

## 09 | Bioinformatics: family tree



### Aim

Explore evolutionary relationships between the invertebrates identified. Align multiple DNA sequences, use the number of differences to make a phylogenetic tree, then consider different ways of presenting phylogenetic trees, generating a 'Tree of Life' for the invertebrate samples.

### Activity outline

This is an **optional activity**. Where younger students are involved, you may wish to use this session to allow them to begin preparing their scientific posters and spend 2 lessons on the poster activity (session 10) instead.

Explain what a phylogenetic tree shows and how DNA sequence comparison allows phylogenetic relationships to be determined.

### Age range

Key stage 4 and above (14 years and older)

### Timing

15 min - explanation of a Tree of life (phylogenetic tree)

10 min - sharing of DNA barcode sequences

15 min - alignment of multiple sequences

20 min - making, displaying and sharing phylogenetic trees

### Venue

Classroom with laptops or a computer room

### Resources

- Access to all student's sequence in FASTA format
- Instructions for making multiple sequence alignments and creating a phylogenetic tree (with **additional online guide**)
- **Presentation:** 09\_P\_Bioinformatics-family-tree

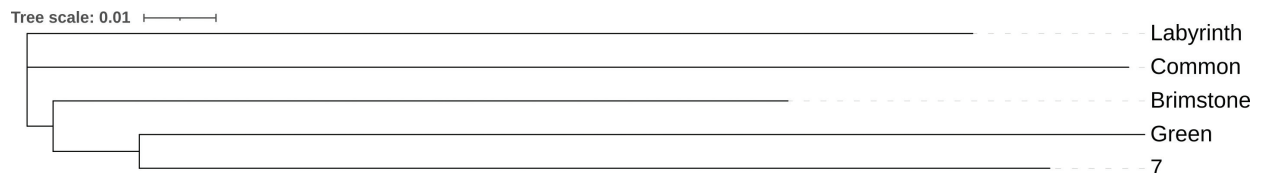
## Preparation

For each pair who have sent off DNA sequencing there should be a chromatogram and a sequence file returned. If you wish to speed up the construction of a phylogenetic tree you could combine the sequence files in FASTA format prior to the session and make this available for students to use.

## Answers to questions

### A. Which barcodes (and therefore organisms) are most closely related from this phylogenetic tree?

If using the 5 sequences from the **09\_R\_Known-barcodes** file, you should see a phylogenetic tree that looks like this:



On this phylogenetic tree the green peach aphid and 7-spot ladybird are most closely related, then the Brimstone butterfly. The labyrinth spider and common woodlouse are less closely related to the other invertebrates.

### B. Look at the organisms most closely related – does this make sense with your knowledge of the invertebrates sampled?

Student answers will vary depending on the range of invertebrates sampled. Try to encourage them to link physical appearance to DNA similarities shown in the phylogenetic tree.

Certainly the spider and woodlouse have different numbers of legs to the butterfly, aphid and ladybird, so the fact that they are less related is not surprising. The ladybird and aphid both have a rounded body shape with head, thorax and abdomen and each has 6 legs, so the fact that they are most related is also believable.

### C. How could you make the phylogenetic tree more accurate?

To make the phylogenetic tree more accurate, a longer DNA sequence should be used. This will give greater ability to examine similarity at the genetic (or even genomic) level between species.