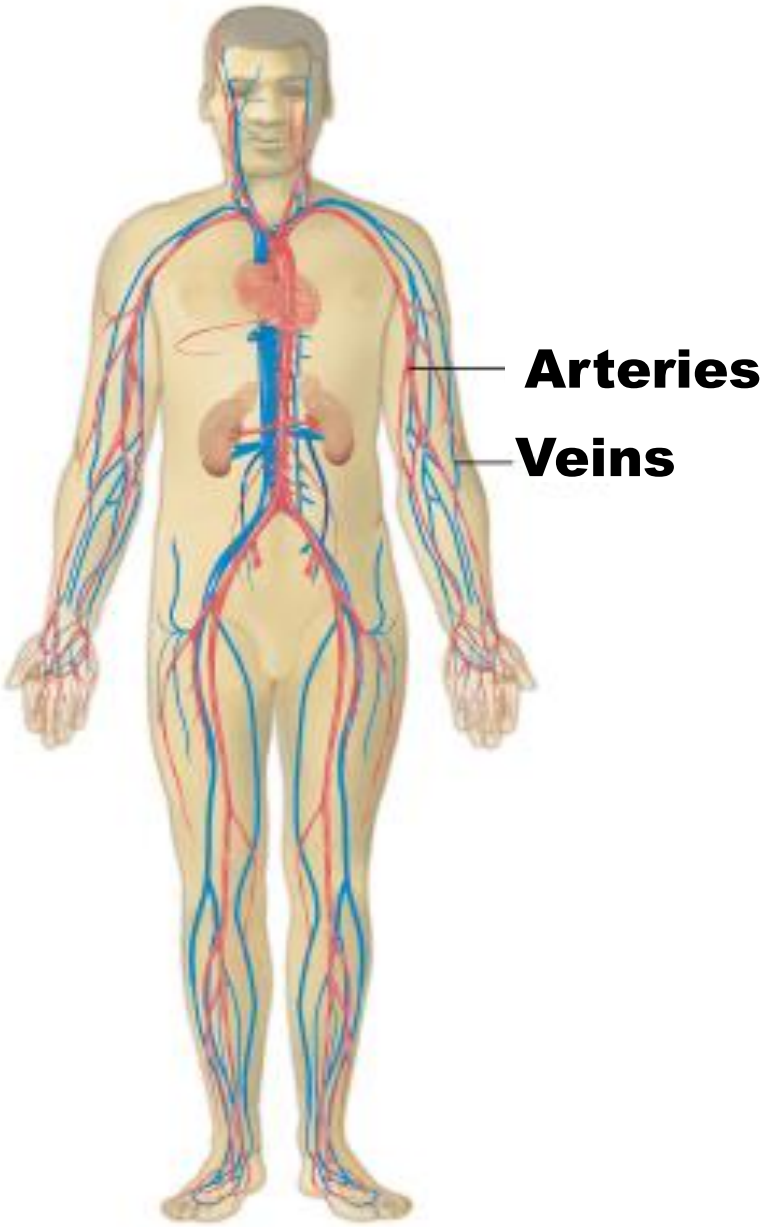
The Blood System



Objectives

After studying this chapter, you will be able to

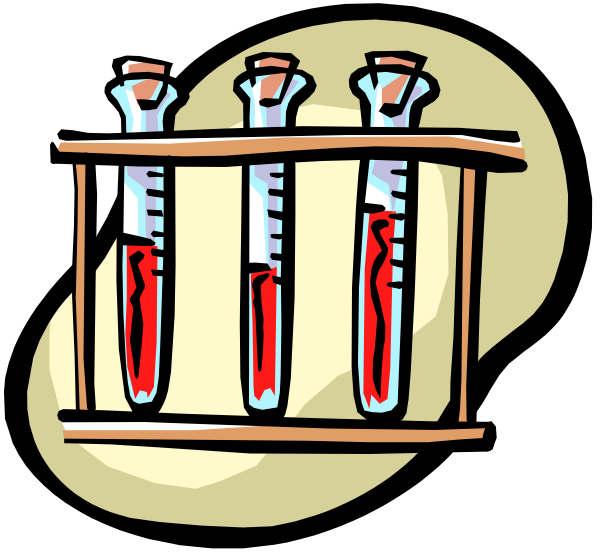
- **Name the parts of the blood system and discuss the function of each part**
- **Define combining forms used in building words that relate to the blood system**
- **Identify the meaning of related abbreviations**
- **Name the common diagnoses, clinical procedures, and laboratory tests used in treating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

