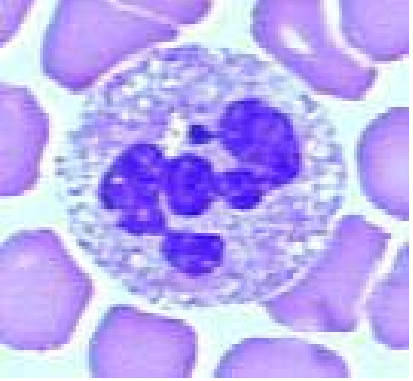
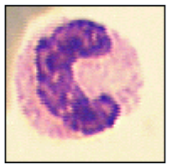
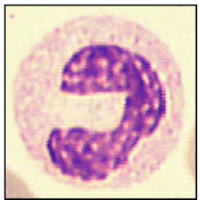
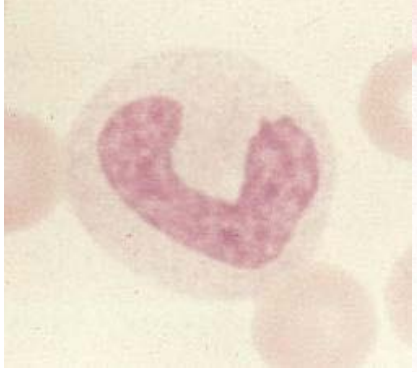
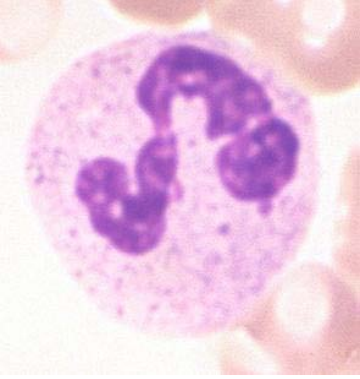
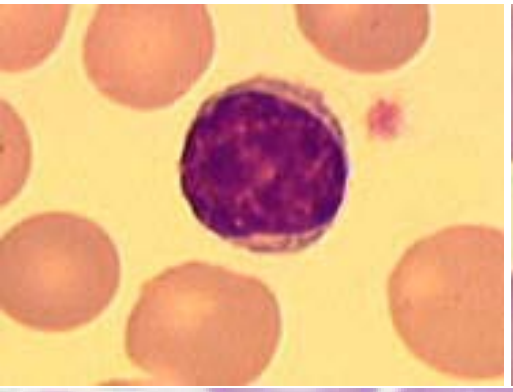
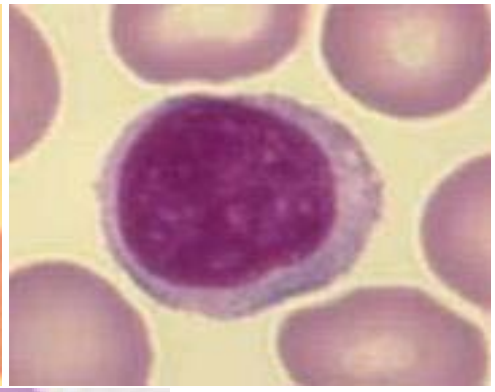
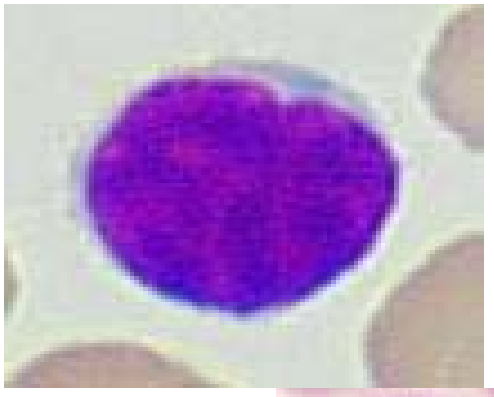
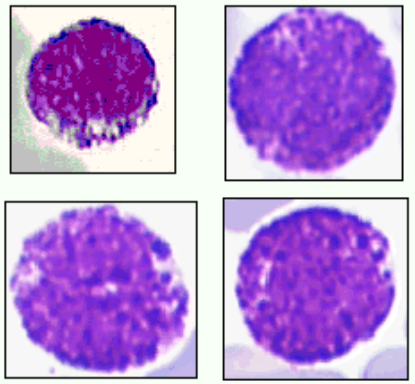
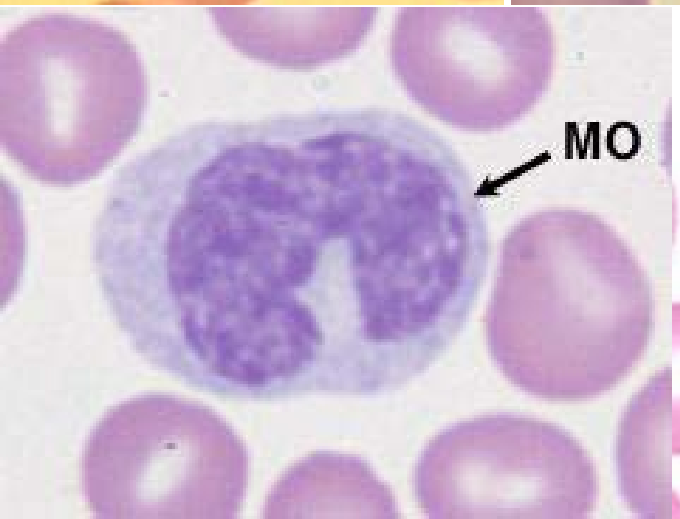
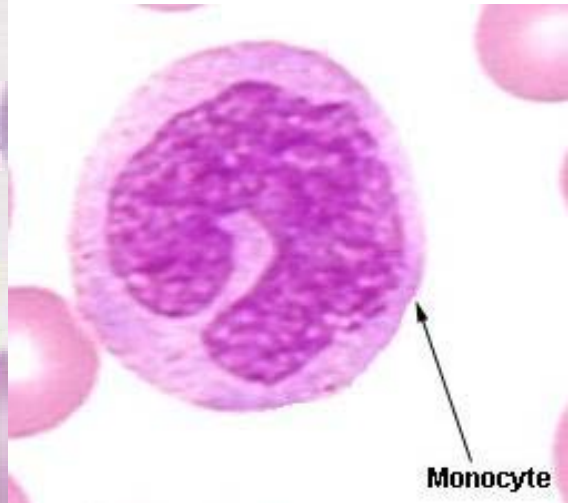
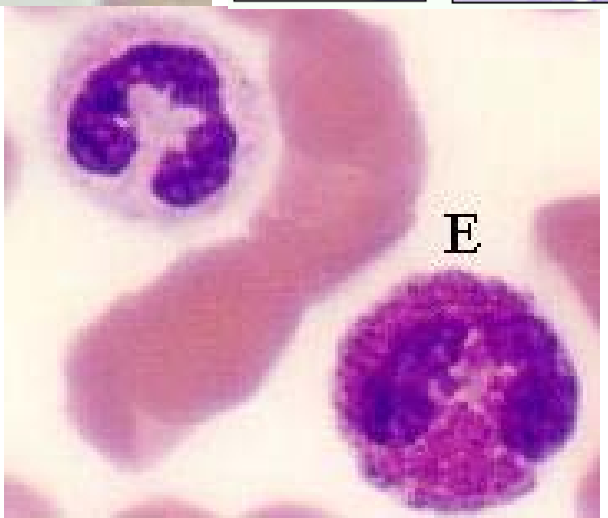






DISEASES of WHITE CELLS and LYMPHOID TISSUE



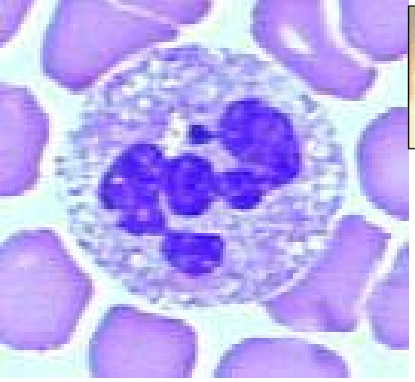
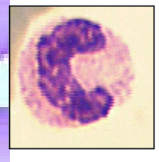
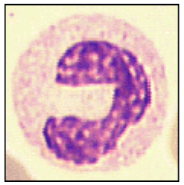
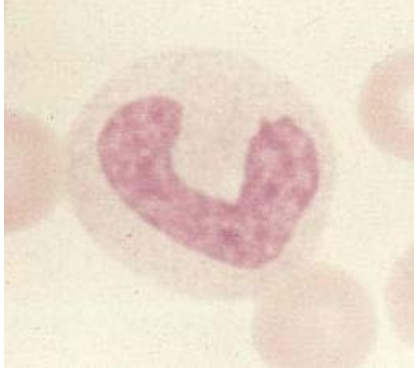
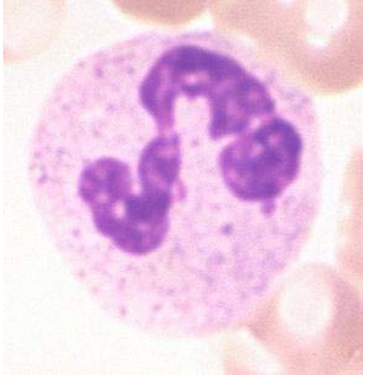
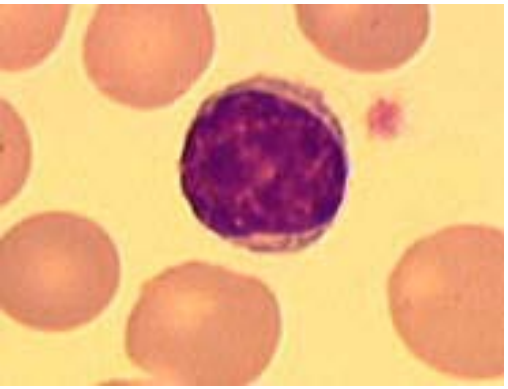
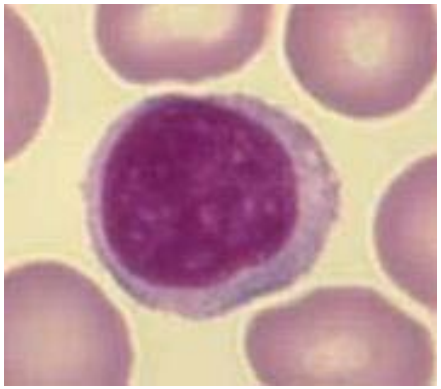
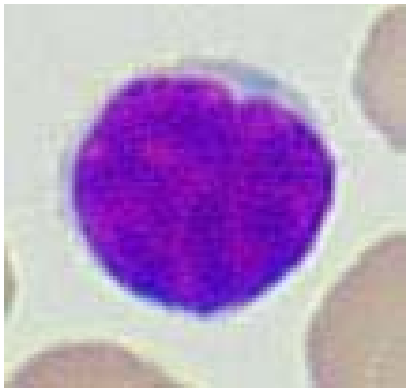
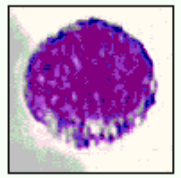
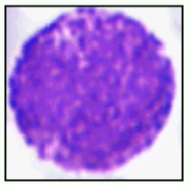
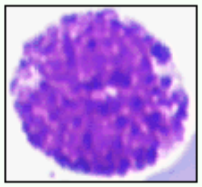
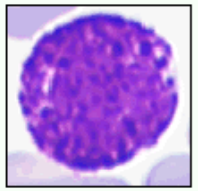
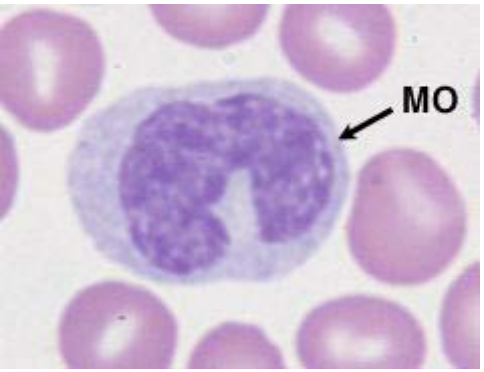


Topics for Chapter 14

- Leukopenia/Neutropenia
- Leukocytosis
- Lymphadenitis/Lymphadenopathy
- (Malignant) Lymphoma
- NON-Hodgkins Lymphoma
- Hodgkins Lymphoma (Hodgkins Disease)
- ALL/CLL (Acute/Chronic Lymphocytic Leukemia)
- Multiple Myeloma
- M1/M2/M3/M4/M5/M6/M7
- Myeloproliferative Disorder
- CML and Polycythemia Vera
- Essential Thrombocytosis
- Splenomegaly
- Thymoma

WBC/LYMPHOID DISORDERS

- Review of Normal WBC Structure/Function
- Benign Neutrophil and Lymphoid Disorders
- Leukemias
- Lymph Nodes
- Spleen/Thymus
- REVIEW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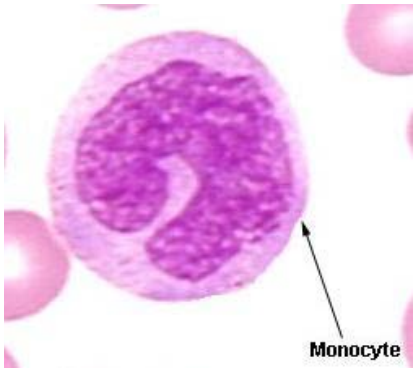
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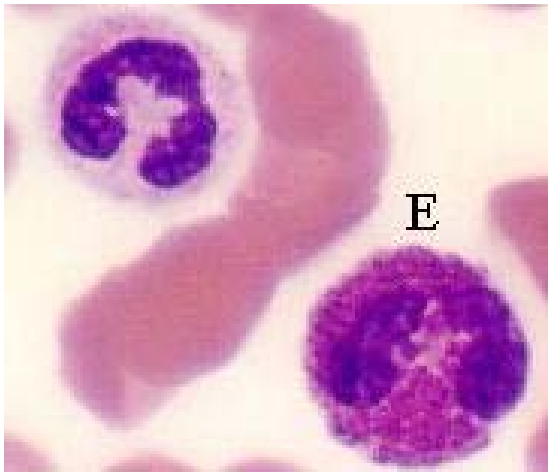
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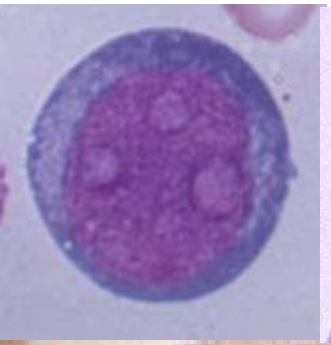
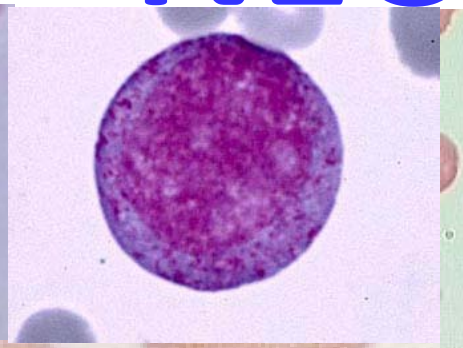
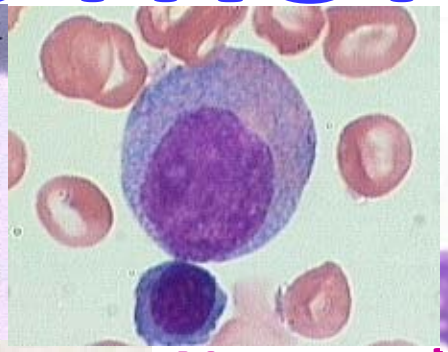
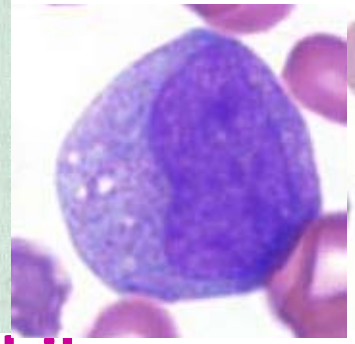
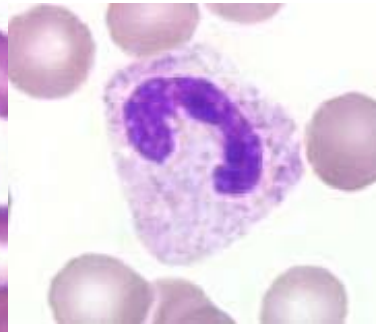
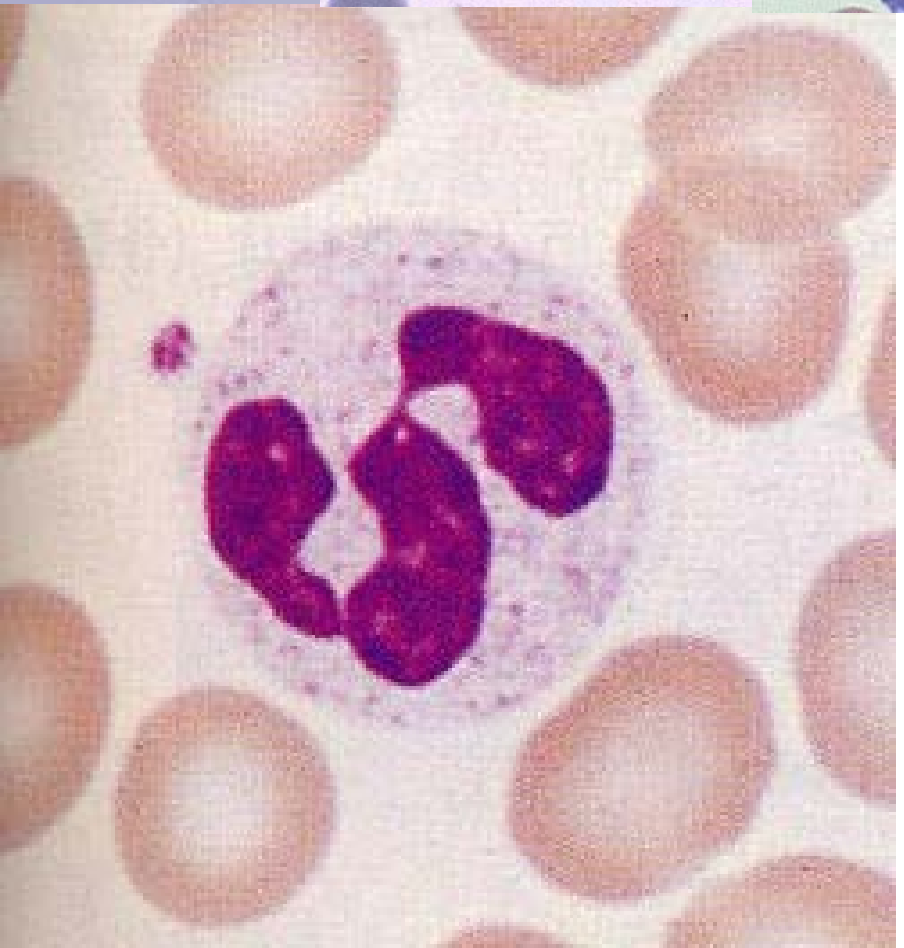
NEUTROPHILS

- Normal TOTAL WBC count 6-11 K
- Neutrophils usually 2/3 of total normal
- Myeloblast→ Promyelocyte→ Myelocyte→ Metamyelocyte→ Band (stab)→ Mature Neutrophil (Poly, PMN, Neutrophilic Granulocyte)
- Produced in red (hematopoetic) marrow, sequester (pool) in spleen, live in peripheral blood, migrate OUT of vascular compartment PRN, live a couple days normally

NEUTROPHIL

Neutrophil

Polymorphonuclear Leukocyte, PMN, PML

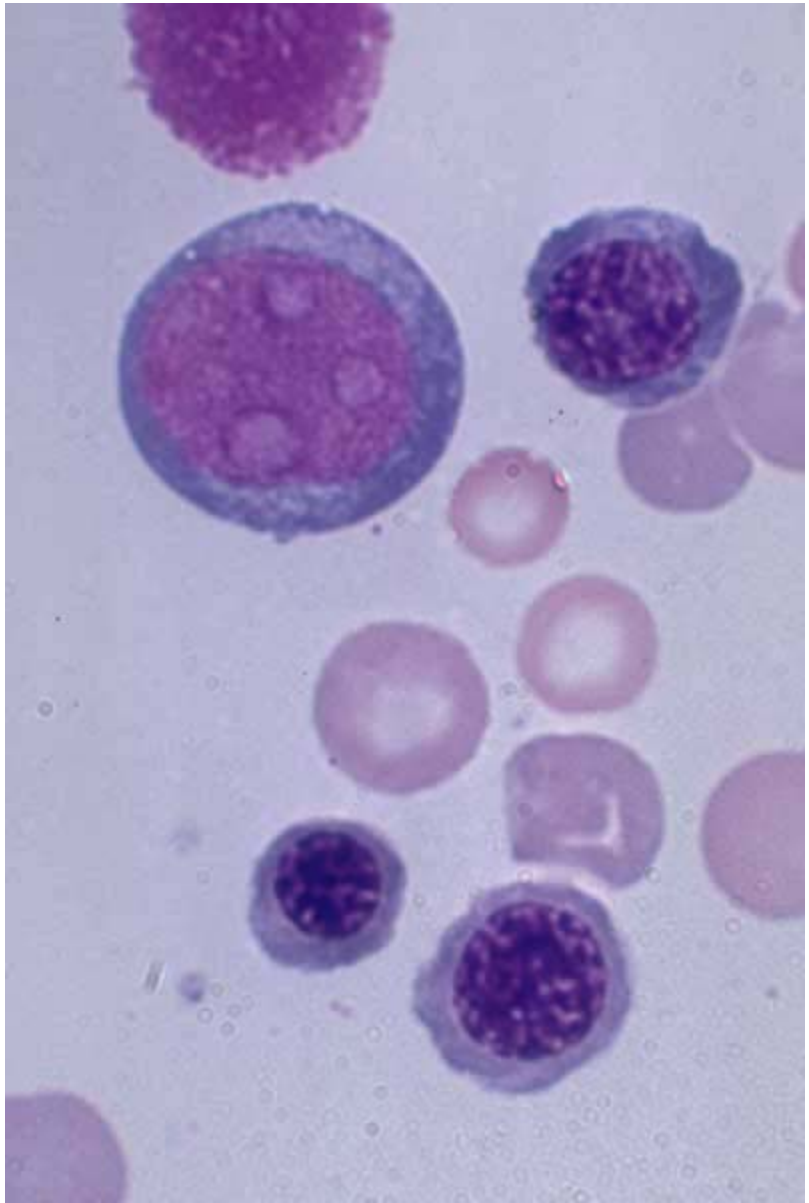
“Leukocyte”

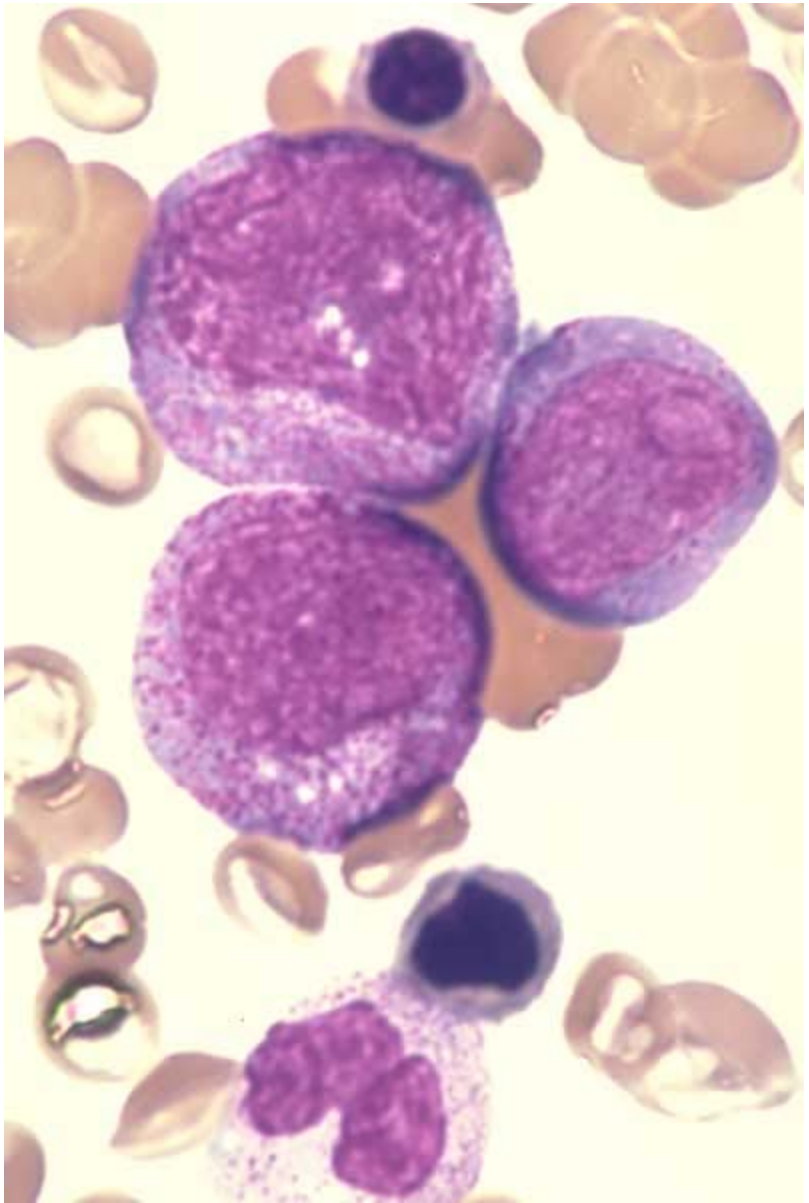
Granulocyte, Neutrophilic granulocyte

“Poly-”

