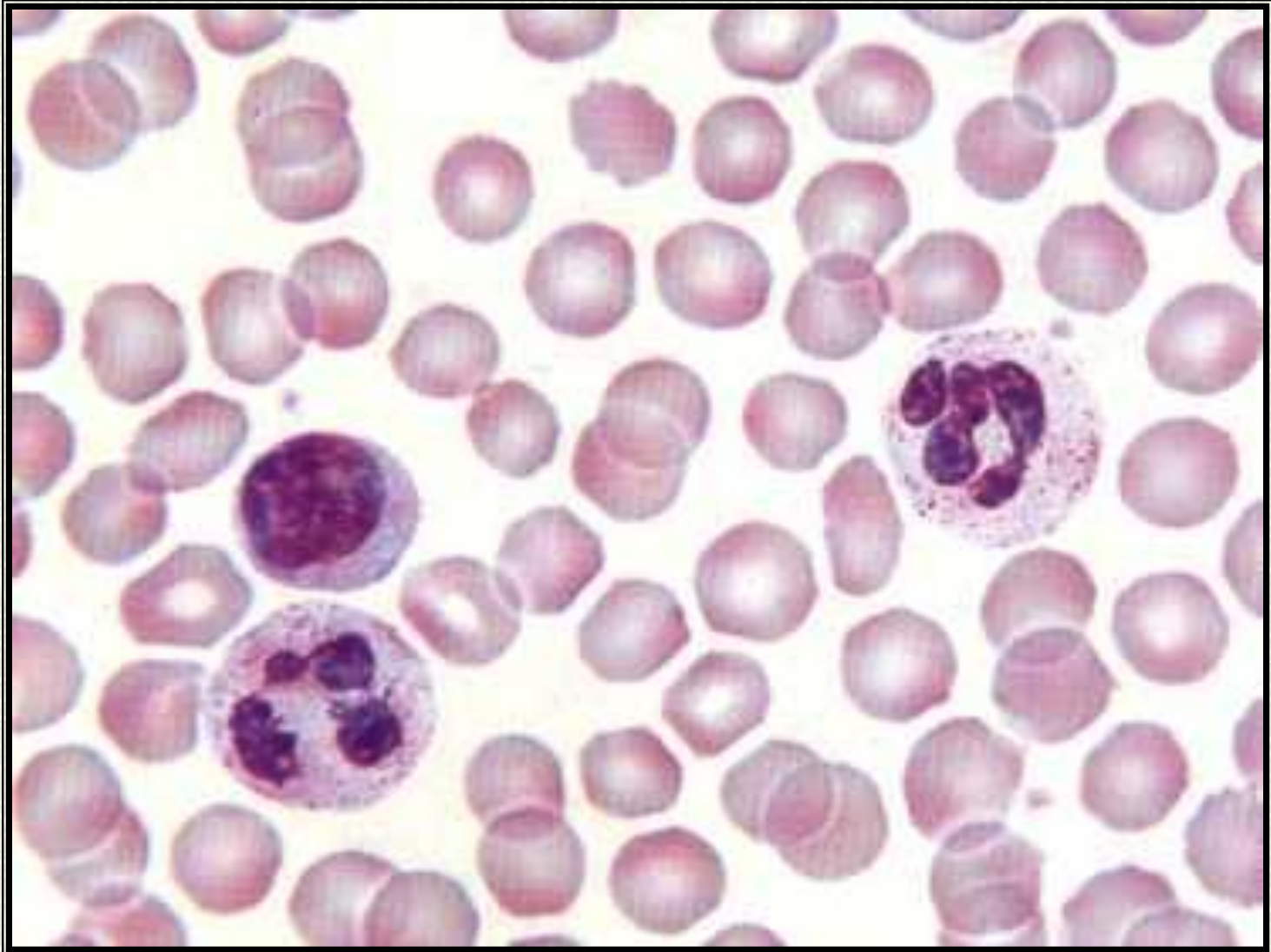


WBC Disorders:

lecture for english students

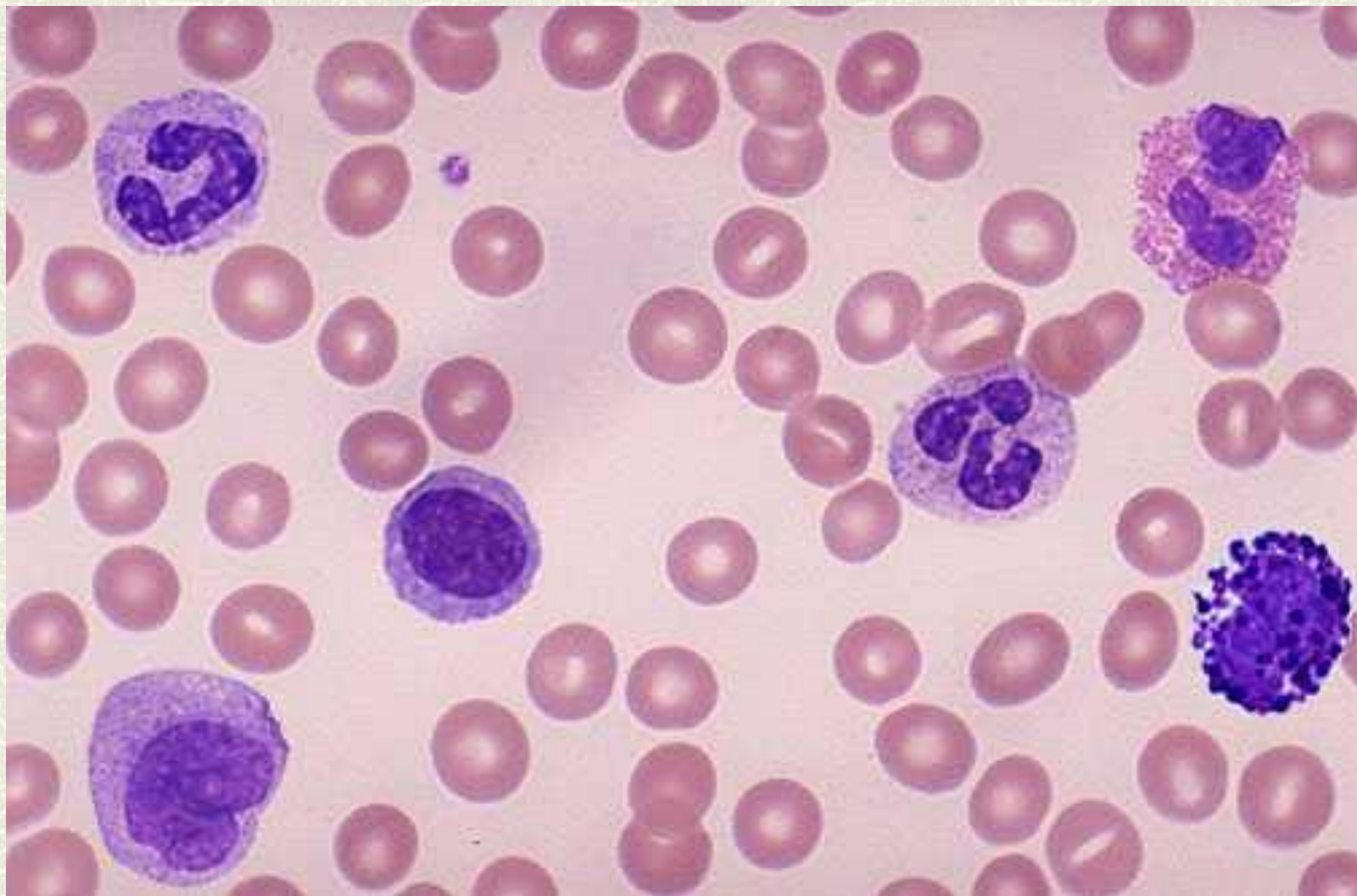


Normal Blood Film:



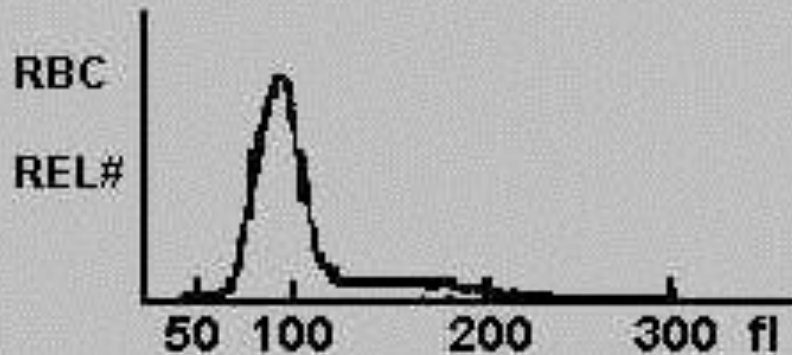
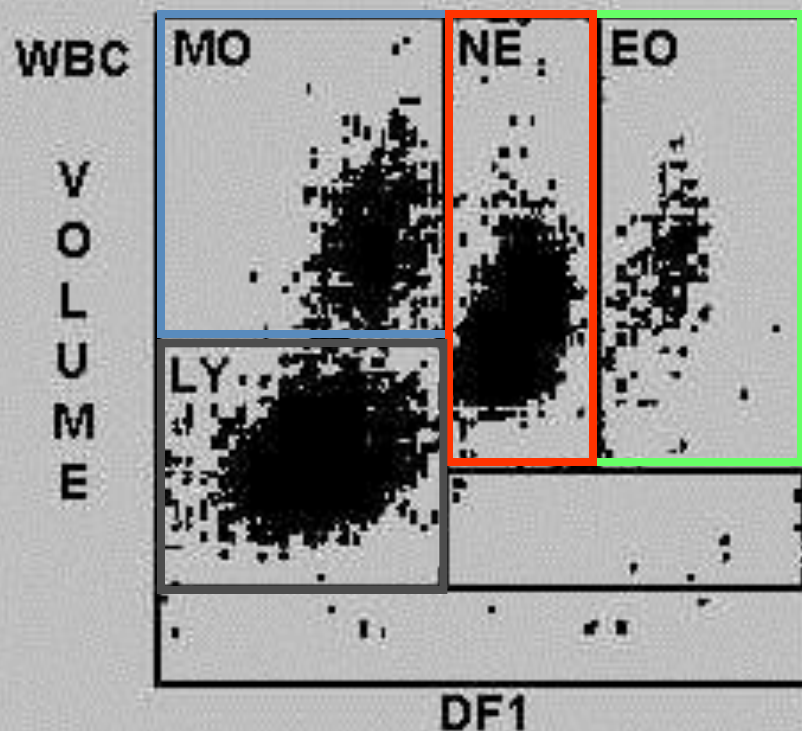


White Blood Cells:

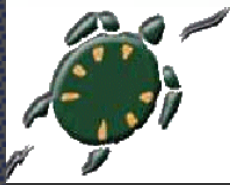




CBC - WBC Histogram:



WBC	6.8	
	%	#
NE	52.6	3.6
LY	36.7	2.5
MO	7.8	0.5
EO	2.5	0.2
BA	0.4	0.0
RBC	5.29	
HGB	16.2	
HCT	47.0	
MCV	88.8	
MCH	30.7	
MCHC	34.5	
RDW	12.5	
PLT	179	
MPV	8.4	

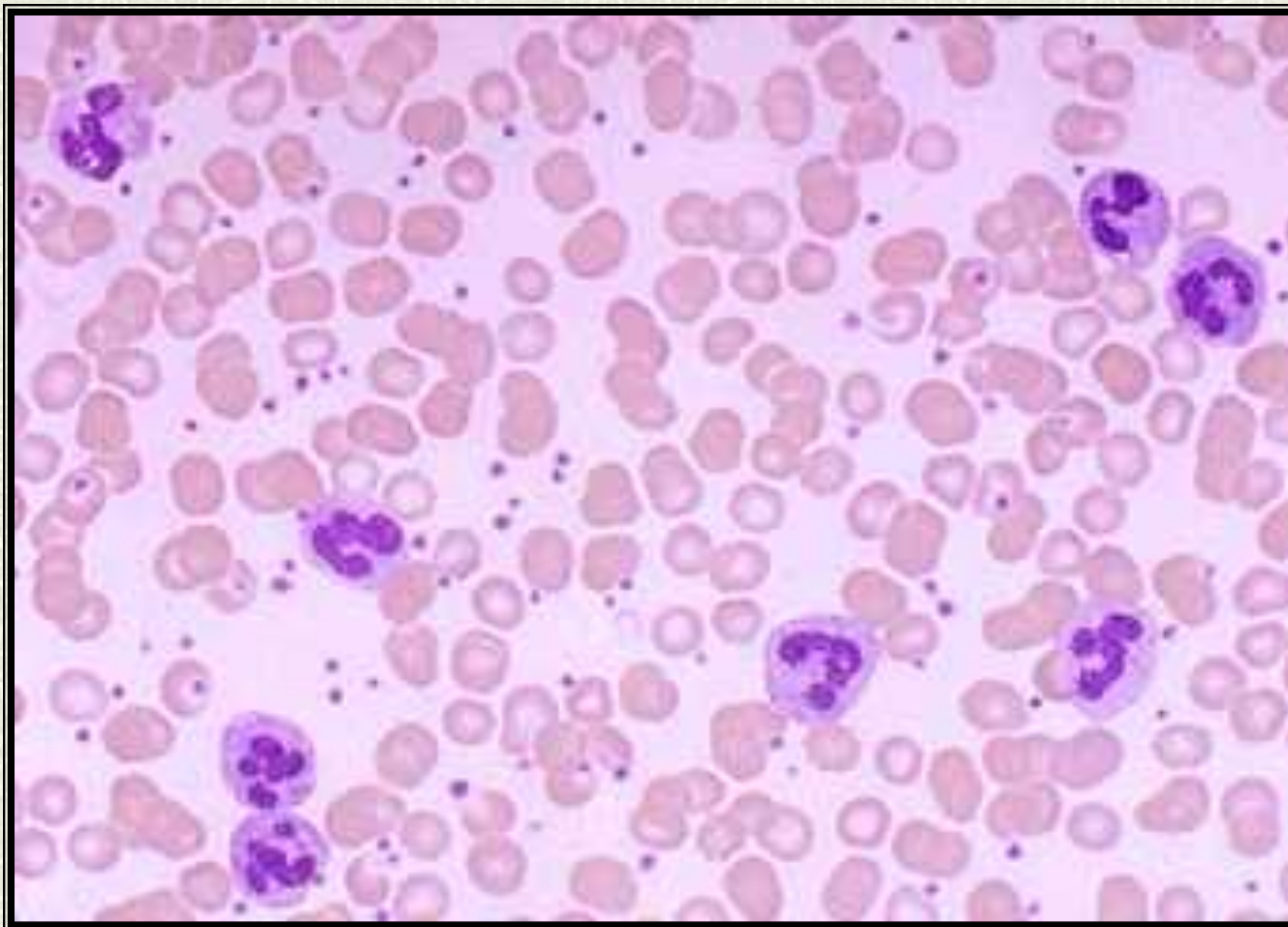


WBC disorders:

- # Reactive increase in number – “philiias”
 - ***Neutrophilia*** – Bacterial sepsis
 - ***Lymphocytosis*** – viral, Immune
 - ***Eosinophilia*** – Allergy & Parasites.
- # Decreased number – “penias”
 - ***Neutropenia, Lymphopenia & Eosinopenia, Pancytopenia***
 - Drugs, viral infections, Radiation, chemotherapy etc.

