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From scene to DNA : A systematic approach to blood stain pattern analysis in complex crime scene.

From Scene to DNA: A Systematic Approach
to Bloodstain Pattern Analysis in Complex
Crime Scenes
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Bloodstain Pattern Analysis (BPA) is a forensic method that studies how bloodstains form and where they are found to understand events in violent incidents. By examining the size, shape, and spread of stains, investigators can identify the positions of people involved, their movements, and the sequence of actions. In firearm cases, BPA can reveal where individuals stood, how they moved, and how a weapon was used. Blood on a victim's hands can provide clues about weapon handling and firing positions in suspected suicides. To protect evidence, the scene must be documented before gunshot residue (GSR) testing or moving the body.Modern BPA goes beyond simple observation. Advanced techniques such as probabilistic modelling and fluid dynamics consider gravity, air resistance, and droplet deformation. These methods make it possible to accurately reconstruct how blood drops travel, even over distances greater than one metre or in downward paths, improving accuracy and reliability in complex cases.BPA examines various stain types, including arterial spurts, cast-off patterns, and contact marks, while addressing challenges like overlapping stains and environmental contamination. It can also guide DNA profiling when samples are mixed or unclear.The process follows a systematic approach—starting with a broad view of the scene and moving to detailed pattern analysis. It is performed by trained professionals with expertise in injury biomechanics and experience in both crime scene work and autopsies.When done with scientific precision, BPA is a valuable part of modern forensic science, helping reconstruct events, confirm or challenge witness accounts, and ensure correct interpretation of physical evidence in violent crime investigations.
Keywords: Bloodstain Pattern Analysis (BPA) , Forensic Reconstruction , Gunshot Residue (GSR) , Injury Biomechanics , DNA Profiling.

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