

BIOLOGY 115

GENETICS

SUMMER, 2011

PROFESSOR: DR. RACHAEL FRENCH

LECTURE 1
JULY 5, 2011

1. SYLLABUS/GREENSHEET HIGHLIGHTS
2. DROPPING OR ADDING THIS CLASS
3. REVIEW OF FUNDAMENTAL GENETIC PRINCIPLES
(CHAPTER 1)

COURSE INFORMATION

- Instructor: Dr. Rachael French
- Office Location: Duncan Hall 438
- e-mail: rachael.french@sjsu.edu
- Office hours: Monday 1-3
Wednesday 3-5

COURSE INFORMATION

- Class Days/Time:
 - Lecture: M-Th, 10 to noon
 - Important note: The last exam will be given on Monday, August 8
 - Discussion: T, Th, 2-3:15
- Classroom: Both lecture and discussion will be held in Science 258
- e-mail: rachael.french@sjsu.edu
- Office hours: Monday 1-3
Wednesday 3-5

PREREQUISITES

The following must be turned in by noon TODAY to Dr. French:

- *SJSU Students: Unofficial transcripts with your name and ID number (not hand-written) showing completion of Bio 3 or 1B with grades of C or higher, Chem 1A, and Chem 1B.*
- *Transfer Students: Equivalency Form signed by Stephanie Trehitt (408-924-5096, DH-237, stephanie.trehitt@sjsu.edu) showing equivalent prerequisites to those described for SJSU students at another institution.*

PREREQUISITES

- *Students wishing to add the course must also turn in these documents.*
- *Incomplete forms will result in the student being dropped from the course.*
- *Electronic copies e-mailed to Dr. French before the deadline are acceptable.*

SOME COURSE MATERIALS ARE ON D2L

- Syllabus
- Copies of lecture slides (available no sooner than the morning of the specific lecture)
- Weekly problem sets
 - Problem sets will not be graded, but serve as practice and a study guide

LOGGING INTO D2L:

- Go to <https://sjsu.desire2learn.com/>
- If you have used D2L before, use the same username and password.
- If this is your first time, your username and password are available in your mySJSU page under the "D2L Login" tab.

PROBLEMS WITH D2L

- Contact the Help Desk at (408) 924-2377 or visit them in the first floor of Clark Hall.
- If you do not have a computer, see "Student Technology Resources" in the syllabus.

IN ADDITION:

- Information will be presented in class and discussion that is not on D2L or in your book.
- Students are not required to come to class; however they are responsible for getting the information given during lectures from other students.

COURSE GOALS

Biology 115 is a challenging upper division class.

- Five VERY intense weeks
- Five exams, none cumulative
- Simple "cramming" prior to an exam will be ineffective

COURSE GOALS

Your goals:

- Learn to perform genetic analysis.
- Learn the basic vocabulary of genetics.
- Become familiar with genetic model organisms.
- Gain knowledge necessary for advanced courses.

COURSE GOALS

Your goals, continued:

- Acquire the ability to interpret societal issues involving genetics.
- Strengthen critical thinking and problem-solving skills.
- Strengthen good study habits.

STRENGTHENING GOOD STUDY HABITS

- Bad study habits are a primary reason that students fail.
- Good study habits will help you:
 - To do well in this course
 - To retain information and the logic behind it for future work.

STRENGTHENING GOOD STUDY HABITS

- Good study habits include:
 - Reading and solving problems each day, not cramming.
 - Long-term retention increases with repeated exposure to information and active participation in learning.

REQUIRED TEXTS/READINGS AND SUPPLIES

Textbook

- Pierce, BA, *Genetics: A Conceptual Approach*. 4/e.

Other Readings

- Additional reading materials will be provided on D2L.

Other Materials

- For all exams bring a #2 pencil and scantron form 886-E

LECTURES AND EXAMS

- Course lectures will include material most important in a genetics course. Additional material will be presented in discussion.
- There will be an exam every Monday, for one hour in the first half of the class period.
- The exams will not be comprehensive, and there will be no final exam.
- If material is presented in a lecture, your textbook, a problem set, discussion section, or quiz, it could be on your exam.

PROBLEM SETS

- Problem sets are optional; however, success in the course will depend on the ability to solve the assigned problems.
- It is your responsibility to work the problems and ask questions during discussion sections.

DISCUSSION SECTIONS

- The discussion sections are used for discussion and to solve genetics problems.
- Some of the problems and activities will be new ones, not from the text, and others will be selected from the text.