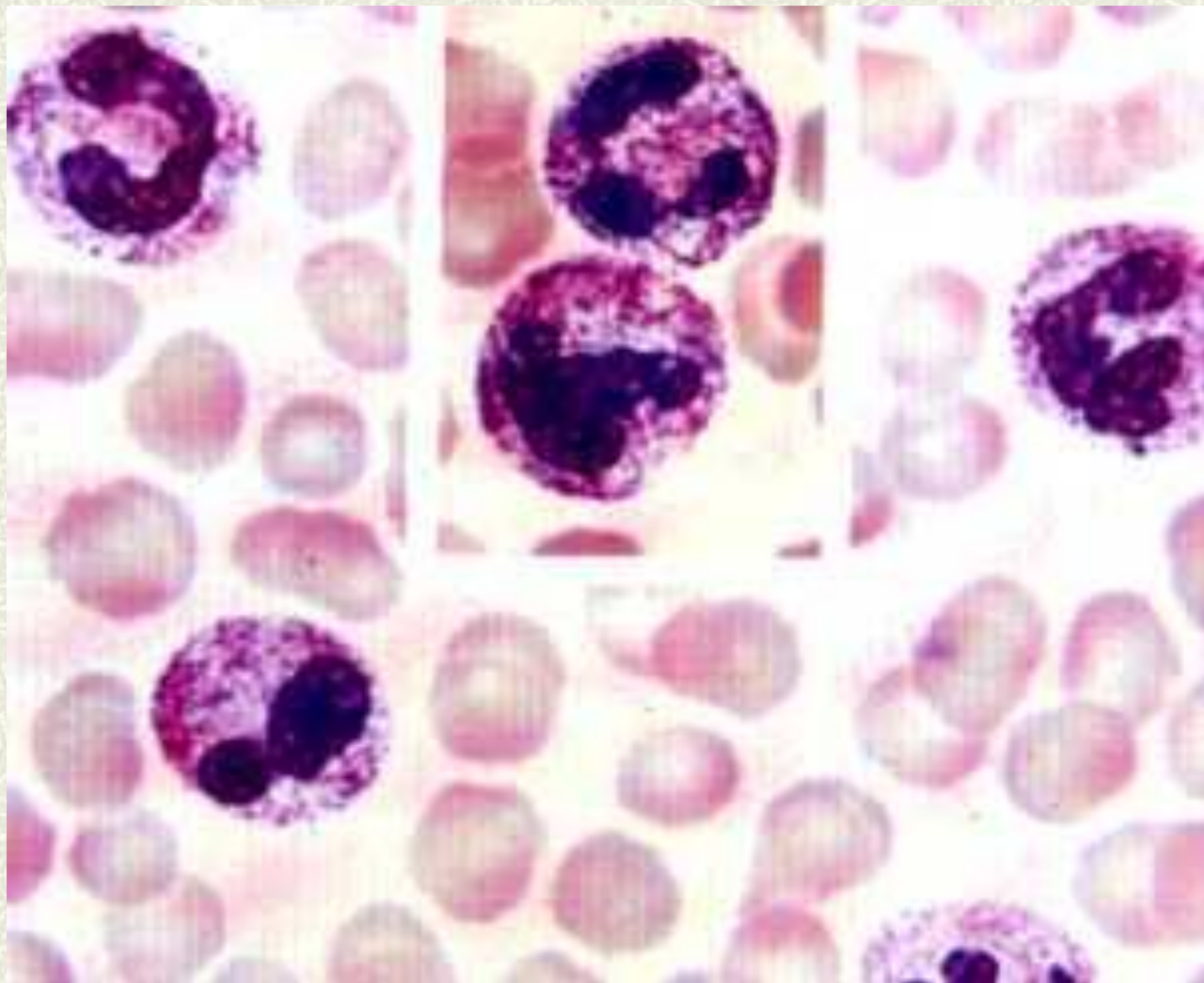


Neutrophilia:



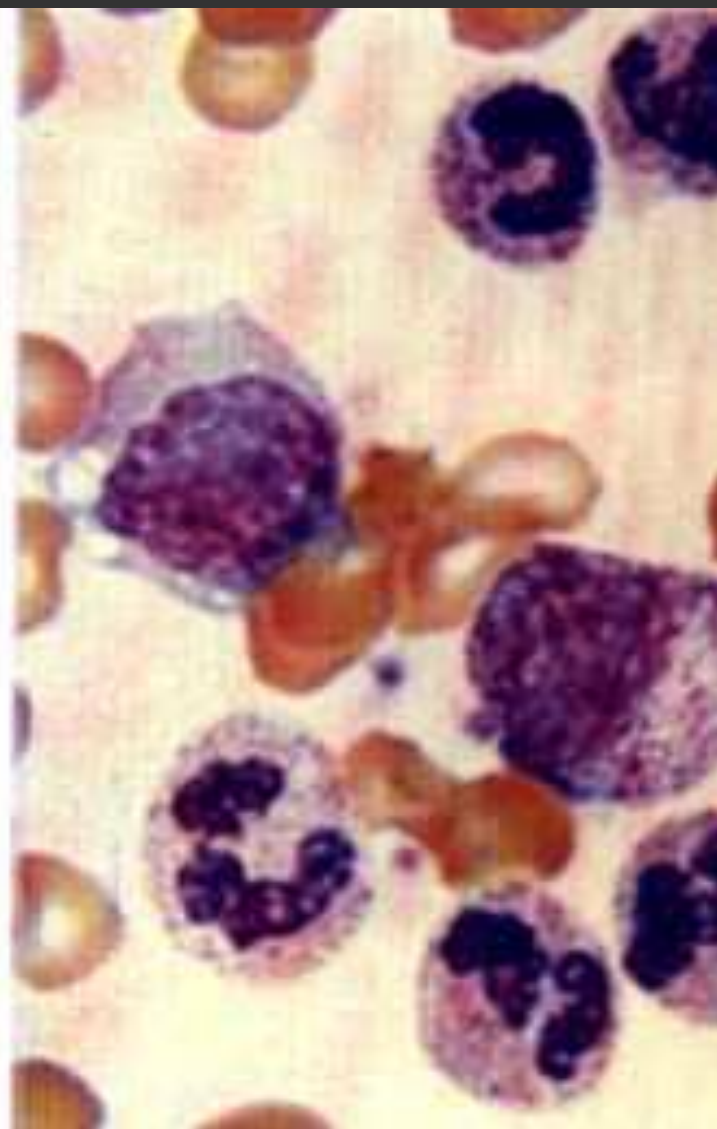
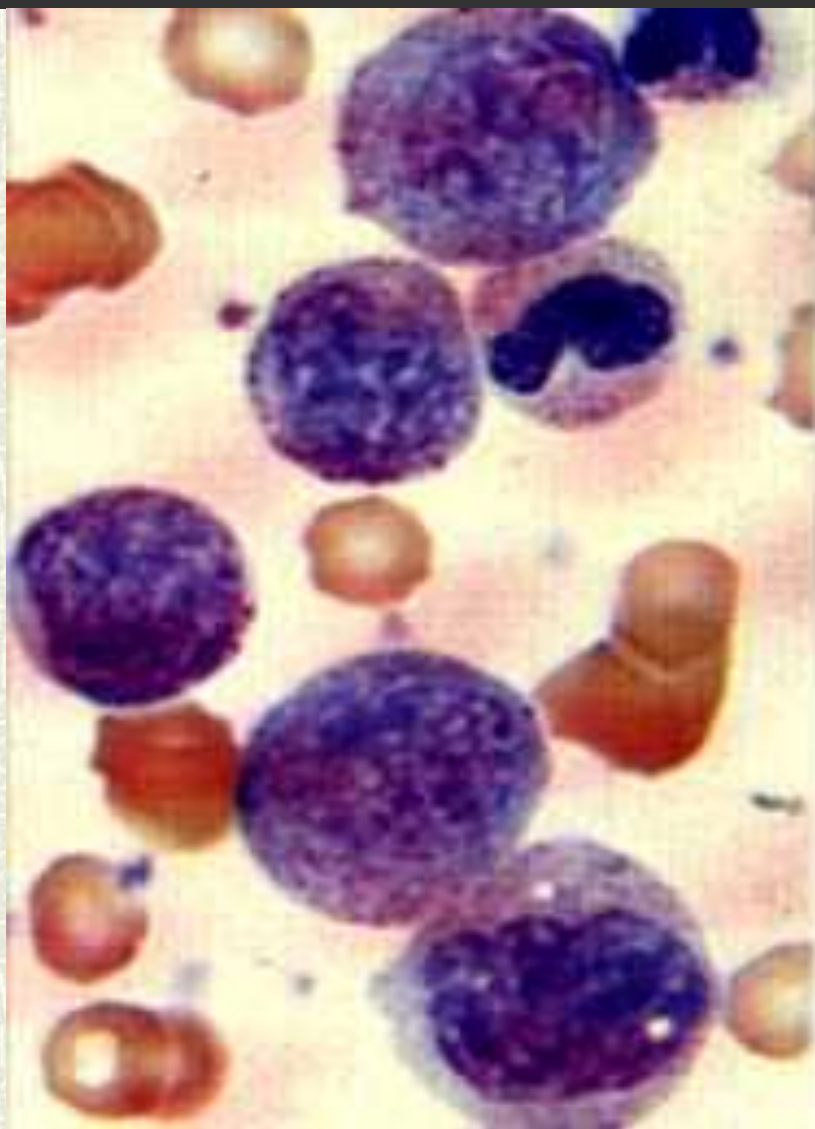


Toxic Granulation:

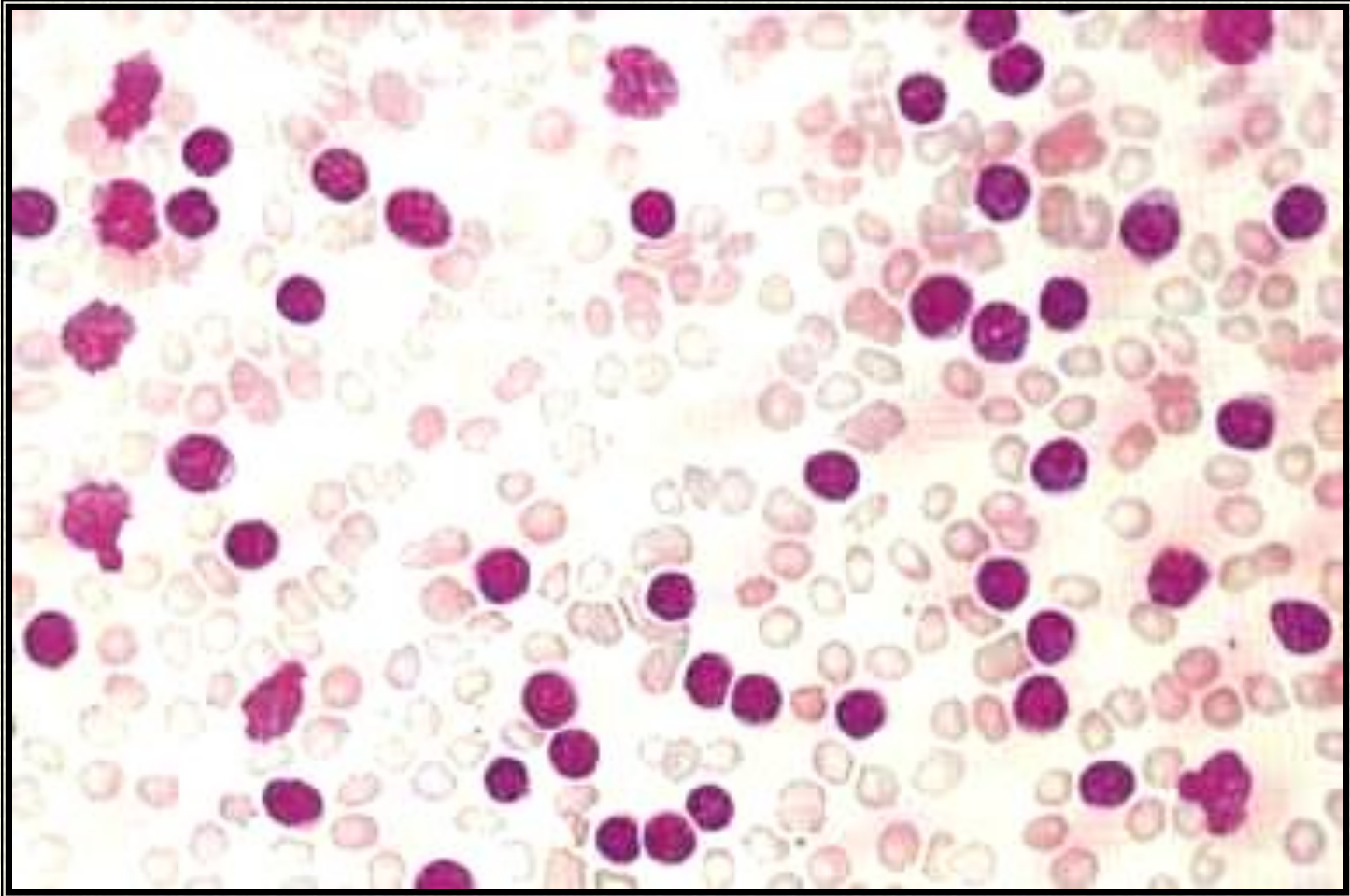




Leukemoid Reaction:

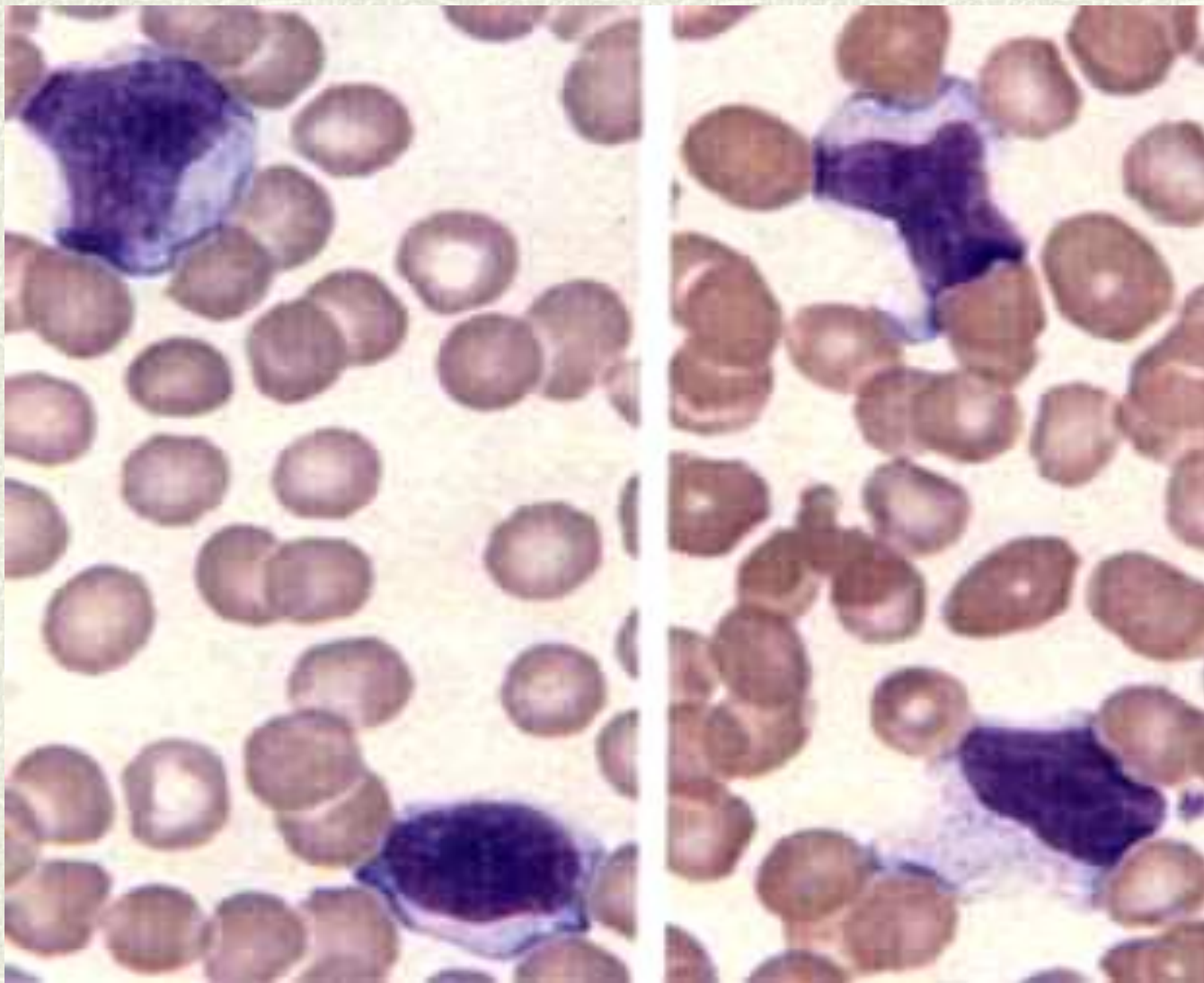


Lymphocytosis:





Lymphocytosis - Virocytes:





NEUTROPHILS

NEUTROPENIA ($<1.5 \times 10^9/L$)

- Drug-induced, e.g. cancer chemotherapy, chloramphenicol.
- Immune neutropenia (antibodies to surface antigens) associated with autoimmune disorders (SLE or RA).
- Myelodysplastic syndromes (MDS).
- Infections; HIV,
Chronic idiopathic neutropenia; possibly a mixture of congenital and acquired disorders.
- Congenital neutropenia, e.g. Kostmann's syndrome (very rare).
- Cyclic neutropenia (three week intervals), due to abnormal regulation of haemopoietic stem cells.

Diagnosis: BM helps to discriminate between peripheral destruction and decreased production.

Management: Remove underlying cause.



NEUTROPHILIA

Often accompanied by other reactive changes, e.g. atypical lymphocytes.

Varied aetiology, e.g. exercise, emotional (stress), inflammation, infection, drugs (glucocorticoids, epinephrine, G-CSF), tumours, smoking.

Left shift results from increased granulopoiesis.

Leukaemoid reactions must be distinguished from CML.

