H9 Metacarpal and Metatarsal Histology of Humans and Black Bears

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After attending this presentation, attendees will understand the histological differences in the metacarpals and metatarsals of human hands and feet and black bear (*Ursus americanus*) paws.

This presentation will impact the forensic community by aiding in the separation and identification of morphologically similar osseous human and nonhuman remains.

The similarities between the bones of human hands and bear paws have been noted by numerous authors, and the morphological similarities and differences have been described extensively. While useful when whole bones are discovered, gross morphological characteristics may fail in the context of damaged or fragmented bones. In these situations, an alternative method of identification is necessary. Histology has been used to describe both human and nonhuman bones, and can be employed in separating bones as similar as those in this study. The histology of bear bones has been limited to femur and tibia midshaft cross sections, so descriptions of bear metapodials are needed in order to differentiate them from metacarpals and metatarsals in humans.

The human sample consists of two unprovenienced feet and an unprovenienced hand from the University of Tennessee's Anthropological Research Collections. The bear sample consists of sixteen paws from four bears (eight front and eight back) obtained in Minnesota, Wisconsin, Maine, and Tennessee, one back paw obtained in Georgia, one front paw obtained in Wisconsin, and a back paw that came in as a forensic case to the University of Tennessee, giving a total of 9 front paws from 5 bears and 10 back paws from 6 bears.

Cross sections were made at midshaft of all bear metapodials and in 5 mm increments proximally and distally from midshaft on the second metapodials of one front paw and one back paw from a single bear. This allows for examination of variation both within and across metapodials in a single bear and across metapodials in multiple bears. Cross sections were also made at midshaft of all human metapodials and in 5 mm increments proximally and distally from midshaft on the second metapodials of one hand and one foot. All thin sections were cut 15 µm thick and ground. Slides were viewed using a light microscope and photographed using the computer program ImagePro Express.

Several quantitative variables were examined in order to determine the difference between human and bear metapodials at the histological level. Quantitative measurements included maximum osteon diameter (µm), osteon area (μm^2), maximum Haversian canal diameter (µm), and Haversian canal area (μm^2). One to four osteons were measured per thin section and the values averaged for each species. The means were then tested using ANOVA to see if they differed between human and bear. In addition, the percentage of overlap in osteon and Haversian canal sizes was calculated between the two species. The incidence of several qualitative features was also noted when encountered, including osteon banding, resorption spaces, and plexiform bone.

Results show that human osteons and Haversian canals are larger in both diameter and area than those found in bears. The mean human osteon area and diameter are 39,081μm^2 and 249 µm, respectively, while the mean bear osteon area and diameter are 21,421 μm^2 and 183 µm, respectively. The mean human Haversian canal area and diameter are 2,160 μm^2 and 58 µm, respectively, while the mean bear Haversian canal area and diameter are 580 $\mu m^2$and 29 µm, respectively. In addition, the qualitative features of osteon banding, resorption spaces, and plexiform bone are more prevalent in bear metapodials than human metacarpals and metatarsals. These results indicate that it is possible to differentiate between fragmented bear and human metacarpals and metatarsals using a combination of qualitative and quantitative microscopic features.

Black Bear, Human, Metacarpals/Metatarsals

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