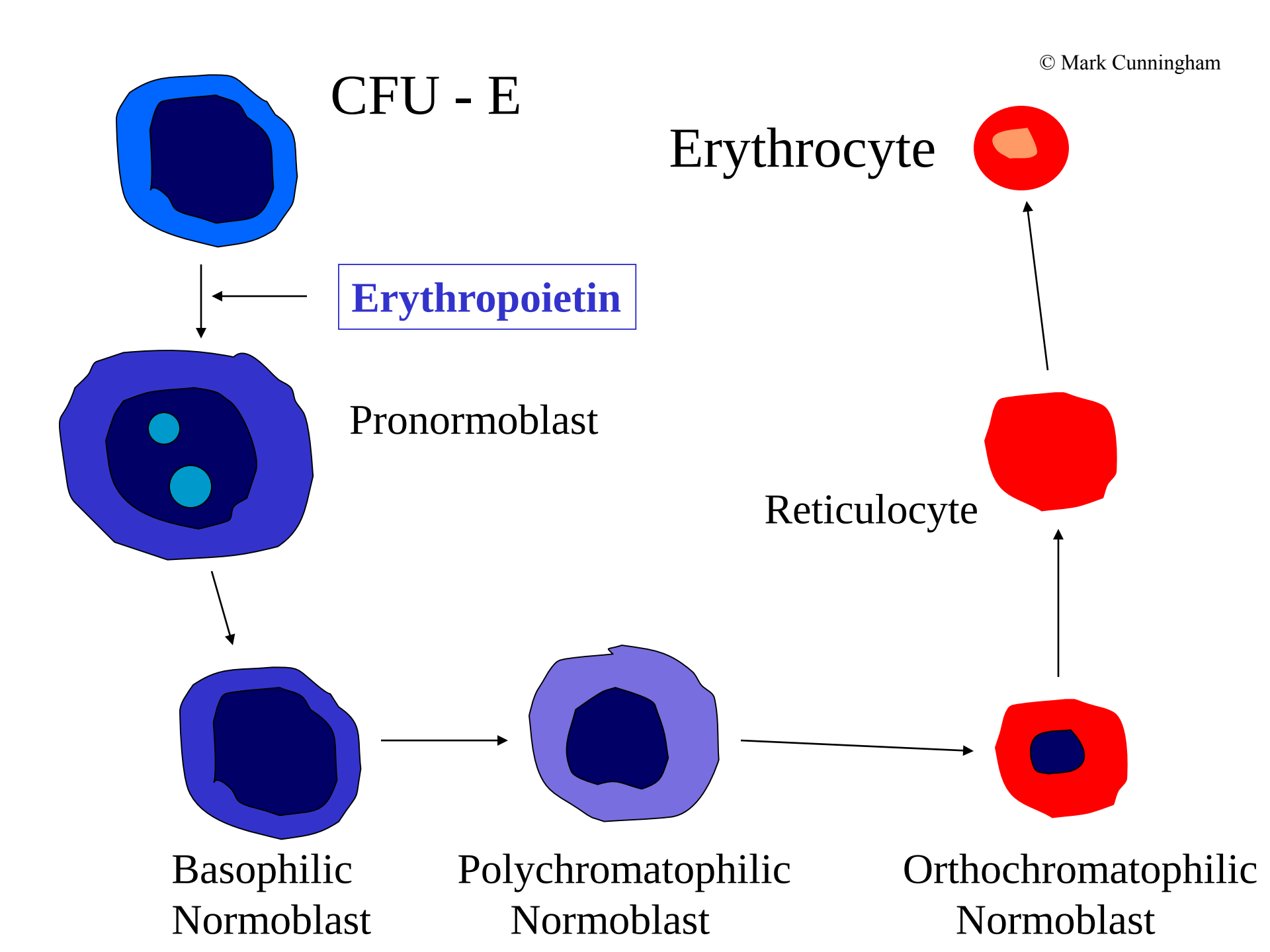
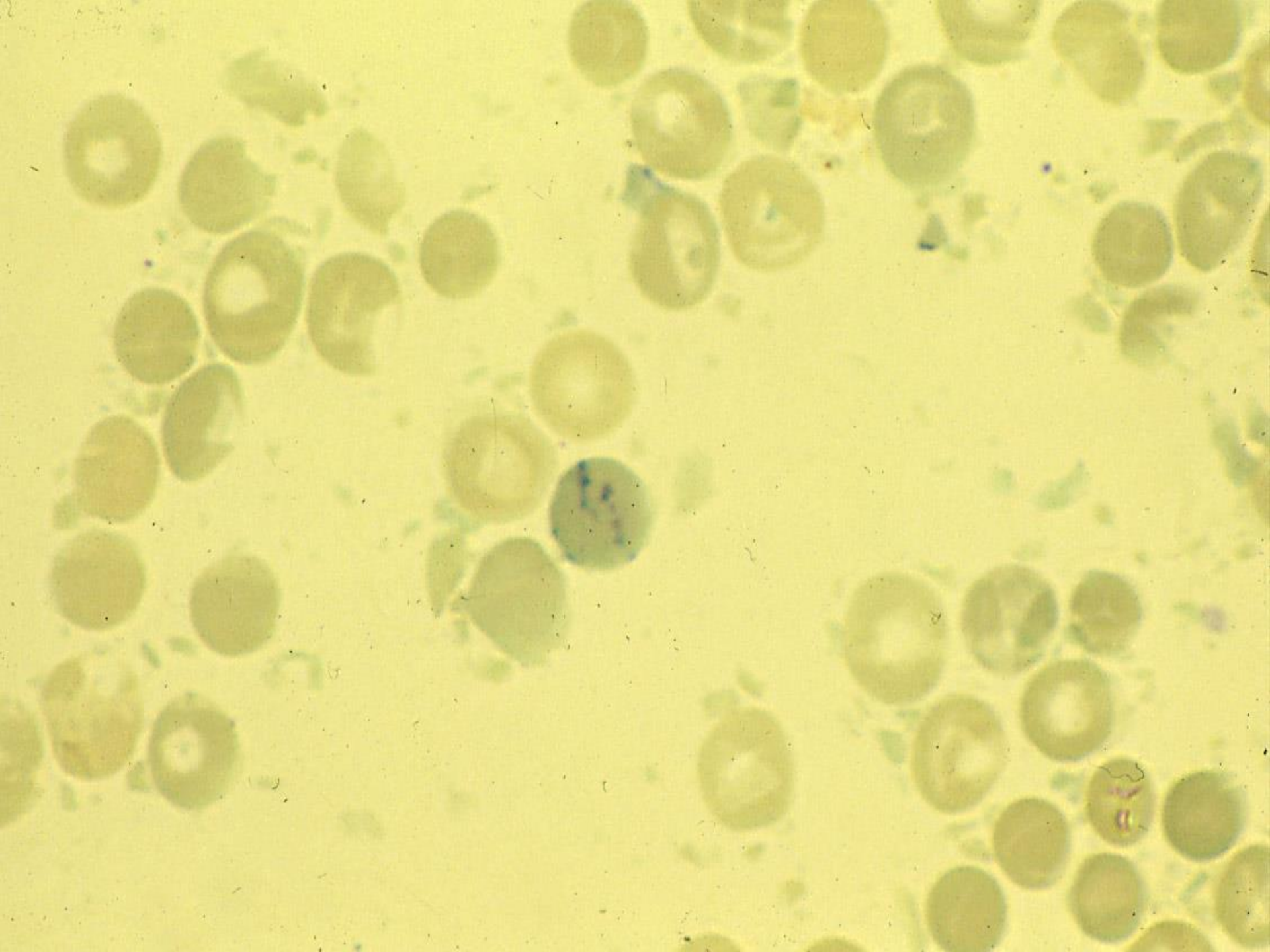
Anemia due to Increased Destruction

