

BIOU3GE: Review Session

(Please remind me to record if I forget)

20 November 2023

Attendance code

BF-PH-OR

Focus of review session

- ▶ Phylogenetics Lab Report
- ▶ Exam questions
- ▶ Any other questions

Phylogenetics Lab Report

- ▶ Due: 24 NOV 2023 at 23:59 UK time

Phylogenetics Lab Report

- ▶ Due: 24 NOV 2023 at 23:59 UK time
- ▶ 25% of total grade

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- ▶ Follow Phylogenetics Labs 1 and 2

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- ▶ Follow Phylogenetics Labs 1 and 2
- ▶ Turn in on Canvas Assignments

Phylogenetics Lab Report

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- ▶ Follow Phylogenetics Labs 1 and 2
- ▶ Turn in on Canvas Assignments
- ▶ Can update before deadline

Phylogenetics Lab Report

- ▶ Answer 3 questions
 - ▶ Question 1 (400 words; 30%)
 - ▶ Question 2 (300 words; 30%)
 - ▶ Question 3 (300 words; 40%)
- ▶ Word count does not include tables, figures, captions, or references

Phylogenetics Lab Report

- ▶ Answer 3 questions
 - ▶ Question 1 (400 words; 30%)
 - ▶ Question 2 (300 words; 30%)
 - ▶ Question 3 (300 words; 40%)
- ▶ Word count does not include tables, figures, captions, or references
- ▶ Post questions in Discussion board

Review of Phylogenetics Lab

Week 3: DNA extraction

- ▶ Collected plant samples on campus

Review of Phylogenetics Lab

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- ▶ Collected plant samples on campus
- ▶ Extracted plant DNA

Review of Phylogenetics Lab

Week 3: DNA extraction

- ▶ Collected plant samples on campus
- ▶ Extracted plant DNA
- ▶ Sent samples for analysis
 - ▶ Polymerase Chain Reaction (PCR)
 - ▶ Sanger Sequencing

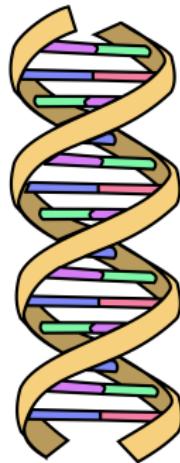
Review of Phylogenetics Lab

Week 3: DNA extraction

- ▶ Collected plant samples on campus
- ▶ Extracted plant DNA
- ▶ Sent samples for analysis
 - ▶ Polymerase Chain Reaction (PCR)
 - ▶ Sanger Sequencing
- ▶ Sequences returned for Week 10

Extracted plant DNA: Week 3 lab

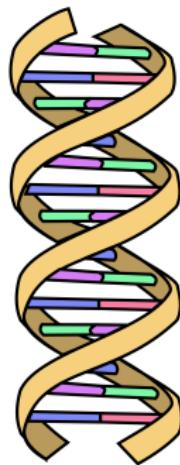
Objective: Get DNA from a plant leaf and remove everything else.



- ▶ Grind up the plant tissue

Extracted plant DNA: Week 3 lab

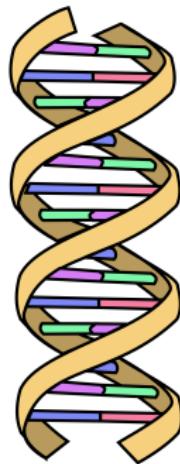
Objective: Get DNA from a plant leaf and remove everything else.



- ▶ Grind up the plant tissue
- ▶ Lysis to digest proteins

Extracted plant DNA: Week 3 lab

Objective: Get DNA from a plant leaf and remove everything else.

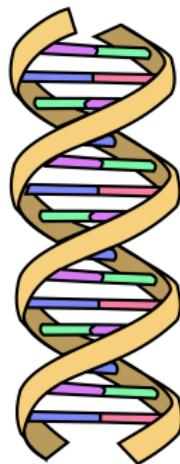


- ▶ Grind up the plant tissue
- ▶ Lysis to digest proteins
- ▶ Enzymes degrade RNA and other materials

¹Image: Public domain

Extracted plant DNA: Week 3 lab

Objective: Get DNA from a plant leaf and remove everything else.

