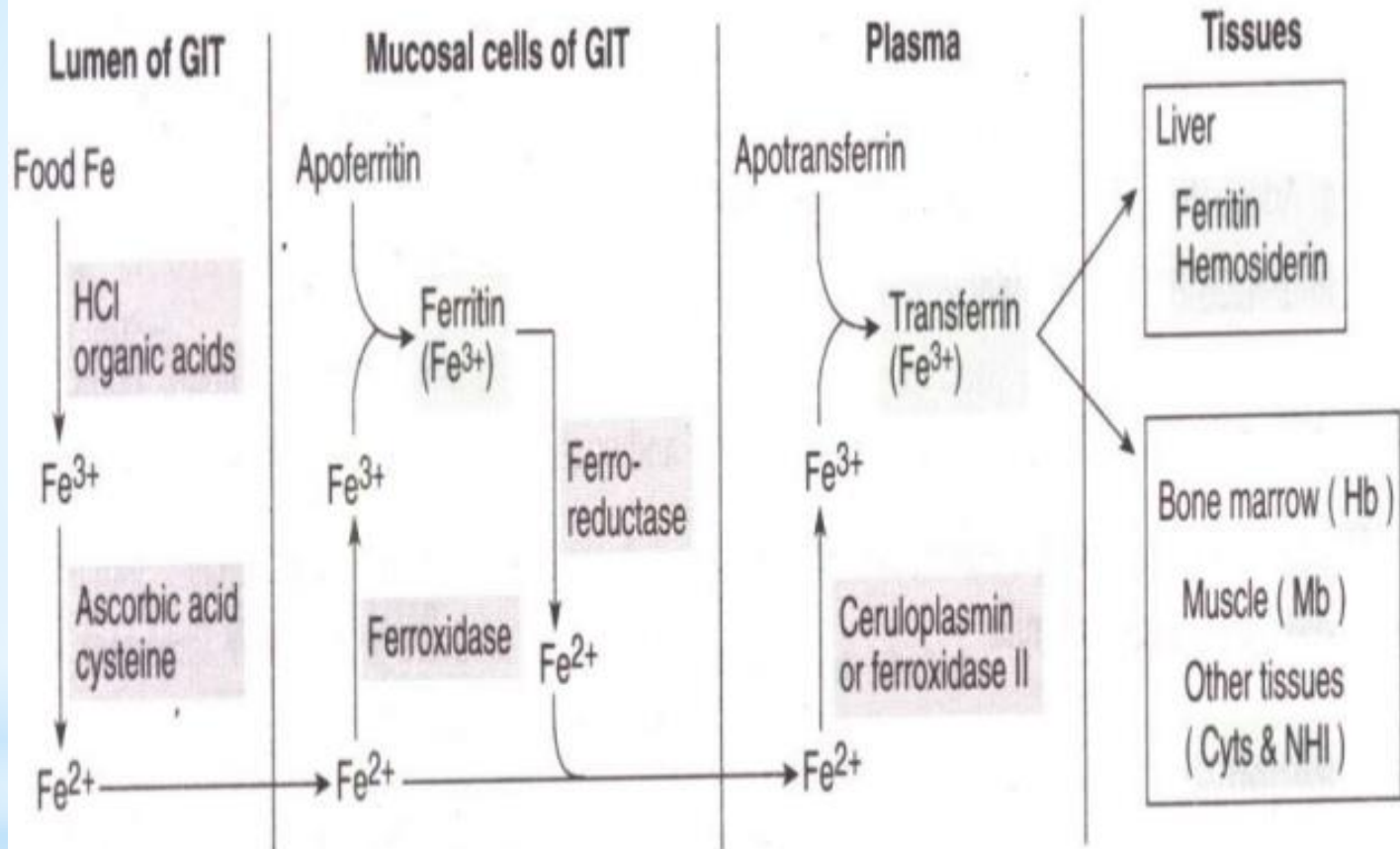
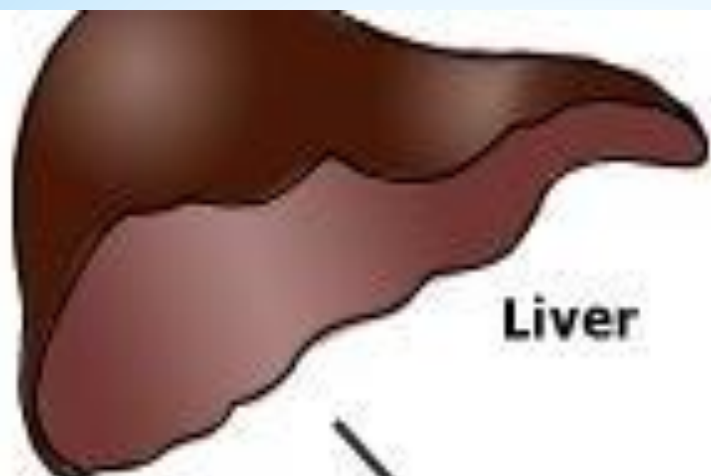




