Genetic Analysis I: 384
For Genetics Majors Only
Tuesday and Thursday, 3:20-4:40, Pharmacy Building, Room-115 (PH-115)

Dr. Mike Verzi will lead the class from 9/3 – 10/17
Dr. Mary Konsolaki will lead the class after 10/18 to the final

Dr. Konsolaki will have another syllabus for the second part of the course.

Sakai site: https://sakai.rutgers.edu/portal/site/4eb4a321-cd42-4c62-945b-9b9e5a8338fc

You should have received an e-mail with this link.

Class environment: I assume you are scientists. As such, you will be expected to work as colleagues (with me and each other), practice evidence-based thinking and learning, and value collaboration and diversity. I encourage you to strive towards learning, not grades!

In an effort to work as scientists in class we can't afford as much time for content transfer you could easily get by reading. Therefore pre-class reading assignments are essential. These assignments will be assessed by on-line quizzes.

Materials: iClicker (please bring to every class), 3x5 notecards (in-class assignments will be handed in each class. They must be 3x5 to stack correctly, no paper ripping).

Text: Brooker Genetics Analysis and Principles 4th edition.

> Textbook: Genetics: Analysis and Principles (4th edition) by Robert J. Brooker.
> **ISBN # 978-0-07-352528-0**

Disability – If you have a documented disability and require special accommodations, please let us know as soon as possible.

Assessment: Ideally, you will acquire skills necessary to assess your own learning. You will be able to integrate ideas and concepts, form your own questions, decide which questions are the most important, and then seek evidence to answer them.

Below is the breakdown for class assessment:
10% for pre-class reading –timed quizzes on Sakai
20% for recitation work – problem sets
5% for pre- and post- course essays and your biography
15% for in-class group work
20% for mid-term exam
30% for final exam

(Assessment on current events will be interwoven into all of the above; current events relevant to the class material will begin each class period)

Attendance: Attendance is mandatory. Unexcused absences are not tolerated, as per Rutgers policy. This is particularly important in a class aimed at developing collaborative problem solving. You can't collaborate if you are not in class. Unexcused absences from class will be graded as zero for class participation and group work for that day. One unexcused absence from recitation will be scored as zero for the missed week and two unexcused absences from recitation will result in failing the class. Part of class participation will include use of iClickers and 3x5 notecards. Failure to bring these to class will impact your in-class grade. If you expect to miss one or two classes, please use the University absence reporting website https://sims.rutgers.edu/ssra/ to indicate the date and reason for your absence.

Extra Credit: There will be no individualized opportunities for special credit. There may be opportunities for the entire class during the course.

Office Hours:

Verzi 9/3- 10/17 Mondays 8:30-11:00am, Life Sciences Building, LSB127
verzi@biology.rutgers.edu

Konsolaki (starting after Oct. 18): Mondays 9:00-11:30am, Nelson Labs, B422
konsolaki@biology.rutgers.edu

Arunika Das: Mondays 2-4, Waksman 205
arunikad@eden.rutgers.edu

Current Events: Each class will contain a current event that relates to the day's lesson, typically to start the class. The content of these discussions will be interwoven into the assessments. It's advisable to be on time to class.

ACADEMIC INTEGRITY AT RUTGERS: In accordance with departmental and University Policy, violations of academic integrity will immediately be referred to the dean.

Genetics Department Goals Covered in this course:

1) Know the terms, concepts and theories in genetics.
2) Integrate the material from multiple courses and research. That is, to think holistically and to see the whole as well as the parts.

Core curriculum Goals Covered in this course: In this course you will analyze the relationship that science and technology have to contemporary social issues in each class meeting. Therefore, the course meets the 21st Century Challenges requirement in the SAS core curriculum.

Course Goals: We will attempt to accomplish the following goals, roughly in chronological order; each learning goal will be approximately 1 class length. However, it's important to be able

to relate each goal to the others. I will attempt to design assessments around your ability to demonstrate you've accomplished these learning objectives.