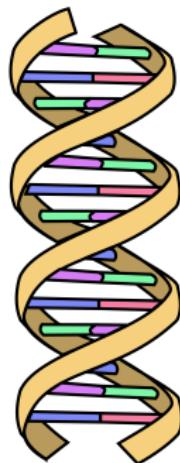


- ▶ Grind up the plant tissue
- ▶ Lysis to digest proteins
- ▶ Enzymes degrade RNA and other materials
- ▶ Separate as solid with centrifuge

¹Image: Public domain

Extracted plant DNA: Week 3 lab

Objective: Get DNA from a plant leaf and remove everything else.

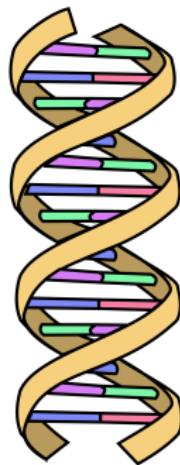


- ▶ Grind up the plant tissue
- ▶ Lysis to digest proteins
- ▶ Enzymes degrade RNA and other materials
- ▶ Separate as solid with centrifuge
- ▶ Filter DNA out

¹Image: Public domain

Extracted plant DNA: Week 3 lab

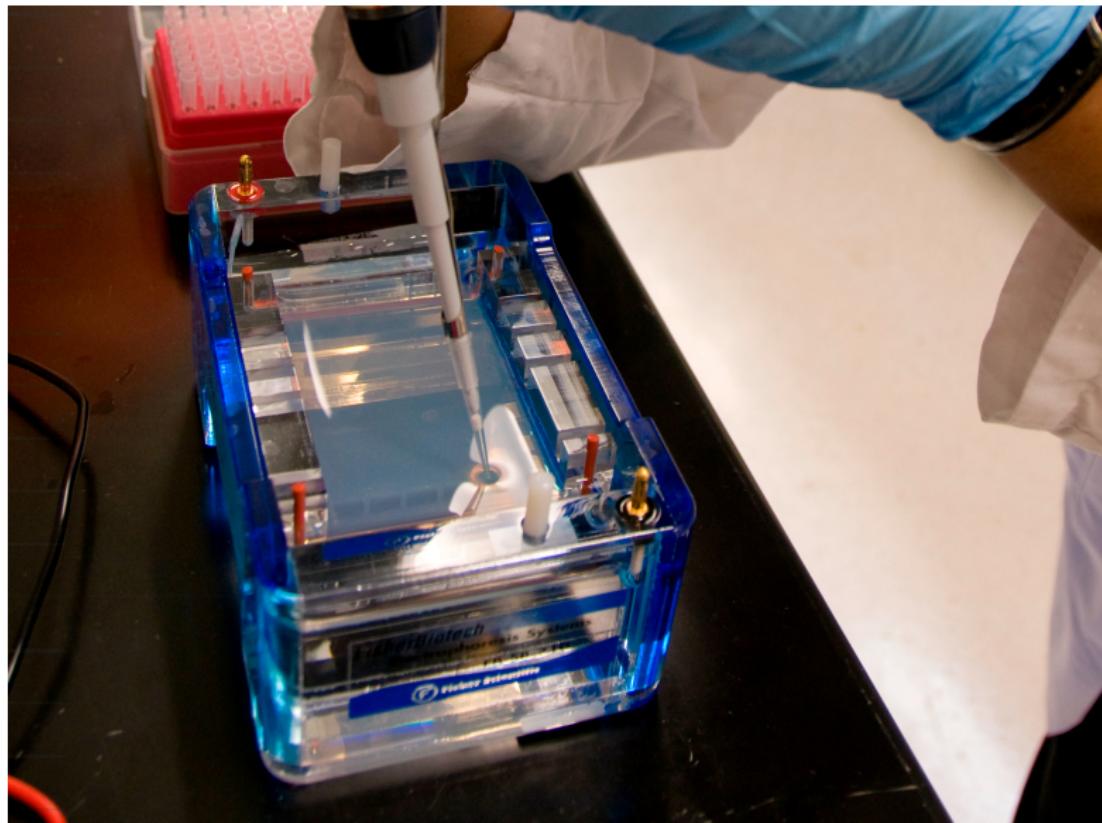
Objective: Get DNA from a plant leaf and remove everything else.