- **Hemolysis**
- **Blood loss**

Lab Features of Hemolysis

- Elevated reticulocyte count
- Elevated LDH (isoenzyme 1 &2)
- Decreased serum haptoglobin
- Elevated plasma hemoglobin
- Elevated unconjugated bilirubin





Reticulocyte Count

- **Normal range**
  - **Relative count: 0.5% - 1.5%**
  - **Absolute count: 25,000 - 75,000 cells/uL**

Mechanisms of Hemolysis

- Intrinsic RBC defects
  - Abnormal hemoglobin
  - Abnormal membrane
  - Abnormal enzyme
- Extrinsic defects
  - Autoantibodies
  - Mechanical destruction

Hemolytic Anemias
Abnormal Hemoglobins

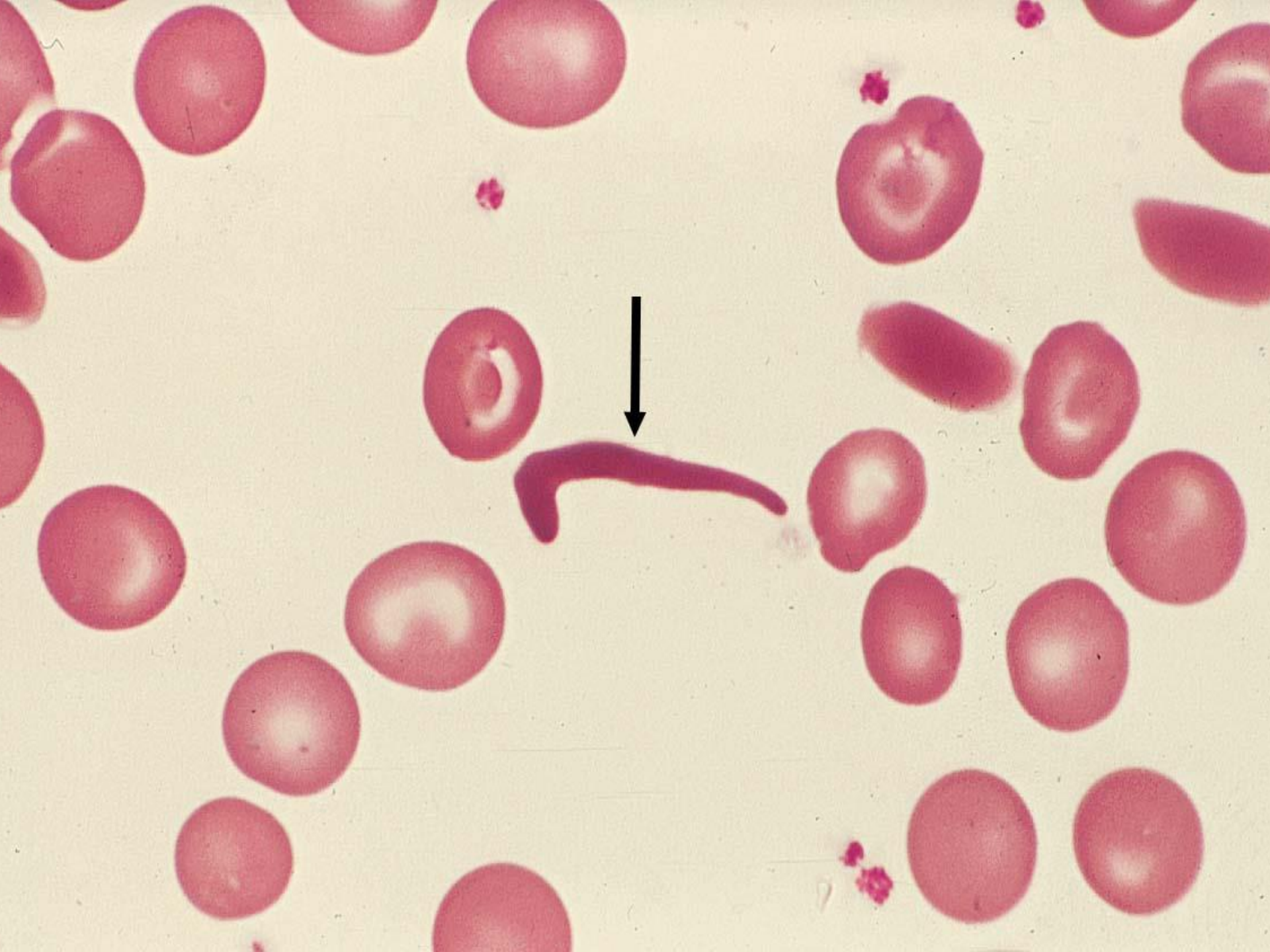
- **Sickle cell disease**

Sickle Cell Disease

- Definition
  - Hereditary hemoglobinopathy causing red cell structural change to sickle form
- Pathogenesis
  - autosomal recessive
  - 6glu $\rightarrow$ val mutation in β globin chain
  - Hb S precipitation under deoxygenated state
  - hemolysis and vascular occlusion by sickle cells

Sickle Cell Disease

- Clinical features
  - painful crises (abdomen, bones, chest)
  - organ infarction (heart, lung, brain, spleen, kidney, bones, eye)
  - infections
  - hemolytic (aplastic) crisis
- Pathology
  - sickle cells, target cells on blood smear
  - elevated Hb S on electrophoresis (80-95%)



