
بسم الله الرحمن الرحيم

- A 25 years old lady presented with , fatigue,lethargy ,palpitation and shortness of breath on exertion. she is also having polymenorrhagia. On examination she is pale and her nails are spoon shaped. Her blood picture show low Hb, low haematocrit, RBC are small and hypochromic…..

- A 7 years old boy having pallor, prominent cheek bones and abdominal distension.His symptoms started during first year of his life. He has received several blood transfusion. His liver and spleen enlarged. Hb electrophoresis show high %age HbF……

Anemia

- Learning objective..

- Define Anemia.
- Classification Anemia.
- Types of Anemia.
- Signs and Symptoms of Anemia.
- Investgation of Anemia.
- Treatment of Anemia.

Anemia

- In its broadest sense, anemia is a functional inability of the blood to supply the tissue with adequate O_2 for proper metabolic function.
- Anemia is not a disease, but rather the expression of an underlying disorder or diseases.

Anemia

- Blood has abnormally low oxygen-carrying capacity
  - Blood oxygen levels cannot support normal metabolism
  - It is a symptom rather than a disease itself

Anemia

Quantitative and/or qualitative deficiency of RBC

- ↓ No of RBCs
- ↓ Amount of Hb
- ↓ O_2 carrying capacity

Anemia

Determinants of anemia

- Insufficient Erythrocytes
- Decreased Hemoglobin Content
- Abnormal Hemoglobin

Insufficient Erythrocytes

- Hemorrhagic anemia – result of acute or chronic loss of blood
- Hemolytic anemia – prematurely ruptured erythrocytes
- Aplastic anemia – destruction or inhibition of red bone marrow

Decreased Hemoglobin Content

- Iron-deficiency anemia results from:
  - A secondary result of hemorrhagic anemia
  - Inadequate intake of iron-containing foods
  - Impaired iron absorption
- Megaloblastic anemia results from:
  - Deficiency of vitamin B_{12}
  - Pernecious Anemia…Lack of intrinsic factor needed for absorption of B_{12}
  - Defeciency of Folic acid.

Abnormal Hemoglobin

- Thalassemias – absent or faulty globin chain in hemoglobin
- Sickle-cell anemia – results from a defective hemoglobin called hemoglobin S (HbS)

Anemia

- Anemia may develop:
  - When RBC loss or destruction exceeds the maximal capacity of bone marrow RBC production
  - When bone marrow production is impaired

Anemia

- Various diseases and disorders are associated with anemia include:
  - Nutritional deficiencies
  - External or internal blood loss
  - Increased destruction of RBCs
  - Abnormal hemoglobin synthesis

    Ineffective or decreased production of RBCs
  - Bone marrow suppression by toxins, chemicals, radiation, Infection
  - Bone marrow replacement by malignant cells

Classification of anemias

- Anemia may be classified morphologically based on the average size of the cells and the hemoglobin concentration into:

Microcytic, hypochromic

Macrocytic

Normocytic, normochromic

Normocytic RBC

NORMOCYTE

DESCRIPTION | VARIATIONS | CONFUSIONS

Description:

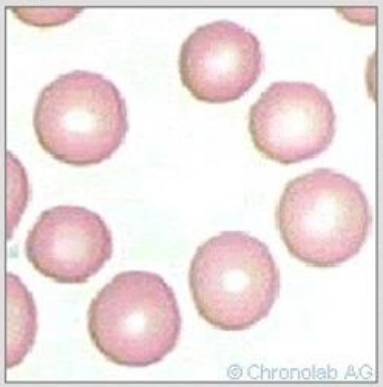
Normal size and volume, mean cell volume (MCV) 80-100 fl.

Shape:

Flexible biconcave, discoid shape. Non-nucleated cell, no Golgi's complex, centriole or lysosomes.

Significance:

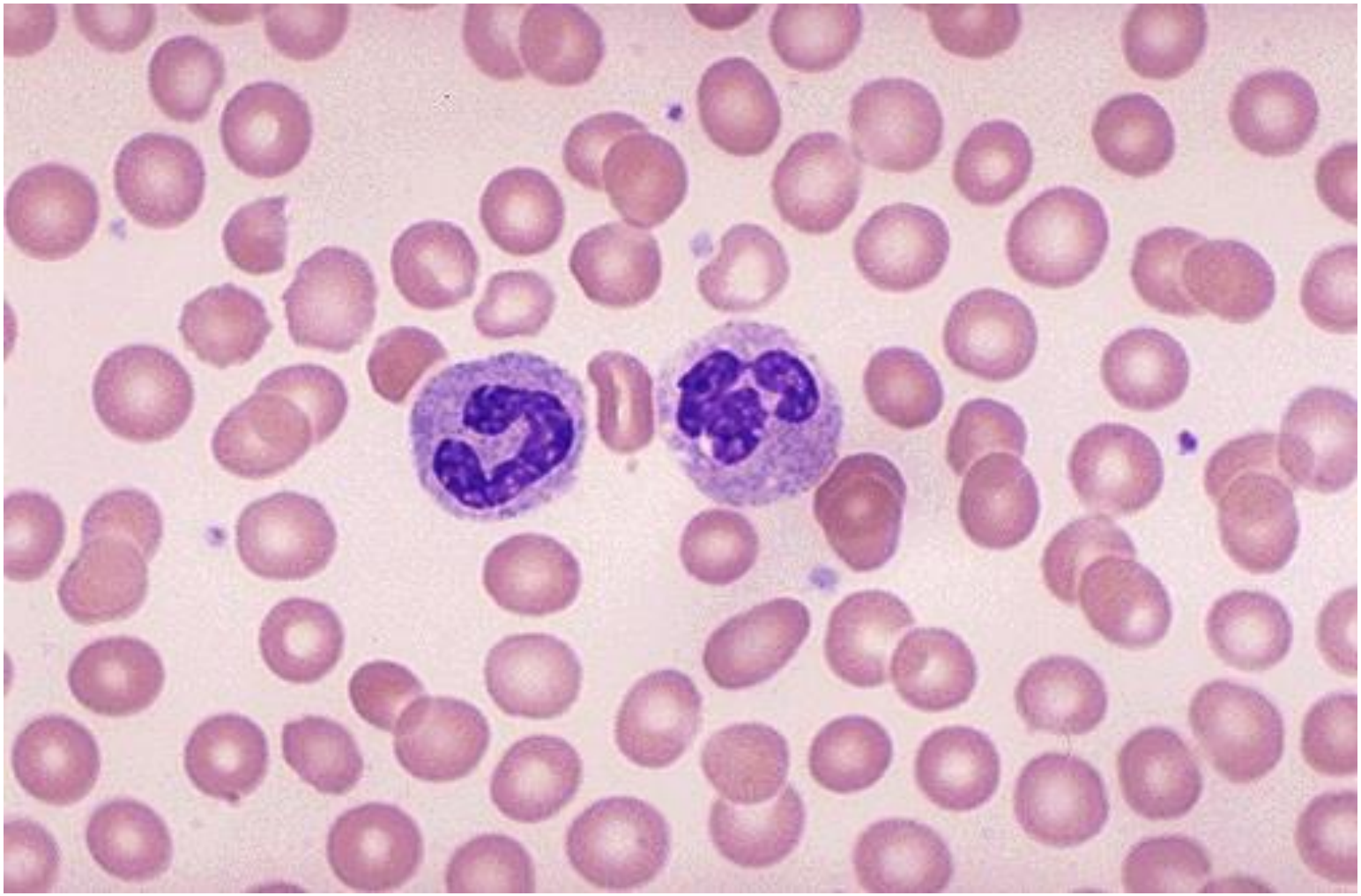
Healthy state.



