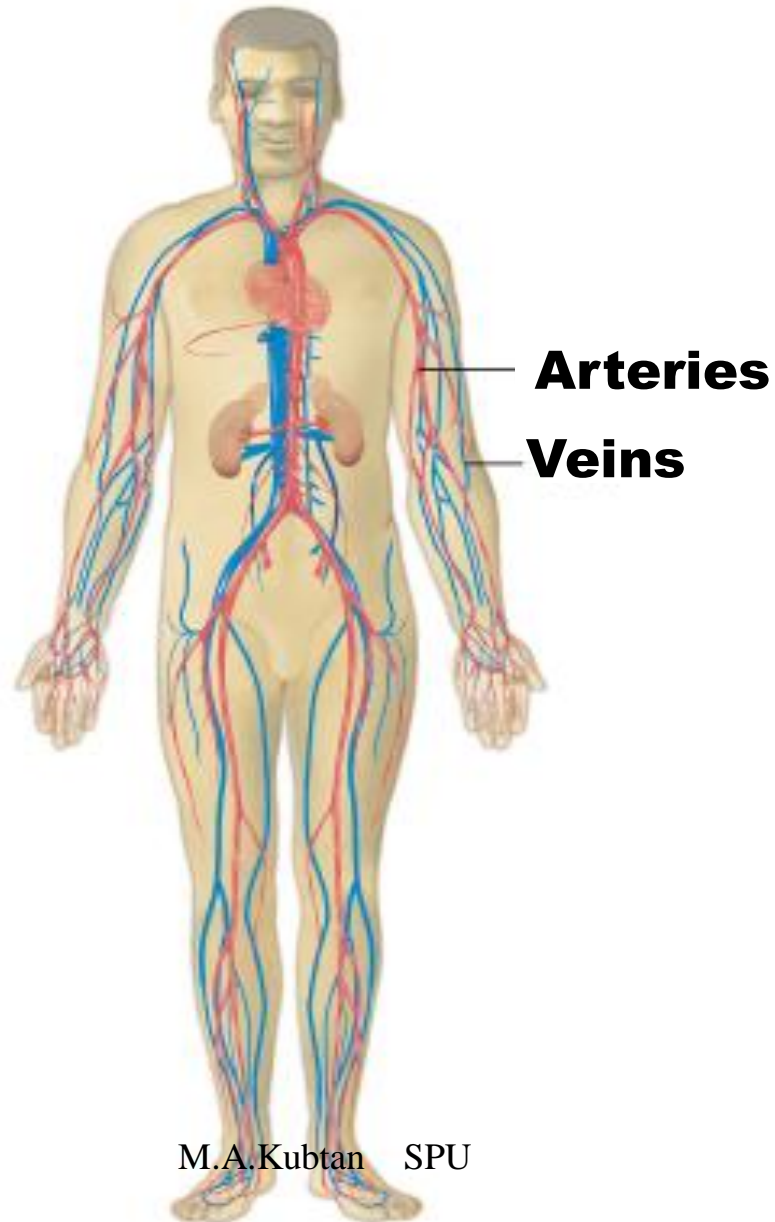


The Blood System



Objectives

After studying this chapter, you will be able to

- **Name the parts of the blood system and discuss the function of each part**
- **Define combining forms used in building words that relate to the blood system**
- **Identify the meaning of related abbreviations**
- **Name the common diagnoses, clinical procedures, and laboratory tests used in treating the blood system**