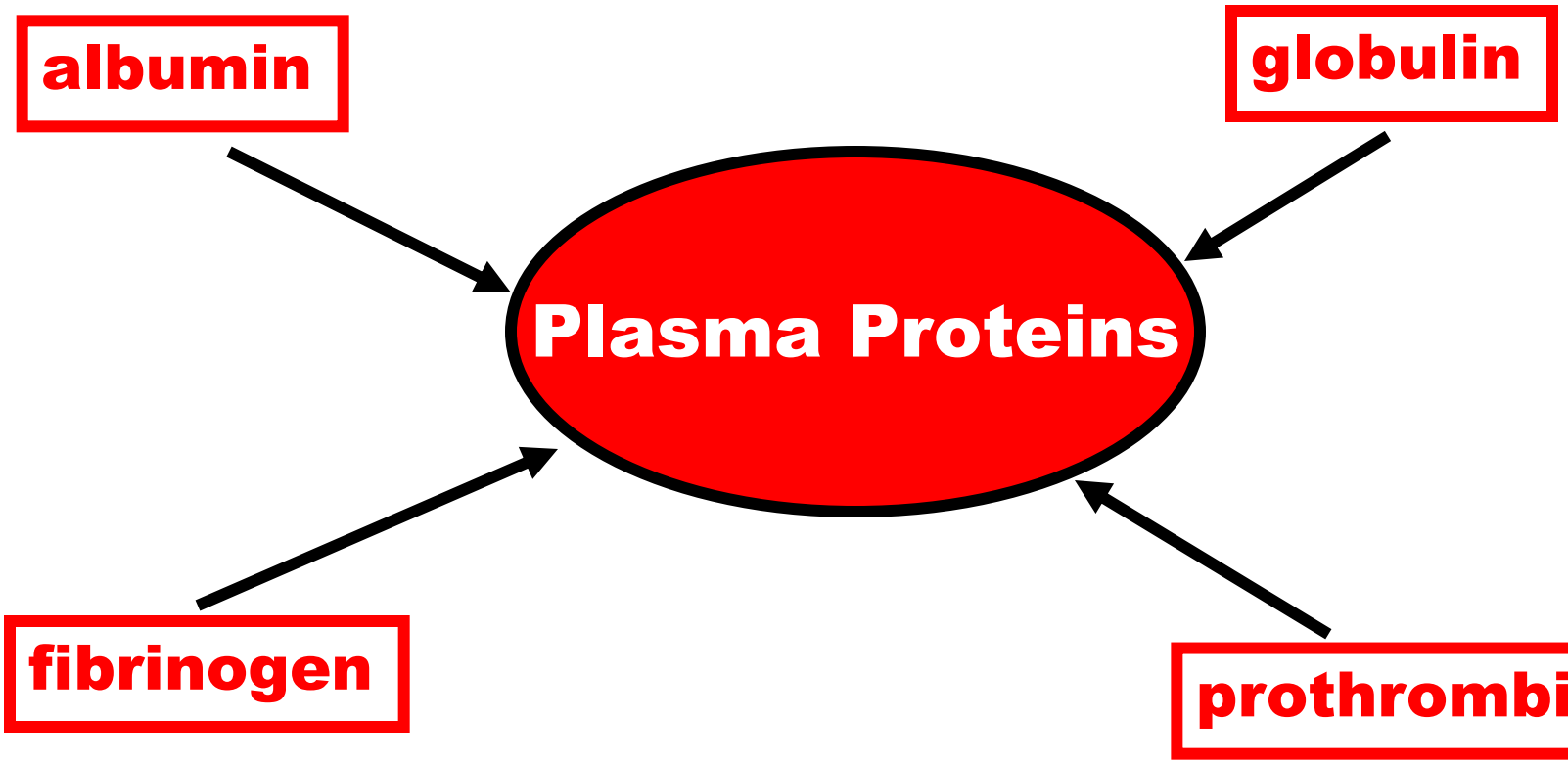
- **red blood cells**
- **white blood cells**
- **platelets**