Staining method: May-Grünwald/Giemsa
Microscope: Light
Magnification: 1:1000

Size: 7 - 8,5 µm

Normal RBCs



Microcytic RBC

MICROCYTE

DESCRIPTION | VARIATIONS | CONFUSIONS

Description:

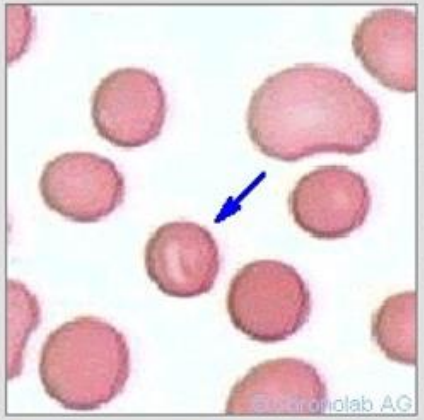
Smaller diameter and volume than normal, round or slightly oval red cells, normal thickness (MCV < 70 fl).

Shape:

Flexible biconcave, discoid shape.

Significance:

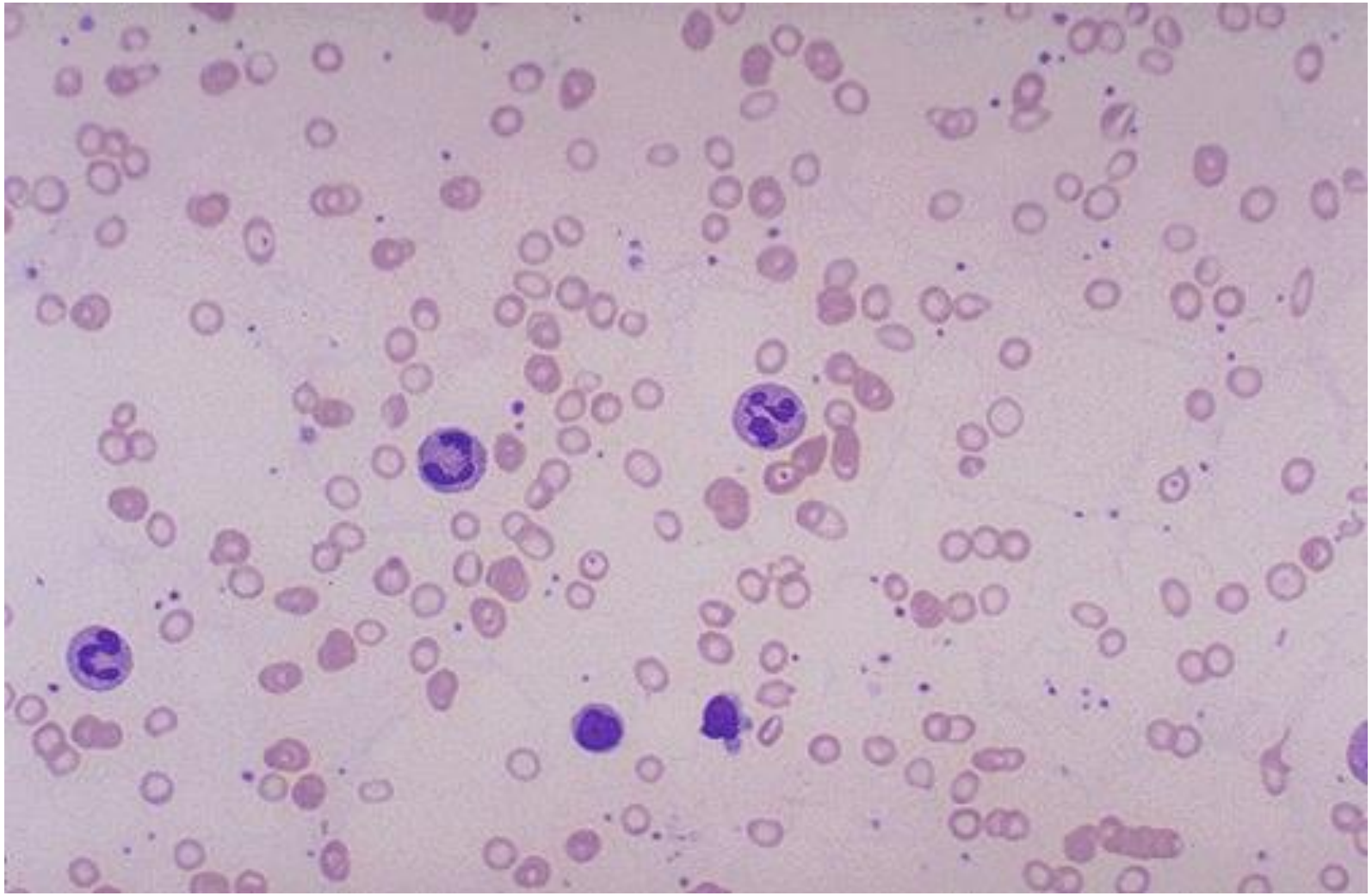
Iron deficiency, thalassemias, sideroblastic anemia.



Staining method: May-Grünwald/Giemsa
Microscope: Light
Magnification: 1:1000

Size: < 6 µm

Micocytic Hypochromic anemia



Macrocytic RBC

MACROCYTE

DESCRIPTION | VARIATIONS | CONFUSIONS

Description:

Larger volume than normal (MCV >100 fl).

Shape:

Discoid shape, a complete mature cell filled with hemoglobin.

