Laboratory Procedures for Primate Osteometrics

- Read these materials BEFORE laboratory day and meet with the instructor PRIOR to laboratory if you need clarifications.
- There is rarely time on laboratory day for any detailed conversations; therefore, you are expected to prepare for laboratory and not just “show up”
- This lab is packed with work; I am going to urge you to work in teams of 2 people, but to share your work with the rest of the class.
  - Coordinate the work so that duplication is avoided.
  - Post your results at the front of the room as soon as you have data; others are depending on your results.

Scenario

A fire in the primate building of the Philadelphia Zoo during the early morning hours of December 24, 1995 killed 23 animals, including a family group of six lowland gorillas, a family group of three orangutans, four white-handed gibbons, and ten lemurs (2 ruffed, 6 ringtail, and 2 mongooses) (see Appendix A).

You were hired to help identify the cranial remains of these fire victims and to preserve them. The plan is to send them to Skulls Unlimited, Inc. to be replicated. You have taken on this project, knowing that a portion of the proceeds will be used by the Zoo to help offset the costs of a new Primate House. Further, a teaching library of primate skulls is not commonly available except to the major universities. You recognize this project would provide replicas of several primates that could be made available to the many universities and colleges that do not have a primate reference library.

Usually trained graduate students are available, but it is Christmas break. You need help with this work and are short-handed. Luckily, you have identified a group of interested undergraduate students who are willing to volunteer for this project (for extra credit, of course).

You decide to develop a ‘cheat sheet’ wherein you put the most obvious skull/dental traits. This cheat sheet can then be used as a starting point for identification of the deceased primate remains. You have at your disposal an impressive reference library of primate skulls, primate and non-primate teeth, and dental casting equipment. It is here that you start your training of the undergraduate volunteers.

Equipment

1) A collection of primate skulls, and other comparative skull and teeth specimens.
2) Specimen pad protectors
3) Nine (9) tooth and mandible replicas
4) Calipers
5) Rulers (optional)
6) Magnifying glasses (limited availability)
7) Drawings of dentition and other osteological traits
8) Set of dental casts (based on sex).
Part 1: Animal Bites Identification

A set of eight (8) jaw fragments and a single tooth are provided (n = 9). They group into three dietary categories: herbivore, carnivore, and omnivore.

Special Note: If data is not available make as MD (missing data).

- As a first step into the identification of teeth, it is important to recognize the 3 categories (carnivores, herbivores, and omnivores). Read about these species in Appendices B and C.
- Use Appendix C to organize the casts before you begin your inspection.
- If you are the first to use these casts, leave the casts organized to save time for subsequent teams.
- Then, complete Table 1 by using a visual examination of the specimens as a guide to your description of teeth shape.
- Then complete the 3 questions associated with this exercise.

Part 2A: Skull Selection from the Library of Primate Skulls (Handout Data)

Each undergraduate student team will begin by selecting a representative of each primate listed in Table 2. A set of photographs for each primate skull has been prepared and are available from your professor.

- When you determine the genus and/or species of the primates you are using for this exercise, fill in the following blanks. If you can identify the common name include this information in Table 2.
- Use the same primates for all data in Part 2B.
- I urge you to divide the workload between members of your lab group, each person concentrating on collecting the data for a specific primate and then pooling your efforts.
- If you can’t identify the scientific name of your specimen, use the computer at the front of the room and go to this website: http://www.skullsunlimited.com

Part 2B: Primate Skull Comparisons (This will not be quantitative data, but descriptive).

Table 3A

1. Compare the front of the skull of your primates. To what degree is there facial **prognathism**? Determine this by using the Alveolar Index.
   - Alveolar Index = (Basion-Prosthion length/Nasion-Basion length) x 100.
   - Labeled as follows: Orthognathic = 97.9 & under (straight faced); Mesognathic = 98 - 103 (medium faced); and Prognathic = 103+ (jutting face)

   M  **Basion**  Midpoint of the anterior margin of the foramen magnum.

   D  **Prosthion**  On the maxilla, the most anterior point between the upper central incisors. (Do not confuse with the alveolare).

