**Activity 15: Project Framework**

**Purpose of this assignment:** The goal of this assignment is to help you develop the structure for your research project.

**How does it fit within the entire project?** The key to a successful research project lies in part in a well-structured study with a clear question, hypotheses, and data collection plan. These guide the project throughout its entirety, determine the scope and focus of the work, and serve as reminders of the intent of the research all the way to its completion.

**Tasks required:** Complete the activity below.

**Deliverable:** Upload of agenda on discussion board of [LMS] by [deadline].

**Estimated time:** about 1 hour

**Group work or individual work?** Combined individual and group work – use the discussion board

**Notes to instructor:**

* In an effort to guide students, they are provided below with examples from a published paper. The publication chosen as a reference should be:
	+ Recently published
	+ Relevant to the topic of the CURE
	+ If appropriate be authored or co-authored by an instructor of the course to enable (1) a personal connection with the research of students and (2) students to see their instructor as experts they can turn to. Consider featuring peer-assistants, graduate student instructors, or postdoctoral researchers involved in the course if relevant and possible.
* Similarly, the selection of articles presented as examples for the selection of titles should be selected carefully, although the direct relevance to the CURE is not as necessary.

**Step-by-step:**

1. Identify a title for your paper. This does not have to be the final title of your manuscript. Rather, you should think of it as a guiding thread. There are many different ways to phrase a title. Below are a few examples from my own research:
* A narrow topic and the more general issue it relates to are mentioned together: [A new species of *Ceratogaulus* from Nebraska and the evolution of nasal horns in Mylagaulidae (Mammalia, Rodentia, Aplodontioidea) – Calede and Samuels 2020]
* The title is a simple statement of the topic of research: [Locomotory adaptations in entoptychine gophers (Rodentia: Geomyidae) and the mosaic evolution of fossoriality – Calede et al. 2019]
* The title gives away the main finding: [Geometric morphometric analyses of worn cheek teeth help identify extant and extinct gophers (Rodentia: Geomyidae) – Calede and Glusman 2017]
* A colon enables the specific scope or focus of the paper to be mentioned: [Skeletal morphology of *Palaeocastor peninsulatus* (Rodentia, Castoridae) from the Fort Logan Formation of Montana (Early Arikareean): ontogenetic and paleoecological interpretations – Calede 2014]

Your title should be different from the project topic I gave you.

1. Go back to your mind mapping activity as well as the notes from your framework meeting. What are the questions you are investigating in your project? Remember that a question ends with a question mark.

[For example, in the Calede and Samuels (2020) paper mentioned above and available on the shared box folder, the question we addressed was: “What was the pattern and process of the evolution of horns in mylagaulids?”]

1. Explicitly articulate the hypothesis or hypotheses you will be testing. A hypothesis is an affirmative or negative statement that can be tested. A hypothesis proposes a specific pattern, relationship, or explanation for a phenomenon. A hypothesis is not a theory. In research, a theory is a general explanation backed up by lots of data (e.g., the theory of evolution). A hypothesis may be a small-scale observation that is yet to be tested. Do you have a null hypothesis and an alternative hypothesis?

[For example, in the Calede and Samuels (2020) paper, the hypothesis was: “Mylagaulid horns were linked to defense and could have been subject to natural selection driven by their effectiveness in increasing survival”]

1. What data support your hypothesis / lead you to state your hypothesis as such? Reference the papers from the literature you have read as necessary. In other words, what is the context from the published literature for your hypothesis? Are you trying to test a long-standing assumption? Are you trying to test a pattern supported in one taxon in another? …?

[For example, in the Calede and Samuels (2020) paper, we base our hypothesis on body mass and locomotion data on rodents and horn data from lizards (and other more minor lines of evidence).]

1. What variables will you be analyzing? How will you treat your data (use of averages, use of subset of data, data normalization, etc.), what summary statistics you will be calculating (mean, median, centroid, standard deviation …), and any other variable you will include in your analyses (mention all control variables, explanatory variables, response variables).

[For example, in the Calede and Samuels (2020) paper, we used data on horn height in relation to body mass, data on body mass evolution, and data on the pattern of evolution of horns in mylagaulids. We log-transformed linear measurements and use phylogenetic comparative methods to account for the role of evolutionary history. The data are all based on adult unbroken fossils (no sex data) at the species level (means).]

1. What are the predictions you make for your variables if your hypothesis is supported? What about if it is not?

[For example, in the Calede and Samuels (2020) paper, we predicted (among other things) that we should see jumps in body size when horns evolved if the two are in fact associated. We also predicted that the horns should scale with positive allometry if they are indeed associated with defense.]