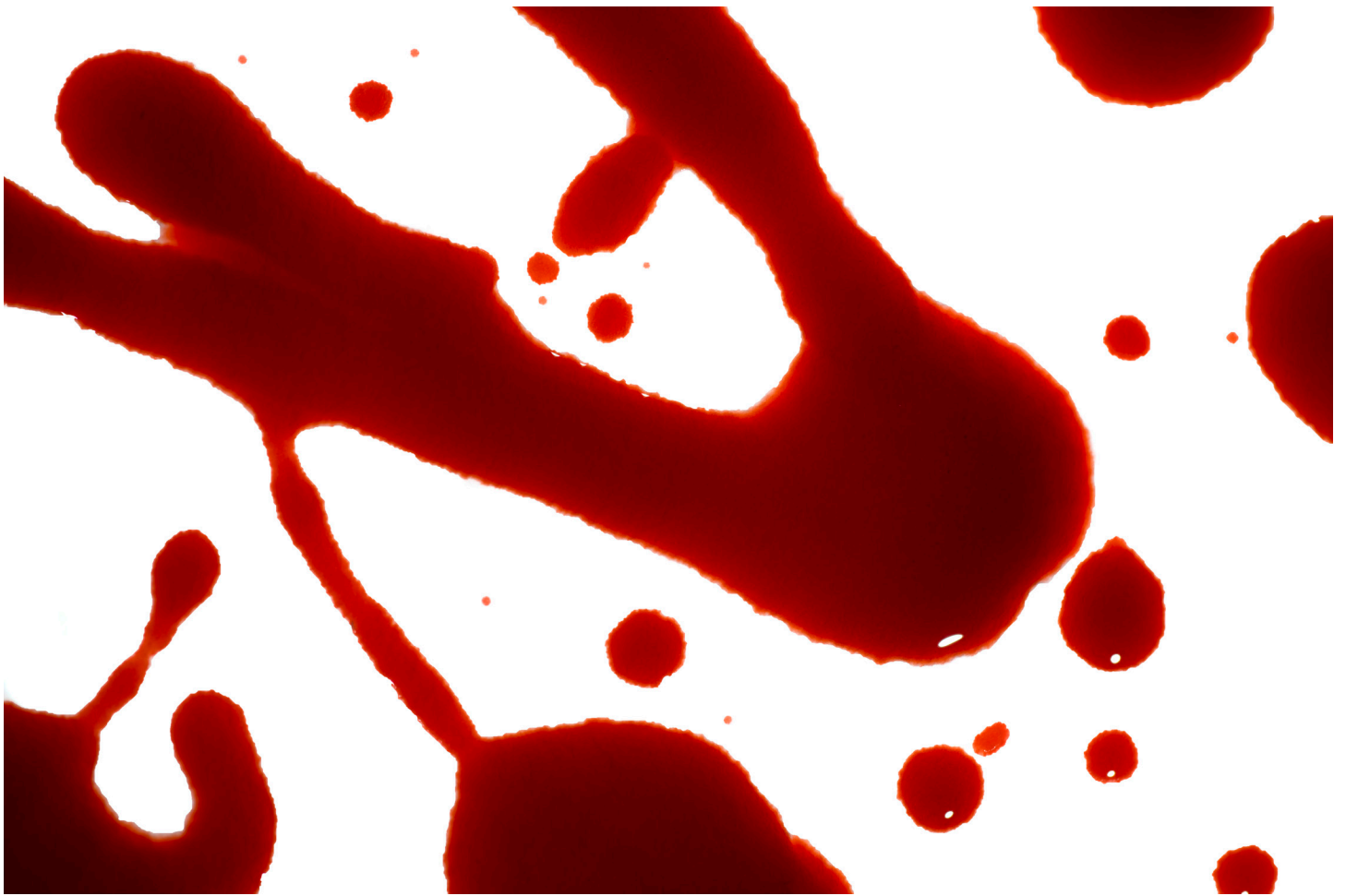
