Our Animal DNA:
Comparing genes across the Tree of Life

Practical 1: find a protein sequence and run BLAST

Suggested answers to questions:

Based on what you've done in the practical so far, consider:

1. Why do you think the proteins in sea otter, black swan and Atlantic cod have long codes instead of names?

There is limited information about these genes and names have not been assigned yet.

2. The human protein is more similar to the sea otter protein than it is to the black swan and the Atlantic cod proteins. Why is this?

More closely related species

Based on what you've learned about the human protein:

3. Knowing *KRT71*'s involvement in hair follicles, now why do you think the fish and bird genes are so different?

Birds have feathers and fish have scales, not hair.

4. Orthologues are genes that started out the same and diverged over time between species. Would you class these genes as orthologues?

Yes, they are still similar. They may have evolved to produce similar proteins in feathers and scales.

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Practical 2: align sequences with Clustal

Suggested answers to questions:

1. Could you do this without a computer? How long do you think it would take to align all these sequences and spot similarities and differences between them by hand?

2. What if you had to do this for all 20,000 protein coding genes in a species?

These are discussion points that students can discuss in class. Whilst there is no definitive answer, students should identify the advantages in using a computer programme to do this rather than doing it by hand.

3. Can you find any sections in the alignment with long runs of matching sequence? What is the longest you can find?

The longest sequence is 19 amino acids LNNKFASFIDKVRFLEQQN on the third line

4. Look at position 5 in the alignment. What amino acids can you see there? Why have these been coloured differently? This is a great chart to look at for amino acids: https://www.compoundchem.com/2014/09/16/aminoacids/

S (Serine) and F (Phenylalanine). These are chemically different, hydroxylic vs aromatic.

5. Why do you think that some parts of the protein have lots of similarity between species, and other parts do not?

Similar regions are very functionally important. Other parts may be linker regions or regions that allow the protein to carry out different functions in other species.

6. Which sequences are most similar to each other?

Human and sea otter

7. Why do you think this is?

Both are mammals and both have hair. Cod and swan have scales and feathers respectively, which would mean the protein is probably doing something very different.