**Instructor’s Manual**

Lab 1 Biological Anthropology and the Scientific Method

**Answers to Lab 1 Concept Review Questions**

1. **Context and comparison** are the two fundamental ideas used in anthropology.

2. **D. Cultural anthropology** studies the practices, beliefs, economics, politics, and gender roles of living people.

3. **C. Biological anthropology** uses a wide range of data about living and past organisms to study human evolution.

4. **B. Paleoanthropology** uses the fossil record to examine the anatomy and behavior of our relatives in the past.

5. **A. Forensic anthropology** applies methods of skeletal analysis to study humans in a legal context.

6. **D. Interpretation** is the stage of the scientific method at which the hypothesis evaluated.

7. **The hypothesis is a testable explanation of observations. In contrast, a scientific theory is an explanation that has already been repeatedly tested.**

8. **No, they are not absolute truths. Scientific theories are always open for refinement and rejection as new data become available.**

9. **No, they are not guesses. Scientific theories are supported by substantial, widely accepted evidence.**

10. **The biocultural approach is an approach that recognizes that human biology and culture are closely intertwined and need to be examined and understood simultaneously.**

**Answers to Lab 1 Exercises**

Exercise 1: Fields of Anthropology Scenarios (30 to 40 minutes)

*This exercise uses real examples to foster students’ ability to compare the four fields of anthropology (cultural anthropology, linguistic anthropology, archaeology, and biological anthropology) and identify the broader significance of anthropological research. Students are asked to read the scenarios and discuss the questions that follow.*

*Note: The answers provided may not be the only possible answers. They are given as a representation of the types of comments that may arise in the discussion.*

Scenario A: Soybean consumption research

1. What is the primary field of anthropology addressed in this research? **Cultural anthropology**

2. Are there any other fields of anthropology addressed in this research?   
**Diet may be relevant to aspects of biological anthropology, although this example focuses more on the cultural significance of food.**

3. What aspects of context must be considered as part of this research?   
**Time (present practices compared to past and future); variations in study participant responses based on age, gender, class**

4. How might this research contribute to a comparative approach?   
**This research can be readily compared to soybean product significance in other parts of the world, particularly as these products are increasingly incorporated into Western diets. This research can also be compared to research that examines the significance of other foods in this and other cultures, for example, research on the importance of rice in Japan.**

Scenario B: Impact on Native Californians by Spanish missionization

1. What is the primary field of anthropology addressed in this research? **Archaeology**

2. Are there any other fields of anthropology addressed in this research?   
**Some of the broader implications and ideas are related to cultural anthropology**.

3. What aspects of context must be considered as part of this research?   
**Site use (patterns of use for excavated living sites, burial sites, food processing sites, etc.) may impact the type of materials recovered; time (whether the sites are from early in the Mission Period or later) may impact the amount of colonial influence in the region, including at the sites studied.**

4. How might this research contribute to a comparative approach?   
**This work can be compared to colonial interactions in similar time periods, involving similar cultural groups, or in similar regions or environments.**

Scenario C: Gendered communication

1. What is the primary field of anthropology addressed in this research? **Linguistic anthropology**

2. Are there any other fields of anthropology addressed in this research?   
**The consideration of the role of language in negotiating relationships makes this research relevant to cultural anthropology.**

3. What aspects of context must be considered as part of this research?   
**Variations among study participants need consideration, including ages, number of family members of each gender, number of family members total, family income, family members’ occupations, amount of time family members spend with each other, and family members’ education.**

4. How might this research contribute to a comparative approach?   
**This research could be compared to similar research in other cultures to understand the degree to which the findings are culturally** **dependent. The research could be compared to similar research in the same culture with different participants to understand the degree to which the findings are dependent on additional factors (such as age, income, education, and amount of time spent together).**

Scenario D: Y chromosome DNA analysis

1. What is the primary field of anthropology addressed in this research? **Biological anthropology**

2. Are there any other fields of anthropology addressed in this research?   
**Issues of migration are relevant to all other fields of anthropology.**

3. What aspects of context must be considered as part of this research?   
**Study participants are needed in adequate sample size from all regions under study so that regions aren’t over- or underrepresented.**

4. How might this research contribute to a comparative approach?   
**Again, the research can be used to help understand migration and isolation in non-humans, including our extinct relatives. It can also be used to help understand these processes in other parts of world and in other time periods.**

Exercise 2: Types of Biological Anthropology Scenarios (30 to 40 minutes)