Polymorph

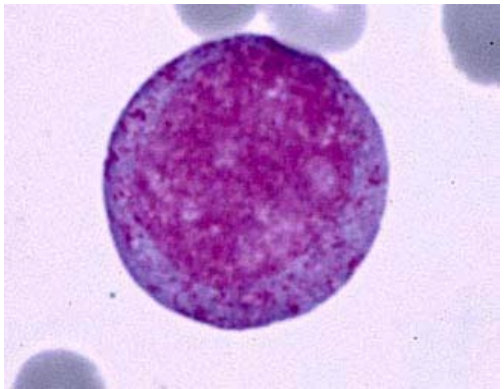
NEUTROPHIL MATURATION



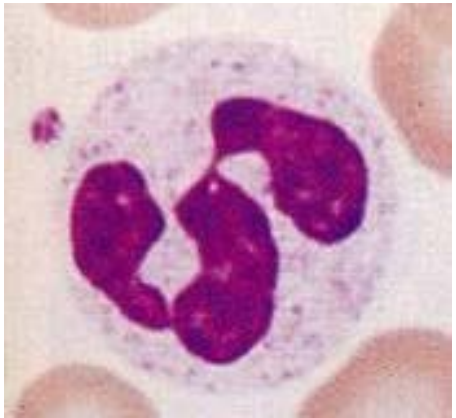


LYSOSOMAL CONSTITUENTS

- **PRIMARY**
- Also called AZUROPHILIC, or NON-specific
- Myeloperoxidase
- Lysozyme (Bact.)
- Acid Hydrolases



- **SECONDARY**
- Also called SPECIFIC
- Lactoferrin
- Lysozyme
- Alkaline Phosphatase
- Collagenase

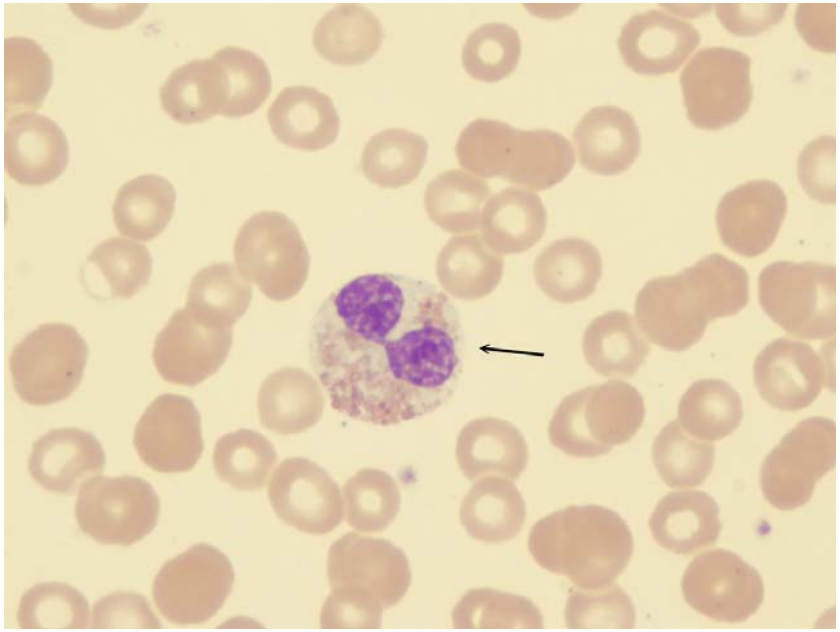


FUNCTIONS

- Margination
- Rolling
- Adhesion
- Transmigration (Diapedesis)
- Chemotaxis
- Phagocytosis: Recognition, Engulfment, Killing (digestion)
- Equilibrium with splenic pool

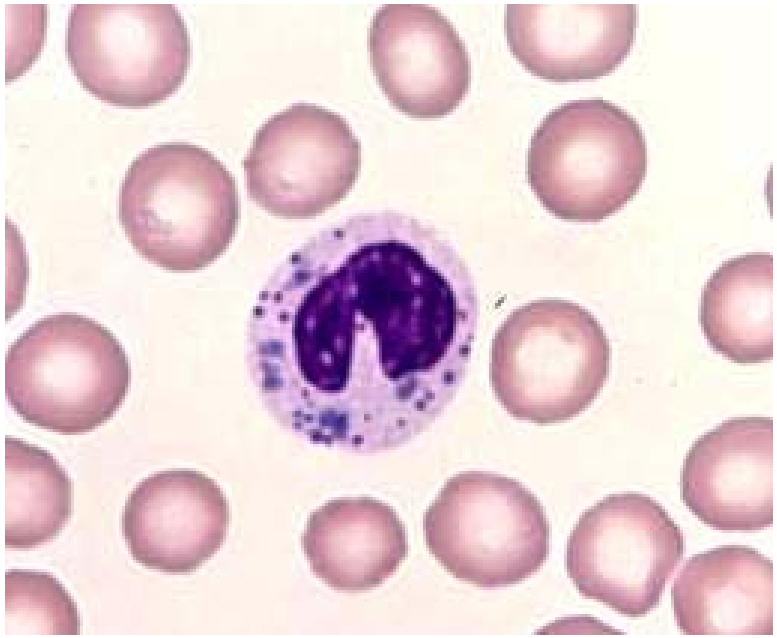
PELGER-HUET ANOMALY

- Genetic
- Sometimes ACQUIRED (Pseudo-PELGER-HUET)
- **All neutrophils look like BANDS**
- NOT serious, mostly a cute incidental finding



CHEDIAK-HIGASHI SYNDROME

- Also genetic
- Abnormal LARGE irregular neutrophil granules
- Impaired lysosomal digestion of bacteria
- Associated with pigment and bleeding disorders
- CAN be serious, especially in kids



LEUKO-penia/NEUTRO-penia
Neutropenia/Agranulocytosis

- INADEQUATE PRODUCTION
- INCREASED DESTRUCTION

- 500-1000/mm3 is the **DANGER** zone!

INADEQUATE PRODUCTION

- Stem cell suppression, e.g., aplastic anemias
- DRUGS, esp. CHEMO, MANY antibiotics, aminopyrene, thio-uracil, phenylbutazone
- DNA suppression due to megaloblastic/myelodysplastic states
- Kostmann Syndrome (genetic, congenital)
- Marrow usually shows granulocytic **HYPO-**plasia, just as in RBC and PLAT decreased production

INCREASED DESTRUCTION

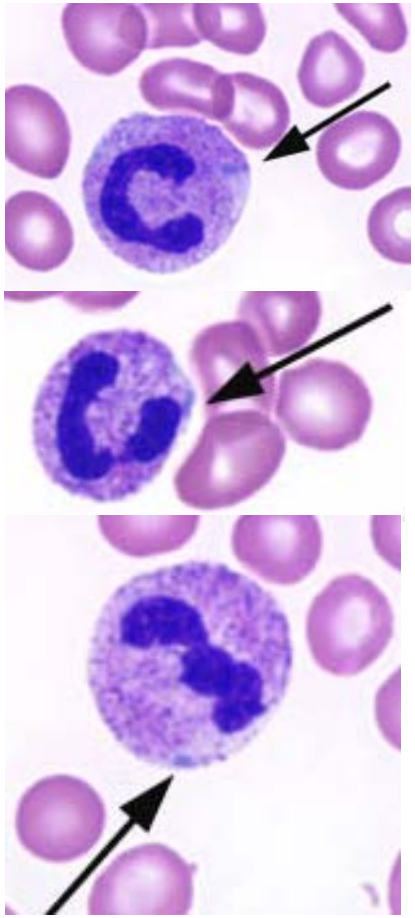
- Immune mediated
  - By itself (idiopathic), or as in SLE
  - After "sensitization" by many drugs
- Splenic sequestration, hypersplenism
- Increased peripheral demand, as in overwhelming infections, esp. fungal
- Marrow usually shows granulocytic **HYPER-**plasia, just as in RBC and PLAT increased destructions

Leukocytosis/Neutrophilia

- Marrow and splenic pool size
- Rate of release between pool and circulation
- Marginating pool
- Rate of WBCs (neutrophils/monocytes) leaving the vascular compartment
- NON-vascular pools FIFTY times larger than the vascular pools
- TNF/IL-1/cytokines stimulate T-cells to produce CSF, the WBC equivalent of EPO

NEUTROPHIL INCREASES (e.g., "NEUTROPHILIA")

- BACTERIA
- TISSUE NECROSIS, e.g., MI
- DÖHLE BODIES and TOXIC GRANULES are often seen with NEUTROPHILIA
- Accompanied by a "LEFT" shift



EOSINOPHIL INCREASES (i.e., "EOSINOPHILIA")

- ALLERGIES (esp. DRUG allergies)
- PARASITES

BASOPHIL INCREASES (i.e., "BASOPHILIA")

- RARE. Period.
- But if you want to remember something at least, remember myeloproliferative diseases in which ALL cell lines are increased

MONOCYTE INCREASES (i.e., "MONOCYTOSIS")

- **TB**
- **SBE**
- **RICKETTSIAL DISEASES**
- **MALARIA**
- **SLE**
- **IBD, i.e., ULCERATIVE COLITIS**

LYMPHOCYTE INCREASES (i.e., "LYMPHOCYTOSIS")

- TB
- VIRAL
  - –Hep-A
  - –CMV
  - –EBV
- Pertussis (whooping cough)

"MYELOPROLIFERATIVE" disorders

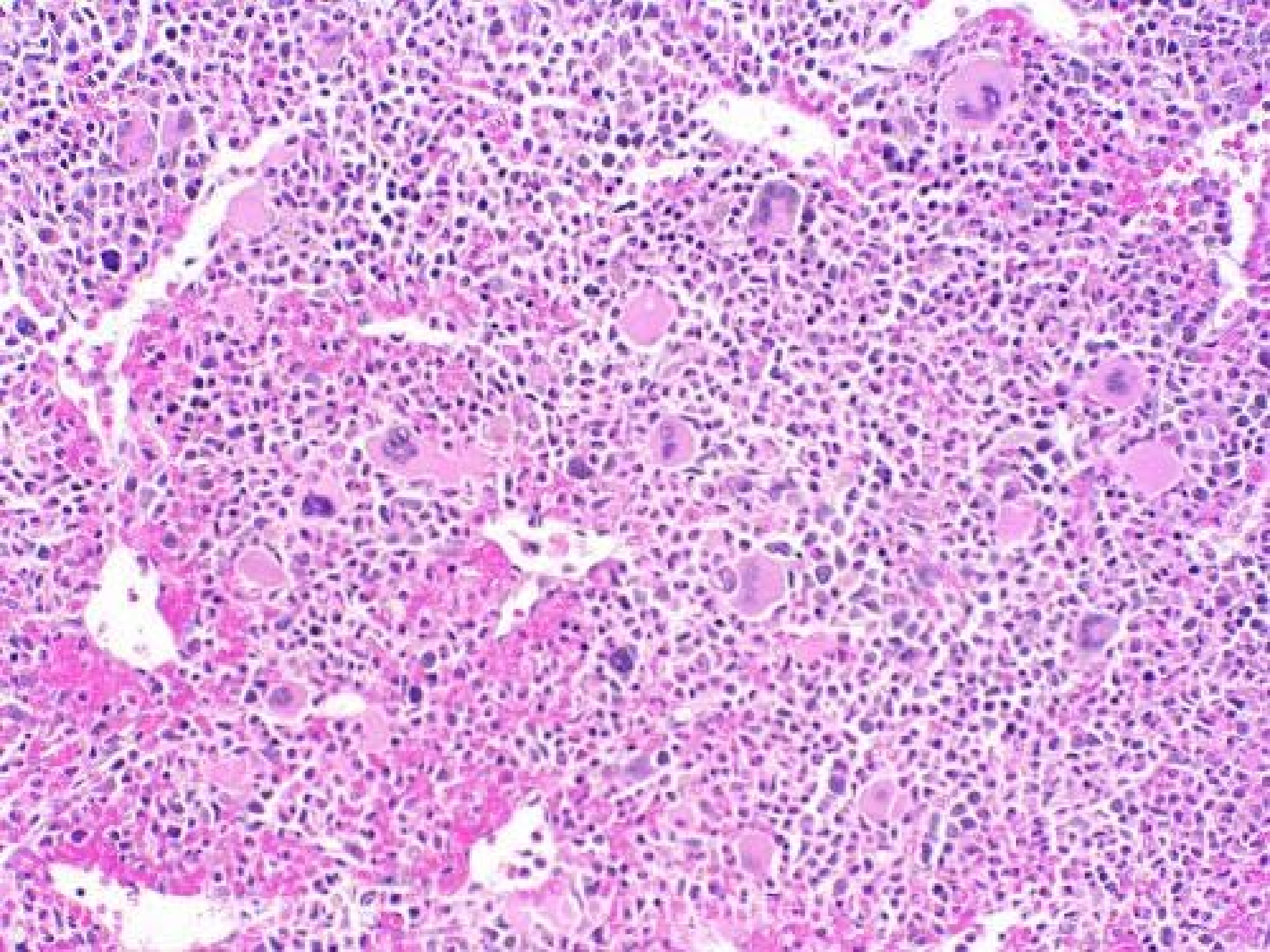
- Also called "chronic" myeloproliferative disorders because they last for years
- ALL marrow cell lines are affected, splenomegaly
- Proliferating cells do NOT suppress residual marrow production, and go OUTSIDE marrow→, and EXPAND marrow to fatty appendicular marrow
- Associated with EXTRA-medullary hematopoesis
  - Chronic Myelogenous "Leukemia" (CML)
  - P. Vera
  - Essential Thrombasthenia (aka, Essential Thrombocytosis)
  - Myelofibrosis

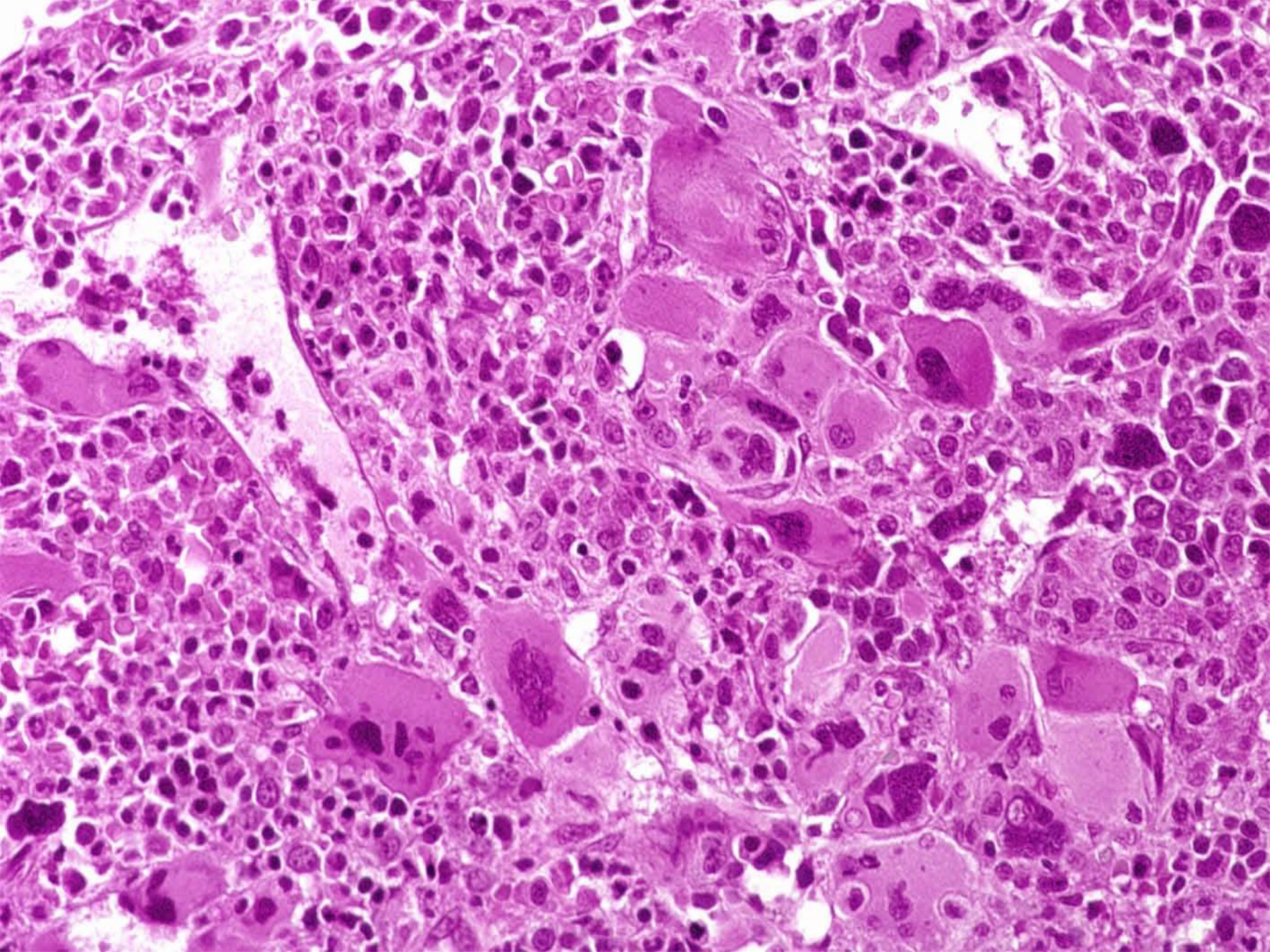
CML

- NOT AT ALL like an “acute” leukemia, but can develop into one as a condition called a “blast crisis”
- Age: adult, NOT kids
- 90% have the “Philadelphia” chromosome, which are aberrations on chromosome #9 (BCR) and #22 (ABL), the BCR-ABL “fusion”

CML

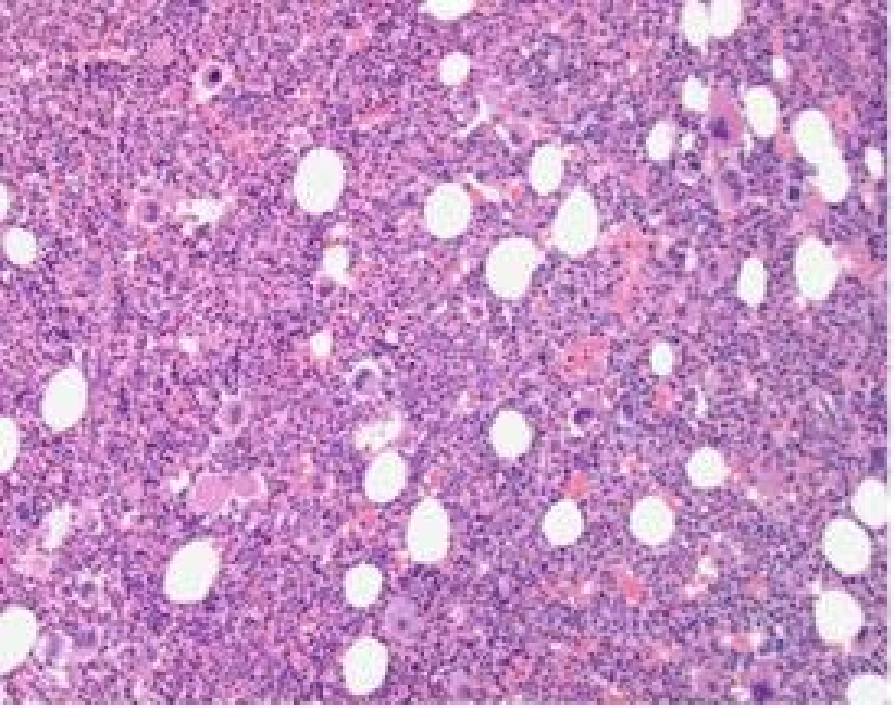
- Marrow 100% cellular, NOT 50%
- ALL cell lines increased, M:E ratio massively increased, 50K-100K neutrophils with **SIGNIFICANT "left shift"**, but not more than 10% blasts
- **SIGNIFICANT SPLENOMEGALY!!!!!**
- Significant breakthrough with BCR-ABL kinase inhibitors!!! (90% remissions)

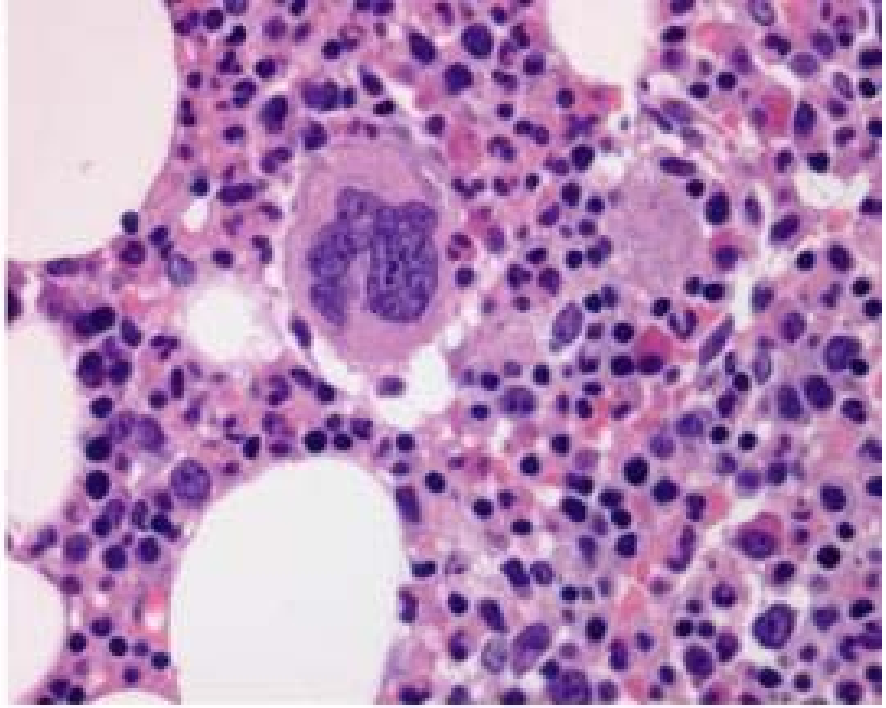


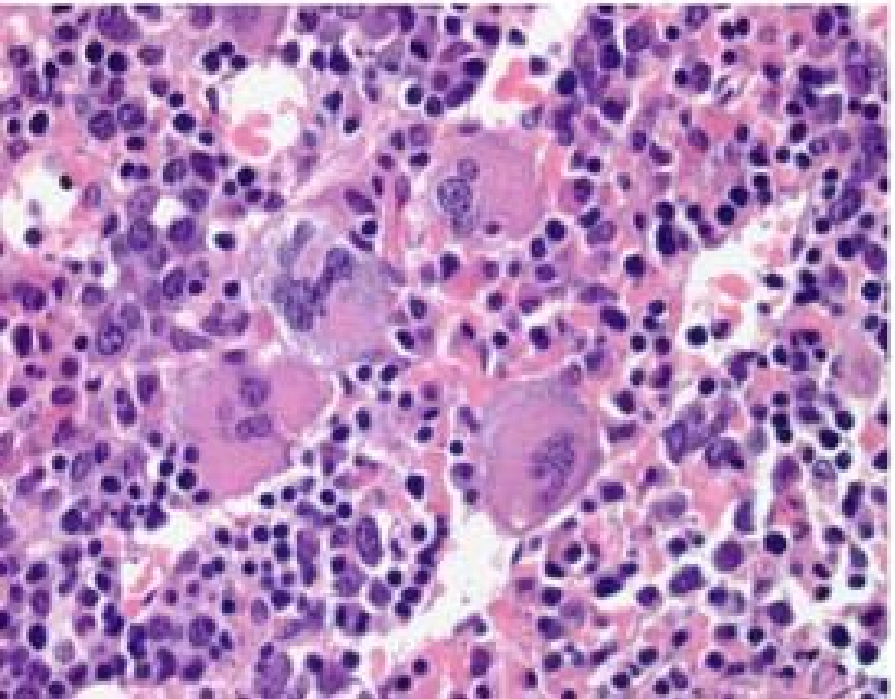


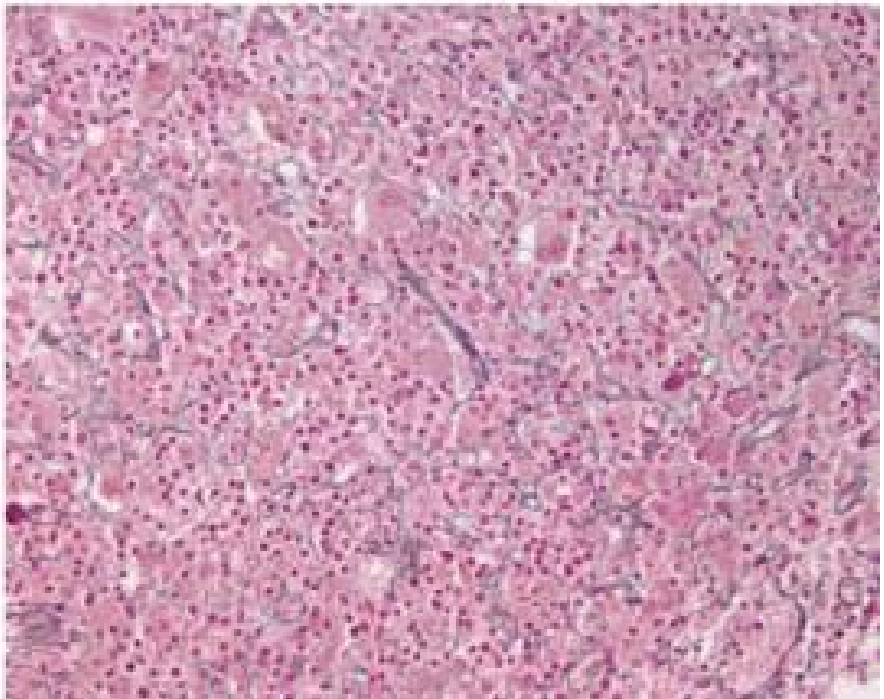
Polycythemia Vera

- All cell lines increased, NOT just RBC
- HIGH marrow cell turnover stimulates increased purines which often cause gout (10%)
- BOTH thrombosis AND bleeding risks are present because the increased platelets are AB-normal
- Do not get “blast” crises, BUT can progress to myelofibrosis