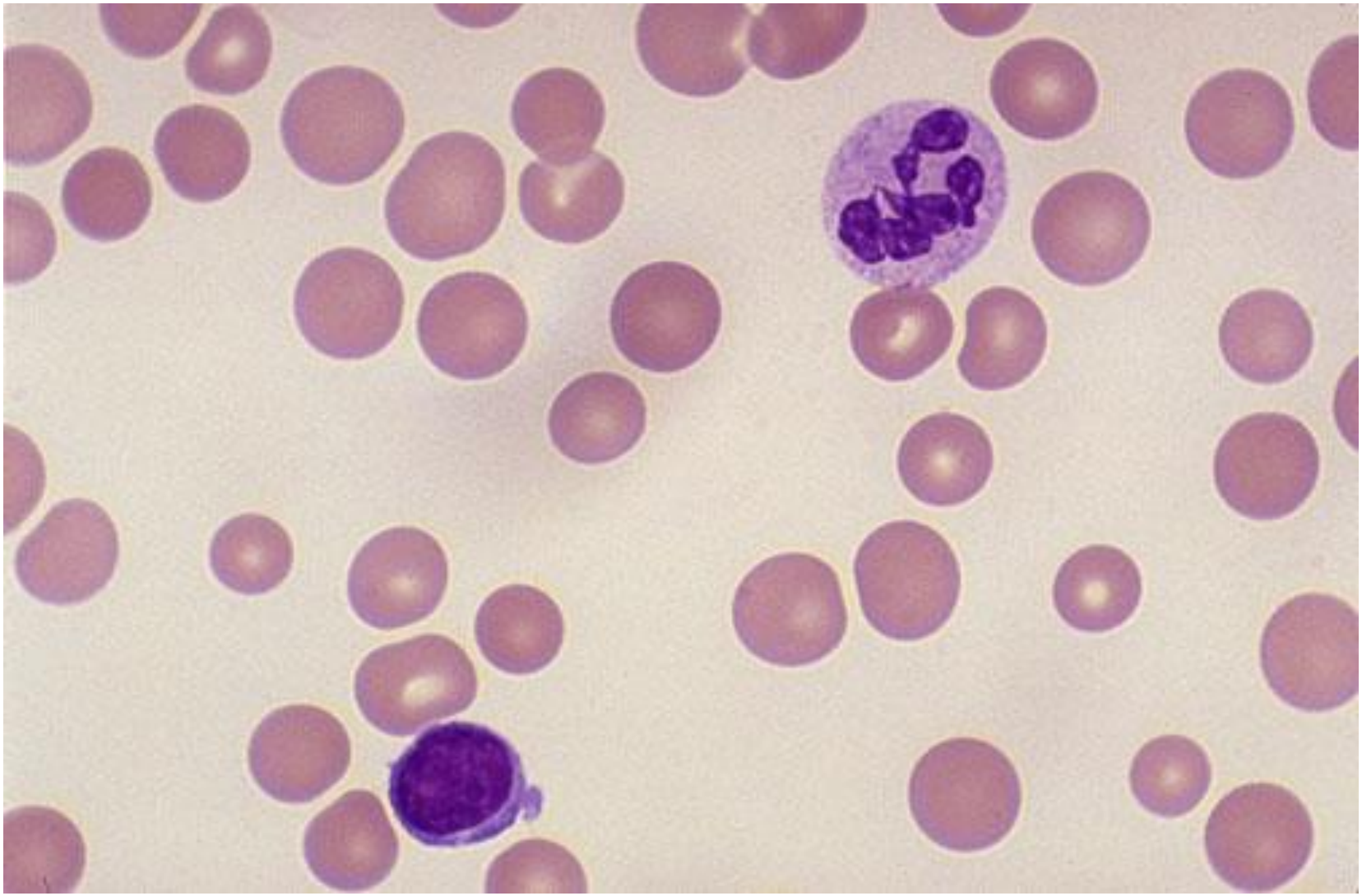
Significance:

Liver disease, drug induced anemia, Vitamin B_{12} deficiency, folic acid deficiency.

Staining method: May-Grünwald/Giemsa
Microscope: Light
Magnification: 1:1000

Size: 9 - 10 µm

Macrocytic anemia



Normochromic RBC

NORMOCHROMIC ERYTHROCYTE

CHRONOLAB

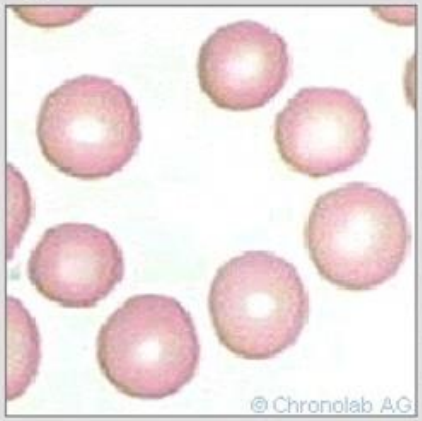
DESCRIPTION | VARIATIONS | CONFUSIONS

Description:

Normally colored.

Shape:

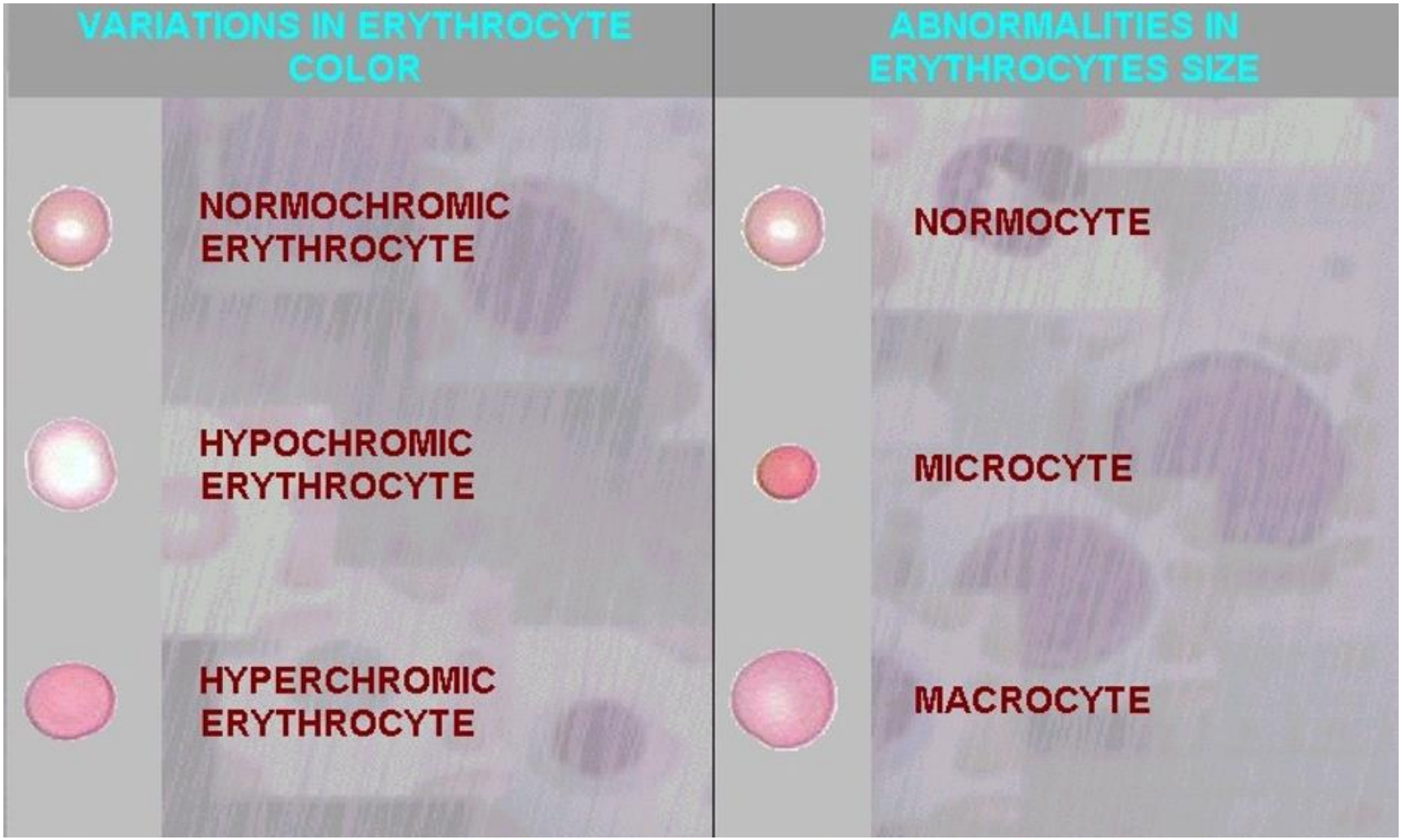
Flexible biconcave, discoid shape. Non-nucleated cell, no Golgi's complex, centriole or lysosomes.