Hemolytic Anemias
Abnormal Membrane

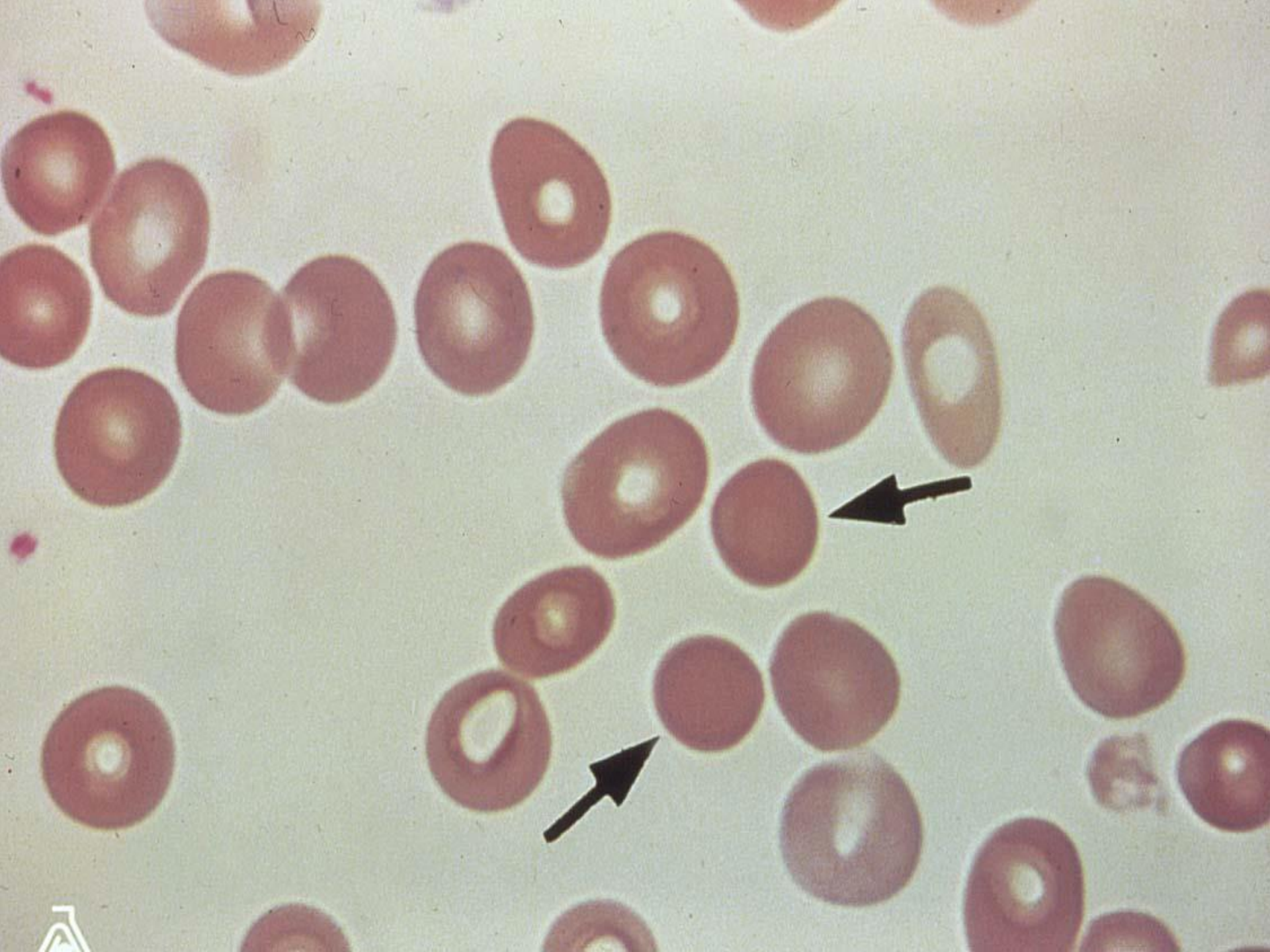
- **Hereditary spherocytosis**

Hereditary Spherocytosis

- Definition
  - hereditary hemolytic anemia caused by cytoskeletal protein defect
  - autosomal dominant (ankyrin)
- Pathogenesis
  - loss of biconcave structure
  - splenic trapping of spherocytes

Hereditary Spherocytosis

- Clinical features
  - splenomegaly
  - bilirubin gall stones
- Pathology
  - hemolysis, elevated MCHC
  - spherocytes on blood smear
  - increased osmotic fragility

