

# BIOU3GE: Review Session

(Please remind me to record if I forget)

20 November 2023

## Focus of review session

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

# Phylogenetics Lab Report

- ▶ Due: 24 NOV 2023 at 23:59 UK time

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- ▶ 25% of total grade

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- ▶ Follow Phylogenetics Labs 1 and 2

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- ▶ Turn in on Canvas Assignments

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- ▶ 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

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- ▶ Post questions in Discussion board

## Review of Phylogenetics Lab

### **Week 3: DNA extraction**

- ▶ Collected plant samples on campus

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### Week 3: DNA extraction

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

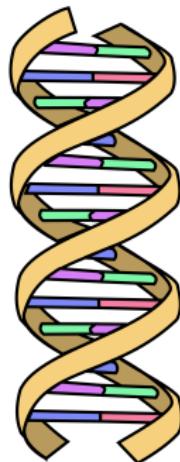
## Review of Phylogenetics Lab

### 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

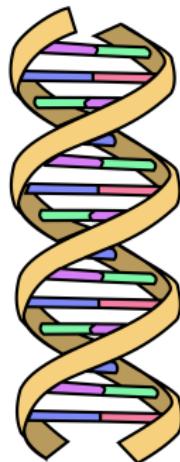
**Objective:** Get DNA from a plant leaf and remove everything else.



- ▶ Grind up the plant tissue

## Extracted plant DNA: Week 3 lab

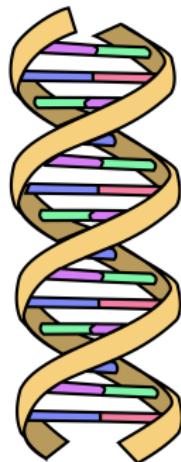
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- ▶ Grind up the plant tissue
- ▶ Lysis to digest proteins

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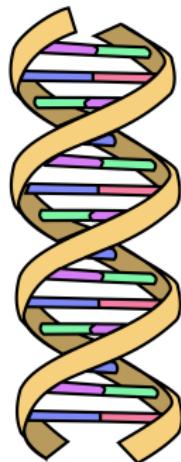
- ▶ Grind up the plant tissue
- ▶ Lysis to digest proteins
- ▶ Enzymes degrade RNA and other materials

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<sup>1</sup>Image: Public domain

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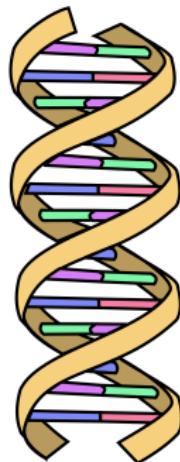
- ▶ Grind up the plant tissue
- ▶ Lysis to digest proteins
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- ▶ Separate as solid with centrifuge

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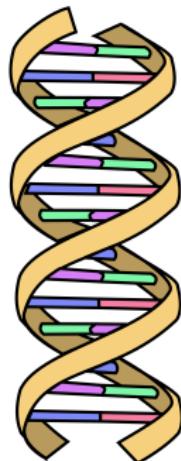
- ▶ Grind up the plant tissue
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- ▶ Enzymes degrade RNA and other materials
- ▶ Separate as solid with centrifuge
- ▶ Filter DNA out