Staining method:
May-Grünwald/Giemsa
Microscope: Light
Magnification: 1:1000

Size:
7 - 8,5 µm

Summary of variations in color and size



Etiological classification

1. Impaired RBC production.
2. Increased RBC destruction.
3. Blood Loss.

Classification of Anemia

- Nutritional anemia
- Pernicious anemia
- Aplastic anemia
- Renal anemia
- Blood loss anemia
- Hemolytic anemia
- Congenital anemia

Nutritional Anemia

- Iron deficiency anemia
  - ↓ intake of iron
  - ↓ absorption of iron
  - Chronic blood loss
  - ↑ demand of iron (e.g. pregnancy)
  - No of cells may be normal
  - ↓ iron → ↓ Hb → ↓ size of cells (microcytic)
  - ↓ iron → ↓ Hb → ↓ colour (Hypo chromic)

  (brittle spoon shaped nails- koilonychias- is a common feature)

Nutritional Anemia

- Magaloblastic anemia
  - ↓ dietary Vitamin B12
  - ↓ intrinsic factor
  - ↓Folic acid
  - Maturation failure
  - Cells- bigger (megaloblasts)
  - Cell membrane – fragile → easy rupture
  - Hb contents - normal

Hypochromic RBC

HYPOCHROMIC ERYTHROCYTE

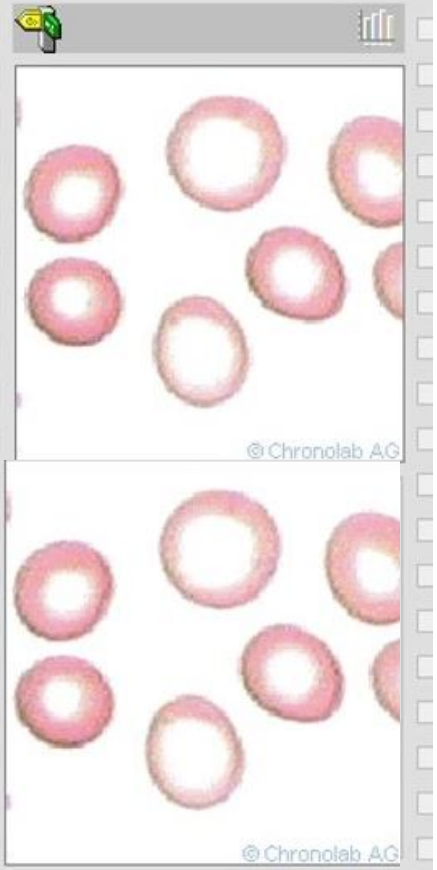
DESCRIPTION | VARIATIONS | CONFUSIONS

Description:

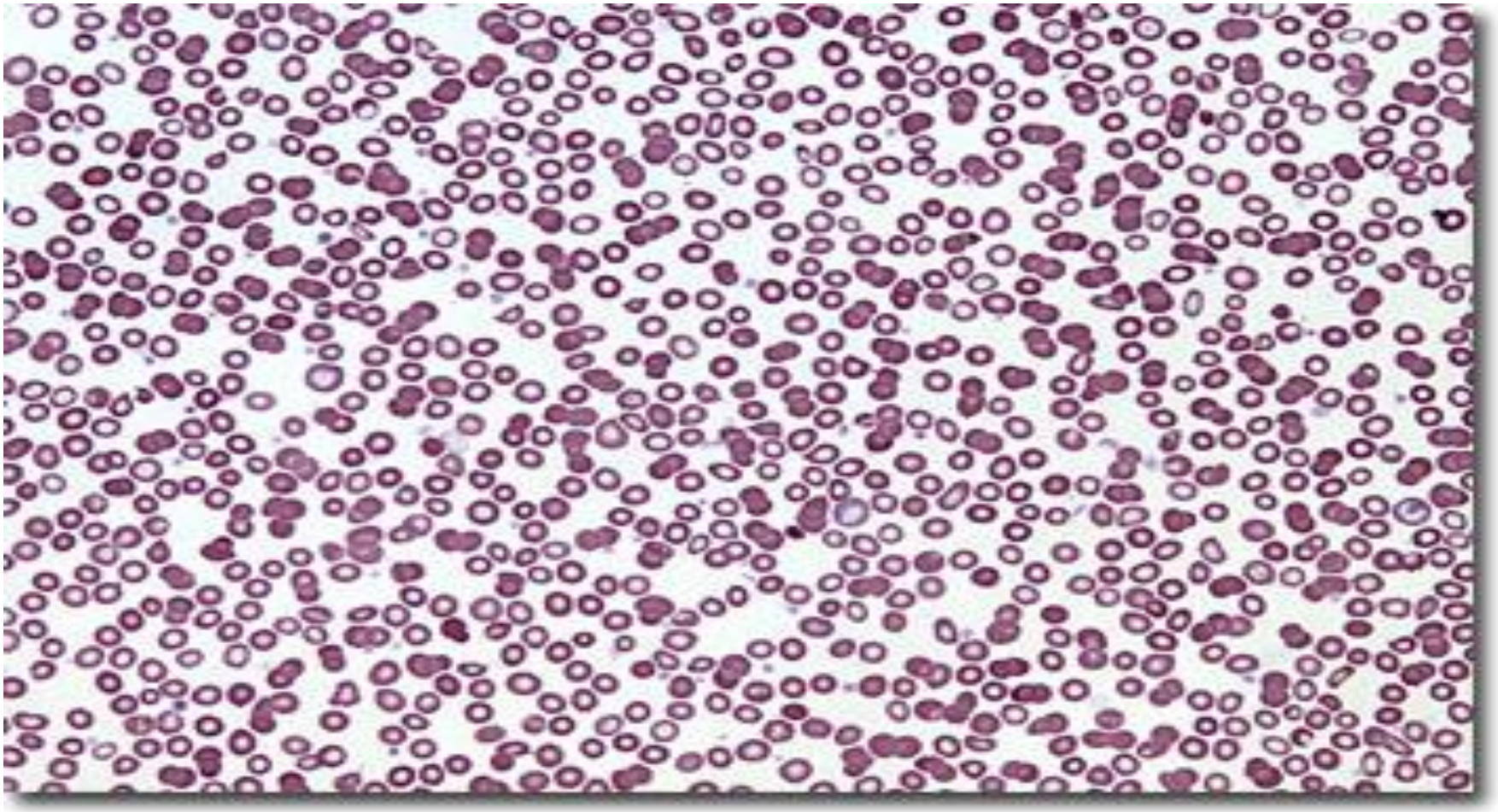
Increased area of pallor to >1/3 diameter of cell.