*This exercise uses real examples to foster students’ ability to compare different subfields or types of biological anthropology (human biology, forensic anthropology, primatology, and paleoanthropology) and identify the broader significance of biological anthropology research. Students are asked to read the scenarios and discuss the questions that follow.*

*Note: The answers provided may not be the only possible answers. They are given as a representation of the types of comments that may arise in the discussion.*

Scenario A: Fossil species from 4.4 million years ago

1. What is the primary type of biological anthropology addressed in this research? **Paleoanthropology**

2. Does the research also touch on topics that might be relevant to researchers in disciplines outside anthropology, such as biology or psychology? If so, which ones?   
**Biology is concerned with understanding that last common ancestors are not necessarily directly similar to their living descendent groups.**

3. How does this research relate to human evolution? In other words, what can we learn about human evolution from research along these lines?   
**Research like this helps us understand the changes that made us who we are today, such as the evolution of bipedalism. In particular, this research highlights the complexity of our evolutionary past. We did not suddenly have all of the traits we have today at one time.**

Scenario B: Chimpanzee spear production and use

1. What is the primary type of biological anthropology addressed in this research? **Primatology**

2. Does the research also touch on topics that might be relevant to researchers in disciplines outside anthropology, such as biology or psychology? If so, which ones?   
**Biology is concerned with understanding behaviors of different organisms; psychology involves understanding the ability of different organisms to plan and implement tasks such as tool production and use.**

3. How does this research relate to human evolution? In other words, what can we learn about human evolution from research along these lines?   
**This research calls into question our supremacy as the only animals that can make or use tools. It also raises questions about the ability a range of primates have to learn new behaviors and purposefully modify their surrounding environment. This work also offers insight into the possibility that our view of our ancestors’ tool technology may be biased toward more readily preserved stone tools. Our ancestors may have been using tools of perishable materials such as wooden spears without our being able to see it in the fossil record.**

Scenario C: Stress and female reproduction in rural Guatemala

1. What is the primary type of biological anthropology addressed in this research? **Human biology**

2. Does the research also touch on topics that might be relevant to researchers in disciplines outside anthropology, such as biology or psychology? If so, which ones?   
**Biology and medicine cover understanding reproduction and factors that impact fertility.**

3. How does this research relate to human evolution? In other words, what can we learn about human evolution from research along these lines?   
**Because evolution is about changes in populations, it is also inherently about reproduction. So, issues of reproductive success, such as those addressed in this work, are central to understanding human evolution and the various factors throughout our past and into our future that may impact that success.**

Scenario D: Identification of fire victims in Australia

1. What is the primary type of biological anthropology addressed in this research? **Forensic anthropology**

2. Does the research also touch on topics that might be relevant to researchers in disciplines outside anthropology, such as biology or psychology? If so, which ones?   
**This work is directly relevant to a range of other forensic sciences and criminal investigation fields.**

3. How does this research relate to human evolution? In other words, what can we learn about human evolution from research along these lines?  
**This work is not directly tied to human evolution, in that it does not ask or pose questions about our species, our history, our relatives, etc. However, the work does apply a range of techniques that are relevant to understanding our evolution. For example, the aging and sexing methods used in the research are usefully applied by paleoanthropologists. For a paleoanthropologist, this kind of demographic information is central to understanding social organization, life expectancy, etc., at various points in our evolutionary history.**

Exercise 3: Biological Anthropology News Article Discussion (30 to 40 minutes)

*This exercise requires the instructor to provide students with a current news article related to a biological anthropology topic (for example, a recent fossil find or a newly endangered primate). We specifically suggest the use of a news article, rather than a scholarly article, as a scholarly article may be overly challenging at this point in students’ training. This exercise allows students to begin to utilize their biological anthropology knowledge as an informed, critical thinker and apply their knowledge to the biological anthropology issues that are constantly in the headlines and the focus of the latest television specials. As such, we want students to practice thinking about issues such as informed expertise and intended audience.*

*Students should be given the article to read and then discuss the questions that follow. The discussion can be conducted in small groups or as a large class. You may also design the activity so that students work in small groups, and each group has a different article. This allows students to discuss their article with their group and compare their discussion with another group.*

*Note: As the discussion will be heavily dependent on the article or articles assigned, we do not provide specific answers to the six Exercise 3 questions:*

1. What is the overall topic of the article?

2. How does your article relate to human evolution? In other words, what can we learn about human evolution from the article?

3. Who do you think is the target audience for the article?

4. Is the author an expert biological anthropologist? Did the author interview and/or quote an expert biological anthropologist(s)?

