**Week 4**: Evolution and Osteology

**Activity**: Identify your skull

**Discussion**: Evolution and Osteology

1. Review of CLAP
2. Intro To Physical/Biological Anthropology
   1. What is Physical Anthropology?
      1. Physical Anthropology is the study of the biology and behavior of humans and human relatives and how they evolved.
3. Evolution
   1. Evolution is descent with modification
4. Evolutionary forces
   1. Mutation
   2. Natural selection
   3. Gene flow
   4. Genetic drift
5. Osteology
   1. A way to “see” evolution in humans and primates
6. Primate evolution
   1. Not unidirectional, not all leading to humans
7. Human evolutionary traits on the skull
   1. Foramen magnum
   2. Teeth size
   3. Face angle
   4. Sagittal crest
   5. Chin
8. Review Questions

**Independent practice**: Identify your skull

* Kids will identify their skull’s place on the primate family tree
  + Go through each human evolutionary trait on the skull with the worksheet
* Questions we want the kids to answer in group:
  + What is culture?
  + What are some types of language?
  + What is evolution?
  + What are some recent human traits?

**Activity Supplies:**

* Skull casts
* Worksheets

**Review**:

* What is anthropology?
* What are some types of language?
* What do archaeologists do?
* What is evolution?
* What are some human adaptations?

**Worksheet :** Field notes

* Each of the evolutionary traits, kids can check off each one
* Picture of the human phylogeny where kids can mark where their skull falls

**Script**:

Hello, I am Ms. Julia, and welcome back to anthropology.

Does everybody remember CLAP? What does it stand for again? Let’s clap it out. So what do you think we will be studying this week?

Physical anthropology is also called biological anthropology. Do you know what biological anthropologists do? They study the biology and behavior of humans and their close relatives. They also study how these characteristics evolved.

Does anyone know what evolution is? In simplest terms, it is descent with modification, or change over time in organisms in response to their environment. Do you remember in the first week when we made family trees for our familias? Well this is like a family tree for every living thing on earth. Pretty cool right?

We just have a few definitions to go through before we move on. A trait is any characteristic of an organism. For example, one that is very visible for us is hair and eye color, but another could be, say, the size of your blood vessels. Natural selection acts on the traits of an organism, and those traits that help an organism survive are called adaptations. Some examples of adaptations are the color changing ability of chameleons and the blubber of monk seals, which keeps them warm in the cool water.

We’re going to break evolution down to its simplest parts and talk about the four main forces of evolution, or factors that can change populations over time. The first is mutation, which is just a change in DNA. It is the original source of all differences in every organism. Mutations can be good, bad or neutral.

The second is natural selection. Has anyone heard of this before? Well natural selection is the idea that organisms that are better adapted to their environments can live longer and survive to pass their traits on to the next generation, which will increase the abundance of those traits. For example, take the peppered moths. Usually, the trees are white, so the white moths will blend in and the black ones will stick out, causing them to be eaten because birds can see them easier. And therefore the black wing color trait will decrease in the population. However, if there is a fire that turns the trees black, then the black moths will blend in and what will happen to the white moths? Right, they’ll get eaten.

Next is gene flow. Gene flow is just the movement of individual organisms from one population to another. This increases the amount of traits in the populations. Say this beetle is bringing new traits into the other population, like brown color. When it moves to the other population, it increases the traits in the second polutiation.

The fourth evolutionary force is genetic drift. This is the idea that with a limited number of individuals the composition of a population and the traits present will randomly change because of random sampling. If you have twenty marbles in a jar, 10 red and 10 blue, and you randomly pick out 10, do you think those will always be 5 red and 5 blue, same as the original jar? No, because that would be unlikely.

Evolution is a bit difficult to see, as it usually acts on such a large time scale, but we can see evidence of evolution in things like bones and fossils. As anthropologists, we tend to study the skeletons of humans, their close ancestors, and closely related species, like primates

The evolution of humans is typically shown like this. But this is an incorrect picture. First, evolution isn’t a straight line, all leading to humans. Evolution is unpredictable, as you can probably tell based on all the different ways that evolution works.

A more accurate picture of the evolution of humans would look like this. The gorilla and chimpanzee have been evolving just as long as humans have, and Gorillas are really good at what they do, and we are really good at what we do. And we all have a common ancestor, back here. We can tell that we are all related because all primates have opposable thumbs, hair, and eyes that face forward. This is a bonobo, a close relative to chimpanzees. This is a human, or Homo sapiens. And these two are reconstructions of extinct human ancestors based on fossil evidence. This one is called Australopithecus afarensis. Afarensis lived around 3.5 million years ago, probably in the woodlands of Africa. They represent a transitional fossil between gorilla-like ancestors and humans. They are a little closer to the common ancestor than they are to humans, as you can see on the family tree. They did walk on two legs, though, and stood about 4.3 feet tall. Have any of you heard of Lucy before? Well, Lucy was one of the earliest and most complete afarensis skeletons found, and she is what this reproduction is based on.

This one is called Homo erectus. Homo erectus lived from 1.8 million to 400 thousand years ago, and was the first human ancestor to expand out of Africa.They were found in Europe, Africa, and Asia. They also represent a transitional fossil, but one closer to modern humans, and they were about as tall as modern humans as well.

These are two of many extinct lineages.

So now we will go over a few osteological, or bone characteristics that can help us identify evolution in humans and human relatives and ancestors.

Foramen magnum literally means big hole. It is the hole at the bottom of the skull where your spine attaches. In humans it is towards the center of the skull so that we can walk upright on two legs, which is called bipedal locomotion. Gorillas on the other hand walk on four legs, so their foramen magnum is located towards the back of their skull so that they can walk like this. They actually walk on their knuckles, which is known as knuckle walking, as you can see here. You’ll hear more about that in the primates lesson.

Another trait is the size of the teeth. Gorillas have very large teeth so that they can chew the tough plant fibers that make up their diet. Humans, on the other hand, could process their food so large teeth were less helpful. We can use our hands to break up our food, and we can also cook food to make it more tender and easier to eat.

A third trait is the absence of a sagittal crest. A sagittal crest is a ridge on the top of the skull that serves as a muscle attachment for jaw muscles. Like we talked about, Gorillas eat really tough food, so their jaw muscles are very strong, and they therefore need a large muscle attachment. Humans on the other hand, don’t need quite so strong jaw muscles because we can process food, so humans don’t have a sagittal crest.

Next is the angle of the face. Gorillas have a very angled face because they have such a large jaw. Humans, on the other hand, have a flat face. This resulted from the rearrangement of the different parts of the skull.

One last trait is the presence of a chin. Humans have chins because, like with the face angle, with the rearrangement of many of the skull parts, the development of the chin just came along with them. As you can see, Gorillas don’t have chins

For our activity this week, each of our familias have found a skull while they were excavating.

Each group has to determine the relative identity of the skull by going through each of the traits we just went over and placing it on the primate family tree