

Anatomy & Physiology 12

Circulation – Blood

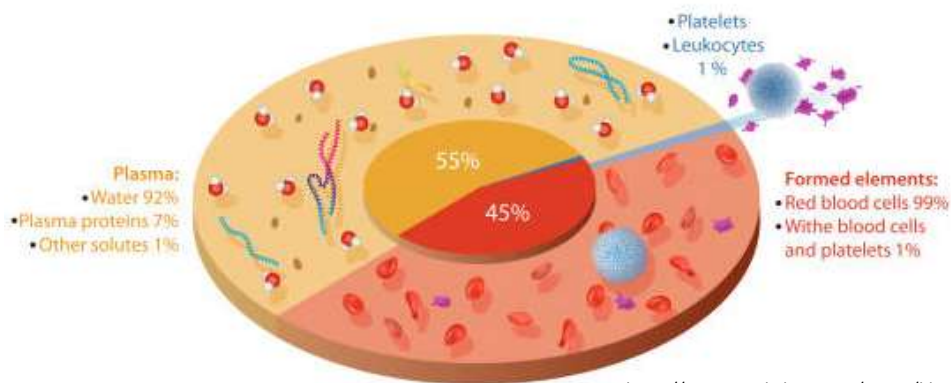
Do intro activity pg. 296.

Blood (pg. 299-305)

- A liquid connective tissue that has many functions
 - transports nutrients, water and metabolic waste products around the body
 - transports hormones
 - helps regulate body temperature
 - helps regulate blood pressure
 - helps protect against invasion by pathogens
 - helps heal cuts and other wounds

Two Parts of Blood

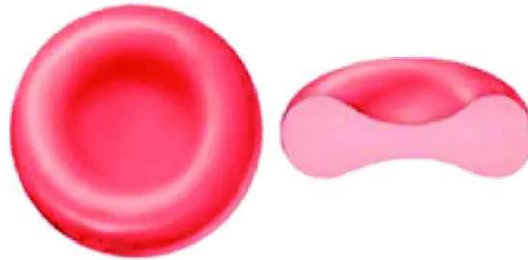
1. Plasma
 - 55% of blood is plasma
 - 90% of plasma is water
 - 7-8% of plasma are plasma proteins
 - because they are too large to leave the capillaries, the solute concentration in the capillaries is higher than in tissue cells, so water diffuses into the capillaries --> helps maintain blood volume
 - used in transporting large organic molecules such as cholesterol and bilirubin
 - antibodies for fighting infection
 - fibrinogen used for blood clotting
- also contains nutrients, gases, hormones, vitamins, and waste products



<https://www.istockphoto.com/vector/blood-composition-diagram-gm1547970269-526198389?searchscope=image%2Cfilm>

2. Formed Elements
 - 45% of the blood
 - composed mainly of red blood cells (> 44%), and white blood cells and platelets (< 1%)
 - Red Blood Cells
 - approximately 7-8 um in diameter
 - made by bone marrow

- has no nucleus → life span of 120 days
- contain hemoglobin --> red iron-containing pigment that carries oxygen
- biconcave shape
 - maximize surface area:volume ratio → maximizes diffusion of oxygen across the cell membrane
 - maximizes flexibility



- White Blood Cells
 - important in fighting off infections

Blood Clot Formation

- also referred to as coagulation
- three components necessary for this process
 - a. platelets
 - manufactured by the fragmentation of large cells called megakaryocytes located in the bone marrow
 - b. prothrombin (a globular protein)
 - manufactured in liver
 - Vitamin K is necessary for the production of prothrombin, therefore the lack of it in the diet is linked to hemorrhagic (bleeding) disorders
 - c. fibrinogen
 - manufactured in the liver
- when a blood vessel has been damaged
 - platelets clumping together at the site of injury → partially seals the puncture
 - injured tissues release a chemical called prothrombin activator → converts prothrombin to thrombin (requires Ca^{2+})
 - thrombin acts as an enzyme to convert fibrinogen to fibrin by severing two short amino acid chains from each fibrinogen molecule
 - the amino acid chains link end-to-end to form long threads
 - these threads wind around the platelet plug to form a framework which traps red blood cells

Blood Typing

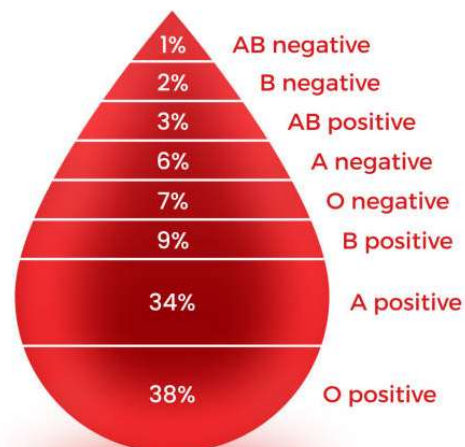
- two possible antigens present on red blood cells → antigen A and B
 - if A antigen present → type A blood
 - if B antigen present → type B blood
 - if both antigens present → type AB blood
 - if neither antigen present → type O blood

- within the plasma of a person there are antibodies to these antigens
 - type A blood has the B antibody
 - type B blood has the A antibody
 - type AB blood has neither antibody
 - type O blood has both antibodies
- if the donor's blood type matches the antibodies in the recipient's blood, then it is not compatible and agglutination will occur → donor's blood cells clump together inside the blood vessels
- this is dangerous because this condition may lead to heart attack or stroke

BLOOD GROUP	A	B	AB	O
RED BLOOD CELL TYPE				
ANTIGENES IN RED BLOOD CELLS	 A ANTIGEN	 B ANTIGEN	 A AND B ANTIGEN	NONE
ANTIBODIES IN PLASMA	 ANTI-B	 ANTI-A	NONE	  ANTI-B ANTI-A

<https://www.istockphoto.com/vector/abo-blood-group-system-blood-groups-with-antigens-and-antibodies-gm2135107973-568202244?searchscope=image%2Cfilm>

anti-A	anti-B	anti-Rh	type blood
			O ⁺
			A ⁻
			B ⁺
			AB ⁻



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Questions

1. What is the shape of a red blood cell? What is this shape helpful for a red blood cell to have?
2. What is the name of the oxygen carrying pigment in blood?
3. Name the three types of Granular Leukocytes and state the main function of each?
4. Name the two types of Agranular Leukocytes and state the main function of each?
5. Indicate successful blood transfusions:

A to B	_____	A to AB	_____	A to O	_____
A to A	_____	B to B	_____	B to AB	_____
B to O	_____	B to A	_____	AB to B	_____
AB to AB	_____	AB to O	_____	AB to A	_____
O to B	_____	O to AB	_____	O to O	_____
O to A	_____				

6. In the three circles below, draw in the results of blood typing for someone who is blood type A+.

