

BLOOD

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- Body fluid in circulatory system of humans and other vertebrates
- It delivers necessary substances such as nutrients and oxygen to the cells and transport metabolic waste products away from those same cells
- 7% - 8% body weight is blood
- Blood is circulated around the body through blood vessels by the pumping action of the heart. In animals with lungs, arterial blood carries oxygen from inhaled air to the tissues of the body, and venous blood carries carbon dioxide, a waste product of metabolism produced by cells, from the tissues to the lungs to be exhaled.

Components of blood

- Plasma
- RBC(Red Blood Cells) also known as Erythrocytes
- WBC (White Blood Cells) also know as Leukocytes
- Platelets

PLASMA

- Plasma is a thick fluid
- constitutes 55% of blood fluid, is mostly water (92% by volume), and rest is proteins, Nutrients, mineral ions, Waste products and gases
- Albumin is the main protein in plasma, and it

functions to regulate the colloidal osmotic pressure of blood.

- Other proteins present in plasma are immunoglobulins and clotting factors

RBC (Red blood cells)

- Constitute 40% of blood fluid.
- Hemoglobin is the main protein in RBC
- Function of Hemoglobin is to give red colour to the blood

WBC(White blood cells)

- WBC are very few in numbers
- Function of WBC is to protect against infection by strengthening the immune system.

PLATELETS

- Platelets are very few in numbers
- Functions of platelets is clotting of blood at site of wound.

FUNCTIONS OF BLOOD

- Supply of Oxygen to tissue.
- Supply of nutrients such as Glucose, Amino Acids and Fatty acids.
- Removal of Waste such as Carbon dioxide, Urea and Lactic acid.
- Regulation of Body Temperature.

MEDICOLOGICAL IMPORTANCE OF BLOOD

- In civil cases
- In criminal cases

In civil cases:- To find the Maternity and Paternity .

In criminal cases:- To find victim, offender, weapon, site of crime etc.

Civil Cases:-

1. Disputed paternity/maternity
2. Divorce and nullity of marriage

Criminal Cases:-

1. Identification of victim
2. Identification of offender, offending site, offending weapon, etc.

EXAMINATION OF BLOOD

Examination of blood/bloodstains consist of following steps:

1. Is it bloodstain?
2. If blood, whether human or animal? (What is species?)
3. If human, then:
 - Age of stain
 - Sex
 - Blood group
 - Distribution of pattern of bloodstains

1. Blood/Blood Stain or Not

Bloodstains may resemble rust stains or pan stains.

Therefore it is essential to determine whether the given sample is blood or not.

Identification of blood in stain is based on presence of

1. Blood cells — RBCs, WBCs, platelets
2. Hemoglobin and its derivatives
3. Serum proteins It is done by screening (preliminary test) and confirmatory tests

Screening Tests (preliminary test)

- Screening tests are based upon the principle of presence of enzyme peroxidase in red blood cells.
- Such reagents are used in these tests so that action of peroxidase is demonstrated with change in the colour of reagents, so that it could be said whether given sample is blood or not.

Following are chemical screening tests.

1. Benzidine test
2. Phenolphthalein test (Kastle-Meyer test)

1. Benzidine test

Benzidine + Hydrogen peroxide = Blue or green colour

1. Phenolphthalein test (Kastle-Meyer test)

Alkaline phenolphthalein + Hydrogen peroxide = pink colour

Advantages of Screening Test

1. Screening tests are sensitive tests
2. Less time is required and are economical

3. If screening tests are negative, then no need to proceed for confirmatory tests

Disadvantages of screening test

1. These are only screening tests and are not confirmatory
2. Tests can be positive with any organic substance, which contains peroxidase enzyme example sputum, pus, body fluid, green vegetable, apple, potato, onion, pan etc. So false positive results may be obtained.

Confirmatory Tests are:

1. Crystal tests, e.g. Teichmann test, Takayama test
2. Microscopic examination

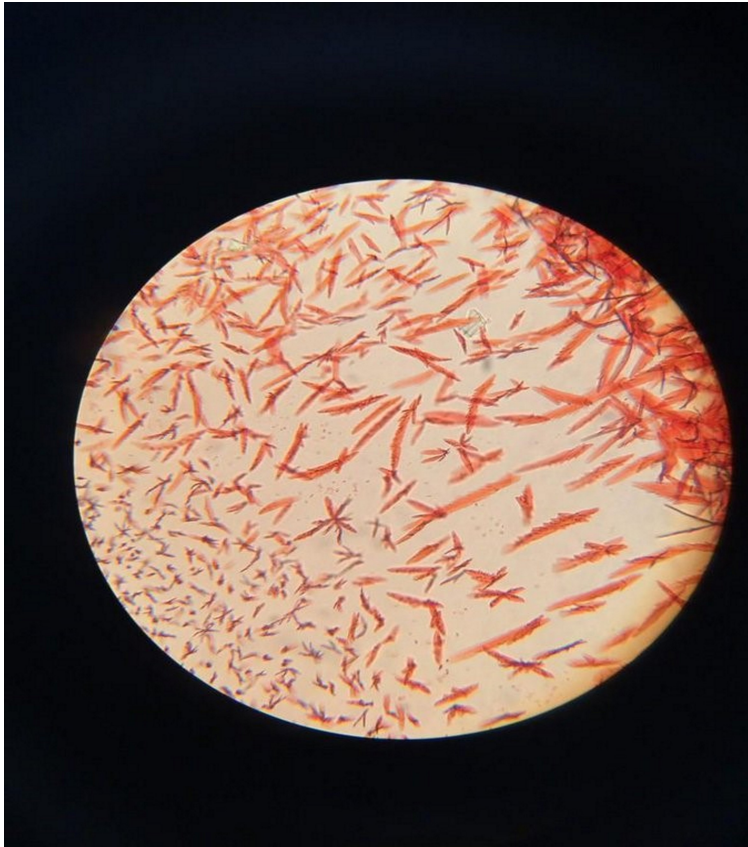
- **Teichmann test (Hemin crystal test):**

