



Physical Anthropology Section – 2010

H54 Histological Age Estimation: Towards Standardizing Definitions of Bone Histological Variables

Meghan-Tomasita J. Cosgriff-Hernandez, MS*, *The Ohio State University, Department of Anthropology, 4034 Smith Laboratory, 174 West 18th Avenue, Columbus, OH 43210*; and Sam D. Stout, PhD, *Ohio State University, Department of Anthropology, 4034 Smith Laboratory, Columbus, OH 43210-1106*

After attending this presentation, attendees will be familiarized with certain definitions of bone histological variables that pose interpretation problems when microscopic age estimation methods are employed; and which definitions may help reduce the amount of subjectivity and observer error leading to increased accuracy and reliability of such methods.

This presentation will impact the forensic science community by enhancing the understanding of how to reduce differences in interpretations of various histological definitions, or descriptions, used in histomorphometric age-at-death estimation methods.

The admissibility of expert testimony in federal courts is governed by the U.S. Supreme Court decisions made in *Daubert v. Merrell Dow Pharmaceuticals and Kumho Tire Co. v. Carmichael*. While the trial judge must function as a gatekeeper, it is the responsibility of experts in the forensic community to reach an agreement about the reliability and accuracy of scientific methods. Quantitative histological methods can be reliable for estimating age at death. Their reliability is contingent upon the accuracy and precision produced by the method of evaluation. The use of age at death estimations that employ histomorphometry rely on the definitions that the method in use presents. The descriptions, or definitions, of histological variables often differ between methods. These differences in definitions between researchers and methods leave the door open for one forensic expert's testimony to be negated by another forensic expert who may use a method that uses different definitions of the same variables. Forensic scientists should be concerned with standardizing the specificity of these definitions. In doing so, the variation in interpretation of the variables will be reduced, and in turn, inter- and intra- observer error that results from such differences in interpretations can be addressed, and ultimately, disputes about definitions that are employed by forensic scientists in court may be reduced.

This report presents the results of an inter-observer study testing how individuals interpret the definitions set out by the originators of two microscopic age estimation methods commonly used by forensic anthropologists. To explore how differences in definitions affect the identification of histological variables, three groups of readers carried out two age estimation methods: Kerley's (1965) age estimation method was tested on femora cross-sections, and Cho et al.'s (2002) method on cross-sections of ribs. In testing these two commonly used methods that employ different bones, it is clear that the actual description, or definition, of the histological variables affect the accuracy and reliability of the method used. To ensure that the readers read the same defined area, duplicates of the same calibrated digital image of several different areas were taken from cross-sections of bone, as specified by the histological age estimation method being tested, and corresponding grid overlays for each method under review, were distributed to each reader. The readers were divided into three groups, composed of three

individuals each, according to their respective levels of training in skeletal biology. The three groups were divided as follows: novice; intermediate; and advanced. The readers were given written instructions on how to carry out each method and provided with several different definitions of histological structures from different sources. In addition to receiving different definitions of these structures, the readers were provided with images of intact Haversian systems, osteon fragments, primary vascular canals, and primary osteons.

Previous studies have examined the inherent deficiencies in microscopic age estimation methods. This study is unique in that it is concerned with definitions of variables relied upon when employing histomorphometric methods for age estimation. This study takes a step towards recognizing why the process of standardizing histological definitions is important. The standardization of these definitions will make future use of histomorphometric age estimation methods more reliable and easier to use.

Forensic Anthropology, Bone Histology, Age Estimation