CHAPTER 17 BLOOD

BLOOD

• connects all cells and tissues

• connective tissue =
  — cells - formed elements
  — matrix - liquid

Functions of Blood

• transportation
  — nutrients glucose, AA, etc
  — waste products urea, lactic acid, creatinine
  — gases O₂, CO₂
  — hormones
  — electrolytes Na⁺, K⁺, Cl⁻, Ca²⁺

• regulation
  — ph

• protection
  — infection WBC
  — blood loss platelets, clotting factors

Facts about blood

• 4 – 6 liters

• whole blood = cells + matrix

• cells = formed elements
  • RBC, WBC, Platelets
  • 38 – 48 % volume

• liquid = plasma
  • 52 – 62 % volume

characteristics of blood

• color
  • oxygenated - bright red
  • de-oxygenated - dark red

• pH
  • 7.35 – 7.45
  • venous < arterial

• viscosity
  • thicker than water

Plasma

• plasma
  • 52 – 62 % of blood, by volume
  • 90% water
  • solvent molecules must dissolve in plasma for transport
  • plasma proteins
  • nutrients
  • hormones
  • wastes
  • electrolytes
  • gases
Plasma proteins

- albumin ~ 55% of plasma proteins
  - reabsorbs water from tissues osmotic pressure
- globulins ~ 38%
  - γ globulins = immunoglobulins = antibodies
  - α, β globulins = carrier proteins
- fibrinogen = clotting factor
- transferrin = iron transport

Serum

- plasma = liquid + all contents
- serum = plasma w/o clotting factors

Blood Cells / formed elements

- RBC = erythrocyte O₂ transport
- WBC = leukocyte defense
- Platelet = thrombocyte clotting

RBC = Erythrocytes

- carry Oxygen in blood
- mostly hemoglobin
- no nucleus
- biconcave discs
- life span ~ 120 days
  - normal RBC count 4.5 - 6.0 mill/mm³

RBC = Erythrocytes

- Hemoglobin (Hb) 12 – 18 grams / 100ml
  - made in red bone marrow
  - heme = Iron (Fe) + bilirubin
- Hematocrit (Hct) 38 – 48%
  - % packed RBC

WBC

- = leukocytes
  - 5,000 – 11,000 / mm³
  - most are in connective tissues and lymph nodes
  - function: defense
    - phagocytosis
    - chemical destruction - antibodies

WBC

- granulocytes = granules in cytoplasm lobed nucleus
  - neutrophils
  - eosinophils
  - basophils
- agranulocytes = no granules large single nucleus
  - lymphocytes
  - monocytes
neutrophils
• polymorphonuclear leukocytes = PMN’s = polys = segs
• stain neutral
• 50 – 70 % of WBC
• phagocytosis - esp vs bacteria
eosinophils
• stain red / rosy (eosin stain)
• 2 – 4 % of WBC
• phagocytosis parasites, worms
• allergic reactions limit inflammation
basophils
• stain blue
• 0.5 – 1.0 % of WBC
• inflammatory response
• histamine vasodilation increase tissue fluid
• heparin anticoagulant
lymphocytes
• immune response
• 25 – 40 % of WBC
• T lymphocytes = T cells
  • develop in Thymus
• B lymphocytes = B cells
  • develop in Bone marrow
  • produce antibodies
monocytes
• 3 – 8 % of WBC
• look like large lymphocytes
• become macrophages outside of blood
  • phagocytosis
  • areolar ct
  • spleen, liver (RBC destruction)

WBC count
• WBC count 5,000 – 11,000 / mm³
• Differential
  — neutrophils 50 – 70 %
  — eosinophils 2 – 4 %
  — basophils 0.5 – 1 %
  — lymphocytes 25 – 40 %
  — monocytes 3 – 8 %
Platelets
• = thrombocytes
• 150,000 – 500,000 / mm³
• function - blood clotting = hemostasis
  • stick to rough edges
Blood Cell Formation

- **hemopoiesis** making blood cells
  - red bone marrow
  - hemocytoblasts
- **erythropoiesis** making RBC
- **leukopoiesis** making WBC

**regulation of RBC production**

- regulator - low Oxygen levels

- **erythropoietin** = hormone stimulates RBC production
- **erythroblast** stem cells
- **reticulocyte** immature RBC ~ 1%

**WBC production**

- **leukopoiesis**
  - lymphoid stem cell forms lymphocytes
  - myeloid stem cell forms other blood cells

- most granulocytes remain in bone marrow
- most agranulocytes remain in tissues
  - lymphocytes in lymph nodes
  - macrophages in lymph tissue and areolar ct

**what could go wrong?**

- **RBC**
  - anemia low RBC or Hemoglobin
  - polycythemia high # RBC
- **WBC**
  - leukocytosis increased #WBC
  - leukemia extreme increased # WBC
- **Platelets**
  - thrombocytopenia decreased # platelets

**Blood types**

- named for antigens on RBC
- ABO group
  - A antigen
  - B antigen
  - A and B
  - no antigen
- Rh factor
  - have D antigen
  - no D antigen