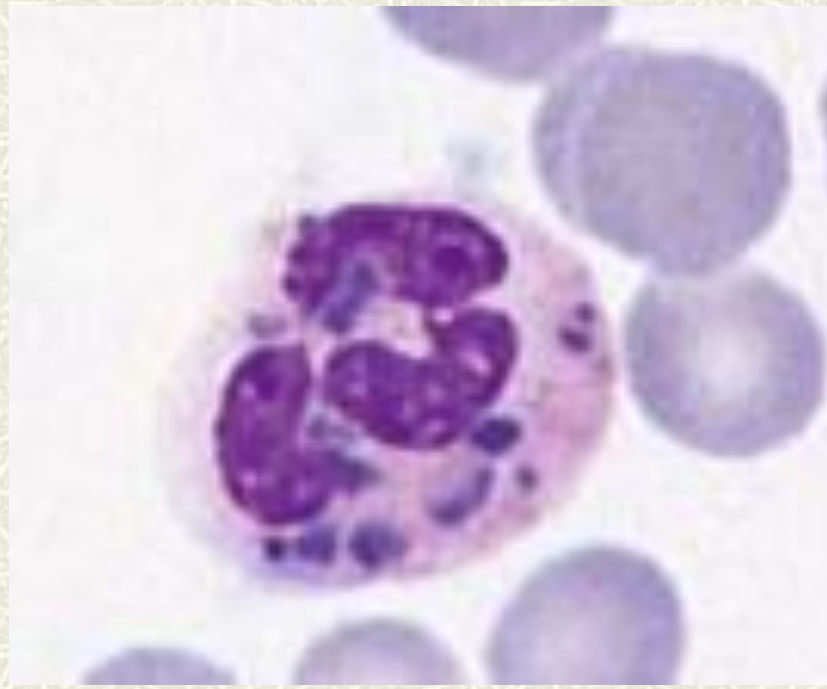
Morphological changes include : toxic granulation (persistence of primary granules) and cytoplasmic vacuolation.

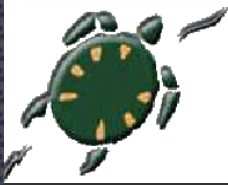


FUNCTIONAL / MORPHOLOGIC DISORDERS OF NEUTROPHILS

Chediak-Higashi Syndrome

Large cytoplasmic granules in all leucocytes; autosomal recessive. Neutropenia, thrombocytopenia and hepatosplenomegaly. Recurrent infections.





Chronic Granulomatous Disease (CGD)

Impaired generation of oxygen metabolites; ingestion but no killing of catalase-positive organisms.

Recurrent infections with catalase-positive organisms, e.g. *Staph. aureus*

Myeloperoxidase Deficiency

Diminished lysosomal effectiveness of hydrogen peroxide.

Other enzyme deficiencies

Lack of glutathione reductase, oxidase or catalase.

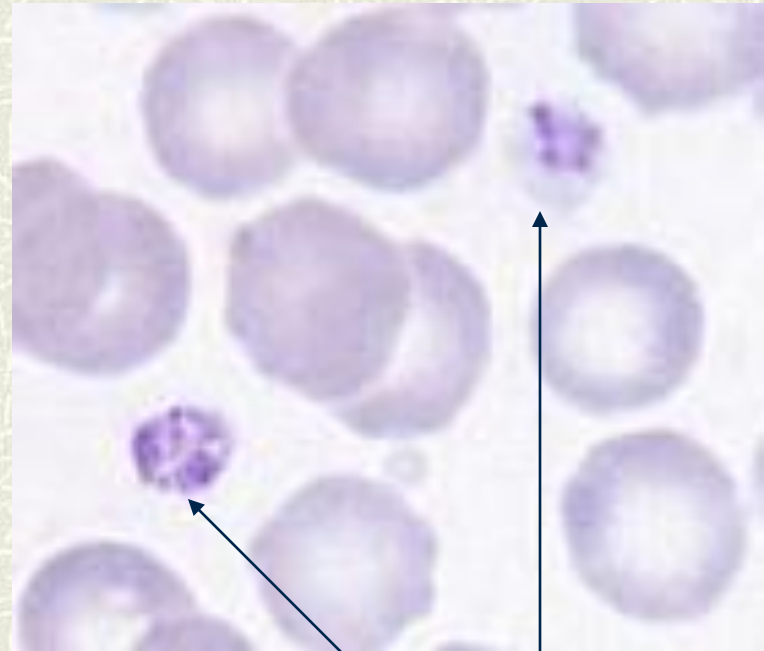


May-Hegglin Anomaly

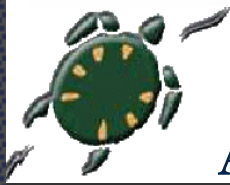
Döhle bodies (RNA) in granulocytes and monocytes; thrombocytopenia with giant platelets; autosomal dominant inheritance.



Döhle body

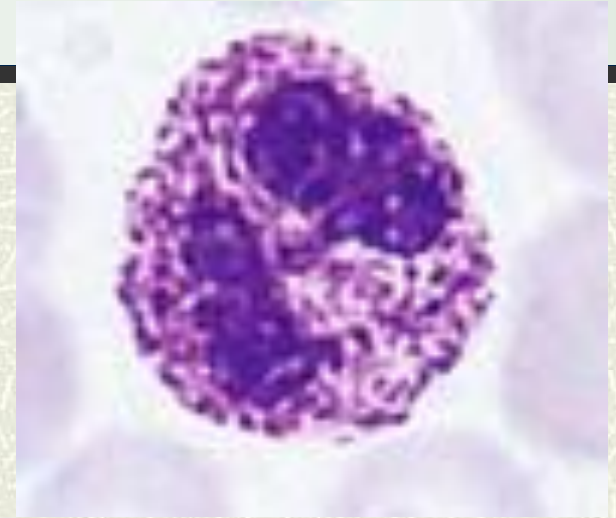


Giant platelets



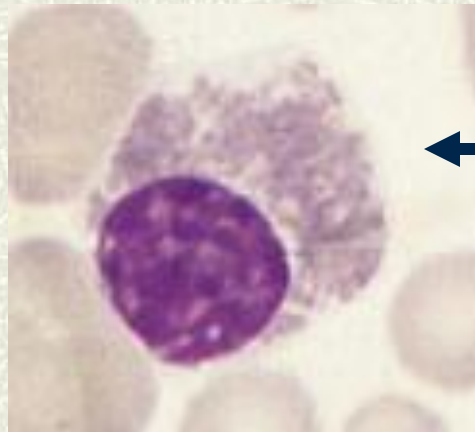
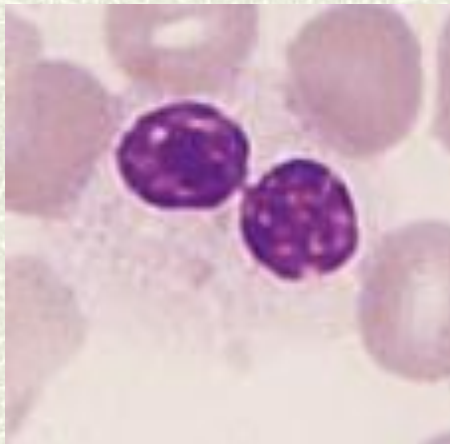
Alder-Reilly Anomaly

Prominent red-purple granules
in neutrophils. →



Pelger-Huet Anomaly

Bilobed or monolobed granulocytes; autosomal dominant
inheritance.



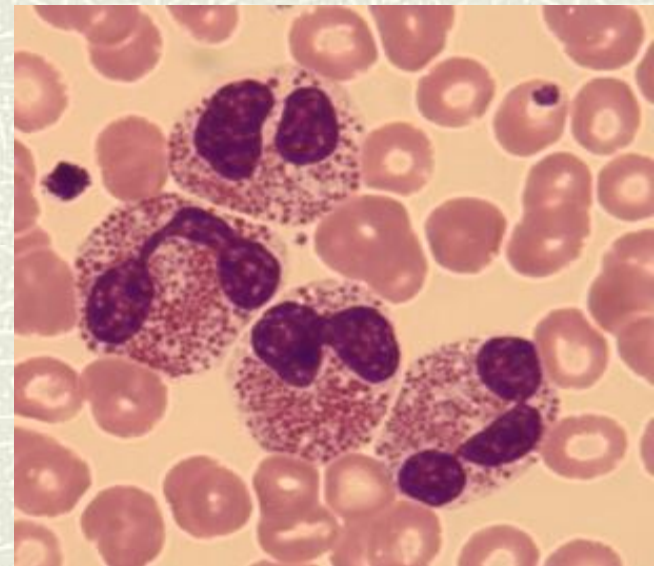
← Unsegmented
eosinophil



EOSINOPHILS

EOSINOPENIA occurs in association with acute infections and with administration of adrenocorticotrophic hormone (ACTH), prostaglandins, epinephrine and glucocorticoids. An eosinophil absolute count must be performed as the eosinophil percentage of the WBC is not accurate for low counts.

EOSINOPHILIA ($>0.5 \times 10^9/L$) is associated with parasitic infestation, allergic states (asthma, drug reactions) and neoplasms (e.g. CML).





BASOPHILS / MAST CELLS

BASOPENIA is not readily apparent or actively investigated.

BASOPHILIA ($>0.1 \times 10^9/L$) is seen in reactive immunologic conditions, e.g. IgE-mediated hypersensitivity or in chronic inflammatory disorders, e.g. RA.

Basophilia is commonly found in CML .

MASTOCYTOSIS (concentration of mast cells) is seen locally in tissues associated with hypersensitivity reactions and in lymph nodes or bone marrow affected by low-grade lymphoproliferative disorders.



MONOCYTES / MACROPHAGES

MONOCYTOPENIA is most frequently part of leucopenia seen in autoimmune disorders (e.g. SLE), hairy cell leukaemia (HCL) or chemotherapy.

MONOCYTOSIS ($>1.0 \times 10^9/L$) is seen in MDS, leukaemias, lymphoma, myeloma and TB.



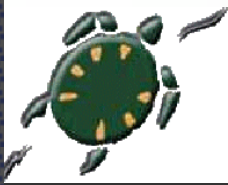
LYMPHOCYTES

LYMPHOCYTOPENIA ($<1.0 \times 10^9/L$)

Decreased production, e.g. congenital immunodeficiency, aplastic anaemia, chemotherapy.

Increased destruction, e.g. HIV, autoimmune disorder.

LYMPHOCYTOSIS ($>4 \times 10^9/L$); must distinguish non-neoplastic from neoplastic, e.g. CLL, ALL.



INFECTION- INDUCED LYMPHOCYTOSIS:

lymphocytes are normal in appearance, mature and small.

Acute infectious lymphocytosis is a contagious disorder of unknown aetiology.

Bordetella pertussis infections are associated with significant lymphocytosis.



Neoplastic Disorders: Hemato-Oncology





WBC Neoplastic disorders

- # **Leukemias** Bone marrow, blood, blast cells
 - Acute/Chronic & Myeloid/Lymphoid
 - AML / ALL & CML / CLL
- # **Lymphomas** – Lymph nodes,
 - Hodgkins -
 - Non-Hodgkins.
- Myeloproliferative syndromes (**MPS**)
- Myelodysplastic syndromes (**MDS**)

Leukemia - Clinical Features

- # Anemia (low RBC)
- # Fever - Infections (low WBC)
- # Bleeding tendency (low PLT)
- # Tender bones, lymphadenopathy, splenomegaly (Leukemic infiltration)

Leukemia Classification

Acute Leukemias:

- Acute Myeloid Leukemia - AML
 - AML **M0, M1, M2, M3**, M4, M5, M6 & M7
- Acute Lymphoid Leukemia - ALL
 - ALL - **L1, L2 & L3** - maturity

Chronic Leukemias:

- Chronic Myeloid Leukemia- **CML**
- Chronic Lymphoid Leukemia - **CLL**

Platelet



Petechiae, Purpura

Coagulation



Hematoma, Joint bl.



Liver failure

AML-M5 - Gum Hypertrophy:



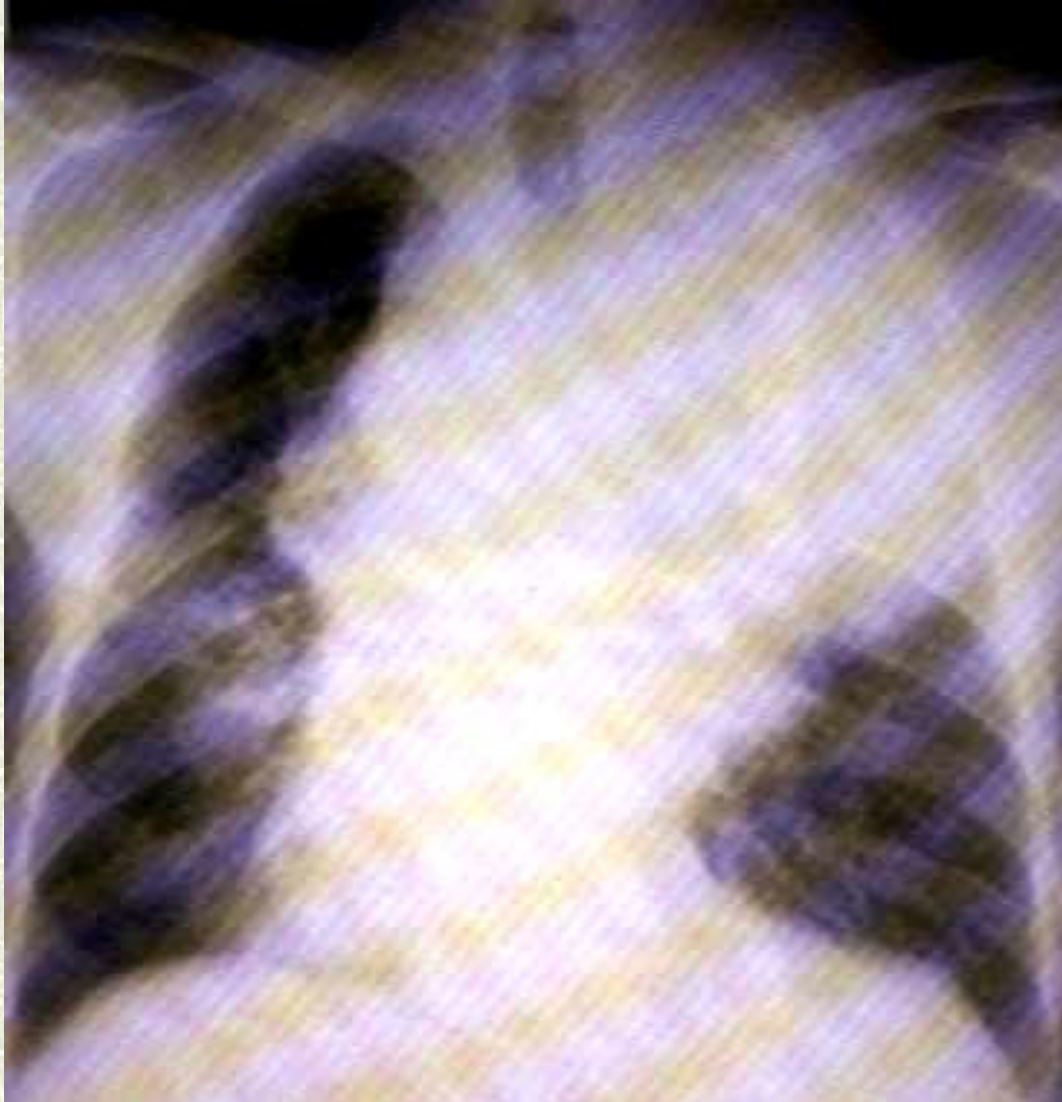
ALL:Cervical Lymphadenopathy



Organomegaly



Mediastinal Lymphadenopathy - ALL





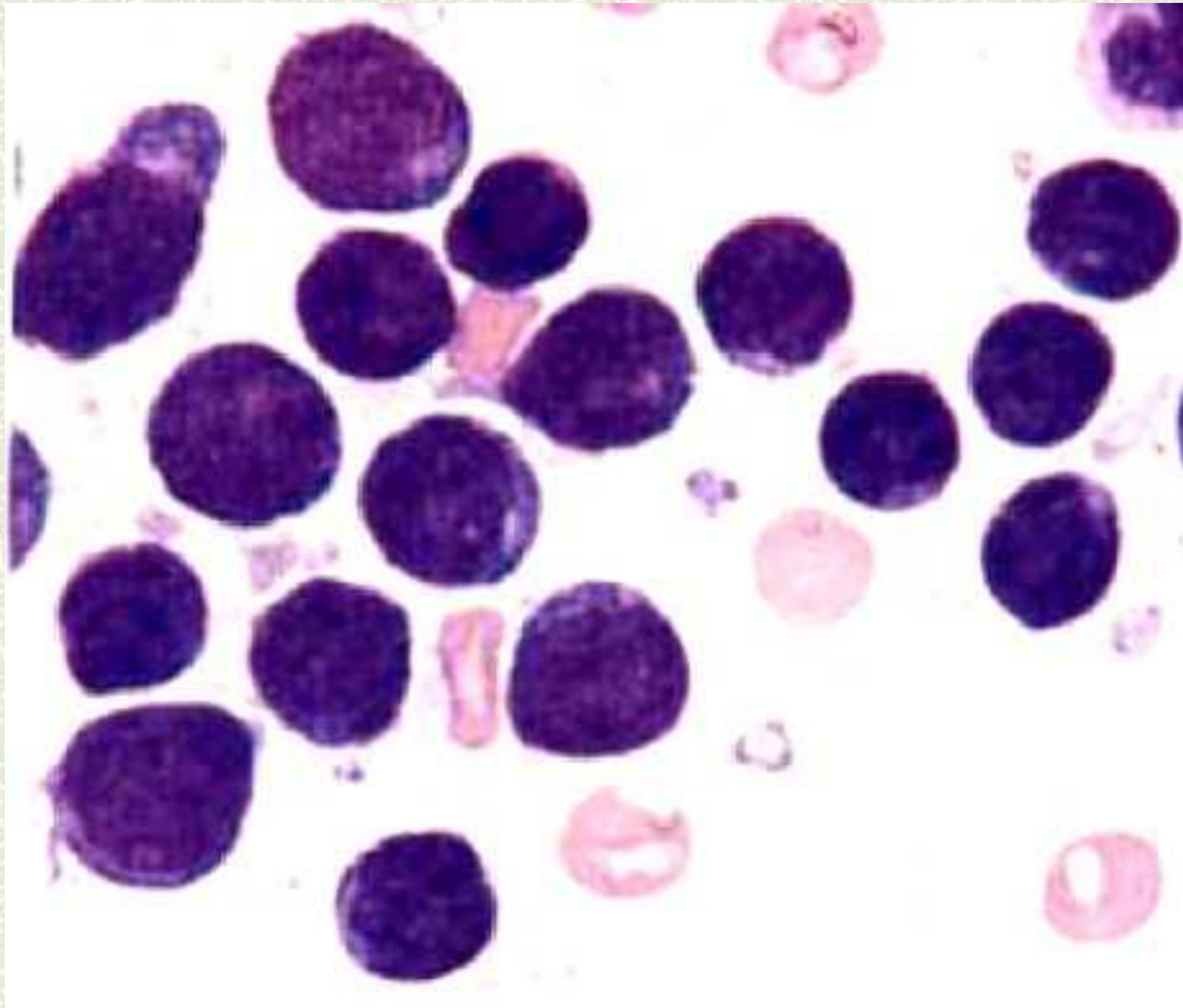
ALL-Acute Lymphocytic Leuk.

