BIO201 Genetics and Evolution

Brooke Jude- Spring 2015

Office: RKC 210
Phone: (845) 752-2337
Email: bjude@bard.edu
You will be responsible for checking your Bard email account often, as this is the primary way I will contact you with information critical for your success in this class.

OFFICE HOURS: Monday 1:00-2:30
Thursday 2:00-3:00

MOODLE: will contain all primary literature for journal club, important papers, notes about class, and other critical information.
YOU WILL NEED TO CHECK THIS OFTEN
https://moodle2.bard.edu
Enrollment key for this class is: **mutationS15**

Class meetings:	Monday	8:30-11:30	RKC111/112
	Wednesday	8:30-11:30	RKC111/112

Although we do have a dedicated lab time slot, there will be work required outside of the scheduled laboratory section. Advanced lab research requires continued commitment to maintenance and care of the experiments. Lack of attention to your experiments may result in experimental failure, and data may not be able to be recovered. Permission will be on file with security for you to access the lab during off hours.

COURSE GOALS:

As this is a writing intensive course, a significant amount of class time will be spent working on writing goals in parallel with content goals. Following this course you should be able to:

- Understand the learning goals for this class (separate document)
- Learn to analyze and evaluate the concepts of genome expression and analysis using the primary literate and secondary review documents
- Learn the basic principles of population and quantitative genetics from an evolutionary perspective
- Be able to write a clear and coherent results and discussion section of primary manuscripts, including figures, tables and legends
- Be able write an abstract of a paper based on the content included in subsequent sections
- Be learning to give oral and written presentations of figures and content from the primary literature

TEXTBOOKS
The genetics textbook listed is a reference, for you to consult for background information. I will put a copy out on the RKC pods for use if you choose not to purchase the text, however, I will be suggesting readings from these textbooks to provide background information. The writing text should be a purchased text, as you will likely be assigned from it in future biology courses!

Genetic Analysis: and integrated approach
Mark F. Sanders
John L. Bowman
Benjamin Cummings Publishing
12/14/2011
ISBN-10: 0321732502 • ISBN-13: 9780321732507

Writing in the Biological Sciences
Author: Angelika Hofmann
Publisher: Oxford University Press, USA; 2013

ISBN: 978-0-19-976528-7

SUGGESTED COMPUTER PROGRAMS:
Papers: (http://www.papersapp.com/mac/) ~$48 for student license
Dropbox- use for all file back up, and to share files between group members
Evernote- use to take notes, store documents, backup work, use as a lab notebook

EXAMS AND ASSIGNMENTS:
In terms of course grading, this course will have:

- 3 exams, (2 mid term exams, 1 final)
- in class assignments
- responses on course blog
- various homework/problem sets
- 2 short writing assignments
- multiple lab write up assignments

WRITING TUTOR:
Our class will be working closely with a Writing Fellow from the Learning Commons. Working with a Writing Fellow is an excellent way to get the most out of the writing component of this class, as you will get feedback on three of your drafts and have the opportunity to revise your papers. Becoming comfortable and proficient at revision is perhaps the single-most important aspect of developing as a college writer, and the tutors assigned to this class will work with you to sharpen these skills. Note that tutors are not meant to be experts in the texts that we read in this class. Rather, they offer a second pair of eyes on your writing, a

chance to strengthen your thesis and argument, and an active sounding board for your ideas. Virtually all writers (including your professors here at Bard) rely on feedback from their peers on their written work. Because this process has the potential to contribute significantly to your development as a writer, these meetings with tutors are required, and any missed appointments will be reported to me and will lower your grade. **The writing tutors for this class are Andrea Szegedy-Maszak (as3395@bard.edu) and Shaya French (sf1357@bard.edu).** It will be required for you to meet with a tutor AT LEAST twice this semester to go over a draft of a writing assignment. Failure to meet with the writing tutor will result in a reduction of the overall class grade. **Keep in mind that a writing tutoring session is not the same as a content tutoring. In a writing tutoring session you should be comfortable with the biology/genetics content and should be looking for help from the perspective of writing style and mechanics.** *If you require a content tutor, please seek one out in advance of the writing tutoring session.*

