FRSC 622-001 (4899) Advanced Sequencing Techniques (Lecture/Laboratory) (3)

Meeting Times: TuTh 2:00 pm-4:20 pm, SC 5325
Instructor: Simao, Filipa, Ph.D.
Office Hours: M 1:00 am-2:00 pm, W 11:00am-1:pm or by appt.
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Catalog Description:

Theory and application of DNA sequencing technology, including Sanger sequencing, pyrosequencing, and massively parallel sequencing, and their uses in forensic DNA analysis. Five lecture/laboratory hours. Prerequisites: FRSC 621 Advanced DNA Technologies or permission of instructor.

Objective:

Students will gain theoretical understanding and laboratory experience with good lab practice, sample handling and preparation, implementing quality assurance and quality control processes, advanced sequencing techniques, data analysis and statistics applied to real world problems.

Required Text:

Elkins KM and Zeller CB. Next Generation Sequencing in Forensic Science: A Primer. CRC Press / Taylor and Francis, Sept. 16, 2021. ISBN 9781032072043

Additional reading bibliography is provided at the end of this syllabus. Selected readings will be posted on Blackboard.

Teaching Methods:

This class will be presented in a lecture/discussion/demonstration/laboratory format. Emphasis will be on project-based problem solving and hands-on application of DNA typing and DNA sequencing methods, and data analysis using specialized software. PowerPoint presentations, videos, and other visual aids will be used during class. Reading assignments and journal articles will be assigned as appropriate.

IMPORTANT: Students who fail to appear for the first two class sessions, or the first session of evening classes, may forfeit their space in class. Instructors have the right to release these spaces to other students wishing to add the class to their schedules. Students who lose their spaces must officially withdraw from the course through Enrollment Services to avoid earning an FX grade for non-attendance.

Important Dates:

February 5: Change of Schedule period ends for full term (14 weeks).
Last day to drop a course with no grade posted to academic record.

No class:
March 15 - 22: Spring Break

Attendance:

All classes are considered equally important and full attendance and participation is expected. Analysis and planning for lab work may need to be completed out of class as homework.

Course repeat policy

Students may not repeat a course more than once without prior permission of the Academic Standards Committee.

Semester Class Tentative Schedule by Week*:

As we are scheduled in a lab, please wear closed-toed shoes and ankle-length pants/skirt. Bring safety goggles for lab activities. All students must take the department Lab Safety Quiz.

Date	Topic	Reading	Deliveries
Week 1 (Jan 29)	Introduction to the course - information on evaluation and scheduling History of Human Identity Approaches - STR analysis History of Sequencing for Human DNA Typing - First Generation sequencing (Sanger Sequencing and SNaPshot)	Chapter 1 Chapter 2	
Week 2 (Feb 3 - 5)	Next Generation Sequencing Chemistries Overview of NGS on MiSeq FgX, Sequencing by synthesis Journal Club #1 (Jäger AC et al., Developmental validation of the MiSeq FGx Forensic Genomics System for Targeted Next Generation Sequencing in Forensic DNA Casework and Database Laboratories. FSI: Genetics 28 (2017) 52–70.) Group Pairing and Project Topic	Chapter 2	In class Journal Club #1 5-Feb
Week 3 (Feb 10-12)	NGS Data analysis and interpretation Mitochondrial DNA (mtDNA) using Sanger Sequencing mtDNA - DNA extraction and amplification Research Question and Project Design Submission **Laboratory:** mtDNA - DNA extraction and amplification	Chapter 7	Project proposal due 12-Feb
Week 4 (Feb 17-19)	Mitochondrial DNA (mtDNA) data analysis **Laboratory:** mtDNA - purifications, Sanger sequencing, Capillary electrophoresis		Review paper topic due 19-Feb
Week 5 (Feb 24-26)	NGS applications Seminar #1 **Laboratory:** ForenSeq PCR1/Amplify and Tag Targets to create MPS library		
Week 6 (Mar 3-5)	**Laboratory:** ForenSeq PCR2/Enrich Targets to attach indexes and adaptors, PCR cleanup/Purify Libraries	Chapter 3	Seminar #1 due 3-Mar
Week 7 (Mar 10-12)	**Laboratory:** Gel analysis to detect the DNA amplicon product. Multiplexing/Pool libraries. Load samples. Take-home Exam distributed	Chapter 3 Chapter 4	Review paper due 12-Mar
Spring Break			
Week 8 (Mar 24-26)	Did my run work? Run analysis **Laboratory:** Run analysis	Chapter 5 Chapter 6	Peer Review due 26-Mar
Week 9 (Mar 31 - Apr 2)	Data analysis using UAS software: Sequence, Graphs and Charts, Phenotype and Ancestry **Laboratory:** Data analysis using UAS software: Sequence, Graphs and Charts, Phenotype and Ancestry	Chapter 5	Exam due 2-Apr

