

# California State University | Stanislaus

## BIOL 4850- DNA Technology in Forensic Science

|                         |   |                      |             |
|-------------------------|---|----------------------|-------------|
| Instructor:             | Dr. James J. Youngblom                                  | Term:                | Spring 2016 |
| Office:                 | Naraghi Hall 264  | Class Meeting Day:   | Tuesday     |
| Phone:                  | 667-3950  | Class Meeting Hours: | 1:00-4:50   |
| Best way to contact me: | jyoungblom@csustan.edu                                  | Class Location:      | Naraghi 334 |
| Office Hours:           | 12-1 Mon, 1-2 Wed, Tu 11:30-12:30 (in N124) or by appt. |                      |             |

### University Course Catalog Description

(2 Units) Applications of DNA technology in forensic investigation will be explored. The laboratory segment will expose students to a variety of molecular biology techniques used in forensic laboratories. The lecture component will introduce fundamental concepts in molecular biology and expound on the analysis and interpretation of results obtained in the lab.

Prerequisites: BIOL 2310 or BIOL 3350 and CHEM 1100, or consent of instructor. (Lecture, 1 hour; laboratory, 3 hours)

### Course Requirements

Students need knowledge of DNA structure, genetic terminology, molecular properties, and chemical bonds. Students need proficiency in elementary probability and statistics. Basic computer skills are required.

### Course Learning Outcomes

By the end of this course students will be able to properly use microliter pipetmen, gel electrophoresis equipment, a thermocycler, and mini- and micro-centrifuges. Students will be able to analyze and explain human forensic DNA profiles and accurately determine genotypes, including genotypes from DNA mixtures. Students should be capable of generating STR profile frequency estimates. Students will be able to analyze forensic DNA output from Y-chromosome STRs and human mitochondrial DNA. Students will be able to explain PCR, DNA isolation protocols, DNA quantification methods, and the historical changes in DNA forensic technology.

**Required Texts-** “Fundamentals of Forensic DNA Typing” by John Butler (Acad. Press, 2009)  
“The Blooding” by Joseph Wambaugh

**Equipment needed-** Simple three-ring binder to organize weekly handouts.

### Dates to Remember-

Wed. Feb. 24- Last day to drop a course

Fri. May 13- Warrior Day

Thurs. Mar. 31 – Campus closed, Cesar Chavez Day

Wed. May 18- Last day of classes

Spring Break- No classes, Mar. 28- Apr. 1

Final Exams- Tues. May 24, 11:15

## In Class Exams/Quizzes:

Mar. 22- **Exam #1 (60 pts)**

**Tuesday May 24, 11:15 a.m. - Final Exam (140 pts)**

May 10- **Quiz #1 (20 pts)**

| Assessment:<br>Due dates | Date            | Points   | Percent of<br>Final Grade |
|--------------------------|-----------------|----------|---------------------------|
| Lab notes                | Feb. 23         | 10 pts.  | 2.6%                      |
| Take home Exam 1         | Mar. 1          | 30 pts.  | 8.3%                      |
| Lab notes                | Mar. 15         | 20 pts.  | 5.5%                      |
| Mid-term Exam            | Mar. 22         | 60 pts.  | 17.7%                     |
| Lab notes                | Apr. 19         | 30 pts.  | 8.3%                      |
| Take home Exam 2         | Apr. 26         | 30 pts.  | 8.3%                      |
| Class Presentation       | May 3, 10 or 17 | 20 pts.  | 5.5%                      |
| Quiz-The Blooding        | May 10          | 20 pts.  | 5.5%                      |
| Final Exam               | May 24          | 140 pts. | 38.9%                     |
|                          |                 | 360 pts. | 100.0%                    |

**Each exam will be a mixture of different types of questions (such as true/false, multiple choice, problems, short answer, and short essay).** The exams will be based on lecture material, reading in the text, and the laboratory exercises. The first two exams are not comprehensive. The final exam is comprehensive. A simple calculator may be used during the exams. **No leaving** the classroom during exams. The quiz on May 10 will be taken entirely from the book "The Blooding" by Joseph Wambaugh. This book is available in paperback (< \$10) and is found in many libraries. Read it in its entirety and you will do well on this quiz.