CLASSROOM PROTOCOL

- Be punctual.
- Be respectful.
- Participation in class is strongly encouraged.
- Attendance in lectures and classes is not mandatory, however:
 - students who miss more than three lectures will have difficulty succeeding in the course

CLASSROOM PROTOCOL - ELECTRONIC DEVICES

- Cell phones, PDAs, and other electronic devices must be put on silent (not vibrate) and placed inside a purse or backpack for the duration of the class.
 - If the device makes noise or if a student uses or views it during class, it will be confiscated and the student may be asked to leave the class.
 - The student will still be responsible for the information provided in class that day.

CLASSROOM PROTOCOL - ELECTRONIC DEVICES

- Students are allowed to use laptop and table computers in the class, however similar rules apply:
 - if the computer makes noise or is used for purposes other than viewing the lecture presentation or taking notes, it may be confiscated and the student asked to leave the class

EXAM PROTOCOL

- Sit in a seat for exams.
- Put all materials except a pencil and scantron in a zipped bag or backpack underneath your desk.
- Earpieces are not allowed, and neither are hats or hoods that could conceal earpieces.
- Students must remain quiet from the time the exam is passed out until ALL exams are collected and the professor tells you that you are allowed to speak.

GRADING POLICY

- Final course grades:
 - Five exams, each worth 20% of your final grade.
 - THERE ARE NO MAKEUP EXAMS!
 - You may retake ONE exam in the event of an official medical excuse; further missed exams, for ANY reason, will receive a 0.
 - Exams will not be given early or outside of normal class time unless the student has an official accommodation.
- Final grades will be scaled if the average class grade is below 75%.

GRADING POLICY

- Final grades will be scaled if the average class grade is below 75%.
Otherwise:
 - 90% and above is at least an A-
 - 80-89% is at least a B-
 - 70-79% is at least a C-
 - 60-69% is at least a D-
 - 0-59% is at least an F.

STUDENTS WITH DISABILITIES

- If you need course adaptations or accommodations because of a disability, please make an appointment with me as soon as possible, or see me during office hours.
- Presidential Directive 97-03 requires that students with disabilities requesting accommodations register with the Disability Resource Center (<http://www.dro.sjsu.edu/>) to establish a record of their disability.

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DROPPING OR ADDING

- We are now PAST the official add/drop deadline for summer session II
- The ONLY way to add or drop the course is through instructor request
- I will entertain add requests until Friday; See me IMMEDIATELY after class if you wish to drop.

SUMMARY

- Log into D2L to download the syllabus
- Bring proof of prerequisites (or see me if you can't) by NOON today.
- Exam 1 will be on Monday morning at 10:00 am for the first 50 minutes of class.
 - Bring a pencil and scantron, but no hats or hoods.
- Students who want to add, see me by Friday. Students who want to drop, see me after class today

BREAK

BACK IN 10 MINUTES

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WHAT IS "GENETICS"?

- The study of how hereditary information is transmitted from one generation to the next, and how this information is stored, altered, expressed, and regulated

DIVISIONS OF GENETICS

- Transmission genetics
- Molecular genetics
- Population genetics
- Cytogenetics
- Genomics/bioinformatics

DIVISIONS OF GENETICS

- **Transmission genetics: the study of the basic principles of heredity and the inheritance of traits**
- Molecular genetics
- Population genetics
- Cytogenetics
- Genomics/bioinformatics



DIVISIONS OF GENETICS

- Transmission genetics
- **Molecular genetics: the study of the structure and regulation of genes at the molecular level**
- Population genetics
- Cytogenetics
- Genomics/bioinformatics



DIVISIONS OF GENETICS

- Transmission genetics:
- Molecular genetics
- **Population genetics: the study of genetic variation within groups of individuals**
- Cytogenetics
- Genomics/bioinformatics



DIVISIONS OF GENETICS

- Transmission genetics:

- Molecular genetics

- Population genetics



- **Cytogenetics: the study of chromosomes and chromosome structure**

- Genomics/bioinformatics

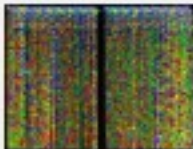
DIVISIONS OF GENETICS

- Transmission genetics:

- Molecular genetics

- Population genetics

- Cytogenetics



- **Genomics/bioinformatics: the development and application of entire genomes' worth of genetic/protein information**

A NOT-SO-BRIEF HISTORY OF GENETICS: SELECTIVE BREEDING

- 10,000 - 12,000 years ago



ANCIENT PHILOSOPHY OF HEREDITY

- Pangenesis:
 - "humors" produced by various body parts mix in the gametes
 - individuals can acquire alterations in their humors, and can then pass these changes on to offspring
 - abnormalities are the result of "diseased" humors

