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The Impact of Intentional Postmortem Chemical Alteration on Bone Fluorescence Under an Alternate Light Source

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Abstract: A forensic anthropologist's responsibilities may include both field recoveries and laboratory analyses. Alternate light sources (ALS) are often used to assist in field recoveries in contexts where remains are highly fragmented and spread across a wide area. This project examines the impact of intentional postmortem exposure to commercially available caustic chemicals on the successful application of an ultraviolet ALS. Bone fluorescence under ALS occurs due to three aromatic amino acids (tryptophan, phenylalanine, and tyrosine) present in small amounts in human collagen. Fluorescence results from the excitation of electrons in certain molecules capable of fluorescence, or fluorophores, by exposing these molecules to a specific wavelength of light, referred to as the excitation wavelength. As the electrons relax, fluorescence is emitted from the object being lit. This study uses an ALS with an excitation wavelength in the ultraviolet range (365 nm), which is supported by existing literature in the field as the best ultraviolet wavelength for visualizing bone. Eight porcine femora (procured from the University Farm Meats Lab) are sectioned into 14 pieces and exposed to one of five different treatments: concentrated and diluted acidic, concentrated and diluted basic, and water. The fifth treatment is used to account for the effects of submersion on fluorescence intensity. All samples are exposed to the ALS and photographed prior to submersion, and then again at varying intervals over the course of 30 days. Fluorescence intensity will be determined using the ImageJ software to calculate a grayscale intensity value. These intensity values will be compared across treatments and bone sample composition (cortical or trabecular) to quantify the effects of chemical alteration on the success of ALS applications. I anticipate that a greater rate of fluorescence intensity loss will be observed in the more concentrated treatments, as well as with the trabecular samples. The results of this research project will fill a gap that currently exists in forensic anthropological literature, as ALS has been examined with other postmortem alterations like burning, but not chemical alteration. Additionally, this project could provide support for the continued use of nonhuman analogues like pigs in current and future research.

Keywords: *forensic anthropology, fluorescence, ultraviolet alternate light source, postmortem chemical alteration*