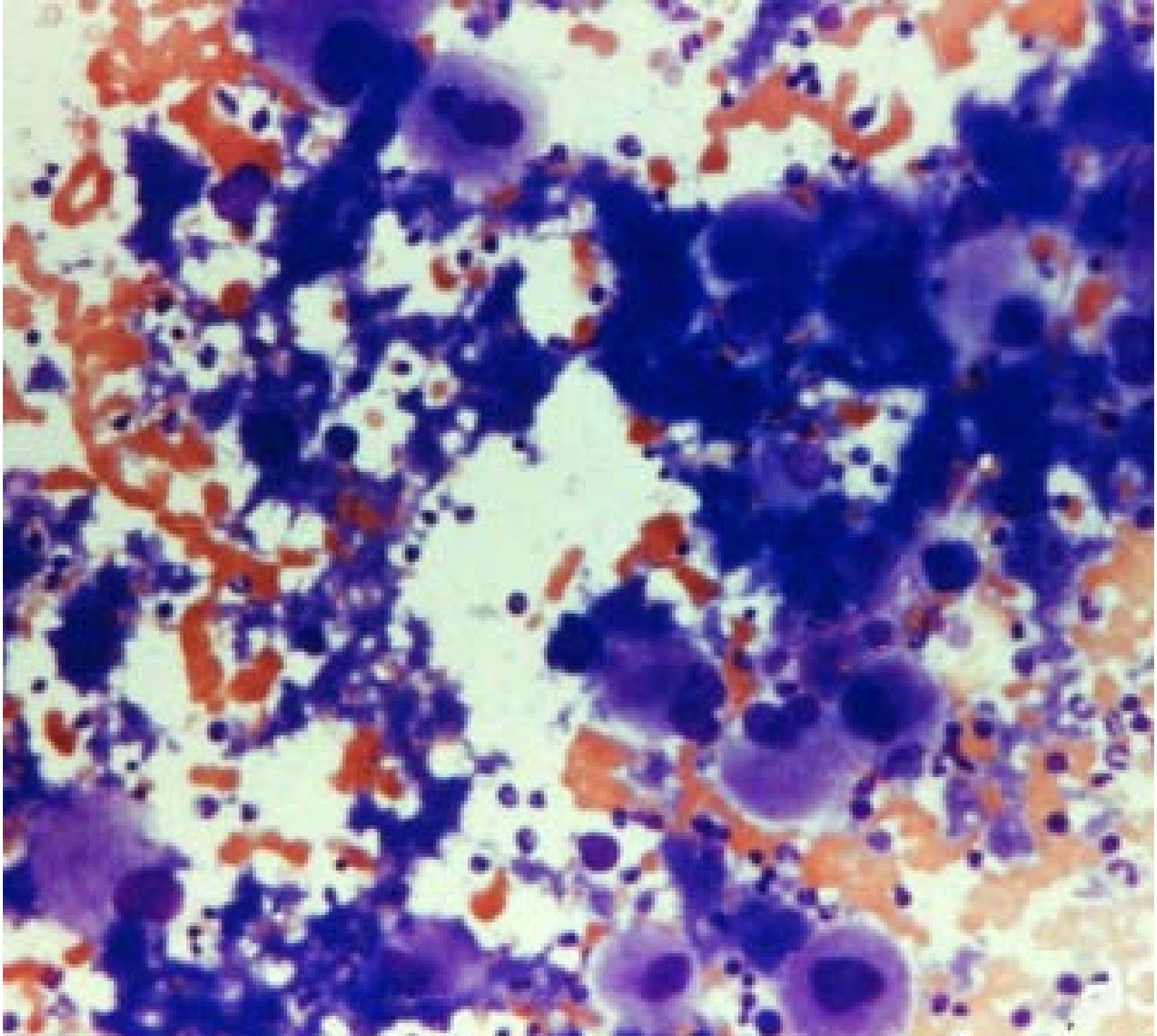






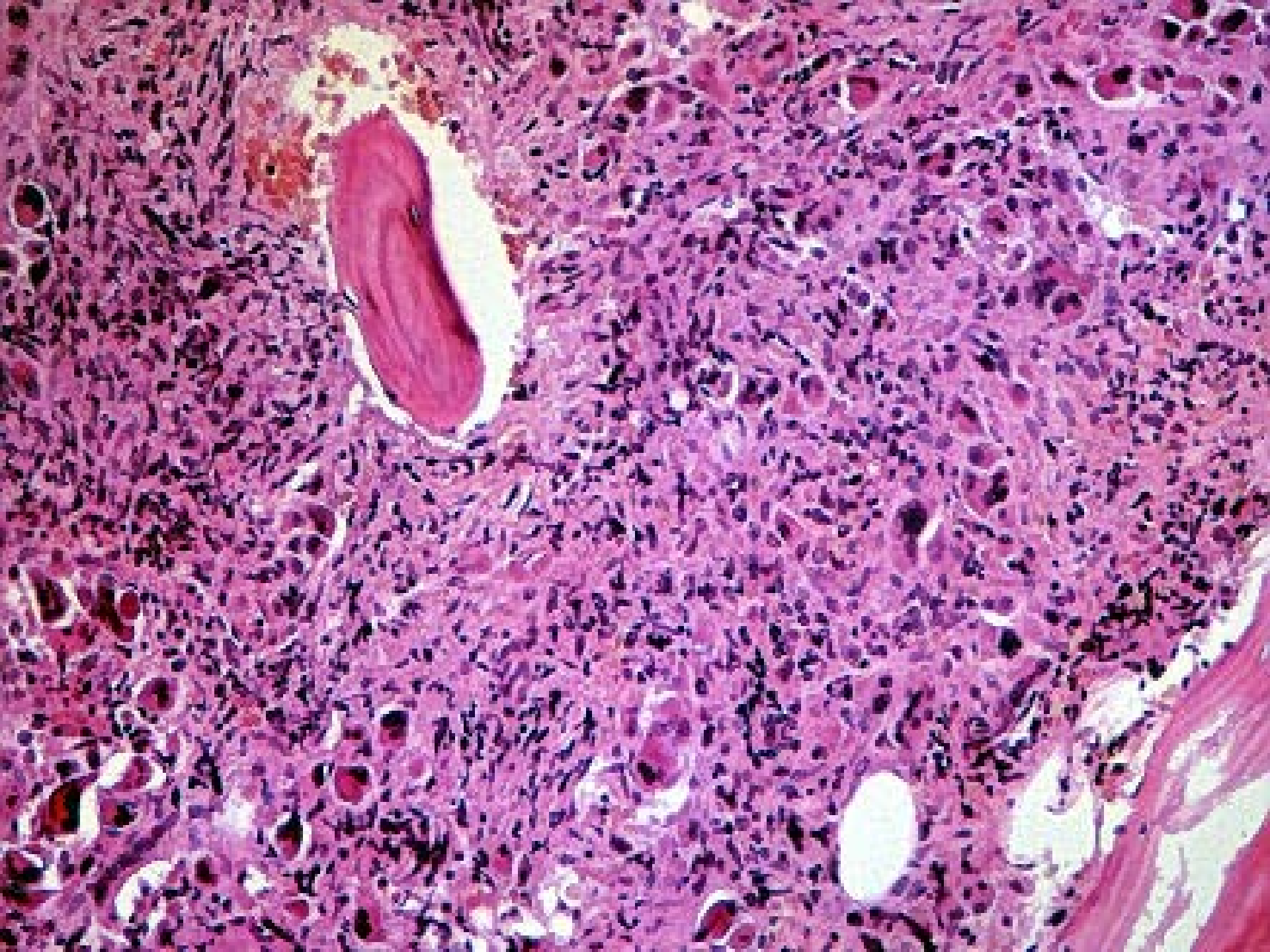
ESSENTIAL THROMOCYTOSIS

- Platelet count often near 1 million/mm3
- Often a diagnosis of exclusion.
- The RAREST of all myeloproliferative disorders
- Giant platelets usually. Why? Ans: Quicker release from marrow (RPW/RDW)
- Massively increased megakaryocytes in the marrow



PRIMARY MYELOFIBROSIS

- Rapid progressive marrow fibrosis
- Oldest age group of all the MPD's, >60
- Can follow other MPD's. Why?
- Usually the most extensive extramedullary hematopoesis because the marrow is NOT the primary site of hematopoesis
- LEUKOERYTHROBLASTOSIS
- Like CML, 10-20% can progress to AML



WBC/LYMPHOID DISORDERS

- Review of Normal WBC Structure/Function
- Benign Neutrophil and Lymphoid Disorders
- **Leukemias**
- Lymph Nodes
- Spleen/Thymus
- REVIEW

LEUKEMIAS

- MALIGNANT PROLIFERATIONS of WHITE BLOOD CALLS
- In the case of neutrophilic precursors, the primary process is marrow and peripheral blood, but can involve any organ or tissue which receives blood
- In the case of lymphocytes, there is an intimate concurrence with malignant lymphomas

Leukemias vs. Lymphomas

- All leukemias of lymphocytes have lymphoma counterparts
- Primary lymphomas can have “leukemic” phases, including multiple myelomas
- Any myeloid leukemia can infiltrate a lymph node, or any other site, but if/when it does it is NOT called a lymphoma, but simply a myeloid infiltrate INTO a lymph node
- ALL lymphomas are malignant proliferations of lymphocytes
- ALL leukemias involve bone marrow changes

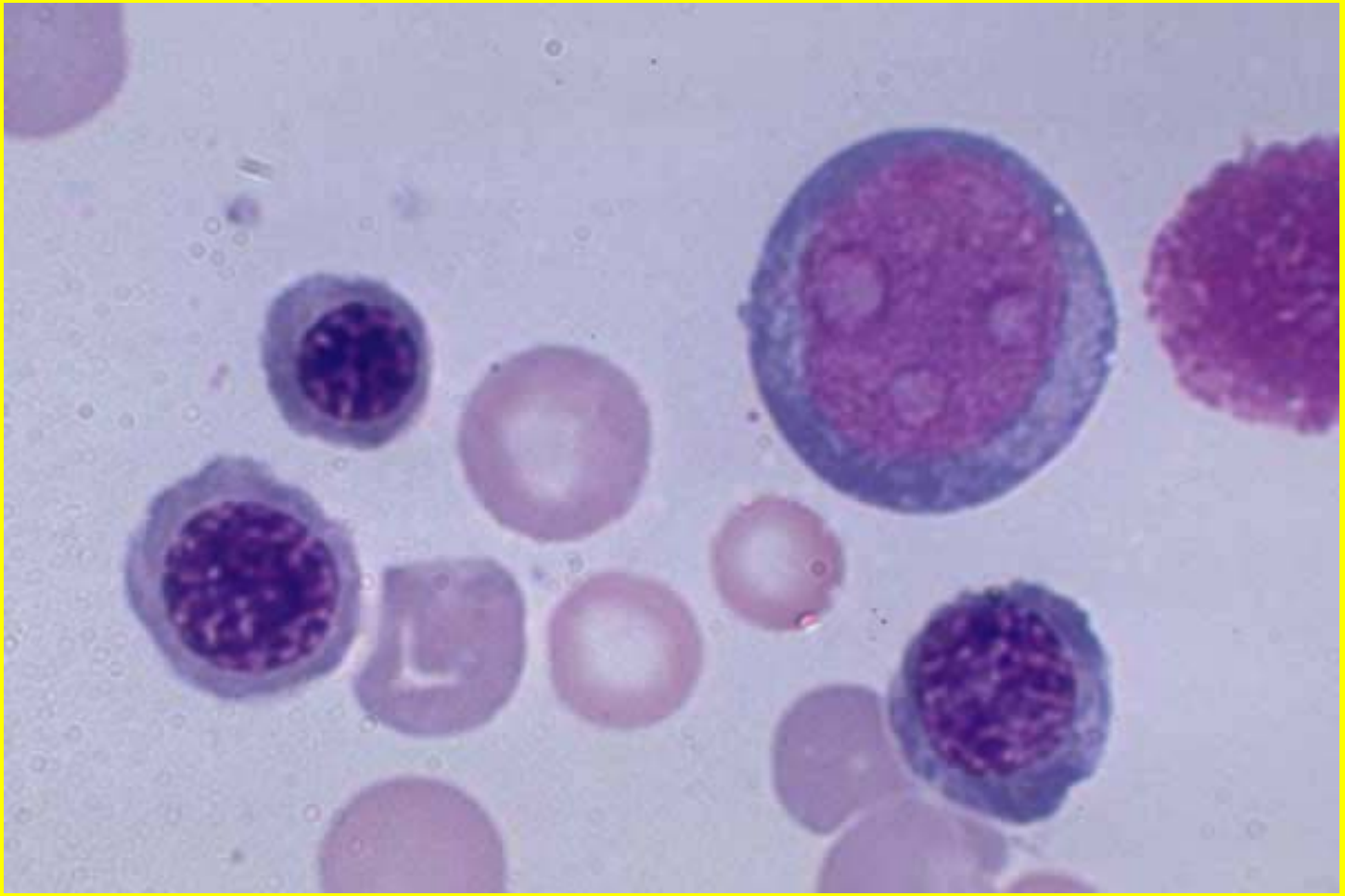
LYMPHOMAS

- NODAL or EXTRANODAL
- T or B
- SMALL or LARGE CELLS
- FOLLICULAR or DIFFUSE
- Hodgkins or NON-Hodgkins
- "F.A.B. classification" is currently popular this week (**F**rench**A**merica**B**ritish), for the NON-Hodgkins lymphomas

LEUKEMIAS

- Acute or Chronic
- Myeloid or Lymphocytic
- Childhood or Adult
- All involve marrow
- All ACUTE leukemias suppress normal hematopoesis, i.e., have anemia, thrombocytopenia
- Most have chromosomal aberrations
- Some can respond DRASTICALLY to chemo, most notably ALL in children, even be cured!!!!

BLAST



WHITE CELL NEOPLASMS Leuk/Lymph

- Many have chromosomal translocations
- Can arise in inherited and/or genetic diseases:
  - Downs Syndrome (Trisomy 21)
  - Fanconi's anemia (hereditary aplastic anemia)
  - Ataxia telangiectasia
- May have a STRONG viral relationship:
  - HTLV-1 (lymphoid tumors)
  - EBV (Burkitt Lymphoma)
  - Human Herpesvirus-8 (B-Cell Lymphomas)

WHITE CELL NEOPLASMS Leuk/Lymph

- Can be caused by H. Pylori (gastric B-Cell lymphomas)
- Can follow celiac disease (gluten sensitive enteropathy→ T-Cell lymphomas)
- Are common in HIV, T-Cell lymphomas, CNS lymphomas

A.L.L./LYMPHOMAS*

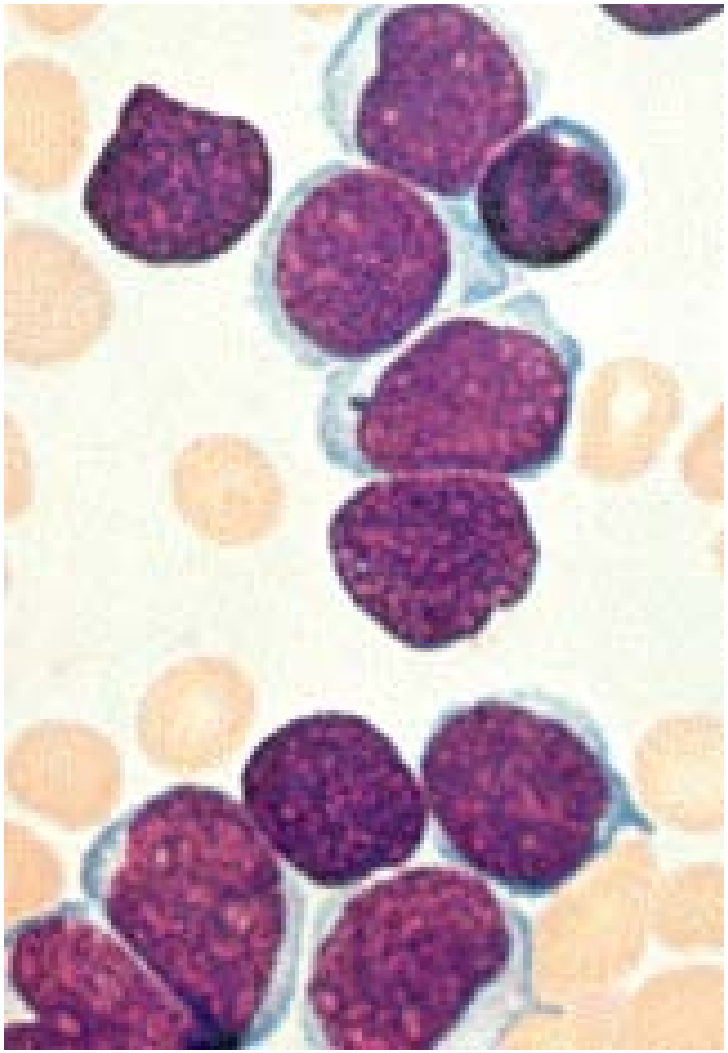
- SUDDEN ONSET
- ANEMIA, BLEEDING, FEVER
- Bone pain, adenopathy, hepatosplenomegaly
- CNS: headaches, vomiting, nerve palsies

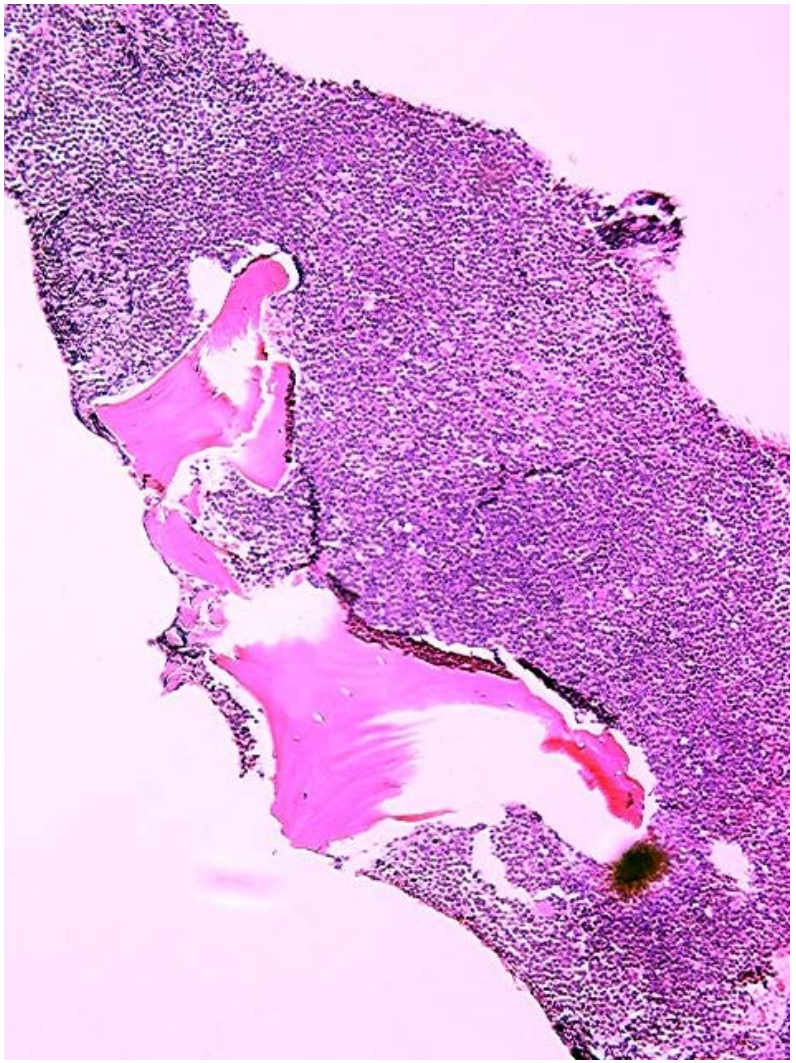
- (* NB: These are pretty much the symptoms of A.M.L. too and vice versa)

A.L.L./LYMPHOMAS

- "Lymphoblasts" which can give rise either to T or B cells are the cells of malignant proliferation
- All lymphocytic leukemias CANNOT be classified independently of lymphomas because they all have lymphoma counterparts
- A.L.L. mostly in children
- Most have chromosomal changes, hyperploidy, Philadelphia chromosome, translocations
- SIGNIFICANT response to chemo: 90% remission, 75% CURE!!!

A.L.L.

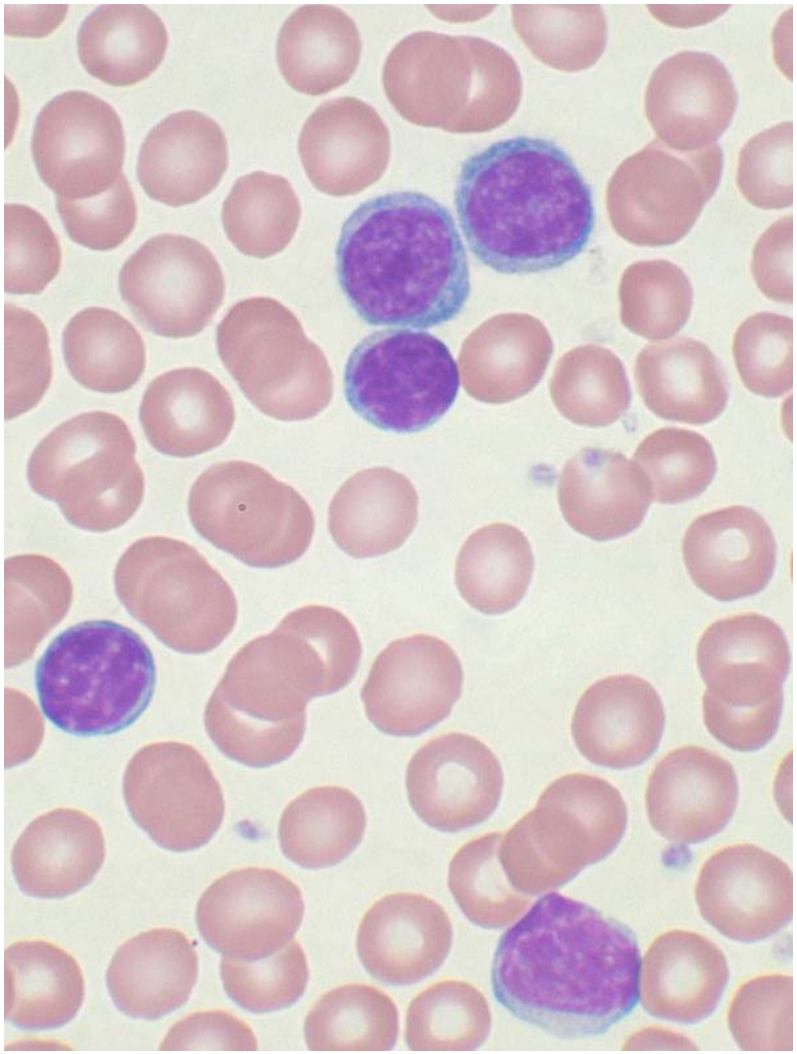


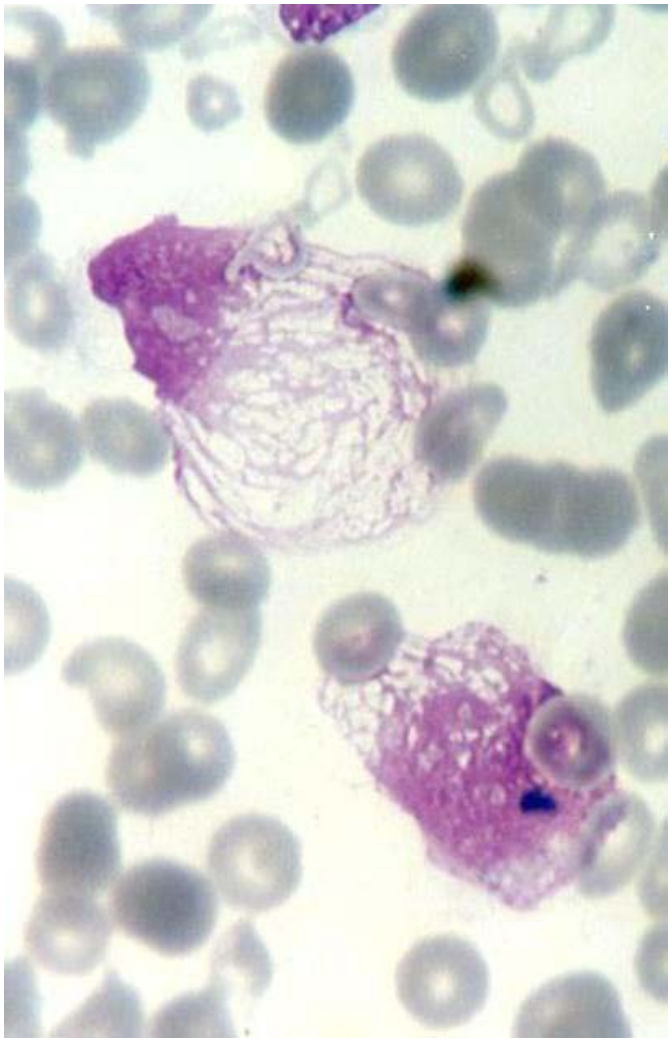


C.L.L.

- Unexplained sustained (months) lymph count of > 4000/mm3 is CLL, usually picked up on CBC
- M>F
- Lymphs look normal and are **NOT** blasts
- No need for marrow exam for dx, but progressive involvement of marrow, nodes, and other organs is the usual biologic behavior
- Liver can be involved portally or sinusoidally
- Translocations RARE, but trisomies and deletions common

C.L.L.





C.L.L.