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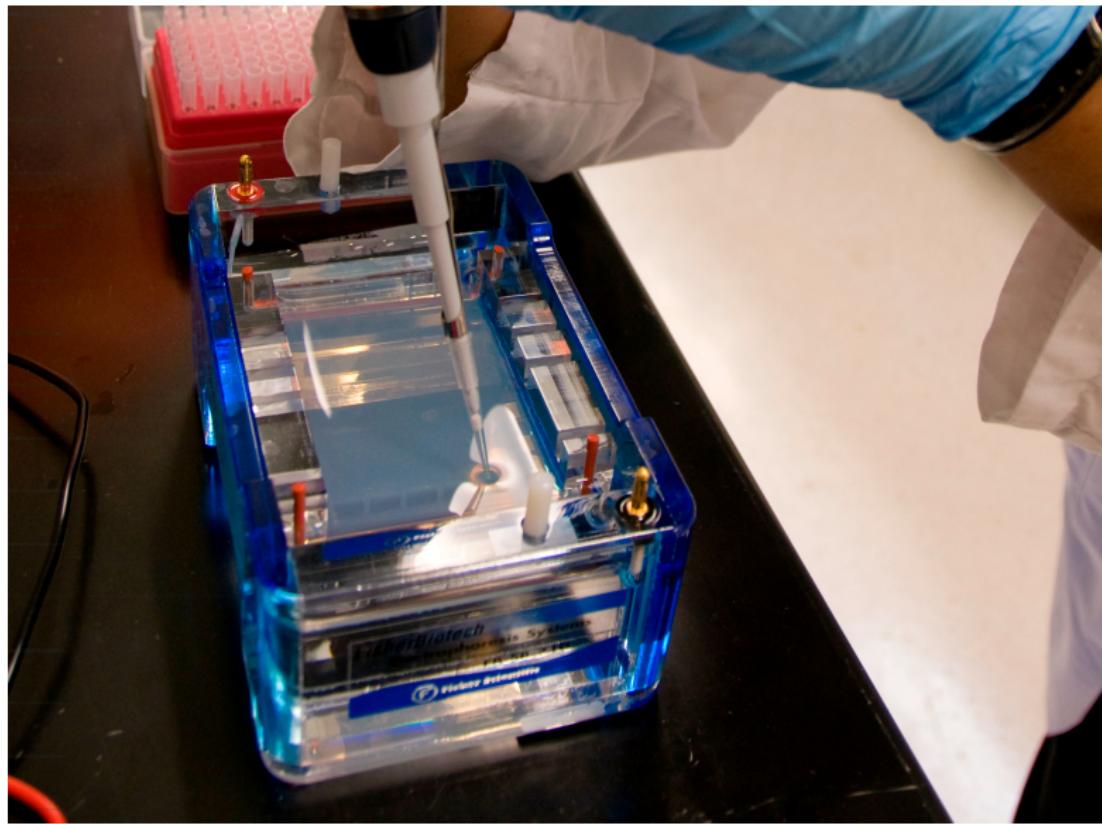


- ▶ Grind up the plant tissue
- ▶ Lysis to digest proteins
- ▶ Enzymes degrade RNA and other materials
- ▶ Separate as solid with centrifuge
- ▶ Filter DNA out
- ▶ Hold DNA in buffer

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<sup>1</sup>Image: Public domain

## Extracted plant DNA: Checking it worked



<sup>1</sup>**Image:** 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

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# DNA Amplification: Polymerase Chain Reaction (PCR)

**Objective:** Replicate the *rbcL* gene many times



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

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- ▶ Cool to anneal primers

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- ▶ Extend each strand

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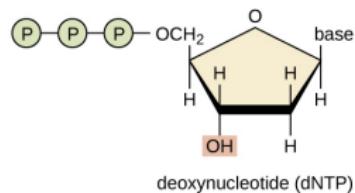
- ▶ Many copies of *rbcL* gene
- ▶ Denature DNA with heat
- ▶ Cool to anneal primers
- ▶ Extend each strand
- ▶ Repeat many times
- ▶ 1,000,000,000+ copies
- ▶ Check with gel electrophoresis

<sup>1</sup>Image: Public domain

# Sanger sequencing

**Objective:** Read the sequence of base pairs

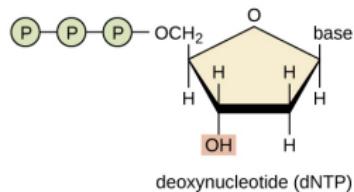
► PCR, but with some ddNTPs



# Sanger sequencing

**Objective:** Read the sequence of base pairs

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

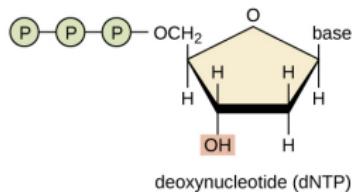


<sup>1</sup>Image: CNX OpenStax. 2016. Creative Commons Attribution 4.0

# Sanger sequencing

**Objective:** Read the sequence of base pairs

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

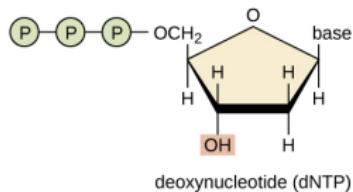


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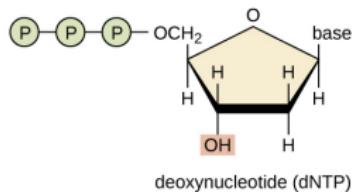
- ▶ PCR, but with some ddNTPs
- ▶ Different lengths of rbcL made
- ▶ Fluorescent labels on ddNTPs
- ▶ Fragments vary in speed



