

## Part 1.

- 1,2. Species 1: 1, 8, 11, 20, 21
- Species 2: 9, 10, 16, 19, 22, 25
- Species 3: 2, 5, 6, 12, 18, 24,
- Species 4: 3, 4, 7, 13, 14, 17, 23

Species 1 Characteristics: Large diameter, with the average of 57.2, with prevalent ridges. There is typically a large U/D ratio and a small W/D ratio.

Species 2: Moderate to large diameter with very small frequent ridges. Moderate U/D ratio and a W/D ratio that is around .227.

Species 3: The smallest diameter species. Shell is smooth and has an overhanging edge. A relatively large U/D around .37. This species has a moderate W/D ratio.

Species 4: This species has a moderate diameter about 31.5. The shell is smooth, without ridges. The species typically has a high U/D and a low W/D ratio.

3. To me, it seemed that there was not a large amount of ontogenetic change. The biggest contributor to ontogenetic change seems to be size. In the species, this can be contributed to both development and to gender of the species. This is due to the fact that the species do not show other dramatic signs of ontogenetic change in morphology or statistically. However, there is a some variation in the size of species.

4. As stated previously, there does seem to be signs of sexual dimorphism. This can be seen primarily in the size of the species. For example, it is largely reflected in Species 1, where there is a large disparity between the size of individuals. Originally, I thought that the this was because there was two different species, but when I looked closer, the two prospective species were extremely similar, except for a large divide in size. I attributed this difference in size to the two different genders. This difference in size, while most dramatically displayed in species 1 is present in the other species as well. Statistically, we saw this displayed because the distributions of diameter were not a typical normal curve, but typically bimodal.

## Part 2

- 1. Land, Links, Species, Site, Outline
- 2. Land: numeric, Links: numeric, Species: character, Site: character, Outline: numeric
- 3. (12, 2, 40)
- 4. The "land" object. This has the dimensions of (25, 5, 44)
- 5. `ProcrustesHummingbirds<-gpagen(hummingbirds[["land"]])`
- 6. `>plotTangentSpace(ProcrustesHummingbirds[["coords"]],warpgrids=FALSE,verbose=FALSE)`
- 7. According to the PCA, it appears that there is only one species of the hummingbirds due to the fact that there are no distinct clusters in the plot. This could also be explained by multiple species having a similar morphological characteristics.

### Part 3

1. Fangs longer than 6 inches
2. Sulfurous odor
3. Adorable Eyelashes
4. C, D, E
5. Species E has a laser death ray, while species D does not.
6. They are a synapomorphy because they are shared by both A and B.
7. 1: Monophyletic   2: Polyphyletic   3: Monophyletic
8. This is not advisable. This is not the simplest form of the tree because it requires more evolutions to take place for the family to exist.
9. 1: Polyphyletic  
2: Monophyletic  
3: Paraphyletic  
4: Monophyletic  
5: Polyphyletic

### Part 4

1. Paedomorphosis.
2. *Gryphaea gigantea*.
3. Peramorphosis.