**Blood** (chapter 13) **Page 1**

## Blood

The liquid connective tissue that transports substances throughout the body

• Blood transports nutrients and oxygen to the cells and carries away

 the cell’s CO2 and other wastes

 • Blood also contains cells and proteins that fight infections

 • Blood is composed of plasma (a liquid) and the formed elements

 (the blood cells)

Fig 13.1

Plasma

 The liquid part of the blood; It transports dissolved molecules

 • The plasma is about 55% of the total blood volume

 • Mostly water, with the following dissolved molecules:

 • Salts (ions/electrolytes)

 √ Examples: Na+, K+, Ca2+

 • Nutrients and monomers

 √ Examples: Glucose, fatty acids, amino acids

 • Cellular wastes

 √ Examples: CO2, urea

 • Proteins

√ Examples: Albumin (a blood protein for osmotic

 balance and pH buffering), antibodies, and clotting

 proteins

 • Hormones

Fig 13.1, table 13.1

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Formed elements (blood cells)

 The cells suspended in the plasma

 • The blood cells are about 45% of the total blood volume

• There are three major blood cell types: Red blood cells, white blood

 cells, and platelets.

 • Red blood cells (RBCs, erythrocytes) = Blood cells that carry O2

 √ Flat round cells with an indent on each face

 √ No nucleus or other major organelles

 √ RBCs are filled with the protein hemoglobin, which binds O2

 √ They are the most numerous of the formed elements

• White blood cells (WBCs, leukocytes) = Blood cells that fight infections and cancer

 √ There are five white blood cell types

 • Platelets = Tiny irregular shaped cells that involved in blood clotting

Figs 13.2 and 13.3; table 13.2

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Formation of blood cells

 All blood cells are formed from stem cells in the red marrow of

bones

• Mostly in ribs, sternum, pelvis, and skull bones

 • Blood cell formation is controlled by hormones

 √ Erythropoietin (EPO) increases RBCs production

√ Cytokines and interleukins increase WBC prduction

Fig 13.4; table 15.7

Anemia

 Weakness due to inability of blood to carry sufficient O2

 Possible causes of anemia:

 • Lack of iron in diet

 √ Hemoglobin uses iron to bind the oxygen it carries

 • Loss of erythrocytes through bleeding

 • Chemotherapy

 • Hemolytic (bursting RBCs) diseases

 √ Examples: Malaria, sickle cell anemia

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Hemostasis

 The series of events that stops blood from flowing out of a broken

blood vessel

• Hemostasis begins with platelets binding to the exposed collagen in

 the connective tissue around the vessel

 (1) Vasocontriction (constriction of the blood vessel) occurs to slow

 blood flow

 • Vasoconstriction is caused by molecules secreted from

 the platelets bound to the collagen

 (2) A platelet plug forms

 • The platelets in the cut stick to the collagen and to each other

(3) Coagulation (formation of a solid clot that stops the bleeding and

 covers the break until the tissues are repaired)

 • The blood clot is a web of fibrin protein with trapped RBCs

 and platelets

• Fibrin = A large sticky protein made by linking smaller

 fibrinogen proteins together

 • Thrombin = The blood enzyme that links fibrinogen together

 to make fibrin

 √ Thrombin is made from prothrombin (an inactive

 precursor)

√ Molecules secreted from torn cells and tissues

 activate a series of clotting factor proteins, which in

 turn activate prothrombin to become thrombin

 • Serum = The liquid left in a blood sample after it has clotted

 (plasma without fibrinogen)

Figs 13.7, 13.8, 13.9; table 13.4

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Disorders of hemostasis:

 • Inability to stop bleeding

 √ Causes: Hemophilia (genetic lack of a clotting factor),

 deficiency in vitamin K, low platelet count

 • Thrombus = A clot that forms in an unbroken blood vessel

 √ Embolus = Anything that can block a blood vessel, such as a

 dislodged thrombus that travels in the blood stream

√ Myocardial infarctions are usually caused by a thrombus

 blocking a coronary artery that is already partially blocked by

 plaque

Fig 13.9; table 13.5

Thrombolytic drugs

 Medicines that dissolve a thrombus

 • Given to patients to dissolve an existing thrombus (to treat a heart

 attack, stroke, or pulmonary embolism)

Anticoagulant (blood thinners)

 Medicines that inhibit hemostasis

 • Given to patients to prevent thrombus formation (to reduce the risk

 of heart attack or stroke)

 • Examples: Coumadin, heparin, aspirin

Fig 13.9; table 13.5

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Antigen

 Molecules (usually proteins, carbohydrates, and lipids on the surface

of a cell) that the immune system can interact with

 • Foreign antigen = A molecule that does *not* occur naturally the body

 √ The immune system attacks cells that have foreign antigens

 using proteins called antibodies

 • Self antigen = A molecule that does occur naturally in the body

 √ The immune system does not attack cells that have self

 antigens

Fig 15.8

Blood types (blood groups)

 Different types of blood caused by different antigens on RBCs

 • There are 3 major antigens that can be found on RBCs:

 √ A antigen , B antigen, and Rh antigen

 • There are 8 possible blood types, based on which antigens are found

 on the person's RBCs\*

 √ A+, A-, B+, B-, AB+, AB-, O+, or O-

 \* O = Neither A nor B antigen is present

 \* + = Rh antigen is present, - = No Rh antigen

 Table 13.3

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Blood transfusion

 Giving blood to a patient

 • Transfusion mismatch = Giving a patient a transfusion of blood that

 has a foreign RBC antigen to that patient (can be fatal)

 √ The RBCs with foreign antigen are lysed by the patient’s

 antibodies

 √ The cellular debris clogs the patient’s blood vessels

 • Never give a patient blood cells that have a foreign RBC antigen to

 that patient

Fig 13.5; table 13.3

A method of finding safe blood types for transfusion to a patient

 (1) Make a table of all 8 blood types

 (2) Write the patient’s blood type next to the table

 (3) Below the patient’s blood type, make a list of the antigens that are

 foreign to the patient

 √ These are all the antigens that the patient does **not** have

 (4) On the blood type table, cross out any blood types that have any of

 the patient’s foreign antigens

(5) The not-crossed out blood types are safe to give to the patient