

FRNSC 421W: FORENSIC MOLECULAR BIOLOGY

Welcome to FRNSC 421W!



This is an important course in your forensic science curriculum as it's the forensic molecular biology capstone experience, and will prepare you well for a career in forensic science, or any field of study involving molecular applications. Through active learning, you'll more effectively grasp the course material and move closer to becoming proficient as a forensic DNA examiner.

This course is challenging, so be sure to read through the syllabus where you'll find important resources and information that will help you achieve the collective goals; *prepare, learn and earn!*

I'll be the Instructor for this course. Your TA will be Sidney Gaston-Sanchez (second year graduate student). Our *contact information* is provided below:

Mitchell Holland, 014 Thomas Basement, mmh20@psu.edu, 865-5286

Office Hours: By appointment

Sidney Gaston-Sanchez, sag91@psu.edu, 787-467-0773

Office Hours: By appointment



We're here to help, so be sure to use us as a resource. Sidney is a Master's student in Forensic Science. She hopes to join a forensic DNA lab in the near future (hopefully AFDIL). Her experience as a TA will strengthen her depth of knowledge in forensic molecular biology, and will further develop the strong communication skills needed when testifying in a court of law or presenting scientific findings in a public forum.

Roles: It's important to understand everyone's role in the course.

1. My role is to prepare and deliver the lectures for class, laboratory, and recitation; prepare and deliver active learning materials for class and recitation; design the laboratories; provide guidance in the laboratory; and prepare the TA to run the laboratories.
2. The role of the TA is to run the laboratories; i.e., responsible for making sure the laboratories run smoothly.
3. Regarding the grading process:
 - a. I will grade all quizzes and exams; will grade the qualifying test (QT) case file that you produce at the end of the course; and will conduct the depositions (oral examination).
 - b. The TA will grade the laboratory exercises associated with the training binder; based on rubrics provided by me.
4. Your role is to show up, work hard, and LEARN!! ☺

Because this is a laboratory course, we have a **Safety Officer** (Troy Adams, tja5245@psu.edu) who ensures your working environment is safe, addresses safety requirements given to us by the College of Science, and conducts/oversees the annual safety audits. Please bring any safety concerns to me, Sidney, or Troy immediately.

NOTE: Students working in the laboratory must have completed Bloodborne pathogen (BBP) training through Penn State. Documentation of completion of BBP training is required before students can work in the laboratory.

We'll meet in two places this semester:

Lecture will be held on MW at 10:10-11:00 AM in **222 Thomas Bldg**

Required Recitation will be held on F at 10:10-11:00 AM in **222 Thomas Bldg**

Laboratories are M/W (Sec 1) and T/R (Sec's 2 & 3) from 1:25-5:25 PM in **015 Thomas**

Optional Textbook:

Butler's *Advanced Topics in Forensic DNA Typing: Methodology*

Additional resources: Watson et al's *Molecular Biology of the Gene*, 7th Edition

Course Resources:

You can find most of the material for this course at the *FRNSC 421, Section 001: Forensic Mol Bio* site on CANVAS (<https://lmstools.ais.psu.edu/login.html>); for example, PowerPoint pdf's, protocols, forms, recommended journal articles, the syllabus, and example exam questions. In addition, you are strongly encouraged to use the University library system to search for journal articles on topics encountered throughout the course (www.lias.psu.edu). This is an excellent way to supplement your learning.

Learning Objectives: *Achieved through lectures, recitation sessions, and laboratory exercises. Assessed through exams, quizzes, laboratory reports/products, and class participation.*

PLEASE READ THE LEARNING OBJECTIVES

At the end of this course, you should better understand ...

