

FIVS 316 – BIOTECHNOLOGY & FORENSICS

Syllabus

Instructor Information:

Name: Dr. Craig J. Coates

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Office location: 110A Heep Center

Office hours: MWF - 1:30-2:30pm

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Laboratory TA Information:

Name: Ashleigh Faris

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Office location: 308 Heep Center

Office hours: T - 9-10am, R - 1-2pm

Class Information:

Lecture Location: Heep Center, Rm 207

Lecture Meeting days: TR

Lecture Meeting time: 9:35am – 10:50am

Prerequisite: GENE 301, or GENE 302, or BIMS 320; & FIVS Upper Division Classification.

Laboratory Location: Heep Center, Rm 207

Laboratory Meeting Day: Monday

Laboratory Meeting Time: 1:50pm – 4:40pm

Course Description:

This course is designed to illustrate the uses of biotechnology for forensic applications. The students will gain an appreciation and understanding of the underlying molecular biology techniques that are used in a diverse array of settings; including blood analysis, blood typing, DNA fingerprinting and genetic testing. The potential future use of advanced sequencing technologies for forensic applications will be discussed. Additionally, the social, ethical and legal implications of these procedures and applications will be fully considered.

The lecture component is composed of a series of lectures designed to ask and answer questions related to the use of a variety of biotechnology techniques for forensic applications. While each lecture period will address technical aspects and terminology to build base scientific knowledge, time will also be dedicated to discussion of the broader aspects of the impact of biotechnology on forensics and society.

The laboratory component will expose students to techniques utilized in forensic laboratories to conduct presumptive tests for fluids, isolate DNA, quantify DNA, perform PCR amplifications, analyze a STR profile, perform DNA sequencing and analyze a mtDNA profile. The students will become proficient in the required molecular biology techniques and develop an understanding of the procedures for minimizing contamination, maintaining accurate records and trouble-shooting their techniques.

The assignments will cover topics both related to and outside of the lecture material. The mid-term exams are based on the breadth of biotechnology knowledge and an understanding of the technology, terminology and forensic applications. The final written paper will describe a future biotechnology application or issue, including a thorough discussion and critique of all options and impacts at social, ethical and legal levels. Prior to the final submission of each paper, each student will give a brief presentation to the class. Each student will also perform a Peer assessment of student papers.

The overall goal is for each student to participate in an intellectual discussion of the use of biotechnology in the forensic field, and be able to make a rationale argument for the scope, potential, and limitations of current and future biotechnology applications for forensic purposes. The laboratory component of the course will provide the students with technical skills and an appreciation and understanding of the molecular biology techniques utilized in forensic investigations.

Course Goals

- Increase the students' base knowledge of biotechnology techniques and applications for forensics.
- To provide a balanced risk vs. benefit assessment of current and future biotechnology applications from both scientific and social perspectives.
- Allow students to independently assess and critique information provided from a variety of sources.
- Enable students to become effective communicators of this information to others.
- Develop laboratory skills and techniques in commonly used molecular biology techniques.

Student Learning Outcomes:

1. Describe biotechnology advances, techniques and biological components of forensic investigations.

Assessment: Assignments, mid-term exam questions.

2. Formulate a balanced position paper on a future topic/issue in forensic biotechnology.

Assessment: Final Paper

3. Effectively communicate biotechnology advances to a lay person audience.

Assessment: Oral Presentations, Final Paper

4. Understand the scope, application and limitations of forensic biotechnology applications.

Assessment: Assignments

5. Develop laboratory technical skills and be able to trouble shoot molecular biology techniques.

Assessment: Laboratory Quizzes and Notebook evaluation.

Policies:

Americans with Disabilities Act: The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, in Cain Hall, Room B118, or call 845-1637. For additional information visit - <http://disability.tamu.edu>

Scholastic Dishonesty and Attendance: Student rules governing class attendance and scholastic dishonesty, including plagiarism, can be found on the Texas A&M University Website, under Student Rules at <http://student-rules.tamu.edu/>.

Aggie Honor Code: An Aggie does not lie, cheat, or steal, or tolerate those who do. Academic misconduct, a violation of the Texas A&M Honor System, involves any of the following: cheating, fabrication, falsification, multiple submission, plagiarism, and complicity. The Honor Council Rules and Procedures can be found at: <http://aggiehonor.tamu.edu>

Make-up Exams: These will only be provided for official University sanctioned excused absences. The make-up exams will be oral or written exams at a time and in a format to be determined by the instructor.

Late Assignments: 100% late penalties will be applied to all assignments or quizzes that are not submitted on time.