READINGS:
It will be critical to be up to date with the readings prior to attending class. Typically we will be examining primary literature as a class or in small groups. It is your responsibility to bring the papers to class with you (if I've handed them out), and to have read the papers/portions of papers assigned. Failure to read the papers will limit your ability to participate in class presentations and discussions and could negatively impact your grade. **This semester there will also be writing responses on Moodle2 for you to submit as well as in class responses.**

LABORATORY:
The purpose of the lab section is to give you hands on experience for some of the concepts we will be going over in class. Additionally, the lab provides a forum to tackle inquiry-based questions, analyze data, and present that data in a written format.

Lab projects for this course will be conducted in pairs. It will be the responsibility of all group members to participate fully in ALL aspects of the project. All sections of written assignments will be written and handed in individually- no exceptions. All writing and assignments must be your own, ***copying from lab partners or other students in the class is not permitted.*** Use of work that is not your own is subject to penalties of plagiarism, detailed below.

There will be work required outside of the scheduled class meetings. Permission will be on file with security for you to access the lab during off hours.

ATTENDANCE POLICY:

Attendance for all classes is highly suggested. Due to the high level of class participation, your presence at all sessions will be critical for keeping up with the material to do well in the class. If you will be absent, and you know in advance, please make me aware so that arrangements can potentially be made to make up the work.

SNOW ATTENDANCE POLICY:
In the event that the official Bard Shuttle is cancelled during the start time of our class (8:30 AM Mondays, Wednesdays), class will be cancelled. Shuttle cancellation is announced via the emails and the college's transportation website and the E2 Campus Alert System (http://www.bard.edu/alerts/). Should this occur, you will be required to check on the class Moodle page, as there may be an assignment posted (likely a reading or case study) to complete in lieu of the class meeting.

Late arrivals to class are not acceptable, as it disrupts those who have arrived on time, and you will likely miss whatever information delivered (usually announcements and reminders) in the first few minutes.

Multiple unexcused absences and repeated late arrivals to class will likely negatively impact your final grade.

ALL ASSIGNMENTS MUST BE SUBMITTED ELECTRONICALLY VIA MOODLE (or on class blog page, where appropriate)

All assignments will be due by 11:59 pm of the stated due date

Graded assignments	Date	Weight
Exam 1	2/23/2015	12.5%
Exam 2	3/30/2015	12.5%
Exam 3	5/13/2015	15%
Primary Literature Analysis Paper 1	3/2/2015	10%
Primary Literature Analysis Paper 2	4/28/2015	10%
Lab Write ups	TBA	20%
Class and Lab attendance/participation (including blog comments)		10%
Problem Sets, class assignments		10%

Grade Distribution

A	94-100
A-	90-93
B+	87-89
B	84-46

B-	80-83
C+	77-79
C	74-76
C-	70-73
D	60-69
F	<60

MISSED WORK/LATE WORK POLICY:
Work is to be handed in on time. Late work will be accepted for 7 days past the due date- however 5% will be taken off automatically for each day the work is late. Work handed in 1 week past the due date will not be graded.

ACADEMIC HONESTY/ PLAGIARISM/ CHEATING:
The following is taken from the Bard Student handbook concerning plagiarism and academic honesty:

"To plagiarize is to "steal and pass off as one's own the ideas, words, or writings of another." This Webster's Dictionary definition is quite straightforward, but it is possible for students to plagiarize inadvertently if they do not carefully distinguish between their own ideas or paper topics and those of others. The Bard faculty regards acts of plagiarism very seriously." The Student Handbook as well as the Bard Academic Resource Center has suggestions for avoiding academic dishonesty and plagiarism, as well as the penalties that they can invoke.