## Grading Scale (%)

(these numbers will not be raised; they could be lowered slightly)

| %      | Grade | %     | Grade |
|--------|-------|-------|-------|
| 94-100 | A     | 74-76 | C     |
| 90-93  | A-    | 70-73 | C-    |
| 87-89  | B+    | 67-69 | D+    |
| 84-86  | B     | 64-66 | D     |
| 80-83  | B-    | 60-63 | D-    |
| 77-79  | C+    | 0-59  | F     |

## Make-up:

If you know you can not be in class on the day of an exam, please see me beforehand so we can discuss the situation. I may allow you to take the exam at a later date. If something comes up unexpectedly on the day of an exam, please contact me. If you leave a message, leave a phone number and so we can be in touch. Don't 'let it ride' and plan on discussing it with me later. If I don't hear from you promptly, you get a 0.

## Notes:

Take home exams- 30 pts. each = 60 pts.

Lab Notes #1= 10 pts.

Lab Notes #2= 20 pts.

Lab Notes #3= 30 pts.

Take home exams and lab notes are due at the beginning of the lab. See the lab schedule for the due dates.

Take home exams are not group activities. Do your own work and don't copy the answers from someone else's exam. These exams are designed as a checkpoint- a chance for you to see if you are learning the right things. If you are unable to complete the exams, you need to see your instructor for extra help. Save these. They are valuable study guides.

The lab write-ups are an exercise in taking good lab notes. The first one is designed to give you feedback for the second lab write up. We will discuss good note taking in class.

### **Notes:**

Each Thursday you will complete a laboratory exercise. A PowerPoint lecture of 30-60' will be presented some time on Thursday afternoon. The lecture will not be given at 1:00 but will be presented when there is an appropriate window of time in the lab protocol. At some time during the afternoon, there will be a formal break (~10') where everyone should step out of the lab.

All work will be done in pairs. There are 12 sets of equipment and will be 24 students in this class. The lab exercises will be described in lab handouts. Both the lab exercises and the PowerPoint lectures will be available electronically on the class Blackboard site.

The lectures will relate to the use of DNA in U.S. courtrooms. I will describe how DNA evidence was introduced in the late 1980s, modified in the mid 1990s and how it is used today. I have a number of thought provoking films we will watch. Some of these films document important criminal cases that hinged on DNA evidence. Some analyze the U.S. criminal justice system.

It is expected that each student in this class will be willing to donate tissue for purposes of isolating and analyzing your own DNA. The tissue requirements are minimal- cheek cells removed with a mouthwash. It is unlikely but possible that we could discover an abnormality in your DNA should such an abnormality exist. However it is not possible that we could uncover an informative abnormality as all of the DNA sites examined are specifically selected as nonphenotypic loci. The only exception would be in the multiplex PCR analysis where one of the sites analyzed will reveal the sex chromosome constitution of the donor. Should someone possess something outside the norm (XX in females, XY in males) it could be revealed in this exercise. Students have the option of declining to use their DNA in this exercise.

### **Late Work**

Take home exams and lab notes turned in late will be assessed a penalty: 10% if it is one day late, or 20% for 2-6 days late. These assignments will not be accepted if overdue by more than six days.

### **Email**

I will use email to send you course announcements. The emails are sent to your csustan email account. Email is the good way for you to communicate with me outside of class time. I check my email many times per day on weekdays and periodically on weekends.

**Student Conduct-** Most labs will run the full four hours. Attendance is required. Do not enroll in this class if you have conflicts or other commitments on Thursday afternoons. If you fail to attend you are guilty of dumping extra work on your partner. Be on time for class. During the first few minutes of each class period we will discuss the day's activities. Do not leave the classroom in the middle of a lecture. Do not use cell phones, ipods, or other electronic devices during class. Computers are only allowed in class as a tool for note taking or class exercises.