Shape:

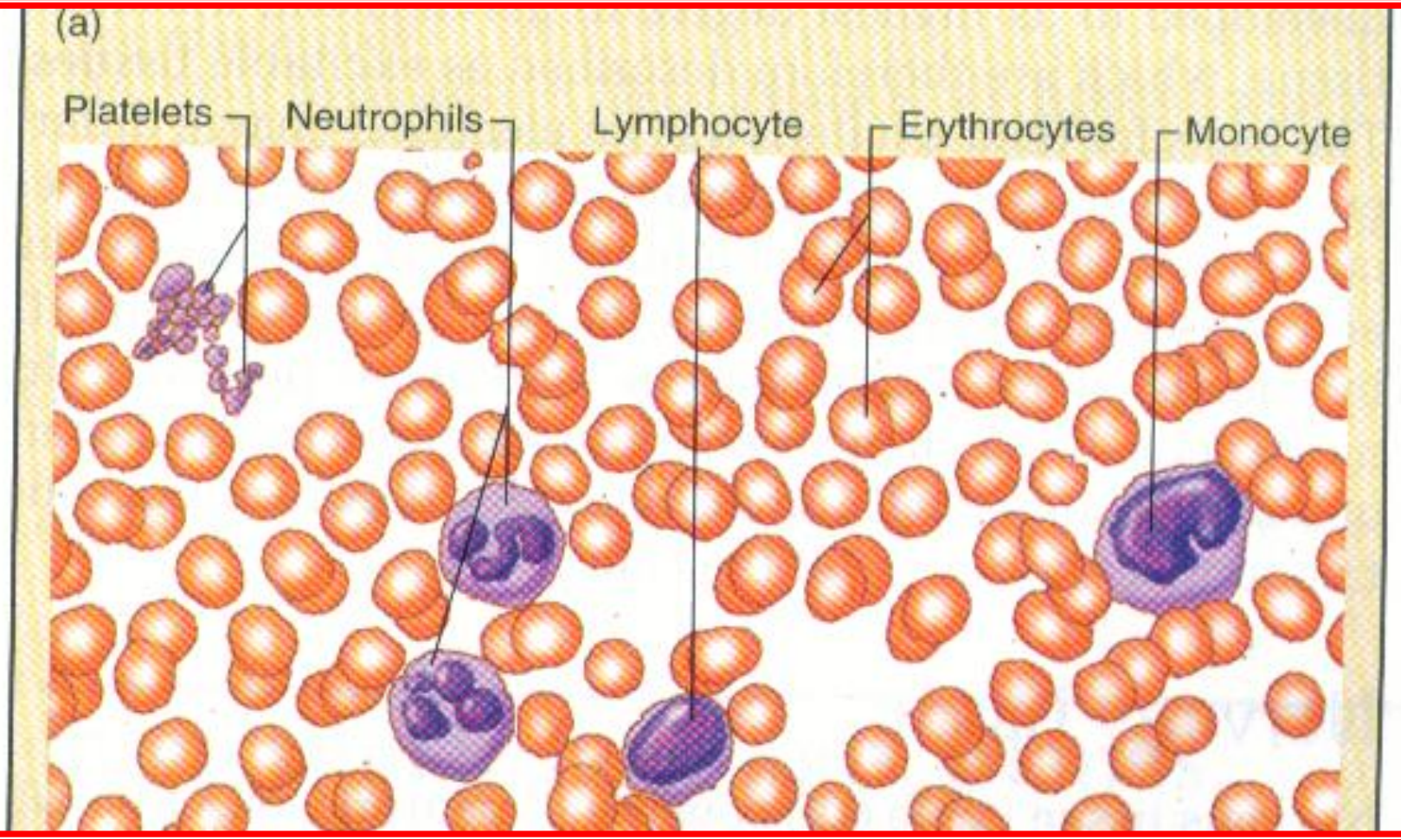
Flexible biconcave, discoid shape. Non-nucleated cell, no Golgi's complex, centriole or lysosomes.



Microcytic Hypochromic anemia



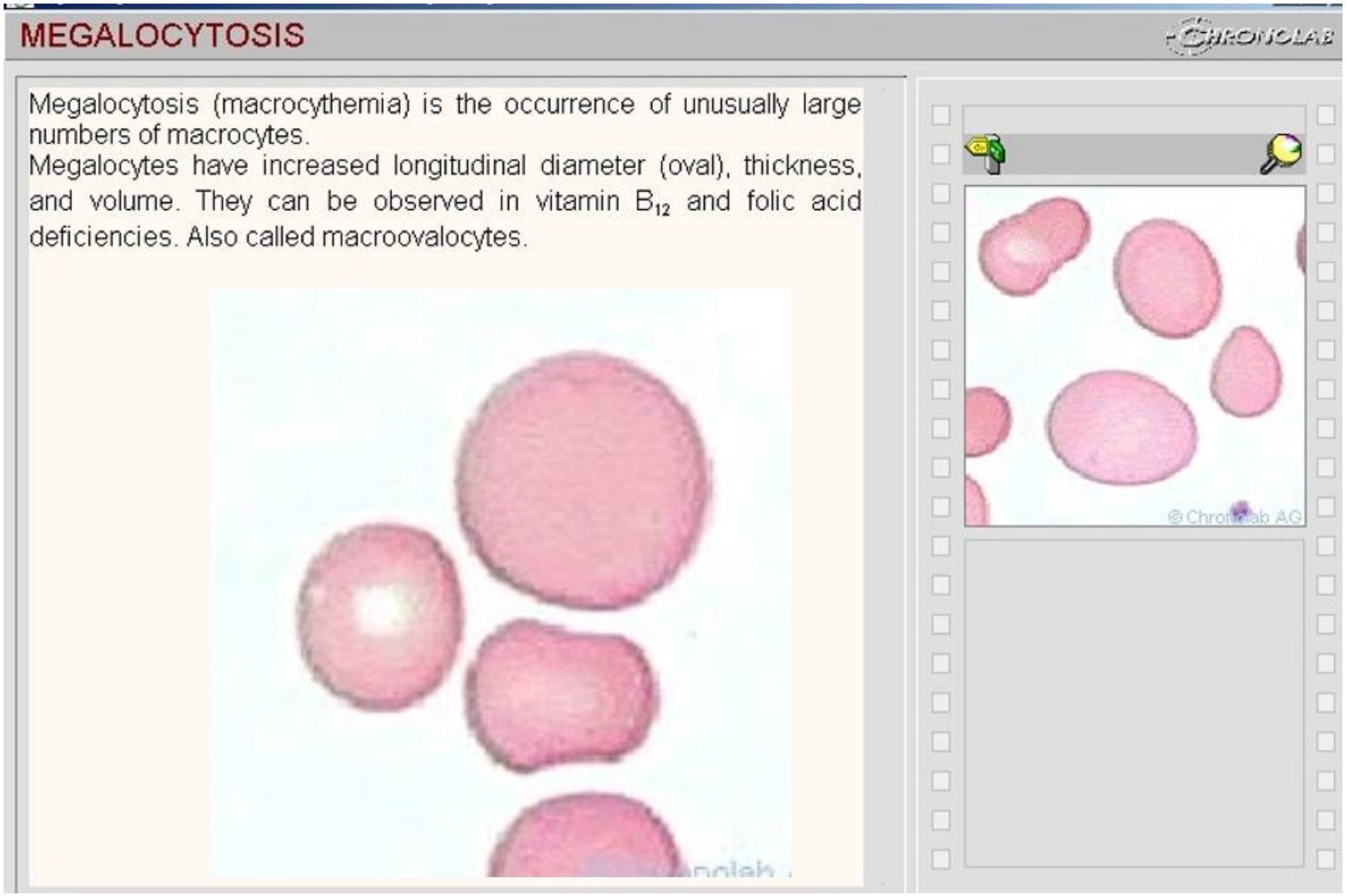
Hypochromic Anemia



Pernicious Anemia

- Maturation failure anemia
- ↓ Vit. B12 due to poor absorption from GIT
- ↓ intrinsic factor in the stomach
  - Autoimmune destruction of parietal cells
  - Atrophy of gastric mucosa
  - Gastrectomy
- Megaloblastic anemia
- Cell membrane fragile → easy rupture