It will be considered as cheating on an assignments or exams if you are witnessed using ineligible resources for an assignment or during an exam (ie. looking up material online, in a book, in your notes, on Moodle), asking another for an answer, looking at another's work prior to writing your answer. If you have a question as to whether a source is eligible for use, you should ask me prior to using it for clarification (ie. working in groups on a homework assignment).

In this class, evidence of plagiarism or cheating on an assignment or exam will result in a score of 0 on the assignment or exam, in addition to other sanctions, including, but not limited to: report to Dean of Academic Affairs office and criteria sheet documentation. 2 or more incidents of cheating and/or plagiarism will result in an F for the course.

SERVICES FOR STUDENTS WITH DISABILITIES:
http://inside.bard.edu/academicresources/academics/services.shtml
"Statement of non-discrimination on the basis of learning or psychological disability : In compliance with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990, Bard College is committed to providing otherwise qualified individuals with disabilities equal access to the

College's academic courses, programs, and activities. In support of this mission, the College provides services and reasonable accommodations to self-identified students who present the appropriate documentation.

Procedure for Registering for Accommodations

Students who claim learning or psychological disabilities should register with The Disability Support Coordinator in the Academic Resources Center at the start of the semester or as soon as the diagnosis of disability is made. The student will be asked to present documentation supporting the claim to disability and suggested accommodations."

Forms for download:
http://www.bard.edu/admission/forms/pdfs/disability.pdf

Resources: Bard Academic Resource Center - The Learning Commons :
Resources for dealing with grammar, bibliography, citations, help writing papers, tutors etc. It is a phenomenal resource; you should check it out as early as possible in the semester and keep the site bookmarked. In fact, here it is!!
http://inside.bard.edu/academicresources/about/

BIO201 Course Reading List

subject to change- please see Moodle2 and be alert in classes for additional or changed reading assignments

Week 1: Molecular basis of heredity, variation, evolution, transmission genetics

- Ketchum et al. *Novel North American Hominins, Next Generation Sequencing of Three Whole Genomes and Associated Studies*, 2012
- Kean, Chapter 1, *The Violinist's Thumb* *See assignment sheet
- Hofmann, Chapter 1 and 2, *Writing in the Biological Sciences,* 2014
- Crick, *Central Dogma of Molecular Biology*, 1970
- Prusiner, Nobel Lecture, *Prions,* 1997

Week 2/3: Genetic analysis of quantitative traits, population genetics, genetic drift

- Mackay, *Epistasis and quantitative traits: using model organisms to study gene–gene interactions,* 2014
- Mackay et al. *The genetics of quantitative traits: challenges and prospects*
- Kowalko et al. *Genetic analysis of the loss of schooling behavior in cavefish reveals both sight-dependent and independent mechanisms*
- Linnen et al. *Adaptive Evolution of Multiple Traits Through Multiple Mutations at a Single Gene*
- Weber et al. *Discrete genetic modules are responsible for complex burrow evolution in Peromyscus mice*

Week 4: Epigenetics

- Herb, *Epigenetics as an answer to Darwin's "special difficulty"*
- Vargas, *Did Paul Kammerer Discover Epigenetic Inheritance? A modern look at the controversial midwife toad experiments*
- Haig, *The (Dual) Origin of Epigenetics*
- Foret et al., *DNA methylation dynamics, metabolic fluxes, gene splicing, and alternative phenotypes in honey bees*
- Lyko et al., *The Honey Bee Epigenomes: Differential Methylation of Brain DNA in Queens and Workers*

Week 5: DNA replication, chromosomal licensing, cell division

- Kabeche and Compton, *Cylin A regulates kinetochore microtubules to promote faithful chromosome segregation*
- Simon and Schwacka *The Mcm2-7 Replicative Helicase: A Promising Chemotherapeutic Target*
- Blow and Dutta (R) *Preventing Re-Replication of Chromosomal DNA*
- Koren et al. *Genetic Variation in Human DNA Replication Timing*