**D .SAHAR, LECTURE 2 ,ANEMIAS
2019,physiology ,medical collage**

Summary – iron absorption and transport





Liver



Hepcidin



**Decreased iron
absorption**

**Decreased release
of iron from
macrophages**

Molecules involved in iron metabolism

Iron transport in circulation and storage

Transferrin

Ferritin

Hemosiderin

Protein controls iron homeostasis by regulating all above proteins

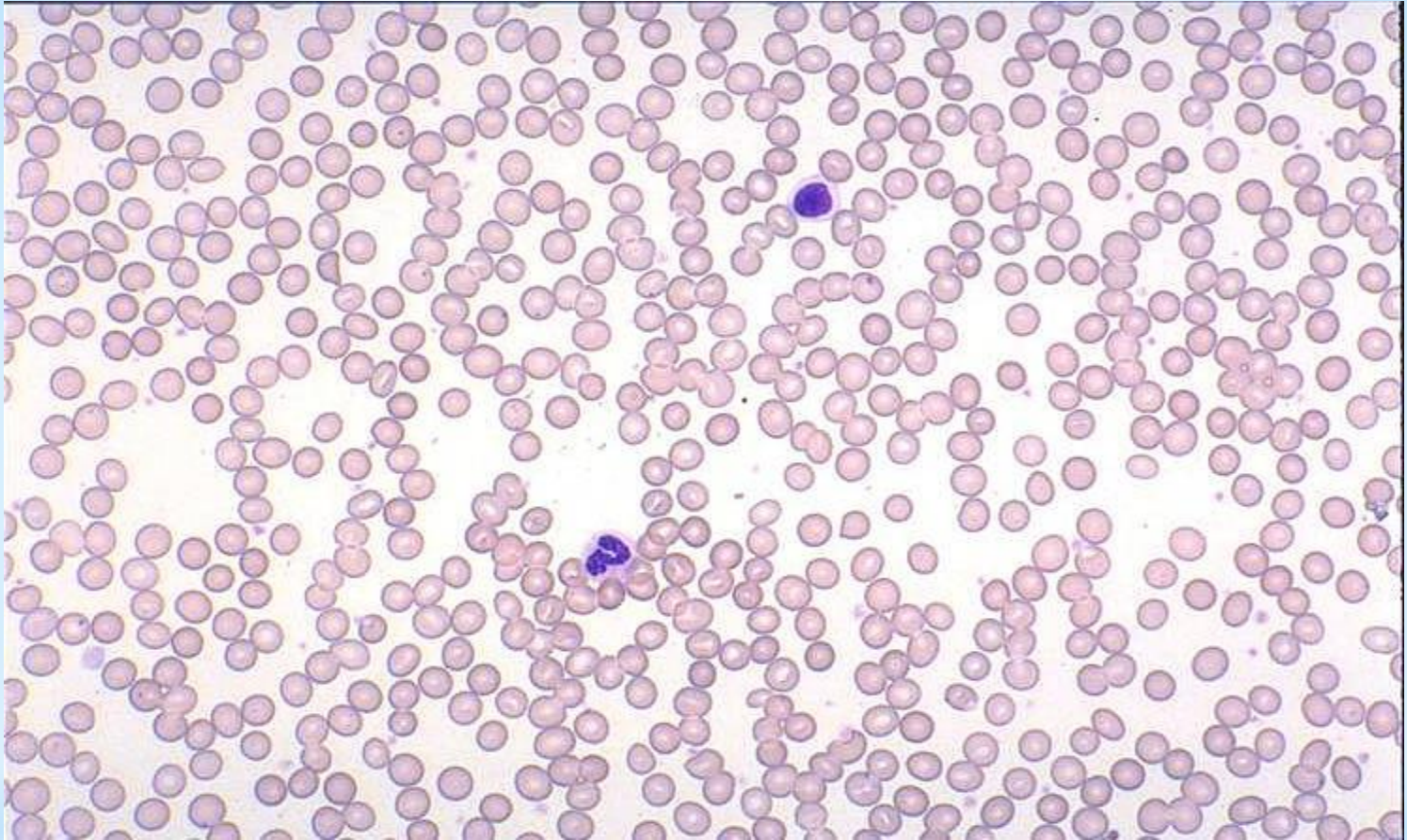
Hepcidin

Functional compound

Hemoglobin, Myoglobin

Cytochrome

Catalase, Peroxidase.



* Normal blood film

Anemia

Condition occur due to lack enough healthy Red blood cells or hemoglobin

1- loss of large volume of blood

usually when the blood loss occur like hemorrhoid, gastritis. here is blood loss, plasma replaced quickly while RBC takes few weeks to replaced .this caused by some chronic condition.



2- Decrease production of Red blood cell

A-Iron deficiency anemia

Lack of iron cause decrease Hb production

B-Bone marrow aplasia

-Loss of function of bone marrow due to

-Drug poisoning

-Gamma ray irradiation

-Viral infection.