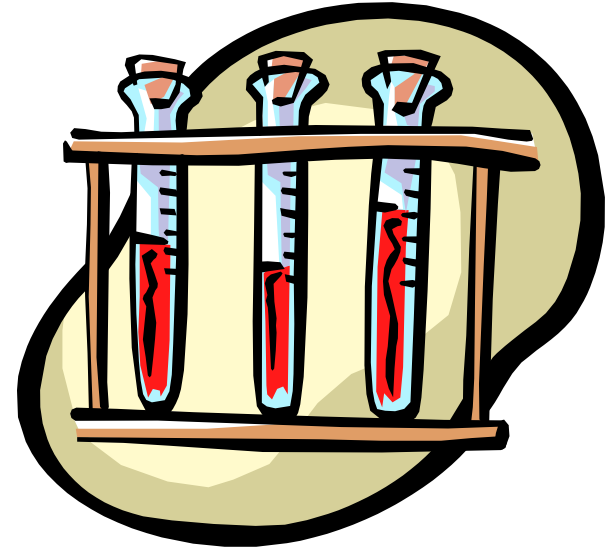
Objectives cont'd

- **List and define the major pathological conditions of the blood system**
- **Explain the meaning of surgical terms related to the blood system**
- **Recognize common pharmacological agents used in treating the blood system**

Structure and Function

Blood

- **complex mixture of cells, water, proteins and sugars**
- **transports nutrients, oxygen, and hormones to all parts of the body**
- **helps regulate body temperature**



- **helps maintain stability of the body's fluid volume**
- **transports waste products away from body cells**

Structure and Function



Without **blood,
human life is
impossible**

Blood Composition

Fluid Portion

-Plasma consisting of:

- water
- proteins
- salts
- nutrients
- vitamins
- hormones

Cellular Portion

-Blood cells consisting of:

- red blood cells
- white blood cells
- platelets

NOTE: If some proteins and blood cells were removed from plasma the remaining fluid would be called serum .

Structure and Function

Plasma

Clear liquid made up of 92% water and 8% organic and inorganic biochemicals.

albumin

globulin

Plasma Proteins

fibrinogen

prothrombin

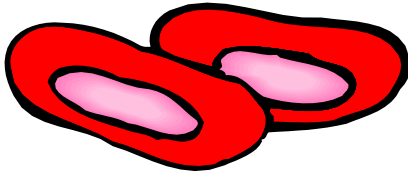
Structure and Function

Red Blood Cells

- Also known as **erythrocytes**
- Produced in the bone marrow in response to **erythropoietin**
- Mature red blood cells have no nucleus and appear **biconcave**
- **Hemoglobin** is a protein in red blood cells that is essential to the transport of oxygen
- Red blood cells live about 120 days

Structure and Function

Red Blood Cell



Hemoglobin

heme

globin

Red Blood Cell Count

Average red blood cells in a cubic millimeter of blood

Male = 4.6 to 6.4

Female = 4.2 to 5.4

Structure and Function

Leukocytes

- Also known as **white blood cells**
- Function to destroy foreign substances
- Two main groups are **granulocytes** and **agranulocytes**