Note: ***see Sakai website for updated due dates on reading assignments.*** *Dates are approximate, and the syllabus may be updated, but the following topics will be covered roughly in chronological order:*

Introduction to Genetic Analysis – Sept. 3

Learning Goal 1: Understand common patterns of inheritance (September 3, 5)

Pre-class reading 1: 18-30; quiz on Sakai

Specific learning objectives:

-Be able to predict the outcome of a genetic cross

-Relate common genetic terms to one another (gene, allele, genotype, phenotype, trait, heterozygous, homozygous, allele segregation, dominant, recessive, independent assortment)

- Create pedigrees showing inheritance of a dominant or recessive trait

Learning Goal 2: Appreciate how inheritance patterns can be predicted using statistics and the laws of inheritance (September 5, 10)

Pre-class reading 2: 30-35; quiz on Sakai

Specific learning objectives:

-Discern between and apply the sum and product rules to predict the probability of genetic cross outcomes

-Apply the binomial expansion equation to calculate the probability of more specific cross outcomes

-Apply the Chi square test as a mechanism to relate the concepts of hypothesis testing, proof, *P* value and probability.

-Appreciate the importance of statistics in research, know how to choose an appropriate statistical test, and plan for an adequate sample size in your experiments

Learning Goal 3: Understand Chromosome Structure and the process by which chromosomes are duplicated and segregated in mitosis and meiosis (September 10-12)

Pre-class reading 3: 44-54; quiz on Sakai

-Explain how to create and interpret a karyotype, and what you'd use it for

-Diagram the order of steps in mitosis and the importance of restriction points (aka checkpoints)

Pre-class reading 4: 54-64; quiz on Sakai

-Discuss the advantages of sexual reproduction and how meiosis contributes to these advantages

-Relate differences in mammalian male and female meiosis to chromosomal disorders

Learning Goal 4: Understand inheritance patterns that don't fit the simple dominant/recessive relationship observed by Mendel. (September 17)

Pre-class reading 5: 71-85; quiz on Sakai

-Explain the relationship between an inheritance pattern and the likely underlying

molecular mechanism
-Define and contrast different types of Medelian inheritance
-Discuss the influence of environment on traits
-Explain how multiple alleles contribute to the inheritance pattern of blood type
-Be able to explain sex-lined inheritance pattern and be able to create a pedigree exhibiting sex-linked inheritance

Learning Goal 5: Understand how gene interactions can impact phenotypes (September 19)
Pre-class reading 6 (applies to goals 5 and 6): 86-108(top); quiz on Sakai
-Be able to apply epistasis, complementation, modifying genes, gene redundancy, and suppressor mutations to experiments involving research model systems and/or human genetic disease

Learning Goal 6: Understand non-Mendelian mechanisms of inheritance (September 24)
-Define and give an example of a gene with a maternal effect
-Discuss why dosage compensation is important and how it is achieved in mammals
-Be aware of non-mammalian mechanisms of dosage compensation

Learning Goal 7: Understand epigenetic mechanisms of inheritance (10/1)
Pre-class reading 7: 108-120; quiz on Sakai
-Define the 3 stages of the imprinting process and relate these stages to an example of the molecular process (such as Igf2 or Angelman/Prader-Willi)
-Give examples of extranuclear inheritance
-Relate extranuclear inheritance, symbioysis, and infective particles to inheritance of traits

Learning Goal 8: Understand Genetic Linkage (10/3)
Pre-class reading 8: 126-136; quiz on Sakai
-Explain how crossing over can yield new combinations of alleles (nonparental)
-Discuss why independent assortment isn't observed with linked traits and explain the relationship between linked genes and the distance between them
-Apply Chi square analysis to predict whether traits are linked or sorting independently