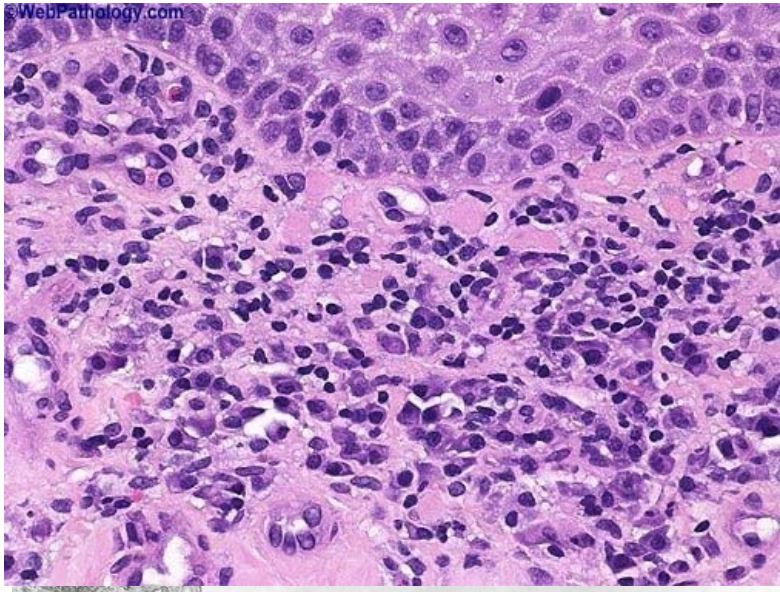
- HYPO-gammaglobulinemia
- 15% have antibodies against RBC's or PLATS
- CANNOT be classified as separate from lymphomas

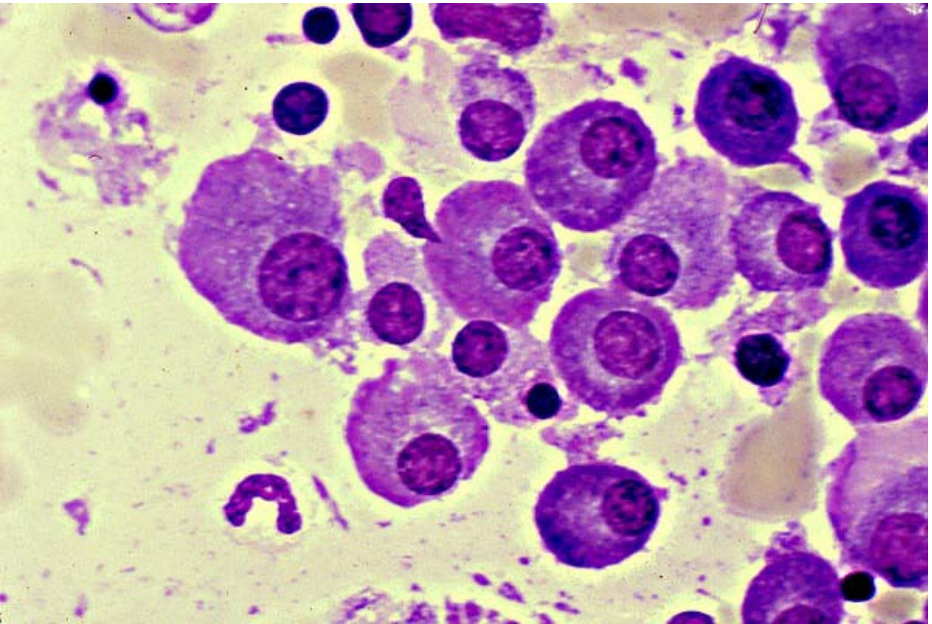
MULTIPLE MYELOMA

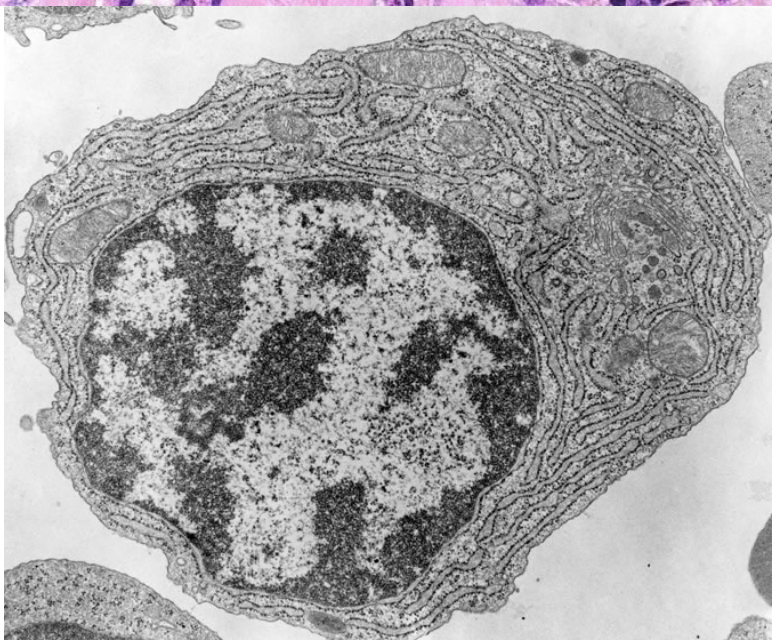
- DEFINED AS A MALIGNANT PROLIFERATION OF PLASMA CELLS
- Can have a “leukemic” phase, but the BONE MARROW is the usual primary site of origin
- Usually have MONOCLONAL GAMMOPATHIES
- Secrete Heavy and Light chains, and Light chains in the urine is known as Bence-Jones protein
- Usually have elevated IL-6 (bad prognosis)

PLASMA CELL classic features

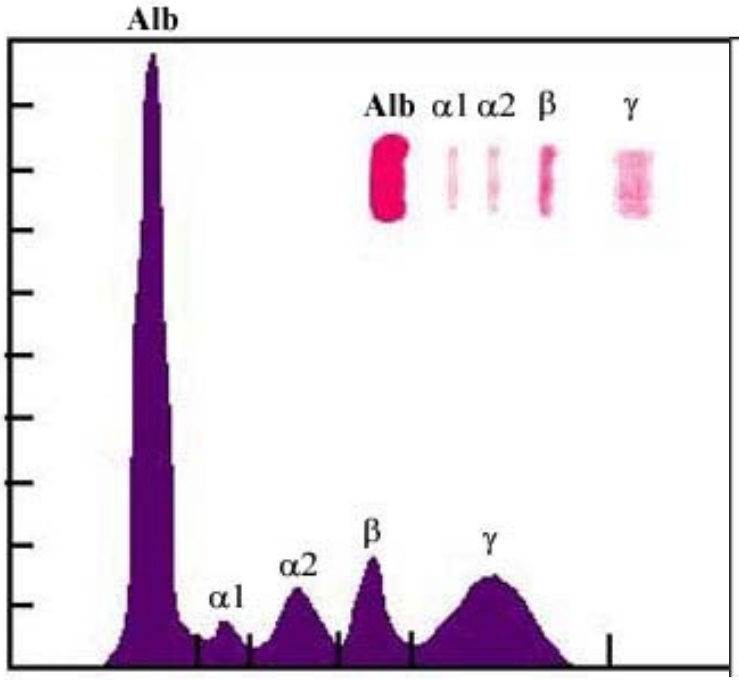
- OVAL cytoplasm, ROUND nucleus off to side
- Cartwheel/Clockface chromatin
- Prominent Golgi or “Hoff”

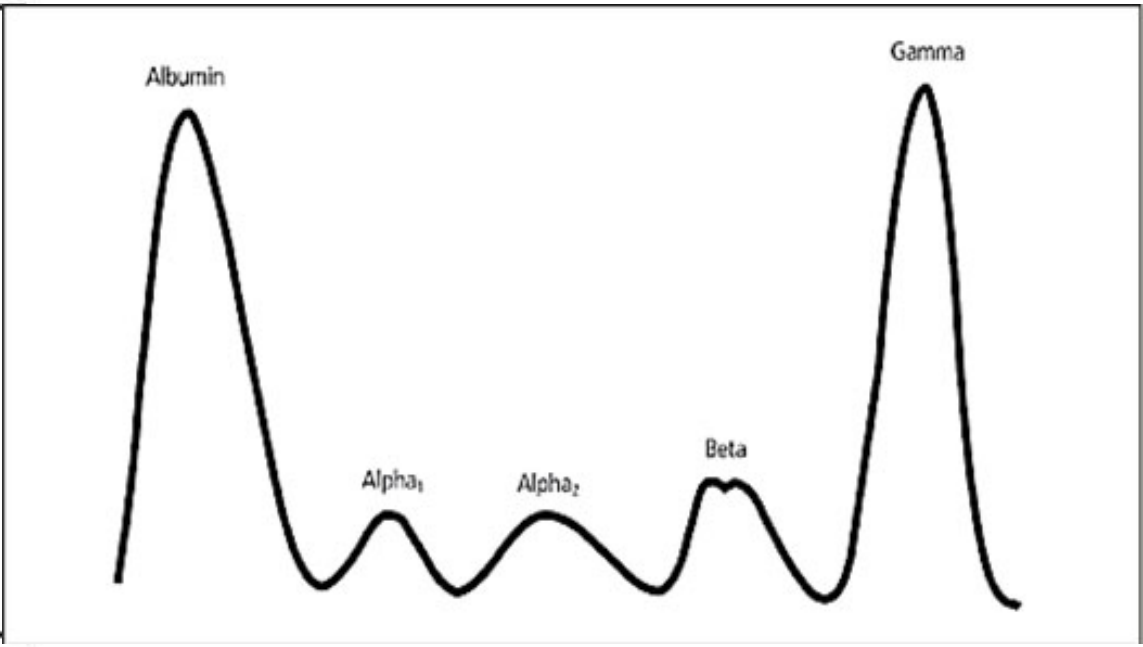






MONOCLONAL “SPIKE” on SPE

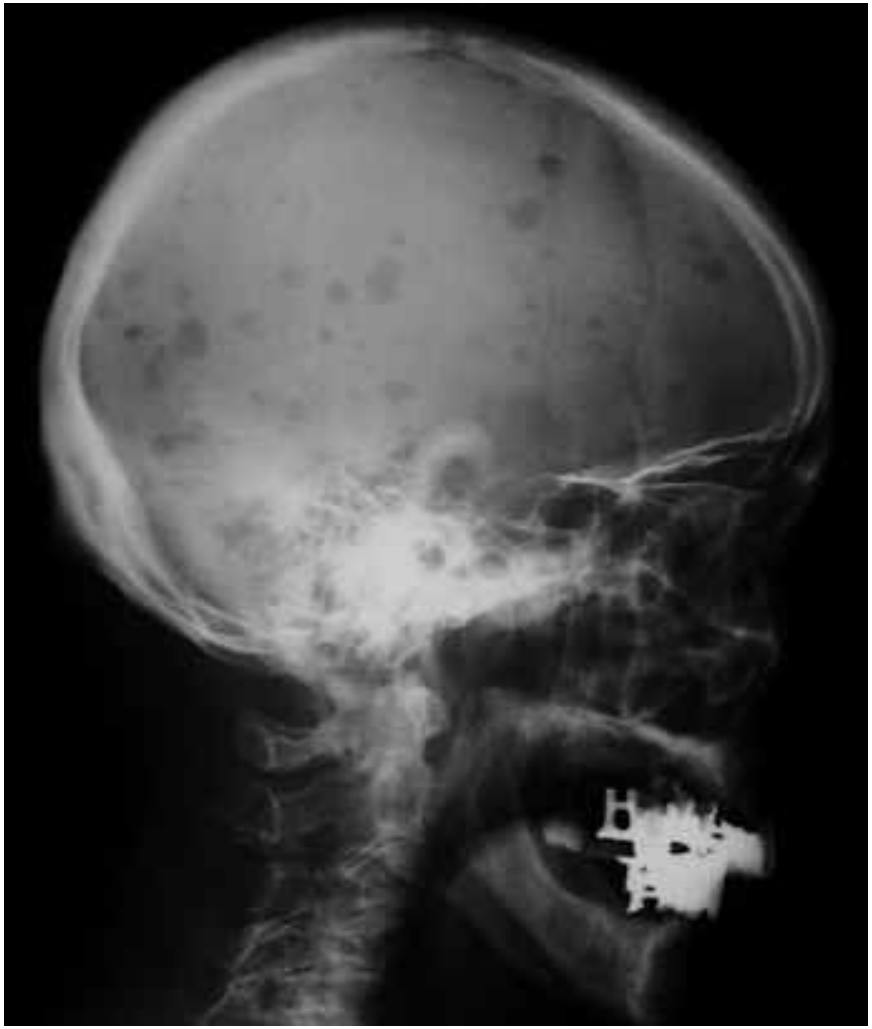




MULTIPLE MYELOMA

- BONE DESTRUCTION
- Various deletions and translocations
- Plasma cells usually 1-3% of marrow, but >20% or plasma cells in SHEETS is diagnostic
- Plasma cells usually look normal
- IgG >> IgA, other immunoglobulins are rare
- Staph, Strep, E. coli infections
- Bleeding
- Amyloidosis
- RENAL FAILURE

Multiple Myeloma: Skull X-ray



“Solitary” Plasmacytoma

- Progression to MM is “inevitable”, with time, perhaps 10-20 years even

M.G.U.S.

- **M**onoclonal **G**ammopathy of **U**nknown **S**ignificance, i.e., no plasma cell proliferation is found
- Age related
- 1% of 50-year olds, 3% of 70-year olds, etc.
- Same chromosomal aberrations as MM, but generally follow a BENIGN course

Other "GAMMOPATHIES"

- **Waldenstrom's MACROglobulinemia** (associated with lymphomas)
- **Heavy Chain Disease** (associated with lymphomas)
- **AMYLOID**, follows MM and/or chronic granulomatous diseases

A.M.L.

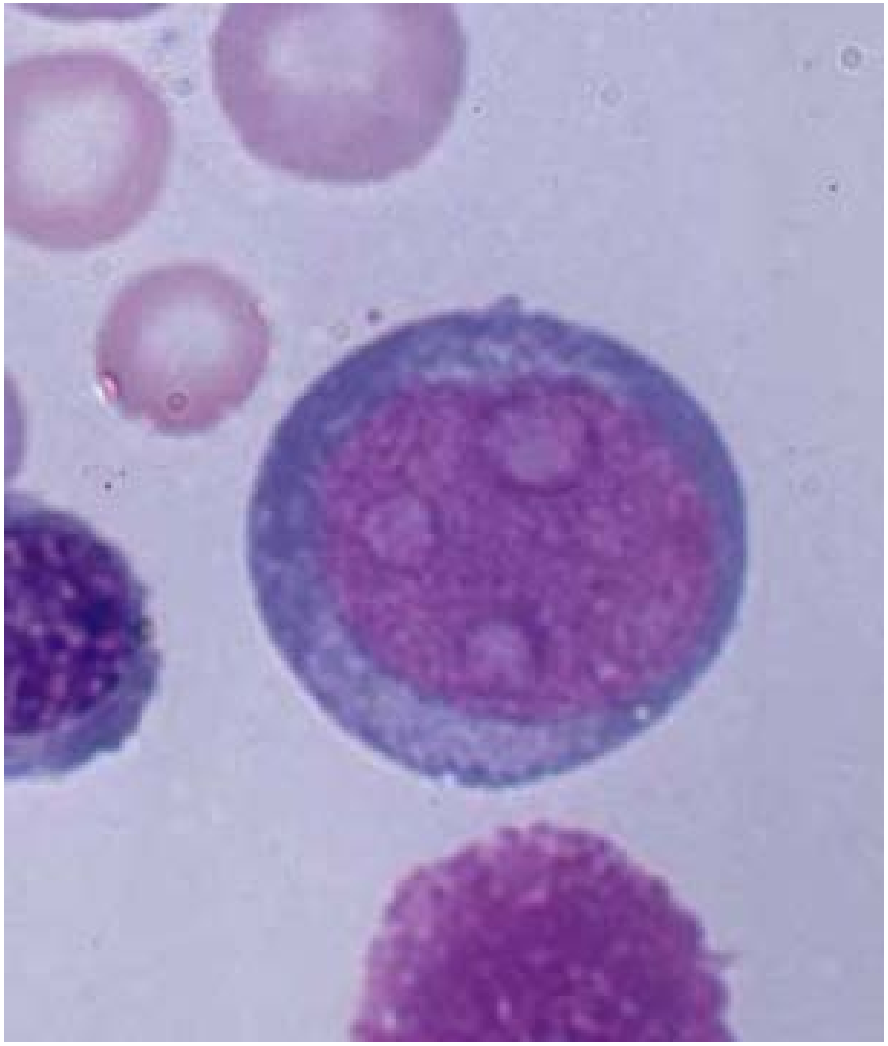
- GENETIC ABERRATIONS INHIBIT DIFFERENTIATION
- Many have various TRANSLOCATIONS
- F.A.B. classifies them as M0→ M7
- MORE than 20% of BLASTS are needed in the marrow for a diagnosis of acute leukemia!!! (i.e., ANY kind of BLAST
- NORMALLY, a marrow should have only about 1-2 % blasts

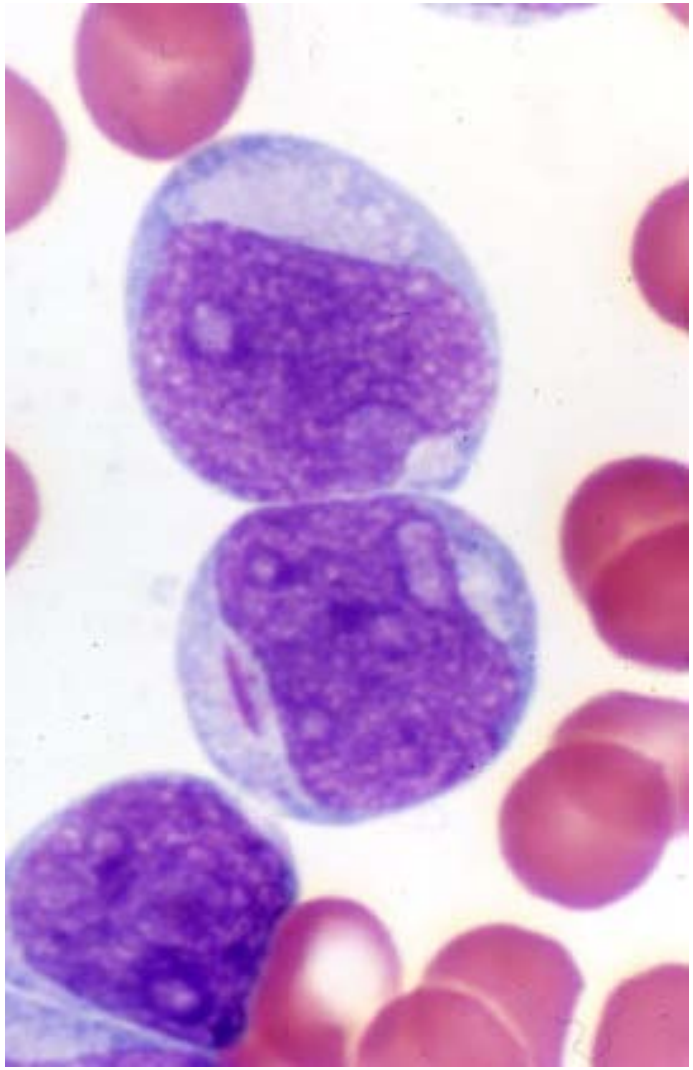
A.M.L.

- M0 Minimally differentiated
- M1 AUER rods rare (COMMON)
- M2 AUER rods common (COMMON)
- M3 Acute PRO-myelocytic leukemia
- M4 AMML (myelo-Mono cytic) (COMMON)
- M5 Monocytic
- M6 ErythroLeukemia
- M7 Acute Megakaryocytic leukemia

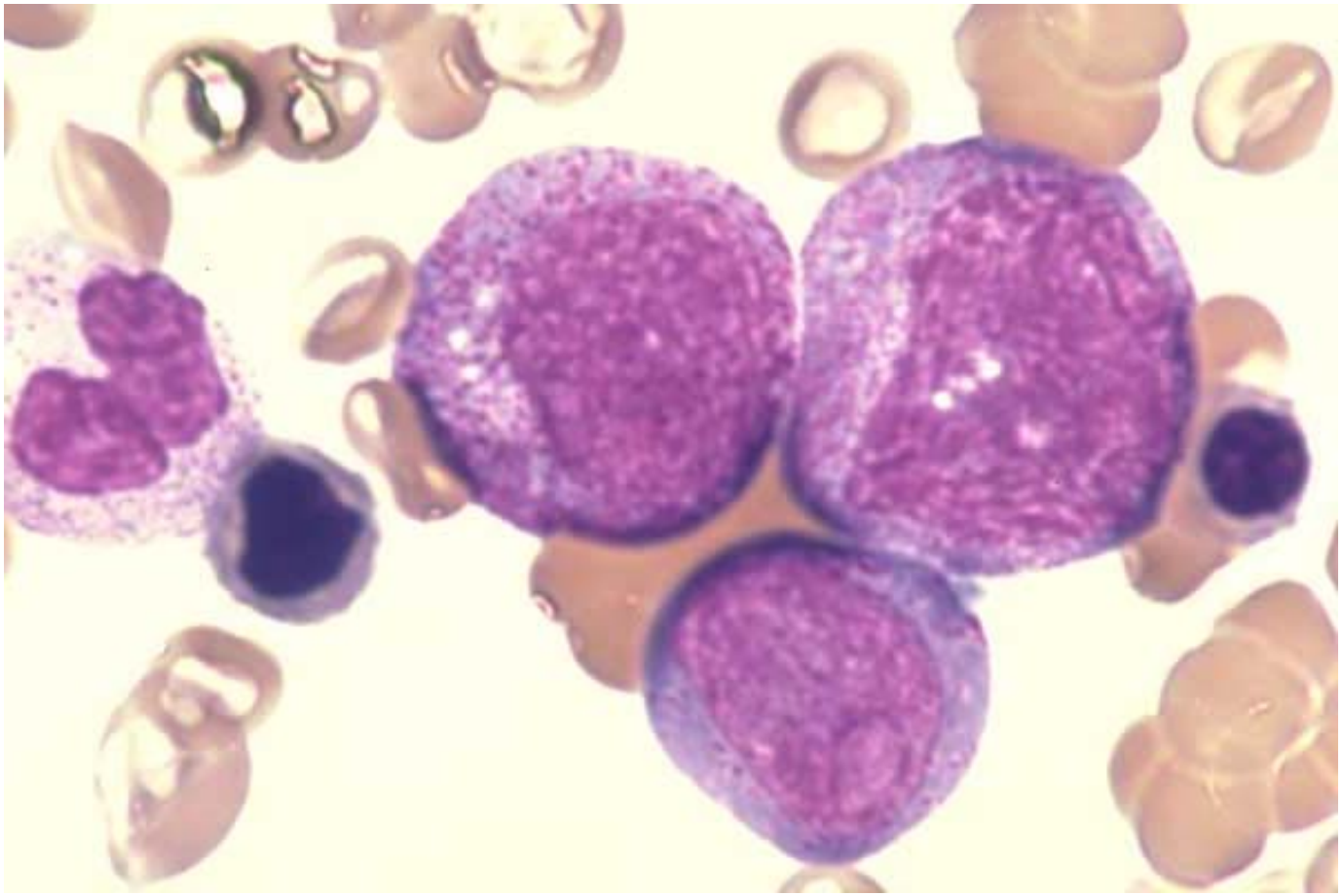
NOTE: Diagnosis is CONFIRMED by special markers, not just visual identification