# Sanger sequencing

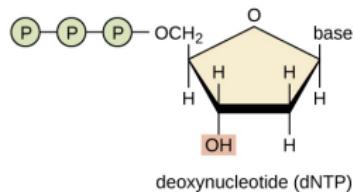
**Objective:** Read the sequence of base pairs

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



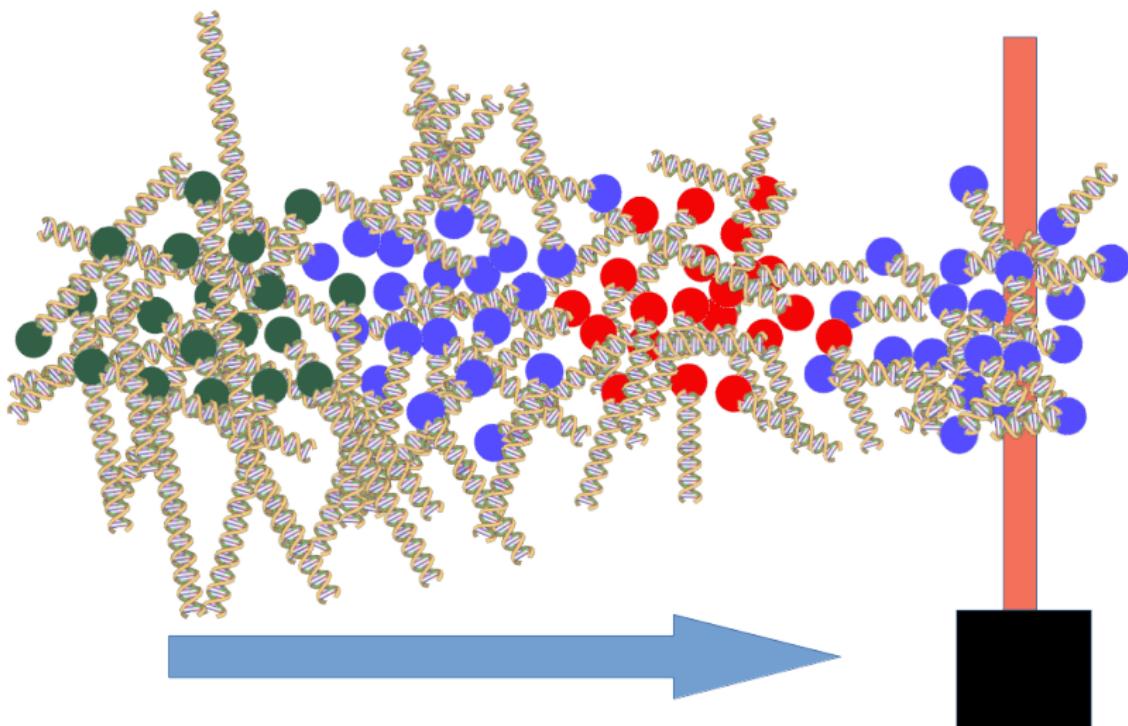
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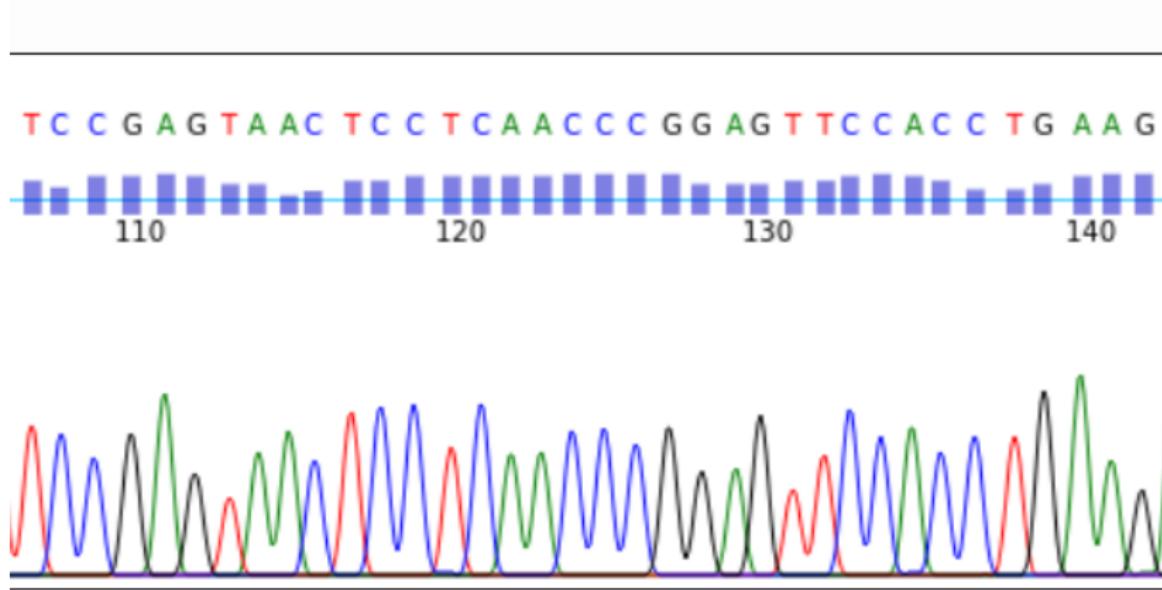
- ▶ PCR, but with some ddNTPs
- ▶ Different lengths of rbcL made
- ▶ Fluorescent labels on ddNTPs
- ▶ Fragments vary in speed
- ▶ Laser records fluorescence
- ▶ Colours for terminal ddNTPs

