H15 Histology at the Central Identification Laboratory as a Method to Analyze Pathological Conditions in Modern Human Osseous Remains

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After attending this presentation, attendees will understand how histological techniques used at the Central Identification Laboratory (CIL) at the Joint POW/MIA Accounting Command (JPAC) were used to identify a pathological condition in human osseous remains and how these techniques could be used to distinguish inconclusive osseous remains from non-human osseous remains.

This presentation will impact the forensic science community by providing an example of how our normal histological analytical techniques were used to identify human osseous remains which could have been easily misinterpreted as non-human due to their pathological alterations that lead to abnormal anatomical morphology.

The CIL has consistently focused on the use of various types of validated methods for the assessment of osseous remains, including metric analysis, chest radiographic comparison, and various types of DNA testing. Additionally, the CIL has incorporated histological analysis for the assessment of possible human osseous remains (inconclusive osseous remains) since 2006.

Numerous disease processes leave characteristic signatures on bone. Some of these processes are often recognizable at the macroscopic level, while others can be identified at the microscopic level. Whether gross or microscopic, hard tissue pathology can provide useful information for identification as well as contributing to the determination of cause and manner of death or the individual's health status at time of death. Bones that differ from their regular anatomical structure can easily be misinterpreted as non-human osseous remains. Histological analysis can aid in the identification of osseous remains with pathological conditions from non-human osseous remains and can additionally provide detailed information regarding the pathological processes differential diagnosis.

The utilization of common histological techniques as employed in modern forensic anthropological casework may significantly reduce the number of osseous remains misinterpreted as non-human osseous remains due to pathological changes.

An example is provided of a portion of a human fibula associated with forensic casework that displayed significant pathological changes. This fibula was sampled for mitochondrial DNA (mtDNA) analysis, as is common protocol at the JPAC-CIL. While the mtDNA analysis yielded a human signature, the gross morphological characteristics were not suggestive of human remains. A section of this fibular fragment was subjected to histological analysis and was identified as probable human due to histological characteristics of the pathological bone. The findings were indicative of a pathological process that led to fast-growing new bone formation inside the normal medullary cavity, which modified the cross-sectional morphology of the bone.

The methodology for standard histological analysis at the CIL utilizes three steps: embedding, sectioning, and analysis. Basic epoxy-embedding techniques are used to stabilize the fragment for thin sectioning. Then a thin-sectioning saw capable of making bone sections approximately 0.8mm thick is used and the specimen is cut transverse to its longitudinal axis. Finally, the thin section is attached to a glass slide, viewed under a standard light microscope at 50x magnification, and compared to our SOP decision matrix. This common methodology used for distinguishing human osseous remains from non-human osseous and non-osseous remains can also be used for analyzing possible pathological conditions and gathering additional information regarding individual health status at time of death. The example given in this presentation describes how histological analysis of osseous remains can distinguish osseous remains with pathological conditions from non-human osseous remains, which may avoid misinterpretations of the gross morphological characteristics.

Physical Anthropology, Histology, Pathological Conditions

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