Credit Hours: 3.0
Class Time/Place: Lecture: Tuesday & Thursday 3:30-4:20. Lab: Tuesday & Thursday 4:30-5:20.
Course Description: This course explores fundamental procedures of DNA technology as it applies to forensic settings (human and non-human). In the laboratory students will manipulate DNA via PCR in a semester-long research project.
Prerequisite: Genetics or permission of the instructor
Instructor: Dr. Trevor Stamper
Instructor Contact Information: Smith Hall, Room B-9
Office Hours: by appointment
Phone: 765-494-1262
e-mail: stampert@purdue.edu

Required Textbooks and other materials:
Additional readings, as assigned.

Course Objectives Overview
This course focuses on the following learning outcomes:

Learning Outcome A: Understand and appreciate the scope of forensic biology.
Learning Outcome B: Understand and appreciate the scope, diversity and utility of a variety of DNA typing techniques.
Learning Outcome C: Perform the primary technique used in Forensic DNA analysis: PCR.
Learning Outcome D: Perform post-PCR Processing.
Detailed Course Objectives

Learning Outcomes: Upon completion of this course the student should:

Objective A:
Understand and appreciate the scope of forensic biology.

Learning Outcomes: The student will:
• A-1 Develop a definition of forensic biology sub-disciplines:
  o Forensic Anthropology
  o Forensic Botany
  o Forensic Odontology
  o Forensic Serology
  o Forensic DNA Typing
• A-2 Review the history and development of aspects of forensic biology:
  o Serology
  o DNA typing
• A-3 Review the nature, collection and preservation of forensic DNA evidence
• A-4 Explain the role and functions of a forensic DNA scientist.
• A-5 Explore the organizational strategies of a DNA laboratory.

Outcome Assessment Method: Examination

Objective B:
Understand and appreciate the scope, diversity and utility of a variety of DNA typing techniques.

Learning Outcomes: The student will:
• B-1 Compare, contrast and explain the genetic and technical differences between various DNA typing techniques:
  o Human vs. non-human
  o RFLP, STR, sequence-based
  o mtDNA, nDNA, Y-chromosome
• B-2 Explain the different statistical methods for determining a “match” from a “non-match”

Outcome Assessment Method: Examination

Objective C:
Perform the primary technique used in Forensic DNA analysis: PCR.

Learning Outcomes: The student will:
• C-1 Define and describe the polymerase chain reaction
• C-2 Conduct experiments on how to manipulate PCR reactions for increased/decreased fidelity
• C-3 Use PCR to optimize the thermal conditions for amplifying fly DNA at a mtDNA locus
• C-4 Amplify mtDNA locus for 15 unknown fly species
• C-5 Perform post-sequencing processing of amplified fly mtDNA locus
• C-6 Mitigate PCR contamination

Outcome Assessment Method: PCR Project & Examination

Objective D:
Perform post-PCR Processing.

Learning Outcomes: The student will:
• D-1 Analyze the products of their results versus other existing data to ensure product accuracy
• D-2 Align multiple sequences across a single locus
• D-3 Use online tools (NCBI BLAST) to check for the accuracy of their sequences
• D-4 Edit their sequences based on quality thresholds and comparisons of raw chromatograms
• D-5 Define and describe what a raw chromatogram illustration is visually depicting

Outcome Assessment Method: Alignment Project
Course Assessment

Methods of Assessment:

<table>
<thead>
<tr>
<th>Abstracts</th>
<th>Participation</th>
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<tr>
<td>Attendance</td>
<td>Peer Evaluation</td>
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<td>Capstone Project</td>
<td>Portfolio</td>
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<td>Case Study</td>
<td>Portfolio Lab Performance</td>
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<td>Exams</td>
<td>Presentations</td>
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<td>Group Projects</td>
<td>Professional Evaluation</td>
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<td>Homework Assignments</td>
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<td>Internet Research</td>
<td>Research project</td>
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<td>Journaling</td>
<td>Lab Performance</td>
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<tr>
<td>Oral/written review of literature</td>
<td>Lab Notebook</td>
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Grading:

