Blood – Chapter 10

Blood

The only fluid tissue in the human body
Classified as a ____________________ tissue
Living cells = _______________ _________________
Non-living matrix = ___________________

Blood Components (Fig 10.1, pg. 309)

Physical Characteristics of Blood

Color range:
Oxygen-rich blood is _____________ red
Oxygen-poor blood is ________ red
pH must remain between 7.35-7.45 (slightly ____________________)
Blood temperature is slightly _______________ than body temperature
Volume in healthy males is _______ liters

Blood Plasma

Composed of approximately 90 percent ______________
Includes many dissolved substances:
  - Nutrients -
  - Salts (metal ions) -
  - Respiratory gases -
  - Hormones
  - Proteins
  - Waste products

Plasma Proteins

_______________ – regulates osmotic pressure
_______________ proteins – help to stem blood loss when a blood vessel is injured
_______________ – help protect the body from antigens

Formed elements

___________________ = red blood cells (RBCs)
___________________ = white blood cells (WBCs)
_________________ = cell fragments

Characteristics of Formed Elements (Table 10.2, pg. 313)

Erythrocytes (RBCs)

The main function is to carry _______________
Anatomy of circulating RBCs:
_______________ disks
Essentially bags of ___________________
______________ (no nucleus)
Contain very few organelles
Outnumber WBCs 1000:1

Hemoglobin

_______________-containing protein
Binds strongly, but _________________, to oxygen
Each hemoglobin molecule has________ oxygen binding sites
Each erythrocyte has 250 million hemoglobin molecules

Sickle Cell Anemia (pg. 310-11)

Leukocytes (WBCs)

Crucial in the body’s defense against _______________
These are complete cells, with a nucleus and organelles
Able to move into and out of blood vessels (__________________)
Can move by _________________ motion
Can respond to chemicals released by damaged tissues
Leukocyte Levels in Blood
Normal levels are between 4,000 and 11,000 cells per millimeter
Abnormal leukocyte levels:

Above 11,000 leukocytes/ml
Generally indicates an infection or leukemia

Abnormally low leukocyte level
Commonly caused by certain drugs, such as corticosteroids and anticancer agents

Types of Leukocytes (p. 313)
Granulocytes-

Agranulocytes-

Platelets
Derived from ruptured multinucleate cells
Needed for the clotting process
Normal platelet count = 300,000/mm³

Hematopoiesis
Blood cell formation
Occurs in ________________
All blood cells are derived from a common stem cell
Hemocytoblast differentiation
______________ stem cell produces lymphocytes
______________ stem cell produces other formed elements

Fate of Erythrocytes
Unable to divide, grow, or synthesize proteins
Wear out in ______ days
When worn out, are eliminated by phagocytes in the spleen or liver
Lost cells are replaced by division of hemocytoblasts in the red bone marrow

Control of RBC Production
Rate is controlled by a hormone (erythropoietin)
Kidneys produce most erythropoietin as a response to reduced oxygen levels in the blood
Homeostasis is maintained by negative feedback from blood oxygen levels

Jaundice
___________ is an accumulation of a product of hemoglobin catabolism (bilirubin) in the blood producing a yellow color of the skin
___________ is responsible for the yellow color in bruises, urine, and in newborns, whose immature liver cannot rid the body of bilirubin fast enough

Hemostasis
Stoppage of blood flow
Result of a break in a blood vessel
Involves three phases:
1. ____________ formation
2. ________________
3. ________________

1. Platelet Plug Formation
___________ fibers are exposed by a break in a blood vessel
Platelets become “___________” and cling to fibers
Anchored platelets release chemicals to attract more platelets. Platelets pile up to form a clot.

2. Vascular Spasms
Anchored platelets release serotonin. Serotonin causes blood vessel muscles to contract. Spasms constrict the blood vessel, decreasing blood loss.

3. Coagulation
Injured tissues release a phospholipid, PF₃. PF₃ interacts with thromboplastin, blood protein clotting factors, and calcium ions to trigger a clotting cascade. Thrombin converts prothrombin to thrombin (an enzyme). Thrombin joins fibrinogen proteins into hair-like fibrin. A meshwork forms (the basis for a clot).

Blood Clotting
Blood usually clots within 10 to 40 minutes. The clot remains as endothelium. The clot is broken down after tissue repair.

Undesirable Clotting
A clot in an unbroken blood vessel can be deadly in areas like the heart.
A thrombus that breaks away and floats freely in the bloodstream can later clog vessels in critical areas such as the brain.

Bleeding Disorders
Platelet deficiency can cause bleeding from small blood vessels that require platelets for clotting.

Hereditary bleeding disorder normal clotting factors are missing.

Blood Groups and Transfusions
Large losses of blood have serious consequences. Loss of 15 to 30 percent causes shock, which can be fatal. Transfusions are the only way to replace blood quickly. Transfused blood must be of the same type.

Human Blood Groups
Blood contains genetically determined proteins. A foreign protein may be attacked by the immune system. Blood is “typed” by using antibodies that will cause blood with certain proteins to clump. There are over 30 common red blood cell antigens. The most vigorous transfusion reactions are caused by ________ and ________ blood group antigens.

ABO Blood Groups
ABO Grouping is based on the presence or absence of two antigens: Type A Type B. The ________ of these antigens is called Type O. The presence of both A and B is called Type AB. The presence of either A or B is called Types A and B, respectively.
Rh Blood Groups
Named because of the presence or absence of one of eight Rh antigens (agglutinogen D, originally identified in _______________ ________________ )
Most Americans are ______
Problems can occur in mixing Rh+ blood into a body with ______ blood

Rh Dangers During Pregnancy
Danger is only when the mother is ______ and the father is ______, and the child inherits the Rh+ factor
The mismatch of an Rh- mother carrying an Rh+ baby can cause problems for the unborn child
The first pregnancy usually proceeds without problems
The immune system is _______________ after the first pregnancy
In a second pregnancy, the mother’s immune system produces antibodies to ______ the Rh+ blood
(__________________ disease of the newborn)

Blood Typing
Blood samples are mixed with anti-A and anti-B serum
____________ or no coagulation leads to determining blood type
Typing for ABO and Rh factors is done in the same manner
_________________ – testing for agglutination of donor RBCs by the recipient’s serum, and vice versa

Phlebotomy Technician
Phlebotomy comes from the Greek for “________” and “____ _________”
A Phlebotomist is trained to collect and process blood samples for laboratory analysis

**ABO Practice:**
Use Punnett Square cross to predict the offspring for:
  1. Types AB and O parents:

  2. Heterozygous A and heterozygous B parents:

  3. Two type AB parents:

  4. Complete the table:

<table>
<thead>
<tr>
<th>Blood Type</th>
<th>Antigens on red blood cells</th>
<th>Antibodies produced in body</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AB-</td>
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</tr>
<tr>
<td>O-</td>
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<td>O+</td>
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