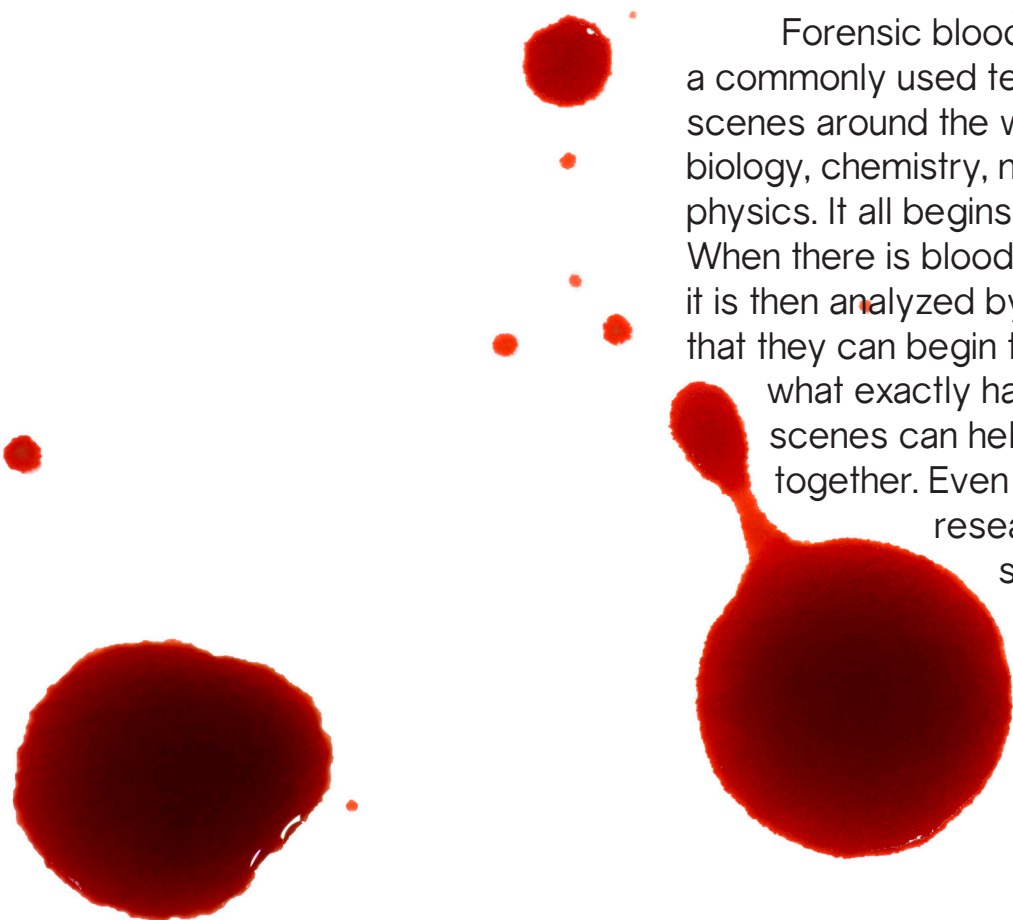