Week 6/7: Transcription and Translational dynamics

- Gingold et al. *A Dual Programfor Translation Regulationin Cellular Proliferation and Differentiation*
- Novoa and De Pouplana (R) *Speeding with control: codon usage, tRNAs, and ribosomes*
- Novoa et al. *A Role for tRNA Modificationsin Genome Structure and Codon Usage*
- Ginglold and Pilpel (R), *Determinants of translation efficiency and accuracy*

Week 8: Spring Break

Week 9: Genetic regulation

- Radtke and Raj, *The role of notch in tumorigenesis: oncogene or tumor suppressor?*
- Matsumoto et al. *A functional genomics strategy reveals* clockwork orange *as a transcriptional regulator of the* Drosophila *circadian clock*
- Lewis et al. *Angelman syndrome imprinting center encodes a transcriptional promoter*

Week 10: RNA, gene therapy

- Mand et al. *Predictive genetic testing in minors for late-onset conditions: a chronological and analytical review of the ethical arguments.*
- Aiuti et al. *Gene therapy for immunodeficiency due to adenosine deaminase deficiency.*
- Meng et *al Towards a therapy for Angelman syndrome by targeting a long non-coding RNA*

Week 11: Mutagenesis and DNA repair pathways

- Keskin et al. Transcript-RNA-templated DNA recombination and repair
- Guo et al. Protein tolerance to random amino acid change

Week 12/13: ENCODE

- Graur, *On the Immortality of Television Sets: "Function" in the Human Genome According to the Evolution-Free Gospel of ENCODE*
- Djebali et al. *Landscape of transcription in human cells*
- *An integrated encyclopedia of DNA elements in the human genome*
- Carninci, *Mice in the ENCODE Spotlight*
- Stergachis et al. *Conservation of trans-acting circuitry during mammalian regulatory evolution*

Week 14: Genomics/ Applications and Advances

- Annaluru et al. *Total Synthesis of a Functional Designer Eukaryotic Chromosome*

- Malyshev et al. *A semi-synthetic organism with an expanded genetic alphabet*

Week 15: Human Genetic Disorders

TBD

BIO201 Laboratory Related Readings

- Mackay, *The Drosophila melanogaster Genetic Reference Panel*
- Mackay, *QUANTITATIVE TRAIT LOCI IN DROSOPHILA: Mutations and quantitative genetic variation: lessons from Drosophila*
- Stone, *Joint genotyping on the fly: identifying variation among a sequenced panel of inbred lines.*
- Nichols et al. *Methods to assay Drosophila behavior*
- Gerber et al. *Odor–Taste Learning Assays in Drosophila Larvae*
- Berni et al. *Using Neurogenetics and the Warmth-Gated Ion Channel TRPA1 to Study the Neural Basis of Behavior in* Drosophila.
- Colinet et al. *Functional characterization of the Frost gene in* Drosophila *melanogaster: importance for recovery from chill coma*.
- Lee et al. *Genetic mapping of adaptive wing size variation in* Drosophila *simulans*
- King et al. *Using Drosophila melanogaster To Identify Chemotherapy Toxicity Genes*

BIO201 Learning Goals (based off of **MCDB 2150–Genetics: Course and Topic Learning Goals** SP2013)

After completing this course you should be able to:

1. Analyze phenotypic data and deduce possible modes of inheritance (e.g. dominant, recessive, autosomal, X-linked, cytoplasmic) from family histories.

- ☐ Draw a pedigree based on information provided.
- ☐ Calculate the probability that an individual in a pedigree has a particular genotype.
- ☐ Define the terms "incomplete penetrance," "variable expressivity," and "sex-limited phenotype," and explain how these phenomena can complicate pedigree analysis.

