Exam 3
review
Three Ways to Get Anemic

Lose blood

Destroy too much blood
  - Extracorpuscular reasons
  - Intracorpuscular reasons

Make too little blood
  - Too few building blocks
  - Too few erythroblasts
  - Not enough room
We went through 10 anemias (11 if you count warm and cold autoimmune hemolytic anemia separately). The next 11 slides are representative slides for each anemia, one slide per anemia. You might use them to jog your memory to see how much you remember about each type.
Reticulocytes
Red cells snagged on fibrin strand
Warm AIHA
Cold AIHA
Sickle cell anemia
Hemoglobin chain development

Hgb F = $\alpha_2\gamma_2$
Hgb A$_2$ = $\alpha_2\delta_2$
Hgb A = $\alpha_2\beta_2$

Hemoglobin chain development
G6PD deficiency: Heinz bodies
Iron-deficiency anemia
Megaloblastic anemia
Empty bone marrow in aplastic anemia
Which of the following red cell indices tells you how much hemoglobin is in an average red cell?

A. RBC
B. Hgb
C. MCHC
D. Hct (hematocrit)
E. MCV
Complete Blood Count (CBC)

**MCV**
- microcytic
- normocytic
- macrocytic

**MCHC**
- hypochromic
- normochromic
What does it mean if a patient’s red cells have a lot of poikilocytosis?

A. They vary a lot in size
B. They have Heinz bodies
C. They vary a lot in shape
D. They have a lot of hemoglobin
E. They are very immature
Additional Red Blood Cell Properties

Size variation

anisocytosis

Shape

poikilocytosis
Which anemia is characterized by the presence of these cells, called schistocytes?

A. Microangiopathic hemolytic anemia
B. G6PD deficiency
C. Thalassemia
D. Sickle cell anemia
Which anemia is characterized by these inclusions, called Heinz bodies?

A. Microangiopathic hemolytic anemia
B. G6PD deficiency
C. Thalassemia
D. Sickle cell anemia
What is the defect in this disorder?

A. A point mutation in a beta chain gene
B. A translocation between chromosomes 9 and 22
C. Absence of one or more beta chain genes
D. A membrane defect that renders the cells fragile and non pliable
What is the diagnosis?

A. Iron-deficiency anemia
B. Megaloblastic anemia
C. Hereditary spherocytosis
D. Warm autoimmune hemolytic anemia
E. G6PD deficiency
Your healthy, 15-year-old brother was found to have an abnormality on his blood smear during a routine sports physical for school. His indices are as follows:

- **Hgb**: 10 g/dL (12-16)
- **MCV**: 75 fL (80-100)
- **RBC**: 7.0 x 10^{12}/L (4.5-6.0)
- **WBC**: 10 x 10^9/L (4-11)
- **Plt**: 300 x 10^9/L (150-450)

The most likely diagnosis is:

A. Iron-deficiency anemia
B. Thalassemia
C. Megaloblastic anemia
D. Aplastic anemia
E. Acute myeloid leukemia
What's this called?
What’s wrong with this cell?
What’s wrong with the patient?
What do these things signify?
What’s this called?
What is this called?
What kind of cell is this?
What is most likely wrong with this patient?
How would you tell which one is benign?
How could you tell which one was malignant?
Hematologic Malignancies

Leukemias
- Acute leukemias
- Chronic leukemias

Lymphomas
- Hodgkin lymphoma
- Non-Hodgkin lymphoma

Plasma cell disorders
- Multiple myeloma
Hematologic Malignancies

Leukemias

- Acute leukemias
- Chronic leukemias
Hematologic Malignancies

Leukemias

- Acute leukemias
Acute lymphoblastic leukemia

Acute myeloid leukemia
Acute leukemia: bone marrow biopsy
What is this cell?
What is this cell?
If this patient has an acute leukemia, what kind is it, most likely?
Hematologic Malignancies

Leukemias

- Acute leukemias
- Chronic leukemias
What’s the translocation in this leukemia?
What’s this disorder?
What disorder is likely in this patient?
This 65 year old male is asymptomatic. On a routine CBC he was found to have a WBC of 60,000. His blood smear is shown here. The cells are CD19 positive and CD5 positive. What’s the diagnosis?
Hematologic Malignancies

Leukemias
- Acute leukemias
- Chronic leukemias

Lymphomas
- Non-Hodgkin lymphoma
- Hodgkin lymphoma
Which germinal center is benign?
This skin biopsy is from a 65 year old male with red skin nodules and cerebriform cells in his blood. What is the diagnosis?
ALL

B-lineage ALL
(= B-lymphoblastic lymphoma)

T-lineage ALL
(= T-lymphoblastic lymphoma)
What’s the translocation?
Name the cell and the disease.
Hodgkin lymphoma
Multiple Myeloma
Multiple Myeloma
Serum protein electrophoresis
Serum protein electrophoresis

M Protein
Pro-Clotting

\[
\text{Protein + Platelets + Fibers} = \text{clot}
\]
Platelet activation
SIN_{\text{trinsic}} \quad \text{SEX}_{\text{trinsic}}

\text{VIII} \quad \text{IX} \quad \text{VII}

\text{X} \quad \text{thrombin} \quad \text{fibrin} \quad \text{clot}

\text{TF}
Anti-Clotting

fibrinogen → fibrin → clot → FDPs

plasminogen → plasmin

t-PA
Extrinsic coagulation sequence

Exposure of membrane-bound tissue factor

Platelet adhesion: Held together by fibrinogen

vWF

Collagen
Inheritance of Hemophilia

“Carrier” Mother and Father Without Hemophilia

Parents

Father (without hemophilia)  
XY

Mother (carrier for hemophilia gene)  
XX

Children

Son (without hemophilia)  
XY

Daughter (carrier for hemophilia gene)  
XX

Son (has hemophilia)  
XY

Daughter (does not carry hemophilia gene)  
XX
Thrombosis

Hemorrhage
Cleaved unusually large multimers of von Willebrand factor

Adhesion and aggregation of platelets
Uncleaved unusually large multimers of von Willebrand factor

Endothelial cell
Secretion of multimers from Weibel–Palade body
Hemolytic Uremic Syndrome

Things you must know

- MAHA and thrombocytopenia
- Most are related to E. coli infection
- Toxin damages endothelium
- Treat supportively
Idiopathic Thrombocytopenic Purpura

Things you must know

- Antiplatelet antibodies coat platelets
- Splenic macrophages eat platelets
- Diagnosis of exclusion
- Steroids or splenectomy