- ▶ Grind up the plant tissue
- ▶ Lysis to digest proteins
- ▶ Enzymes degrade RNA and other materials
- ▶ Separate as solid with centrifuge
- ▶ Filter DNA out
- ▶ Hold DNA in buffer

¹Image: Public domain

Extracted plant DNA: Checking it worked



¹Image: Public domain. United States Food and Drug Administration.

DNA Amplification: Polymerase Chain Reaction (PCR)

Objective: Replicate the *rbcL* gene many times



- ▶ Many copies of *rbcL* gene

¹Image: Public domain

DNA Amplification: Polymerase Chain Reaction (PCR)

Objective: Replicate the *rbcL* gene many times



- ▶ Many copies of *rbcL* gene
- ▶ Denature DNA with heat

¹Image: Public domain

DNA Amplification: Polymerase Chain Reaction (PCR)

Objective: Replicate the *rbcL* gene many times



- ▶ Many copies of *rbcL* gene
- ▶ Denature DNA with heat
- ▶ Cool to anneal primers

¹Image: Public domain

DNA Amplification: Polymerase Chain Reaction (PCR)

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- ▶ Many copies of *rbcL* gene
- ▶ Denature DNA with heat
- ▶ Cool to anneal primers
- ▶ Extend each strand

¹Image: Public domain

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- ▶ Repeat many times

¹Image: Public domain

DNA Amplification: Polymerase Chain Reaction (PCR)

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- ▶ Repeat many times
- ▶ 1,000,000,000+ copies

¹Image: Public domain

DNA Amplification: Polymerase Chain Reaction (PCR)

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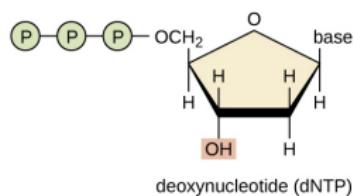
- ▶ Many copies of *rbcL* gene
- ▶ Denature DNA with heat
- ▶ Cool to anneal primers
- ▶ Extend each strand
- ▶ Repeat many times
- ▶ 1,000,000,000+ copies
- ▶ Check with gel electrophoresis

¹Image: Public domain

Sanger sequencing

Objective: Read the sequence of base pairs

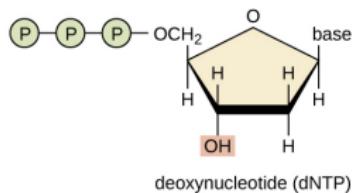
► PCR, but with some ddNTPs



Sanger sequencing

Objective: Read the sequence of base pairs

- ▶ PCR, but with some ddNTPs
- ▶ Different lengths of rbcL made

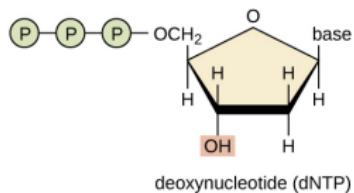


¹Image: CNX OpenStax. 2016. Creative Commons Attribution 4.0

Sanger sequencing

Objective: Read the sequence of base pairs

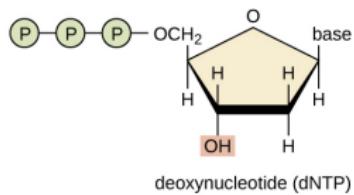
- ▶ PCR, but with some ddNTPs
- ▶ Different lengths of rbcL made
- ▶ Fluorescent labels on ddNTPs



Sanger sequencing

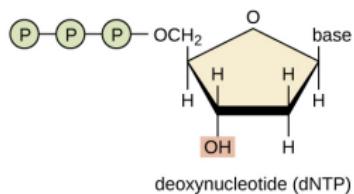
Objective: Read the sequence of base pairs