2. Describe the molecular anatomy of genes and genomes.

- ☐ Differentiate between a gene and an allele.
- ☐ Diagram a typical eukaryotic gene and indicate the locations of (a) regions that are genic but are not coding, (b) regions that are transcribed but not translated, and (c) regions that are both transcribed and translated.
- ☐ Describe the general organization, possible function, and frequency of genes and non-gene DNA sequences in a typical eukaryotic genome.
- ☐ Explain the functional significance of packaging DNA into chromosomes and the lack of correlation between chromosome number and genetic information content.

3. Describe the mechanisms by which an organism's genome is passed on to the next generation.

- ☐ Define somatic and germline cells, and list similarities and differences between them.
- ☐ Recognize why germline mutations can be passed onto the next generation, whereas somatic mutations cannot.
- ☐ Describe, using diagrams, the sequence of events involving DNA in meiosis from chromosome duplication through chromosome segregation.
- ☐ Describe the phenomena of linkage and independent assortment of alleles during meiosis, and explain why some pairs of alleles exhibit linkage and others do not.
- ☐ Explain how independent assortment can lead to new combinations of alleles of unlinked genes.
- ☐ Diagram the process of homologous recombination during meiosis and explain how it can lead to new combinations of linked alleles.
- ☐ Explain how a specific combination of linked alleles (haplotype) can persist through many generations.

4. Extract information about genes, alleles, and gene functions from genetic crosses and human pedigree analysis.

- ☐ Design genetic crosses to provide information about genes, alleles, and gene functions.
- ☐ Explain why it is advantageous to use true-breeding organisms in crosses.
- ☐ Predict progeny genotypic frequencies given the genotypes of the parental gametes.

- ☐ Identify an allele's mode of inheritance from progeny phenotypes.
- ☐ Place genes in a functional order based on the phenotypes of double mutants, and explain the assumptions that must be made when interpreting these results.
- ☐ Determine gene linkage and genetic map distances by analyzing progeny with recombinant phenotypes.
- ☐ Use statistical analysis to determine how well data from a genetic cross or human pedigree analysis fits theoretical predictions.
- ☐ Determine if two mutations affect the same gene using complementation tests, and explain the requirements and the basis for interpreting results from these tests.

5. Describe the processes that can influence the frequency of alleles in a population.

- ☐ Determine allele frequencies based on phenotypic data for a population in equilibrium.
- ☐ Explain how natural selection and genetic drift can affect the elimination or maintenance of deleterious alleles in a population.

6. Cite examples of gene dosage variation (ploidy), and explain why it affects phenotype.

- ☐ Discuss why alterations in chromosome number can be detrimental.
- ☐ Describe the process of X inactivation in mammals, and explain its function.

7. Compare different types of mutations and describe how each can affect genes, mRNA and proteins.

- ☐ Explain, using diagrams, how nucleotide changes result in the alteration of protein activity.
- ☐ Explain why some mutations do not affect protein structure or function.
- ☐ Describe how deletions, inversions, translocations, and the movement of transpositional elements can affect gene function, gene expression, and genetic recombination.
- ☐ Describe how mutations arise and how environmental factors can increase mutation rate. Cite examples of mutations that can be beneficial to organisms.
- ☐ Explain why some DNA damage does not result in mutation.
- ☐ Distinguish between a DNA replication error and a mutation.
- ☐ Explain what is meant by a single-nucleotide polymorphism (SNP) and how SNPs can be used as genetic markers even if they do not affect protein structure or function.

8. Explain the molecular basis at the protein level for allele types with different genetic behaviors.

- ☐ Describe the differences between loss of function and gain of function mutations and their potential phenotypic consequences.
- ☐ Predict the most likely effects on protein structure and function of null, reduction-of-function, overexpression, dominant-negative and gain-of-function mutations.