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.



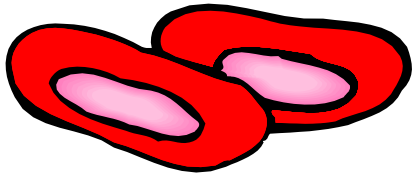
Structure and Function

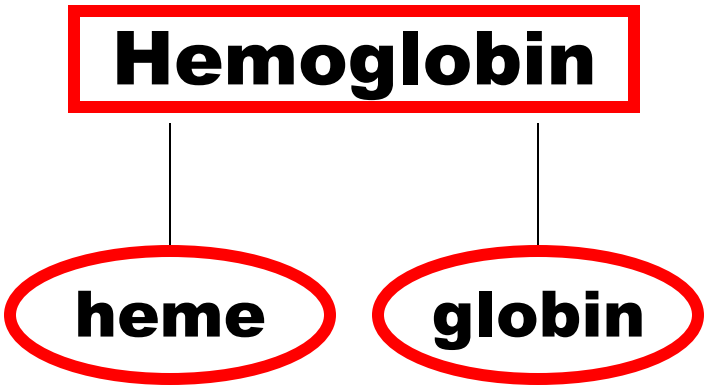
Red Blood Cells

- 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





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

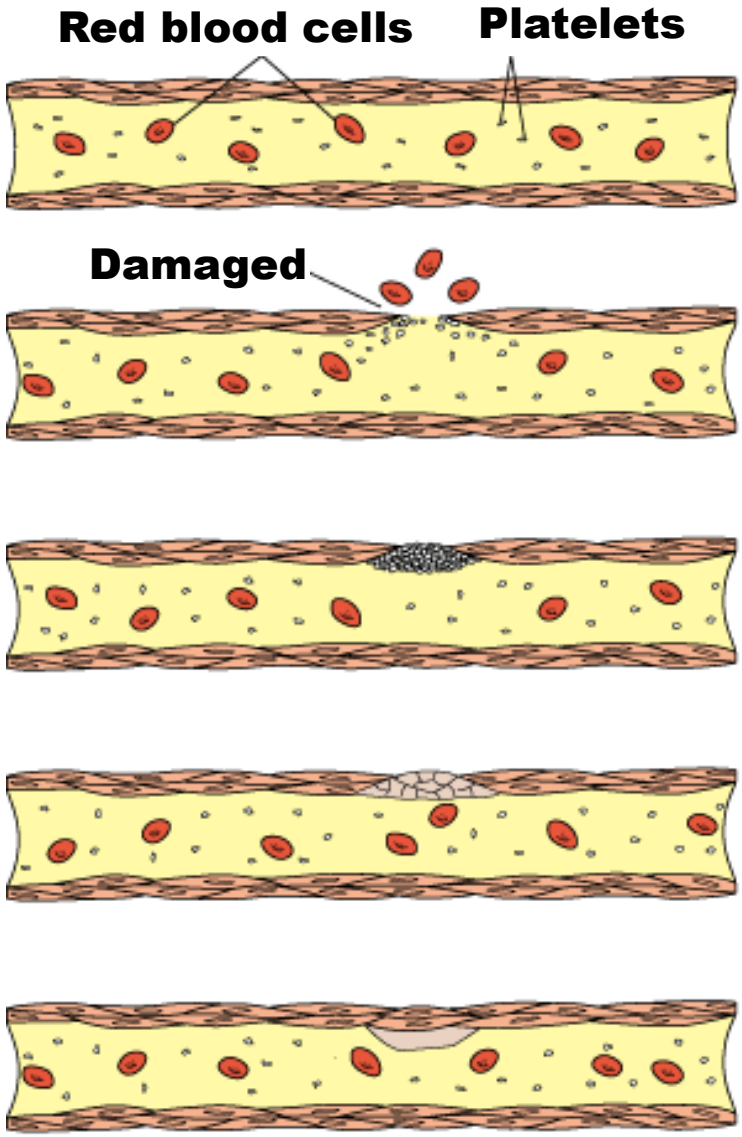
- Also known as white blood cells
- Function to destroy foreign substances
- Two main groups are granulocytes and agranulocytes

