Investigating Blood Back Spatter

Researchers use fluid dynamics to understand and investigate gunshot blood evidence

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- 69th DFD Annual Meeting
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Newswise — Washington, D. C., November 21, 2016 -- The popularity of forensics and crime scene investigation fueled by a glut of television programs has familiarized many of us with the basics of forensic medicine. However, not much is, in fact, understood about blood back spatter. A team of researchers from the University of Illinois and Iowa State University is exploring the science behind blood back spatter using fluid dynamics to develop a theoretical model for predicting and interpreting blood spatter from gunshot wounds, and it could significantly impact the field of forensic science. The work will be presented at the 69th Annual Meeting of the APS Division of Fluid Dynamics held in Portland, Oregon, Nov. 20-22, 2016.

Funded by the U.S. National Institute of Justice, this is the first work explaining the origin of blood back spatter. The physical process generating a backward spatter of blood is linked to its Rayleigh-Taylor instability, which describes how fluid streams disperse into droplets, as they accelerate toward the surrounding air, allowing initial distribution of drop sizes and velocities to be determined.

The motion of the many resulting drops in air is then modeled with equations that account for gravity, air drag and aerodynamic interactions between drops. The model predicts the atomization process (the process also sought with fancy perfume spritzers), the trajectories of the back spatter drops from the wound to the ground, the impact angle and velocity on the ground, as well as the number of, distribution, location and potentially shapes and sizes of the blood stains.

Researchers then compared their models with experimental results generated by a gunshot impacting a sponge impregnated with blood. “What surprised me is that nobody tried to explain the origin of blood back spatter before,” said Alexander Yarin, a fluid dynamics researcher at the University of Illinois. “I started thinking about it after watching, on a flight to a conference, a very interesting movie [called] ‘Phil Spector’ where a lawyer (played by Helen Mirren) organized a forensic experiment with a picturesque blood back spatter caused by a bullet.”

The research thus far only addresses the case where the bullet is sharp. Cases involving a relatively blunt bullet and a detailed description of the angle of the spatter cone are challenging issues that remain -- so far -- unresolved. There are currently several research directions underway to understand and characterize the blood back spatter caused by relatively blunt bullets, and the theory of the forward blood spatter caused by a gunshot is also under development.

“Many additional interesting questions that are important to BPA (bloodstain pattern analysis) community are also fascinating from the fluid dynamical point of view: the effect of blood viscoelasticity and the yield stress on its atomization, the effect of muzzle gases, etc.,” Yarin said. “While there is still much to learn, I hope that this is an important step to provide the bloodstain pattern analysis experts solid hydrodynamic foundations for their forensic methods.”

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Abstract: M30.00003: "Predictions and Measurements of Blood Backspatter from a Gunshot in Bloodstain Pattern Analysis," by Patrick Comiskey, Alexander Yarin, Sungu Kim and Daniel Attinger is at 8:26-8:39 a.m. PST, Nov. 22, 2016 in Room F151.
http://meetings.aps.org/Meeting/DFD16/Session/M30.3

For more information about the APS DFD 2016 meeting, visit http://apsdfd2016pdx.org/.

MORE MEETING INFORMATION

USEFUL LINKS
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Press Room: http://www.aps.org/newsroom/index.cfm

PRESS REGISTRATION
We will grant free registration to credentialed journalists and professional freelance journalists. If you are a reporter and would like to attend, contact Julia Majors (jmajors@aip.org, 301-209-3103) who can also help with setting up interviews and obtaining images, sound clips, or background information.

LIVE MEDIA WEBCAST
A press briefing featuring a selection of newsworthy research will be webcast live from the conference on Monday, Nov. 21. The first briefing at 2:00 p.m. (EST) is about the forensic analysis of blood spatter and how changing the position of your fingers can help you swim faster. The second one at 4:00 p.m. (EST) is about cat's Velcro-like tongues and bubbles. More information can be found at the following link: https://www.aps.org/units/dfd/pressroom/

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