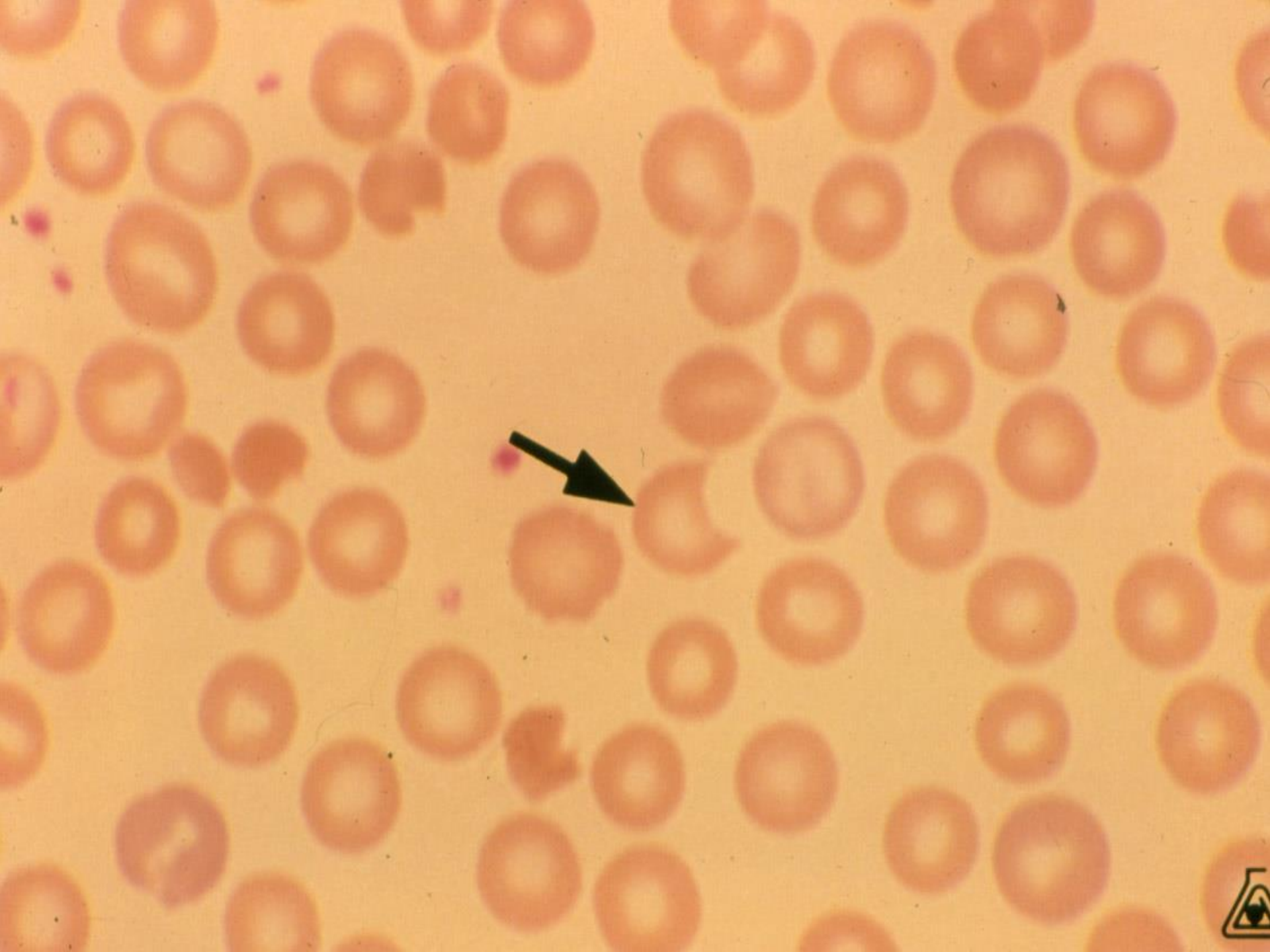


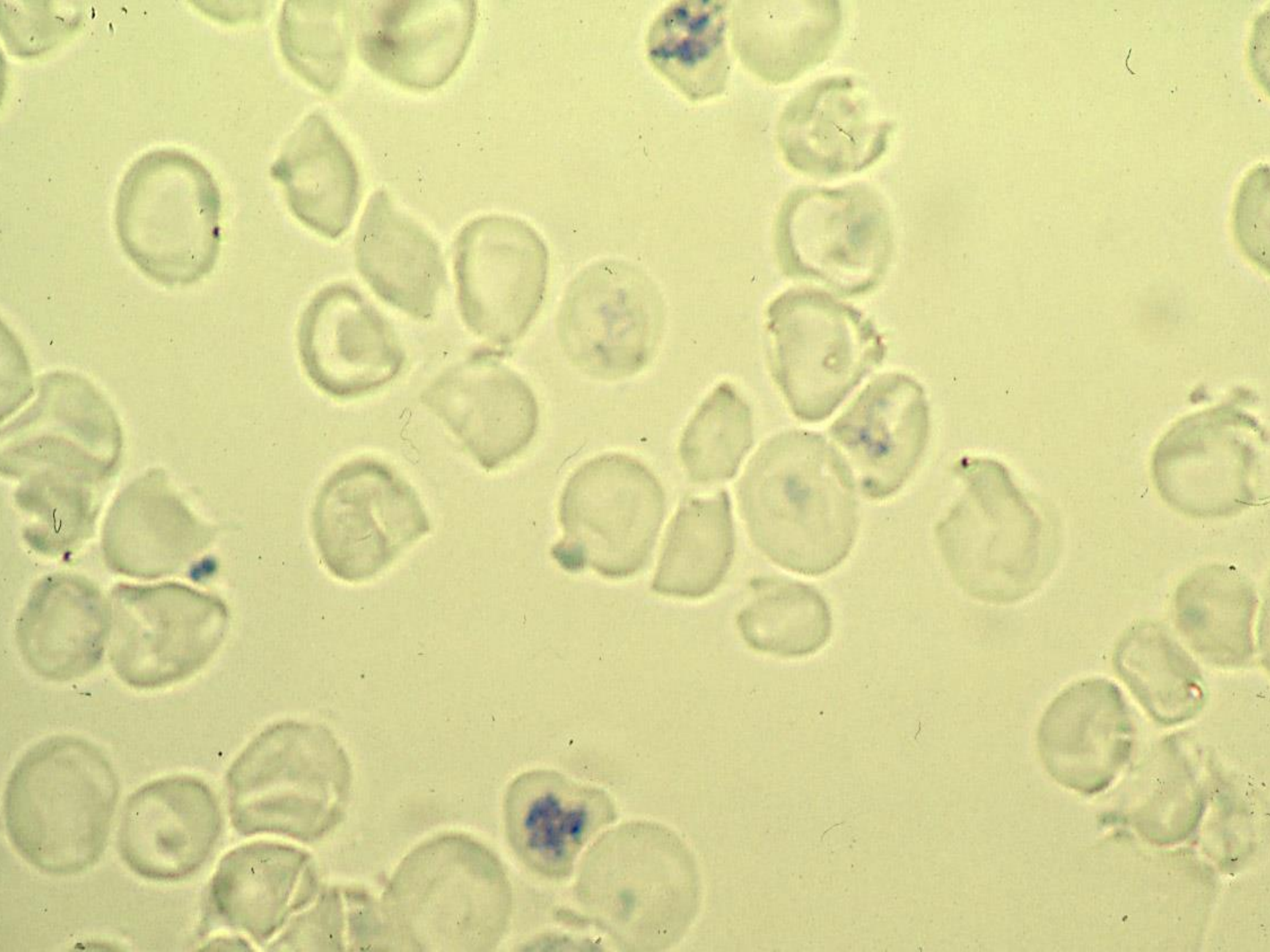
Hemolytic Anemias
Abnormal Enzyme

- **Glucose-6-phosphate dehydrogenase deficiency**

G6PD Deficiency

- Hereditary hemolytic anemia caused by erythrocyte G6PD deficiency
- X-linked recessive
- Kurdish Jews, West African blacks
- Sensitive to oxidative stress
- Precipitated by infection, drugs, fava beans
- Bite cells, Heinz bodies on blood smear



