

FRSC 601  
Forensic Molecular Biochemistry  
Fall 2025  
1:00-3:50 pm Tuesday in SC 3333

Dr. Cynthia Zeller  
SC5301B  
410-704-2170  
czeller@towson.edu  
Office Hours Tuesday and Thursday  
9:30-10:45 am or by appointment

---

---

**Required Texts:**

Butler, John M. Advanced Topics in Forensic DNA Typing: Methodology, Academic Press, 2011. ISBN 978-0-12-374513-2 (ELECTRONIC LINK PROVIDED)

Butler, John M. Advanced Topics in Forensic DNA Typing: Interpretation, Academic Press, 2015. ISBN 978-012-405213-0 (ELECTRONIC LINK PROVIDED)

These books are also required for FRSC 620 and FRSC 621.

Other Readings from the Scientific Literature will be provided via Blackboard

**Recommended text:**

---

---

Watson, J.D.; Baker, T. A; Bell, S.P.; Gann, A.; Levine, M.; Losick, R. Molecular Biology of the Gene, 7<sup>th</sup> ed. Pearson, 2014. ISBN-10:0-321-76243-6; ISBN 13: 978-0-321-46243-6 (ELECTRONIC LINK PROVIDED)

**Assessment:** The student's grade will be determined through the midterm exam, final exam, DNA analysis problem set, and research paper/presentation.

|                                   |            |
|-----------------------------------|------------|
| Midterm Exam                      | 200 points |
| Serology Module                   | 50 points  |
| DNA Mixture Deconvolution project | 100 points |
| Annotated Bibliography            | 50 points  |
| Research Paper                    | 100 points |
| Presentation                      | 100 points |
| Mock Trial                        | 100 points |
| DNA analysis set                  | 100 points |
| Final Exam                        | 200 points |

The assignment of grades will follow the standard graduate school formula of:

| GRADE | POINTS    |
|-------|-----------|
| A     | 930-1000  |
| A-    | 900-929   |
| B+    | 870-899   |
| B     | 830-869   |
| C     | 700-829   |
| F     | Below 700 |

**Tentative Lecture Schedule:**

| <b>Date</b> | <b>Lecture Topic</b>  | <b>Action Items</b>   |
|-------------|---|---|
| 8/28/25     | Introduction and Overview of Forensic Molecular Biology, Central Dogma, Biological Evidence Concepts DNA replication and PCR (traditional, RT-PCR, and quantitative)  |   |
| 9/4/25      | DNA damage and repair mechanisms<br>Serological Analysis: Blood Semen and Saliva- Traditional methods, Quality Assurance/Quality Control  | <b>Research Paper topic due with link to circa 2020 review article</b>            |
| 9/11/25     | Serological Analysis: Blood Semen and Saliva- molecular biological based methods (mRNA, miRNA, methylation qPCR) DNA case workflow, DNA extraction and quantitation, DNA separation methods, STR genotyping<br>Quality Assurance/ Quality Control |   |
| 9/18/25     | STRs/ Issues Unique to Forensic DNA samples, artifacts and artifact control<br>Quality Assurance/ Quality Control, Mixture analysis<br>Major/Minor Profiles   |   |
| 9/25/25     | <b>Mixture Deconvolution</b>  | <b>Annotated Bibliography Due</b>   |
| 10/2/25     | Genetics, single gene inheritance<br>Meiosis and germ cell formation<br>Probability, Population Genetics<br>Hardy Weinberg equilibrium<br>Inbreeding and mutation   | <b>Online module</b>  |
| 10/9/25     | Intro to DNA Stats<br>Random Match Probability<br>Paternity Testing   | <b>DNA mixture Deconvolution project due Midterm opened</b>                       |
| 10/16/25    | <b>TAKE HOME MIDTERM-no class meeting</b>   | Due by midnight 10/23/24<br><b>NO CLASS MEETING</b>                               |
| 10/23/25    | Statistics of Mixture analysis  | <b>In class activity</b>  |
| 10/30/25    | Decision making in statistical analysis   |   |
| 11/6/25     | DNA Problem Sets  | <b>Online Module</b>  |
| 11/13/25    | Evolution and heritage (ySTRs, mtDNA, SNPs)<br><br><b>Student presentations (8)</b>   | Research Paper Due<br>PowerPoint presentations due by midnight, 11/20/24          |
| 11/20/25    | Next Generation Sequencing<br>Forensic Applications<br><b>Student presentations (8)</b>   | Schedule a 30 minute time for mock trial on 12/5/24<br><b>DNA Problem set due</b> |
| 12/4/25     | <b>Mock Trials</b>  |   |
| 12/9/25     | <b>TAKE HOME FINAL EXAM</b>   | <b>DUE at 11:59 pm</b>  |