The student will be evaluated on the following basis:

- 400 pts Examinations (100 pts each; final cumulative)
- 200 pts Lab Notebook
- 200 pts PCR Project
- 100 pts Alignment Project

Grading Scale/Distribution:

A = 90%, B = 80-89%, C = 70-79%, D = 60-69%, F = 59% or less

Examinations: There are four exams. The first three are focused on the material since the last examination, but the final examination is cumulative. Examinations come in two parts: take home and in-class components. The take home portion consists of multipart essay questions that require you link information learned in class, assigned reading and additional research together into a narrative that answers specific questions. You complete the at-home portion on your own time, and submit it through the safe-assign feature in Blackboard. The in-class portion is more geared to technical questions, definitions and technique descriptions. You complete the in-class portion during class time (see the course schedule for dates).

Lab Notebook: Part of good science is good lab notebook upkeep. Each class will require some lab time, and each time you work in the lab, you need to keep an accurate record of what you are doing. The specifics of what this entails will be outlined in class lecture, or you can ask the instructor if you are ever unsure. Each Friday a copy of that week’s lab notes is due in the instructor’s mailbox. Lab notes are graded on a not turned in, ✓-, ✓, or ✓+, system. This will be recorded weekly and at the end of the semester, if there are any “not turned in” or zero spots in your record, you will receive no credit for that portion of the grade. Likewise, if your ✓- grades outweigh your ✓, or ✓+ grades, you will also receive no credit for the notebook.

PCR Project: Modern forensic biology is a study in the use of polymerase chain reaction (PCR), regardless of the application (human or non-human). Good PCR skills are essential to being a forensic biologist and this course is designed to allow students time to develop those skills. Each student will be presented with 15 unknown fly specimens, each represented by three legs. You will extract the DNA...
from those legs, and over the course of the semester amplify the DNA using PCR techniques for the chosen locus of the current continental US carrion fly database. During this project you will also practice the use of positive and negative controls to ensure the quality of the products you produce. As the semester closes, you will organize your samples for sequencing, and just before the thanksgiving holiday, we will send out plates for sequencing. After the holiday, we will finish the semester by analyzing our returned data using the techniques you learned from the alignment project, and then, we will align that data to the master continental US dataset so you can see what species you have been investigating. Late assignments will not be accepted.

PCR projects are worth a total of 200 points, and these points will be divided as follows:

<table>
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<th>Parts</th>
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<tr>
<td>DNA Extraction Report</td>
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<td>PCR Report</td>
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<td>QA/QC Report</td>
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<td>Final Analysis</td>
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Alignment Project: Implicit in working with DNA technology is the analysis of DNA data at some level. In this class we will be working with fly sequence data. This data is presented to the student as it comes from the sequencer—as a raw electropherogram. Students partake in a project to transform the raw data into a form that is ready for analysis. This involves: editing raw code, BLAST checking for accuracy, aligning forward and reverse sequences to check for internal inconsistencies then performing a multiple specimen alignment and checking for codon alignment and errors. This work will be done out of the classroom, but we will provide time for discussion and tutorials during the class (see course schedule). More information about this assignment will be made available as we approach the project start date. All Alignment assignments are due at the beginning of class on the scheduled due date. Late assignments will not be accepted.

Alignment projects are worth a total of 100 points, and these points will be divided as follows:

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**Final Exam <insert time here>**
General Policies

Student e-mail Etiquette: All email correspondence to the instructor will be conducted in a professional manner. When utilizing email for this class, students should:

1. Include the course code, number, and section in the email subject heading (ENTM318 for example)
2. Address the recipient appropriately, using proper spelling, grammar, and punctuation,
3. Close with your full name, day of week and time of class you meet (Example: Bob Smith, Tue & Thur 12:20pm to 1:45pm)
4. Name file attachments by including the course and number, student last name, and assignment/document title (for example, ENTM318_smith_case2p132).

