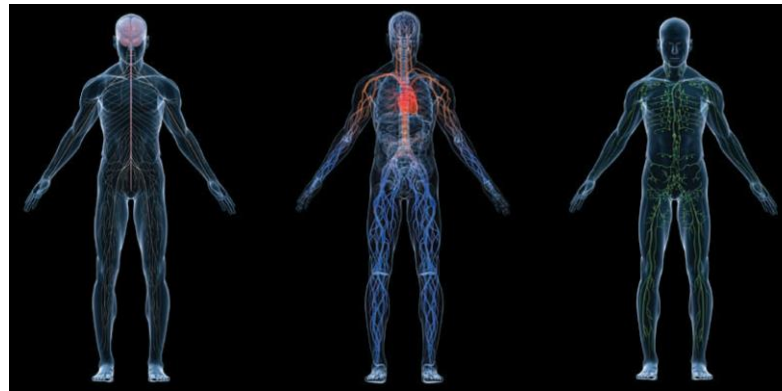


UNIT VI

Chapter 33



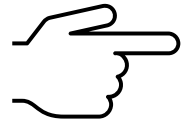
GUYTON AND HALL TEXTBOOK OF **MEDICAL PHYSIOLOGY**



Introduction: Red Blood Cells, Anemia
and Polycythemia

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Learning Objectives

- Identify blood components (formed elements), their main characteristics and functions.
- Understand genesis of blood cells (hematopoiesis)
- Describe regulation red blood cells production
- Identify requirements for erythropoiesis
- Describe red blood cells cycle
- Define abnormalities of red blood cells