- ❖ how to identify and sample biological evidence for DNA analysis, including the importance of evidence collection at the crime scene and how surfaces, materials and sources relate to sampling strategies; a refresher on screening biological evidence for source attribution will be provided.
- ❖ the scientific principles behind DNA analysis techniques: DNA extraction, quantification, STR amplification, CE instrument analysis, interpretation of STR data including mixtures, interpretation of Y STR data, and statistical analysis of both types of DNA profiles.
- ❖ the DNA analysis protocols, how to use the forms for each type of analysis, and how to write consultation reports that reflect laboratory findings.
- ❖ the laboratory techniques for conducting confirmatory testing of biological fluids, and for DNA analysis.
- ❖ how to construct a forensic DNA case file of your laboratory findings (QT), and how forensic DNA testimony is given at the deposition level.
- ❖ how a forensic DNA laboratory functions, including the accreditation requirements for forensic DNA laboratories.

Graded Opportunities:

- I. *Quizzes*: Nine (9) quizzes given during recitation. The quiz schedule can be found in the Tentative Agenda provided at the end of the syllabus.
- II. *Exams*: Three (3) exams. The third exam will be given over two class periods. The exam schedule can be found in the Tentative Agenda provided at the end of the syllabus. Exams 1 and 2, and the Part 1 of Exam 3, will be given at night from 6:00-7:30 PM.
- III. *Class/Recitation*: Attendance is expected at each class, laboratory, and recitation, allowing students to achieve the most positive outcome in the course.
- IV. *Training Binder*: The training binder is a compilation of the laboratory work product. A detailed description of each section of the training binder, including grading for each section, can be found on CANVAS (Training Binder Guidelines & Assessment); **PLEASE READ** this document **CAREFULLY**. Quizzes will be given during laboratory when new topics are introduced, and will count as 5% of the Training Binder grade.
- V. *Qualifying Test*: The qualifying test is a combination of independent laboratory analysis and oral examination. Students will complete the analysis of a mock case, from receipt to report. Each student will then be deposed by a defense attorney (me), defending their findings in a mock testimony experience.

Grading:**Quizzes**

15 pts for the first four quizzes (60 pts total) and 18 pts for the last five quizzes (90 pts) = **150 pts (15%)**

Exams 1, 2 and 3

100 pts for exams 1 & 2, and 200 pts for exam 3 = **400 pts (40%)**

Class/Recitation

5 pts lost for each absence **w/out** an acceptable excuse
See Penn State Policy 42-27 for more information about attendance = **0 pts (0%)**

Training Binder

See the Training Binder Guidelines & Assessment document (posted on CANVAS) for a breakdown of the graded sections of the raining binder = **225 pts (22.5%)**

Qualifying Test

160 pts for the mock case & 65 pts for the oral deposition = **225 pts (22.5%)**

TOTAL = **1000 pts (100%)**

Grading Scheme:

Grading will follow the University's guidelines. The following is a typical grading scheme used in previous semesters in 421W:

93-100 = A, 88-92 = A-, 84-87 = B+, 80-83 = B, 76-79 = B-
72-75 = C+, 68-71 = C, 58-67 = D, <58 = F

Exam Policy:

Other than unexpected illnesses, all requests for a makeup exam must be made by email to me no later than two weeks prior to the scheduled exam. If an unexpected illness keeps a student from attending the exam, an email must be sent to me prior to the class period in order for the student to be allowed to take a makeup exam.

No bathroom breaks are allowed during exams, and nothing is allowed on the desk while taking an exam, other than writing utensils and a calculator when required.

Academic Integrity:

Academic integrity is an essential component of your education. The following is a quote from the "PSU Faculty Senate Policies for Students" - Academic integrity *"is the pursuit of scholarly activity free from fraud and deception and is an educational objective of this institution. Academic dishonesty includes, but is not limited to, cheating, plagiarizing, fabricating of information or citations, facilitating acts of academic dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, or tampering with the academic work of other students."* All University and Eberly College of Science policies regarding academic integrity/academic dishonesty apply to this course and the students enrolled in this course. Refer to the following for further details on academic integrity policies: <http://science.psu.edu/current-students/Integrity/Policy.html>

Matters of academic dishonesty will be turned over to the University disciplinary system and may result in a failing grade for the course.

