Blood

1. Functions

 A) Transportation of

 B) Regulation of

 C) Protection from

2. Characteristics

 A)

 B) of human body weight

 C) 4-5 times more viscous than water

 D) NaCl conc. of

 E) pH ranges from

 F) Total blood volume varies

 1)

 2)

 G) Components

 1)

 a) About

 b) Contains

 c) Contains

 d) Serum

 2)

 a)

 b)

 c)

3. Red Blood Cells (erythrocytes)

 A) shape – provides:

 1)

 2)

 B)

 C) Contain hemoglobin (~280 million molecules/RBC)

 1) – structural protein composed of 4 polypeptide chains each

 containing a heme group

 2) group – iron-containing functional portion of the hemoglobin

 a) – forms a reversible bond with O2

 D) Normal RBC counts: (1 drop ~50mm3)

 Males =

 Females =

 Children =

 E) New cells produced at rate of

 1) Controlled by

 F) Erythrocytic Disorders

 1) Anemia

 a) Aplastic anemia – faulty bone marrow

 i) Often caused by radiation, drug use, bacterial toxins, some poisons, and some

 antibiotics

 b) Pernicious anemia – decreased B12 (necessary for RBC production)

 c) Hemolytic anemia

 d) Hemorrhagic anemia

 e) Iron-deficiency anemia

 i) Results in microcytes

 f) Sickle-cell anemia

 i) Genetic defect causes one globin chain to become rigid

 g) Thalassemia

 i) Genetic defect resulting in absent or faulty globin chain

 2) Polycythemia

 a) Primary polycythemia (polycythemia vera)

 b) Secondary polycythemia

 FYI: Blood-doping

 G) Erythropoiesis – controlled by

 1) Hemocytoblast

 2) Proerythroblast

 3) Erythroblast

 4) Normoblast

 5) Reticulocyte – enter circulation and carry O2; continue to lose organelles

 6) Erythrocyte (RBC)

4. White Blood Cells (leukocytes)

 A) , most live only a few days, but their lifespan ranges from a

 few minutes to years

 B) There are 5 types of WBC broken down into 2 categories

 1) Granulocytes (granular WBC)

 a) (polymorphonuclear leukocytes)

 i) Numerous fine granules which stain pale lilac w/ a darker multi-lobed nucleus

 ii)

 b)

 i) Purplish-black granules that often obscure a bilobed nucleus

 ii) Intensify

 iii) Chemicals released include

 iv) Were once thought to develop into

 (a) Have identical functions except mast cells are only found outside the

 bloodstream

 c)

 i) Distinct red granules; bilobed nucleus

 ii) Phagocytes, combat parasitic worms & release anti-inflammatory chemicals

 2) Agranulocytes

 a)

 i) Pale-blue cytoplasm w/ U or kidney shaped nucleus

 ii) Develop into macrophages once in tissue

 iii)

 b)

 i) Large, dark-purple nucleus occupies most of the cell

 ii)

 iii) 3 types

 (a)

 (i) Attack bacteria & their toxins

 (ii) Develop into which release

 (b)

 (i) Attack viruses, fungi, cancer cells, transplanted cells & some bacteria

 (ii) Work w/ B cells to provide

 (c)

 (i) Kill cells that have been bound by antibodies or cells that exhibit

 abnormal traits

 (ii) Use perforins & granzymes to destroy the cells

 C) Leukocytic Disorders

 1) Leukopenia – decreased WBC count

 a) Often caused by gluccocorticoids and various cancer & HIV drugs

 2) Leukocytosis – increased WBC count

 a) Often caused by acute infections, inflammation, or hemorrhage

 3) Infectious mononucleosis (mono)

 a) Caused by Epstein-Barr virus

 4) Leukemia

 a) Group of cancerous conditions involving WBC

 b) May be named for cells affected

 i) Ex. myelocytic leukemia or lymphocytic leukemia

 c) May be named for the WBC’s stage

 i) Ex. acute leukemia or chronic leukemia

 D) Leukopoiesis

 1) Stimulated by

 2) Multiple pathways but all start w/ hemocytoblasts in red bone marrow

 a) Monoblast

 i) Promonocyte

 ii) Monocyte

 b) Lymphoblast

 i) Prolymphocyte

 ii) Lymphocyte

 c) Myeloblast

 i) Promyelocyte

 ii) Myelocyte

 (a) Eosinophilic, basophilic or neutrophilic

 iii) Band cell

 (a) Eosinophilic, basophilic or neutrophilic

 iv) Eosinophil, basophil or neutrophil

5. Platelets

 A)