Functions of Blood

- Transport

O₂, CO₂, nutrients, wastes, hormones

- Regulation

pH, temp, Bp, Osm. P, volume

- Protection

Clot, immune, proteins

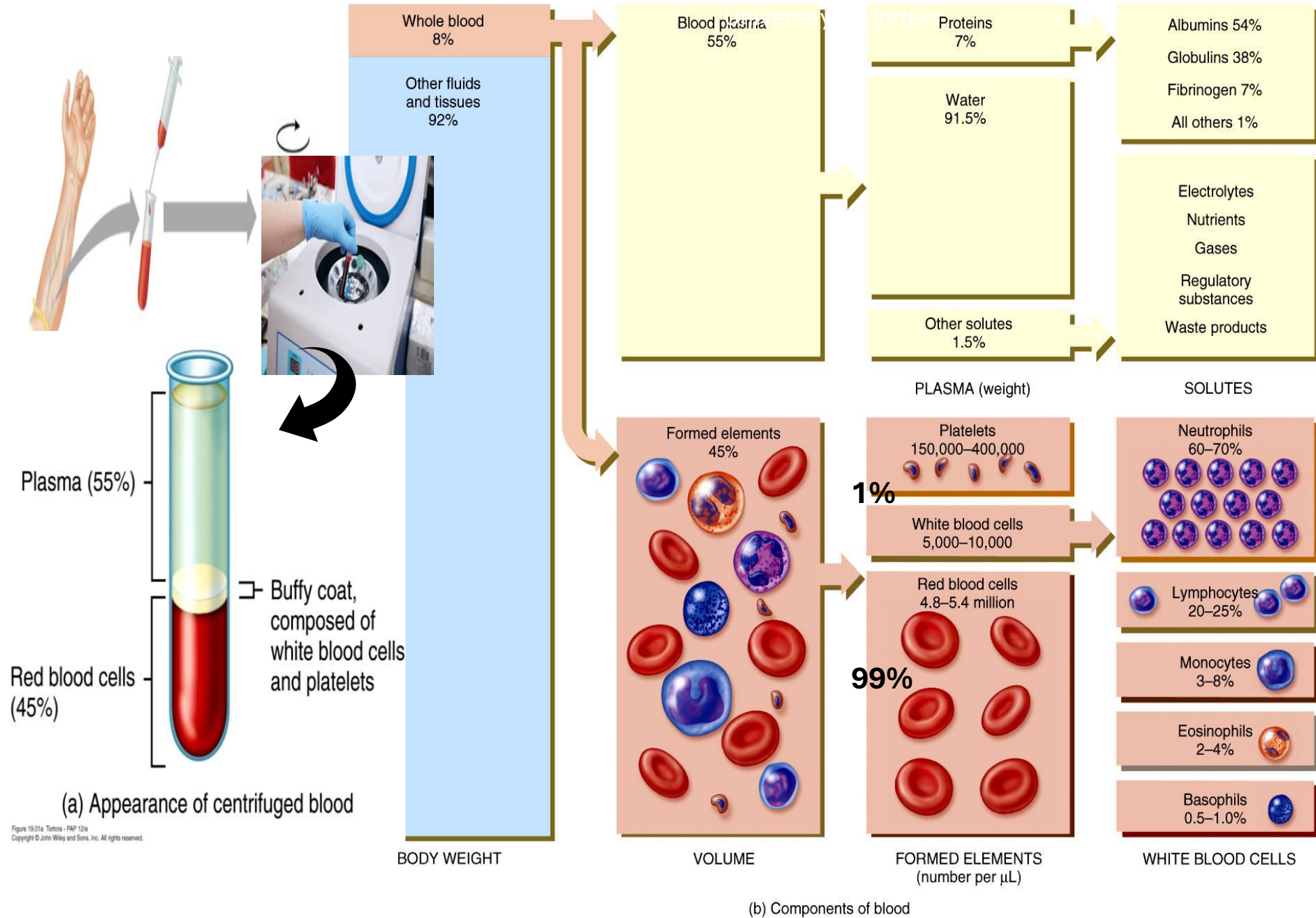


Figure 19.01b Tortora - PAP 12/e
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- Blood physical characteristics:
- 38 C
- Viscous sticky
- alkaline pH 7.35-7.45
- Color depends on O₂ (bright-dark) red
- 20% of ECF, 8% by weight
- Blood volume: 5-6 males, 4-5 females
/ Body size
- Hormonal regulation: RAAS, ANP, ADH



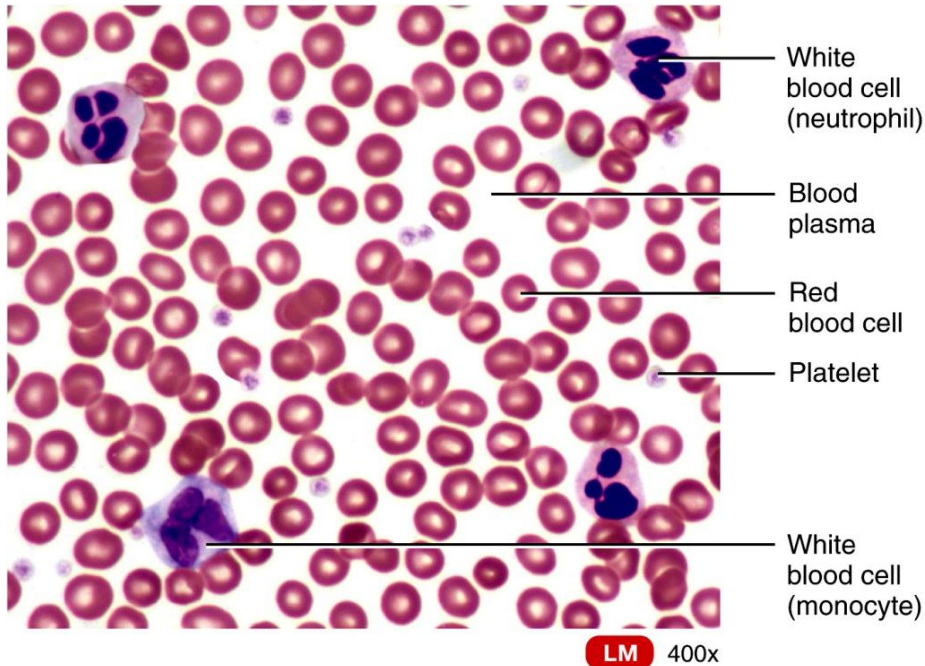
Question

Are all blood sampling tubes the same? And procedures?

