Hematopoiesis and Hemostasis

HAP
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Hematopoiesis

- Blood Cell Formation
- Occurs in red bone marrow
  - Red marrow - found in flat bones and proximal epiphyses of long bones.
- Each type of blood cell is produced in response to changing needs of the body.
- On average, an ounce of new blood is produced each day with about 100 billion new blood cells/formed elements.
**Hemocytoblast**

- *Hemo*- means blood
- *Cyto*- means cell
- *-blast* means builder
- Blood stem cell found in red bone marrow.
- Once the precursor cell has committed to become a specific blood type, it cannot be changed.
Erythropoiesis

• Erythrocyte Formation
• Because they are *anucleated*, RBC’s must be regularly replaced.
  – No info to synthesize proteins, grow or divide.
• They begin to fall apart in 100 - 120 days.
• Remains of fragmented RBC’s are removed by the spleen and liver.
• Entire development, release, and ejection of leftover organelles takes 3-5 days.
The stimulus for RBC production is the amount of OXYGEN in the blood not the NUMBER of RBC’s.

The rate of RBC production is controlled by the hormone ERYTHROPOIETIN.
Leuko- and Thrombopoiesis

- Leukopoiesis = WBC production
- Thrombopoiesis = platelet production
- Controlled by hormones

### Leukopoiesis
- (CSF) Colony stimulating factor
- Interleukins
  - Prompts WBC production
  - Boosts other immune processes including inflammation.

### Thrombopoiesis
- Thrombopoietin
- Little is known about this process.
HEMOSTASIS
Hemostasis

- *Hemo-* means blood
- *-stasis* means standing still
  – Stoppage of bleeding
- Fast and localized reaction when a blood vessel breaks.
- Involves a series of reactions.
- Involves substances normally found in plasma but **not** activated.
- Occurs in 3 main phases
Phases of Hemostasis

• Step 1: Vascular Spasm
  – Vasoconstriction, narrowing of blood vessels.

• Step 2: Platelet Plug Formation
  – Platelets “stick” to collagen, exposed by broken blood vessels causes more platelets stick to each other.
  – Forms a platelet plug

• Step 3: Coagulation
  – Series of events that lead to a FIBRIN plug and a BLOOD CLOT.
**Coagulation**

Requires

- Calcium ions
- Chems from damaged tissue
- Chems from platelets

**Events of Clotting Cascade**

- Prothrombin activator
- Activates prothrombin
- Activates thrombin
- Activates fibrinogen
- Activates fibrin
- Blood clot is formed
Hemostasis

- Takes about 3-6 minutes
- Clotting proteins (factors) are quickly inactivated to prevent widespread clotting.
- Placing gauze or using pressure on the wound speeds the clotting process
Disorders of Hemostasis

- **Thrombus** – clot formed in unbroken blood vessel.
  - If thrombus is large enough it can prevent blood flowing beyond the clot.
  - Blockage in heart vessel is coronary thrombosis.

- **Embolo**s – a thrombus that breaks away and floats freely in blood.
  - Only a problem if it lodges into a small vessel; can cause a stroke.
Disorders of Hemostasis

- **Thrombocytopenia** – not enough platelets.
  - Can lead to spontaneous bleeding

- **Hemophilia** – inherited disease
  - Lack of specific clotting proteins (factors)
  - Can be life threatening