Granulocytes	Agranulocytes
Neutrophils	Monocytes
Eosinophils	Lymphocytes
Basophils	

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

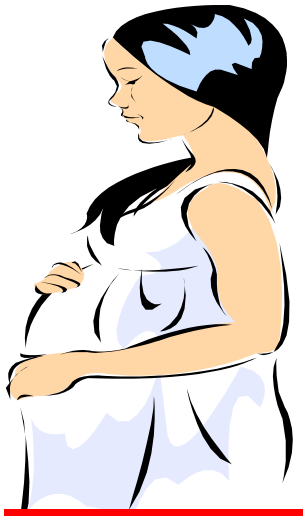
Rh Factor

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.

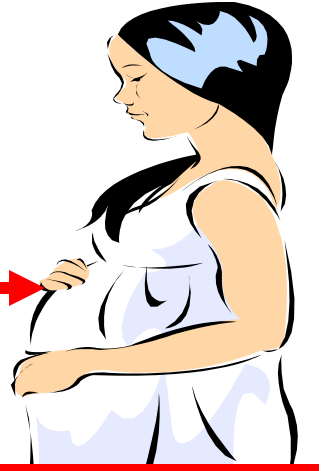
Structure and Function



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

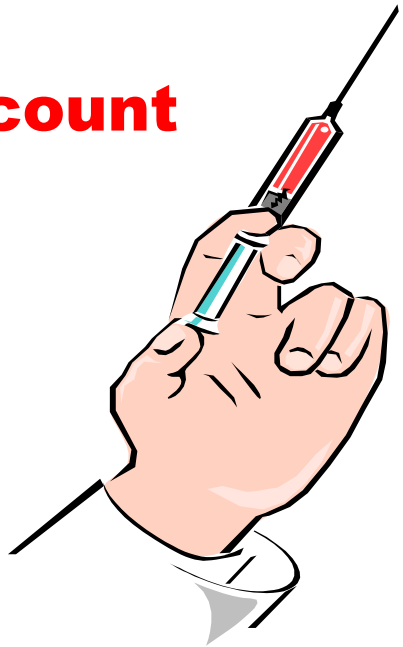
Abbreviation	Meaning
RBC	red blood cell count
SR	sedimentation rate
seg	segmented mature white blood cells
WBC	white blood cell count