5. Is there some information that might be missing from the article? If so, what might have been left out?

6. Based on what you have discussed about this article, what biases and other factors should you consider when following popular media coverage of biological anthropology topics?

Exercise 4: Apply the Scientific Method (Human Biology) (15 minutes)

*This exercise requires students to apply the scientific method to a real biological anthropology research scenario. The students are given a brief set of findings (observations) from previous research. This gives the students the first stage of the scientific method. The students are then asked to discuss the questions that follow to apply the other stages of the scientific method to their research scenario.*

*This can be an idealized scenario, where students have endless hypothetical funding and time to collect as many types of data as possible. Or, you can choose to make the activity more realistic by asking students to limit themselves as expert biological anthropologists must.*

*Note: The answers provided may not be the only possible answers. They are given as a representation of the types of comments that may arise in the discussion.*

1. Generate a hypothesis about why people in high altitudes have larger lungs.   
**Having larger lungs helps people to take in more oxygen at high altitudes.**

2. Describe the type or types of data you would ideally collect to test this hypothesis.   
**Make measurements of lung size and lung capacity of people at different elevations, also measurements of natural oxygen levels at these elevations and oxygen levels of people at these elevations.** (*Note*: Large sample size is required as many individuals are needed to account for variation.)

3. Describe what hypothetical data might support the hypothesis. For example, the hypothesis would be supported if we found data that indicated \_\_\_\_\_.   
**Larger lung size corresponded with larger lung capacity and lower natural oxygen levels and/or higher oxygen levels in people’s bodies.**

4. Describe what hypothetical data might reject the hypothesis. For example, the hypothesis would be rejected if we found data that indicated \_\_\_\_\_.  
**Larger lung size did not correspond to greater lung capacity; the presence of larger lung size or capacity did not correspond to areas of low oxygen levels; the presence of larger lung size or capacity did not correspond to higher oxygen levels inside people’s bodies.**

5. If you found data that rejected the hypothesis, how would you rewrite your hypothesis to account for your findings and begin again?  
**Larger lung size correlates to overall larger body size at high altitudes.**

Exercise 5: Apply the Scientific Method (Forensic Anthropology) (15 minutes)

*This exercise requires students to apply the scientific method to a real biological anthropology research scenario. The students are given a brief set of findings (observations) from previous research. This gives the students the first stage of the scientific method. The students are then asked to discuss the questions that follow to apply the other stages of the scientific method to their research scenario.*

*This can be an idealized scenario, where students have endless hypothetical funding and time to collect as many types of data as possible. Or, you can choose to make the activity more realistic by asking students to limit themselves as expert biological anthropologists must.*

*Note: The answers provided may not be the only possible answers. They are given as a representation of the types of comments that may arise in the discussion.*

1. Generate a hypothesis about what causes this pattern [pelvis wider in females than in males].  
**The female pelvic opening is larger to allow for childbirth.**

2. Describe the type or types of data you would ideally collect to test this hypothesis.  
**Make measurements of numerous female pelvic openings and male pelvic openings, also measurements of numerous newborn head sizes.** (*Note*: Many individuals are needed to account for variations.)

3. Describe what hypothetical data might support the hypothesis. For example, the hypothesis would be supported if we found data that indicated \_\_\_\_\_.  
**Female pelvic openings accommodate newborn heads better than male pelvic openings (i.e., male pelvic openings tend to be too small to accommodate newborns, but female pelvic openings are large enough).**

4. Describe what hypothetical data might reject the hypothesis. For example, the hypothesis would be rejected if we found data that indicated \_\_\_\_\_.  
**Newborn heads could be easily accommodated by most male and female pelvic openings; newborn heads could not be accommodated by most male or most female pelvic openings.** (*Note*:This answer could be a little complicated because, in reality, the fetal head is too large in one direction to pass through the female birth canal. This is why human childbirth requires fetal head rotation.)

