



Physical Anthropology Section - 2013

H80 Received Wisdom vs. Reality: Utilizing Amelogenin Profiles to Evaluate the Accuracy of Skeletal Morphologic and Metric Sex Assessments in Adults

Bruce E. Anderson, PhD*, Pima County Medical Examiner's Office, 2825 E District St, Tucson, AZ 85714

After attending this presentation, attendees will gain a further appreciation of how genetic data can enrich the field of forensic anthropology by providing an independent line of evidence for the assessment of sex.

This presentation will impact the forensic science community by providing one method to evaluate the accuracy of morphologic and metric analyses to assess sex from the skeleton, but exactly how accurate is any individual practitioner?

The received wisdom is, in part, based upon forensic anthropology pioneers T.D. Stewart and W.M. Krogman stating they each could assess sex with 90% to 100% accuracy utilizing the entire skeleton and 80% to 92% utilizing the skull alone. Although these estimates are individual accuracy rates, the implication was that with enough practice, these percentages could be attained by other forensic anthropologists. Obviously, this is flawed logic and in these days of *Daubert* and error rate issues, individual forensic anthropologists should know their own error rate. Historically, the only way for the forensic anthropologist to learn the accuracy of a sex assessment was through identification. Thus, errors were likely under-reported. Today, we have another tool to reveal these errors: the Amelogenin locus that is a part of many DNA analyses.

The medical examiner's office has submitted more than 1,000 postmortem tissue samples for DNA analyses. Amelogenin profiles were derived for 862 cases and skeletal sex assessments were performed on 840 of these cases, with 350 of these being performed by the author. Thus, for each of these 350 sex assessments, there now exists a genetic line of evidence that can be used as a source of comparison and evaluation. While genetic data are not infallible, these Amelogenin profiles are a powerful tool for such an evaluation.

After controlling for variables that can influence a skeletal sex assessment, these 350 individual cases were subdivided by condition and completeness into categories ranging from a full body to a single osseous element. Because accuracy can be affected by incompleteness, different rates are expected and discussed. Additional sources of potential bias, such as the presence of soft tissue, personal effects, and name associations are also utilized to pare down the number of cases to minimize bias. A total of 203 cases involved skeletonized remains with no appreciable soft tissue or other associated factors. This present research will demonstrate that when all known biases are minimized, such as can be expected when only a cranium is present for assessment, a truer accuracy rate for skeletal assessment may be attained. However, if the error rate becomes unacceptably high, the recommendation is made to not render a sex assessment.

Of particular interest are sex assessments from the cranium alone. More errors were made when the cranium alone was relied upon than any other skeletal element or set of elements. Almost all of these errors were in the same direction: misclassifying small males as females. One explanation for this is that the majority of the skeletal analyses were performed upon foreign national migrants, most of whom are small males. Other errors were made on single elements, such as a femur, so one question to ask is, "Why render an assessment in all instances?" One reason, albeit poor, for stretching the limits of sex assessment methods is to choose one of two database categories: John Doe vs. Jane Doe.

Forensic anthropologists stand on the shoulders of giants. Today, the field is better for at least two reasons: anthropologists have learned from mentors and have developed methods that can test pronouncements. Observation and experience founded this field, and additional research and education are refining it. A part of this refinement is knowing one's own error rates for the different methods employed. After determining these rates, limitations can then be set on what skeletal elements should be used in sex assessments. Many forensic anthropologists chose this field because our assessments can be proven wrong or validated. DNA results enrich our field. Amelogenin profiles should be viewed as an independent line of evidence to evaluate skeletal sex assessments and should be welcomed. Other new tools, such as the National Missing and Unidentified Persons System (NamUs), now enable entry of the sex assessment of *Undetermined* because program algorithms will search all missing person lists, regardless of sex.

Forensic Anthropology, Sex Assessments, Amelogenin Locus