3- failure of maturation of RBC

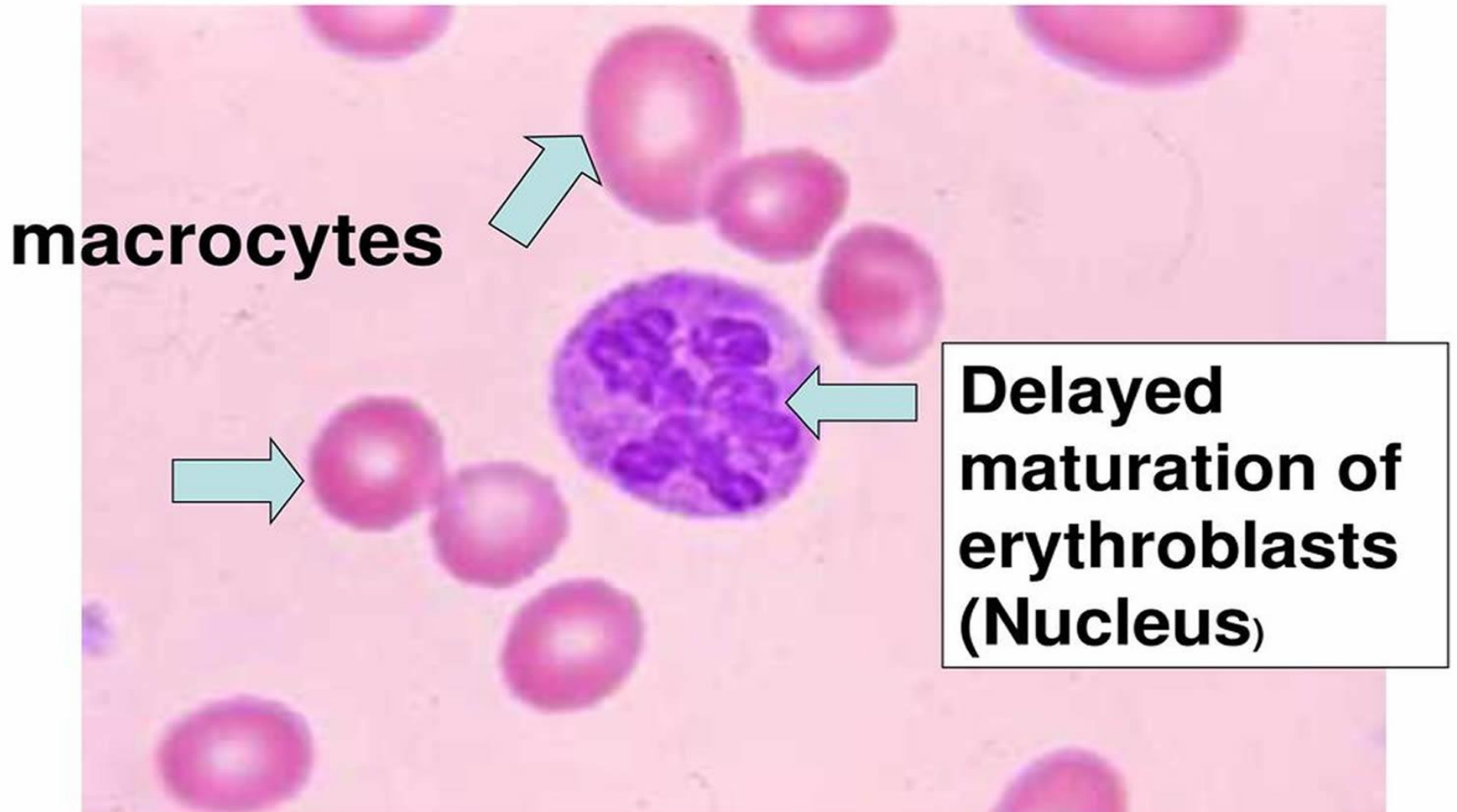
-B12 and folic acid

-B12 important for synthesis of DNA ,and caused failure of nuclear maturation and division so inhibit RBC production.

that cause (megaloblastic anemia),pernicious anemia



Megaloblastic Anemia



3-Hemolysis of RBCS

- a.** Drug poisoning
- b.** Hemolytic disease (sickle cell anemia, spherocytosis)
- c.** Erythroblastosis fetalis ,disease of newborn - antibodies from mother during pregnancy destroy fetal RBC
- d.** Thalassemia(cooly's anemia),also called Mediterranean anemia ,due to deficiency of globulin caused low concentration of Hb

EFFECT OF ANEMIA ON CIRCULATING SYSTEM

- Viscosity of blood decreased.
- Decreased resistance of blood flow in peripheral blood vessels.
- Cardiac output increased 2 times, Hypoxia caused increased return of blood to the heart and increased cardiac output more.

symptoms of anemia

fatigue.

weakness.

pale skin.

shortness of breath.

Dizziness

Soreness of the mouth with cracks at the corners

❖ strange **cravings** to eat items that aren't food, such as dirt, ice, or clay. (pica) (**IRON DEFICIENCY**)

➤ A tingling, "pins and needles" sensation in the hands or feet ,Lost sense of touch ,tongue swelling (**B12 DEFICIENCY**)

mean cell volume(mcv)

- ❑ is the **average volume of individual RBCs.**
- ❑ **MCV=PCV/RBC×10**
- ❑ the normal value **80–100 fl.** femtoliters (fL, or 10^{-15} L)
- ❑ RBC is the quantity expressed in millions per microliter ($10^6 / \mu\text{l}$).