MODERN THEORIES OF HEREDITY

- Preformation vs. Epigenesis
 - Preformation: sperm contain a fully-formed, miniature adult human "homunculus":



EPIGENESIS

- Organisms develop from substances present in the egg
- Structures are formed *de novo*, rather than pre-existing

MODERN THEORIES OF HEREDITY

- Blending inheritance: hereditary material from parents "blends" in offspring, resulting in offspring that are a mixture of parental traits

EMERGENCE OF GENETICS AS A SCIENCE



Charles Darwin: Theory of Evolution by Natural Selection

- attempts to explain the causes of evolutionary change
- competition between excess offspring
- Heritable traits conferring reproductive advantages accumulate - "natural selection"
- Speciation results if enough changes accumulate
- One key feature lacking: no explanation of the genetic basis of inheritance

EMERGENCE OF GENETICS AS A SCIENCE



Gregor Mendel:

- Each feature is encoded by two parental factors, one contributed by each parent
- Some factors are "dominant" to others
- Factors encoding one feature are independent from factors encoding another

REVIEW OF FUNDAMENTAL GENETIC CONCEPTS

- Cells are of two basic types: eukaryotic and prokaryotic.
 - Prokaryotes:
 - no nuclear membrane
 - no membrane-bound organelles
 - Examples: bacteria and archaea
 - Eukaryotes:
 - have a nuclear membrane
 - have membrane-bound organelles (examples: chloroplasts and mitochondria)
 - Examples: plants, animals, and everything else.
 - Viruses are neither cells nor free-living.
 - A protein coat surrounding nucleic acid.
 - Can reproduce only in a host cell, using host machinery

REVIEW OF FUNDAMENTAL GENETIC CONCEPTS

- The gene is the fundamental unit of heredity.
 - Genes are segments of DNA that typically encode proteins.
 - Units of information that encode a genetic characteristic.
- Genes come in multiple forms, called alleles.
 - For example, a gene for coat color in cats may exist as an allele that encodes black fur or an allele that encodes orange fur.

REVIEW OF FUNDAMENTAL GENETIC CONCEPTS

- Genes confer phenotypes
 - Genes are inherited and, along with environmental factors, determine the expression of traits.
 - The genetic information that an individual organism possesses is its genotype.
 - The trait is the phenotype.

REVIEW OF FUNDAMENTAL GENETIC CONCEPTS

- Genetic information is carried nucleic acids (DNA and RNA)
 - Nucleic acids: polymers of repeating units called nucleotides: a sugar, a phosphate, and a nitrogenous base (A, C, G, or T/U).
 - Nucleotide sequence determines what proteins are encoded and how and when they are produced, or expressed.
 - Genes are sequences of DNA or RNA
- Genes are located on chromosomes
 - Chromosomes are long pieces of DNA and associated proteins.
 - They are individual genetic units that segregate independently.
 - Chromosome number varies from species to species

REVIEW OF FUNDAMENTAL GENETIC CONCEPTS

- Chromosomes separate through the processes of mitosis and meiosis.
 - Mitosis is the separation of replicated chromosomes in the division of somatic (nonsex) cells.
 - After mitosis, daughter cells have the same chromosome number as parent cells.
 - Meiosis is the pairing and separation of replicated chromosomes in the division of sex cells to produce gametes.
 - After meiosis, gametes have half the original number of chromosomes.

REVIEW OF FUNDAMENTAL GENETIC CONCEPTS

- Genetic information is transferred from DNA to RNA to protein
 - Most genes encode traits by specifying the structure of proteins.
 - Genetic information is first **transcribed** from DNA to RNA, then **translated** from RNA to the amino acid sequence of a protein.

REVIEW OF FUNDAMENTAL GENETIC CONCEPTS

- Mutations are permanent, heritable changes in genetic information.
 - Gene mutations affect the genetic information of a single gene.
 - Chromosome mutations alter the number or structure of chromosomes and therefore usually affect many genes.
- Some traits are affected by multiple factors.
 - Some traits are affected by multiple genes that may interact or function in parallel.
 - Traits may also be affected by environmental factors.
 - Example: Human height is affected by many genes as well as environmental factors such as nutrition.

REVIEW OF FUNDAMENTAL GENETIC CONCEPTS

- Evolution is genetic change.
 - Evolution can be viewed as a two-step process
 1. Genetic variation arises
 2. Some genetic variants are selected for and increase in frequency, while others are selected against and decrease in frequency.

FOR NEXT TIME:

- READ CHAPTER 3 (BASIC PRINCIPLES OF HEREDITY)
- ATTEND YOUR FIRST DISCUSSION SECTION THIS AFTERNOON