## **ASSESSMENT:**

### **Annotated Bibliography:**

Students will research one of the topics listed below and will provide the instructor with an annotated bibliography listing at least 10 resources from peer-reviewed scientific literature. Each entry will be annotated with at paragraph outlining the content of the paper. This paragraph is NOT a copy of the abstract, but a student-generated summary of the paper AS IT RELATES TO THEIR PARTICULAR PRESENTATION TOPIC.

### **Research Paper Topics:**

1. Non-human and Microbial Forensic DNA Analysis
2. Next generation sequencing in forensics
3. Genetic Genealogy

### **Research Paper:**

Students will prepare a 12–15-page, double spaced research paper in the form of a scientific review article on one of the topics listed above. You will be updating a review article that was written approximately 5 years ago (ca. 2020), if available. To accomplish this, you will use the review article as background and write your review using more recent literature. Papers will be submitted on BlackBoard by 11/27/23. Papers should include a technical background of the molecular biology, statistical approaches used, and case studies if available. Papers will be graded for accuracy, thorough use and review of relevant literature, and mechanics (including spelling, grammar, and proper citation of references). A rubric will be posted on Blackboard.

### **Take Home Exams:**

Take home exams will be given at least 5 days prior to the date due. The midterm will be due at midnight on Sunday, October 30, 2023, and the final will be due at noon on Wednesday, December 13, 2023. These exams will be turned in via BlackBoard.

### **Mock Trials:**

Students will sign-up for a 30-minute time slot in which to have a mock trial on December 11, 2023. A partial report of two cases will be provided to the students. Dr. Zeller will ask questions which should be answered as if the student were answering in court. Students will be assessed on their understanding of the concepts and on the ease in which a jury will be able to understand the response.

### **Presentations:**

Each student will present a current case in which DNA evidence has been used in an interesting way. These presentations will be 10-15 minutes in length and should include a description of the case, the forensic evidence, a thorough review of the molecular biological method and data analysis that was used in the case. Any background information that that would help other students develop a better understanding of the material should be included. The student presenter should upload the presentation, the original article, and any supplementary materials to Blackboard by **TUESDAY** November 12, 2025, BEFORE the first presentations. These materials will be provided to the class and will be used to develop exam questions for the final exam.

**Academic Dishonesty Policy: All types of Academic Dishonesty are deplorable and will be dealt with accordingly. Please read and familiarize yourself with the University Academic Dishonesty Policy, found at the link below. Plagiarism, obtaining aid from or giving aid to another student, as well as obtaining aid through electronic devices or notes constitutes cheating and will result in failure of the course.**

Plagiarism can result from copying an entire document to inappropriate paraphrasing. In order to avoid plagiarism, the use of words or ideas of another without proper citation, it is imperative to consciously think about what you have read and what you are trying to write. In scientific literature, we do not normally use direct quotes from the primary resources that we are using to gather our information. It is important to paraphrase the ideas and conclusions obtained from the primary literature and rewrite them in your own words. One method to assure that you will not plagiarize is to take notes on each of your primary resources and then write the paper based on your notes, not from the references. Your paper will summarize the works of others, not directly quote from them. Citations should follow the format for the Journal of Forensic Sciences. If you have any questions about plagiarism and correct citations, see <https://towson.libguides.com/c.php?g=530232> for further examples and methods to correct the problems.

### **Chemistry Department Statement on Classroom Diversity and Inclusion**

The students, faculty, and staff at Towson University represent a diverse and vibrant community of learners and scholars. As a community, we value the unique contributions of each individual and promote active participation in all aspects of the learning process by each community member. Your instructor supports

Towson University's goal of fostering a diverse and inclusive educational setting. Your instructor strives to create a classroom environment built upon the principles of mutual respect and support. Toward this end, all members participating in this course are expected to demonstrate respect for all other members of the class. If you feel these expectations have not been met, please speak with your instructor or the designated diversity liaison, Dr. Beth Kautzman(kkautzman@towson.edu).

For further information regarding the diversity and inclusion policies of Towson University, please see [Towson University's "Strategy 1:Exposure to Diversity"](#) , [the Fisher College of Science and Mathematics Diversity Action Plan](#), and the [Chemistry Department Diversity Action Plan](#).