B154 Identification of Artificially Aged Silk at the Molecular Level

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After attending this presentation, attendees will understand how molecular biomarkers can be used to determine the age of historical silk textiles; they will also gain insight into how these same biomarkers can be used to detect forgeries.

This presentation will impact the forensic science community by speaking to the importance of art forensics in the preservation of cultural heritage, the detection of forged artworks, and the need to further understand our history. Many museums' artifacts are composed of or contain proteinaceous materials such as silk, wool, parchment, wood, etc. The research presented focuses on the molecular biomarkers of natural ageing in museums' proteinaceous specimens and how to use these markers to identify the age or the authenticity of these artifacts. Among the examples discussed will be some of the Iranian Buyid textiles in the United States that contain a large amount of fake ancient silk.

Shortly after the 1925 excavation of a number of genuine silk articles at the Bibi Shahr-Banu site south of Tehran, Iran, the market was flooded with forged Bibi Shahr-Banu silk textiles. Museums in the United States and Europe bought many examples, both genuine and fake; later, the authenticity of many of the specimens was questioned, resulting in a decades-long controversy concerning Buyid silks. Today, many believe that a vast number of these artifacts are fake; however, since no scientific method was available, the claims on the forgery nature of these silks were mostly based on speculation rather than sound scientific methods. The purpose of the research presented is to develop molecular level biomarkers for scientific identification of bona fide silks and forgeries using separation, mass spectrometry, and proteomics.

The degradation of silk — both natural and artificially induced — has been studied using X-ray diffraction, Ultraviolet/Visible spectrometry, and Fourier transform infrared spectroscopy, among others. Mass spectrometry is an ideal technique for studies of the biomarkers of degradation at molecular levels. In addition, it is a highly sensitive technique which allows species identification as well as post-translational modifications of proteins at low microgram levels. The high sensitivity of mass spectrometry allows for the identification of biomarkers of aging with minimal effect to the artifacts, which is essential for the analysis of precious museums' artifacts. The molecular markers of natural aging and degradation of proteins studied for this research include racemization, deamidation, oxidation, truncation, and amino acid conversion. After comparing these biomarkers of aging for the Buyid silk samples, the physical and chemical methods that could have been used to produce the forged silk were studied. For example, it was observed that the Bibi Shahr-Banu forgeries yield unusually high levels of racemization, and this could hold true for other post-translational modifications; this is also currently under study.

This presentation will address how biomarkers can indicate age or forgery as proven by the study of genuine and forged textiles and by the re-creation of forgery methods. It is hoped that attendees will learn the importance of understanding such mechanisms in the preservation of culture and the detection of art crimes.

Silk, Forgery, Mass Spectrometry