Tubes:

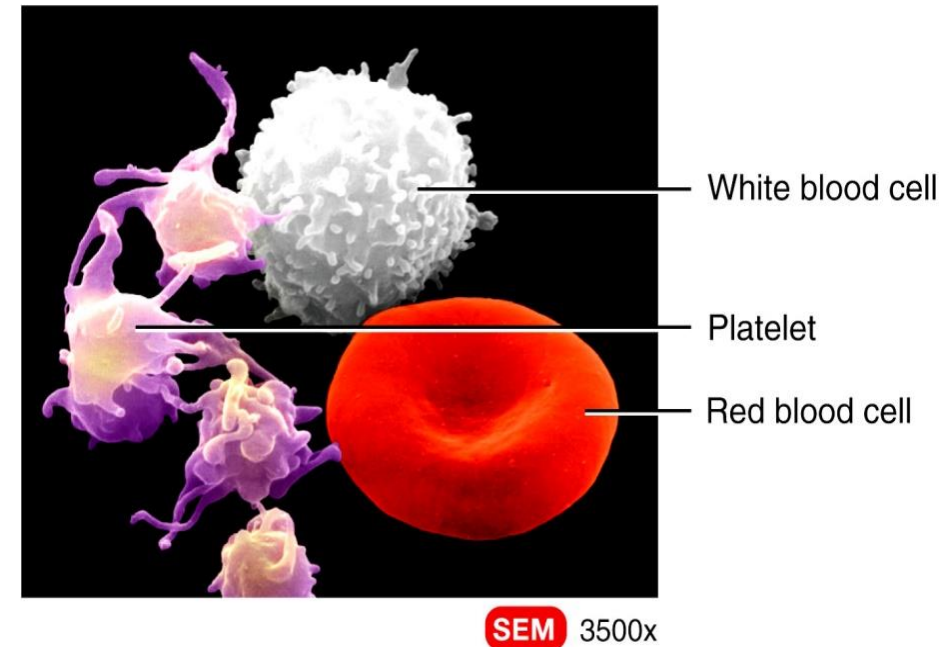
Venipuncture, Finger or heel stick, arterial stick

Formed Elements of Blood



(b)

Figure 19.02b Tortora - PAP 12/e
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(a)

Figure 19.02a Tortora - PAP 12/e
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Blood : a liquid connective tissue, Extracellular matrix is plasma, cells are suspended,

Interstitial fluid: part of ECF renewed by blood

Functions

Red Blood Cells (Erythrocytes)

- Carry hemoglobin, bearing O₂ to the tissues
- Contain carbonic anhydrase, which catalyzes the reaction:



- allows large amounts of CO₂ to be carried in solution as HCO₃⁻

- Hemoglobin is an excellent acid-base buffer

RBC Size and Shape

- **Biconcave discs**
- **Mean 7.8(d) x 2.5 microns (thickest) or x 1 micron (center)**
- **Average volume 90-95 micrometers³**
- **Redundant membranes allows deformation to squeeze through capillaries**

RBC Count and Indices

- Men: 5,200,000 ($\pm$ 300,000) / mm³
- Women: 4,700,000 ($\pm$ 300,000) / mm³
 - RBC counts can be increased at higher altitudes

2 million /sec production

- RBC indices:
 - MCV (Mean cell volume) 90 $\pm$ 9 fl = 10⁻¹⁵ L
 - MCH (Mean Cell Hgb) 32 $\pm$ 2 pg
 - MCHC (Mean cell Hgb conc) 33 $\pm$ 3 %
 - RDW CV 11.6-14.6 %
(SD of MCV/MCV) 39-46 fL

Hemoglobin and Hematocrit

- Normal hemoglobin concentration is 34 g per 100 ml of packed cells
- 33% of RBC weight
- Normal hematocrit (“packed cell volume”) is 40-45% (slightly lower in women)
- Thus normal hemoglobin is 14-15 g per 100 ml of blood
- O₂ carrying capacity is 1.34 ml / g Hgb, or 19-20 ml O₂ / 100 ml blood

Sites of Erythropoiesis

- **First few weeks of gestation – yolk sac**
- **Mid-trimester – Liver (+ spleen, lymph nodes)**
- **Last month of gestation through adulthood – Bone marrow**