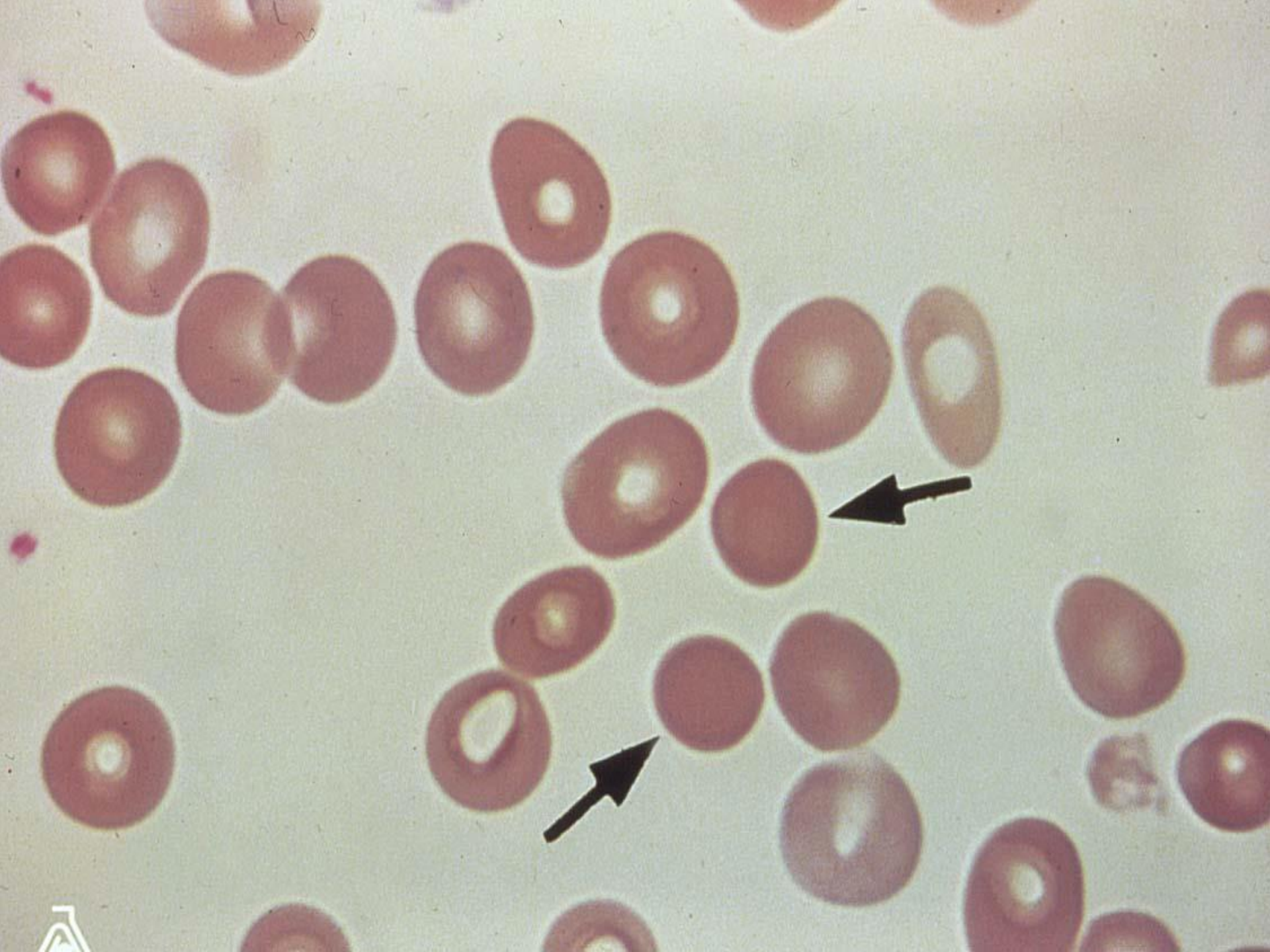


Hemolytic Anemias Autoimmune

- Warm autoimmune hemolysis
- Cold autoimmune hemolysis

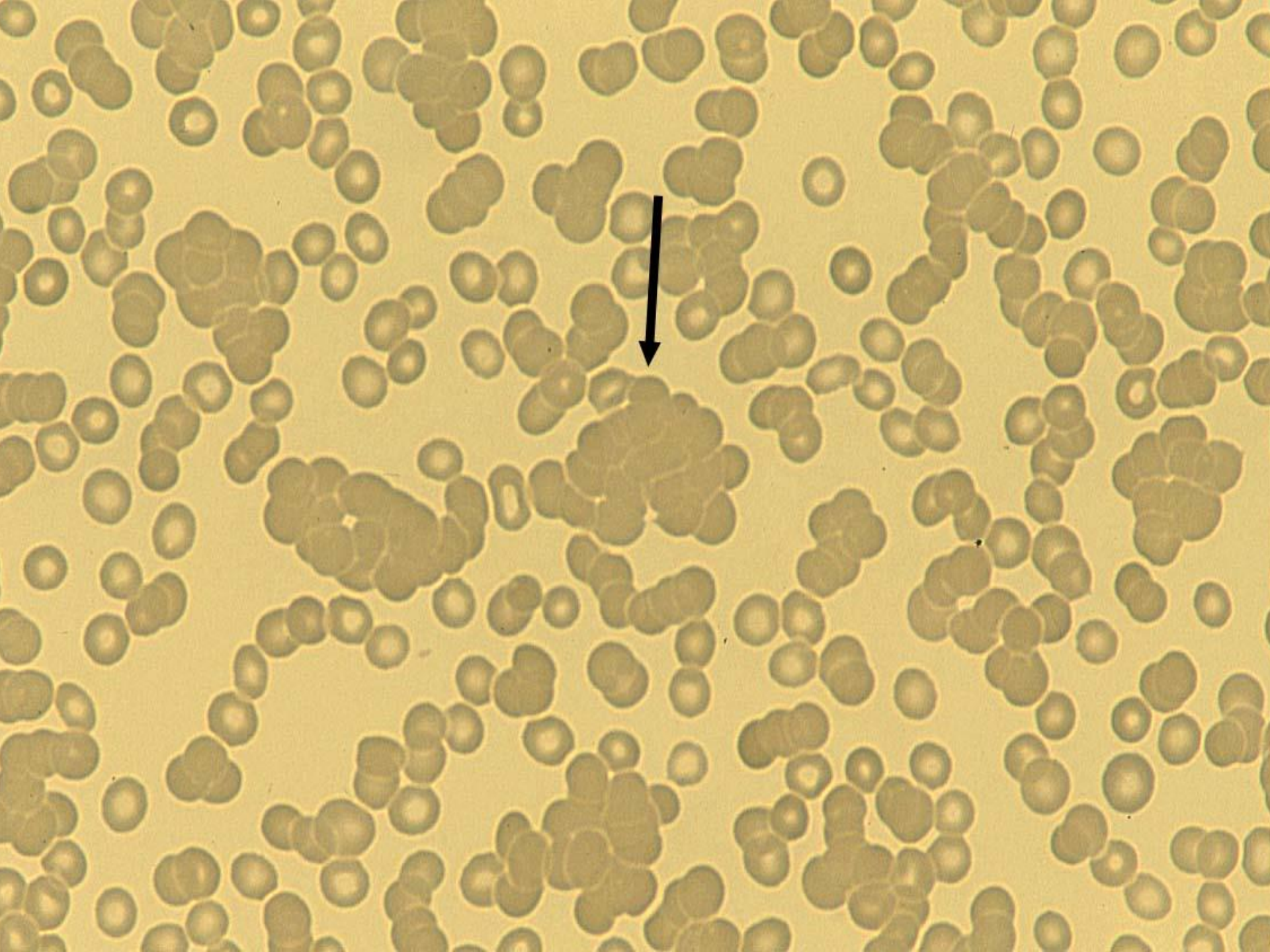
Warm Autoimmune Hemolysis

- IgG antibody against Rh antigen
- Extravascular hemolysis in spleen (Fc receptors)
- Idiopathic, autoimmune disease (SLE), chronic lymphocytic leukemia, drugs (alpha methyldopa, quinidine)
- Spherocytes on blood smear
- Positive direct Coombs test