MCV decreased in (e.g., microcytic anemia). <80fL

- iron deficiency anemia
- thalassemia
- and other chronic diseases

MCV increased in (e.g., macrocytic anemia). >100fL

- in folic acid deficiency
- vitamin B₁₂ deficiency

➤ mean corpuscular hemoglobin (MCH)

or "mean cell hemoglobin" (MCH) :

- ❑ is the average mass of hemoglobin per red blood cell in a sample of blood.

It is calculated by dividing the total mass of hemoglobin by the number of red blood cells in a volume of blood.

* $MCH = (Hgb) / RBC \times 10$

* PICOgram = 10^{-12}

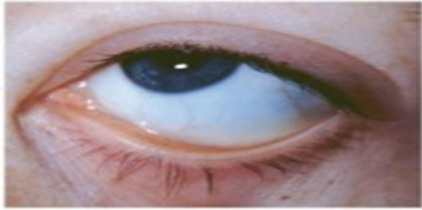
- ❑ A normal value in 27 to 31 picograms/cell.
- ❑ It depends on hemoglobin synthesis.
- ❑ It decreases when Hb synthesis reduces

Mean corpuscular hemoglobin concentration: (MCHC)

a measure of the concentration of hemoglobin in a given volume of packed red blood cells.

- It is calculated by dividing the hemoglobin by the hematocrit.
- $HB/PCV \times 100$ (gm/dl)
- * dl = 10^{-1}
- normal ranges 32 to 36 g/dL

