Phylogenetics Exercise
BIOL01104, Fall 2018
Instructor: Dr. Spielman

QUESTION 1

Using the table that follows, do the following:

- Treat the lancelet as the outgroup.
- Draw all of the possible trees depicting the possible relationships among these taxa.
- Map the characters onto each tree.
- Determine which trees fit the data best by calculating the tree length, i.e. total number of evolutionary changes on the tree.

Taxon	Jaws	Vertebrae	Paired Fins	Pouched Gills	Skull
Lancelet	Absent	Absent	Absent	Absent	Absent
Hagfish	Absent	Absent	Absent	Present	Present
Lamprey	Absent	Present	Absent	Present	Present
Shark	Present	Present	Present	Absent	Present
Goldfish	Present	Present	Present	Absent	Present

Some studies have suggested that hagfish and lampreys are more closely related to each other than to other vertebrates. Is this clade supported by these data?

If it were supported, what would it imply regarding the evolution of vertebrae?

Recent embryological studies have demonstrated that vestigial vertebrae are present in hagfish embryos. If we score hagfish as having vertebrae, how does that change your results?

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QUESTION 2

Using the table that follows, do the following:

- Treat the shark as the outgroup.
- Draw all of the possible trees depicting the possible relationships among these taxa.
- Map the characters onto each tree.
- Determine which trees fit the data best by calculating the tree length, i.e. total number of evolutionary changes on the tree.

Taxon	True Bone	Internal Nostrils	Limbs	Waterproof Skin
Shark	Absent	Absent	Absent	Absent
Lungfish	Present	Present	Absent	Absent
Salamander	Present	Present	Present	Absent
Lizard	Present	Present	Present	Present
Dog	Present	Present	Present	Present

The following two characters relate to the evolution of breathing mechanisms in vertebrates. Map them onto your most parsimonious phylogeny. Based on your results, where did the important changes in breathing mechanisms evolve?

Taxon	Inhalation	Exhalation
Shark	Absent	Absent
Lungfish	Buccal Pump	Passive
Salamander	Buccal Pump	Abdominal Muscles
Lizard	Aspiration	Abdominal Muscles
Dog	Aspiration	Abdominal Muscles