OSAC Research Needs Assessment Form

Title of research need: Behavior of Blood Outside the Body

Keywords: Bloodstain pattern analysis (BPA), bloodstain, physics, fluid dynamics

Submitting subcommittee(s): Bloodstain Pattern Analysis **Date Approved:** July 26, 2019

(If SAC review identifies additional subcommittees, add them to the box above.)

Background information:

1. Description of research need:

SEE ALSO ATTACHED ADDENDUM for additional details.
Currently, there is a limited understanding of how intrinsic properties of liquid blood, environmental factors and fluid dynamic properties relate to the size, shape, distribution and appearance of bloodstains and bloodstain patterns. This understanding is fundamental to enhancing BPA through the ability to develop predictive, interpretative models. Research is needed to study:

1. Intrinsic properties of blood (e.g. hematocrit levels, lipid levels, species, clotting, etc.)
2. Environmental factors (e.g. target surface characteristics, atmospheric conditions, etc.)
3. Fluid dynamic processes (e.g. drop formation, travel of drops through the air, deposition, etc.)

2. Key bibliographic references relating to this research need:

- Adam, CD. Fundamental studies of bloodstain formation and characteristics, Forensic Science International 2012;219(1-3):76-87.
- Flight, C., Jones, M. and Ballantyne, K. (2018). "Determination of the maximum distance blood spatter travels from a vertical impact." Forensic Sci Int 293: 27-36.
- Kabaliuk N, et al. Experimental validation of a numerical model for predicting the trajectory of blood drops in typical crime scene conditions, including droplet deformation and breakup, with a study of the effect of indoor air currents and wind on typical spatter drop trajectories. Forensic Science International 2014;18:107-20.
- Stotesbury, T., M. C. Taylor and M. C. Jermy (2017). "Passive Drip Stain Formation Dynamics of Blood onto Hard Surfaces and Comparison with Simple Fluids for Blood Substitute Development and Assessment1 , 2." Journal of Forensic Sciences **62**(1): 74-82.

3a. In what ways would the research results improve current laboratory capabilities?

This research would enable an analyst to better relate the appearance of bloodstains and the corresponding mechanism. This research leads to objective measurable characteristics which are required for pattern classification.

3b. In what ways would the research results improve understanding of the scientific basis for the subcommittee(s)?

This research is at the core of BPA and contributes to the fundamental understanding of blood behavior outside the body. The scope of this research establishes its scientific basis by determining how bloodstains are affected by:

1. intrinsic properties of liquid blood,
2. environmental factors and
3. fluid dynamic properties

Once established, this knowledge will provide the framework for improved methodologies and interpretations.

3c. In what ways would the research results improve services to the criminal justice system?

Research would provide a basis for a more complete and reliable determination of pattern-producing mechanisms, resulting in a better reconstruction of events. Ultimately, BPA would be more reliably presented to the criminal justice system.

4. Status assessment (I, II, III, or IV): II

	Major gap in current knowledge	**Minor** gap in current knowledge
No or limited current research is being conducted	**I**	**III**
Existing current research is being conducted	**II**	**IV**

This research need has been identified by one or more subcommittees of OSAC and is being provided as an informational resource to the community.

Subcommittee Approval date:

(Approval is by majority vote of subcommittee. Once approved, forward to SAC.)

SAC

1. Does the SAC agree with the research need? Yes ◯ No ◯

2. Does the SAC agree with the status assessment? Yes ◯ No ◯

If no, what is the status assessment of the SAC:

Approval date:

(Approval is by majority vote of SAC. Once approved, forward to NIST for posting.)