Macro ovalocyte



Aplastic Anemia

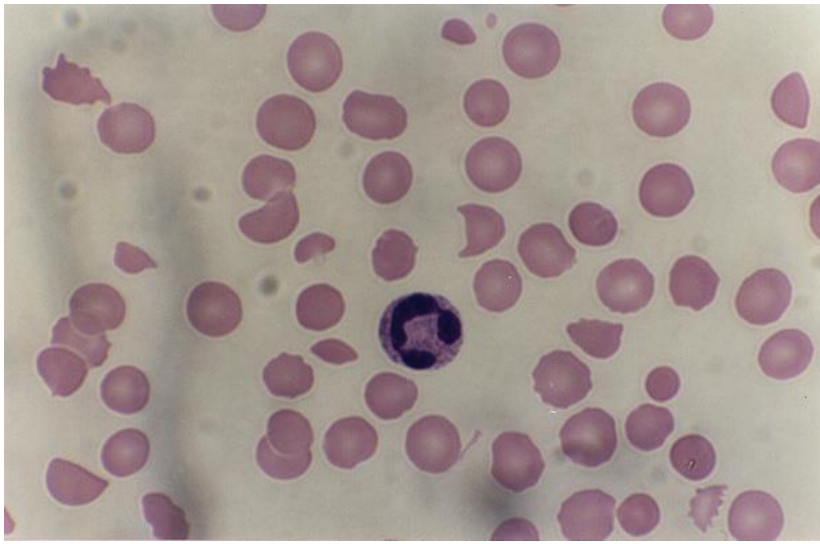
- Failure of bone marrow to produce RBCs
- Aplasia of the bone marrow
- Bone marrow may be destroyed
  - Radiation e.g X-rays, gamma rays, nuclear bomb explosion
  - Chemicals e.g.benzene, arsenic, chloramphenicol. quinine, gold salts, benzene, radium etc
  - Bacterial toxins
  - Tuberculous invasion
  - HIV infections
  - Invasion of bone marrow by cancer cells
  - Chemotherapy for cancer

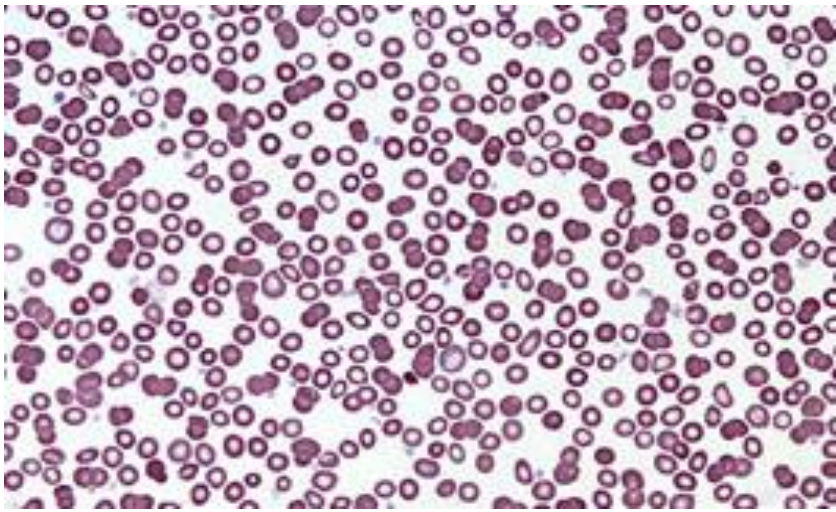
Renal Anemia

- Renal diseases (CRF) → ↓ Erythropoietin
- ↓ Erythropoietin → → ↓ Production of erythrocytes

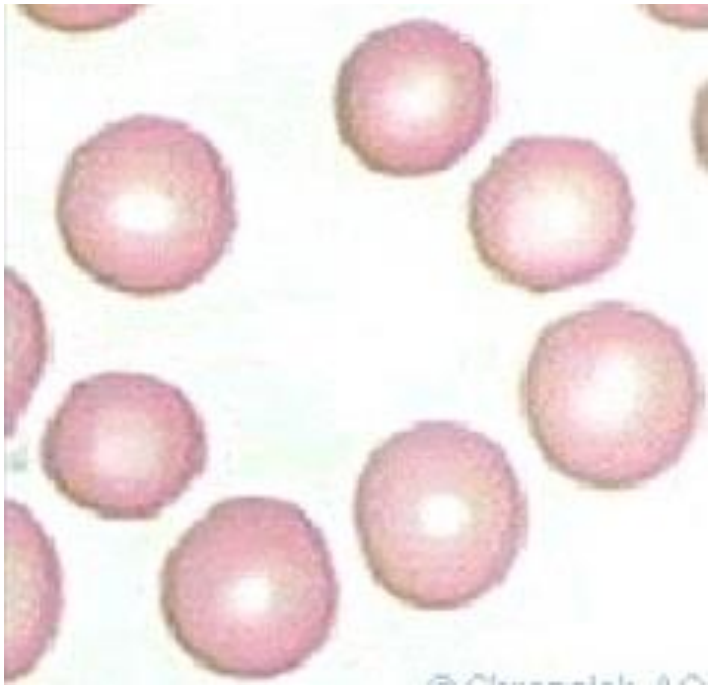
Hemorrhagic Anemia

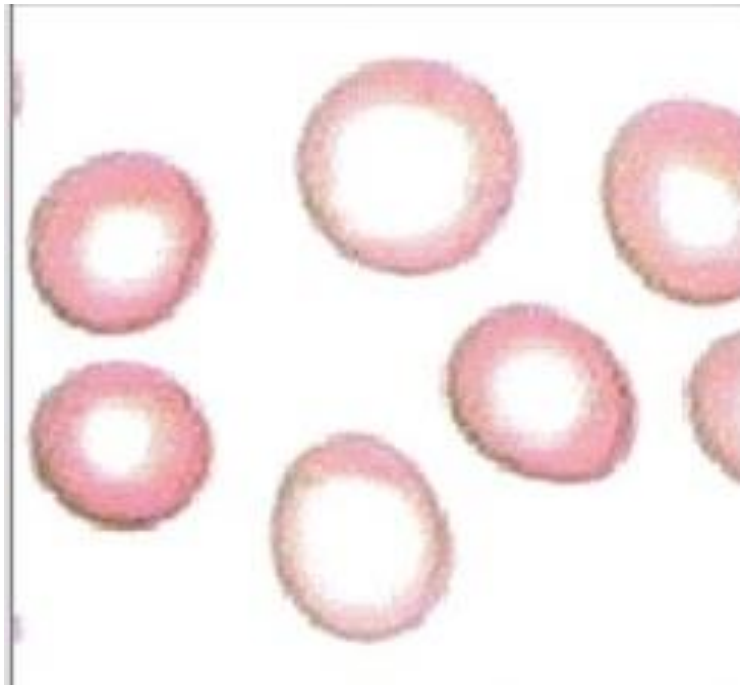
- Acute blood loss anemia
  - Normocytic
  - Normochromic
  - ↓ RBC count
  - ↓ Hb/cmm of blood
- Chronic blood loss anemia
  - Microcytic
  - Hypochromic
  - ↓ RBC count
  - ↓ Hb/cmm of blood