- # **FAB classification L1, L2 & L3**
- # **Anemia**
- # **bleeding.**

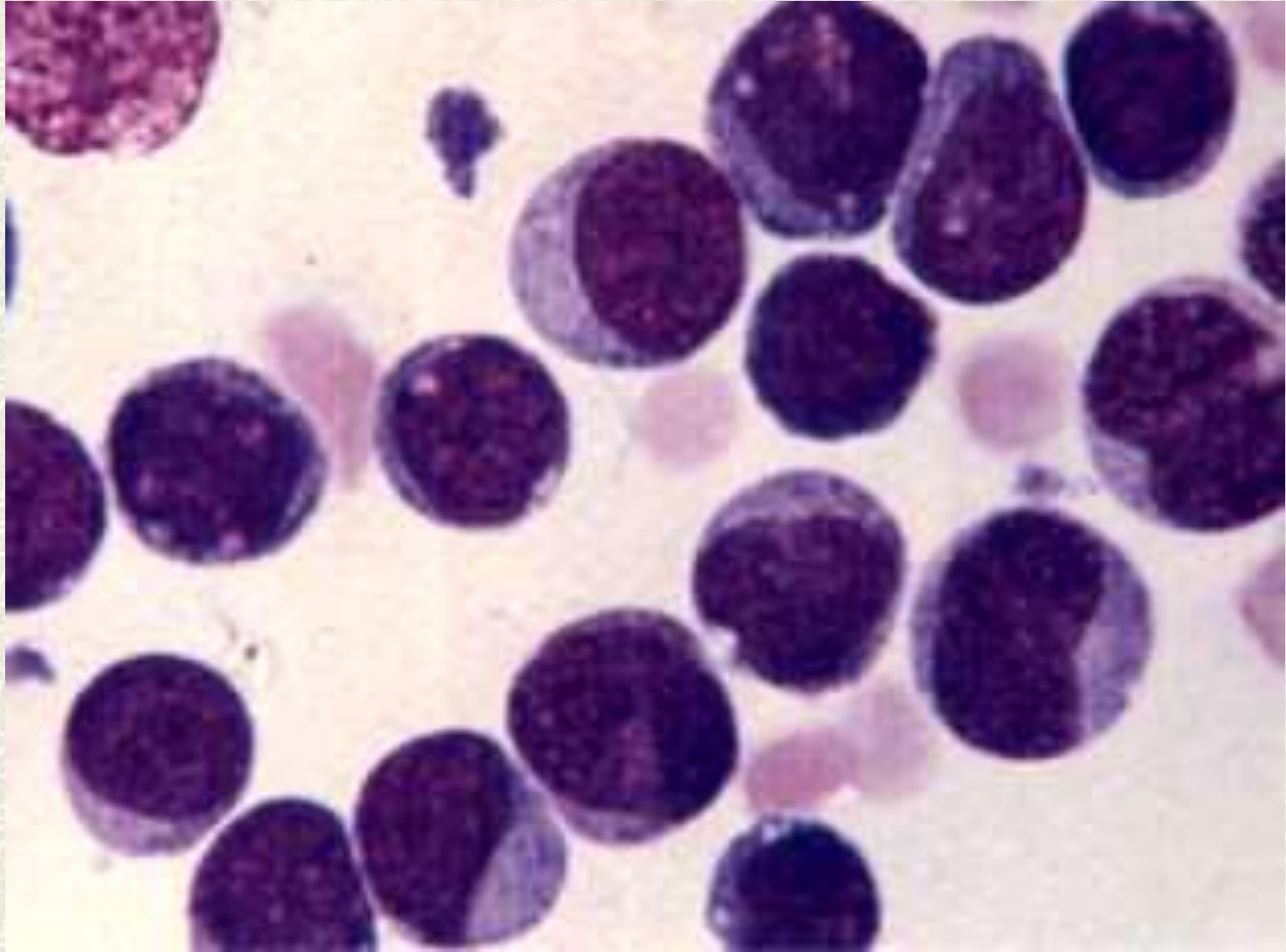
- # **Lymphadenopathy,**

- # **Hepatosplenomegaly**

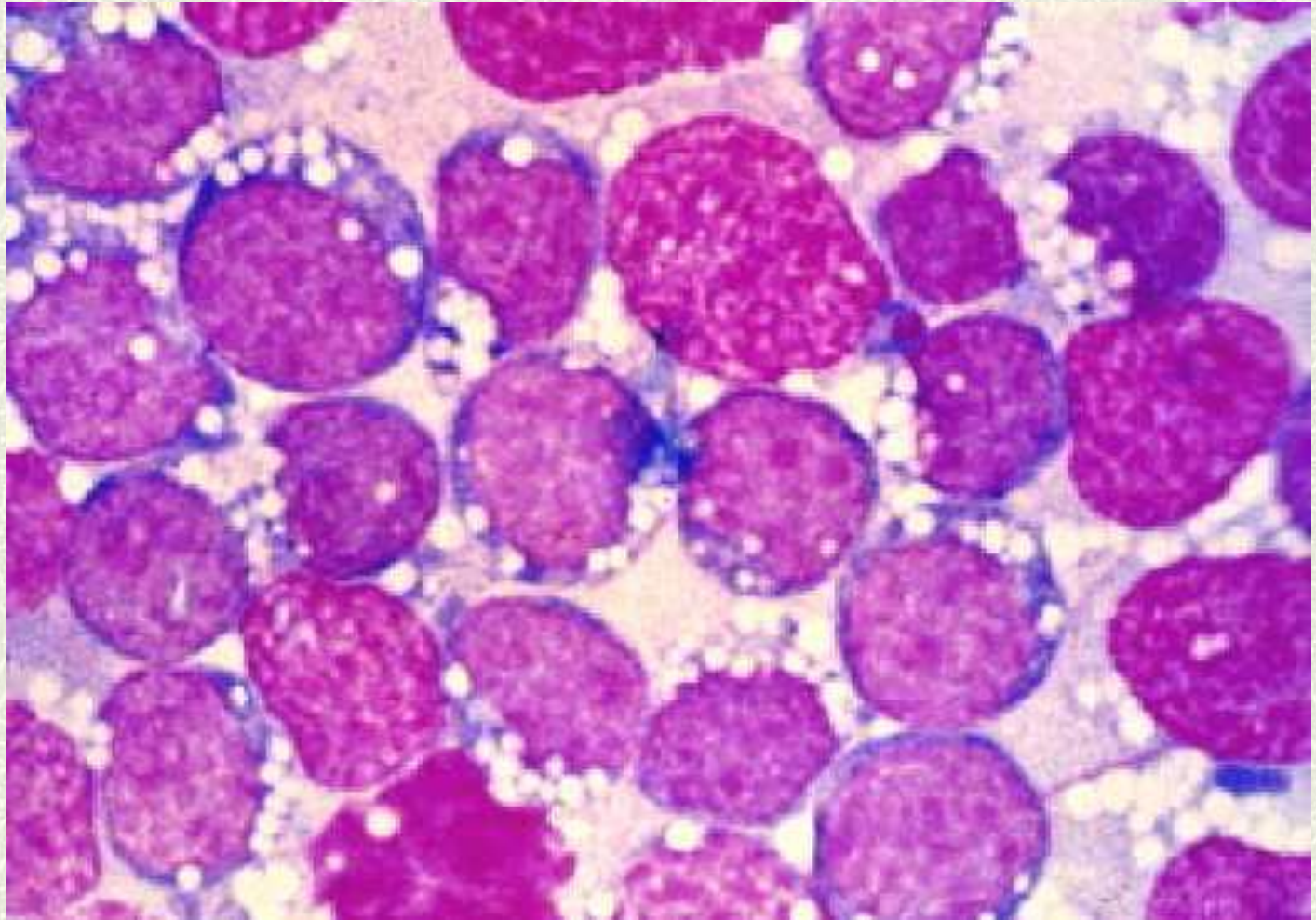
ALL-L1



ALL-L2



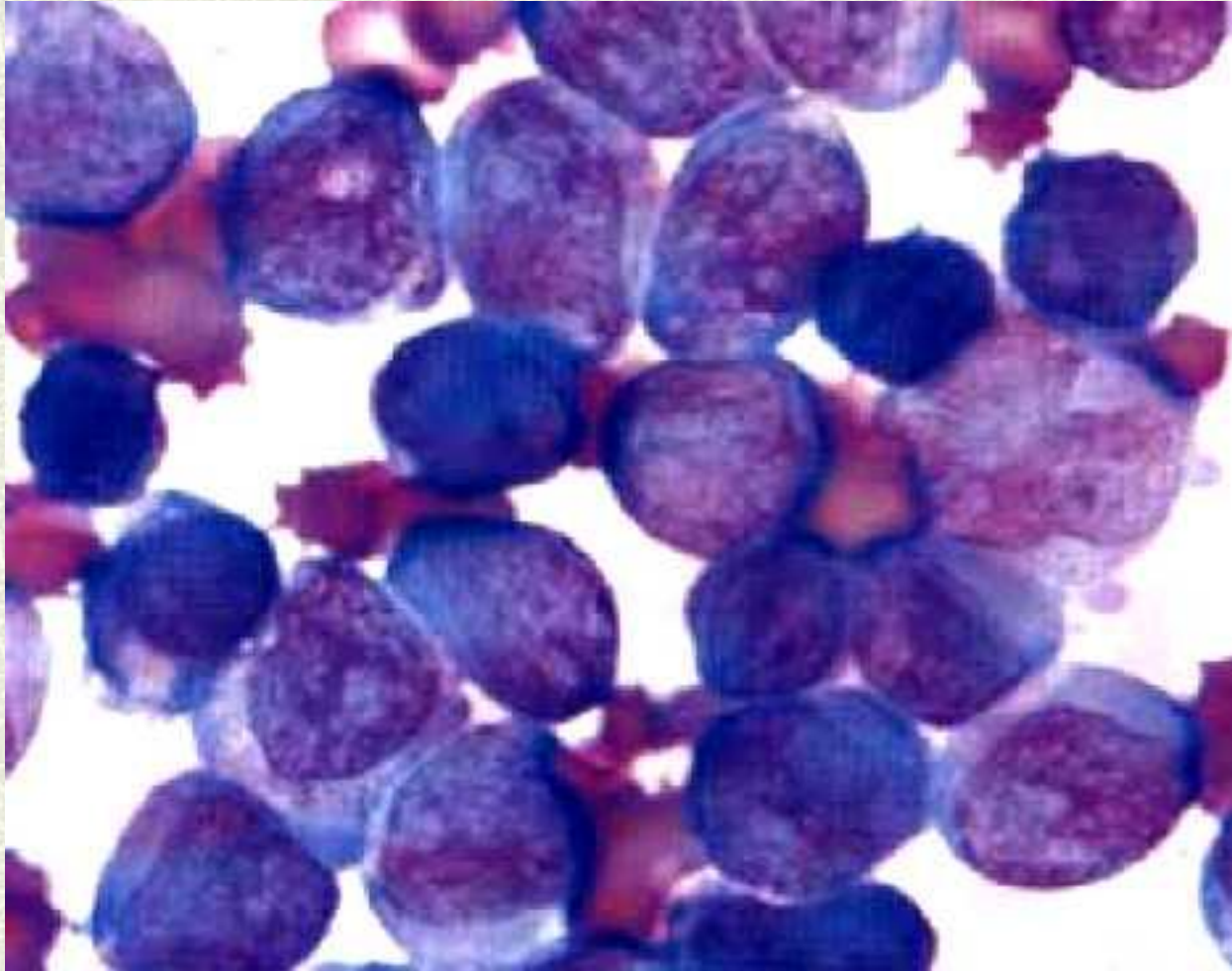
ALL-L3



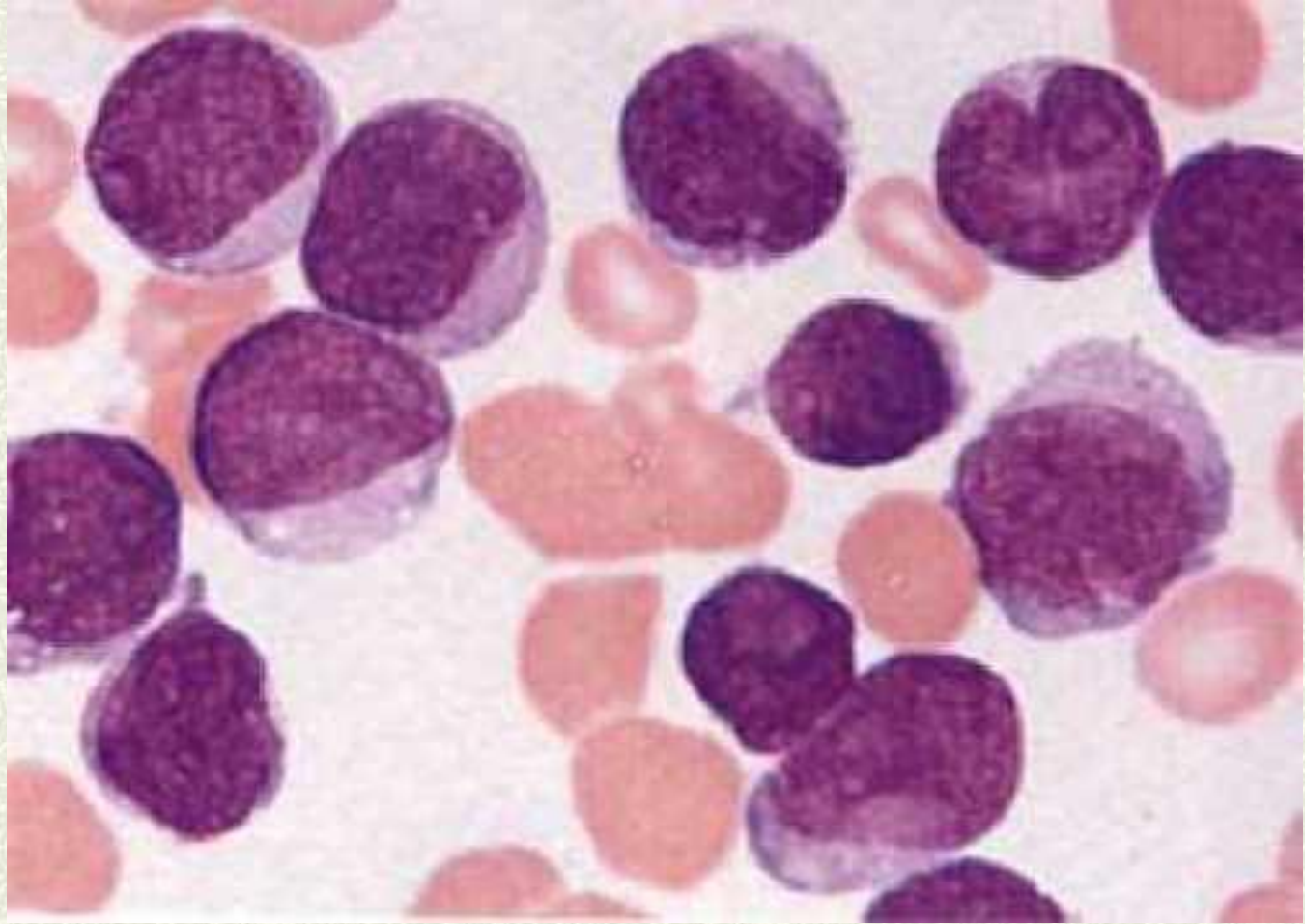
AML-Acute Myeloid Leuk.

