

O19. AFM investigation of the effects of uncontrolled outdoor conditions on bloodstain ageing

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Estimation of the time of death of the victim of a murder or the age of bloodstains left at a crime scene is one of the most significant problems encountered in forensic medicine, science, and law over a century. Although various techniques have been used to help determine reliably the age of dried bloodstains, none has ever been recognised to be authentic enough for use in routine forensic case work. Nanotechnology could possibly provide a solution to solve this problem.

We have investigated the effectiveness and possible application of Atomic Force Microscopy (AFM) in the age determination of dried blood in forensic casework. AFM is a newly emerged and rapidly expanding nanotechnique with the unique ability to visualise the ultrastructure of a sample at the nano-scale and to measure its nanomechanical properties, such as erythrocyte cell-wall elasticity, which can be potentially useful for forensic application.

In order to mimic “real” crime scenes, drops of whole blood obtained from a healthy donor were reverse-smearred on glass, mica, and stainless steel substrates and then exposed to uncontrolled outdoor environmental conditions for different lengths of times ranging from 0 weeks (control) up to 7 weeks. Changes observed in the ultrastructure and nanomechanics of the red blood cells (RBCs) were quantified and related to the time domain. The cells lost their doughnut-shapes, became flatter, and the central grooves shrank with time. The elasticity of the cells decreased over time, showing that with ageing the cell membrane grew stiffer. These changes were found to be time and surface dependent.