   F  **Nasion**  The point where the frontal bones and the two nasal bones join.

2. Are there **brow ridges**? Ranges from “absent”, to “slight” to “moderate”, to “pronounced”. **In your notes define these terms.**
Table 3B

1. Consider the top of the skull. Is there a sagittal crest? Ranges from “absent”, to “slight” to “moderate”, to “pronounced”. In your notes define these terms.

2. Do you find post-orbital constriction?
   • Post-orbital constriction = Minimum facial breath/Upper facial breadth.
   • Labeled as follows: Pronounced (<0.6); Moderate (0.6-0.7), Slight (0.7-0.8), Very Slight (>0.8).

Part 3A: Observation of Dental Traits from Permacasts (Male and Female)

There is an extensive selection of dental permacasts available to you. Each species represented has an example of both the male and female. When possible, use the same species as used in Part 2. Compare the permacasts to note both differences between species and by sex within species.

- When you determine the genus and/or species of the primates you are using for this exercise, fill in the following blanks. If you can identify the common name include this information in Table 4.
- Use the same primate for all data in Part 3B, whenever possible.

Part 3B: Primate Dental Comparisons (This will not be quantitative data, but descriptive).

1. Is there a toothcomb present? Compare the permacasts for evidence of sexual dimorphism in the teeth. Look at size, shape and any other indicators that are evident. Degree of sexual dimorphism (ranges from slight to moderate, to pronounced). Record your data in Table 4A.

2. The form of the dental arcade: parallel or parabolic? It there a diastema? If yes, where is it located and what function might it serve. Record your data in Table 4B.

3. For each entry in Sketch 1, first indicate the dental formula. Then, draw a typical lower molar of the male. Use dots for cusps and lines for grooves (see Appendix C for a general discussion of tooth morphology).

Part 4: Comparing Human Dental Casts

Arrange the set of human dental casts from smallest to largest. Answer the 3 questions associated with this exercise.
Measurements

1. Width of cranium- Use the bow calipers and measure the widest portion of the cranium (ear to ear).
2. Length of cranium- Use bow calipers to measure from anterior to posterior of cranium. Place one end of the calipers on the most forward portion of the forehead and the other end of the calipers on the most posterior point of the skull. Make sure you are measuring the cranium. The brow ridge or the sagittal crest should not be used in taking measurements.
3. Maximum height- Measure from superior to inferior portion (foramen magnum) of the cranium. Place the bow calipers on the midpoint of the anterior of the foramen magnum and the other end of the calipers nearest the midline of the coronal and sagittal sutures on the top of the cranium. Make sure that you are measuring the cranium. Avoid the sagittal crest if present.
4. Determine cranial module- This provides a rough numerical value for the size of the cranium. Add the cranial height, width and length and divide by 3.
5. Post orbital constriction- Using the bow caliper measure across the cranium from behind the eye orbits on each side.
6. Angle of forehead- Place a protractor flat against the eye. Determine the angle of forehead by aligning a ruler so that it is parallel with the forehead. Place the ruler against the protractor to determine the angle of the forehead.
7. Facial angle- Place protractor along the jaw line and align a ruler so it is parallel with the face and record the angle.
8. Determine the angle and location of the foramen magnum. Place the protractor on the foramen magnum using a straight edge perpendicular to the foramen magnum to determine the angle.
9. Supraorbital browridge- Determine if it is present and if so determine if it is small, medium or large.
10. Facial prognathism- Measure the angle of the facial prognathism by placing a protractor onto the eye opening. Align a ruler parallel to a line from the front of the teeth of top jaw to the eye.
11. Shape of chin- Does the chin angle in or out.
12. Dental arcade- Is the jaw U or V shaped. U-shaped jaws are distinguished by the molars and premolars being parallel on each side of the jaw.
13. Dental formula- Count the teeth on half of a jaw. Determine the number of incisors, canines, premolars and molars.
15. Canine diastema- Measure the gap between the upper canines and the incisors using the vernier calipers.
16. Upper Canine- Measure the length of the exposed upper canines using vernier calipers.
17. Lower Canine- Measure the length of the lower canine using vernier calipers.