Granulocytes

Neutrophils

Eosinophils

Basophils

Agranulocytes

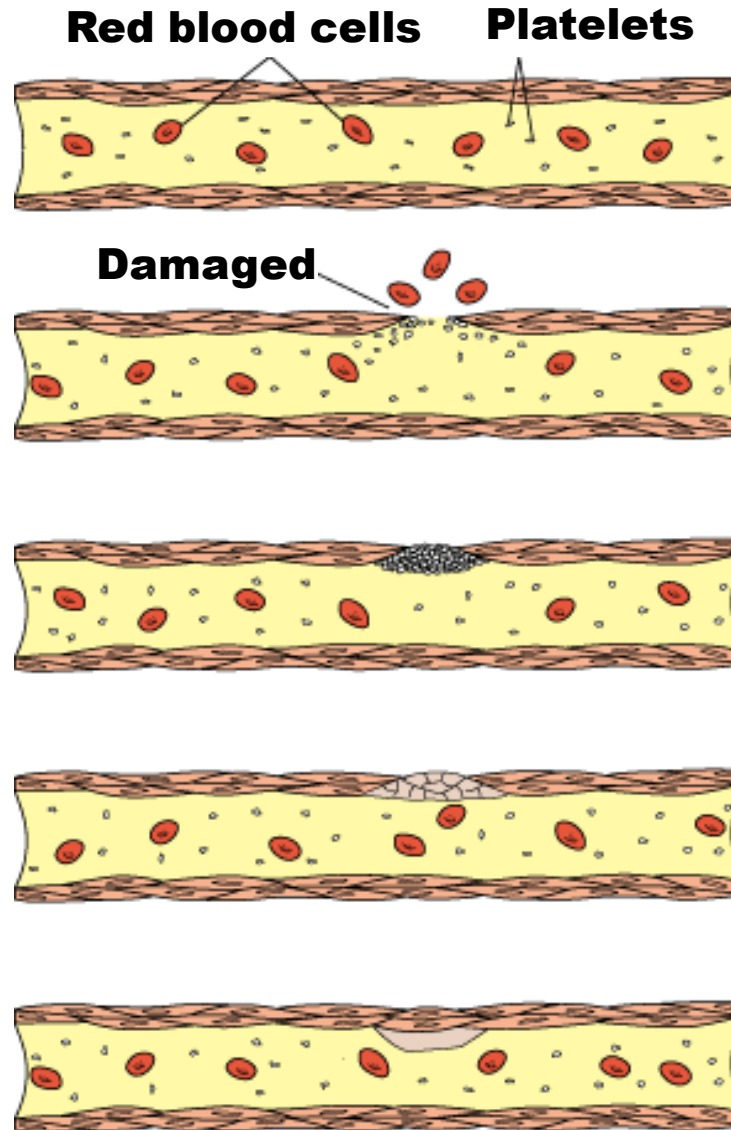
Monocytes

Lymphocytes

Structure and Function

Platelets

- Also known as thrombocytes.
- Live for about 10 days
- Assist in blood clotting



Platelets begin to adhere to tissue edges and to each other as blood escapes.

They form a soft platelet plug.

Other clotting factors make this a stable plug or clot.

Tissue mends and anti-thrombin, and other agents break down the clot.

Structure and Function

Blood Types

- **Four human blood types or groups exist**
- **Individuals needing a blood transfusion must be karyotyped.**
- **Blood typing is based on the presence of **antigens** and **antibodies**.**



Blood Types

A, B, AB, O

People with type O blood can donate to all other types and are called universal donors. Individuals with type AB are called universal recipients.

Structure and Function

Rh Factor

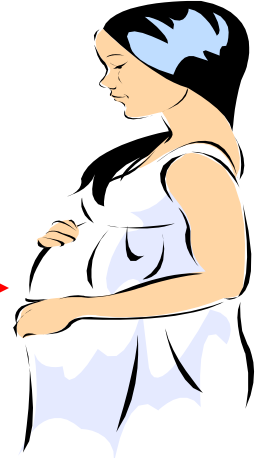
In addition to the blood type, there is a positive or negative element found in the blood.

- **Rh positive blood contains an **antigen** first identified in the rhesus monkeys.**
- **Rh negative blood does not contain the antigen.**

The Rh factor is very important during pregnancy because a mother that is Rh negative carrying a Rh positive fetus will develop antibodies to fight Rh positive blood cells with future pregnancies.



Structure and Function



First Pregnancy

**Rh negative
mom with Rh
positive fetus**

Antibodies develop

Second Pregnancy

**Another Rh
positive fetus**

**If this mother did not receive
Rhogam after her first
delivery, this baby's blood
cells will be attacked
(**erythroblastosis fetalis**)
which could be fatal for the
baby.**

Combining Forms and Abbreviations

Combining Form

Meaning

agglutin (o)	→	agglutinin
eosino	→	eosinophil
erythr (o)	→	red
hemat (o)	→	blood
leuk (o)	→	white
phag (o)	→	eating, devouring
thromb (o)	→	blood clot

Combining Forms and Abbreviations

Abbreviation

Meaning

APTT_____ **activated partial thromboplastin time**

baso_____ **basophil**

BCP_____ **biochemistry panel**

BMT_____ **bone marrow transplant**

CBC_____ **complete blood count**

diff_____ **differential blood count**

eos_____ **eosinophils**

Combining Forms and Abbreviations

Abbreviation

Meaning

ESR	erythrocyte sedimentation rate
G-CSF	granulocyte colony-stimulating factor
GM-CSF	granulocyte macrophage colony-stimulating factor
HCT	hematocrit
HGB	hemoglobin
MCH	mean corpuscular hemoglobin