Special Services: If you are a student with a disability, it is your responsibility to inform your instructor and register with the Disability Resource Center (http://www.purdue.edu/drc or (765) 494-1247) so reasonable accommodations can be made.

If you have a disability that requires special academic accommodation, please make an appointment to speak with me within the first three (3) weeks of the semester in order to discuss any adjustments. It is important that we talk about this at the beginning of the semester. It is the student's responsibility to notify the Disability Resource Center (http://www.purdue.edu/drc) of an impairment/condition that may require accommodations and/or classroom modifications.

Academic Honesty:
"To foster a climate of trust and high standards of academic achievement, Purdue University is committed to cultivating academic integrity and expects students to exhibit the highest standards of honor in their scholastic endeavors. Academic integrity is essential to the success of Purdue University’s mission. As members of the academic community, our foremost interest is toward achieving noble educational goals and our foremost responsibility is to ensure that academic honesty prevails"

–Purdue University Regulations, Part 5, Section II

Any instance of plagiarism, cheating, dishonesty or the facilitation thereof will result in a grade of 0 (zero points) for the assignment. Second offenses will be reported to the Dean of Studies and students will fail the course (grade of F). Please refer to the Purdue student guide for academic integrity:

http://www.purdue.edu/odos/autodos/academicintegrity.php

Use of Copyrighted Materials:
Among the materials that may be protected by copyright law are the lectures, notes, and other material presented in class or as part of the course. Always assume the materials presented by an instructor are protected by copyright unless the instructor has stated otherwise. Students enrolled in, and authorized visitors to, Purdue University courses are permitted to take notes, which they may use for individual/group study or for other non-commercial purposes reasonably arising from enrollment in the course or the University generally.

Notes taken in class are, however, generally considered to be “derivative works” of the instructor’s presentations and materials, and they are thus subject to the instructor’s copyright in such presentations and materials. No individual is permitted to sell or otherwise barter notes, either to other students or to any commercial concern, for a course without the express written permission of the course instructor. To obtain permission to sell or barter notes, the individual wishing to sell or barter the notes must be registered in the course or must be an approved visitor to the class. Course instructors may choose to grant or not grant such permission at their own discretion, and may require a review of the notes prior to their being sold or bartered. If they do grant such permission, they may revoke it at any time, if they so choose.

Attendance:
Students are expected to be present for every meeting of the classes in which they are enrolled. Only the instructor can excuse a student from a course requirement or responsibility. When conflicts or absences can be anticipated, such as for many University sponsored activities and religious observations, the student should inform the instructor of the situation as far in advance as possible. For unanticipated or emergency absences when advance notification to an instructor is not possible, the student should contact the instructor as soon as possible by email, or by contacting the main office that offers the course. When the student is
unable to make direct contact with the instructor and is unable to leave word with the instructor’s department because of circumstances beyond the student’s control, and in cases of bereavement, the student or the student’s representative should contact the Office of the Dean of Students.

The link to the complete policy for attendance can be found at:

http://www.purdue.edu/odos/services/classabsence.php

**Grief Absence Policy for students:**
Purdue University recognizes that a time of bereavement is very difficult for a student. The University therefore provides the following rights to students facing the loss of a family member through the Grief Absence Policy for Students (GAPS). GAPS Policy: Students will be excused for funeral leave and given the opportunity to earn equivalent credit and to demonstrate evidence of meeting the learning outcomes for misses assignments or assessments in the event of the death of a member of the student’s family.

There is a specific policy that MUST be followed in the event of a family death. The link to the complete policy can be found at:

http://www.purdue.edu/odos/services/griefabsencepolicyforstudents.php

**Emergencies:**
In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor’s control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructors or TAs via email or phone. **You are expected to read your @purdue.edu email on a frequent basis.**

**Nondiscrimination:**
Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life.

Purdue University prohibits discrimination against any member of the University community on the basis of race, religion, color, sex, age, national origin or ancestry, genetic information, marital status, parental status, sexual orientation, gender identity and expression, disability, or status as a veteran. The University will conduct its programs, services and activities consistent with applicable federal, state and local laws, regulations and orders and in conformance with the procedures and limitations as set forth in Executive Memorandum No. D-1, which provides specific contractual rights and remedies. Any student who believes they have been discriminated against may visit www.purdue.edu/report-hate to submit a complaint to the Office of Institutional Equity. Information may be reported anonymously.