Reporting Educational Equity Concerns through the Report Bias, Counseling & Psychological Services Resources, and Disability Policy:

Penn State welcomes students with disabilities into the University's educational programs. If you have a disability-related need for reasonable academic adjustments in this course, contact the Office for Disability Services (ODS) at [814-863-1807](tel:814-863-1807) (V/TTY). For further information regarding ODS, please visit the Office for Disability Services Web site at <http://equity.psu.edu/ods/>. You must contact ODS and request academic adjustment letters at the beginning of each semester. In order to receive consideration for course accommodations, you must contact ODS and provide documentation (<http://equity.psu.edu/student-disability-resources/guidelines>). If the documentation supports the need for academic adjustments, ODS will provide a letter identifying the appropriate adjustments. Please share this information and discuss the adjustments with your instructor as early in the course as possible. For counseling & psychological services contact a representative at the following link (<http://studentaffairs.psu.edu/counseling/>). For reporting educational equity concerns through the report bias contact a representative at the following link (<http://equity.psu.edu/reportbias>).

Mutual Respect and Cooperation:

The Eberly College of Science Code of Mutual Respect and Cooperation (<http://science.psu.edu/climate>) embodies the values that we hope our faculty, staff, and students possess and will endorse to make The Eberly College of Science a place where every individual feels respected and valued, as well as challenged and rewarded.

How to be Successful in this Course:

Be prepared for class. Study the PowerPoints and read the assigned material. Come to every class, laboratory, and recitation, ask questions, and schedule one-on-one meetings with me or the TA if you're struggling with the course material. Make sure you *comprehend* the material, as the exams will be short answer questions, so students should practice visualizing, verbalizing, and writing about the course material. Practice questions are a valuable resource reflecting material likely to appear on the quizzes and exams.

TENTATIVE AGENDA (Subject to Change)

WEEK OF: JAN 7 (1):	LECTURE	Introduction: “Start with the end in mind” (PP 1 & 2), Real Time qPCR Quantification (PP 3 & 4) RECITATION QUIZ #1
	LABORATORY	Protocols/Forms, Training Binders & Safety (BBP) Start P1: Mock Quant Data Analysis (homework) <i>Writing Credit Guidance</i> <i>Collect Student Buccal Swab Samples</i>
JAN 14 (2):	LECTURE	PCR Principles (PP 5), DNA Extraction (PP 6) RECITATION QUIZ #2
	LABORATORY	LAB QUIZ #1 (Quant HP Amp)(14/15 Jan) & #2 (DNA Extraction/Chelex)(16/17 Jan)

		P1: Quant HP Amp, Mock Quant Exercise homework due, Go Over Homework P1: Quant HP Data Analysis Start P2: DNA Extraction & Quant
JAN 21 (3):	LECTURE	NO CLASS or LAB on MONDAY (MLK Day), NO LAB on TUESDAY, STRs/Fusion (PP 7), STR Analysis I (PP 8) RECITATION QUIZ #3
	LABORATORY	LAB QUIZ #3 (STR Amp) P2: STR Amp, STR Analysis Tutorial <i>P1 of Training Binder is Due (23/24Jan)</i>
JAN 28 (4):	LECTURE	3130xl Features/Operation (PP 9), STR Analysis II (PP 10), PopGen/Stat I (PP 11) RECITATION QUIZ #4
	LABORATORY	LAB QUIZ #4 (STR Analysis) & #5 (3130)(28/29 Jan) P2: 3130, Mock STR Analysis, Sample STR Analysis <i>P2 Initial Test Set Due (28/29 Jan)</i> <i>Instructor meetings on P1 & P2 Initial Test Set (30/31 Jan)</i>
FEB 4 (5):	LECTURE	PopGen/Stat II (PP 12), Exam Review <u>EXAM 1: 6 FEBRUARY (thru PowerPoint 12)</u> 258 Willard (6:00-7:30 PM) NO RECITATION
	LABORATORY	LAB QUIZ #6 (Stats)(4/5 Feb) P2: Sample STR Analysis, Database Construction, Stats, Report Writing
FEB 11 (6):	LECTURE	Mixture Interpretation and Differential Extraction (PP 13), Mixture Interpretation II (PP 14), Mixture Interpretation III (PP 15) RECITATION QUIZ #5
	LABORATORY	LAB QUIZ #7 (Differential)(11/12 Feb) & #8 (Mixture Analysis)(13/14 Feb) Start P3: Differential DNA Extraction, Quant, Mock Mixture Analysis Tutorial <i>P2 of Training Binder is Due (11/12Feb)</i>
FEB 18 (7):	LECTURE	NO CLASS or RECITATION AAFS Meeting (19-23 Feb)
	LABORATORY	P3: Amp, 3130 & Mock Mixture STR Analysis <i>Instructor meetings on P2 (18/19 Feb)</i> <i>P3 Initial Test Set Due (18/19 Feb)</i> <i>Instructor meetings on P3 Initial Test Set (20/21 Feb)</i>