- ▶ PCR, but with some ddNTPs
- ▶ Different lengths of rbcL made
- ▶ Fluorescent labels on ddNTPs
- ▶ Fragments vary in speed



Sanger sequencing

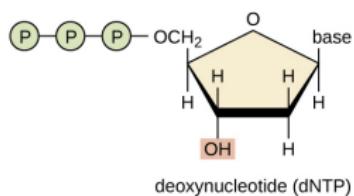
Objective: Read the sequence of base pairs



- ▶ PCR, but with some ddNTPs
- ▶ Different lengths of rbcL made
- ▶ Fluorescent labels on ddNTPs
- ▶ Fragments vary in speed
- ▶ Laser records fluorescence

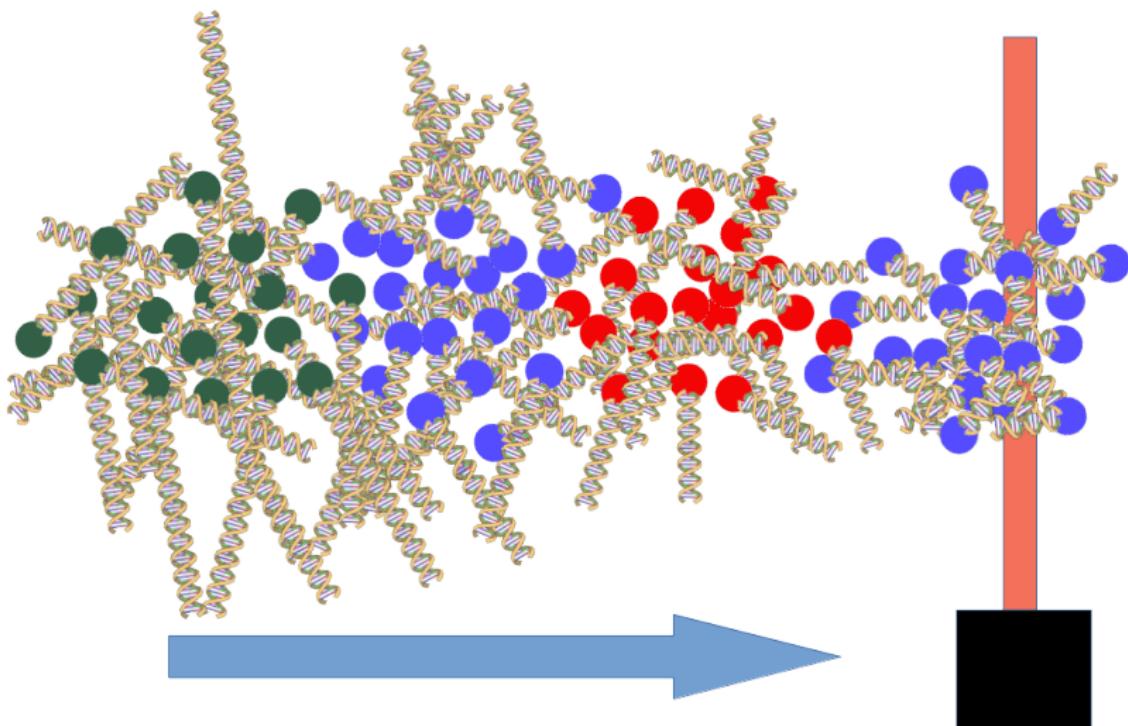
Sanger sequencing

Objective: Read the sequence of base pairs



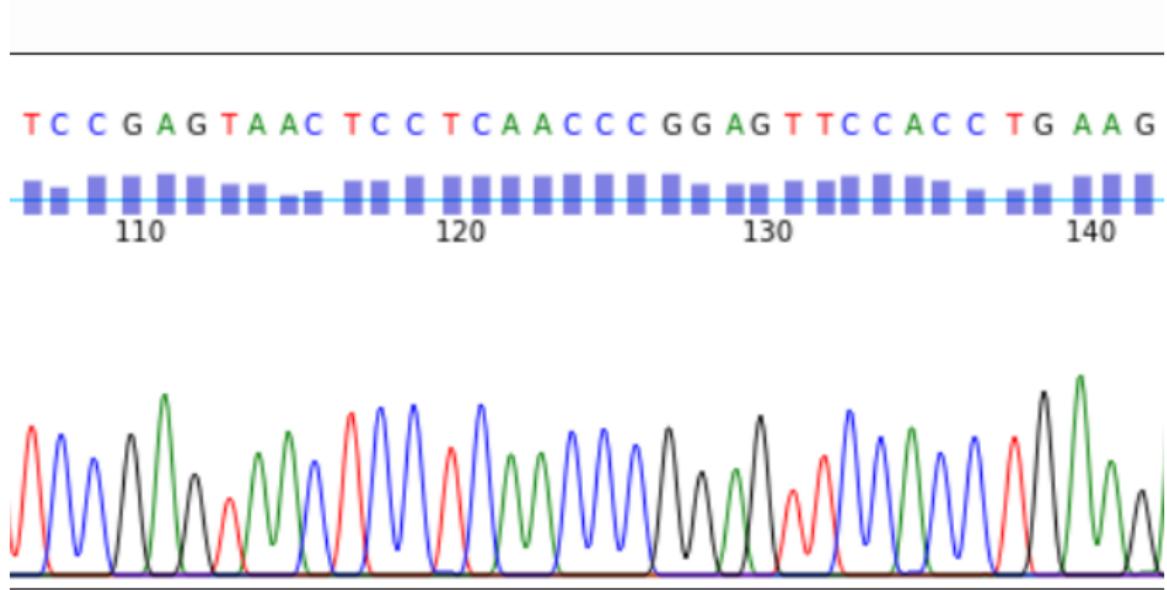
- ▶ PCR, but with some ddNTPs
- ▶ Different lengths of rbcL made
- ▶ Fluorescent labels on ddNTPs
- ▶ Fragments vary in speed
- ▶ Laser records fluorescence
- ▶ Colours for terminal ddNTPs

Sanger sequencing



¹Image: Public domain

Sanger sequencing



Week 10 DNA Subway

Objective: Read the sequence of base pairs

- ▶ Uploaded sequence data

Week 10 DNA Subway

Objective: Read the sequence of base pairs

- ▶ Uploaded sequence data
- ▶ Trimmed the sequences

Week 10 DNA Subway

Objective: Read the sequence of base pairs

- ▶ Uploaded sequence data
- ▶ Trimmed the sequences
- ▶ Compared sample sequences to online database sequences

Week 10 DNA Subway

Objective: Read the sequence of base pairs

- ▶ Uploaded sequence data
- ▶ Trimmed the sequences
- ▶ Compared sample sequences to online database sequences
- ▶ Found closest sequence match to sample

Week 10 DNA Subway

Objective: Read the sequence of base pairs

- ▶ Uploaded sequence data
- ▶ Trimmed the sequences
- ▶ Compared sample sequences to online database sequences
- ▶ Found closest sequence match to sample
- ▶ Included sequences of known plants

Week 10 DNA Subway

Objective: Read the sequence of base pairs

- ▶ Uploaded sequence data
- ▶ Trimmed the sequences
- ▶ Compared sample sequences to online database sequences
- ▶ Found closest sequence match to sample
- ▶ Included sequences of known plants
- ▶ Built phylogenetic tree of sample, match, and known plants

Phylogenetics Lab Report

- ▶ **Question 1:** Summarise obtaining DNA sequence
 - ▶ DNA extraction
 - ▶ DNA amplification
 - ▶ DNA sequencing

