

Blood

Blood Consists of:

Formed elements are:

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-

Plasma contains

Percentages in blood:

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-

Three major proteins in plasma are:

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-
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Proteins are in a

Blood

Blood Consists of: formed elements suspended in plasma.

Formed elements are:

- Erythrocytes – red blood cells RBC
- White blood cells -leukocytes WBC
- Cell Fragments – plateletes or thrombocytes

Plasma contains 7% protein, 93% water.

Percentages in blood:

- 45% of blood are formed elements
- 55% is plasma.

Three major proteins in plasma are:

- Albumin – **50% of proteins**. 70% of colodal osmotic pressure
- Globulins – (coagulation, carrying other molecule, antibodies)
- Fibrinogen – clotting

Proteins are in a colodial suspension rather than dissolved.

More Blood

There are three types of globulins:

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-
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Homeostasis

Total volume of blood is 5 liters.

The term for the production of blood

Normal cell counts: (These are U.S. values)

- RBC's –
- WBC's –
- Platelets –

Hematopoiesis centers

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More Blood

There are three types of globulins:

- Alpha - Alpha and Beta – some blood coagulation, but mainly as transport molecules for other things traveling in the blood. (like hormones, enzymes, etc)
- Beta
- Gamma - act as antibodies.

Homeostasis – the body balance.

Total volume of blood is 5 liters.

The term for the production of blood hematopoiesis (all blood cells, not just RBC)

Normal cell counts: (These are U.S. values)

- RBC's – 4.5 to 5.5 million per cubic millimeter
- WBC's – 5,000 – 10,000 per cubic millimeter
- Platelets - 150,000 to 350,000 per cubic millimeter

Hematopoiesis centers

- babies – made in all bones and some organs,
- adults – sternum and hips.

Formed Elements

RBC

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WBC

Granulocytes

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-
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Agranulocytes

-
-

Thrombocytes

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Reticulocytes:

Two Terms

- -Blast
- -Cyte

Formed Elements

RBC

- Erythrocyte – the only kind.

WBC

Granulocytes

- Basophils – look black with so many vesicles (containing histamine)(allergic reaction)
- Neutrophils – most common. First line of defense. A phagocyte. The first cell that goes to the area of the injury
- Eosinophils – If you see more than you are supposed to see. It's a parasite (commonly)

Agranulocytes

- Lymphocytes – second most numerous. Deals with specific immunity. Deals with one and only one specific invader.
- Monocytes – a truly phagocytic cell. Largest of the WBC

Thrombocytes

- Parts of a bigger cell. It's involved with clotting.

Anything above "that line" in the circulating (out of the box) is a disease. They should not be there. (reticulocytes can, in small quantities can be found)

Two Terms

- Blast – a young cell (immature)
- Cyte – a mature cell

Red Blood Cells

RBC

They have no

In addition the RBC also lacks _____ Instead it

Hemoglobin is composed of

-
-

reticulocyte

- RBC lives about
- The reticulocytes has dark spots
- You should see about ___% to ___% of RBC's as reticulocytes.

RBC production is stimulated by the – kidneys.

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-
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The term for the production of RBC's is

Red Blood Cells

RBC smallest and most numerous cells.

They have no nucleus. It has been replaced by hemoglobin.

In addition to lacking a nucleus: the RBC also lacks mitochondria. Instead it gets its energy from the breakdown of glucose

Hemoglobin is composed of

- Heme – an iron containing porphyrin (a chemical substance)
- Globin – a protein.

reticulocyte An RBC just before it enters the blood.

- RBC lives about 120 days.
- The reticulocytes has dark spots in it that are the remnants of the nucleus. The first day that a retic enters the circulating blood you can still see the spots and this appearance is useful in understanding what is going on with RBC production.
- You should see about 1% to 2% of RBC's as reticulocytes.

RBC production is stimulated by the – kidneys.

- Specialized kidney cells respond to- low levels of oxygen in the blood by
- liberating an enzyme that stimulates erythropoietin.
- Which stimulates the stem cells in the bones which in turn produce of RBC's.

The term for the production of RBC's is erythropoiesis.

Iron

Iron in the body –

The body contains about

hemoglobin –

Apo ferritin –

Two types are:

-
-

Small amounts of iron circulate in the blood

Transferrin functions

- 1.
- 2.

Diet gives us

We absorb about

Iron

Iron in the body – essential for hemoglobin. (hgb) and myoglobin (like hemoglobin, but found in muscles)

The body contains about 4g of iron,

hemoglobin – contains about 75% of the iron in the body.

Apo ferritin – an iron containing protein found in the bone marrow, liver, spleen. (storage form for iron other than hemoglobin)

Two types are:

- Ferritin
- Hemosiderin

Small amounts of iron circulate in the blood attached to a protein called transferrin

Transferrin functions to transfer FE from two locations

1. GI Tract where iron is absorbed
2. Phagocytes that have recovered iron from the breakdown of old red blood cells

Diet gives us 10-20mg of iron today.

We absorb about 1mg a day. (women and kids absorb more. They need more because of periods and growth)

Hemoglobin

Hemoglobin molecules consist of

There are five types of globin chains

- 1.
- 2.
- 3.
- 4.
- 5.

There are different types of chains appear at different times in our development.