9. Justify the value of studying genetics in organisms other than humans.

- ☐ Explain why it is useful to investigate functions of many human genes by

studying simple model organisms such as yeast, nematode worms, and fruit flies.
- ☐ Describe the benefits and limitations of using model systems to study human diseases.
- ☐ Use bioinformatics data to compare homologous genes in different species and infer relative degrees of evolutionary relatedness.

10. Describe the steps that are taken to determine the molecular identity of a human gene that when mutated can underlie a disease.

- ☐ Use information from model organisms to identify candidate genes in humans.
- ☐ Use pedigree information and DNA markers to track a disease trait in a family.
- ☐ Explain, correctly apply, and interpret results from molecular genetic tools such as DNA sequencing, SNP analysis, and microarrays.

WEEK	***DAYS***	***Topic***	***Reading*** *****Sanders and Bowman is the Genetics textbook, and is a reference for background, if needed.***	***Assignments Due*** ***(Dates on Moodle)***
Week 1	1/26 (Monday) 1/28 (Wednesday)	**Week 1: Molecular basis of heredity, variation, evolution, transmission**	Chapters 1 and 2 (Sanders and Bowman) • Ketchum et al. *Novel North American Hominins, Next Generation Sequencing of Three Whole Genomes and Associated Studies*, 2012 • Kean, Chapter 1, *The Violinist's Thumb* *See assignment sheet • Hofmann, Chapter 1 and 2, *Writing in the Biological Sciences,* 2014 • Crick, *Central Dogma of Molecular Biology*, 1970 • Prusiner, Nobel Lecture, *Prions,* 1997	
	Lab	Lab Safety (1/26)/ Taster Day 1		

Week 2	2/2(Monday) 2/4 (Wednesday)	**Genetic analysis of quantitative traits, population genetics, genetic drift**	Chapters 21 and 2 (Sanders and Bowman) McKay et. al. • Mackay, *Epistasis and quantitative traits: using model organisms to study gene–gene interactions,* 2014 • Mackay et al. *The genetics of quantitative traits: challenges and prospects* • Kowalko et al. *Genetic analysis of the loss of schooling behavior in cavefish reveals both sight-dependent and independent mechanisms* • Linnen et al. *Adaptive Evolution of Multiple Traits Through Multiple Mutations at a Single Gene* • Weber et al. *Discrete genetic modules are responsible for complex burrow evolution in Peromyscus mice*	

	Lab	Taster Analysis, *Drosophila* training		
Week 3	2/9 (Monday) 2/11 (Wednesday)	**Genetic analysis of quantitative traits, population genetics, genetic drift analysis model building**	See previous week.	Peer Editing of Primary lit. analysis (Draft due in class 2/9/15)
	Lab	*D. melanogaster* assays Taster wrap up		

Week 4	2/16 (Monday) 2/18 (Wednesday)	Epigenetics	• Herb, *Epigenetics as an answer to Darwin's "special difficulty"* • Vargas, *Did Paul Kammerer Discover Epigenetic Inheritance? A modern look at the controversial midwife toad experiments* • Haig, *The (Dual) Origin of Epigenetics* • Foret et al., *DNA methylation dynamics, metabolic fluxes, gene splicing, and alternative phenotypes in honey bees* • Lyko et al., *The Honey Bee Epigenomes: Differential Methylation of Brain DNA in Queens and Workers*	Taster Lab Results and Discussion due 2/16/15 Refer to Hoffmann For details
	Lab	*S. cerevisiae* set up		
Week 5	2/23 (Monday)	EXAM 1		
	2/25 (Wednesday)	**DNA replication, chromosomal licensing, cell division**	Chapters 4 and 5 (Sanders and Bowman) **Week 5: DNA replication,**	

			chromosomal licensing, cell division • Kabeche and Compton, *Cylin A regulates kinetochore microtubules to promote faithful chromosome segregation* • Simon and Schwacka *The Mcm2-7 Replicative Helicase: A Promising Chemotherapeutic Target* • Blow and Dutta (R) *Preventing Re-Replication of Chromosomal DNA* • Koren et al. *Genetic Variation in Human DNA Replication Timing*	
	Lab	Yeast analysis/ *Drosophila*		