# Sanger sequencing



<sup>1</sup>Image: 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

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**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

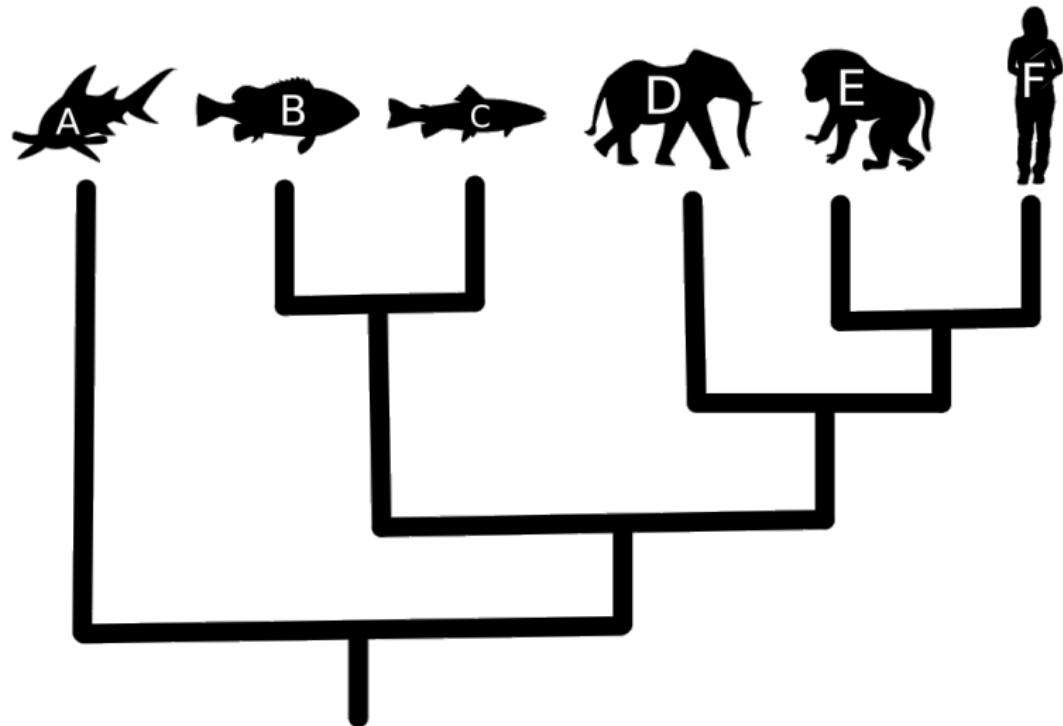
# Phylogenetics Lab Report

- ▶ **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
  - ▶ Compare against APM 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