M0→M2

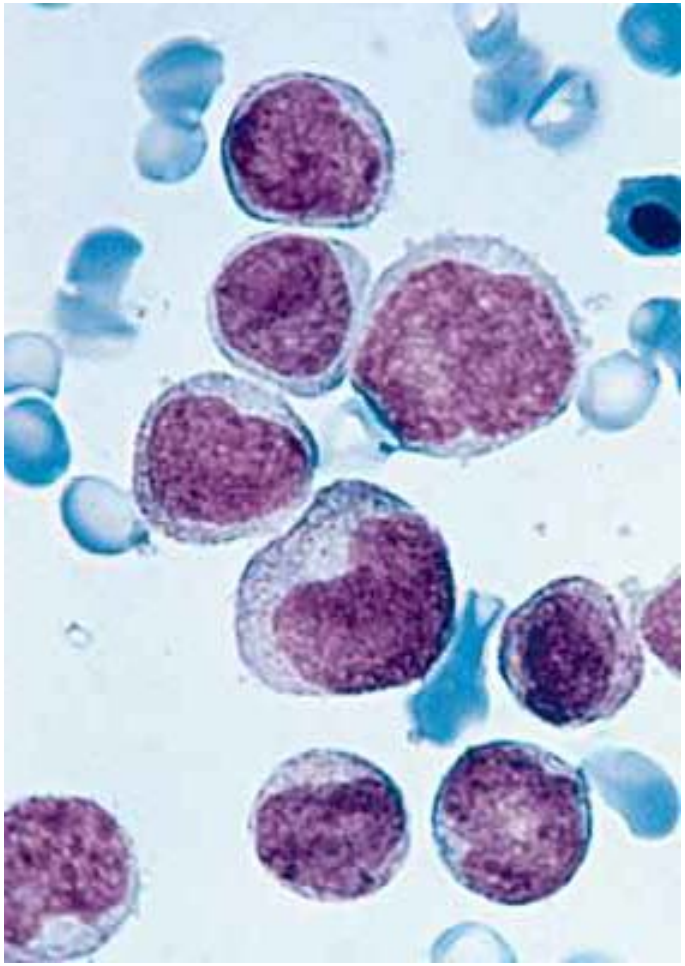




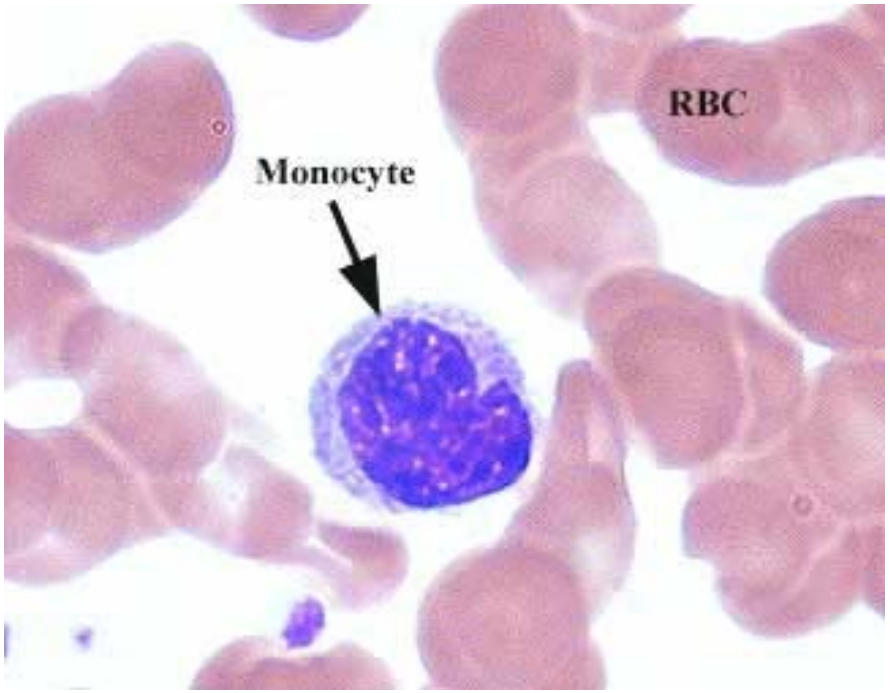
M3



M4-M5

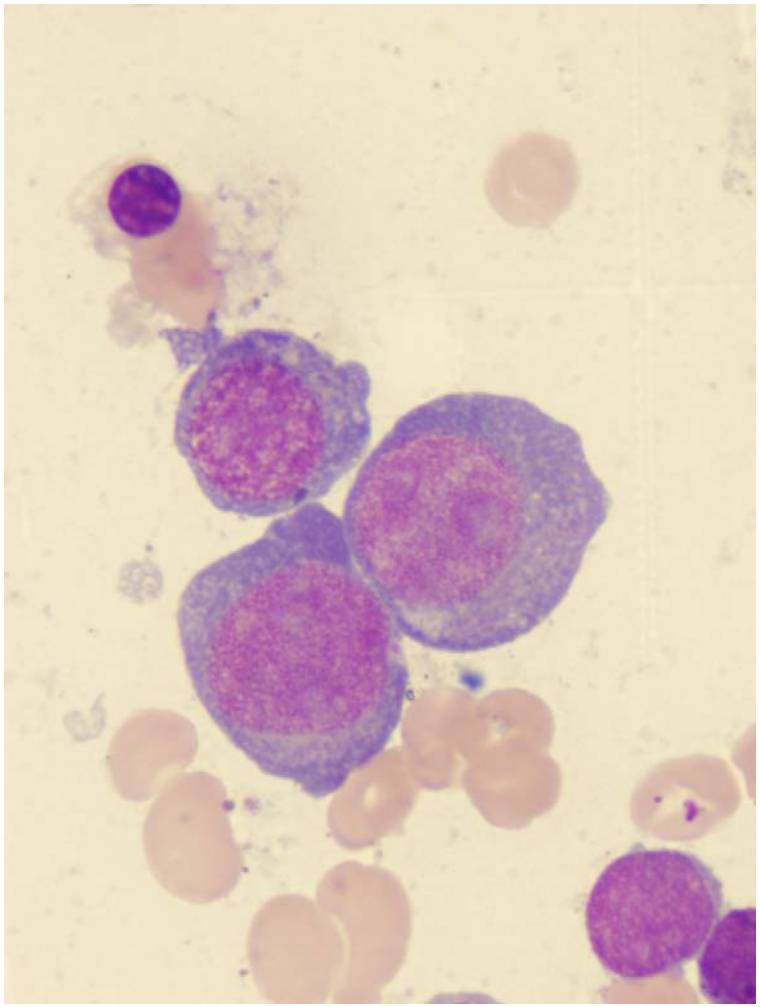


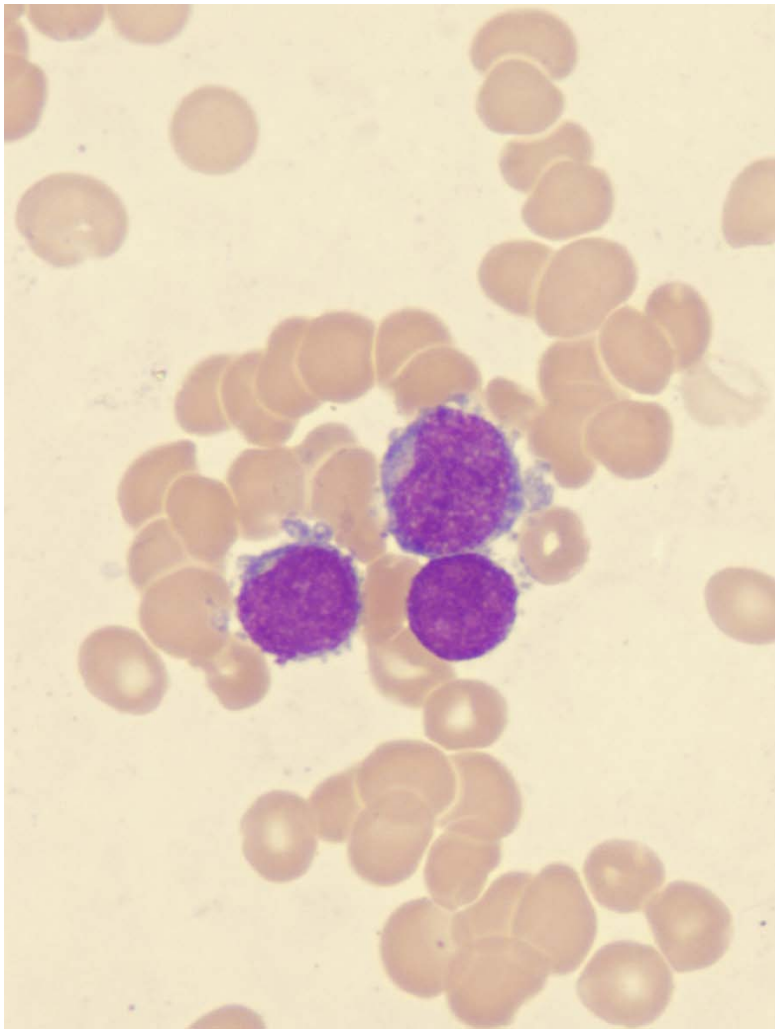
AMML



Normal “classic” monocyte

M6-M7





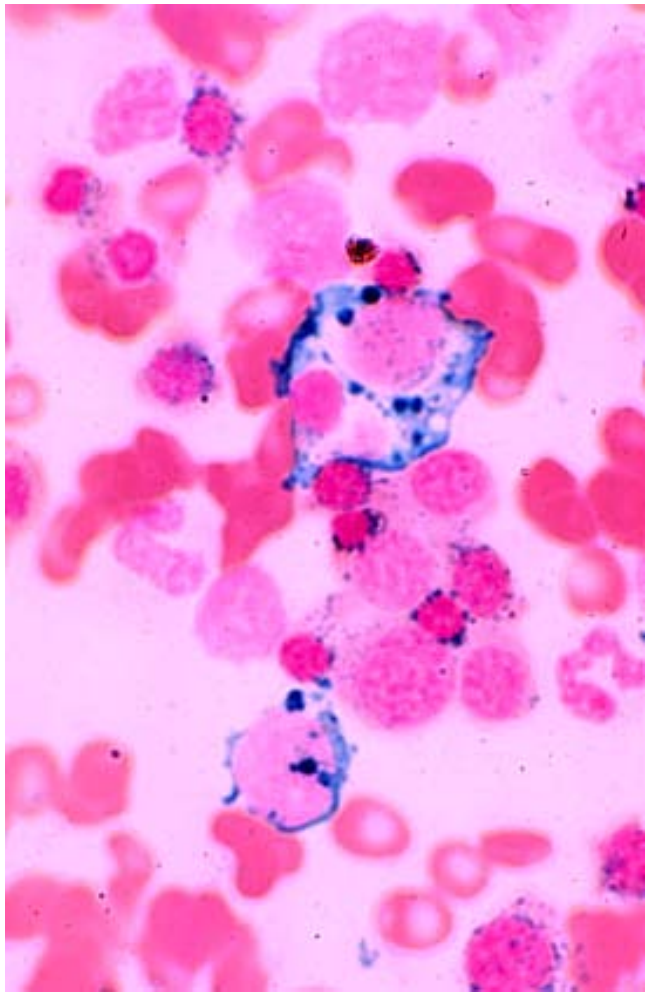
A.M.L.

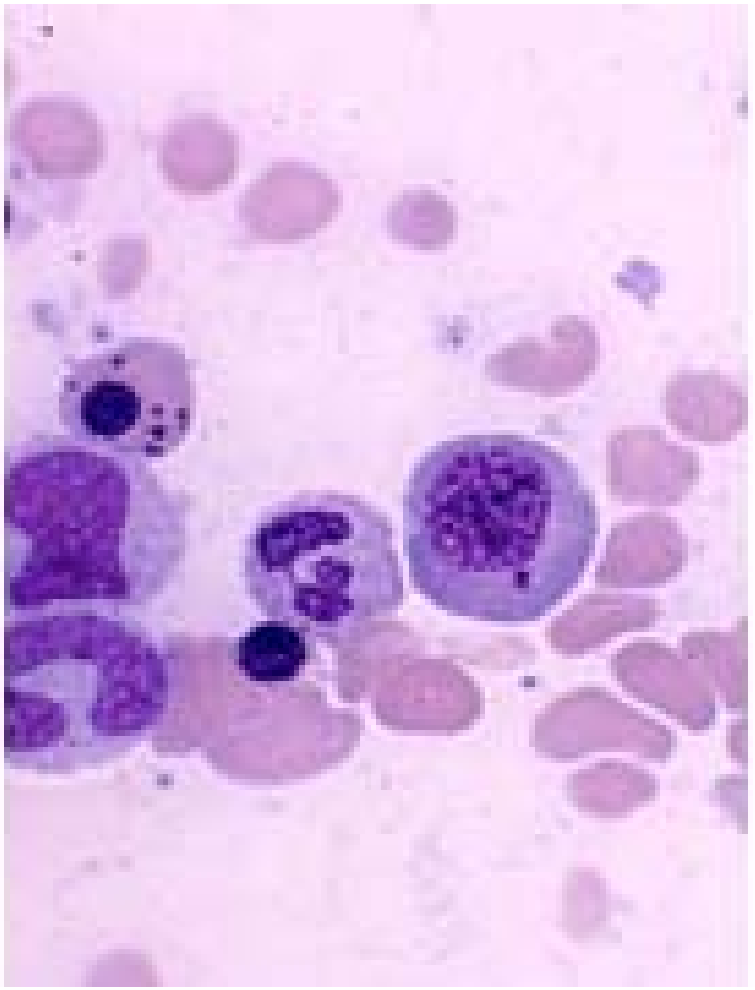
- Anemia
- Thrombocytopenia (bleeding)
  - Petechiae
  - Ecchymoses
- Fever
- Fatigue
- Lymphadenopathy
- 60% respond, BUT only 20 % are free of remission after 5 years, WORSE than A.L.L.

MYELO-DYSPLASTIC SYNDROMES

- Increased risk of acute leukemias
- But, UNLIKE the myeloPROLIFERATIVE syndromes, NOT a hypercellular marrow
- Spontaneous or drug related (even > 5 yrs!)
- Has marrow ABERRATIONS
  - REFRACTORY ANEMIAS
  - RINGED SIDEROBLASTS (Fe in mitochondria)
  - Nuclear "BUDDING"
  - EXCESS BLASTS, but LESS than 20%
  - About, say 25% develop into acute leukemias

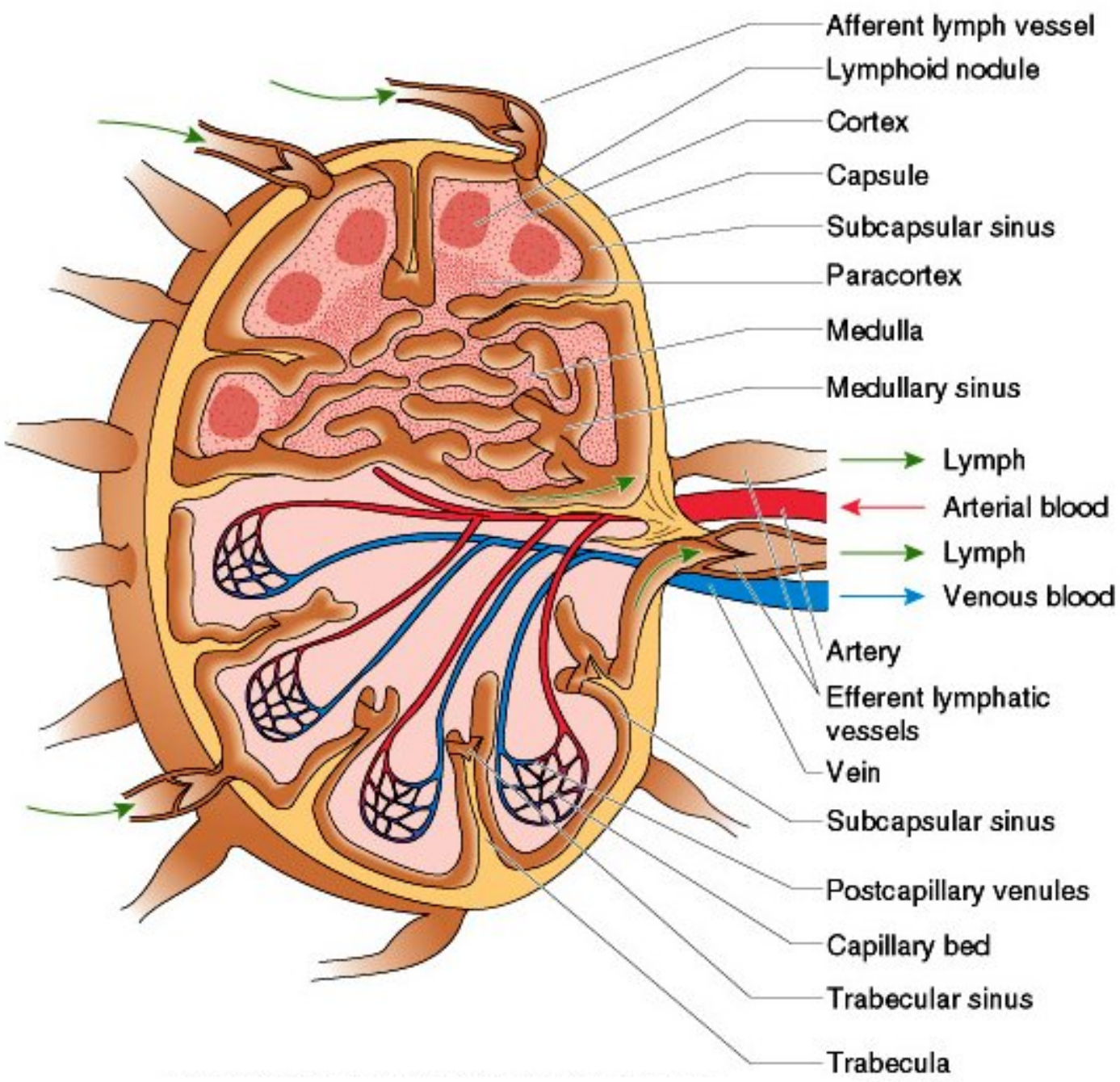
Ring Sideroblasts and “BUDS”

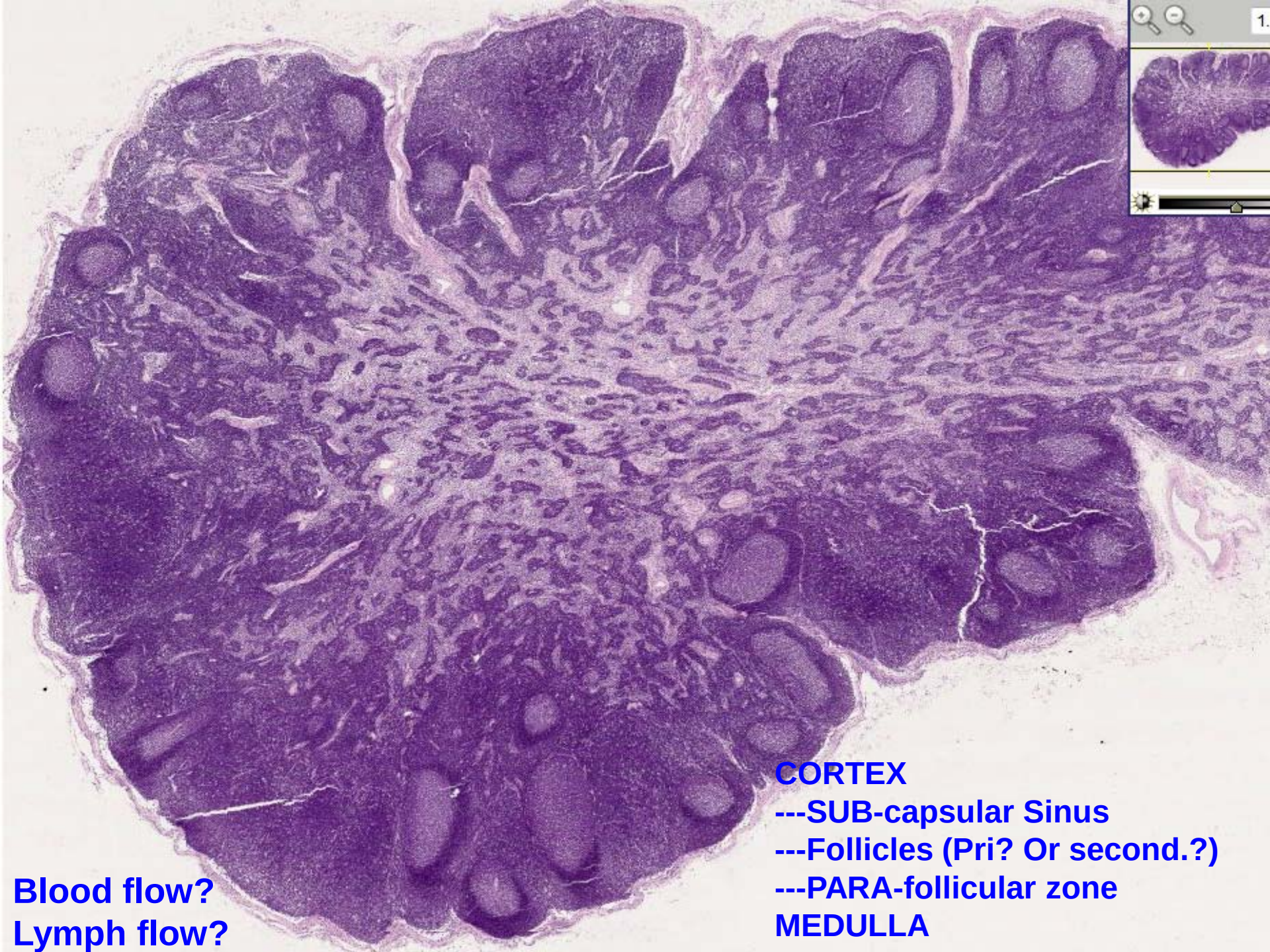




LYMPH NODES

- Normal Structure, Function
- Benign enlargement/Benign disease
  - Acute
  - Chronic (follicular vs. “sinus histiocytosis”)
- Lymphomas/Malignant Lymphomas
  - Adjectives of various classifications
  - Features
  - STAGING
- Metastatic disease TO lymph nodes


Afferent lymph vessel
Lymphoid nodule
Cortex
Capsule
Subcapsular sinus
Paracortex
Medulla
Medullary sinus
Lymph
Arterial blood
Lymph
Venous blood
Artery
Efferent lymphatic vessels
Vein
Subcapsular sinus
Postcapillary venules
Capillary bed
Trabecular sinus
Trabecula

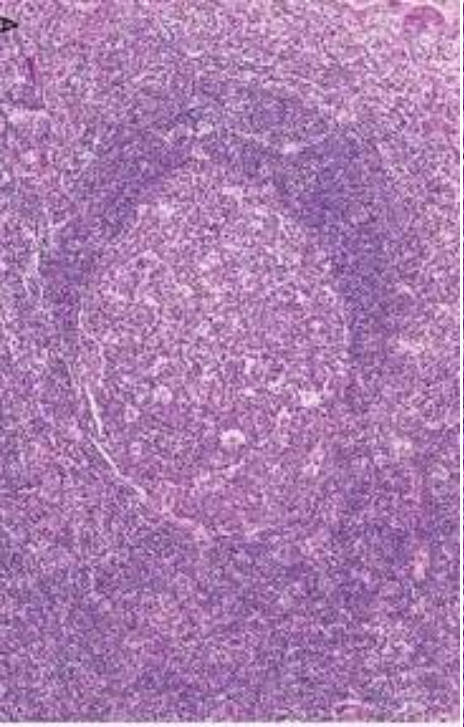

CORTEX
---SUB-capsular Sinus
---Follicles (Pri? Or second.?)
---PARA-follicular zone
MEDULLA
Blood flow?
Lymph flow?

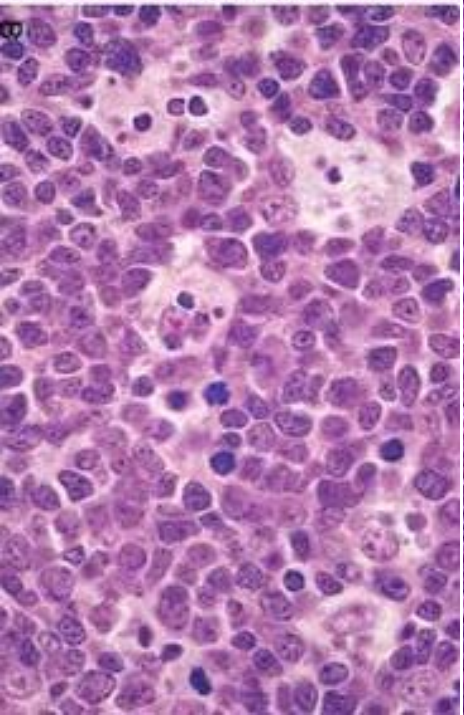
Definition of TERMS

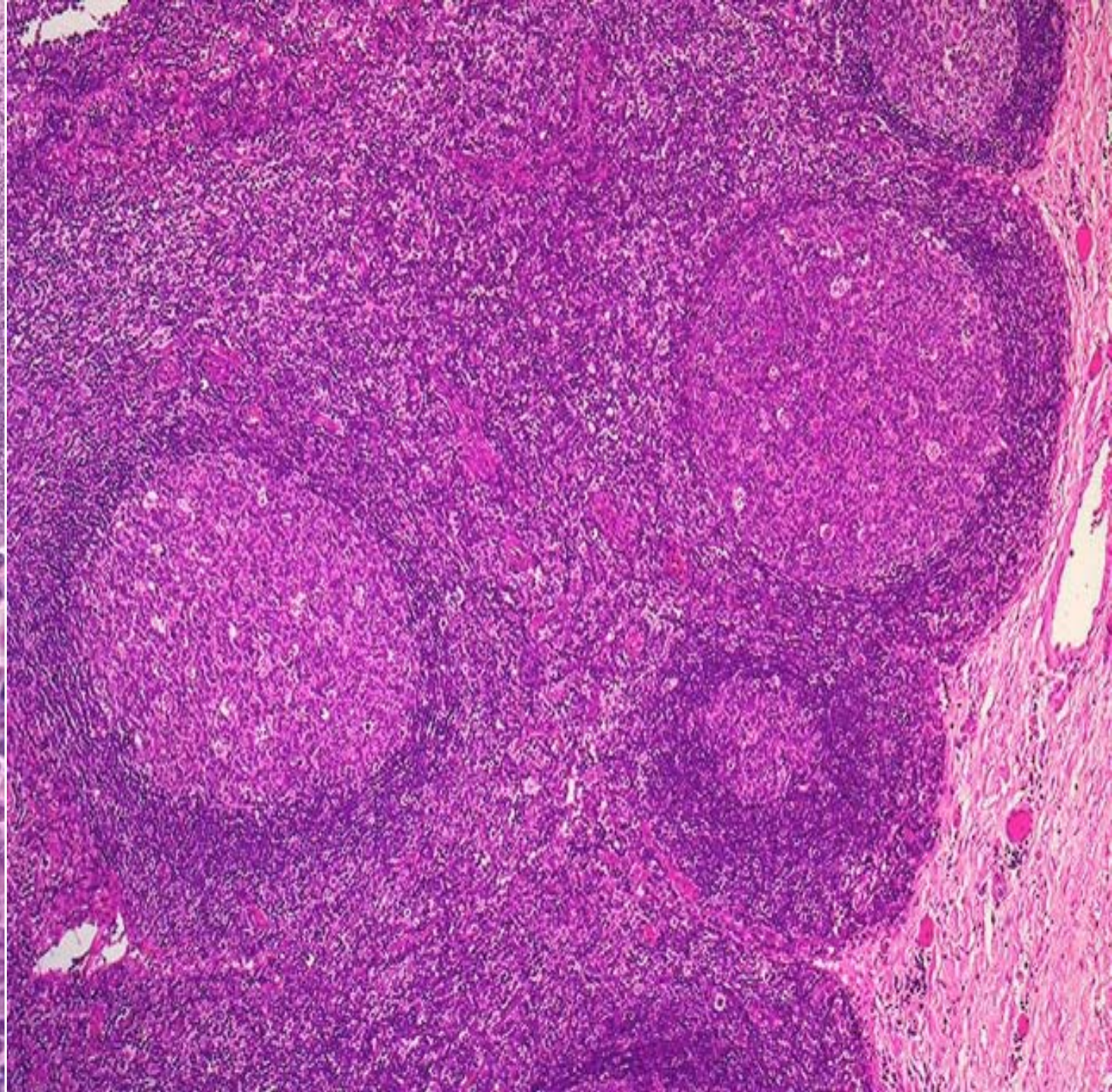
- Lymphadenopathy
- Lymphadenitis
- Dermatopathic
- Normal size?
- Palpation
- What to do if a lymph node is enlarged?
- Diffuse/Follicular
- T/B/NK, Small/Large, Cleaved/Non-cleaved
- Precursor/Peripheral
- HD/Non-HD

