E15 Investigation of Human Skeletal Tissue Using Raman Spectroscopy (RS) and Surface-Enhanced Raman Spectroscopy (SERS) for Forensic Applications

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After attending this presentation, attendees will understand the main principles behind RS and surface enhancement, characteristic spectra of different skeletal tissue and DNA components, examples of when this pre-extraction screening technique would be useful, and the overall effectiveness of the proposed technique.

This presentation will impact the forensic science community by discussing how sequencing DNA from human bones is generally a very expensive and time-consuming process but, by implementing this pre-extraction screening technique for skeletal DNA, viability could be highly useful in avoiding the sequencing of any degraded, non-viable bone DNA samples.

Detection of DNA in various forms is an essential and oftentimes delicate process that plays a key role in everything from forensic science for crime scene information to diagnostic screening in clinical medicine and other biological sciences applications. In forensic cases dealing with human remains, bones are sometimes the only accessible source of DNA. As such, the extraction of DNA from bone tissue is a widely studied area in forensic science. Unfortunately, there is no standard technique to qualitatively assess the likelihood of obtaining a useable amount of high-quality DNA for sequencing. The purpose of this research is to evaluate the utility of RS or SERS as useful diagnostic tools for determining whether a bone sample contains viable DNA for extraction and sequencing.

Raman scattering is a type of vibrational spectroscopy that can identify functional groups of biologically relevant molecules, allowing each molecule to have a fairly unique "spectral fingerprint." Raman scattering is a very rare event that is difficult to measure in low concentrations; however, Raman signal can be significantly *enhanced*, by placing the analyte on/near a nanostructured *surface* of a noble metal, thus *surface-enhanced* RS. RS has gained considerable interest in recent years for the detection and identification of forensically relevant materials such as human bodily fluids, explosives, and illicit drugs.

Previous research has shown that DNA nucleobases can be observed by SERS and that RS has been used to evaluate alterations to bone composition associated with aging, disease, or injury by distinguishing the mineral and matrix markers from other components of a Raman spectrum of skeletal tissue. Individual Raman and SERS spectra of all bone and DNA components will be presented, as well as investigations of the development of a standard SERS procedure to detect DNA in a bone sample and the effect of environmental conditions on sample spectral markers.

SERS, Bone, DNA

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