stain extract and few crystals of sodium chloride are taken and heated with glacial acetic acid. If stain happened to be blood, dark brown rhomboid shaped crystals will be formed as visible under microscope.



- **Takayama test (Hemochromogen crystal test):**

when blood stain extract is heated with Takayama reagent (Pyridin + NaOH + glucose & distilled water), pink feathery crystals will be visible under microscope



Human blood or not?

Microscopic Examination

- Microscopic examination can be done by wet film or stained smears with Leishman's stain.
- Presence of intact red blood cells confirmed presence of blood.
- The morphology of RBCs are noted as follows

Human — RBCs are circular, biconcave, non-nucleated

cells.

All mammals RBCs are circular, biconcave and non-nucleated cells except that of camels.

In camel, the RBCs are oval, biconvex and non-nucleated.

In birds, fish, amphibians and reptiles, RBCs are oval, biconvex and nucleated cells.

If human blood then:-

Age of Bloodstain

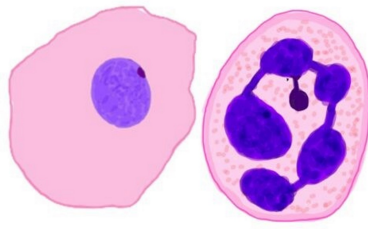
Age of a bloodstain can be known by:

- Change in colour, i.e. gross examination: fresh stains appear red and sticky. As age advances, it turns brown due to oxidation of hemoglobin to methemoglobin.
- Colour changes measured on colorimeter or spectrophotometer

Identification of Sex

Sex from bloodstains can be identified by

- Leishman stained blood films — for presence of Davidson body
- DNA analysis



DEVIDSON BODY:- Drumstick like structure present in WBC of females

Identification of Blood Group

The modern serological techniques have divided blood into three constituent classes for the discrimination of human blood. These are,

- 1.The blood grouping and typing antigens,
- 2.The polymorphic enzymes, and
- 3.The polymorphic proteins.

TYPES OF BLOOD GROUPS

- A+
- B+
- AB+
- O+
- A-
- B-
- AB-





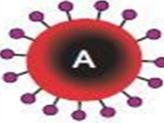
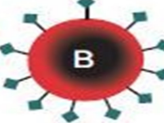








- O-

Rh factors present

- Positive+
- Negative-

ABO Blood grouping system





































ABO blood group system

				
Red blood cell type				
Antibodies in Plasma	 Anti-B	 Anti-A	None	 Anti-A and Anti-B
Antigens in Red Blood Cell	 A antigen	 B antigen	 A and B antigens	None

- Landsteiner established that the serum of one individual would clump the cells of another individual. This is because the cells contain a substance known as an antigen and the serum contains antibodies.
- Two types of antigens and antibodies are known i.e antigens A and antigens B and antibodies anti-A (alpha) and anti-B.
- In the blood of a human being, A and B antigens may occur separately, i.e A alone or

B alone, or they may be found together i.e AB, or they may be totally absent, i.e, O.

- A person having A antigen in his red blood cells has group A blood and B antigens has group B blood, a person having both A and B antigens in his blood cells, has group- O blood. A person having A antigen in his red blood cells, cannot have an anti-A antibody in his serum, for this would clump his own cells. The same is true of individuals having other antigenic properties. The table above shows antigen and antibodies present in different blood groups.

Anti-A	Anti-B	Anti-D	Control	Blood type
				O-positive
				O-negative
				A-positive
				A-negative
				B-positive
				B-negative
				AB-positive
				AB-negative
				Not valid

BLOOD TYPING

- Blood samples are mixed with anti A and anti B serum.

- Coagulation or no coagulation leads to determining blood type.
- Typing for ABO and Rh factors is done in the same manner.
Cross matching is also done

Direction and Distribution Pattern of Blood Stains

The pattern or distribution of blood or stains at the scene of crime is often helpful regarding the idea about the height and direction of blood fall.

- Blood falling vertically from low height (few centimeters):- Round or circular drops with sharply delineated margin
- Vertical fall above 30 cm :- Circular blood drop with irregular margin (prickly edges)
- the projections become finer with increase in height of fall
- Fall from an angle Drops striking surface obliquely may produce spear like shape or exclamation mark like appearance. The pointed end indicates the direction of motion.