- # FAB classification - M0 to M7.
- # Anemia, Fever, Bleeding
- # Hepatosplenomegaly moderate
- # **No** significant lymphadenopathy

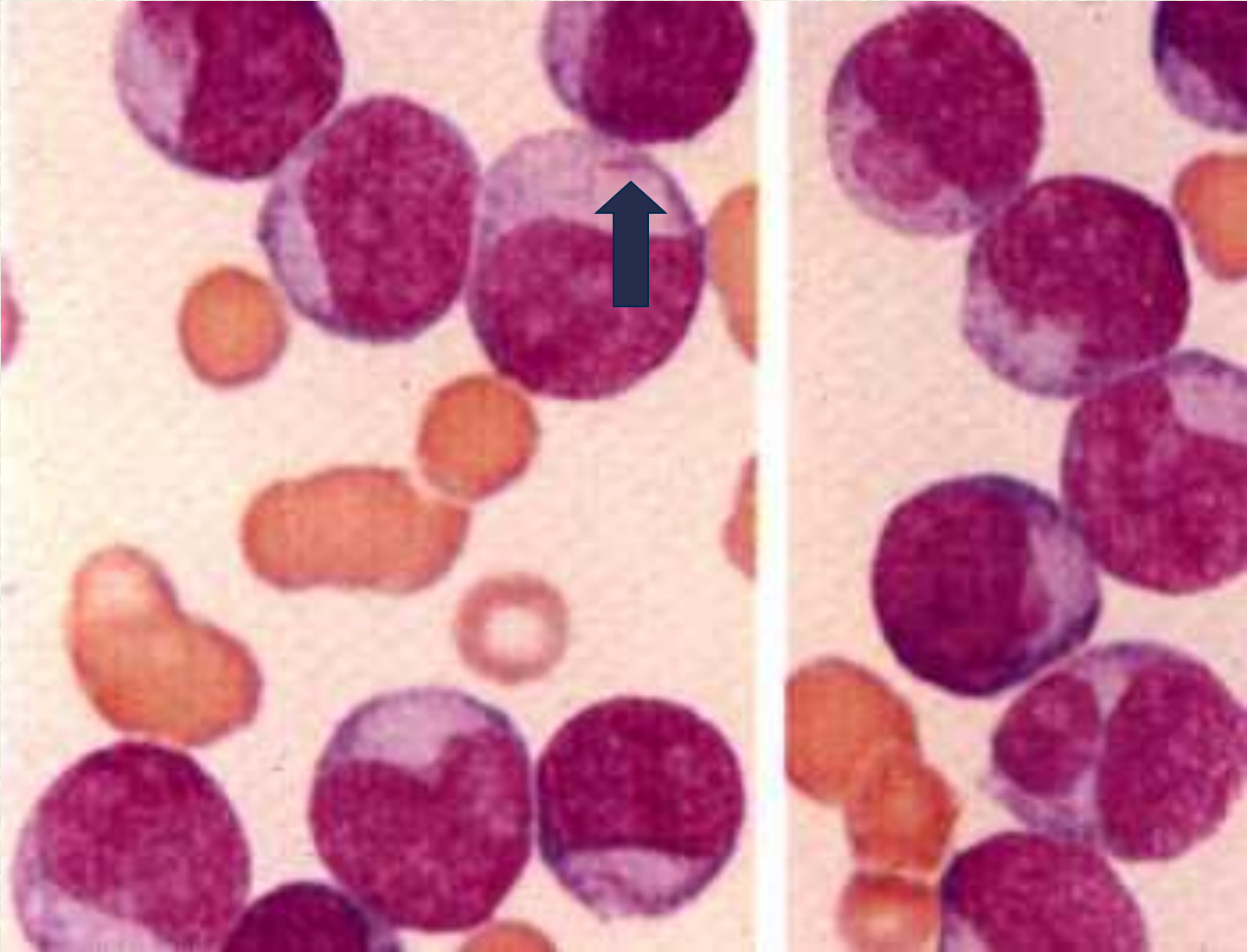
AML-M0 - Undifferentiated:



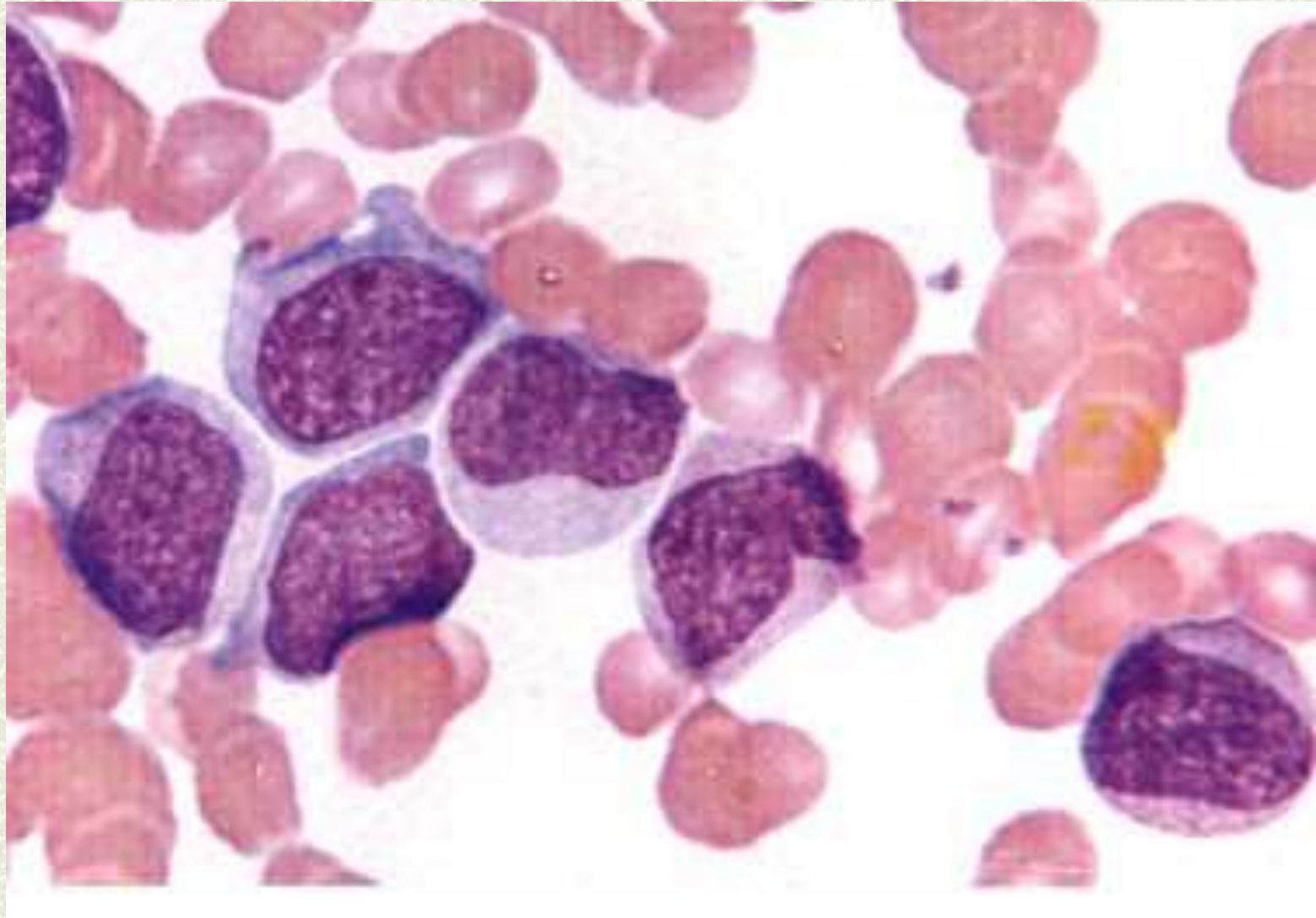
AML-M2 - with maturation



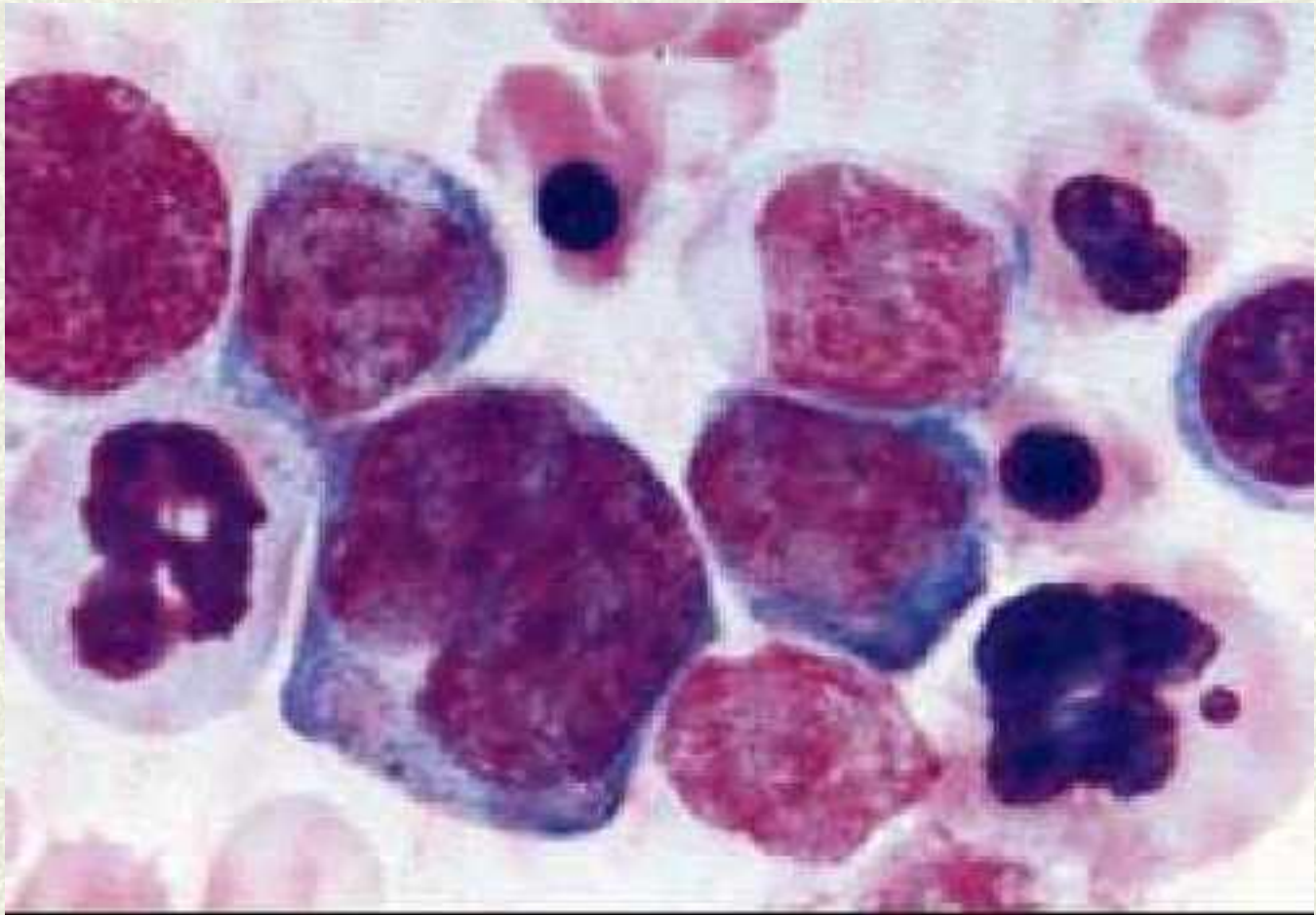
AML-M3 - Auer Rods



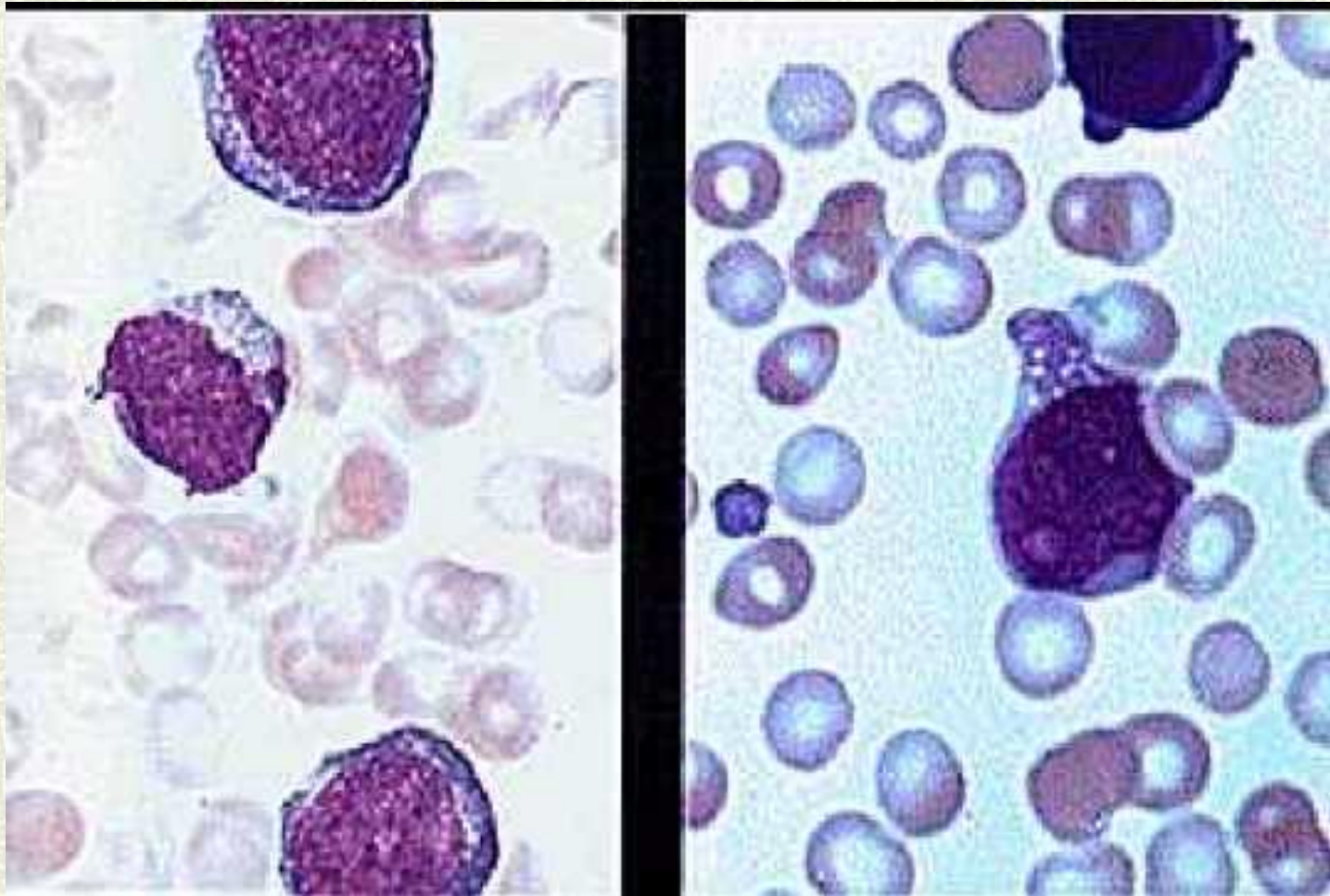
AML-M4 - Myelomonocytic



AML-M6 : Erythroleukemia



AML-M7 : Megakaryocytic

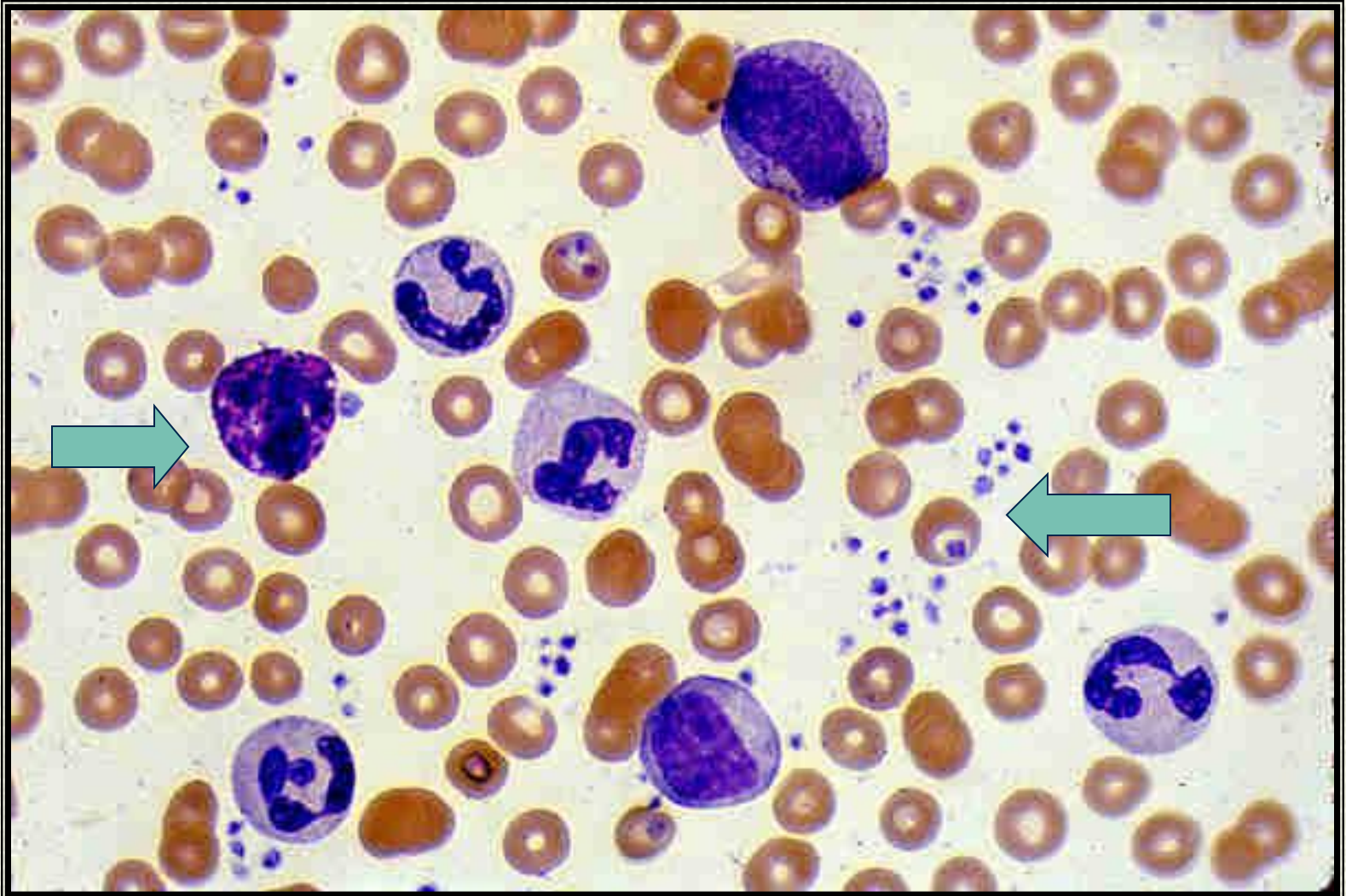




Chronic Myeloid Leukemia

- # Middle age 40-60y
- # Philadelphia chromosome, t(9:22)
- # Anemia, Fever & Bleeding
- # Marked leucocytosis – >50,000 (abnormal)
- # Marked splenomegaly,
- # Hepatomegaly