Clinical sign of anaemia



PALLOR



ATROPHIC GLOSSITIS



KOilonychia



ANGULAR STOMATITIS

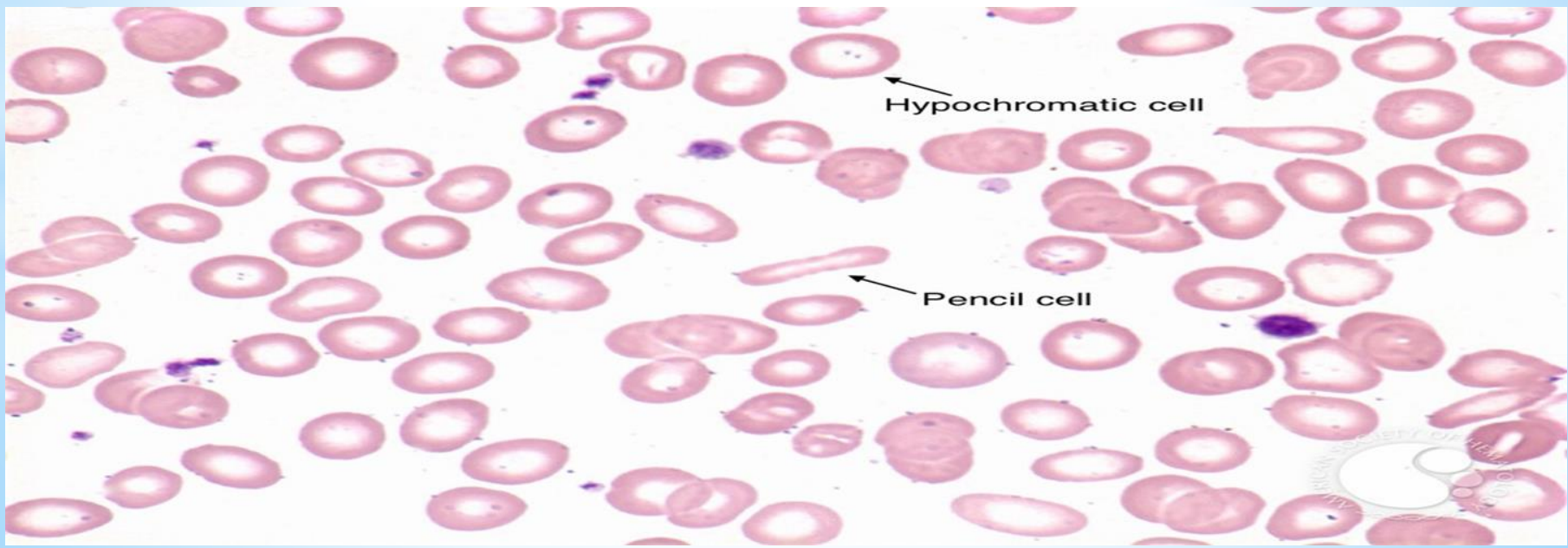


CHEILITIS

* **Iron deficiency anemia**

*Diagnosis of iron deficiency anemia

- * Low Hb
- * Low pcv
- * Low MCV
- * Low MCH, MCHC, LOW IRON, LOW S.FERRITIN
- * Blood film , hypochromic , microcytic , pencil cell , normal wbc, normal platelets



**Without a mutation
enough Hemoglobin**



No thalassemia
carrier

**With one mutation
less Hemoglobin**



β -thalassemia carrier
without illness, but less
hemoglobin (slight
anemia)

**With two mutations
no β -globin**



β -thalassemia major
patient with severe
anemia

thalassemia

CLINICAL PRESENTATION

THALASSEMIA MAJOR