In adults

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-

The Embryo is initially

In the fetus it changes

Hemoglobin

Hemoglobin molecules consist of 4 globulin molecules, each with an embedded heme. The heme contains an atom of oxygen and actually attracts oxygen. It is protected by the globin. If the hemes get too close, they will attach to the oxygen and not let go.

There are five types of globin chains

1. Alpha
2. Beta
3. Gamma
4. Delta
5. Epsilon

There are different types of chains appear at different times in our development.

In adults

- 98% of the Hgb is 2 - Alpha and 2- beta chains.(Adult HBG, or HGB-A)
- 2% is 2- alpha and 2- delta. (HGB-A₂)

The Embryo is initially all epsilon.

In the fetus it changes to 2 - alpha and 2- gamma globins. This is called Hgb-F

The change to Hgb-A begins at birth.

WBC's

Granulocytes

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Agranulocytes include:

- - Specific immunity**
 - Antigen** –
 - Antibody** –
-

Percentages:

- Neutrophils –
- Basophils –
- Eosinophils –
- Lymphocytes –
- Monocytes –

WBC's

Granulocytes

- Neutrophil – phagocytosis of bacteria, viruses, and other foreign material. (usually the first WBC on the scene)
- Eosinophil – phagocytosis of antigen-antibody complex (also in parasitic infections)(and allergic reactions)
- Basophil – also plays a role in allergic reactions, its part of the histamine reaction. (granules contain histamines)

Agranulocytes include:

- Lymphocyte – smallest of the white cells, functions in playing the major role in the body's immune response.

Specific immunity

Antigen – material that is most often a protein or can be a large carbohydrate molecule that the body senses as being foreign (referred to as non-self)

Antibody – a gamma globulin that will react to one specific antigen.

- Monocyte – functions as a scavenger cell. Most often cleaning up debris outside the vascular system. Also the chief defense against some chronic diseases. Outside the vascular system it's called a macrophage

Percentages:

- Neutrophils – 65%
- Basophils – 1%
- Eosinophils - 2%
- Lymphocytes 30%
- Monocytes – 3%

Clotting

Plateletes –

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-

Hemostasis –

Coagulation factors –

Extrinsic pathway

Intrinsic pathway

Both of them

Common pathway

They both end in

Coagulation cascade –

The factors were numbered

Clotting

Plateletes – thrombocytes

- involved with blood clotting
- average numbers 150,000 – 350,000 per cubic millimeter

Hemostasis – Refers to the the stopping of bleeding.

Coagulation factors – A group of precursor substances that circulate in the blood that are activated when blood clotting is needed/required.

Extrinsic pathway (break in vessel) Starts with III, fewer steps

Intrinsic pathway (damage within vessel) Starts with XII (more steps)

Both of them eventually lead to factor X.

Common pathway start with X

They both end in Factor I, Factor XIII stabilizes the clot after Factor I.

Coagulation cascade – the factors are activated in a stepwise fashion to the final step which is a blood clot.

The factors were numbered as they were found rather than in the order in which they are activated.

ABO Blood Type

- Antigen –
- Antibody –
- Genotype –
- Phenotype –
- Agglutinogen –
- Agglutinin –
- Blood Types:

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-
-
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Type A, or B is considered dominant over type O. Not Quite! $A + B = (AO/AA + BO/BB) = AB$

	<i>White</i>	<i>Black</i>	<i>Japanese</i>	<i>Chinese</i>	<i>American Indian</i>	<i>Hawaiians</i>
Type A - 41%	27%	38%	28%	76%	61%	
Type B - 10%	21%	22%	23%	0%	1.5%	
Type O - 45%	48%	31%	36%	23%	37%	
Type AB - 4%	4%	9%	13%	1%	0.5%	

ABO Types

- Antigen – something that's outside the body.
- Antibody – a specific cell or chemical that attacks the antigen. (we'll consider it a chemical)
- Genotype – Our total body composition. It's what our gene say we are or what we might be. Our total genetic composition.
- Phenotype – how our genotype presents.
- Agglutinogen – think antigen. It's A or B. It gives the blood type it's designation. It's found on the surface of the RBC if it exists.
- Agglutinin – think antibody
- Blood Types:

- Type A – contain A antigens. Blood carries B antibodies
- Type B – contain B antigens. Blood carries A antibodies
- Type AB – contain A & B antigens. Blood carries no antibodies
- Type O – contain no antigens. Blood carries A & B antibodies

Type A, or B is considered dominant over type O. Not Quite! $A + B = (AO/AA + BO/BB) = AB$

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Rh Types

Rh –

Patients with Rh Antigens -

Patients without Rh Antigens -

This Means –

Percentages:

- Whites:
- Blacks:
- Asians:
- American Indians:
- Hawaiians:

RH Types

Rh – refers to Rhesus monkey.

Patients with Rh Antigens - (Aka agglutinogens called “D”) Are called Rh+

Patients without Rh Antigens - Are called Rh-. They do not automatically called an Rh Antibody. If and only if they are exposed to Rh+ blood do they form an Rh Antibody.

This Means – It is important to worry about in the case of mother Rh- and child Rh+ for the second child. In cases of blood transfusions, etc...

Percentages:

- Whites: 85%
- Blacks: 95% (88%?)
- Asians: 99.9%
- American Indians: 99.9%
- Hawaiians: 99.9%