Week 6	3/2(Monday) 3/4(Wednesday)	**Transcription and Translational dynamics**	Chapters 7, 8, and 9 (Sanders and Bowman) • Gingold et al. *A Dual Programfor Translation Regulationin Cellular Proliferation and Differentiation* • Novoa and De Pouplana (R) *Speeding with control: codon usage, tRNAs, and ribosomes* • Novoa et al. *A Role for tRNA Modificationsin Genome Structure and Codon Usage* • Ginglold and Pilpel (R), *Determinants of translation efficiency and accuracy*	Primary Lit. analysis paper due 3/2/15
	Lab	Yeast analysis		
Week 7	3/9 (Monday) 3/12(Wednesday)	**Transcription and Translational dynamics**	See previous week.	
	Lab	Drosophila analysis (Make sure your flies are set for spring break!!)		
Week 8	3/16 (Monday)	Spring Break!!!		
	3/18 (Wednesday)			

	Lab			
Week 9	3/23 (Monday) 3/25(Wednesday)	Genetic Regulation	Chapters 14 and 15 (Sanders and Bowman) • Radtke and Raj, *The role of notch in tumorigenesis: oncogene or tumor suppressor?* • Matsumoto et al. *A functional genomics strategy reveals* clockwork orange *as a transcriptional regulator of the* Drosophila *circadian clock* • Lewis et al. *Angelman syndrome imprinting center encodes a transcriptional promoter*	Yeast Results and Discussion due 3/25/15 Refer to Hoffmann
	Lab			
Week 10	3/30 (Monday)	Exam 2		
	4/1 (Wednesday)	**RNA, gene therapy**	• Mand et al. *Predictive genetic testing in minors for late-onset conditions: a chronological and analytical review of the ethical arguments.* • Aiuti et al. *Gene therapy*	

			for immunodeficiency due to adenosine deaminase deficiency. • Meng et *al Towards a therapy for Angelman syndrome by targeting a long non-coding RNA*	
	Lab			
Week 11	4/6 (Monday) 4/8 (Wednesday)	**Mutagenesis and DNA repair pathways**	• Keskin et al. Transcript-RNA-templated DNA recombination and repair • Guo et al. Protein tolerance to random amino acid change	
	Lab			
Week 12	4/13 (Monday)	ENCODE	• Graur, *On the Immortality of Television Sets: "Function" in the Human Genome According to the Evolution-Free Gospel of ENCODE* • Djebali et al. *Landscape of transcription in human*	

			cells • *An integrated encyclopedia of DNA elements in the human genome* • Carninci, *Mice in the ENCODE Spotlight* • Stergachis et al. *Conservation of trans-acting circuitry during mammalian regulatory evolution*	
	4/15 (Wednesday)	NO CLASS – Moderation Day		
	Lab			
Week 13	4/20 (Monday) 4/22(Wednesday)	ENCODE	See previous week.	
	Lab			
Week 14	4/27 (Monday)	NO CLASS-- ADVISING DAY		Primary lit analysis 2 Dud 4/28/15
	4/29 (Wednesday)	Applications and Advances	Chapters 16, 17, 18 (Sanders and Bowman) • Annaluru et al. *Total Synthesis of a Functional Designer Eukaryotic Chromosome* • Malyshev et al. *A semi-synthetic organism with an expanded genetic*	

			alphabet	
	Lab			
Week 15	5/4 (Monday)	Human Genetic Disorders	• TBA	Final lab due 5/6/15
	5/6 (Wednesday)			
	Lab	Clean Up		
Week 16	5/11 (Monday)	REVIEW		
	5/13 (Wednesday)	FINAL EXAM		