ANTH/BIO 3138 Intro DNA Molecular Methods
Anthropology/Biology- Lakehead University
Fall 2025

Instructor Information

Instructor: Amy Junnila
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Office Hours: Mondays 7:30p-8:30p BB2002 or by appointment NO3012 (Paleo-DNA Lab, Alumni House, 3rd Floor)

Course Identification

Course Number: 3138
Course Name: Intro DNA Molecular Methods
Course Location: BB2002 (Lecture) & CB3012 (Labs)
Class Times: Lecture Mondays 5:30p-7:30p
Laboratory Fridays 11:30a-2:30p

Course Description/Overview - An introduction to methods used in molecular biology, biochemistry and molecular anthropology with emphasis on the techniques and their application. The laboratory component covers the analysis of nucleic acids, particularly DNA, and includes basic techniques such as gel electrophoresis, DNA extraction, and the polymerase chain reaction. Methods of DNA data analysis and interpretation are also introduced, and special topics include forensic science, molecular anthropology, environmental DNA (eDNA) and application to medical entomology.

Course Learning Objectives

Upon completion of this course, students should be able to understand:

1. The Nature of DNA and DNA Extraction
    a. Different types of DNA
    b. DNA extractions and problems that can arise
    c. Physical, Chemical and Enzymatic extraction methods

2. DNA Quantification and Purification

3. Polymerase Chain Reaction

4. DNA Sequencing and STR Analysis
    a. DNA testing and reporting

b. Sanger sequencing vs next generation sequencing

5. DNA Sampling

6. Special Topics
    a. Select Special Topics will be examined

7. Lab report write-ups
    a. How to write a comprehensive lab report and interpret data relating to DNA analysis
    b. Each lab will focus on a different aspect of DNA analysis

Course Resources
Course Website(s)
- myCourseLink

Required Course Text(s)
There is no required text for this course.
Selected web sites and electronic resources will comprise the reading materials for this course. Where possible, web links will be provided. Self-directed web investigation is required. Please contact the LU Library to take advantage of tips, workshops, and tutorials to improve online research skills.

Course Schedule/Outline

Topic	**Date**	**Required Readings**
Ancient DNA Foundations	Sept. 8	Recombinant DNA: Chapter 2: DNA is the primary genetic material and 3: Elucidation of the genetic code
Basic organization of DNA	Sept. 15	Recombinant DNA: Chapter 5: Methods of creating recombinant DNA molecules
Creating recombinant DNA molecules	Sept. 22	1. Molecular coproscopy: dung and diet of the extinct ground sloth *Nothrotheriops shastensis*. 2. Ancient DNA: extraction, characterization, molecular cloning, and enzymatic amplification.
Extraction, Purification and Quantification of DNA	Sept. 29	1. Recombinant DNA: Chapter 6: The polymerase chain reaction

		2. The unusual origin of the polymerase chain reaction.
DNA Enrichment & Species Identification	Oct. 06	1. A PCR method for detection of plant meals from the guts of insects. 2. Species identification of plant tissues from the gut of *An. sergentii* by DNA analysis.
Reading week	Oct. 13-17	
Midterm Exam	Oct. 20-24	
Ancient DNA, DNA Damage, and taphonomy	Oct 27	1. Effect of highly fragmented DNA on PCR. 2. Ancient DNA and the polymerase chain reaction: the emerging field of molecular archaeology (Minireview).
DNA barcoding insect plant meals	Nov. 03	Titanic's unknown child: the critical role of the mitochondrial DNA coding region in a re-identification effort (2011)
Titanic	Nov. 10	Genomic identification in the historical case of the Nicholas II royal family
Forensic DNA	Nov. 17	Pleistocene mitogenomes reconstructed from the environmental DNA of permafrost sediments.
Environmental DNA (eDNA)	Nov. 24	1. Reassessing the northern limit of maize consumption in North America: stable isotope, plant microfossil, and trace element content of carbonized food residue. 2. Northernmost precontact maize in North America
Residues	Dec. 01	**TBD**
Final exams	Dec. 06-16	

Lab Assignments and Evaluations

Item	Lab Date(s)	Value

Lab #1 Lab basics, Nature of DNA Lab #2 DNA Extraction Lab #3 Purification and quantification Lab #4 PCR Reading week Midterm Exam Lab #5 Gel Electrophoresis Lab #6 DNA sequencing Lab #7 Bioinformatics Lab #8 STR Analysis Lab #9 Group Presentation	Sept. 19, 2025 Sept. 26, 2025 Oct. 03, 2025 Oct. 10, 2025 Oct. 13-17, 2025 Oct. 20-24, 2025 Oct. 31, 2025 Nov. 07, 2025 Nov. 14, 2025 Nov. 21, 2025 Nov. 28, 2025	5% 5% 5% 5% 5% 5% 5% 5% 5% 5% 20%
Midterm	TBD 2025	20%
Final Exam	TBD 2025	20%
Total		100

Late Assignments
Late assignments will be accepted but there will be a 5% deduction per day late. If you are handing in late, it is your responsibility to ensure that your lab reaches the person marking it.

Weekly Lab Report Guidelines

To support your development in scientific writing, you will complete a weekly lab report for each laboratory session. Each report will be structured as a formal scientific document and must include the following components:

- Introduction and Background: Clearly state the purpose of the experiment and outline the hypothesis or expected outcomes.
- Materials and Methods: Provide a detailed, reproducible account of the procedures and equipment used.
- Results: Present your findings using appropriate tables, figures, and descriptive statistics.
- Discussion and Conclusion: Interpret the results, evaluate their significance, and relate them to the original hypothesis.