**Cheating/Academic Dishonesty-** Students caught cheating are prosecuted as described in the university catalog. A report is filed with the Dean of Student Affairs. Class homework assignments and take-home exams are not group projects. Copying from someone's paper and presenting it as your own is a form of academic dishonesty. All electronic devices (including phones) & headphones must be kept in purses or backpacks during the exams and quizzes. No exceptions. You can use a real calculator and not the calculator function on a cell phone or PDA.

**Taping Policy-** Audiotaping of classes is permitted only with prior permission of the instructor; videotaping is not permitted under any circumstances. Authorized tapes are for the personal use of the student, and may not be distributed to others without the permission of the instructor.

**Guest Policy-** Guests are generally not permitted in this class. For an exception to this policy you must request prior permission.

### **Student Presentations-**

Each student must find a partner and together select one article from the Journal of Forensic Science (full text of this journal is available from Electronic Journal Collection of the CSUS library at <http://library.csustan.edu/serialsolutions/onlineJournals/jnlsIndex.html>). The article must pertain to Forensic DNA and have been published in 2013, 2014, 2015 or 2016. You and your partner must work together to assemble a PowerPoint presentation. This presentation must explain the article. You do not need to explain basic genetic terms that have already been explained in class. Rehearse your PowerPoint presentation. Each person must present half of your slides. The presentation should be 9-12 minutes in length. **Your score will be deducted if your presentation is too long or too short.** You are not allowed to read anything during your presentation. No reading of notes, and no reading of your PowerPoint slides. Use your PowerPoint slides as a rough outline for you to follow and then know the material well enough to explain each slide without reading it or using notes. Show important diagrams from the paper and explain them to the class.

Your classmates will help in grading your presentation- 1/2 of your class presentation score is determined by your classmates. All students in attendance will rate your presentation but the top ¼ and bottom ¼ of student scores are ignored. Students that give all presenters high scores (A- or A) are not utilized in giving out grades.

## Laboratory Schedule; **Lecture Schedule**- in bold \

Feb. 2 (1) Metric System, Use of Pipettors, Lab Safety (video-Sex, Lies, and DNA)

## Feb. 9 (2) Pipetting tests: DNA isolation (human cheek cells), Set up PCR (*Actinin-3*) **(video, Forensic DNA Overview)**

## Feb. 16 (3) Agarose gel electrophoresis

Feb. 23 (4) Finish PCR Analysis **(video, PCR2, controls, precautions)**  
**Lab Notes due**

**Mar. 1 (5) Blood presumptive test, AP testing for seminal fluid (**DNA detection and collection methods**)  
Take home exam 1, due**

## **Mar. 8 (6) DNA isolation (DNA from human blood) (RFLP, early Forensic DNA Tests)**

**Mar. 15 (7) qPCR** **(DNA Quantification)**  
**Lab notes due**

**Mar. 22 (8) 2 p.m. start- Exam #1 Analyze DNA Typing Sticks (video, Crime Scene Analysis)**

Mar. 29 No Class, Spring Break

Apr. 5 (9) Set up Profiler/Cofiler Reactions (STRs)

Apr. 12 (10) Analyze Profiler/Cofiler Results (Allelic Frequencies)

Apr. 19 (11) Analyze mtDNA, Set up PowerPlex Y reactions    **(Forensic Analysis of mtDNA)**  
**Lab notes due; Select topics/dates for presentations**

Apr. 26 (12) Analysis of DNA mixtures **(DNA mixtures)**  
**Take home exam 2 due**

## May 3 (13) DNA mixtures, Analyze Y chromosome sequences, **(Y chromosome STRs)** **Student Presentations**

May 10 (14) Analyze Y chromosome sequences, DNA mixtures, **(CODIS)**  
**Quiz #1, Student Presentations**

**May 17 (15) Video, Clean up  
Student Presentations**