Course Requirements:

Assessment will be based on assignments, quizzes, mid-term exams, class participation, laboratory notebook evaluation, participation in a peer evaluation process, and a final paper.

Total Points = 400.

Grading Scale – A = 360-400; B = 320-359; C = 280-319; D = 240-279; F= 0-239.

Lecture Component – 300 Total Points

Assignments (50 Total Points) - There are 5 assignments (10 points each) to be completed.

Mid-term Exams (130 Total Points) - Mid-term exam #1 (65 Points) will cover the material leading up to that exam. Mid-term exam #2 (65 Points) will cover the material following the first exam. Make-up exams will only be given for official University sanctioned excused absences. The make-ups will be oral or written exams at a time and in a format to be determined by the instructor.

In class participation (30 Total Points) - This will be a combination of attendance, participation in class discussions, and final paper presentations.

Peer Evaluation (15 Total Points) – Each student will perform peer evaluations of student papers.

Final Paper (75 Total Points) – Balanced discussion of future change/issue for forensic biotechnology.

Laboratory Component - 100 Total Points

Quizzes (30 Total Points) – Two laboratory Quizzes worth 15 points each.

Laboratory Notebook Assessment (70 Total Points) – The accuracy and quality of the laboratory notes will be assessed at the end of the semester.

Lecture Schedule:

Week 1

Aug 27 – Central Dogma; Types and Collection of Biological Materials

Aug 29 - Blood – antigens, immunoassays, isoenzymes

Week 2

Sept 3 – Blood, Saliva – collection, identification, investigation

Sept 5 – Semen – collection, screening, identification techniques

Week 3

Sept 10 - DNA – structure, heredity, variability

Sept 12 - RFLPs, PCR – history, technique and use for forensic investigations

Week 4

Sept 17 – STRs – development, use, forensic databases

Sept 19 – Y-STRs, mtDNA – alternative identifiers

Week 5

Sept 24 - In Class Review

Sept 26 – **1st Mid-term Exam**

Week 6

Oct 1 – Quantification of DNA Samples; RNA – collection, variability, information – potential future use in forensic investigations

Oct 3 - SNPs – development, limitations and potential use in forensic investigations

Week 7

Oct 8 – New Sequencing Technologies – whole genome sequencing, advances and future applications for forensic investigations. Genetic Testing – history, basis and use of genetic testing procedures for medical and forensic applications.

Oct 10 – DNA Databases – current and future DNA databases and their use for forensic and medical purposes.

Week 8

Oct 15 – Innocence Project Discussion

Oct 17 – Innocence Project Discussion

Week 9

Oct 22 - In Class Review

Oct 24 – 2nd Mid-term Exam

Week 10

Oct 29 – Class Discussion of Final Paper Topics and Grading Scheme

Oct 31 – Class Discussion of Final Paper Topics and Grading Scheme

Week 11

Nov 5 – No Class, Presentation Preparation

Nov 7 – No Class, Presentation Preparation

Week 12

Nov 12 – Presentations # 1-4

Nov 14 – Presentations # 5-8

Week 13

Nov 19 – No Class, Draft Paper Writing

Nov 21 – No Class Draft Paper Writing

Week 14

Nov 25 – Monday, 5pm – Draft Papers Due (Hard Copy x 2 to Rm 110)

Nov 26 – Hand out Papers and Grading Forms, Reading and Grading in Class

Week 15

Dec 3 - Grading Sheets due at 9:30am, Class Discussion of Final Papers

Week 16

Dec 9 – Monday, 5pm - Papers Due (Hard Copy to Rm 110 AND Electronic Copy to ccoates@tamu.edu)

Laboratory Schedule:

Week 1

Aug 26 - Introduction, Lab Safety, Lab Notebooks/Record Keeping

Week 2

Sep 2 – Pipetting Techniques, Presumptive Tests

Week 3

Sep 9 – DNA Extraction & Quantification

Week 4

Sep 16 – PCR

Week 5

Sep 23 – Gel Electrophoresis, RFLP Analysis

Week 6

Sep 30 – **Quiz 1**, STR Analysis

Week 7

Oct 7 – Primer Design

Week 8

Oct 14 – Mitochondrial DNA Amplification

Week 9

Oct 21 – Sequencing

Week 10

Oct 28 – **Quiz 2**

Week 11

Nov 4 – Case Study

Week 12

Nov 11 – No Lab, Lecture Still Meets

Week 13

Nov 18 – **Notebook Evaluation**

Week 14

Nov 25 – TBD

Week 15

Dec 2 – **Redefined Day: Attend Friday Classes**