Each report must cite at least five peer-reviewed references using the Vancouver citation style. These references should support your methodology, contextualize your findings, or provide relevant theoretical background.

Final Presentation Lab: Analysis of Experimental Results

For your culminating assignment, you will prepare a final group presentation that showcases the results obtained during class experiments. This presentation should

synthesize your findings, demonstrate your understanding of the scientific principles involved, and reflect on the broader implications of your work.

Requirements:

- Scientific Content: Present a clear and accurate summary of your experimental results, including relevant data, observations, and interpretations in 20-25 minutes. Be prepared to answer questions.
- References: Support your analysis with 5 to 7 peer-reviewed sources, cited appropriately. These should relate to your experimental methods, findings, or the broader context of your work.
- Format: You may choose a creative or professional format in Power Point.

Judging Criteria:

Your presentation will be evaluated on:

- Scientific accuracy and depth
- Clarity and organization
- Use of peer-reviewed references
- Creativity or professionalism in delivery
- Critical thinking and reflection
- Visual and verbal communication skills

This is your opportunity to demonstrate not only what you learned, but how you can communicate scientific findings effectively. It should tell a compelling story about your work.

Regulations

> "It is the responsibility of each student registered at Lakehead University to be familiar with, and comply with all the terms, requirements, regulations, policies and conditions in the Lakehead University Academic Calendar. This includes, but is not limited to, Academic Program Requirements, Academic Schedule of Dates, University and Faculty/School Policies and Regulations and the Fees and Refund Policies and Schedules."

Collaboration/Plagiarism

Plagiarism is defined in University Regulation IX with additional examples in Article I, Section 1 of The Code. Sanctions associated with Academic Misconduct are defined in Article II of The Code and Enforcement Procedures are outlined in Article III of The Code.

Students wishing to learn more about Academic Misconduct are encouraged to read the University and relevant Faculty Regulations and The Code (noted above) and access other resources on the Teaching Commons website.

University Policies – all University Policies can be found here. Pay particular attention to those found under the Category of "Regulations" and "Student-Related". If you have a question, please let me know by email or in-class. If you

have a question, it is likely that at least a few others in the class are wondering the same thing.

Supports for Students – there are many resources available to support our students. These include but are not limited to:

- Health and Wellness
- Student Success Centre
- Student Accessibility Centre
- Library
- Academic Support Zone (Writing and Math Tutoring Centre)

Lakehead University is committed to achieving full accessibility for persons with disabilities. Part of this commitment includes arranging academic accommodation for students with disabilities and/or medical conditions to ensure they have an equitable opportunity to participate in all of their academic activities. If you are a student with a disability and think you may need accommodation, you are strongly encouraged to contact Student Accessibility Services (SAS) and register as early as possible. For more information, please contact Student Accessibility Services http://studentaccessibility.lakeheadu.ca (SC0003, 343-8047 or sas@lakeheadu.ca)

Readings (Alphabetical)

Boyd M, Surette C. Northernmost precontact maize in North America. American Antiquity. 2010; 75(1):117-33.

Boyd M, Varney T, Surette C, Surette J. Reassessing the northern limit of maize consumption in North America: stable isotope, plant microfossil, and trace element content of carbonized food residue. Journal of Archaeological Science. 2008; 35(9):2545-56.

Golenberg EM, Bickel A, Weihs P. Effect of highly fragmented DNA on PCR. Nucleic acids research. 1996 Dec 1;24(24):5026-33.

Junnila A, Müller GC, Schlein Y. Species identification of plant tissues from the gut of An. sergentii by DNA analysis. Acta tropica. 2010;115(3):227-33.

Just RS, Loreille OM, Molto JE, Merriwether DA, Woodward SR, Matheson C, Creed J, McGrath SE, Sturk-Andreaggi K, Coble MD, Irwin JA. Titanic's unknown child: the critical role of the mitochondrial DNA coding region in a re-identification effort. Forensic Science International: Genetics. 2011; 5(3):231-5.

Matheson CD, Muller GC, Junnila A, Vernon K, Hausmann A, Miller MA, Greenblatt C, Schlein Y. A PCR method for detection of plant meals from the guts of insects. Organisms Diversity & Evolution. 2008 Jan 23;7(4):294-303.

Murchie TJ, Karpinski E, Eaton K, Duggan AT, Baleka S, Zazula G, MacPhee RD, Froese D, Poinar HN. Pleistocene mitogenomes reconstructed from the environmental DNA of permafrost sediments. Current Biology. 2022 Feb 28;32(4):851-60.

Pääbo S. Ancient DNA: extraction, characterization, molecular cloning, and enzymatic amplification. Proceedings of the National Academy of Sciences. 1989; 86(6):1939-43.

Pääbo S, Higuchi RG, Wilson AC. Ancient DNA and the polymerase chain reaction: the emerging field of molecular archaeology (Minireview). The Journal of biological chemistry. 1989 Jun 15;264(17):9709-12.

Poinar HN, Hofreiter M, Spaulding WG, Martin PS, Stankiewicz BA, Bland H, Evershed RP, Possnert G, Paabo S. Molecular coproscopy: dung and diet of the extinct ground sloth Nothrotheriops shastensis. Science. 1998; 281(5375):402-6.

Rogaev EI, Grigorenko AP, Moliaka YK, Faskhutdinova G, Goltsov A, Lahti A, Hildebrandt C, Kittler EL, Morozova I. Genomic identification in the historical case of the Nicholas II royal family. Proceedings of the National Academy of Sciences. 2009 Mar 31;106(13):5258-63.

Watson JD, Gilman M, Witkowski JA, Zoller M. Recombinant DNA. 2nd ed. New York: Scientific American Books; 1992.