H84 Cranial Histomorphology: Species Identification and Age Estimation

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After attending this presentation, attendees will understand the histo- logical characteristics of neurocranial elements and the usefulness of these elements in species recognition and estimation of age-at-death.

This presentation will impact the forensic community by providing a methodology for identifying and aging fragmentary cranial remains at the microscopic level.

Recent bone histological research on anthropological materials has focused on the postcranial skeleton and specifically, the pelvic and pectoral limb bones. The microscopic characteristics of these long bones have been utilized to ascertain the human or non-human status and to estimate age. However, few studies have undertaken a characterization of flat bones and it is not uncommon in the forensic setting to discover a skull or fragmented neurocranial elements.

This histological research addresses several questions using human and non-human frontal, occipital, and parietal bones to discern the microstructure and to interpret inter-bone and inter-species difference. This study follows up previous research by Cool and coworkers (1995) and Clarke (1987) as it re-examines the utility of using vault bones to ascertain age-at-death. Current histological age estimating methods utilize the Kerley (1965) method relying on diaphyseal mid-shafts. Kerley's method did not consider environmental and mechanical stress factors when it was created. Clarke (1987) considered the parietal and Cool et al, (1995) examined the occipital. Our research re-evaluates these questions and includes the frontal bone to ascertain the most accurate age estimation bone.

Human cranial samples were secured at autopsy from known age, sex and ancestry victims from the University of Tennessee Regional Forensic Center. Nonhuman crania were sampled from specimens in the Zooarchaeological Collection in the Department of Anthropology at the University of Tennessee including animals from four different families: white-tailed deer (O*docoileus virginianus*), goat (Capra hircus), pig (*Sus scrofa), and* dog (*Canis familiaris*).

Bone cores were removed from identical regions of the frontal, parietal and occipital of each specimen. Thin sections were prepared using routine petrographic methods and examined under light microscopy to view histological characteristics. Human samples were neither significant to individual nor to bone. Basic structures analyzed in humans include primary and secondary osteons, secondary osteon fragments and lamellar bone. Plexiform bone characterized the nonhuman specimens along with some primary and secondary osteons. The presence of plexiform bone taken in congruence with quantitative measurements of secondary osteon area and Haversian canal area were successful in differentiating all human from nonhuman samples. In human, fractional volumes of secondary osteons, secondary osteon fragments and lamellar bone were recorded for the frontal, parietals and occipital. These variables were statistically compared using SPSS and analyzed to obtain the best correlation to age-at-death.

This research considers cranial microstructure of human and nonhuman samples and indicates that certain histological structures can differentiate between humans and between and within non-human species. This study also discusses the applicability of using the frontal, parietal and occipital bones to estimate age-at-death in humans.

References:

1. Clarke DF. Histological and radiographic variation in the parietal bone in a cadaveric population. Masters thesis, University of Queensland, Australia, 1987.
2. Cool SM, Hendrikz JK, Wood WB. Microscopic age changes in the human occipital bone. *J Forensic Sci 1995;40:789-796.*
3. Kerley ER. The microscopic determination of age in human bone. *Am J Phys Anthropol 1965;23:149-164.*

Histology, Age Estimation, Neurocranium

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