Chronic Myeloid Leukemia:

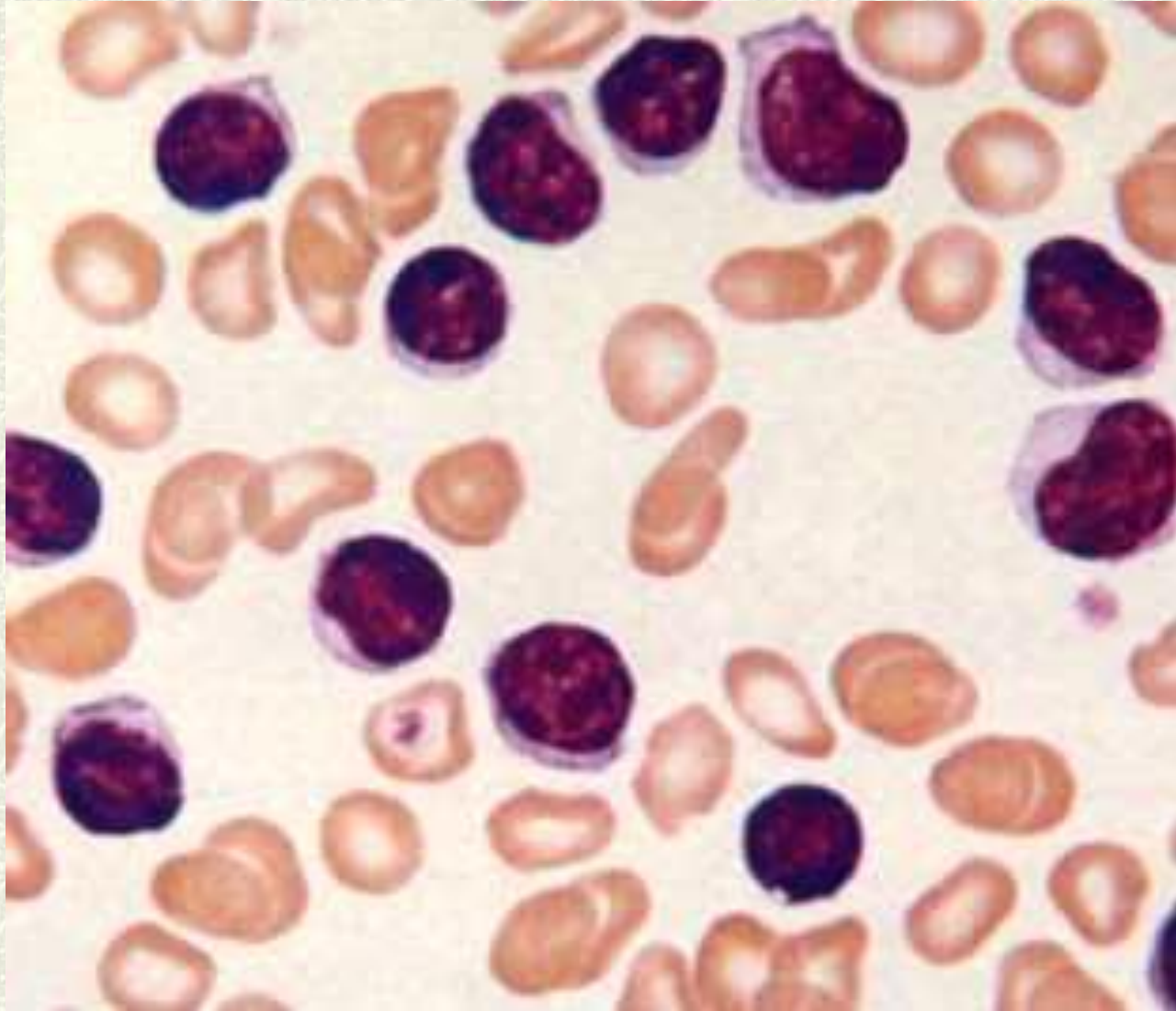




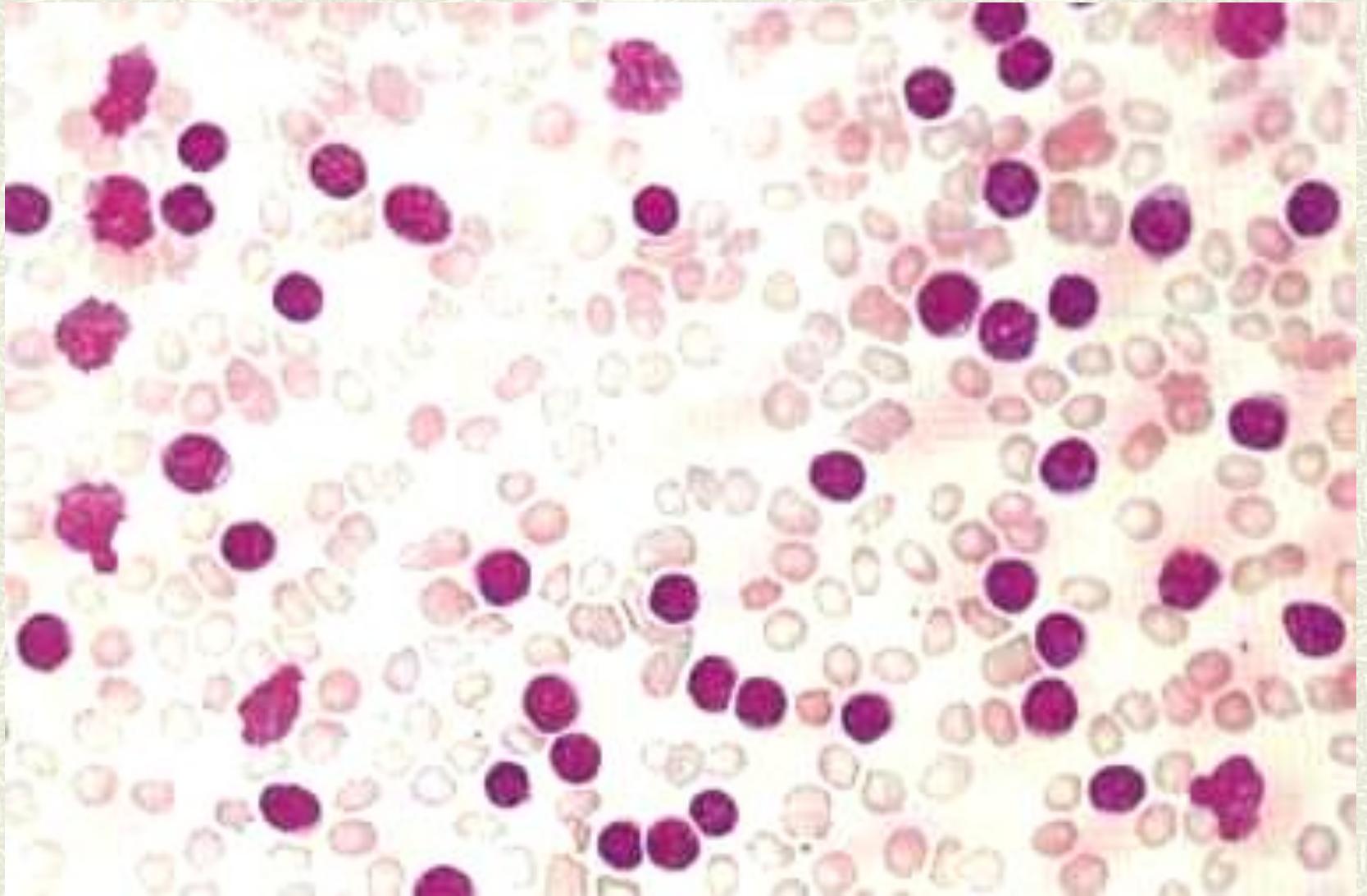
Chronic Lymphocytic Leukemia

- # Elderly age
- # Anemia, fever & bleeding .
- # Lymphocytosis
- # Lymphadenopathy
- # Spleen, & liver enlargement
- # Common B cell (CD5 +ve)

CLL



CLL – Blood Film





Lymphoma





Lymphoma

- # Tumors of lymphoid tissue
- # Lymphadenopathy
- # Fever
- # **Hodgkins lymphoma**
- # **Non-hodgkins lymphoma**

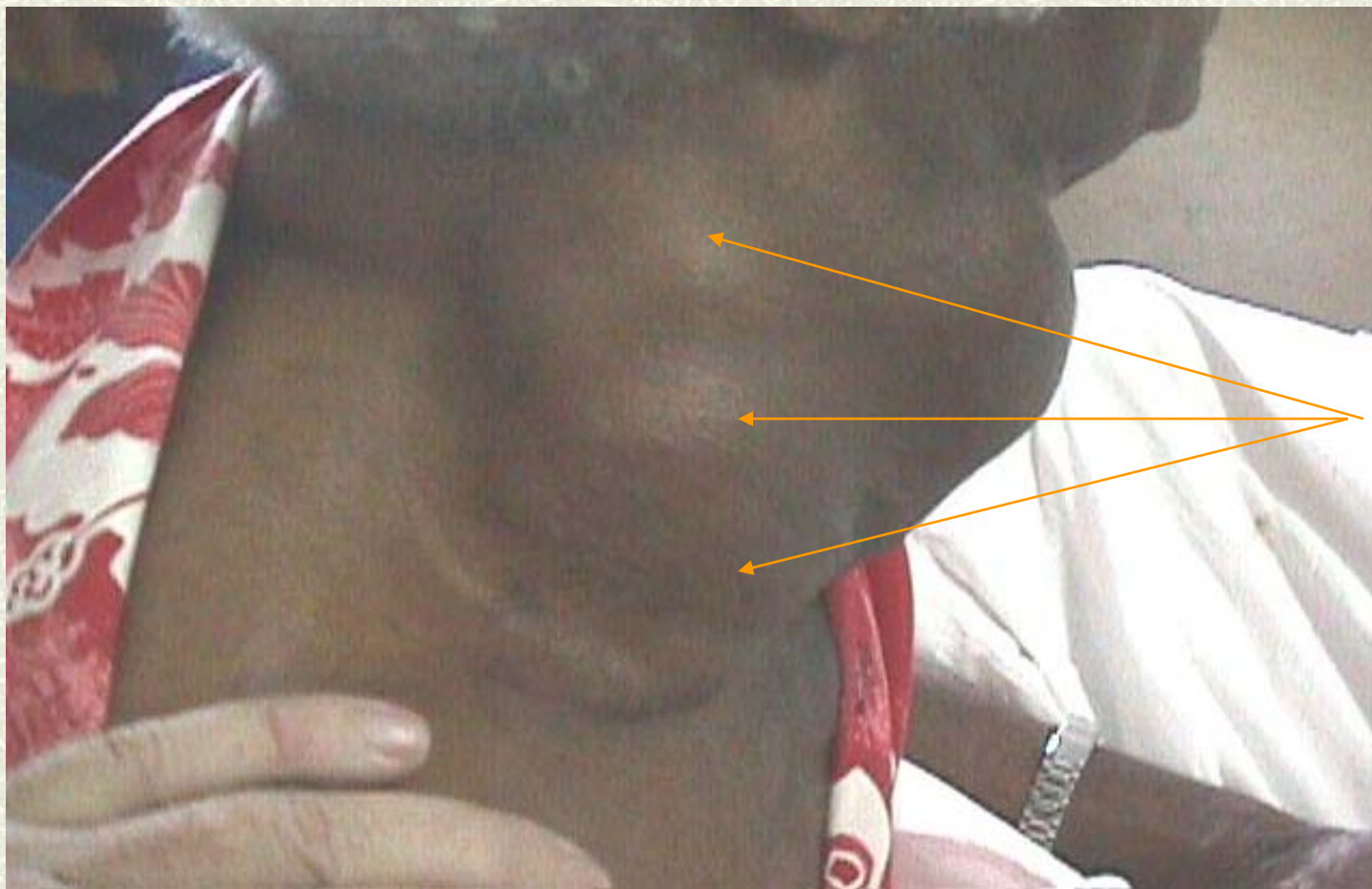


Right neck mass





Lymphoma



Row of
enlarged
lymph nodes

Hodgkins Lymphoma:

- # **Children & adults – double peak.**
- # **Lymphadenopathy, painless, firm**
- # **Fever, Eosinophilia**
- # **Reed-Sternberg cells - B lymphocytes.**