 B) Stop blood loss – 3 mechanisms

 1)

 a) of the damaged vessel

 b) Can last minutes – hours

 2)

 a) Triggered by

 i) Adhere to exposed collagen fibers

 ii) Activates platelets

 b)

 i)

 ii) Activates more platelets

 c)

 i) The sticking of platelets to already present platelets

 d)

 i) A cluster of platelets that temporarily seals the break in a vessel wall

 3) Coagulation (blood clotting)

 a) Involves over 30 different chemicals including:

 i)

 ii)

 iii)

 b) Prothrombin activator (enzyme) is formed following the coming together of

 Various clotting factors

 c) Prothrombin activator converts prothrombin (plasma protein) to thrombin

 (enzyme)

 d) Thrombin converts fibrinogen (plasma protein) to fibrin (fibers of the clot)

 e) Formed elements become trapped in fibrin

 f) Serum filters out

 i) Clot results

 g) Clot retraction

 h) Fibrinolysis

 C) Clotting Disorders

 1) Thrombus – a clot in a healthy vessel

 2) Embolus – a thrombus that has broken free and entered circulation

 3) Embolism – when an embolus becomes trapped in another vessel; can lead to death

 if it occurs in the heart or lungs

 4) Hemophilia – an inability of the blood to clot properly

 a) Sex-linked disorder

 5) Thrombocytopenia

 a) Decreased platelet count

 b) Caused by any condition that suppresses or destroys bone marrow

 D) Thrombopiesis

 1) Stimulated by

 a) Hemocytoblast

 b) Megakaryoblast

 c) Promegakaryocyte

 d) Megakaryocyte

 i) Ruptures as it enters circulation

 e) Platelet

6. Blood Typing

 A) Based on presence/absence of specific antigens

 B) ABO Groups

 1) Determined by the presence or absence of antigens A & B

 a) Type A blood – has only antigen A

 b) Type B blood – has only antigen B

 c) Type AB blood – has antigens A & B

 d) Type O blood – has neither antigen

 2) Blood also contain antibodies against the antigen(s) the RBC don’t have

 a) Type A blood – has B antibodies

 b) Type B blood – has A antibodies

 c) Type AB blood – has no antibodies

 d) Type O blood – has A & B antibodies

 D) Rh Group

 1) Refers to the presence or absence of Rh antigens (there are at least 45 different

 ones)

 a) Rh+ has at least one Rh antigen

 b) Rh- has no Rh antigens

 2) Antibodies are not present against Rh antigen(s) unless conflicting blood has been

 introduced

 a) First exposure – no immune response (rejection)

 b) Subsequent exposures will result in an immune response (rejection)

 E) Transfusions

 1) If the body sees a foreign antigen it will attack the RBC causing them to clump

 together

 2) Always try to match blood types

 3) Some exceptions can be made

 a) Type O is the universal donor

 b) Type AB is the universal recipient

 4) Complications

 a)

 b)

 c)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| BloodType | Antigens Present | Antibodies Present | Can Receive Blood From: | Can Donate Blood To: |
| A | A | B | A & O | A & AB |
| B | B | A | B & O | B & AB |
| AB | A & B | none | A, B,AB & O | AB only |
| O | none | A & B | O only | A, B,AB & O |

 5) Hemolytic Disease of the Newborn

 a) Also called

 b) Results when mother is and baby is

 c) Upon delivery, Rh+ antigens from the baby are transferred to the mother’s

 bloodstream which causes her to produce anti-Rh antibodies

 d) If the mother becomes pregnant again with an Rh+ child, the antibodies cross the

 placenta, enter the circulation of the fetus, and cause extensive fetal erythrocyte

 damage

 e) Can be prevented in most all cases with the use of RhoGam