Combining Forms and Abbreviations

Abbreviation

Meaning

MCV	→	mean corpuscular volume
mono	→	monocyte
PCV	→	packed cell volume
PLT	→	platelet count
PMN	→	polymorphonuclear neutrophil
PT	→	prothrombin time
PTT	→	partial thromboplastin time

Combining Forms and Abbreviations

Abbreviation

Meaning

RBC — . — . — . — red blood cell count

SR — . — . — . — sedimentation rate

seg — . — . — . — segmented mature white blood cells

WBC — . — . — . — white blood cell count

Diagnostic, Procedural, and Laboratory Terms

The withdrawal of blood for examination, known as **venipuncture or **phlebotomy**, is used very frequently as a diagnostic tool.**



Diagnostic, Procedural, and Laboratory Terms

Common Blood Analyses

- **complete blood count**

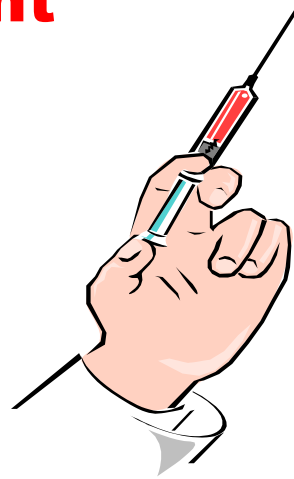
- common screen for basic medical checkup

- **blood indices**

- measures size, volume and content of red blood cells

- **Coomb's test**

- tests for antibodies on red blood cells



- **erythrocyte sedimentation rate**

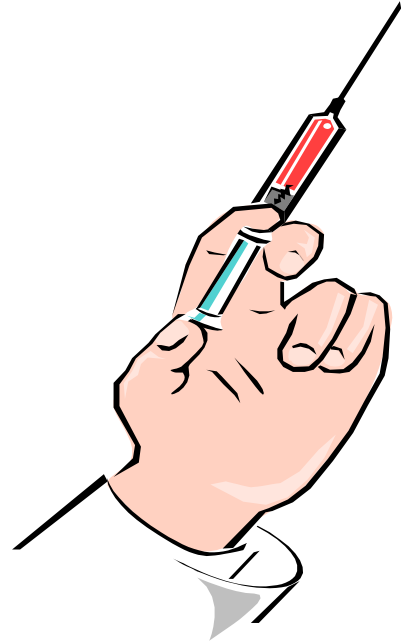
- measures rate at which red blood cells fall through plasma

- **hematocrit**

- measures packed red blood cells in a sample

Diagnostic, Procedural, and Laboratory Terms

Common Blood Analyses



- **blood chemistry**

- tests plasma for various substances such as glucose and electrolytes

- **white blood cell differential**

- tests number and types of leukocytes

- **prothrombin time**

- tests for coagulation defects

- **blood culture**

- tests a blood specimen in a culture to identify the presence of microorganisms

- **hemoglobin**

- measures level of hemoglobin in the blood

Pathological Terms

Dyscrasia is a general term for any disease of the blood with abnormal material present.

•Anemia

•General term for a condition in which red blood cells do not transport enough oxygen to the tissues

•Causes may be related to a low number of cells or due to a low amount of hemoglobin

Common Types of Anemia

- iron-deficiency anemia
- aplastic anemia
- pernicious anemia

- sickle cell anemia
- hemolytic anemia
- posthemorrhagic anemia

Pathological Terms

Disorders Related to Excessive Bleeding

Hemophilia

- **Hereditary disorder in which there is a lack of the clotting factor VIII**
- **Treated with medications and blood transfusions**

Thrombocytopenia

- **Bleeding disorder with a lack of platelets**
- **Occurs in the condition called purpura which is the presence of multiple tiny hemorrhages under the skin**