Normochromic & Hypochromic cells





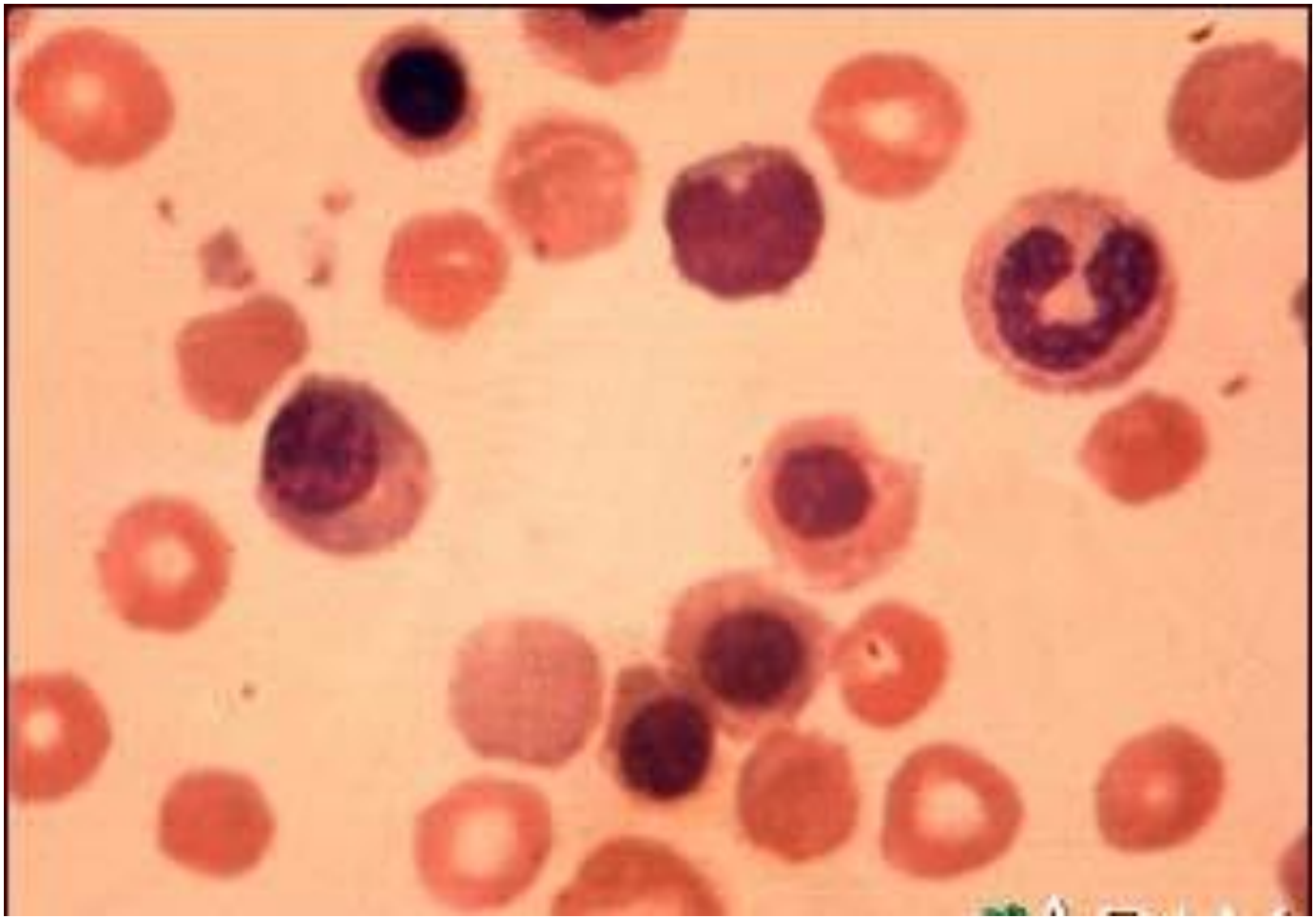
Hemolytic Anemia

- Erythroblastosis Fetalis
- Sickle cell anemia
- Congenital spherocytosis
- Hemolysis due to
  - Infections like malaria, septicemia
  - Chemicals like lead, hemolysins
  - Agglutinins
- (Jaundice is common feature in hemolytic anemia)