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

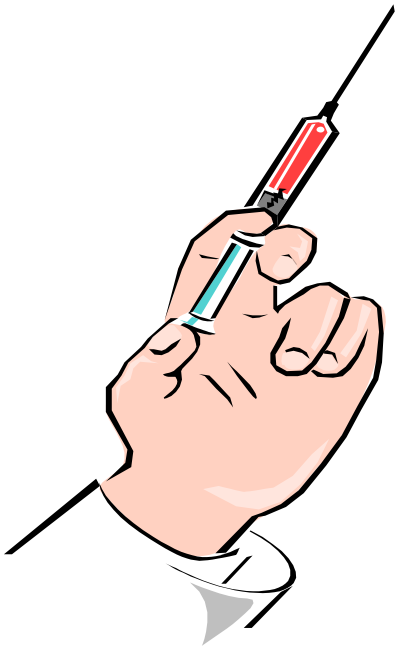


- **complete blood count**
  - -common screen for basic medical checkup
- **blood indices**
  - -measures size, volume and content of red blood cells
- **Coomb's test**
  - -tests for antibodies on red blood cells
- **erythrocyte sedimentation rate**
  - -measures rate at which red blood cells fall through 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
- **blood culture**
  - -tests a blood specimen in a culture to identify the presence of microorganisms



- **white blood cell differential**
  - -tests number and types of leukocytes
- **hemoglobin**
  - -measures level of hemoglobin in the blood
- **prothrombin time**
  - -tests for coagulation defects

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

erythropenia

- Low number of red blood cells

poikilocytosis

- Irregularly shaped red blood cells

hemochromatosis

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

reticulocytosis

- Abnormal number of immature red blood cells

Pathological Terms

hemolysis

•Breakdown in red blood cell membrane

polycythemia

•Abnormal increase in red blood cells and hemoglobin

macrocytosis

•Abnormally large red blood cells

aniosocytosis

•Red blood cells vary in size and shape

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

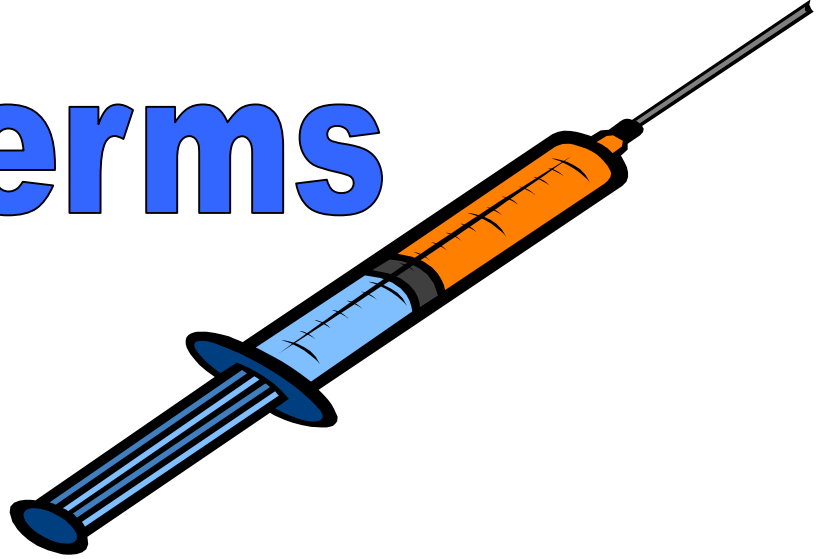
Granulocytosis

- 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	Trade Name
•warfarin	Coumadin®
•heparin	Calciparine®
•aspirin	Bayer®

Pharmacological Terms

Coagulants

Aid in the clotting of blood

Common Coagulants

Generic Name	Trade Name
•phytonadione	Mephyton®
•vitamin K	Konakion®

Pharmacological Terms

Hemostatics

Stops blood flow within the vessels

Common Hemostatics

Generic Name	Trade Name
•desmopressin	Concentraid®
•aminocaproic acid	Amicar®

Pharmacological Terms

Thrombolytics

Dissolves blood clots

Common Thrombolytics

Generic Name	Trade Name
•alteplase	Activase®
•anistreplase	Eminase®
•streptokinase	Streptase®
•urokinase	Abbokinase®

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+

Apply Your Knowledge

Mr. Harrell has had a heart attack and his physician instructs him to take an over-the-counter medication that will keep his blood "thin". Which of the following medications would be appropriate?

A. Mylanta

B. Bayer

C. Doan's Pills

Answer: B. Bayer