Pathological Terms

Disorders Related to Substances in the Blood

pancytopenia

- Low number of all blood cells

hemochromatosis

- Hereditary disorder that causes excessive iron to build up in the blood



Common Disorders

erythropenia

- Low number of red blood cells

poikilocytosis

- Irregularly shaped red blood cells

reticulocytosis

- Abnormal number of immature red blood cells

Pathological Terms

hemolysis

- Breakdown in red blood cell membrane

macrocytosis

- Abnormally large red blood cells

Common Disorders cont'd

aniosocytosis

- Red blood cells vary in size and shape

polycythemia

- Abnormal increase in red blood cells and hemoglobin

microcytosis

- Abnormally small red blood cells

Pathological Terms

White Blood Cell Disorders

Leukemia

- **Neoplastic disorder in which there is an excessive increase in white blood cells**

Granulocytosis

- **Abnormal increase of granulocytes in the bloodstream. Commonly seen during times of infection**

Multiple Myeloma

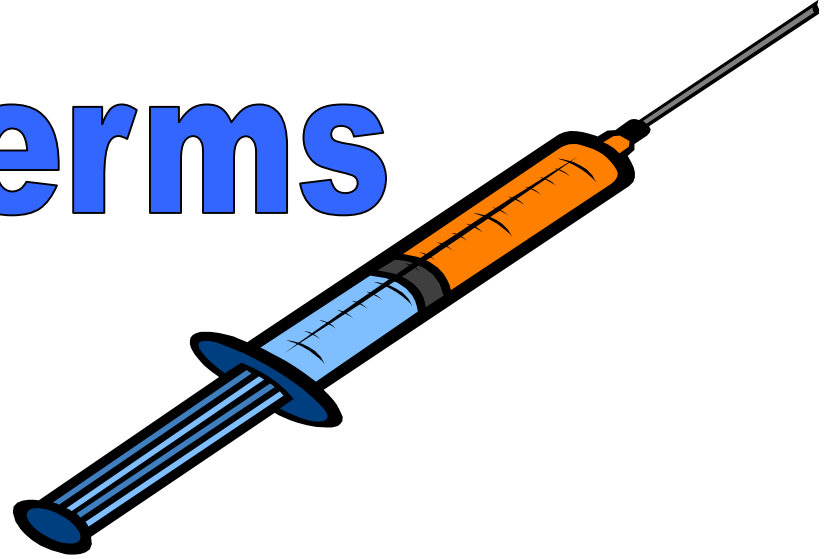
- **Malignant tumor of the bone marrow**

Surgical Terms

Common Procedures

Bone Marrow Biopsy

- **Needle is inserted into the bone marrow cavity and bone marrow is removed for analysis**



Bone Marrow Transplant

- **Performed for serious conditions such as leukemia**
- **Donor bone marrow is inserted into the patient's bone marrow**

Pharmacological Terms

Anticoagulants

Prevents blood from clotting

Common Anticoagulants

Generic Name

- warfarin
- heparin
- aspirin



Pharmacological Terms

Coagulants

Aid in the clotting of blood

Common Coagulants

Generic Name

- **phytonadione**
- **vitamin K**



Pharmacological Terms

Hemostatics

Stops blood flow within the vessels

Common Hemostatics

Generic Name

- **desmopressin**
- **aminocaproic acid**



Pharmacological Terms

Thrombolytics

Dissolves blood clots

Common Thrombolytics

Generic Name

- alteplase
- anistreplase
- streptokinase
- urokinase



Apply Your Knowledge

Jamie is in an auto accident. His medic alert bracelet reads “hemophiliac”. Which of the following conditions would be most serious for Jamie?

A. Infection

B. Bleeding

C. Fracture

Answer: B. Bleeding

Apply Your Knowledge

Sara is in desperate need of a blood transfusion. After type and cross match of the following individuals, which would most likely be the best donor for Sarah, whose blood type is A+?

A. John, type B-

B. Carol, type AB+

C. Steve, Type O+

Answer: C. Steve, type O+