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Introduction to post mortem change

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This lecture is designed to introduce the attendees to the changes which occur to a body during the early, middle and late stages of the postmortem interval (PMI). These changes include rigor mortis, livor mortis and algor mortis. Other topics which will be discussed include the role of forensic entomology in determining the time of death and postmortem changes which can mimic antemortem trauma. The roles that temperature and environment play in the process of decomposition will also be discussed.

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Nanoforensics: Forensic application of nanotechnology in illicit drug detection

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In recent years nanotechnology has been increasingly proven to be a powerful tool in a number of areas including medicine, imaging, and energy sciences. Nanotechnology might have a potential to make significant positive contribution in forensic drug detection to solve crimes. We hypothesized that the nanoparticles and chemically modified nanoparticles may alter or enhance the spectroscopic signals of forensic drugs in fingerprint samples. Nanoparticle has unique and unified nanostructures and may specifically interact with forensic drugs via their well-controlled nanostructures. In this work we explored the spectroscopic properties of the nanoparticles and possible identification of the forensic drug cocaine in fingerprint samples using the comparison microscopy, scanning electron microscopy (SEM), and Fourier transform Infrared Spectroscopy (FTIR). Six types of nanoparticles were used for the analysis of forensic drug cocaine, including gold nanoparticle (10 nm), gold nanoparticle(30 nm), silver nanoparticles(20 nm), and titanium oxide nanoparticles(15 nm). We also utilized four types of fingerprint powders for preparing fingerprint samples, including black powders, red fluorescent powders, orange fluorescent powders and green fluorescent powders. The experimental data indicated that the gold, silver, and titanium oxide nanoparticles exhibited different IR patterns, suggesting that FTIR is able to distinguish these three types of nanoparticles. For example, the silver nanoparticles have a broad linear absorption IR band between 4000 and 500 cm^{-1}. The titanium oxide nanoparticles have two IR signals, a wide peak at 2900-3000 cm^{-1} and a sharp peak at 1620 cm^{-1}. The gold nanoparticles showed three IR peaks at 3400, 1580, and 1390 cm^{-1}. In the presence of the fingerprint powders, the forensic drug cocaine showed negligible IR signal. In contrast, the typical IR signals of cocaine at 2948 cm^{-1}, 1714 cm^{-1}, and 1324 cm^{-1} were observed in the presence of the gold and silver nanoparticle. This observation is stimulating and indicates that the detection of cocaine using nanoparticles is achievable. The reason for the enhancement of cocaine IR analysis in the presence of nanoparticle is likely due to the homogeneity of nanoparticles. We concluded that the nanoparticles promote the detection of the forensic drugs in fingerprint samples. Future work will be placed on the characterization of a variety of novel nanoparticles especially the chemically modified nanoparticles in analyzing forensic drugs including cocaine, methamphetamines and marijuana using bioanalytical methodologies.

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