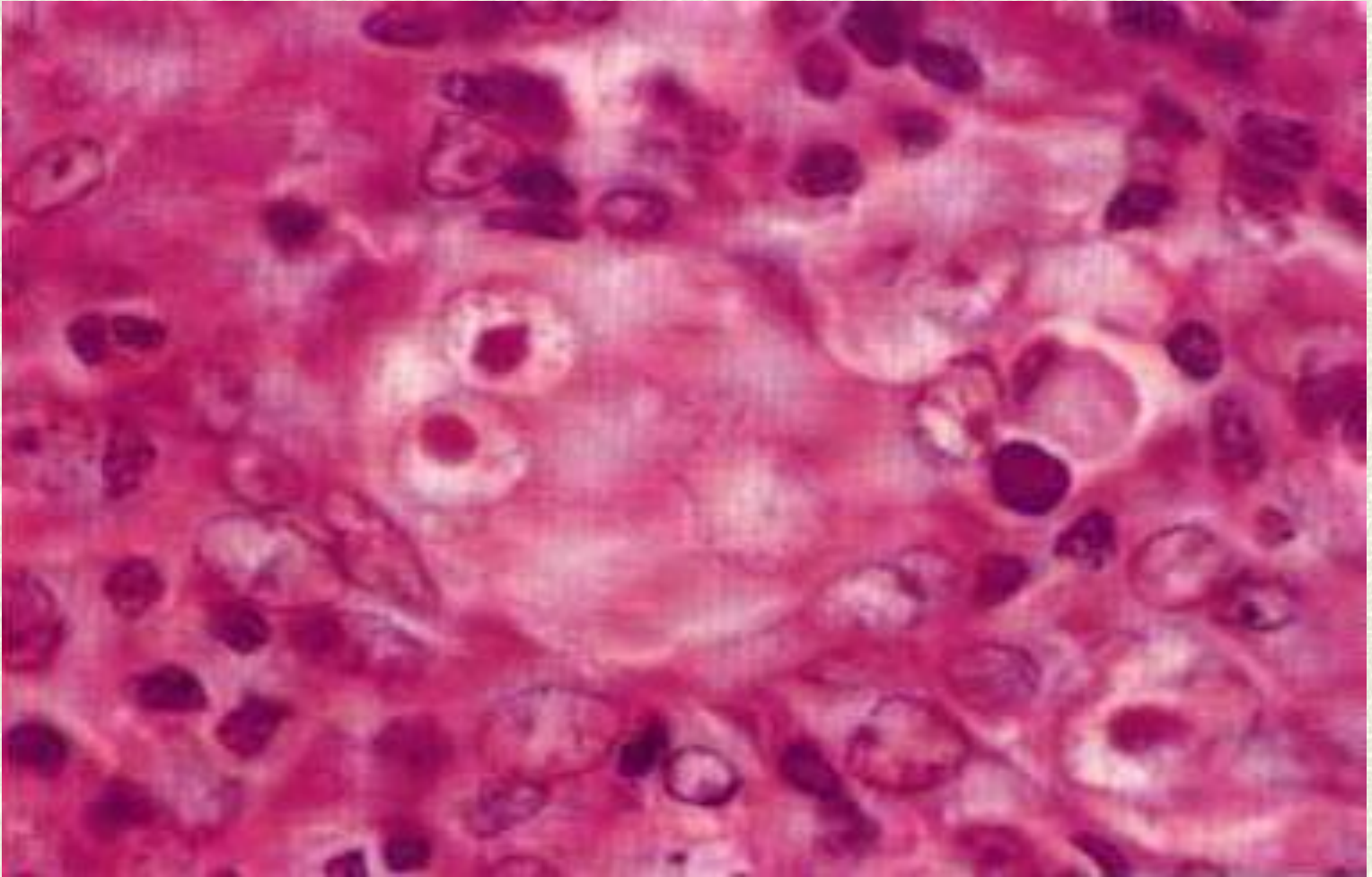


Splenomegaly



Spleen

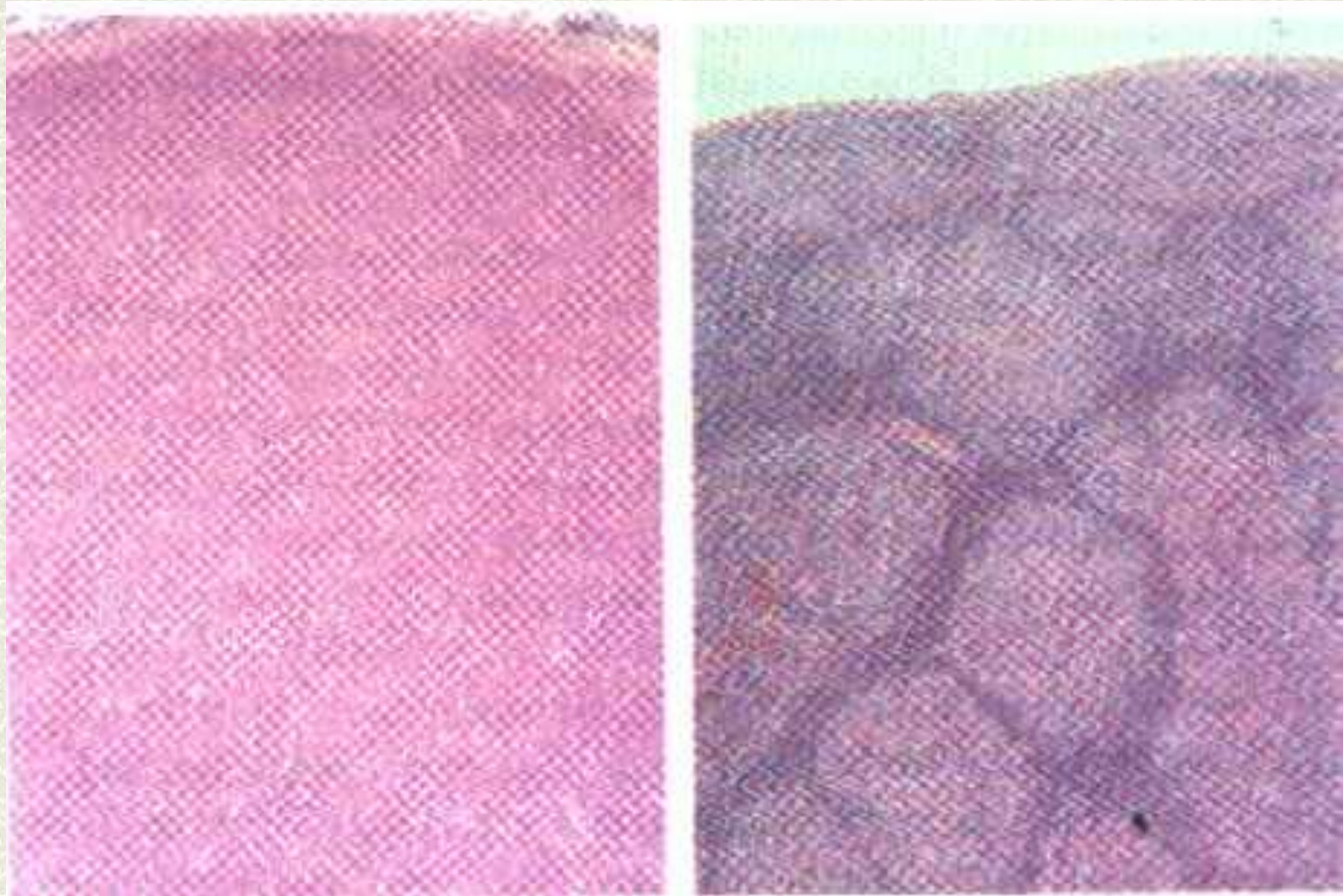
Hodgkins lymphoma



Non-Hodgkins Lymphoma:

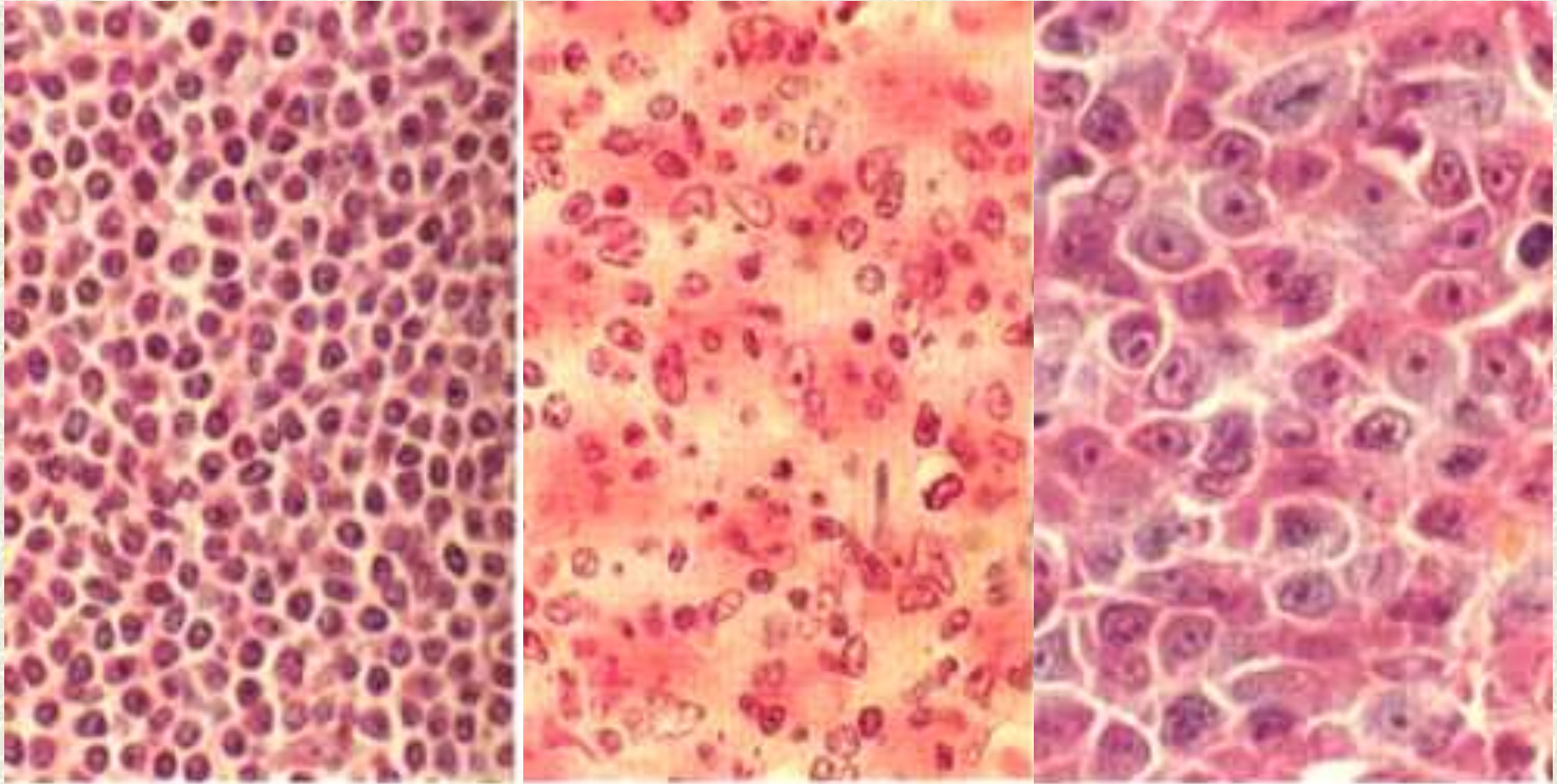
- # Fever, anemia, infections
- # Marked Lymphadenopathy
- # No RS cells
- # Large group of different lymphomas
 - Clinical – low, intermediate & high grade.
 - Cell type – B cell, T cell,
 - Histology – Follicular & diffuse.

NHL- Histologic types



Diffuse - & - Follicular

NHL- Histologic types

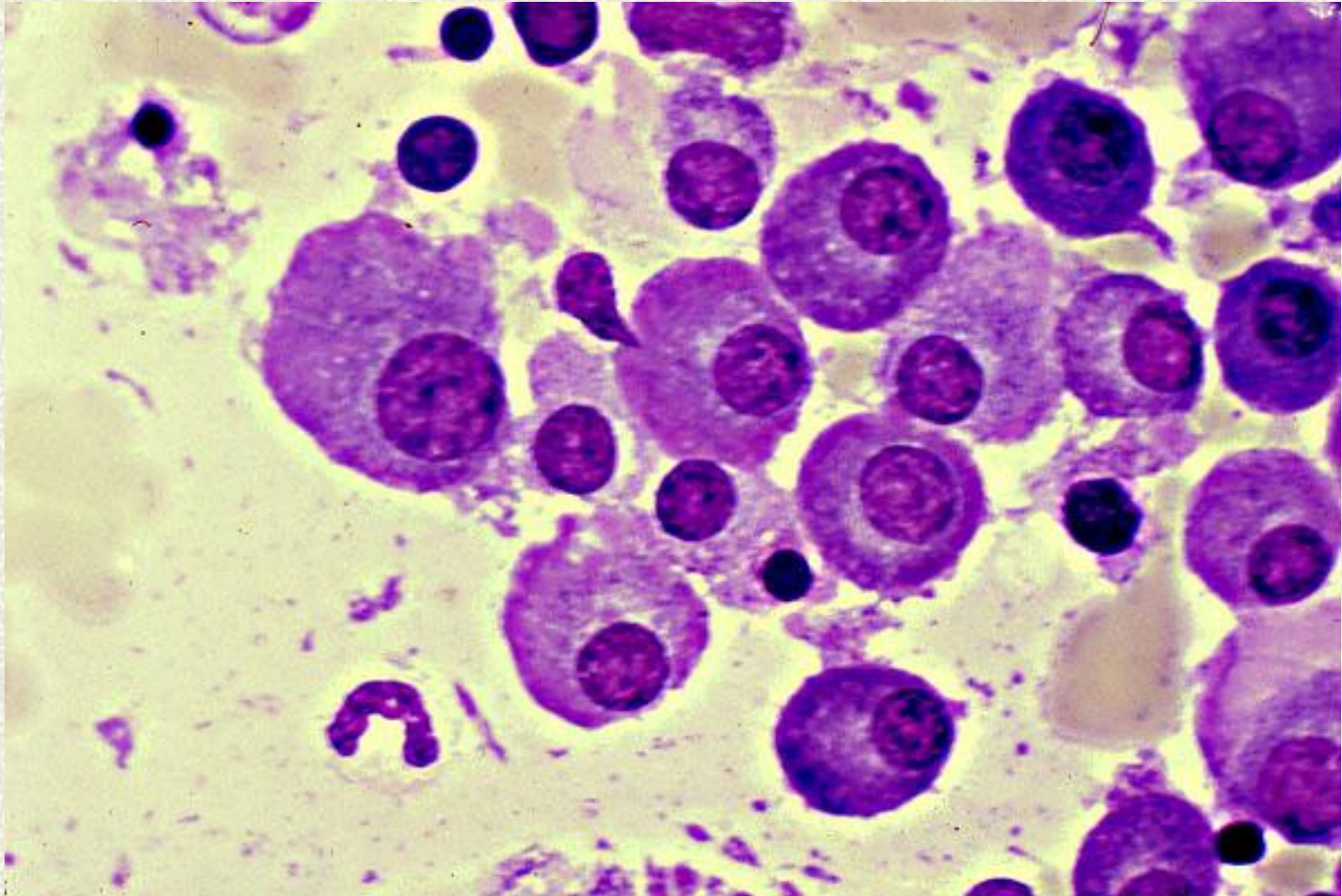


Small — Intermed. — Large

Myeloma:

- # Old age
- # Malignancy of Plasma cells – B lymphocytes
- # anemia
- # Lytic bone lesions.
- # Monoclonal immunoglobulin
- # Renal insufficiency
- # Immunodeficiency – infections

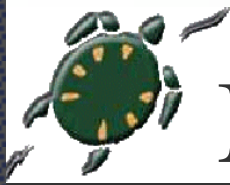
Myeloma – Bone Marrow





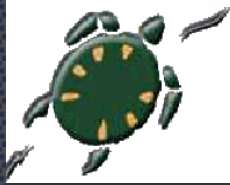
MPS , MDS





Myeloproliferative Syndromes:

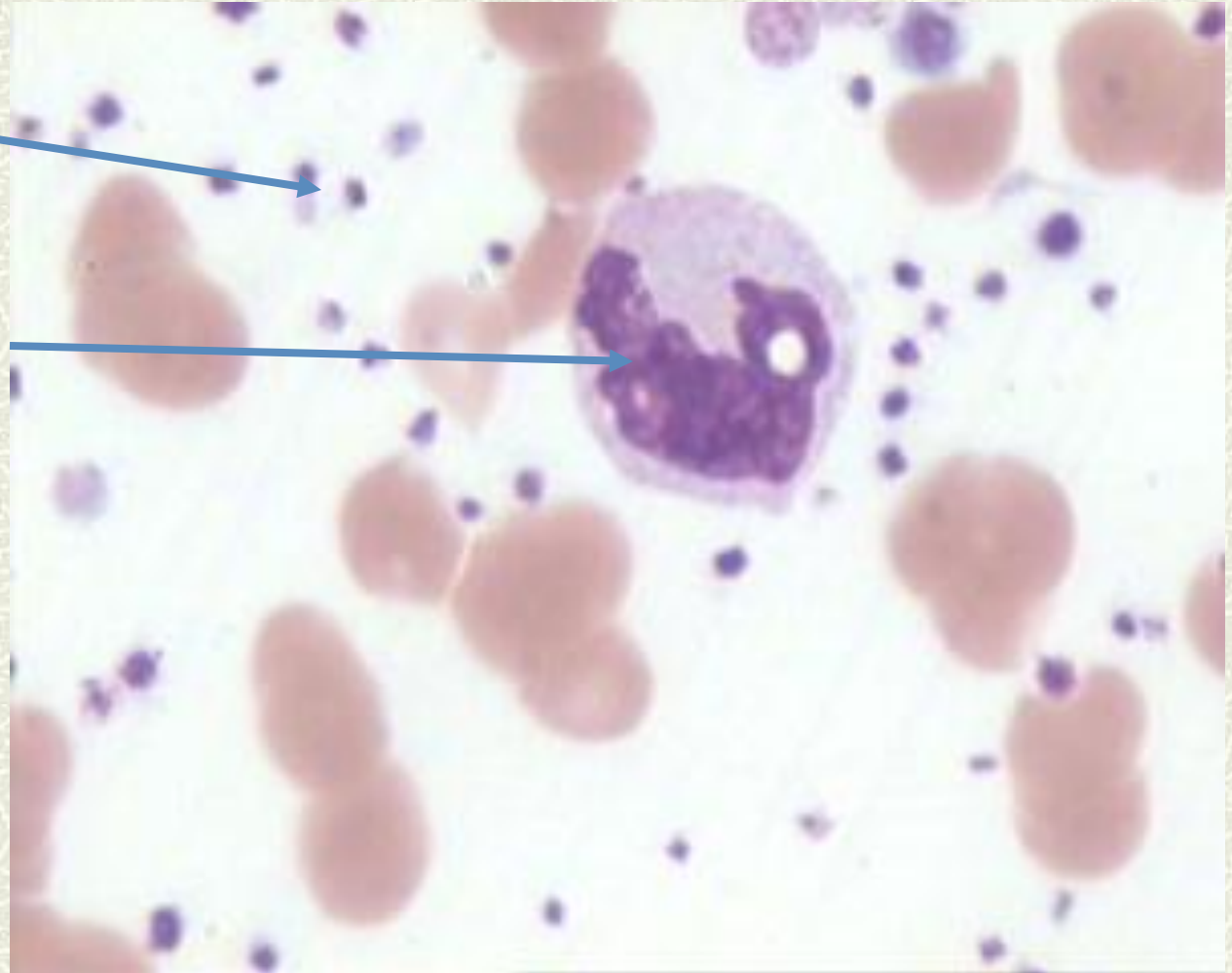
- # **Neoplasms, Slow, Chronic, Proliferation**
 - # **Increased, Functionally abnormal cells.**
 - # **Extramedullary hemopoiesis - Organomegaly**
 - # **Progress to Leukemia – end stage.**
 - # **Classification:**
 - **Polycythemia rubra vera (PV)**
 - **Chronic Myeloid Leukemia (CML)**
 - **Essential Thrombocythemia (ET)**
 - **Myelofibrosis (MF)**
-