GENERAL FEATURES

- Pallor
- Fatigue
- Dyspnea on exertion
- Poor appetite
- Palpitations
- Poor growth

FEATURES OF HEMOLYSIS

- Jaundice
- Hyperuricaemia (Gout)
- Gallstones

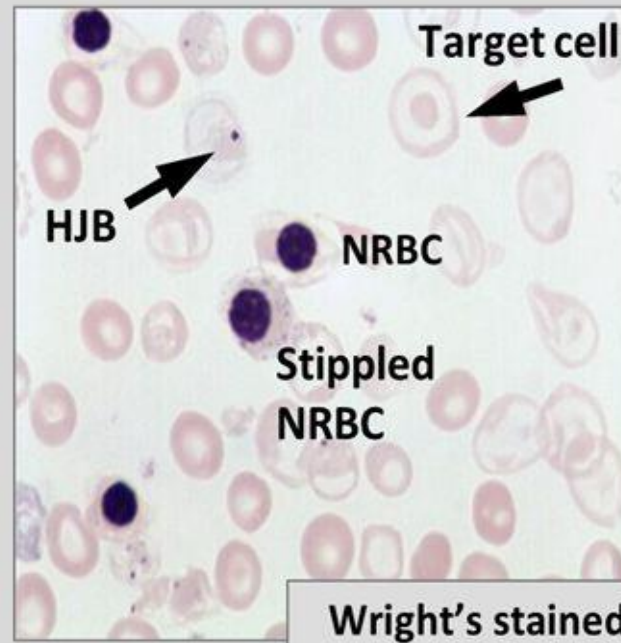
EXCESSIVE ERYTHROPOEISIS

- Maxillary overgrowth (chipmunk)
- Increased spaces, overbite and malocclusion of teeth
- Frontal bossing
- Chronic sinusitis
- Impaired hearing



Lab. Investigations of Thalassemia:

- Laboratory findings:
 - Hb ↓, MCV ↓, MCH ↓, MCHC ↓
 - RBCs :
 - Hypochromic, Microcytic RBCs.
 - Target cells, nucleated red cells
 - Anisocytosis
 - Poikilocytosis
 - Basophilic stippling
 - RBC inclusions
 - Platelets: Normal
 - WBCs: Normal
 - Plasma: - ↑ iron
 - Normal or ↑ ferritin.