# BLOOD SPATTER



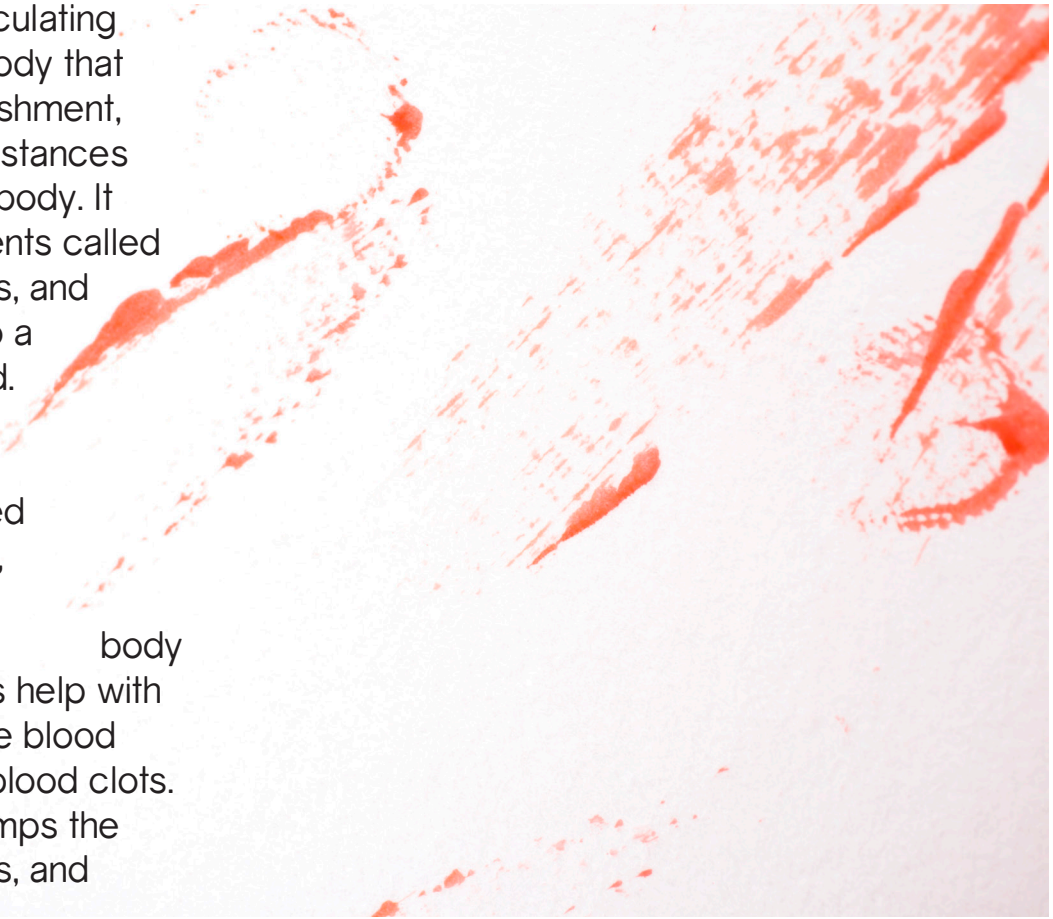
BY ANGELA CHILDRESS



Forensic blood spatter analysis is a commonly used technique at crime scenes around the world. It combines biology, chemistry, mathematics, and physics. It all begins with the blood. When there is blood at a crime scene, it is then analyzed by a specialist so that they can begin to understand what exactly happened. Blood scenes can help to put the pieces together. Even today, there is still research about blood spatter analysis in order to further our knowledge of this fascinating human fluid.

## BLOOD

Blood is a fluid circulating throughout the human body that transports oxygen, nourishment, and disease fighting substances to different parts of the body. It contains three components called erythrocytes, leukocytes, and platelets. Plasma is also a key component of blood. Erythrocytes transport oxygen around the body and are composed of red blood cells. Leukocytes, also known as white blood cells, defend the body from infections. Platelets help with hemostasis (stopping the blood from flowing) and form blood clots. Plasma is a fluid that pumps the erythrocytes, leukocytes, and



platelets, composed of water and proteins.

The red color of blood comes from the erythrocytes. These contain mass amounts of hemoglobin, which carry the oxygen molecules. This is what gives blood the very distinctive color. There are two tones to blood; the first coming from blood that has passed through the heart to become oxygenated, which is a brighter shade of red, and the second from blood that is returning to the heart through the veins.

## BLOOD SPATTER

At a bloody crime scene, a specialist is needed to determine what happened. Depending on a wound, blood will come out in a distinct way. Platelets will cause the blood to clot, but depending on the size of the wound, it will take a certain amount of time. The amount of blood at a scene will help determine how large the wound was. When there is a blood spray, the specialist must determine how the blood got there. Falling droplets of blood form spherically similar to other fluid in free fall. This makes it easier to conclude what happened to the blood.

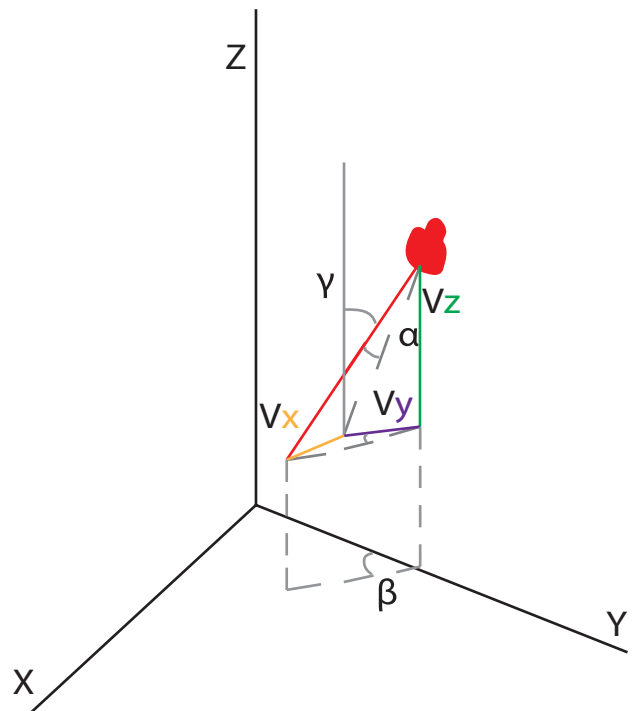
Another important factor to investigate is the angle of impact. Depending on the angle, you can determine how a person was wounded and help figure out what exactly happened at a crime. Blood at an angle of less than 90 degrees will appear in a tear drop type shape, while a more obtuse angle will be circular. Dr. Victor Balthazard and Dr. Herbert Leon MacDonell determined that the ratio of a blood spatter is the sine of the angle of impact. This made it easy to

