I. *Hematology*

“A Blood”

A. Overview – Fig. 6.1

Blood = plasma + formed elements

~55%          ~45%

B. Plasma

1. 90% water → **NOT LYMPH**! (text is misleading)
2. ~7% protein (produced by liver and WBCs)
   -- clotting proteins
   
   thromboplastin
   
   ↓
   
   prothrombin → → → thrombin
   
   ↓
   
   fibrinogen → fibrin → forms net, traps RBCs = clot

serum = plasma minus clotting proteins [preferred over text definition]

3. Clinical → p. 290

   ➢ blood chemistry panels: glucose, cholesterol, enzymes, ions, etc.
   • may scan for general: basic metabolic (BMP) or comprehensive metabolic (CMP)
     or
   • specific (lipid panel, arthritis panel)

   ➢ partial thromboplastin time (PTT)
   ➢ prothrombin time (PT)

B. Formed elements (cellular components)

1. Erythrocytes = red blood cells (RBCs)

   ➢ Small biconcave discs, **no nucleus**
     o macro-, microcytosis
     o anisocytosis (“not equal”) – vary in **size**
     o poikilocytosis (“irregular”) – large & irregular **shape**
     o reticulocytosis (“network”) – immature cells

   ➢ Outnumber WBCs 500:1

   ➢ Red due to **hemoglobin** (Hgb, HGB) – contains iron, carries O₂

   ➢ Determine quantity by spinning a tube to pack cells = hematocrit (HCT, hct)

   ➢ Combining HGB & HCT generates 3 **blood indices** (p. 291-292)
     1. mean corpuscular volume (MCV)
     2. mean corpuscular hemoglobin (MCH)[“quantity”] – macrocytic RBCs will have more, microcytic less
     3. mean corpuscular hemoglobin concentration (MCHC) – diluted in hypochromia, concentrated in hyperchromia
Low HCT or HGB leads to **anemia** → reduced oxygen carrying capacity of blood

i. **aplastic**: normocytic-normochromic → failure of bone marrow to produce RBCs

ii. **iron deficiency**: microcytic-hypochromic → lack of iron (Fig. 6.4)

iii. **pernicious**: macrocytic-normochromic → lack of vitamin B₁₂ (Fig. 6.5)

2. Leukocytes (leucocytes) = white blood cells (WBCs)
   - Larger, irregular spheres with nucleus
   - Protect against pathogens, cancer
   - Types: Fig. 6.2
     a. Agranulocytes [Note typo on p. 278]
        1. **Monocytes** (“monos”) → become macrophages
           ↓
           1 nucleus “eater”

        2. **Lymphocytes** (“lymps”) – many types including **B & T** cells, and **CD4** cells
           Common in lymph

   -- DO NOT CONFUSE LEUKOCYTE W/LYMPHOCYTE

   b. Granulocytes
      1. **Basophils** (“basos”)
         ↓ ↓
         Basic love
         ↓
         Blue, basic dye granules

      2. **Eosinophils**
         ↓
         Acidic, orange dye granules

      3. **Neutrophils** (polymorphonuclear [PMN] leukocytes)
         ↓
         Neutral granules

   - These types & their relative numbers determined by a **differential count** (p. 293)

3. Thrombocytes or platelets
   - Very small cell fragments
   - Play key role initiating clotting, or **coagulation**, just one step of **hemostasis**

4. Complete blood count (CBC) → 8 tests + differential count (Fig. 6.7)
   - RBC count
   - platelet count (PLT)
   - Hgb
   - MCH
   - WBC count
   - Hct
   - MCV
   - MCHC
II. Lymphatic system (=Immune System)

A. Overview – Fig. 6.3

\[
\text{Fluid} + \text{cells} + \text{vessels} + \text{organs} \downarrow \downarrow \downarrow
\text{Lymph} \quad \text{WBCs, many} \quad \text{composed of}
\downarrow \quad \text{are phagocytic}
\text{Similar} \quad \text{lymphatic tissue,}
\text{To plasma} \quad \text{specialized c.t. &}
\text{WBCs}
\]

B. Lymph vessels

Blood capillaries → fluid leaks out → lymph capillaries → lymphatics (lymph vessels)  ↓
lymph ducts (larger vessels)  ↓
fluid returned to subclavian veins

-- Note that lymph return is asymmetrical (Fig. 6.3b)

C. Lymph nodes (should be under “Organs” on p. 280)

1. small knobs of tissue that filter lymph
2. packed with phagocytic WBCs
3. metastasizing cancer cells often caught here → may multiply & spread

D. Tonsils → next chapter

E. Spleen

Upper left abdominal cavity
Filters blood, not lymph → prevents septicemia \[\text{anti} \text{”rotten”}\]
Destroys pathogens and old formed elements

F. Thymus

Upper mediastinum
Essential for T-cell development

III. Immunity

A. refers to body’s ability to defend itself from pathogens and cancer

1. Includes many WBC types
2. Includes chemical defenses produced by B cells (B lymphocytes)
   Antibodies – complex protein that reacts specifically only with certain antigens (“antibody generators”)  ↓
   Agglutination = “clumping” = antigen/antibody reaction \[\text{anti} \text{”glue”}\]

(Don’t confuse with coagulation)
B. Active immunity
   1. your body produces the antibodies in response to infection (naturally) or vaccine administration (artificially)
   2. long lasting

C. Passive immunity
   1. foreign antibodies conveyed naturally (from Mom through placenta) or artificially via serum injection
   2. short lasting

D. Human Immunodeficiency Virus (HIV)
   • attacks CD4 type of T-cell (helper T), disabling entire immune system
   • leads to acquired immunodeficiency syndrome (AIDS)