Blood Film

Plenty of
Platelets

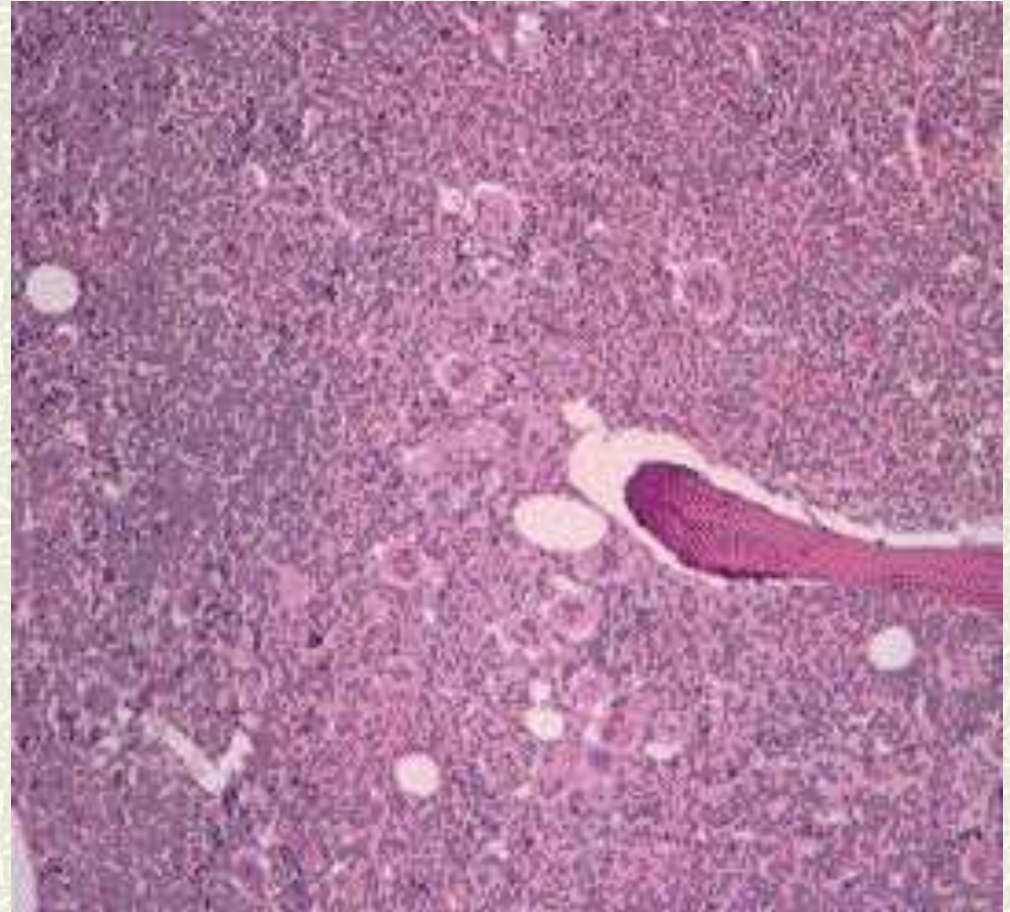
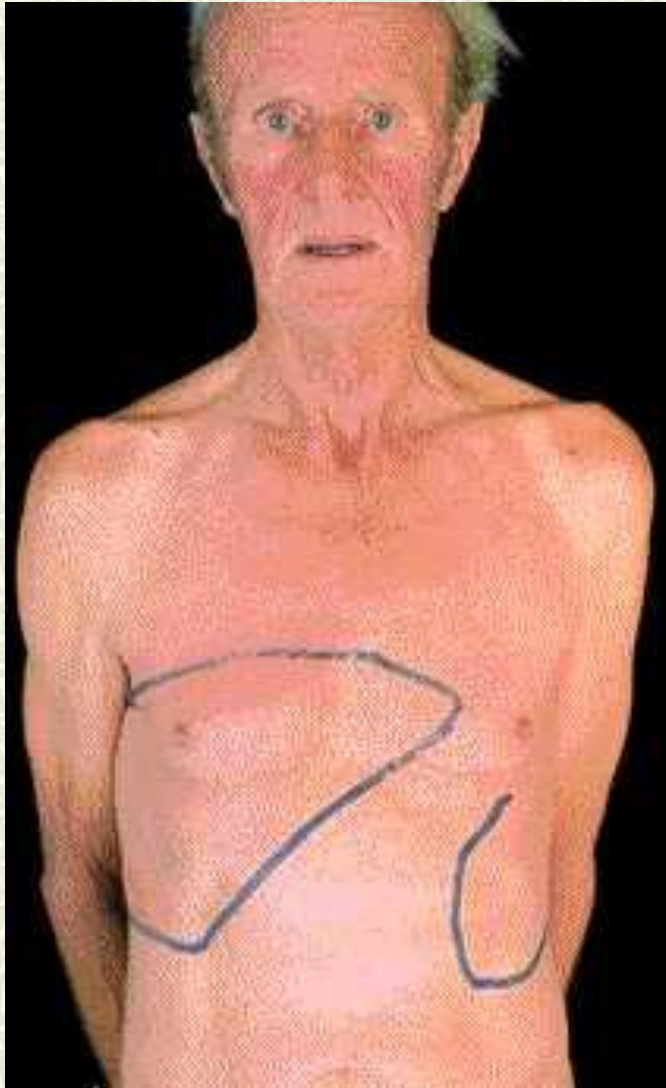
Megakaryocyte



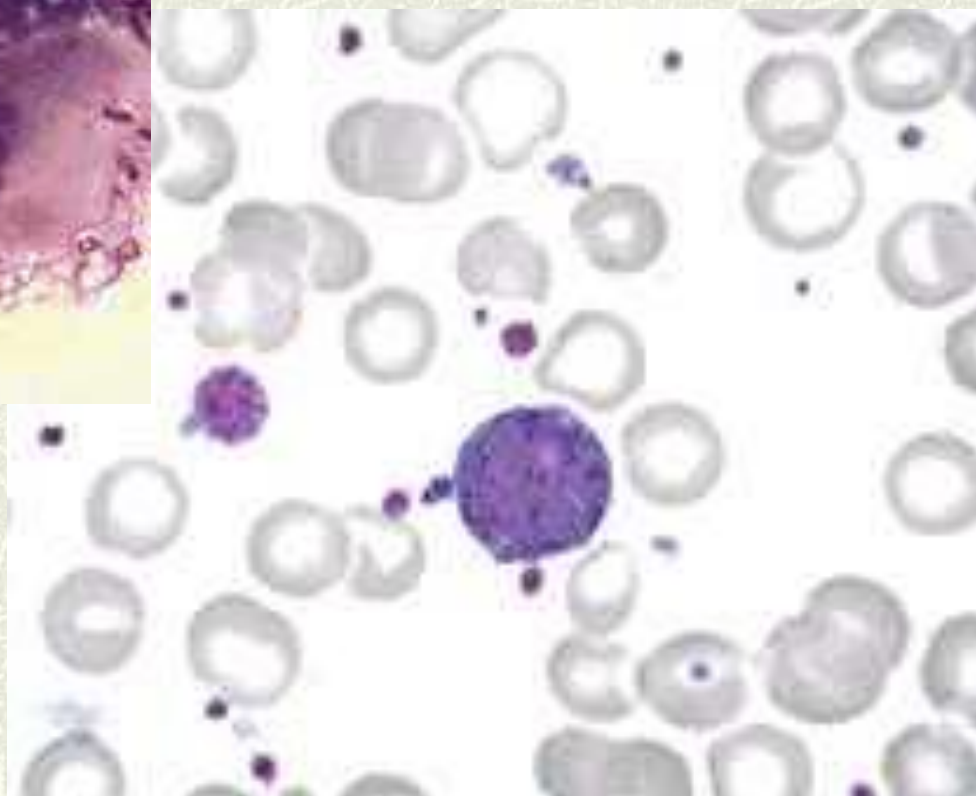
MPS : E.T. Bleeding



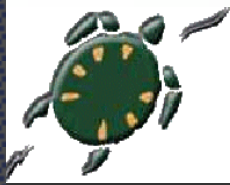
Polycythemia Vera (PV)



Essential thrombocytemia



BM & PS



Myelofibrosis: Organomegaly





Myelodysplastic Syndromes:

- # Excess proliferation in marrow.
- # But functional & Structural abnormality
- # Peripheral pancytopenia.



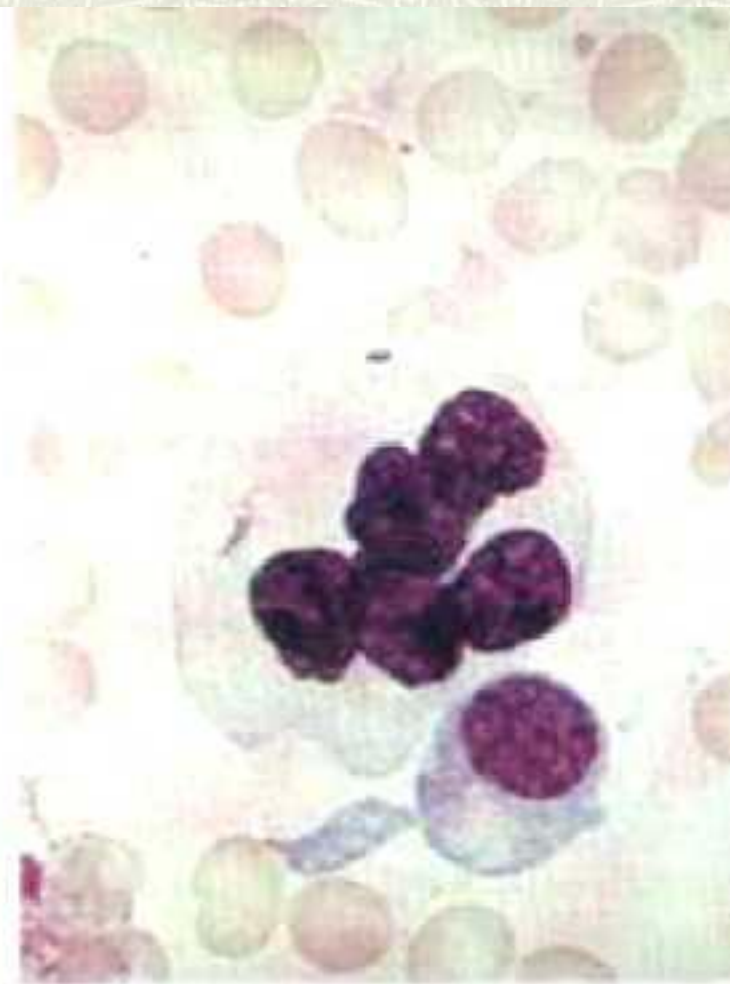
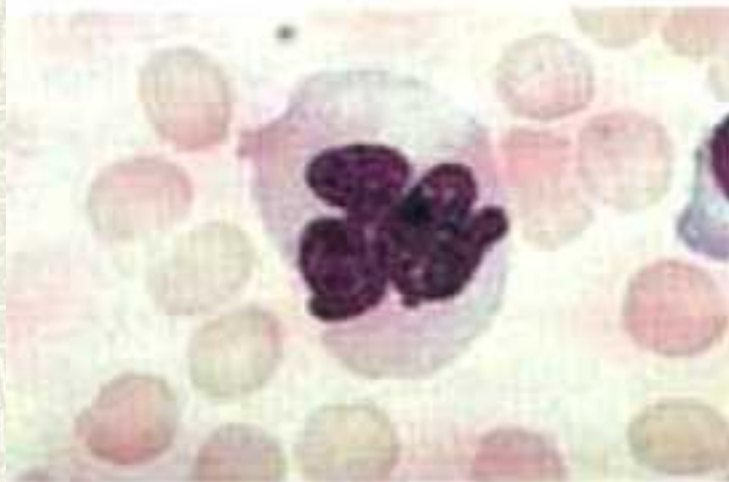
Myelodysplastic Syndromes:

FAB classification

- # **RA** : Refractory Anemia (Blasts $<1\%$)
 - # **RARS** : RA with Ring Sideroblasts ($<1\%$)
 - # **RAEB** : RA with excess blasts ($<5\%$)
 - # **RAEB in T** : RAEB in transformation ($>5\%$)
-

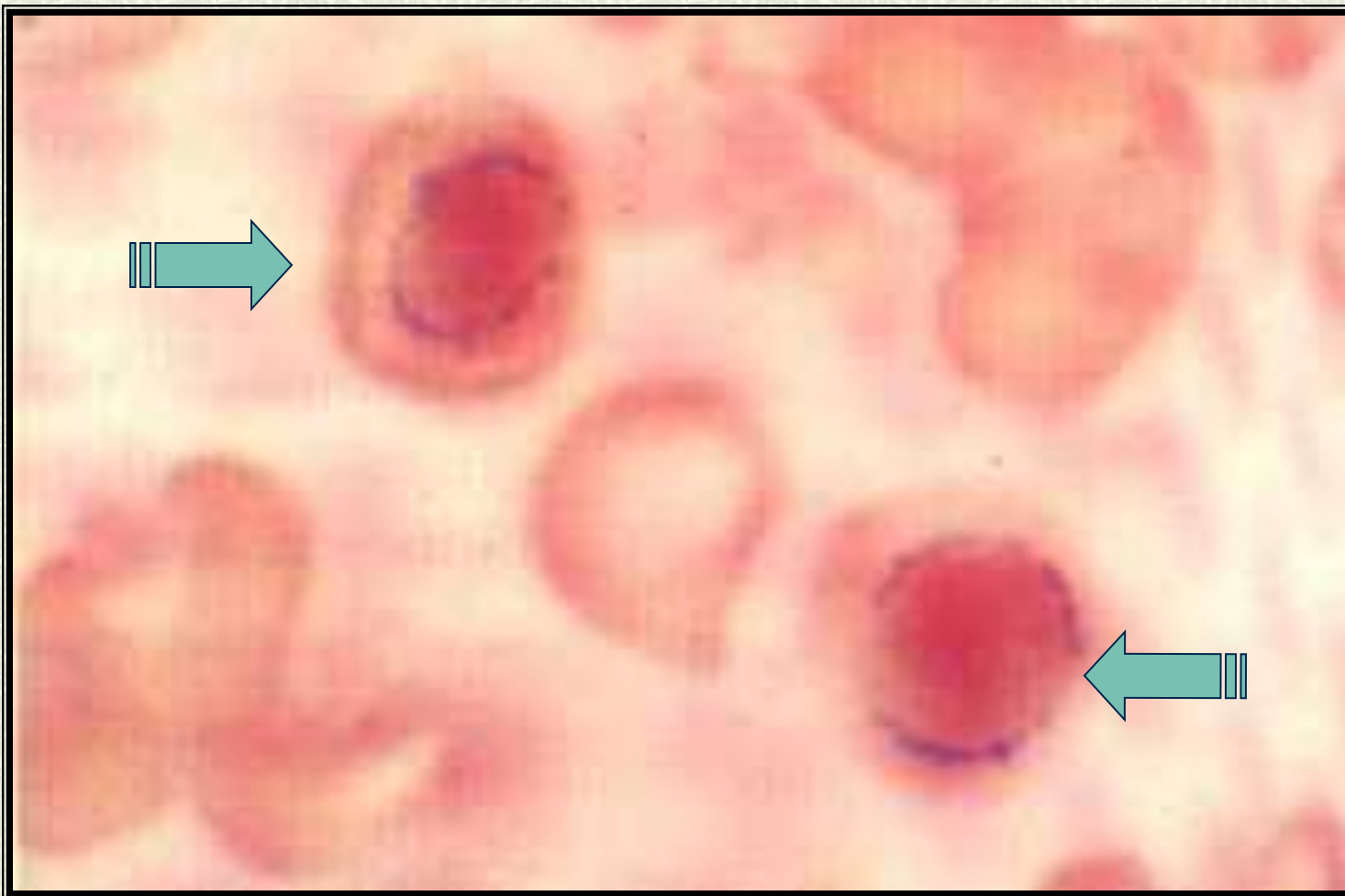


MDS - Dysplastic Erythroblasts





MDS: - Ring Sideroblast





Summary:

- # **Leukemias** – Starts in marrow spread to blood
 - Anemia, infections & Bleeding
 - Enlargement of Liver, Spleen lymphnodes
 - **Acute/Chronic & Myeloid & Lymphoid.**
- # **Lymphomas** – Tumors of lymphnodes.
 - Fever & lymphadenopathy
 - Types - Hodgkins & non- hodgkins,
- MDS: Myelodysplastic syn – Less & Dysplastic
- MPS: Myeloproliferative dis -Excess & abnormal