Week 10 (Apr 7-9)	Journal Club #2 (Barbaric & Horjan-Zanki (2023) Challenges in the recovery of genetic data from human remains found on the Western Balkan migration route. International Journal of Legal Medicine. 137:181-193) **Laboratory:** Data analysis		In class Journal Club #1 7-Apr
Week 11 (Apr 14-16)	Forensic Genetic Genealogy Seminar #2 Writing the final report		
Week 12 (Apr 21-23)	Body fluid analysis NGS Microbial NGS Draft Poster Presentation	Chapter 8 Chapter 9	Seminar #2 due 21-Apr
Week 13 (Apr 28-30)	Project Report Due Draft Oral Presentation Slides Poster Ready to Print		Report due 30-April
Week 14 (May 5-7)	Poster Presentations Draft Oral Presentation Slides		Poster presentation 8-May
Week 15 (May 12-14)	Final Exam Week: Oral Project Presentations		Oral Presentation on 12-May

*The instructor may add additional topics or make schedule changes.

Testing and Grading:

No makeup exams or final exam will be given, unless in a special emergency as defined by the university. There will be no extra-credit opportunity.

Grade Points (1000 points total):

Seminar Summaries (50 points)
Journal Club (50 points)
Research Paper (100 points)
Peer Review (50 points)
Project Proposal (50 points)
Research Project Report (150 points)
Oral Presentation (150 points)
Poster Presentation (100 points)
Exam (300 points)

Grading Scale:

Grade assignment will be based percent of achieved points above on the standard graduate student system: A = 930 points or above
A- = 900 – 929 points
B+ = 870-899 points
B = 829-869 points
C = 700-828 points
F = less than 700 points.

Graded Assignments-Details:

Seminar Summaries (5%): Watch pre-recorded NGS seminar and report upon content. Graded for effort and completion.

Journal Club (5%): Students will participate in Journal Club paper discussions in class on assigned papers. Graded for effort and insight.

Research Proposal (5%): Groups of students will prepare a project proposal complete with a detailed explanation of the number and type of samples, controls, standards, procedures or kits to be used, and research questions. Proposals will be graded by the instructor using a critique rubric. Grading will be based upon study design, thoroughness, and quality of written work.

Review Paper (10%): Students will prepare a 8-10 page review-type article on an advanced sequencing topic approved by the instructor, complete with Abstract, Keywords, Titled sections, Conclusion, and at least ten peer-reviewed journal article References. Grading will be based upon thoroughness, accuracy, and quality of written work using a rubric.

Peer Review of Review Papers (5%): Students will perform peer review for two other student papers. Graded for effort and insight.

Exam (30%): Each student will be evaluated on their responses to essay questions on a take home Exam. Students will be given one week to complete the exam. Grading will be based upon thoroughness, accuracy, and quality of written work using a rubric.

Research Project Report (15%): Students will prepare a Journal of Forensic Sciences quality research report complete with Abstract, Keywords, Introduction, Materials and Methods, Results and Discussion, Conclusion, References, Tables and Figures based upon the group project goals and data. Grading will be based upon thoroughness, accuracy, and quality of written work using a rubric.

Oral Project Presentation (15%): Students will present a seminar on the research project report. The total duration (presentation and questions) will be 15 minutes per group. Presentations will be graded by the instructor and other faculty members in attendance using a critique rubric. Grading will be based upon content provided on slides, content delivery and ability to answer questions correctly.

Poster Project Presentation (10%): Students will present a poster on the research project. The presentation will occur during the Poster Session scheduled for the week before final exams. Presentations will be graded by the instructor and other faculty members in attendance using a critique rubric. Grading will be based upon content provided, content delivery and ability to answer questions correctly.

Late assignments will be penalized 10%.

Cell Phones and Pagers

Cell phone usage in the class meeting/lab is strictly prohibited. If you need to take a call in case of emergency (e.g., sick child, parent care, etc.), exit the classroom to the adjacent hallway.

Department of Chemistry & Forensic Science Expectations Concerning Class Attendance

Student success in chemistry and forensic science courses is closely associated with class attendance. Some learning opportunities (e.g., laboratory experiments, demonstrations, and in-class discussions) cannot be reasonably replicated outside of regular class meetings. Therefore, students are expected to attend all classes. Instructors reserve the right to limit the total number of absences and/or missed assessments (excused or unexcused). Students exceeding these limits may incur grade penalties as described in the syllabus and/or may need to withdraw from the course.

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 an educational 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, both within and outside of the classroom. If you feel these expectations have not been met, please speak with your instructor or the designated diversity liaison, Dr. Cindy Zeller (czeller@towson.edu).

For further information regarding the diversity and inclusion policies of Towson University, please see Towson University's Office of Inclusion and Institutional Equity, the Fisher College of Science and Mathematics Diversity Action Plan, and the Chemistry Department Diversity Action Plan.

Accessibility & Disability Services

This course is in compliance with Towson University policies for students with disabilities. Students with disabilities are encouraged to register with Accessibility & Disability Services (ADS), University Union, Suite 146, 410-704-2638 (Voice) or 410-704-4423 (TDD). Students who suspect that they have a disability but do not have documentation are encouraged to contact ADS for advice on how to obtain appropriate evaluation. A memo from ADS authorizing your accommodation is needed before any accommodation can be made. https://www.towson.edu/accessibility-disability-services/

Laboratory Policy for Pregnant Students

Pregnant students should consult their physicians for advice on whether or not to perform experiments in the laboratory. Students are encouraged to provide their physician with a list of the chemicals that they might be exposed to while in lab. They should also check the SDS sheets (available in the Department) to be aware of the hazards of the chemicals.