**WARNING:** Class contents are graphic in nature. Those who might exhibit a problem with the more explicit material presented in class should exercise caution. **Direct concerns to the instructors for guidance.**

*Federal copyright laws and Indiana State statutes relevant to deceased individuals prohibit the copying or duplication or videotaping of any material presented as a part of this class.*

This syllabus is subject to change. Changes will be announced via blackboard and a modified syllabus will be posted.
Classroom Emergency Preparedness
Attachment for Class Syllabus

EMERGENCY NOTIFICATION PROCEDURES:

- Dial 911 from any public or campus telephone.

- Over 250 Emergency Telephone System (ETS)
  - For assistance push the ETS button which will connect you to the Purdue Police Department

- Immediate warning notifications focuses on two basic concepts:
  - Fire Alarms mean to immediately evacuate the building and proceed to your Emergency Assembly Area (should be specified in the Building Emergency Plan).
  - All Hazards Outdoor Emergency Warning Sirens means to immediately seek shelter (Shelter In Place) in a safe location within closest facility/building.
    - “Shelter in place” means seeking immediate shelter inside a building or University residence. This course of action may need to be taken during a tornado, earthquake, release of hazardous materials in the outside air, or a civil disturbance. When you hear the sirens immediately go inside a building to a safe location and use all communication means available to find out more details about the emergency. Remain in place until police, fire, or other emergency response personnel provide additional guidance or tell you it is safe to leave.

(In both cases, you should seek additional clarifying information by all means possible...Purdue Home page, email alert, TV, radio, etc...review the Purdue Emergency Warning Notification System multi-communication layers at http://www.purdue.edu/emergency_preparedness/warning_system.htm)

EMERGENCY RESPONSE PROCEDURES:

- Purdue’s Emergency Procedures Guide should be periodically reviewed and referenced for all emergencies. Located at: https://www.purdue.edu/emergency_preparedness/flipchart/index.html

- Be familiar with the Building Emergency Plan (each building is required to have a BEP) for:
  - evacuation routes, exit points, and location to report for roll call after evacuating the building.
- when and how to evacuate the building.
- shelter in place procedures and locations
- additional building specific procedures and requirements.

- Understand the University’s emergency warning notification system…Purdue ALERT [http://www.purdue.edu/emergency_preparedness/warning_system.htm](http://www.purdue.edu/emergency_preparedness/warning_system.htm)

**EMERGENCY PREPAREDNESS AWARENESS VIDEOS**

- "Shots Fired on Campus: When Lightning Strikes," is a 20-minute active shooter awareness video that illustrates what to look for and how to prepare and react to this type of incident. See: [http://www.purdue.edu/securePurdue/news/2010/emergency-preparedness-shots-fired-on-campus-video.cfm](http://www.purdue.edu/securePurdue/news/2010/emergency-preparedness-shots-fired-on-campus-video.cfm) (Link is also located on the EP website)

- “To Hell and Back, College Fire Survival” is a 20-minute fire safety video. You must register to view the video. However, the People’s Burn Foundation will not send you e-mail or spam, and your information will not be shared with third parties. The People’s Burn Foundation collects demographic information to study cultural, age and gender awareness pertaining to fire and burn prevention. The video can be seen at: [http://www.igot2kno.org/login.aspx?ReturnUrl=%2fcollege_fire_survival.aspx](http://www.igot2kno.org/login.aspx?ReturnUrl=%2fcollege_fire_survival.aspx)

**MORE INFORMATION**

Reference the Emergency Preparedness web site for additional information: [http://www.purdue.edu/emergency_preparedness/index.htm](http://www.purdue.edu/emergency_preparedness/index.htm)