5. If you found data that rejected the hypothesis, how would you rewrite your hypothesis to account for your findings and begin again?  
**The female pelvic opening is larger because the female pelvis is larger than the male pelvis overall.**

Exercise 6: Apply the Scientific Method (Primatology) (15 minutes)

*This exercise requires students to apply the scientific method to a real biological anthropology research scenario. The students are given a brief set of findings (observations) from previous research. This gives the students the first stage of the scientific method. The students are then asked to discuss the questions that follow to apply the other stages of the scientific method to their research scenario.*

*This can be an idealized scenario, where students have endless hypothetical funding and time to collect as many types of data as possible. Or, you can choose to make the activity more realistic by asking students to limit themselves as expert biological anthropologists must.*

*Note: The answers provided may not be the only possible answers. They are given as a representation of the types of comments that may arise in the discussion.*

1. Generate a hypothesis about why chimpanzees behave this way [females don’t form alliances, split from group during day].  
**Female chimpanzees do not form strong bonds because they do not spend enough time together.**

2. Describe the type or types of data you would ideally collect to test this hypothesis.   
**Make observations of wild chimpanzees, with a focus on female chimpanzee daytime activities, female chimpanzee forms of interaction, female chimpanzee bonding and affiliative behavior; also, for comparison, observations of similar activities and behaviors among male chimpanzees.**

3. Describe what hypothetical data might support the hypothesis. For example, the hypothesis would be supported if we found data that indicated \_\_\_\_\_.  
**Males spend more day hours together, engage in more interactions together, and/or share more affiliative behavior.**

4. Describe what hypothetical data might reject the hypothesis. For example, the hypothesis would be rejected if we found data that indicated \_\_\_\_\_.  
**Males do not spend more time together nor engage in more affiliative behavior than females (either the groups show equal amounts of these behaviors or female behaviors are more frequent).**

5. If you found data that rejected the hypothesis, how would you rewrite your hypothesis to account for your findings and begin again?  
**Female chimpanzees do not form strong bonds because they are not related to one another.**

Exercise 7: Apply the Scientific Method (Paleoanthropology) (15 minutes)

*This exercise requires students to apply the scientific method to a real biological anthropology research scenario. The students are given a brief set of findings (observations) from previous research. This gives the students the first stage of the scientific method. The students are then asked to discuss the questions that follow to apply the other stages of the scientific method to their research scenario.*

*This can be an idealized scenario, where students have endless hypothetical funding and time to collect as many types of data as possible. Or, you can choose to make the activity more realistic by asking students to limit themselves as expert biological anthropologists must.*

*Note: The answers provided may not be the only possible answers. They are given as a representation of the types of comments that may arise in the discussion.*

1. Generate a hypothesis about what caused the demise of the Neanderthals.  
**Humans moved into Europe and killed the Neanderthals that previously inhabited the region.**

2. Describe the type or types of data you would ideally collect to test this hypothesis.  
**Record indicators of violence between humans and Neanderthals in the fossil record, including signs of injury to Neanderthal skeletons, indicators that these injuries were not simply the result of falls or other accidents, evidence that Neanderthals were injured directly by human weaponry (e.g., imbedded stone tool in Neanderthal skeleton), and signs that this weaponry is actually associated with humans and not other Neanderthal groups.**

3. Describe what hypothetical data might support the hypothesis. For example, the hypothesis would be supported if we found data that indicated \_\_\_\_\_.  
**Neanderthals sustained intentional injuries from human-made tools or weaponry.**

4. Describe what hypothetical data might reject the hypothesis. For example, the hypothesis would be rejected if we found data that indicated \_\_\_\_\_.  
**Neanderthals did not sustain a great deal of intentionally inflicted injuries, Neanderthals were not injured by human-made tools, and/or the injuring tools were not only made by humans (suggesting the injuries could be the result of Neanderthal–Neanderthal violence).**

5. If you found data that rejected the hypothesis, how would you rewrite your hypothesis to account for your findings and begin again?  
**Humans were better adapted than Neanderthals for the warming climate at the end of the Ice Age.**

Exercise 8: Data Collection and Interobserver Error (30 to 45 minutes)

*For this exercise, you will need to provide students with four different objects to measure (such as a piece of printer paper, a brand new pencil, a dry erase marker, and a paper clip). If you have a small class, you may be able to use the same four objects and pass them around to each student to measure. If you have a large class (or you want to speed up the activity), you can break your class into small groups and give each group their own set of objects to measure.*

*You will also need to provide students with the same measuring implements, such as tape measures, rulers, and/or measuring sticks. It is important that you give everyone in the class (or everyone in each small group) the same measuring tool. For example, if one student is given a foot-long wooden ruler, everyone should be given the same kind of ruler. This will limit error that is introduced by differences in the measuring device. If you do not have enough of the same measuring tool for each student, you may have them all share, or you may give each small group their own measuring tool to use and share.*

*Note: The students’ raw data will vary depending on the objects measured, but their general responses to the questions of what differences were noted and possible causes for them should be as follows:*

1. What differences do you notice?   
**Not everyone has the same measurements for each object.** (*Note*:Sometimes there may even be patterns, such as one person whose measurements are always a bit larger than everyone else’s, or one object with measurements that are really variable.)