If a student is advised against performing laboratory work, then faculty must make accommodations for the student. Any accommodations should comprise a workload that is approximately equivalent to the regularly scheduled laboratory work. These accommodations may include:

- performing “dry” experiments only, in a place free from exposure to ongoing experiments;
- performing the wet chemistry at a later date;
- receiving an incomplete grade in the course pending completion of experimental work

Chat GPT, Open AI and Internet Resources

As we begin the semester, I want to remind you of the importance of academic integrity. Part of what you learn here at Towson University is how to do your work authentically and honorably, and I am here to help you do that. In my course, you will be given assignments and I will provide you with specific instructions about how to complete them. Sometimes the instructions will tell you to do the work entirely on your own without consulting other people or material, including the internet. At other times, you may be asked to work together or to use certain technology tools. If you are ever uncertain about how you should work on an assignment, please contact me.

Student Academic Integrity Policy (TU 03.01.00)

The academic integrity policy for this course is consistent with the TU Academic Integrity Policy. The policy can be reviewed here: https:// www.towson.edu/about/administration/policies/03-01-00-studentacademic-integrity-policy.htm

Title IX Safe Learning Environment

Towson University (TU) is committed to ensuring a safe, productive learning environment on our campus that does not tolerate sexual misconduct, including harassment, stalking, sexual assault, sexual exploitation, or intimate partner violence [Policy 06.01.60]. It is important for you to know that there are resources available if you or someone you know needs assistance. You may speak to a member of university administration, faculty, or staff, but keep in mind that they have an obligation to report the incident to the Title IX Coordinator. It is a goal that you feel able to share information related to your life experiences in classroom discussions and in one-on-one meetings. However, it is required to share information with the Title IX Coordinator regarding disclosures, but know that the information will be kept private to the greatest extent possible. If you want to speak to someone who is permitted to keep your disclosure confidential, please seek assistance from the TU Counseling Center 410-704-2512 to schedule an appointment, and locally within the community at TurnAround, Inc., 443-279-0379 (24-hour hotline) or 410-377-8111 to schedule an appointment.” http://towson.edu/titleix (http://towson.edu/titleix/).

Reporting Hate Crimes and Bias Incidents

Towson University prohibits all students, staff, and faculty from committing or engaging in any hate crimes as defined under state and federal law, or any acts of bias, hate, or prejudice exhibited in conduct that is in violation of another University policy on campus, on University property, at University sponsored events, or when engaged in University activities and business on or off campus. The University must receive notice to respond effectively to alleged Hate Crimes or Bias Incidents in the University Community. Please report or file a complaint of a Hate Crime or Bias Incident in the following ways:

• Report to University Police: Towson University's Police Department (“TUPD”) will determine if incidents are criminal in nature. In cases of hate crimes, individuals can be punished with fines and/or imprisonment. Felony offenses demonstrated to be motivated by bias are subject to enhanced penalties.

• Contact the Office of Inclusion & Institutional Equity: Online at: https://towson.edu/notattu, email at: OIIE@towson.edu, telephone, in person or via regular mail. https://www.towson.edu/about/administration/policies/06-01-20-policy-procedures-reporting-hate-crimes-bias-incidents.html

Counseling Resources

The Towson University Counseling Center (TUCC) provides free and confidential counseling services. For more information about TUCC, please visit their website at https://www.towson.edu/counseling (https://www.towson.edu/counseling/). To make a same-day appointment or for after-hours crisis assistance, please call 410-704-2512.

In Case of Emergency

In the event of a University-wide emergency course requirements deadlines and grading schemes are subject to changes that may include alternative delivery methods, alternative methods of interaction with the instructor, class materials, and/or classmates, a revised attendance policy, and a revised semester calendar and/or grading scheme. In the case of a University-wide emergency, please refer to the following about changes in this course:
Web Site: www.towson.edu
Telephone Number(s)
TU Text Alert System: This is a service designed to alert the Towson University community via text messages to cell phones when situations arise on campus that affect the ability of the campus to function normally. Sign up: https://www.towson.edu/publicsafety/notification/

Copyright Notice

Your instructor retains all copyrights to all original materials distributed in this course (including, but not limited to, hard copies and electronic copies of lecture slides, notes, practice problems, worksheets, assignments, lab materials, and exams). Reposting, selling, or otherwise distributing these materials in any fashion at any time is prohibited.

Bibliography

Books:

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Jerry Hoogenboom, Kristiaan J. van der Gaag, Rick H. de Leeuw, Titia Sijen, Peter de Knijff, Jeroen F.J. Laros. FDSTools: A software package for analysis of massively parallel sequencing data with the ability to recognise and correct STR stutter and other PCR or sequencing noise. Forensic Science International: Genetics 27 (2017) 27–40.

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