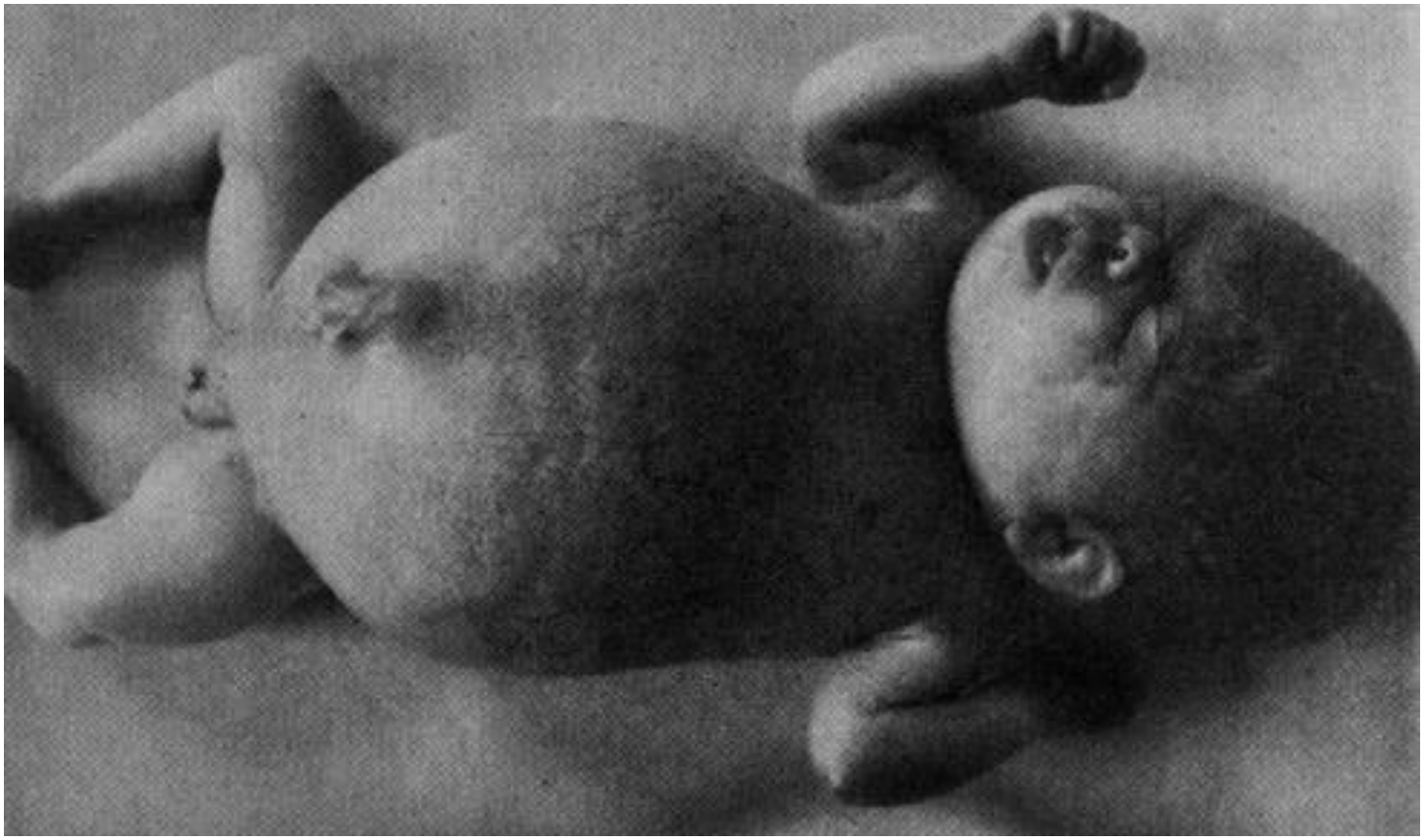
Erythroblastosis fetalis

- Rh negative mother
- Rh positive fetus
- Mother exposed to positive cells during first delivery
- Antibodies formed against positive cells
- Severe anemia in subsequent fetus bec of haemolysis

Erythroblastosis fetalis



Erythroblastosis fetalis



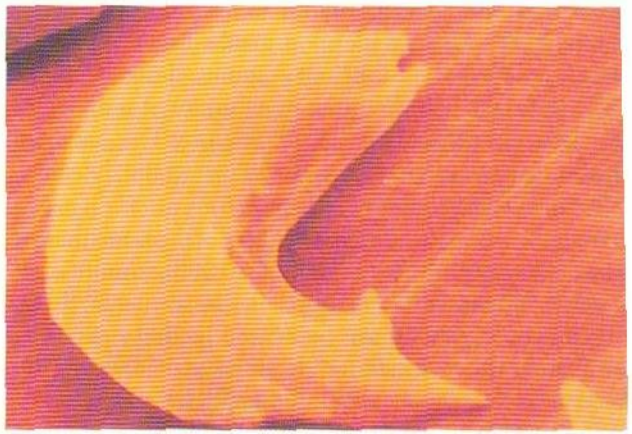
Sickle cell anemia

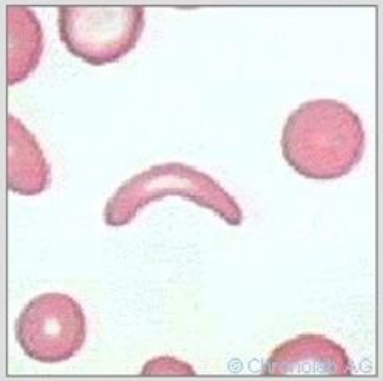
- Sickle-cell anemia – results from a defective gene coding for an abnormal hemoglobin called hemoglobin S (Hb S)
  - Alpha chains are normal, beta chain is defective
  - Hb S has a single amino acid substitution in the beta chain
  - Valine is substituted for Glutamic acid at position 6
  - Low oxygen → Precipitation and crystallization of Hb S → Sickling & hemolysis of RBC
  - Sickle cell disease crises – a vicious cycle
  - Hb S precipitate and cells aggregate may block small blood vessels leading to necrosis

Sickle cells

DREPANOCYTOSIS

Drepanocytosis is the presence of drepanocytes in the circulating blood.
These erythrocytes have a sickle shape, i.e., the shape of a half-moon. They are characteristic for cases of hereditary hemolytic anemia-drepanocytosis (sickle-cell anemia). Drepanocytosis is characterized by crises with great pain (vaso-exclusive crises) caused by the obstruction of blood vessels with rigid sickled red cells that contain HbS.





Hereditary spherocytosis

- One of the congenital anemia
- RBC are spherical instead of being biconcave
- Decreased deformability
- Cannot withstand compression
- Hemolysis in tight vascular beds

Spherocytes

SPHEROCYTE

DESCRIPTION | VARIATIONS | CONFUSIONS

Description:

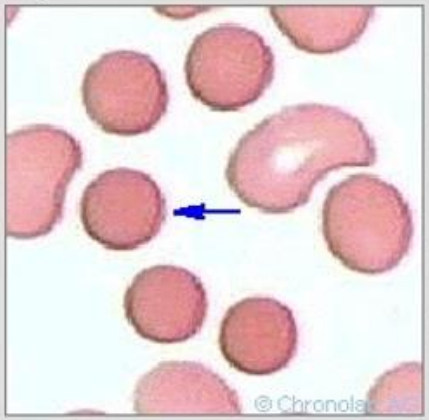
Small erythrocytes containing an increased concentration of hemoglobin, resulting from a loss of the red cell membrane. Their life span in the circulation is extremely short, and osmotic resistance is decreased to hypotonic solution.

Shape:

Spherical cells with very increased thickness (about 3 µm) and reduced diameter (about 6 µm), normal volume and biconcave shape.

Significance:

Spheroid cells occur in hereditary spherocytosis and hemolytic anemia.



Staining method: May-Grünwald/Giemsa
Microscope: Light
Magnification: 1:1000

Size:
about **6** µm

Thalassemia

- Cooley's anemia or Mediterranean anemia
- Impaired α or β chain synthesis due to genetic abnormality
- α thalassemia
  - Decreased, defective or absent β chain
  - There may be an excess of γ chain
- β thalassemia (more common)
  - Decreased, defective or absent β chain
  - Excess of α chain precipitates in hemopoeitic cells

Common clinical features in anemia

- Pale skin, lips, conjunctiva, mucous membrane, koilonychias etc
- Increased HR, COP, murmurs
- Increased Respiration rate, breathlessness
- Anorexia, nausea , vomiting,
- Headache, lack of concentration, irritability, lethargy, lack of energy, fatigue
- Menstrual disturbances, menorrhagia, oligomenorrhea, amenorrhea

- Investigations…

  Peripheral smear.

  To look for the cause.

- Treatment..

  General and supportive.

  Treatment of the underlying cause.

POLYCYTHEMIA

- Learning objectives…

  what is polycythemia.

  classification.

  signs and symptoms.

  investigations and treatment,

- Polycythemia…

  Raised Red cell mass, RBC count,Haematocrit

Classification…

Absolute polycythemia..

polycythemia rubra vera.

Increased erythropoetin level.

appropriatly increased level..CCF,COPD,

inappropriatly increasd level..RCC, HCC

Relative polycythemia..fluid loss from body

- SIGNS AND SYPTOMS

Hyperviscosity syndrome

- TREATMENT…

  Antiplatlets.

  Therapeutic phlebotomy.

Thank-you

Questions ??