determine the exact angle of impact. There are two equations that are used:

$$\sin \alpha = (w/l)$$

$$\tan \beta = \tan \alpha / \sin \gamma$$

Alpha ( $\alpha$ ) is the impact angle moving out from the surface, beta ( $\beta$ ) is the angle pivoting about the vertical axis, and gamma ( $\gamma$ ) is the angle of the path measured from the true vertical of the surface. L is the length of the blood spatter, and w is the width.

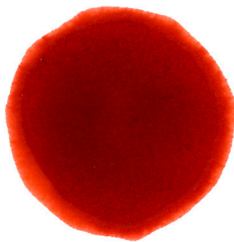


A diagram to depict the equations

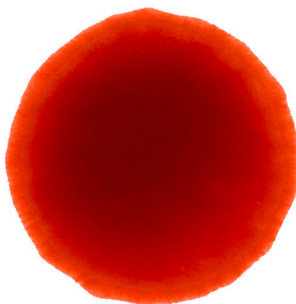
Force is also a factor. When a drop falls slowly to a surface, it will land and barely splatter. On the other hand, if it is forceful, it will cast smaller droplets in the direction that the blood is moving. Evaluating the force of the impact will help determine how deeply someone was wounded. There is also a factor of height involved. Depending on where the blood

fell from, there will be a difference in diameter between the droplets. There are also often points or areas of convergence, where two paths intersect. These points of convergence can be used to determine how many times someone was injured. It can also show how the victim was being attacked. This can be helpful in figuring out the angles of impact.

The following images show the difference in size and shape when dropped from different heights.



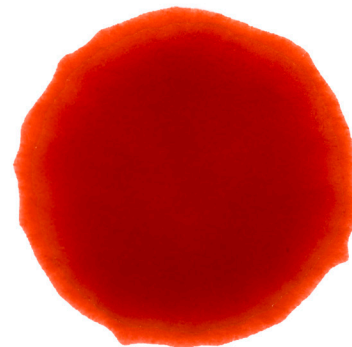
One foot



Two feet



Three feet



Four feet



Five feet



# CURRENT RESEARCH

Even though blood spatter analysis has been around for some time, there is still research being conducted in the field. The International Association of Bloodstain Pattern Analysts (IABPA) have been working on collecting information since 1983. With over 900 members, they aim to standardize techniques, promote education and research about bloodstain pattern analysis, and extend the science behind it. On their website, you can find current research being worked on, and recently published articles.

One recent work was about the blood drippings from weapons, written by Kabaliuk, Jermy, Morison, Stotesbury, Taylor, and Williams (2013). In the article, they went in depth about how the passive

droplets are nearly as important as the active ones. Using volume and velocity, they determined what kind of drops a certain weapon would make, when the blood passively fell off of it. This can help determine what drops came from where, and what weapon was used. One of the unfinished research projects that they have listed is about the relationship of blood and apparel fabrics by Therese de Castro. This is important since not all blood will be in flight, and often will dry on clothing and needed later to prove how crimes happen.

## PHOTO TECHNIQUE

In order to take these photographs, I used a Nikon D800 with a 60mm macro lens. The blood itself was from a synthetic



blood consisting of water, imidazolidinyl Urea, triethanolamine, hydroxyethylcellulose, propylene glycol, methylparaben, red 40 (CI 16035), and blue 1 (CI 42090). Using an eye dropper, I dropped some of the blood onto thick white paper. The lighting was four fluorescent bulbs all aimed at the paper with the camera positioned above it on a copy stand.

## ABOUT THE PHOTOGRAPHER

Angela Childress is a fourth year student at Rochester Institute of Technology in the high magnification class. Originally from Arizona, she is anticipating to graduate with a Bachelor of Science in Biomedical Photographic Communications in May 2014 and return home.

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