Learning Goal 9: Understand how Genetic Linkage is used to map genes (10/8)
Pre-class reading 9: 136-151; quiz on Sakai
-Be able to design crosses that will allow you to: determine if genes are linked, and if so, determine the distance between the genes
-Define mitotic recombination and diagram how it occurs (what stage of the cell cycle)

Learning Goal 10: Understand Mechanisms of genetic transfer in bacteria (10/10-15)
Pre-class reading 10: 160-170; quiz on Sakai
Learning Goal 11: Understand basic concepts of phage genetics and mapping (10/10-15)
Pre-class reading 11: 170-182; quiz on Sakai
-Compare and contrast conjugation, transduction, transformation, horizontal gene transfer

Learning Goal 12: Understand Variation in Chromosome Structure (Konsolaki) (10/10-15)

Pre-class reading 12: 189-202; quiz on Sakai

-Interpret a karyotype
-Diagram how deletions, duplications, inversions and translocations occur
-Discuss the potential consequences of each type of structural variation

Learning Goal 13: Understand variations in chromosome number (10/17)

Pre-class reading 13: 203-215; quiz on Sakai

-Discuss euploidy and aneuploidy
-Provide examples of variations and euploidy within a species or within an individual
-Design an experiment to make monoploids, polyploids or hybrid plants

October 22 – Dr. Konsolaki Begins

Tentative Recitation Topics and Dates:

3 sections of recitation will be held Wednesdays in:
1- ARC-206, 10:35-11:30
2- ARC-205, 12:15-1:10
3- SEC-212, 1:55-2:50

Recitation problem sets and directions will typically be distributed the Wednesday prior to collection.

Recitation 1 9/4/12 – pretest
Recitation 2 9/11/12 – Make a diagram following the alleles of a dihybrid cross during meiosis
Recitation 3 9/18/12 –Mendelian crosses and probability
Recitation 4 9/25/12 – gene-protein relationships, complex Mendelian inheritance
Recitation 5 10/2/12 – gene-gene interactions
Recitation 6 10/9/12 – linkage and chi square
Recitation 7 10/16/12 – linkage and mapping

Take-home Midterm distributed 10/17, collected 10/22.

Due dates as of 8/19/13. We may adjust the schedule as necessary for school closings, class progress, etc. In that case an updated syllabus will be posted on Sakai.

Assignment	Details	Due Date
Recitation 1	**Pre-quiz**	**9/4/13 in recitation**
Pre-reading quiz 1	**Brooker 18-30**	**9/5/13 at 10am**
Pre-reading quiz 2-3	**Brooker 30-35; 44-54**	**9/10/13 at 10am**
Recitation 2	**Meiosis Diagram**	**9/11/13**
Pre-reading quiz 4	**Brooker 54-64**	**9/12/13 at 10am**
Pre-reading quiz 5	**Brooker 71-85**	**9/17/13 at 10am**
Recitation 3	**Crosses and Probability**	**9/18/13**
Pre-reading quiz 6	**Brooker 86-108**	**9/19/13 at 10am**
No quiz		
Recitation 4	**Complex Mendel**	**9/25/13**
Pre-reading quiz 7	**Brooker 108-120**	**9/26/13 at 10am**
Pre-reading quiz 8	**Brooker 126-136**	**10/3/13 at 10am**
Recitation 5	**Gene-Gene Interactions**	**10/2/13**
Pre-reading quiz 9	**Brooker 136-151**	**10/8/13 at 10am**
Pre-reading quiz 10	**Brooker 160 – 182**	**10/10/13 at 10am**
Recitation 6	**Linkage and Chi-Square**	**10/9/13**
Pre-reading quiz 11	**Brooker 189 – 202**	**10/15/13 at 10am**
Pre-reading quiz 12	**Brooker 203 – 215**	**10/17/13 at 10am**
Recitation 7	**Linkage and mapping**	**10/16/13**
Midterm	**Distributed 10/17**	**Due 10/22**