principle. To deter this practice, we scan exam and assignment pages.

c) Laboratory experiments are performed in pairs, and we encourage discussion and collaborative analysis of the data. **However, collaboration in organizing, outlining or writing the lab summary is considered a violation of the Academic Honor Principle.** Any lab summary submitted for grading must represent the original work (words, graphs, tables etc.) of the student submitting that lab summary. **Do not share computer files of work (including text, graphs, tables, etc.) to be submitted for grading!** The student misrepresenting the work of another as his or her own is in violation of the Academic Honor Principle and it is quite possible that the Committee on Standards might find the student providing the original file also to be in violation.

d) Weekly lab assignments must be prepared independently.

Honesty is the foundation of the academic pursuit of knowledge. In recognition of this, the faculty and staff of Biology 13 will not overlook any violations of the Academic Honor Principle. Indeed, the Faculty Handbook of Dartmouth College states explicitly that College Faculty are obligated to report potential violations of the Academic Honor Principle to the Dartmouth College Committee on Standards.
Lab Schedule

June 30, July 1
Lab #1: Chromosomal DNA prep and PCR

July 7 & 8
Lab #2: *Drosophila* Genetics, setting up crosses

July 14 & 15
Lab #3: Gel electrophoresis, DNA sequencing

July 21 & 22
Lab #4: *Drosophila* Genetics, Scoring crosses

July 28 & 29
Lab #5: Analyze DNA sequencing data
*Lab Summary #1 is due on Friday, July 31 at the beginning of lecture*

August 4 & 5
Lab #6 Set-up yeast matings

August 11 & 12
Lab #7 Analyze yeast mating results
*Drosophila* transcriptional assays

August 18 & 19
TA office hours for Lab Summary #2
*Lab Summary #2 is due at start of class on Monday, August 24.*

August 21, 24, & 25
Lab practical - See Canvas for date / time
Orientation to the Laboratory: Rules of Conduct and General Safety

1. Place all jackets, unnecessary books, purses, backpacks, and paraphernalia on the hooks and cubbies in the vestibule to the lab. This includes cell phones and personal listening devices. Cell phones should be turned off for the duration of the lab. The laboratory work area must be kept free of articles not actually in use.

2. Eating, drinking, and smoking are forbidden at all times in the laboratory.

3. Long pants and close-toed shoes must be worn in the laboratory. If you do not arrive in proper lab attire, you will be sent out to change.

4. Do not place anything in your mouth while in the laboratory. This includes pencils, food, and fingers. Learn to keep your hands away from your eyes, nose, mouth, etc.

5. Know the location of safety equipment (fire extinguisher, eyewash, emergency shower, and first-aid kit).

6. Know the location of the nearest fire exit.

7. Return all reagents, cultures, and glassware to their proper places.

8. Avoid contamination of the benches, floor, and wastebaskets.

9. Clean your work area (laboratory bench) with a disinfectant (70% ethanol) before and after each laboratory period. This standard procedure lessens the chance for accidental infection as well as for contamination of lab materials.

10. Wash your hands thoroughly before and after each experiment, using soap. Always wash your hands before leaving the laboratory.

11. You should avoid wearing loose clothing and long hair should be tied back to minimize fire hazard and contamination of experiments and cultures.

12. Never take laboratory materials outside of the laboratory workspace.

Sterile Technique

1. Wash your hands before starting your experiment and throughout the lab period. Always wash your hands before leaving the lab and when you return to the lab.

2. Clean the bench area with 70% ethanol before you begin the lab exercises and when you have finished for the day.
3. Do not touch sterile surfaces or sterile solutions with non-sterile surfaces (such as your fingers).

4. Keep sterile containers covered when not in use. This includes Petri dishes, sterile pipette tip containers and bottles or tubes containing sterile liquids.

5. Do not reuse pipette tips. Use a new, sterile tip for each transfer of liquid.

**Pipettor Operation:**

Pipettors are precision instruments and very expensive. Be sure to place them on the lab bench in a secure place when not in use. Do not drop them!

You will use pipettors in most of the lab exercises this term. The successful completion of your lab work will require the proper use of pipettors.

When using pipettors, be sure that you have the correct model for the volume you want to measure. You will work with three different pipettor models this term, P-20, P-200, and P-1000. Each model is identified by a number on the top of the plunger. For example, the P-20 has "20" on the top of the plunger.

Each pipettor model has a defined volume range. They are as follows:

<table>
<thead>
<tr>
<th>Pipette Model</th>
<th>Volume Range</th>
<th>Tip Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-20</td>
<td>2-20 µl</td>
<td>Clear</td>
</tr>
<tr>
<td>P-200</td>
<td>20-200 µl</td>
<td>Clear or Yellow</td>
</tr>
<tr>
<td>P-1000</td>
<td>200-1000 µl</td>
<td>Clear or Blue</td>
</tr>
</tbody>
</table>

1. Set the desired volume on the digital volume indicator by holding the pipettor body in one hand and turning the "volume adjustment knob" until the correct volume is displayed.

2. Attach a disposable tip (these tips are sterile, so be careful not to contaminate them) to the shaft of the pipettor. Press it firmly with a slight twisting motion to insure a strong, air-tight seal.

3. Using your thumb, depress the plunger to the **FIRST STOP POSITION.** This part of the stroke is the calibrated volume displayed on the volume indicator.

4. Holding the pipettor vertically, immerse the tip into the sample liquid.

5. With your thumb positioned on the plunger, allow the plunger to **SLOWLY** return to the "up" position. **Never permit it to snap up quickly!**
6. Wait 1-2 seconds to ensure that a full volume of sample is drawn into the tip. Viscous fluids in particular will require additional time to flow into yellow or clear pipette tips, which have a small orifice.

7. Withdraw the pipettor tip from the solution. If any liquid remains on the outside of the tip, touch the tip to the interior wall of the tube to remove the excess.

8. Look at the volume of liquid in the pipettor tip. Does the tip appear to contain the expected amount of liquid (we will teach you how to determine this)? If so, proceed to step 9. If it does not, please check with the TA before proceeding to step 9.

9. To dispense the sample, depress the plunger slowly to the FIRST STOP. Wait 1 second. Then depress the plunger to the SECOND STOP POSITION (bottom limit of stroke), expelling any residual liquid in the tip.

10. **With the plunger still fully depressed**, carefully withdraw the pipettor.

11. Return the plunger slowly to the "up" position.

12. Discard the tip into the used tip beaker provided by sharply depressing the "tip ejector button"