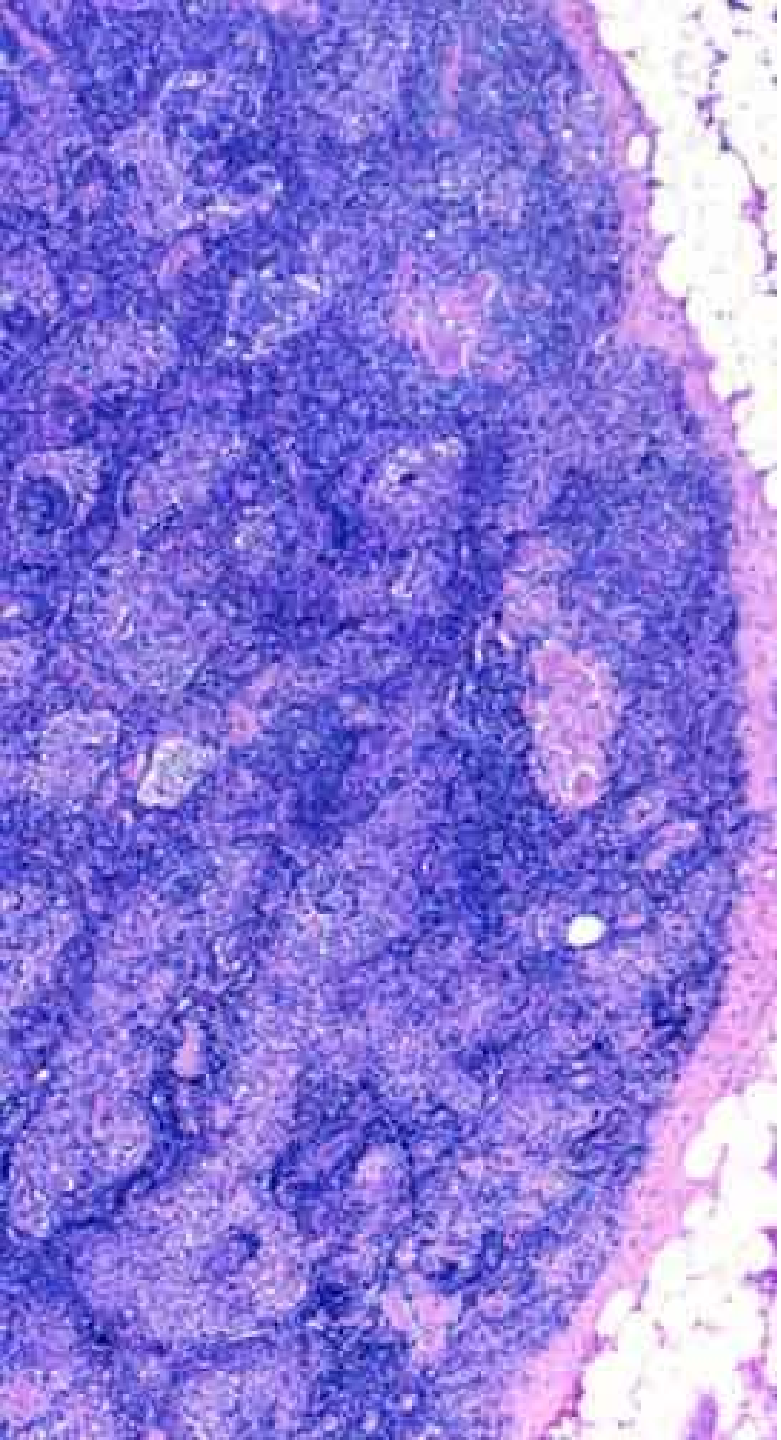
BENIGN ENLARGEMENT

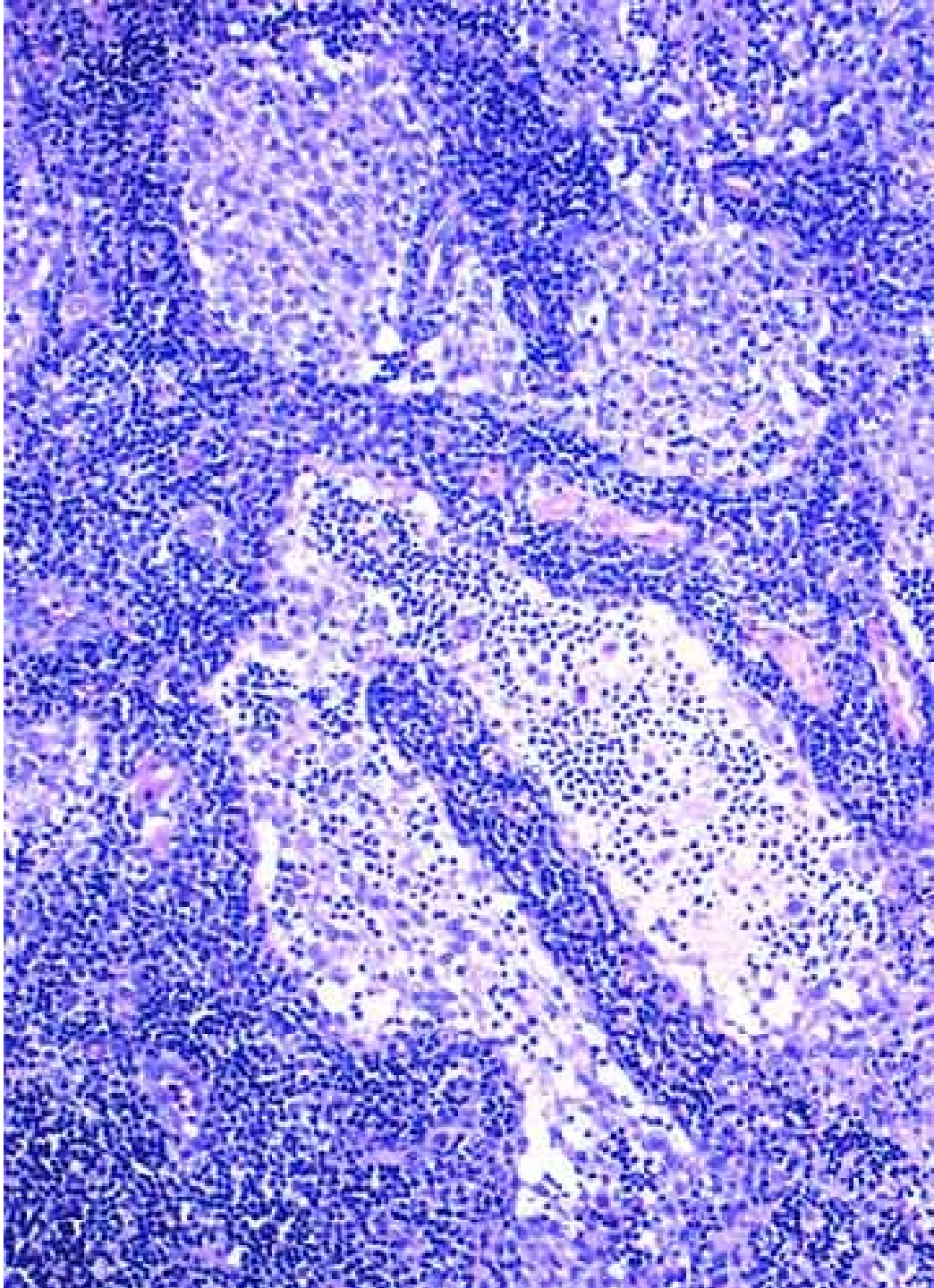
- Also called LYMPHADENITIS, and HYPERPLASIA
- Can be ACUTE (tender), or CHRONIC (non-tender)
- Usually SUBSIDE in, say, less than 6 weeks
- FOLLICULAR HYPERPLASIA is enlargement of the cortical secondary follicles and increase in number of the cortical secondary follicles
- SINUS HISTIOCYTOSIS is prominence in medullary sinuses (also called “reticular” hyperplasia)







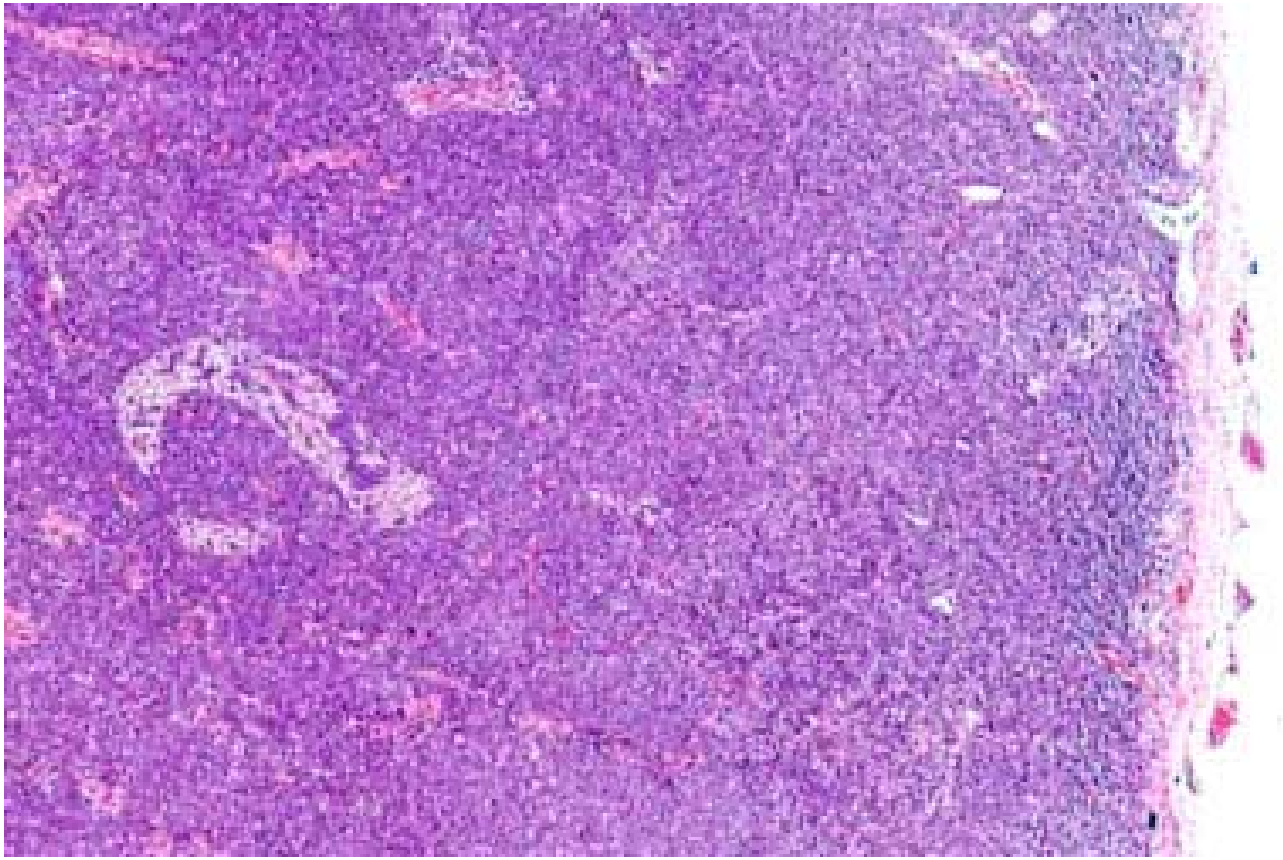




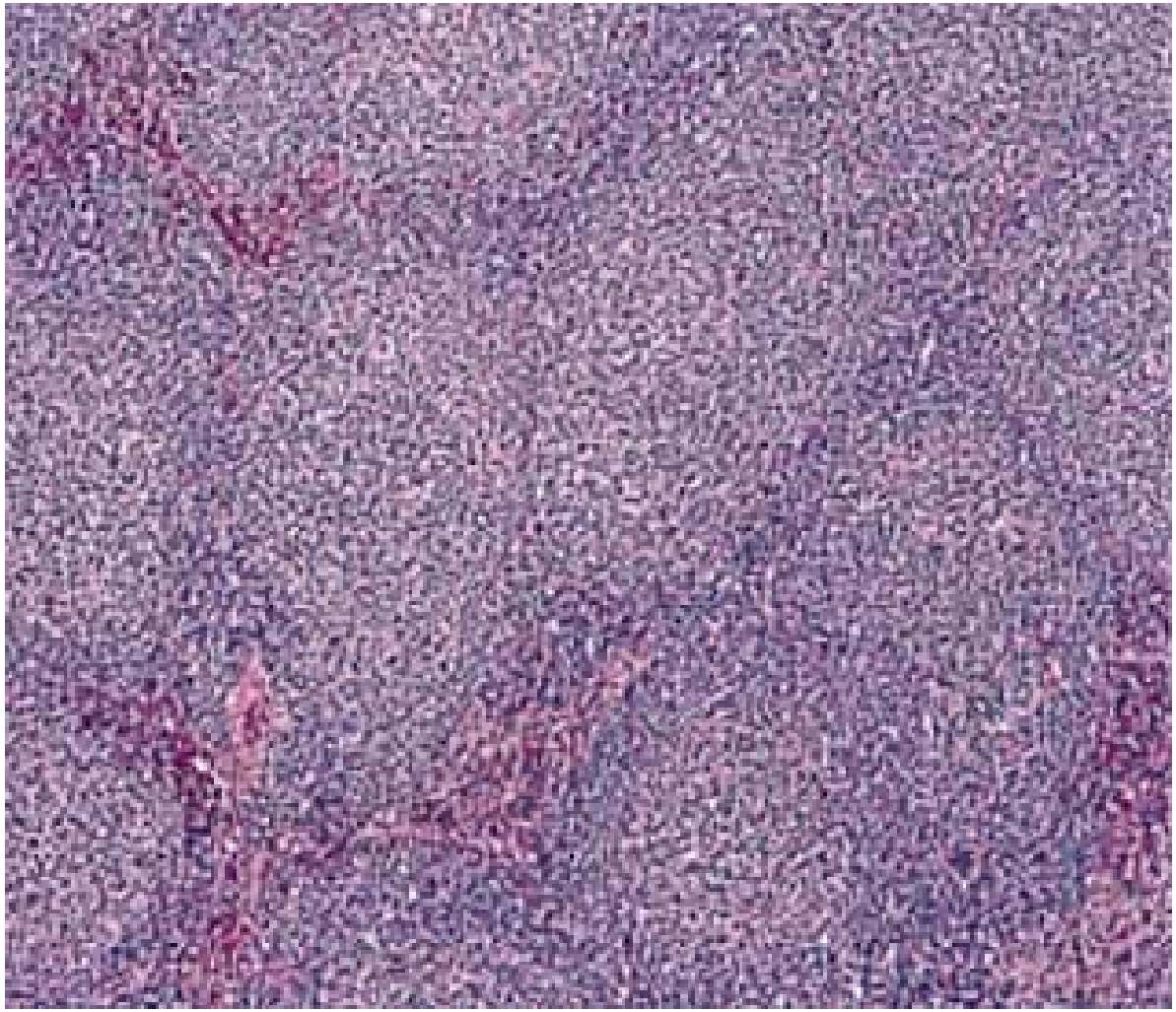
(MALIGNANT) LYMPHOMAS

- **Terms in historic classifications:**
  - **Diffuse/Follicular, Small/Large, Cleaved/Non-cleaved**
  - **Hodgkins (REED-STERNBERG CELL) /NON-Hodgkins**
  - **Lukes, Rappaport, etc.**
  - **Working Formulation, WHO, NIH, FAB, Intl., etc.**
  - **B**
  - **T**
  - **PRECURSOR (less mature looking)**
  - **PERIPHERAL (more mature looking)**

