H99 Distinguishing Between Human and Non-Human Secondary Osteons in Ribs

Elizabeth J. Whitman, MA, 1044 Eugenia Drive, Mason, MI 48854*

After attending this presentation, attendees will understand new criteria helpful in distinguishing human from non-human bone.

This presentation will impact the forensic community by presenting new criteria for distinguishing human from non-human bone in cases where only minute quantities of bone are available. It also demonstrates a need for more research on the histomorphology of non-weight bearing bones in a wider range of species.

This paper will present rib histomorphology research being conducted at the Michigan State University Forensic Anthropology Laboratory. One of the first questions a forensic anthropologist answers is whether a bone is human or non-human. Under normal circumstances, this can be done using gross morphological features. However, this task becomes more difficult when the bone samples are extremely small or fragmentary. In this case, microscopic examination of the histomorphology of the bone tissue may be necessary. Most human compact bone is characterized by cylindrical structures known as primary and secondary osteons. Non-human bone has other distinctive arrangements of bone tissue not commonly found in humans. For example, plexiform bone has a regular "brick wall" appearance that may be briefly seen in human fetal bone tissue, but is commonly found in weight-bearing bones of non-humans. Histological arrangement of bone tissue is not consistent. It varies within the same bone, between bones of the same individual, and between individuals of the same species. In addition, the distinctive non-human forms of bone are all primary in nature; as bone remodels it can be replaced with secondary osteonal bone. As a result, while the presence of plexiform bone, for example, can be used to classify a bone as non-human, the presence of only osteonal bone does not mean that the bone is human. How do we tell human osteons from non-human osteons? Past research has primarily examined this question using weight-bearing bones such as femora. However, this study examines rib histomorphology since secondary osteons have been documented in this non-weight bearing bone in a much wider range of nonhuman species than in femora.

Rib samples of adult humans (n=10), adult dogs (n=10), beef cattle (n=10), and bear (n=1) were obtained for this study. These samples were cleaned, dried, and then thin-sectioned using a diamond blade saw. Each sample was then mounted and examined under a stereomicroscope. The images were digitally captured and measured using SigmaScan software.

Secondary osteons were found in the canine, bovine, and ursine samples as well as in the human samples. Measurements of the diameters of the osteons found that humans, cows, and bear were not reliably distinguishable based on the size of the osteons. However, the sizes of the secondary osteons in dogs were significantly smaller compared to that of humans. The size of the central, or Haversian, canal proved more useful. Both cows and dogs had significantly smaller Haversian canals compared to humans. The central canal was also smaller in the bear rib, but not significantly. Osteonal banding was also observed in most of the bovine samples and a few of the canine samples. These bands were found between plexiform bone and less organized arrangements of secondary osteons. This suggests that osteonal banding may be a transitional developmental feature, with the bands developing as secondary osteons replace the organized plexiform tissue.

Anthropology, Bone Histology, Osteons

 ** Presenting Author*