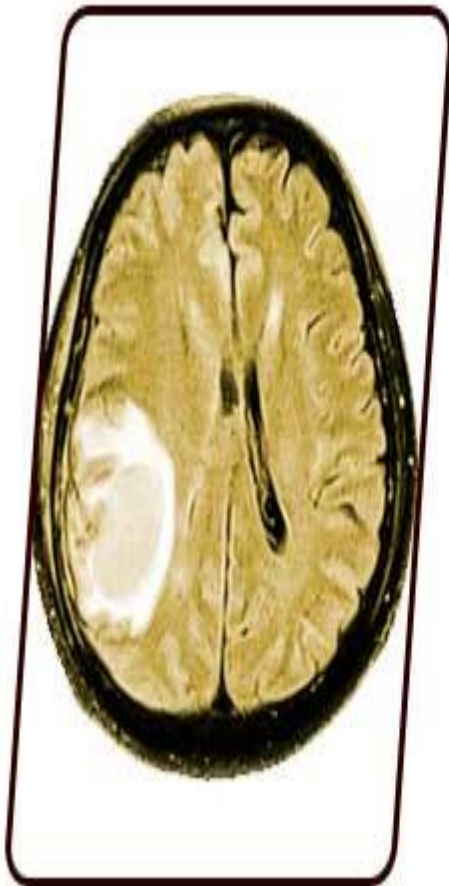
Wright's stained blood smear

RH INCOMPATIBILITY

MOTHER RH negative ,FETUS RH positive

- RBCs from the fetus can go into the mother's bloodstream through the placenta.
- Rh-Negative mother's immune system treats the Rh-Positive fetal cells as a foreign substance and makes *antibodies* against them.
- These anti-Rh antibodies may cross the placenta into the fetus, where they destroy the fetus's circulation red blood cells.

Signs & Symptoms of Erythroblastosis Fetalis



Kernicterus



Hemolytic Anemia



Jaundice

Rh-negative patient before pregnancy

Pregnancy with Rh-positive fetus

Placental separation

Maternal sensitization to Rh-positive blood

Next pregnancy with Rh-positive fetus

Maternal anti-Rh antibodies enter fetal circulation

Anti-Rh antibody to fetal Rh-positive red blood cells (RBCs)

Hemolysis of fetal RBCs



Symptoms

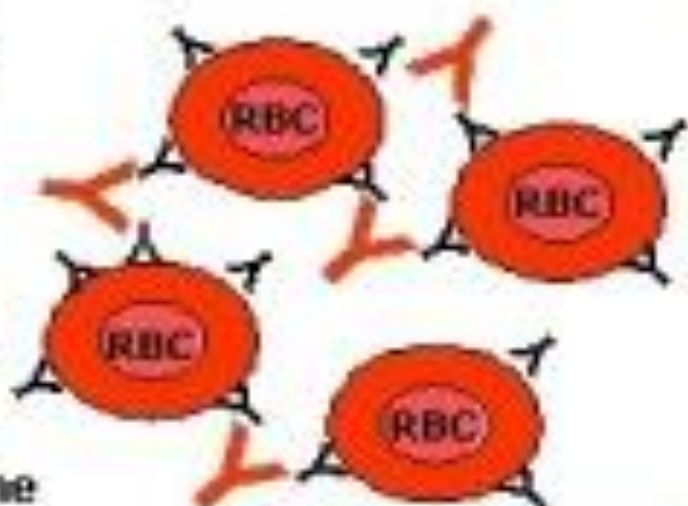
- Hemolytic Anemia
- Jaundice due to hyperbilirubinemia
- Kernicterus
- Treatment phototherapy
- Exchange transfusion

- **Anemia**
- **Hyperbilirubinemia**
- **Reticulocytosis (6 to 40%)**
- **↑ nucleated RBC count (>10/100 WBCs)**
- **Thrombocytopenia**
- **Leukopenia**
- **Positive Direct Antiglobulin Test**
- **Hypoalbuminemia**

DIRECT COOMB'S TEST



**Patient
Sample**



Example: The baby's sample is positive for the presence of the mother's Ab on the surface of RBCs in erythroblastosis fetalis

Agglutination





Do not use any solvents and flammable solutions
Avoid open or closed to clean plastic parts
Use alcohol to clean plastic parts
Do not use water or any other liquid to clean
sensitive electronic parts

Megaloblastic Anemia

↓ RBCs (↓ Hematocrit)

↑ MCV (size RBCs)

Hypersegmented Neutrophils

↑ Homocysteine



Normal Anemia



Megaloblastic Anemia