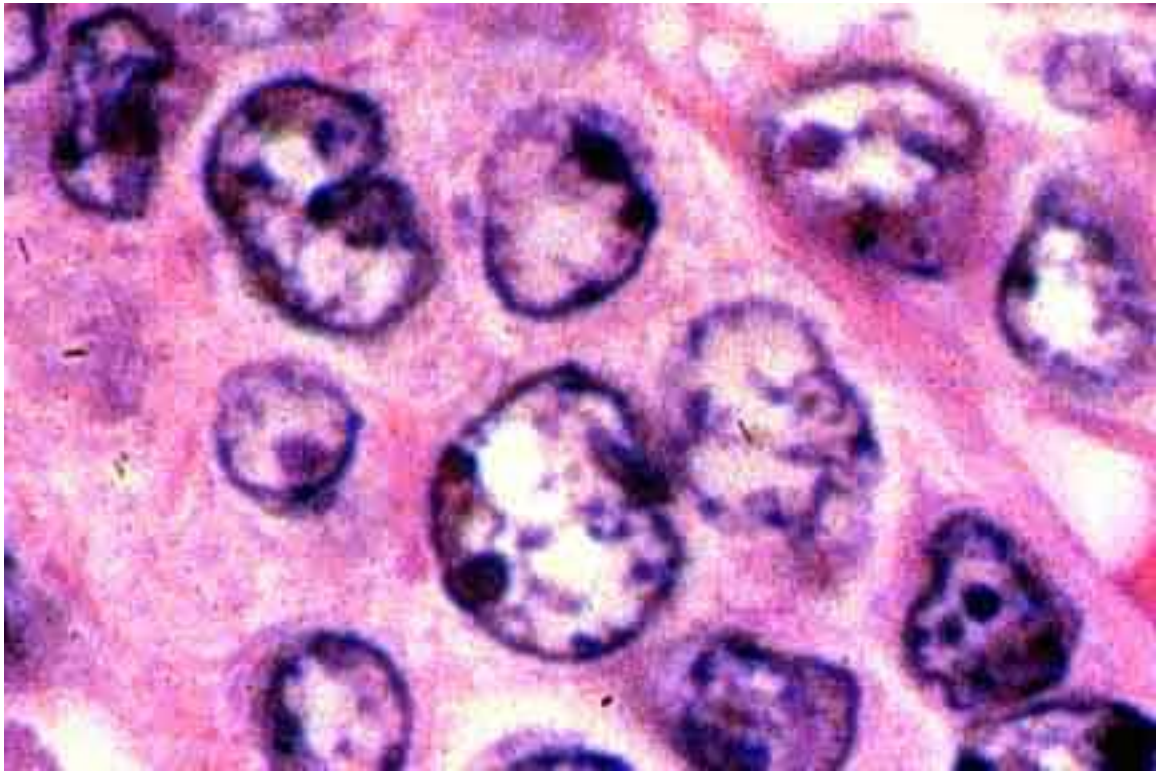
DIFFUSE LYMPHOMA



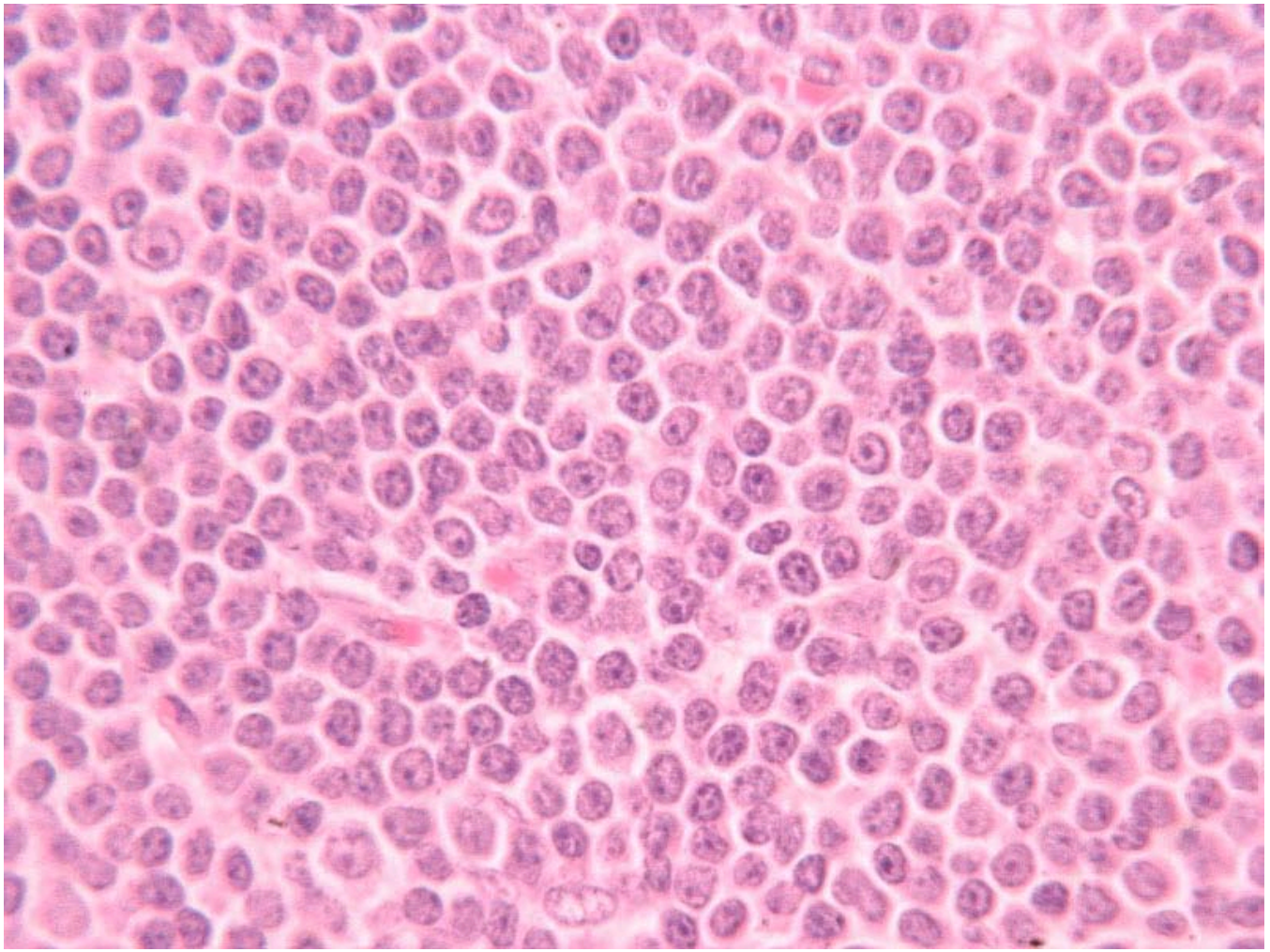
FOLLICULAR LYMPHOMA



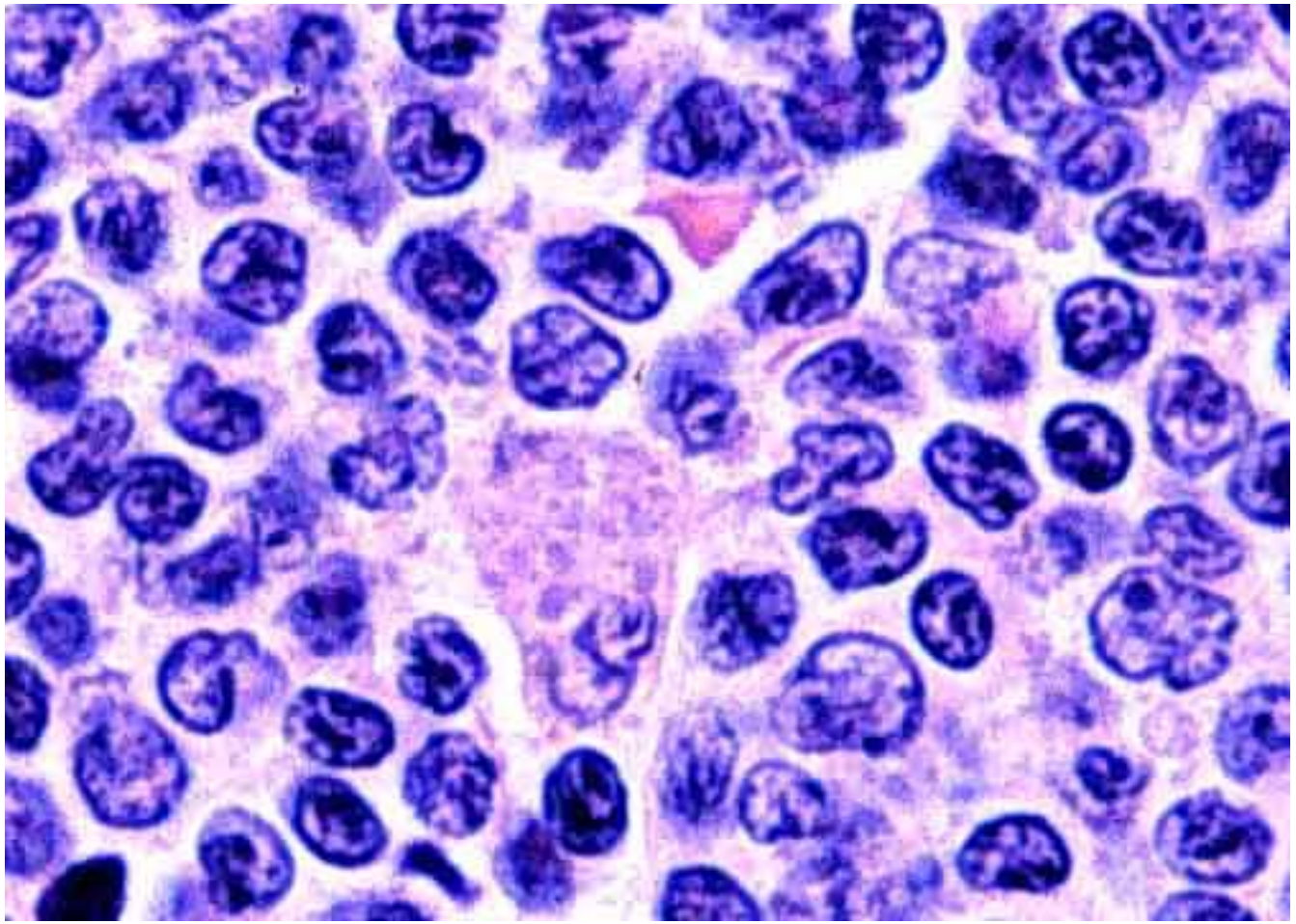
LARGE CELL LYMPHOMA



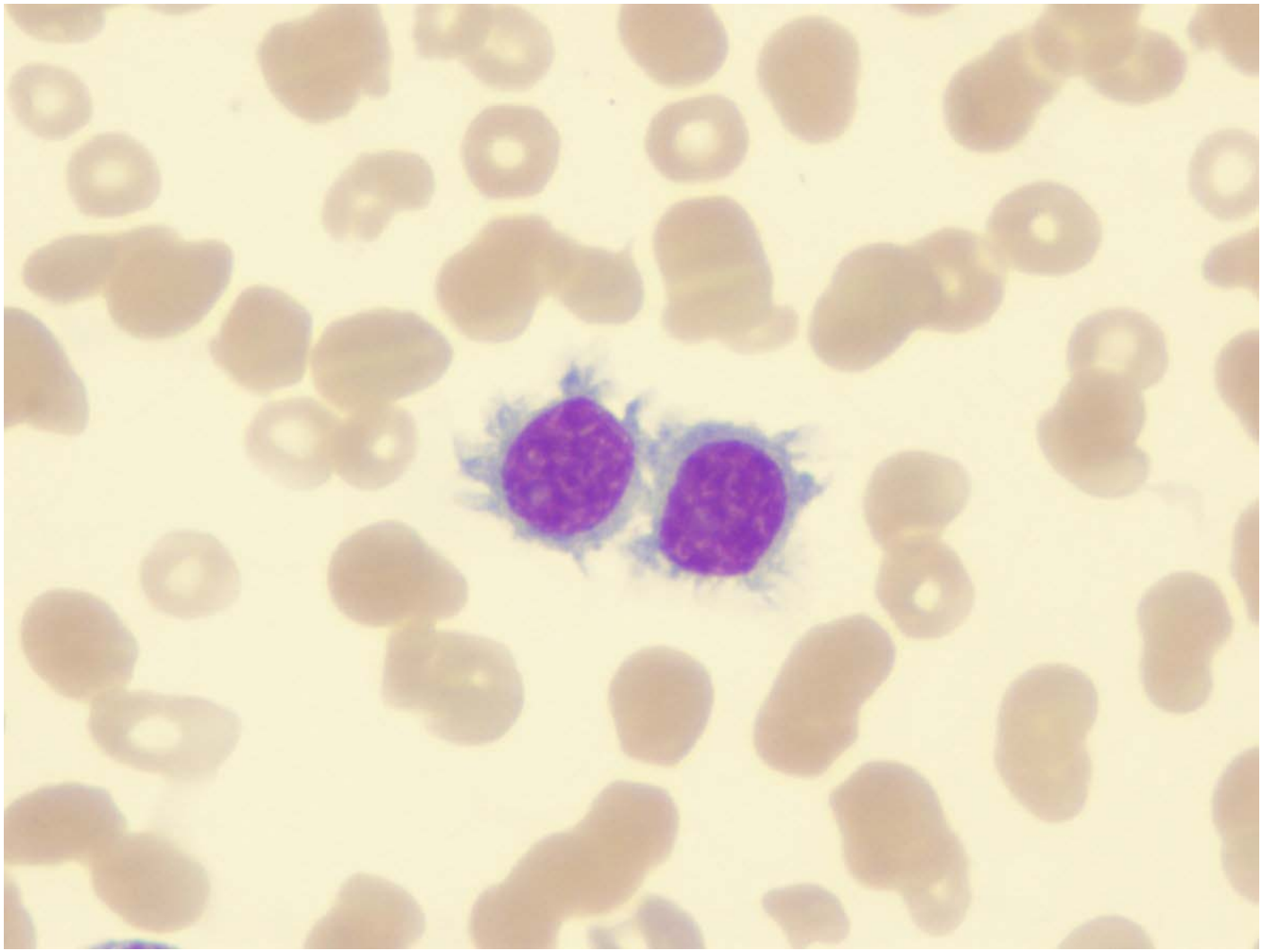
SMALL CELL LYMPHOMA



“CLEAVED” CELL LYMPHOMA



“Hairy” Lymphocyte



FEATURES of LYMPHOMAS

- The Antigen receptor genes re-arrangement PRECEDES malignant transformation, so the cells are MONOCLONAL, NOT the usual POLYCLONAL
- 85% B-cell, 15% T-Cell
- The tumor cells congregate wherever T and B cell congregate normally however
- DISRUPTED or “EFFACED” normal architecture, obliterated subcapsular sinus
- HD/Non-HD staging CRUCIALLY IMPORTANT, esp. HD. Why? HD grows more “linearly”

LATEST CLASSIFICATION

- NON-HODGKIN
  - PRECURSOR B
  - PERIPHERAL B
  - PRECURSOR T
  - PERIPHERAL T
- HODGKIN'S DISEASE (i.e., HODGKINS LYMPHOMA)

PRECURSOR B

- **Precursor B LYMPHOBLASTIC LEUKEMIA/LYMPHOMA**

PERIPHERAL B

- CHRONIC LYMPHOCYTIC LEUKEMIA/LYMPHOMA
- B-Cell PRO-lymphocytic LEUKEMIA
- Lymphoplasmacytic
- Splenic and Nodal Marginal Zone
- EXTRA-nodal Marginal Zone
- Mantle Cell
- Follicular
- Marginal Zone
- Hairy Cell Leukemia
- Plasmacytoma/Multiple Myeloma
- Diffuse B Cell
- BURKITT LYMPHOMA (Starry Sky)

PRECURSOR T

- **Precursor T LYMPHOBLASTIC LEUKEMIA/LYMPHOMA**

PERIPHERAL T and NK

- T-Cell PRO-Lymphocytic Leukemia
- Large Granular
- Mycossis fungoides/Sezary Cell syndrome (skin)
- Peripheral T-Cell
- Anaplastic large cell
- Angioimmunoblastic T-Cell
- Enteropathy-associated T-Cell
- Panniculitis-like
- Hepatosplenic gamma-delta
- Adult T-Cell
- NK/T Cell nasal
- NK-Cell leukemia

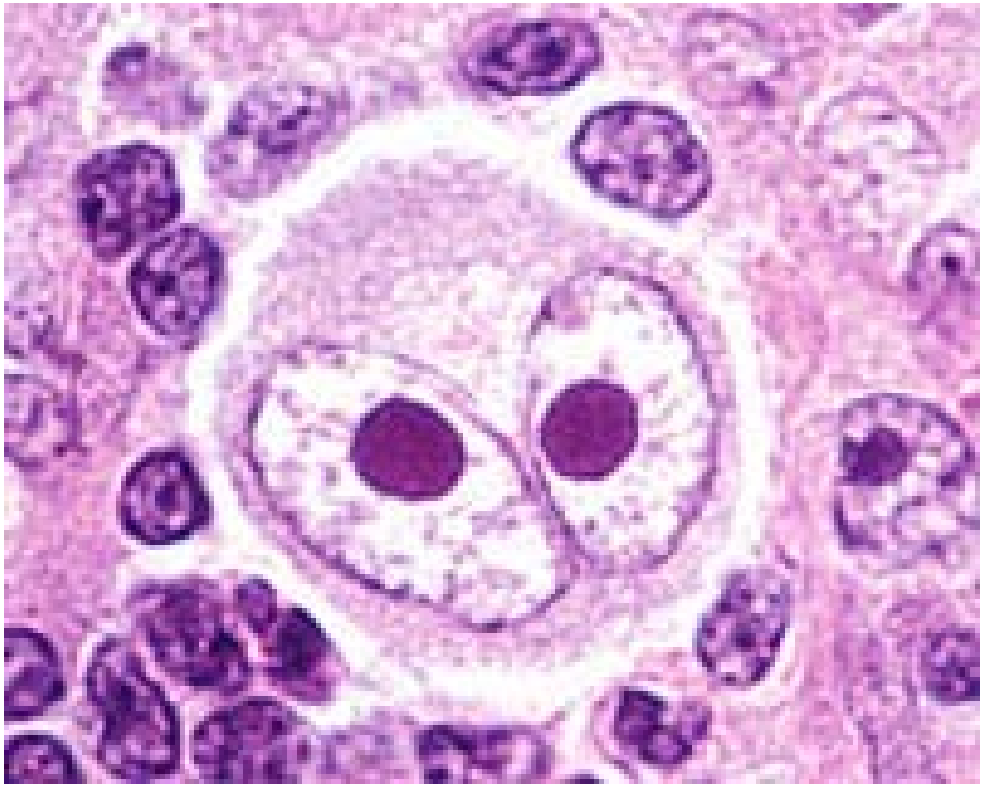
LYMPHOCYTE MARKERS (CD-)
i.e., LYMPHOCYTE ANTIGENS

- **T-Cell:** 1,3,4,5,8
- **B-Cell:** 10 (CALLA), 19,20,21,23,79a
- **Mono/Mac:** 11c, 13, 14, 15, 33, 34
- **STEM:** 34
- **RS:** 15, 30
- **All:** 45 (Leukocyte Common Antigen)
- **NK:** (16, 56)

HODGKINS DISEASE

- NEED R-S (Reed-Sternberg, or Sternberg-Reed) cells for correct diagnosis
  - **NODULAR SCLEROSIS** (Young Women), the R-S cells may be called "LACUNAR" cells
  - **MIXED CELLULARITY**
    - Lymphocyte RICH
    - Lymphocyte POOR
    - Lymphocyte PREDOMINANCE

STERNBERG-REED CELL



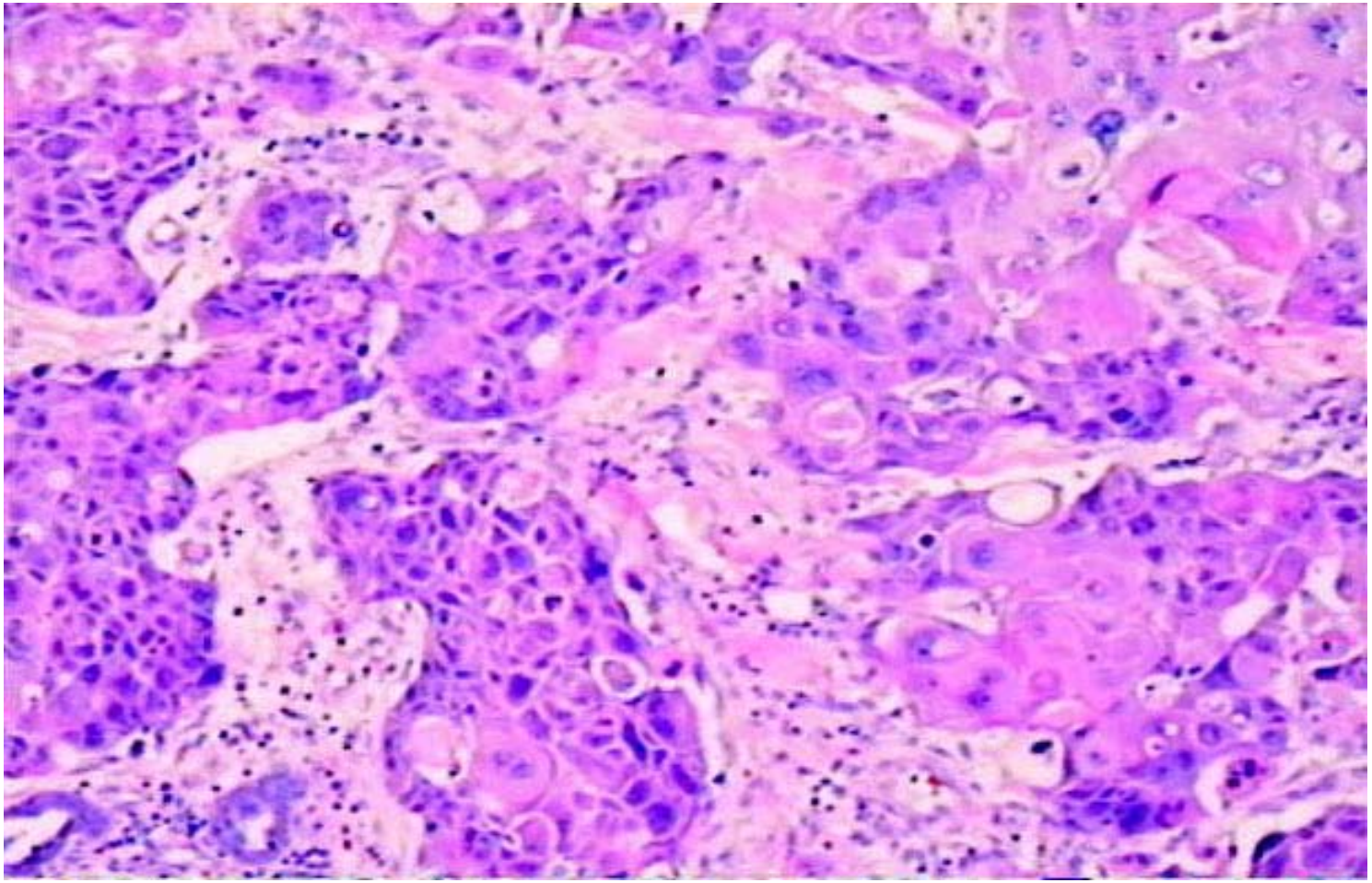
STAGING, HD & NHD

- I ONE NODE or NODE GROUP
- II MORE than ONE, but on ONE side of diaph.
- III BOTH sides of diaph., but still in nodes only
- IV OUTSIDE of NODES, e.g., liver, marrow, etc.
- A No systemic symptoms
- B fever and/or night sweats and/or 10% weight loss

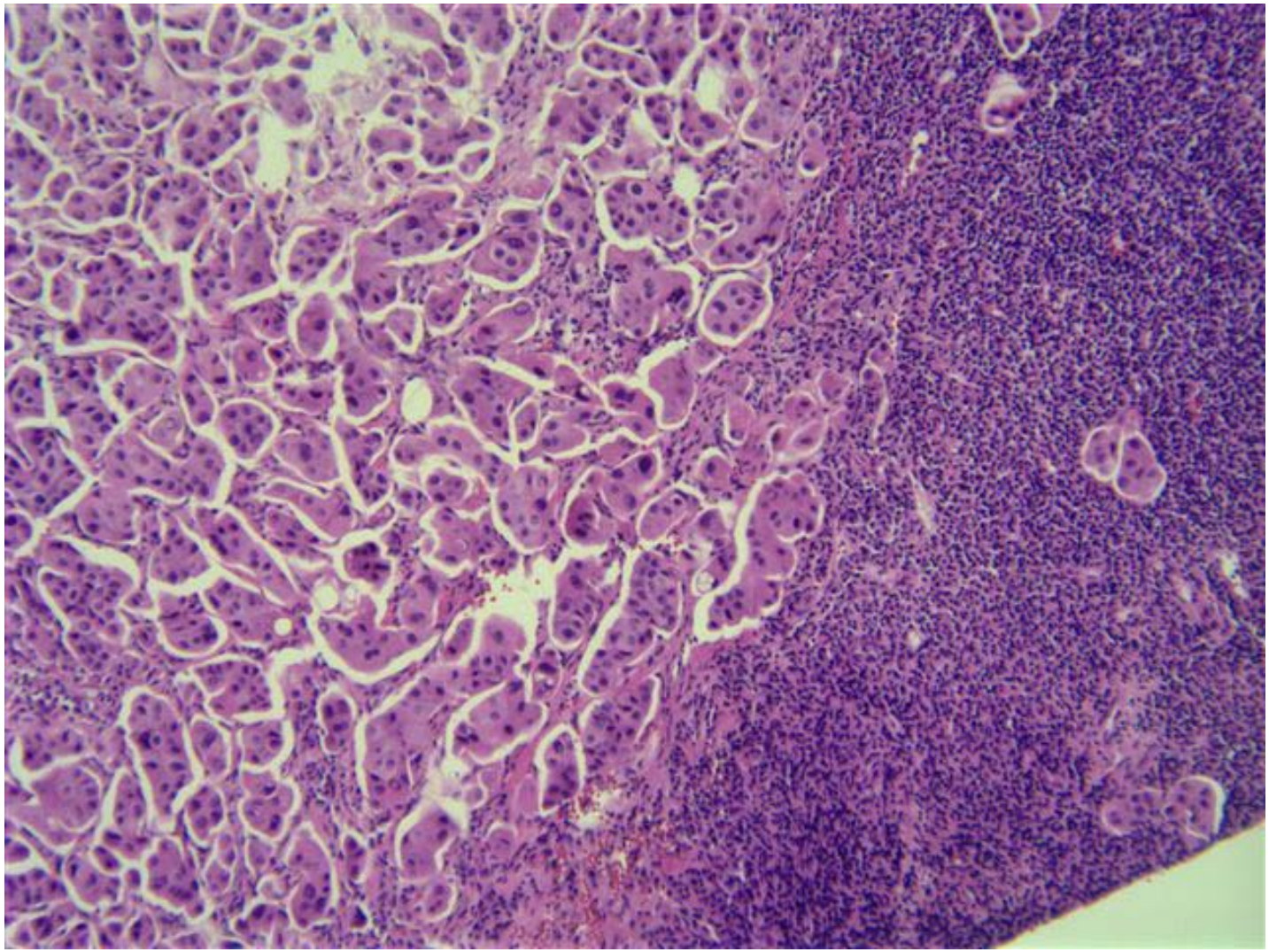
METASTATIC CARCINOMA

- Perhaps the single most important staging and prognostic feature of tumors
- The metastatic cells FIRST enter into the SUBCAPSULAR SINUS
- The tumor may replace the entire node and enlarge it
- The tumor may be focal
- The tumor usually looks the same as it’s primary or other metastases
- The tumor usually ENLARGES the node

