H6 The Bone Histology of Bear Paws and Human Hands

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After attending this presentation, attendees will learn about the potential histological differences in the metacarpals and phalanges of a human hand and a black bear (Ursus americanus) paw.

This presentation will impact the forensic community and/or humanity 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 metacarpals and phalanges is needed in order to differentiate these from the same bones in humans.

The hands of a human male in his mid-thirties and the front paws of a two to three year old bear were obtained for this study. The right second ray of each was selected for study in order to remain consistent with previous research focusing on the second metacarpal of humans. Each ray consisted of the metacarpal, proximal phalanx, and middle phalanx, the distal phalanx was used only in the human. Thin sections were made using Buehler isomet low speed saw at midshaft of all bones, and thin sections were also made at the proximal and distal ends of the metacarpals and proximal phalanges. All thin sections were cut 12 µm thick and ground using a Metaserv 2000 grinder/polisher. Slides were viewed using a LEICA DMRX light microscope and photographed using the computer program ImagePro Express.

Several quantitative and quantitative features were examined in order to determine the difference between human and bear bones 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. All four variables gave p-values less than 0.05, meaning humans and bears were statistically different in all four measurements. In addition, osteon density and lacunae density were calculated for both species, and both of these variables appear to differ by species, with bear bone having more osteons and lacunae per area examined.

The qualitative features that were analyzed included osteon banding, resorption spaces, and plexiform bone. Osteon banding appeared only in the bear thin sections, specifically in the second metacarpal, and never in the human thin sections. Resorption spaces which appeared in rows were also indicative of this osteon banding and were seen in a few of the bear thin sections and never in the human thin sections. Plexiform bone, which is usually a nonhuman trait, was also seen in a few of the bear thin sections and never in the human thin sections. While preliminary, this study indicates that it is possible to differentiate between bear and human metacarpals and phalanges using a combination of qualitative and quantitative microscopic features.

Bone Histology, Nonhuman Remains, Black Bear

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