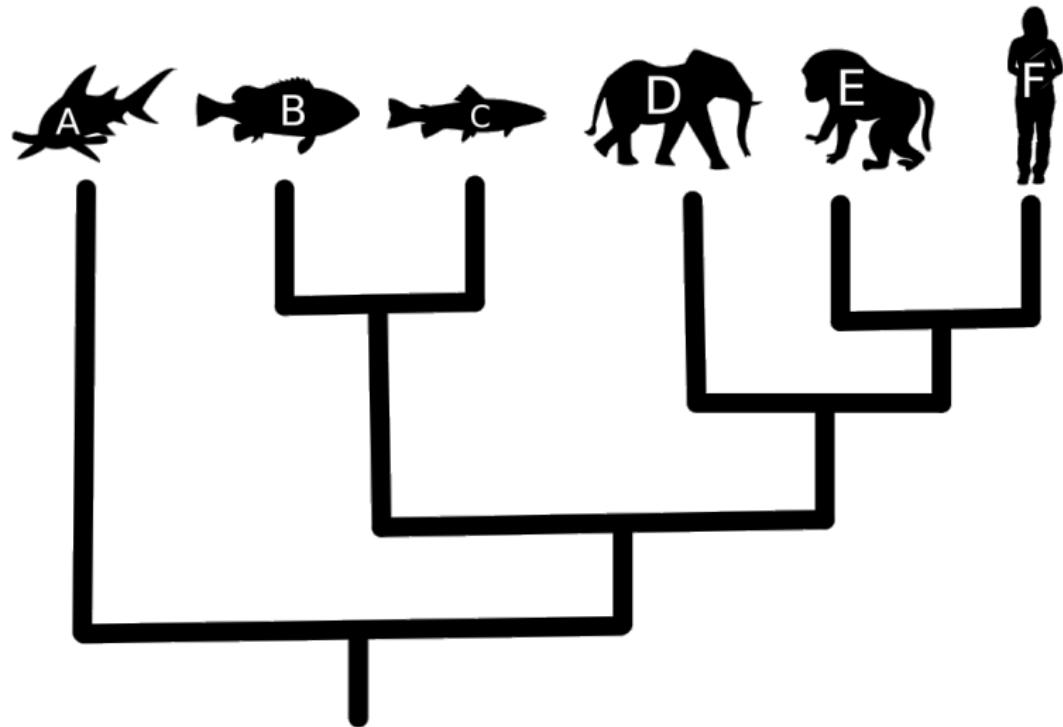
Phylogenetics Lab Report

- ▶ **Question 1:** Summarise obtaining DNA sequence
 - ▶ DNA extraction
 - ▶ DNA amplification
 - ▶ DNA sequencing
- ▶ **Question 2:** DNA barcoding
 - ▶ Summarise the sequence analysis process
 - ▶ Present DNA barcoding as a table

Phylogenetics Lab Report

- ▶ **Question 1:** Summarise obtaining DNA sequence
 - ▶ DNA extraction
 - ▶ DNA amplification
 - ▶ DNA sequencing
- ▶ **Question 2:** DNA barcoding
 - ▶ Summarise the sequence analysis process
 - ▶ Present DNA barcoding as a table
- ▶ **Question 3:** Phylogenetic trees
 - ▶ Present a clearly labelled ML tree

Phylogenetics Lab Report



Exam Questions

- ▶ Canvas Exams page
- ▶ 13 DEC 2023, 14:00-18:00
- ▶ Four questions total
- ▶ Choose *one* option per question
- ▶ Approximately 500 words

Rubric available on Canvas

- ▶ Aims and approaches (10%)
- ▶ Introduction (40%)
- ▶ Understanding & reasoned argument (50%)

Exam rubric: Aims and approaches (10%)

The aim is clearly stated in the introduction and sharply focused, making effective treatment possible within the word limit. A clear outline of the approach to be taken to achieve the aim has been provided. The aims and intentions have been elegantly stated and the choice of topic is novel and original.

Exam rubric: Introduction (40%)

The context of the question is elegantly demonstrated. The introduction clearly explains the significance of the topic and why it is worthy of investigation. There is excellent coverage of the literature.

Exam rubric: Understanding & reasoned argument (50%)

Excellent understanding of the concepts/studies. Conclusions entirely justified from the evidence presented.

Conclusions address and explain relevant ideas completely. The essay provides novel and creative synthesis of the topic. Conclusions are well-placed in a wider context beyond the remit of the essay. Details of the answer are completely correct. Extensive use of relevant references.

Questions