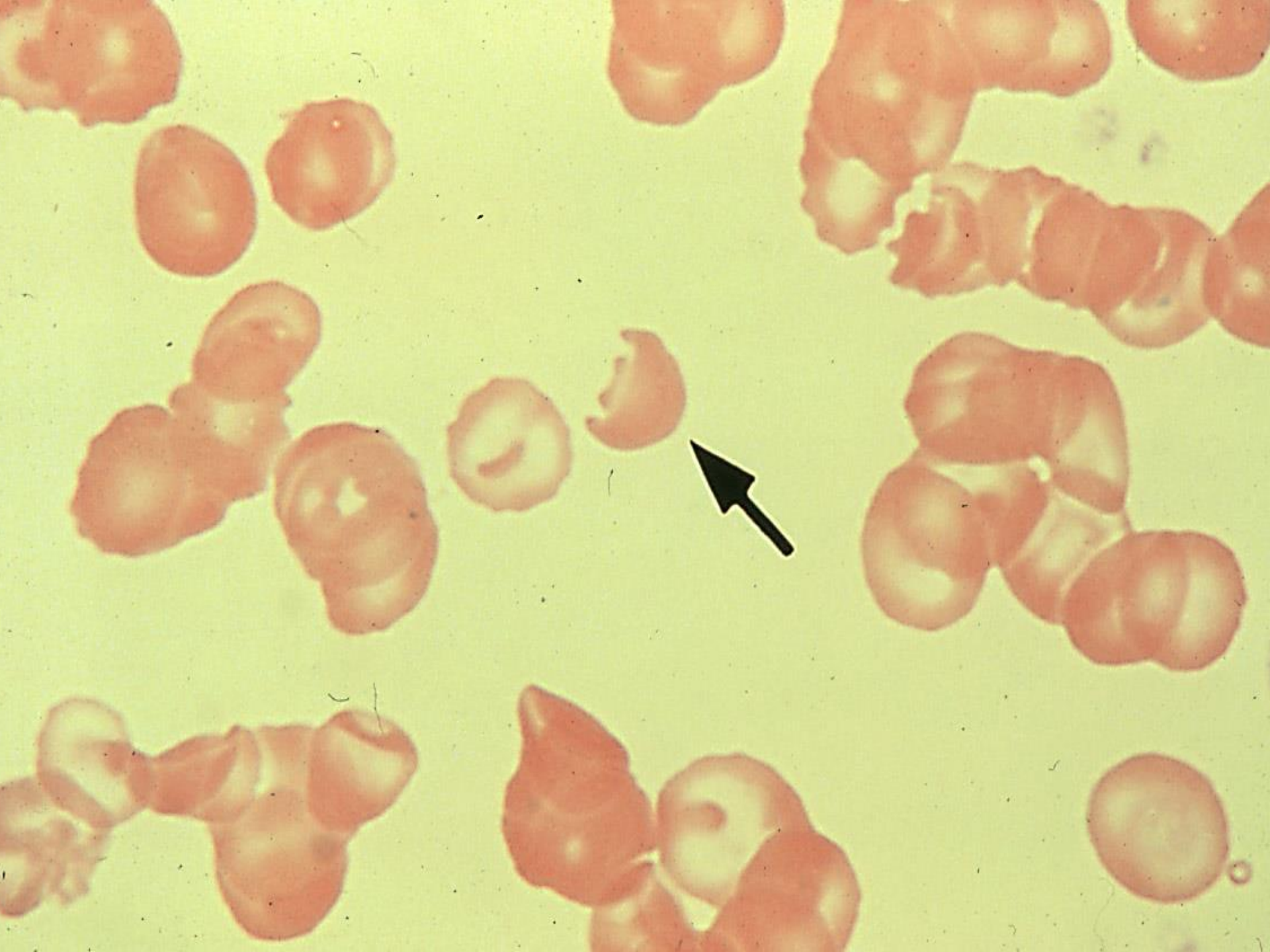
Cold Autoimmune Hemolysis

- IgM antibodies against big I antigen
- Extravascular hemolysis in liver (C3 receptors)
- Usually idiopathic
- Lymphoma, mycoplasma pneumonia, infectious mononucleosis
- Agglutinated RBCs on blood smear



Hemolytic Anemias Mechanical Destruction

- **Macroangiopathic hemolysis**
  - **mechanical heart valves**
  - **schistocytes on blood smear**
- **Microangiopathic hemolysis**
  - **RBC fragmentation on fibrin strands**
  - **DIC, TTP**
  - **schistocytes on blood smear**



Hemolytic Anemias Mechanical Destruction

- March hemoglobinuria
  - fragmentation by external pressure
  - military recruits, athletes
- Hypersplenism
  - pancytopenia
  - cirrhosis, lymphoma, leukemia

Blood Loss Anemia

- **Acute blood loss**
  - **no immediate change in hemoglobin level**
  - **hypovolemic shock**
  - **slow recovery of red cell mass**
- **Chronic blood loss**
  - **no anemia until absent iron stores**