FEB 25 (8):	LECTURE	PopGen/Stat III (PP 16) & Y STRs/Y Quant (PP 17) RECITATION QUIZ #6
	LABORATORY	LAB QUIZ #9 (Y Analysis)(27/28 Feb) P3: Mock Mixture Analysis, Sample Mixture Analysis & Y STR Analysis Tutorial
MAR 4:	LECTURE	NO CLASSES or LABORATORIES THIS WEEK SPRING BREAK
MAR 11 (9):	LECTURE	PopGen/Stat IV (PP 18), QT Evidence Screening Methods, Photodoc, Case File Structure Writing (PP 19), Exam Review <u>EXAM 2: 13 MARCH (thru PowerPoint 18)</u> 258 Willard (6:00-7:30 PM) NO RECITATION
	LABORATORY	Initiate the QUALIFYING TEST (See QT Schedule) P3: Sample Mixture Analysis & Y STR Analysis
MAR 18 (10):	LECTURE	PopGen/Stat V (PP 20) & Y STR Individualization and Rapidly Mutating Loci (PP 21) RECITATION QUIZ #7
	LABORATORY	QUALIFYING TEST (See QT Schedule) P3: Y STR Analysis, Stats & Report Writing
MAR 25 (11):	LECTURE	Advanced Techniques (extraction methods)(PP 22) & Advanced Technologies (Rapid DNA Testing, LIMS, Robotics, NGS)(PP 23) RECITATION QUIZ #8
	LABORATORY	QUALIFYING TEST (See QT Schedule) P3: Stats & Report Writing <i>P3 of TB is Due (27/28 Mar)</i>
APR 1 (12):	LECTURE	Probabilistic Genotyping (PP 24), NRC Reports, QA/QC, and Laboratory Accreditation (PP 25) RECITATION QUIZ #9
	LABORATORY	QUALIFYING TEST (See QT Schedule) <i>Instructor meetings on P3</i>
APR 8 (13):	LECTURE	Exam Review, Testimony Review (PP 26) <u>EXAM 3: 8 & 10 APRIL (CUMULATIVE)</u> Part 1 (8 Apr): 258 Willard (6:00-7:30 PM) Part 2 (10 Apr): 222 Thomas (10:10-11:00 am) Testimony Review (PP26) during RECITATION
	LABORATORY	QUALIFYING TEST (See QT Schedule) <i>QT Case Files are Due by <u>NOON</u> on 12 Apr – drop off in 015 Thomas</i>

APR 15 (14):	LECTURE	NO CLASSES NO RECITATION
	LABORATORY	DEPOSITIONS (15-18 Apr)
APR 22 (15):	LECTURE	NO CLASS on 22/24 Apr & <u>Wrap-up on 26 April</u>
	LABORATORY	DEPOSITIONS (22-23 Apr) Complete TB's <i>Completed TB's are Due by <u>NOON</u> on 26Apr – drop off in 015 Thomas</i>

NOTE #1: Feedback will be provided immediately following the individual depositions.

NOTE #2: **Informal Discussion Sessions** can be organized for individuals or groups of students with an interested in joining a forensic DNA lab – please contact me and/or the TA to setup a meeting.