2. Why might these differences exist (remember to consider the objects being measured, the tool being used, and the people doing the measuring)?  
**The different measurements may result from different factors:**

* **The object itself may be difficult to measure. For example, if measuring a ball or an object with a round end (such as a paper clip), what is the end point used for measuring?**
* **The measuring tool being used may be difficult to read. For example, the tick marks on an English-style ruler will give less accuracy than the tick marks on a metric-style ruler. Also, a clear ruler may provide more accuracy than an opaque ruler because it can be laid directly over the object, rather than off to the side.**
* **The people measuring the object may have different perceptions. For example, one person may have stronger vision that allows them to see the objects and measuring tools more clearly. Also, one person may have more experience using a particular measuring tool than someone else, making their results more accurate.**

Exercise 9: Data Collection and Evaluation (45 to 60 minutes)

*This exercise requires students to collect data in class and use that data to evaluate the hypothesis provided. If you have a small class, all the students could work together and be measured. If you have a large class, the students could be broken into smaller groups of 10 to 15 individuals to complete the activity. Even in a small class, you may want students to work in smaller groups to conduct the measuring, and then compile all the information for the class as a whole.*

*Ideally, students will need access to the following: tape measures, rulers, and/or measuring sticks; scrap paper; pencils; and paper for producing tables (ruled or graph paper would be best). If measuring implements are not available, students could complete the exercise based on their known height (often found on driver’s licenses) and shoe size (often found inside the shoe) instead of foot length.*

*Note: The students’ raw data for height and foot length will vary depending on the people measured, but their general conclusions should be as follows:*

1. Look for patterns in the data. Describe any patterns you find.  
**People who are taller have longer feet than shorter people. Men have taller average heights and longer average feet than women.**

2. Based on the data you collected, is the hypothesis supported or rejected? Why?  
**The hypothesis *Compared to shorter people, taller people have longer feet* is supported. In general, people who are taller do have longer feet. While the exact numbers vary, the general trend is found in both men and women.**

*This exercise could be supplemented with further data analysis. For example, if you have a large data set, you could ask students to calculate the mean heights and foot lengths for the group as a whole and by gender to see if the data and interpretations vary by gender.*

**Answers to Lab 1 Critical Thinking Questions**

1. Similar: Both cultural and linguistic anthropology emphasize living people and use some similar types of data (such as interviews and observations). Different: Linguistic anthropology could also include languages in the past (through recordings, analysis of written languages, or language family comparisons), while cultural anthropology tends to focus on the present; cultural has a wider range of research issues, whereas linguistic is always looking at language in some way.

2. Similar: Both cultural anthropology and archaeology have a similar range of research issues (such as gender, economy, politics and ritual). Different: Cultural = present, archaeology = past; because of this temporal difference, the two fields use different types of data (interviews and observations vs. material remains).

3. Similar: Both archeology and biological anthropology use similar methods (excavation, radiometric dating, DNA analysis, etc.) and have some temporal and research issue overlap (especially in more recent time periods, such as research on Neanderthals). Different: Biological anthropology also has several other subfields that are very unlike archaeology in their methods and research issues (e.g., primatology); even paleoanthropology (which is the most similar to archaeology) often deals with much earlier time periods than archaeology.

4. Depending on the current news article used, answers to the questions (what is the overall topic and subfield of biological anthropology covered, what other fields of anthropology or other disciplines are touched on, and what does the article suggest about the broader relevance and significance of biological anthropology) will vary considerably.

5. Hypotheses determine what data are collected, so the hypotheses must be considered before data collection begins.

6. When one research project interprets its data and evaluates its hypothesis, the research becomes the jumping-off point (initial observations) of another research project, causing a continuous cycle (or spiral) of research. Scientists operate in this research spiral to continually modify and refine their theories.

7. Nonscientist: A theory is a guess. Scientist: A theory is widely accepted and supported by a lot of evidence, although the theory is always subject to changes when new data are available.

8. To avoid interobserver error in future work, you can have all measurements completed by the same person using the same tool, or have measurements taken by multiple people and then average them together (or use the median measurement). To account for interobserver error that occurred in the past, you can take the raw data measurements and average them together (or use the median measurement); you can also note in your interpretations that the data may be biased because of interobserver error.