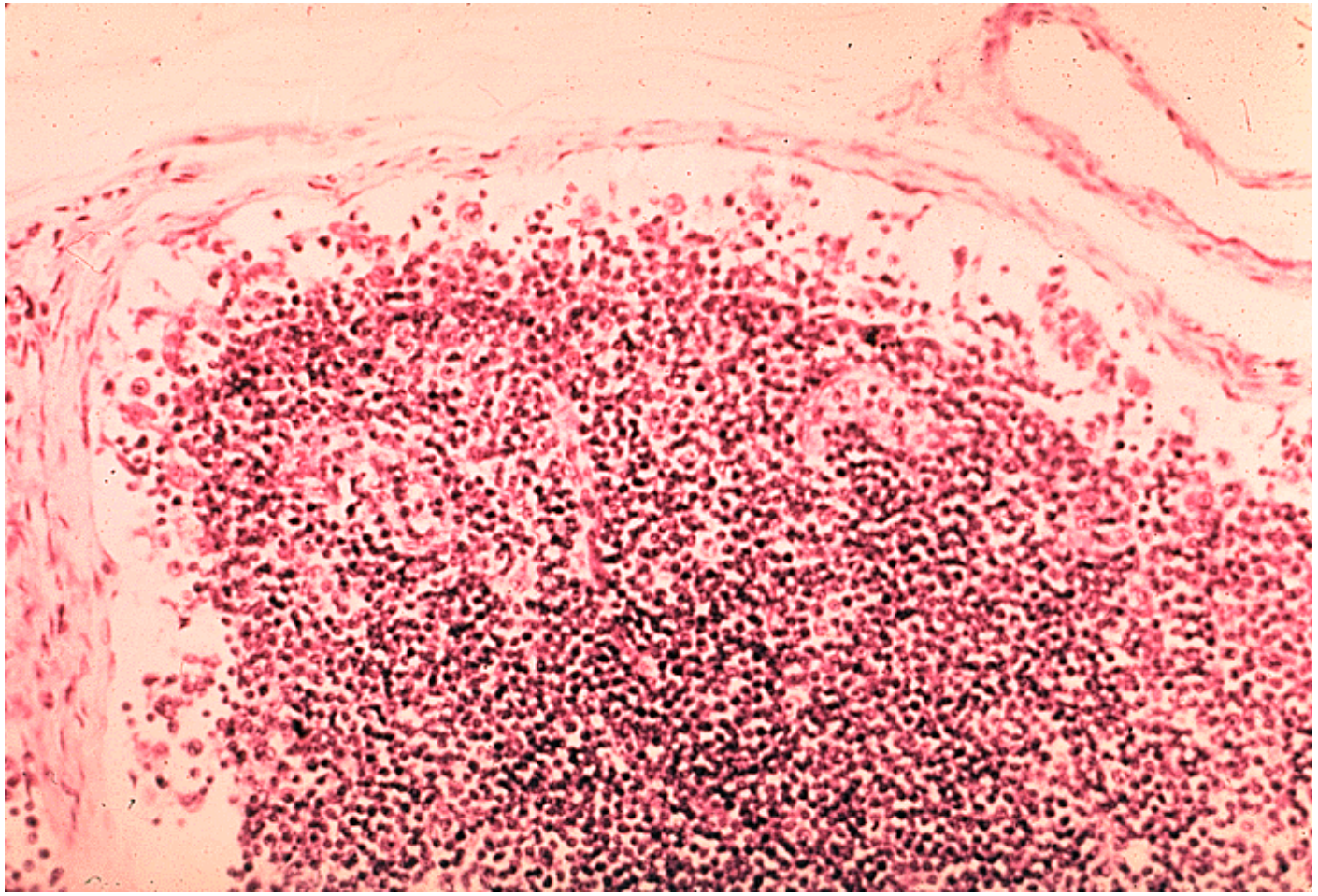
METASTATIC SQUAMOUS CELL CARCINOMA



METASTATIC ADENOCARCINOMA

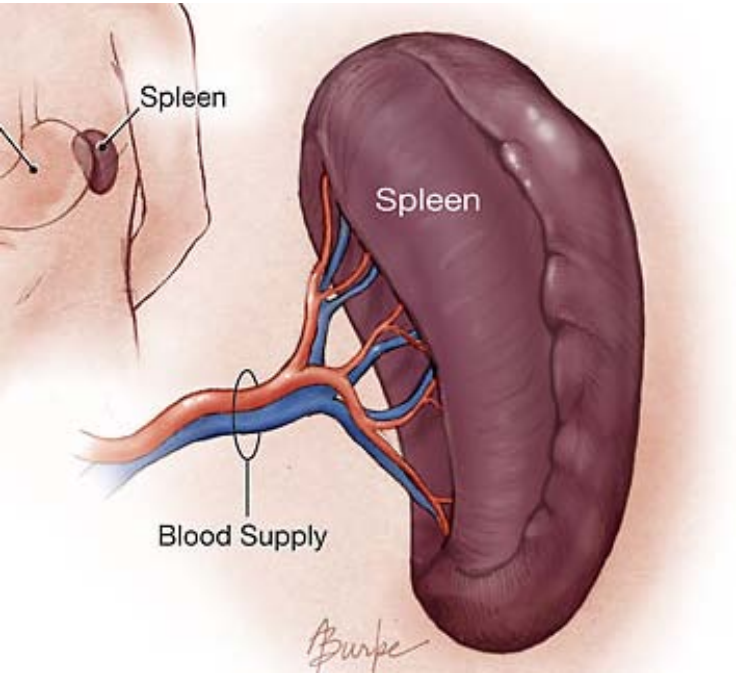


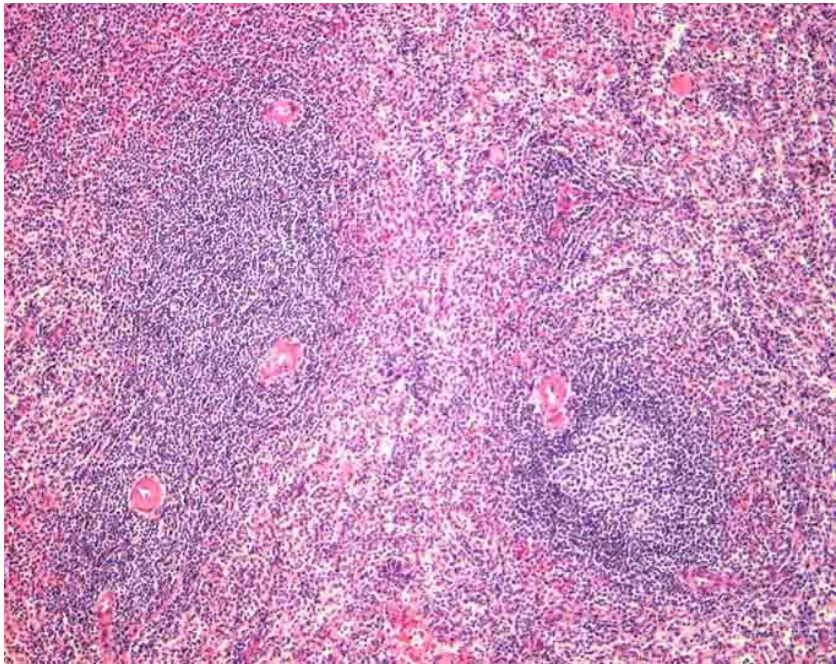
SUBCAPSULAR SINUS

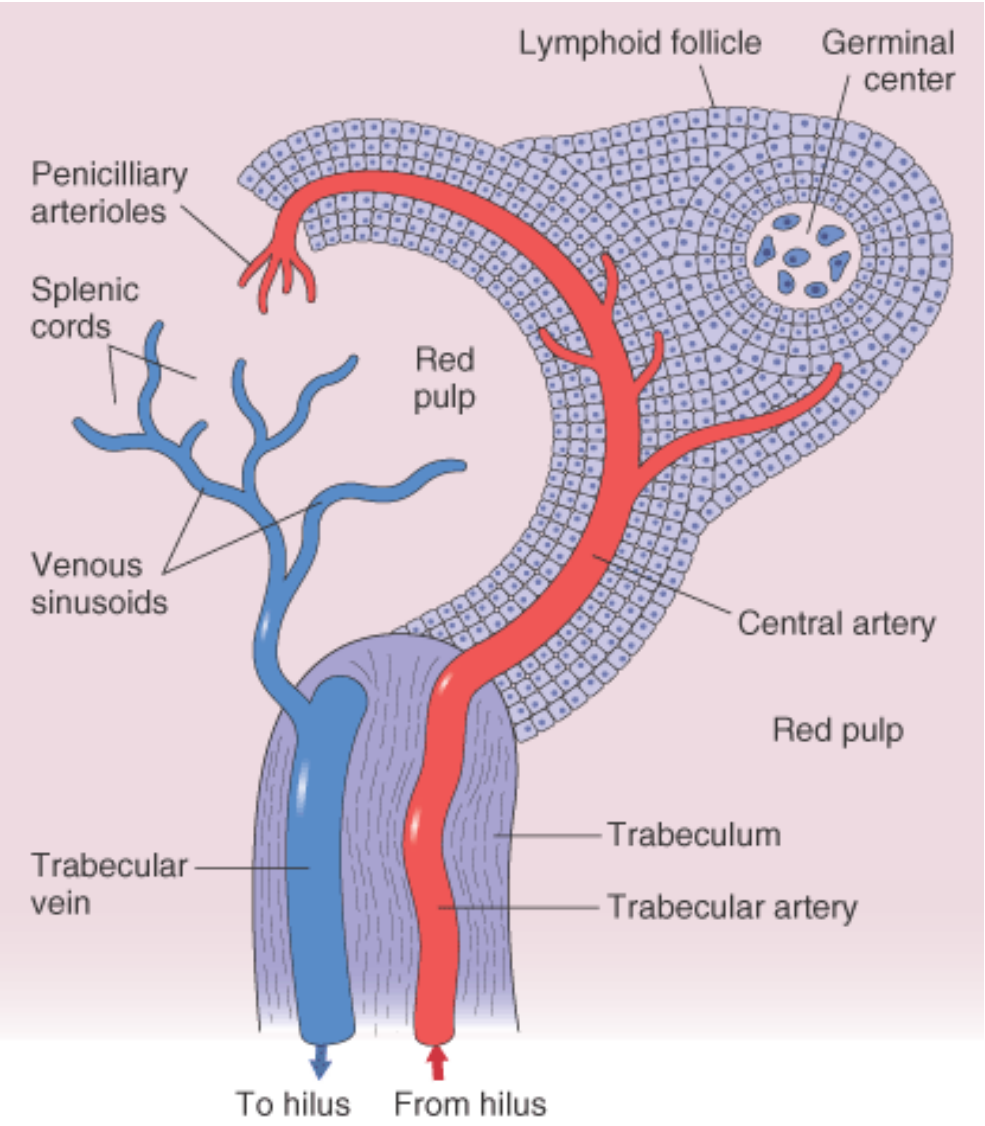


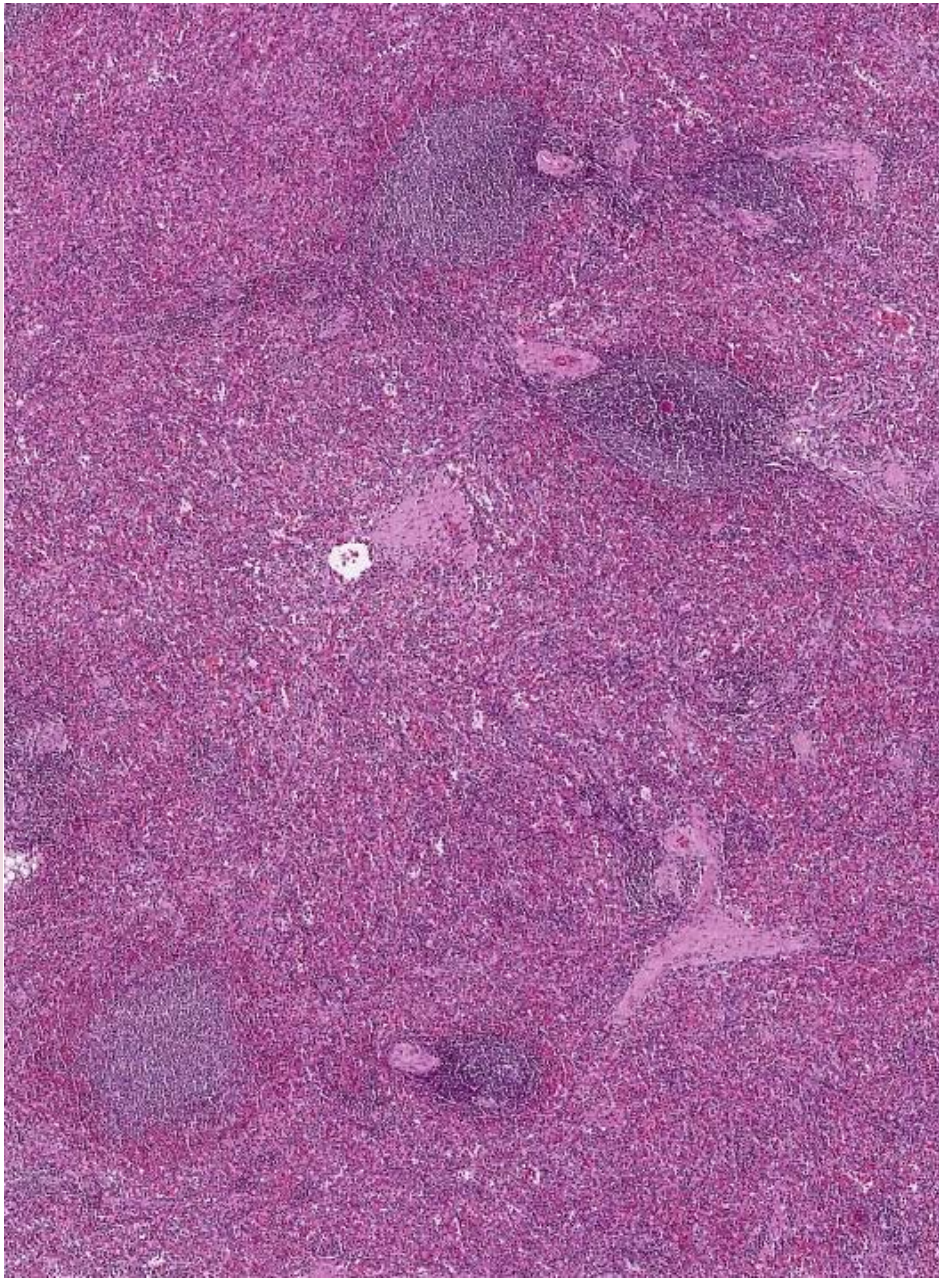
SPLEEN

- 150 grams POST-LUQ (just like kidney, 1/10 of liver)
- Bordered by diaphragm, kidney, pancreas, splenic flexure, stomach
- SMOOTH & GLISTENING capsule
- 50% RED pulp, 50% WHITE pulp

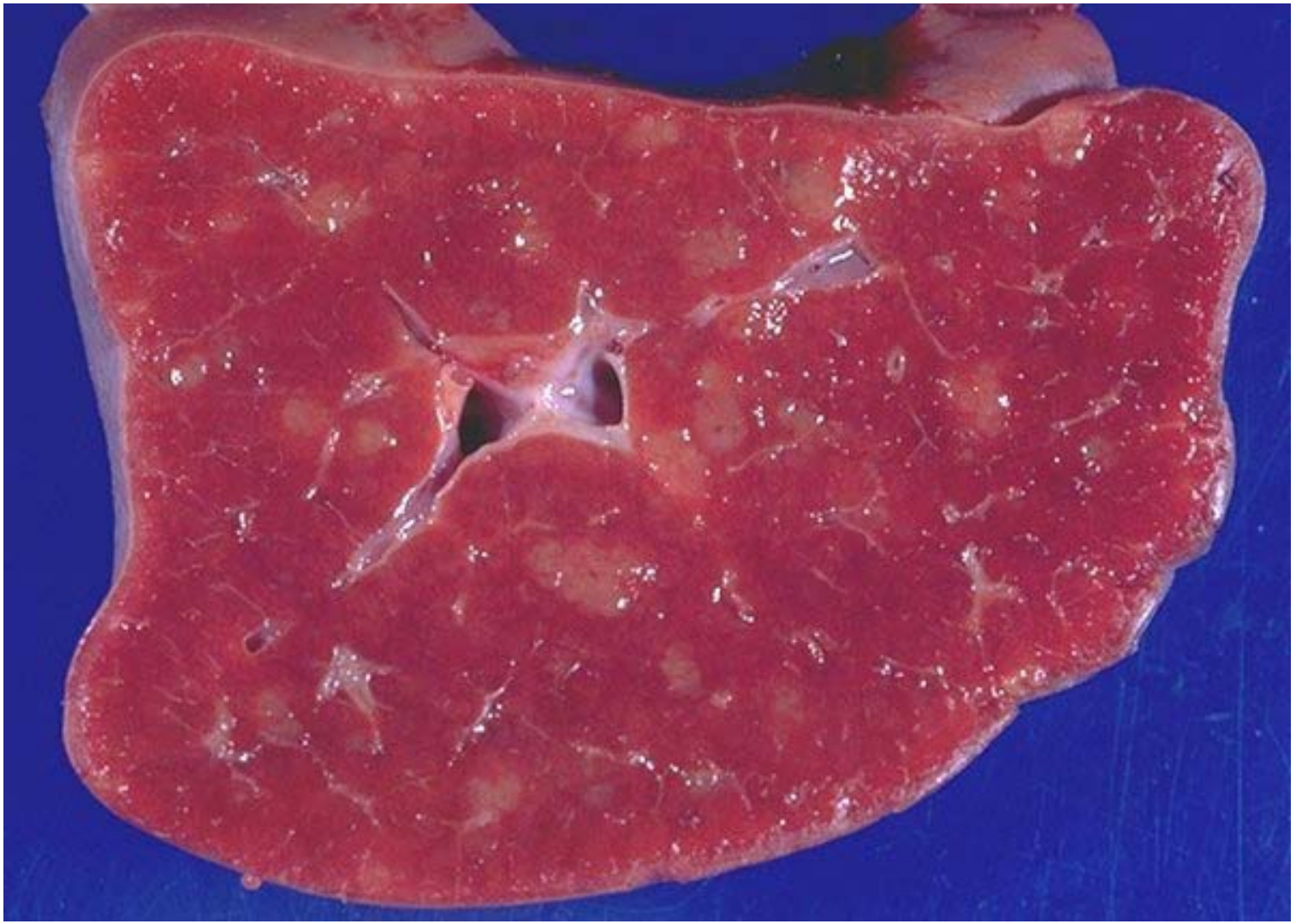




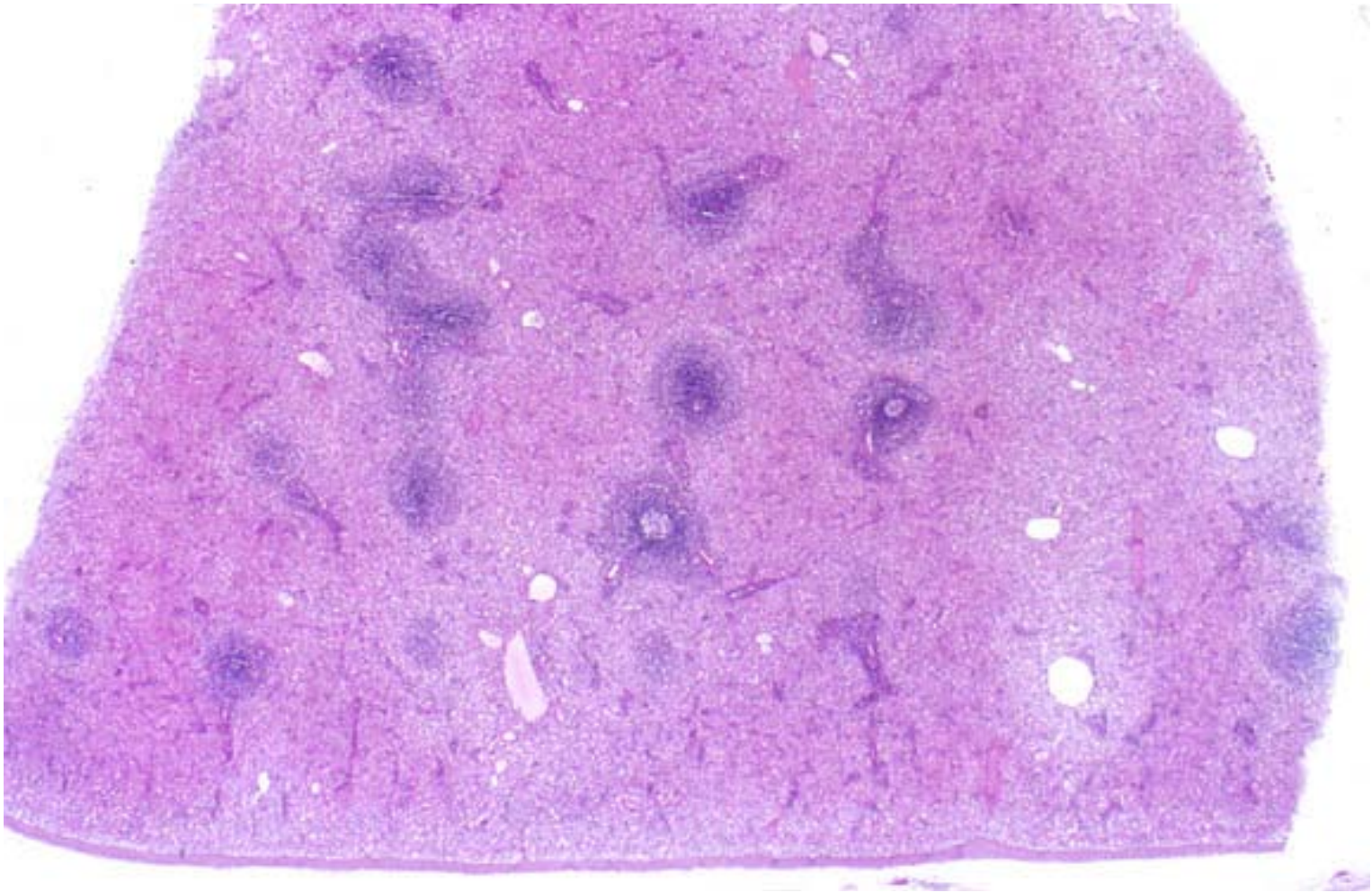

Lymphoid follicle
Germinal center
Penicilliary arterioles
Splenic cords
Red pulp
Venous sinusoids
Central artery
Red pulp
Trabeculum
Trabecular vein
Trabecular artery
To hilus
From hilus



ABNORMAL SPLEEN



ABNORMAL SPLEEN



SPLENIC FUNCTION

- REMOVE OLD BLOOD CELLS
- MAJOR SECONDARY ORGAN of the IMMUNE SYSTEM
- HEMATOPOIESIS
- SEQUESTER (POOL) BLOOD CELLS
- 15% of body's PHAGOCYTIC activity is in the spleen (liver has >80)

SPLENOMEGALY

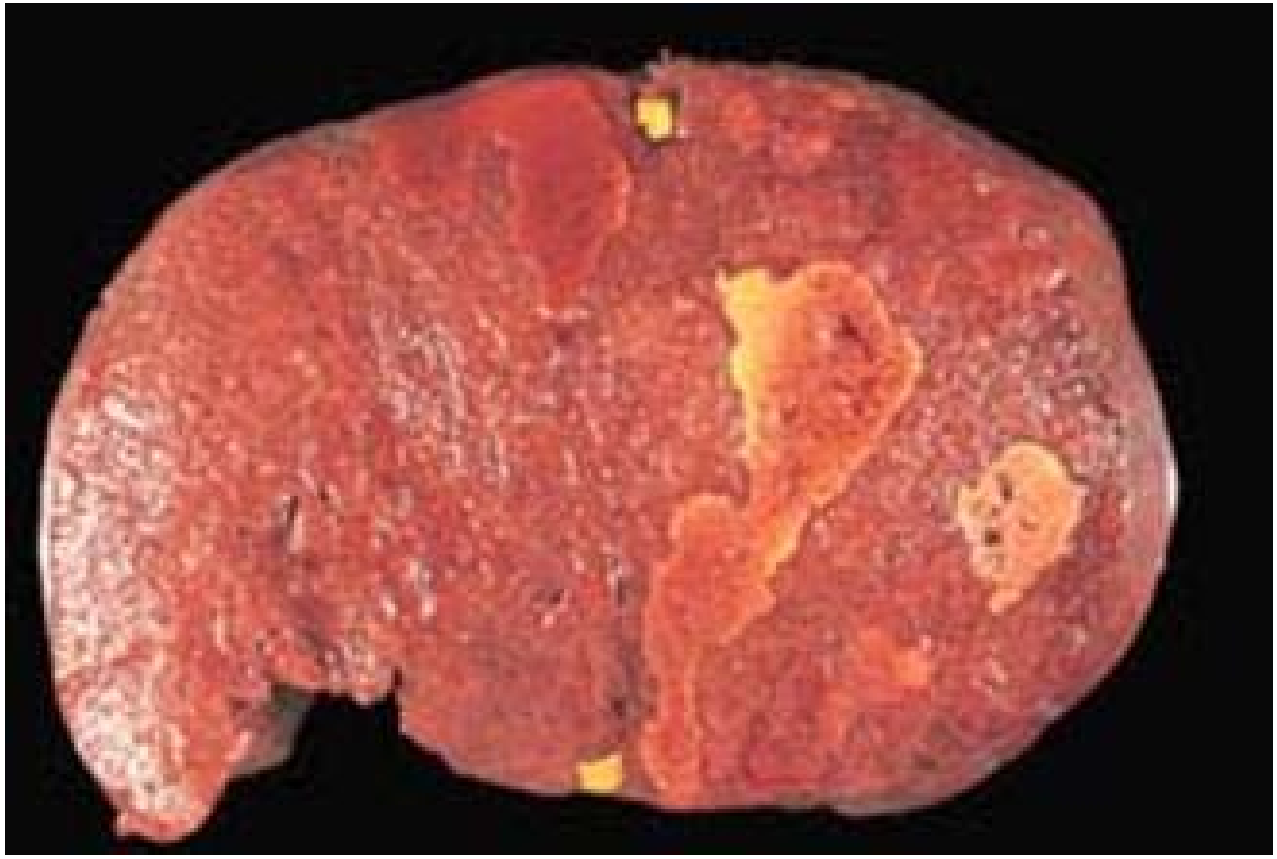
- CONGESTIVE vs INFILTRATIVE
- HYPERSPLENISM
  - –Anemia
  - –Leukopenia
  - –Thrombocytopenia
- DECISION for SPLENECTOMY

SPLENOMEGALY

- **INFECTIONS:** TB, Mono, Malaria, Fungus
- **PORTAL HTN:** CHF, CIRRHOSIS, PV Thromb.
- **LYMPHOHEMATOGENOUS:** Leuk, Lymph
- **IMMUNE:** RA, SLE
- **STORAGE:** Gaucher, Niemann-Pick
- **MISC:** Amyloid, mets (melanoma, lymphoma, Germ cell tumors of testis)

LONG STANDING CONGESTION breeds FIBROSIS

INFARCT



PRIMARY TUMORS (RARE)

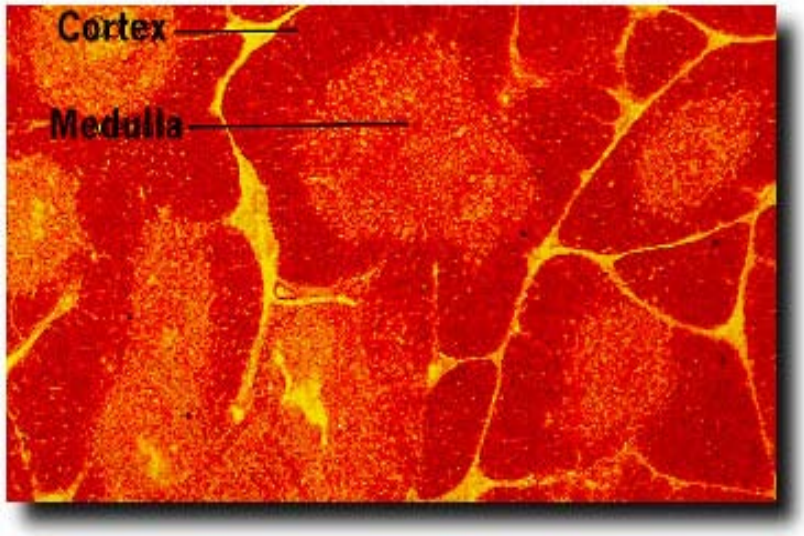
- **HEMANGIOMA**
- **LYMPHANGIOMA**
- fibroma
- osteoma
- Chondroma
- **LYPHOMA**

MISC

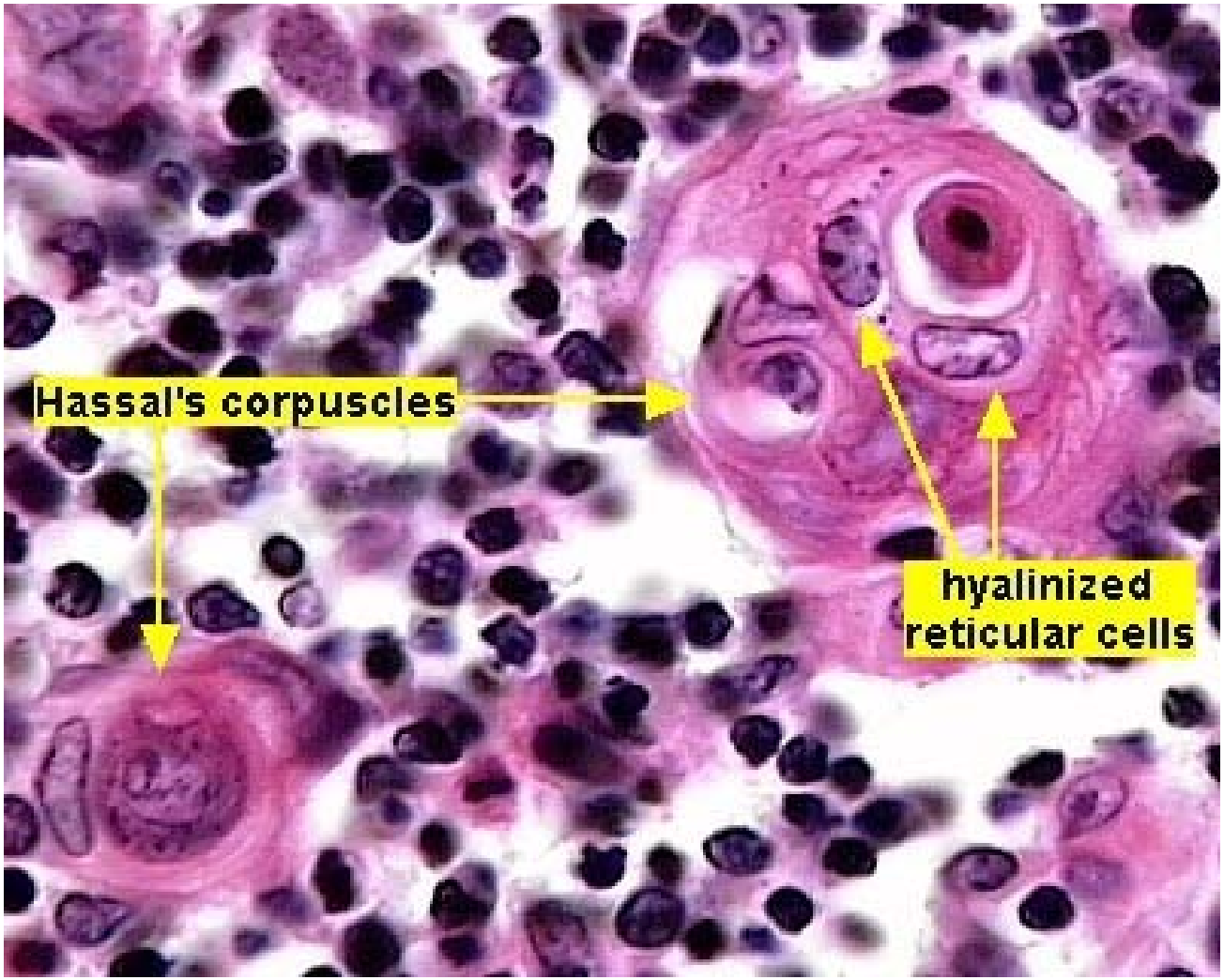
- Congenital Absence (very rare)
- “Accessory” spleens (very common)
- **RUPTURE**

THYMUS

- Mother of all T-Cells
- Massive in newborns, virtually absent in the elderly, bilobed
- Under manubrium
- 1) Thymocytes
- 2) Epithelial Ret. Cells
- 3) Hassal's Corpuscles



HASSAL's CORPUSCLES



DISEASES

- **HYPOPLASIA/APLASIA**
  - » DiGeorge Syndrome
- **CYSTS** (incidental)
- **THYMOMAS**

THYMOMAS

- ALL (most) thymomas show counterparts of BOTH lymphoid as well as epithelial reticular cells, hence, the classic name "LYMPHOEPITHELIOMA"
  - Benign thymoma: (encapsulated)
  - Malignant Thymoma I: (locally invasive)
  - Malignant Thymoma II: (easily metastasizable)

THYMOMAS