

BLOOD BASICS

What makes up our blood?

RED BLOOD CELLS (Erythrocytes) – The most abundant cells in our blood; they are produced in the bone marrow and contain a protein called hemoglobin that carries oxygen to our cells.

WHITE BLOOD CELLS (Leukocytes) – They are part of the immune system and destroy infectious agents called pathogens.

PLASMA – This is the yellowish liquid portion of blood that contains electrolytes, nutrients and vitamins, hormones, clotting factors, and proteins such as antibodies to fight infection.

PLATELETS (Thrombocytes) – The clotting factors that are carried in the plasma; they clot together in a process called coagulation to seal a wound and prevent a loss of blood.

Did you know?

The average adult has about five liters of blood inside of their body, which makes up 7-8% of their body weight.

Blood is living tissue that acts as a transportation system in our bodies. It also fights against infection and helps heal wounds.

There are about one billion red blood cells in two to three drops of blood. For every 600 red blood cells, there are about 40 platelets and one white cell.

Genetics of Blood

Your blood type is established before you are born, by specific **genes** inherited from your parents.

These two genes - one gene from your mother and one from your father - determine your blood type by causing proteins called **agglutinogens** to exist on the surface of all of your red blood cells.








There are **3 alleles or genes** for blood type: A, B, & O. Since we have 2 genes, there are 6 possible combinations: AA, AO, BB, BO, AB, and OO.

★ Give the genotype(s) for each blood type.

Type A = _____ Type AB = _____

Type B = _____ Type O = _____

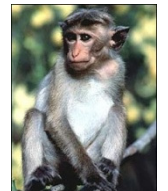
The ABO Blood System

Blood Type (genotype)	Type A (AA, AO)	Type B (BB, BO)	Type AB (AB)	Type O (OO)
Red Blood Cell Surface Proteins (phenotype)	 A agglutinogens only	 B agglutinogens only	 A and B agglutinogens	 No agglutinogens
Plasma Antibodies (phenotype)	 b agglutinin only	 a agglutinin only	NONE. No agglutinin	 a and b agglutinin

<http://learn.genetics.utah.edu/units/basics/blood/types.cfm>

What is the Rh (Rhesus) factor?

A certain blood protein was discovered while studying Rhesus monkeys. The presence of the protein, or lack of it, is known as the **Rh factor**.



★ Rh Blood → Has the protein

★ Rh Blood → Does not have the protein

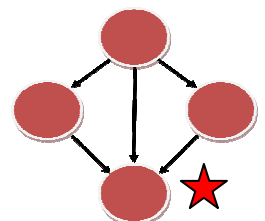
Blood Types

TYPE	DISTRIBUTION	RATIOS
O +	1 person in 3	38.4%
O -	1 person in 15	7.7%
A +	1 person in 3	32.3%
A -	1 person in 16	6.5%
B +	1 person in 12	9.4%
B -	1 person in 67	1.7%
AB +	1 person in 29	3.2%
AB -	1 person in 167	0.7%

<http://www.bloodbook.com/type-facts.html>

Who can give you blood?

People with **Type O** blood are called **universal donors**, because they can give blood to any blood type. People with **Type AB** blood are called **universal recipients**, because they can receive any blood type.



Fill in the diagram with the correct blood

Rh + → Can receive + or - Rh - → Can only receive -

BLOODSTAIN SCIENCE

BPA = Bloodstain Pattern Analysis

What can an investigator learn from the analysis of a blood spatter?

- Type and velocity of weapon
- Number of blows
- Handedness of assailant (right or left-handed)
- Position and movements of the victim and assailant during and after the attack
- Which wounds were inflicted first
- Type of injuries
- How long ago the crime was committed
- Whether death was immediate or delayed

Source: <http://science.howstuffworks.com/bloodstain-pattern-analysis1.htm>

BPA Terms

Spatter – Bloodstains created from the application of force to the area where the blood originated.

Origin/Source – The place from where the blood spatter came from or originated.

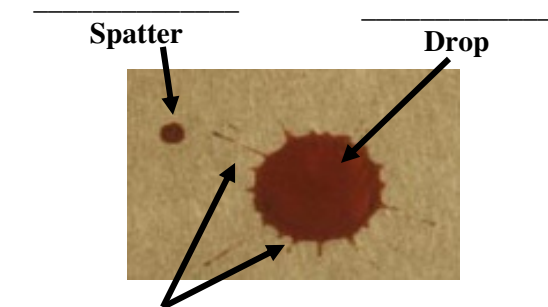
Angle of Impact – The angle at which a blood droplet strikes a surface.

Parent Drop – The droplet from which a satellite spatter originates.

Satellite Spatters – Small drops of blood that break off from the parent spatter when the blood droplet hits a surface.

Spines – The pointed edges of a stain that radiate out from the spatter; can help determine the direction from which the blood traveled.

★ Label the diagram.



Blood Detection Methods

Physical Examination & Light Source

Investigators will first examine the crime scene to look for areas that may contain blood. They may also use a high-intensity light or UV lights to help them find traces of blood as well as other bodily fluids that are not visible under normal lighting conditions.

Blood Reagent Tests (Called presumptive tests)

These tests are used to detect blood at crime scenes based upon the properties of hemoglobin in the blood. Further tests at the crime lab can determine if it is human blood or not. The Kastle-Meyer tests uses phenolphthalein and hydrogen peroxide, while HemaStix is a paper strip coated with TMB.

Luminol

This chemical is used to locate traces of blood, even if it has been cleaned or removed. Investigators spray a luminol solution throughout the area under investigation and look for reactions with the iron present in blood, which causes a blue luminescence.

Fluorescein

This chemical is also capable of detecting latent or old blood using a UV light and goggles. Areas with blood appear greenish-white. It may also react to many of the same things as luminol (copper and bleach).

LCV or Leuco Crystal Violet, is one type of chemical process that is used for blood enhancement to make the blood evidence more visible so it can be photographed and analyzed.

Types of Bloodstain Patterns

Passive Bloodstains - Patterns created from the force of gravity; can be a single drop, series of drops, flow patterns, blood pools, etc.

Projected Bloodstains - Patterns that occur when a force is applied to the source of the blood; includes low, medium, or high impact spatters, cast-off, arterial spurting, and expiratory blood blown out of the nose, mouth, or wound.

Transfer or Contact Bloodstains - These are created when a bloody object comes in contact with a target surface; may be used to identify an object or body part.