

# Hairy Cell Leukemia

## Hairy Cell Leukemia

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### **Definition:**

- Small B-cell neoplasm with oval nuclei and abundant cytoplasm
- Hairy cytoplasmic projections
- Strong expression: CD11c, CD22, and CD103
- Infiltrating BM and splenic red pulp.

### **Synonym:**

Leukemic reticuloendotheliosis.

## Hairy Cell Leukemia

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# Epidemiology:

- 2% of lymphoid leukemias
- 500-600 cases per year in US
- Median age 55
- M:F 5:1

## Hairy Cell Leukemia

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# Sites of involvement:

- Predominantly BM and Spleen
- Small numbers in PB
- Occasionally liver, LN, Skin
- Prominent abdominal lymphadenopathy: associated with large hairy cells and transformation

# Hairy Cell Leukemia

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## Clinical features:

- Splenomegaly
- Pancytopenia
- Monocytopenia
- Recurrent opportunistic infections
- Vasculitis

# Hairy Cell Leukemia

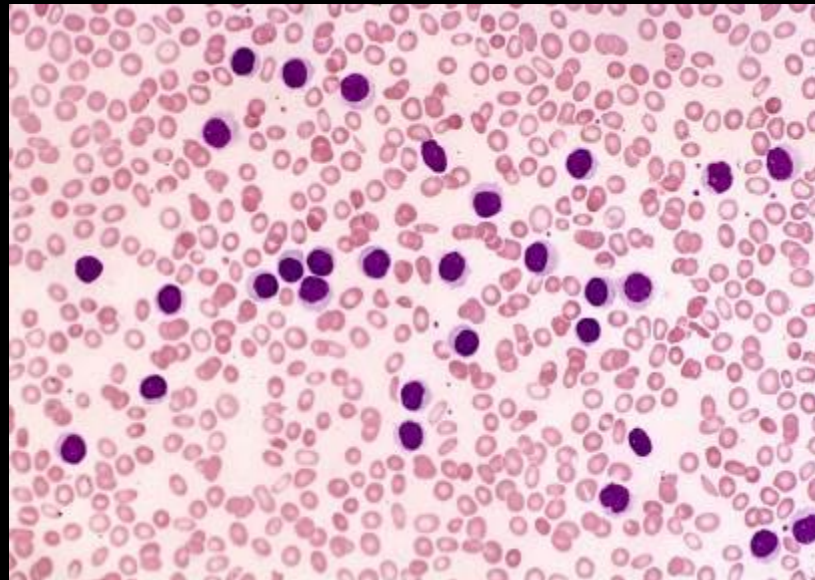
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## **Cytological Features:**

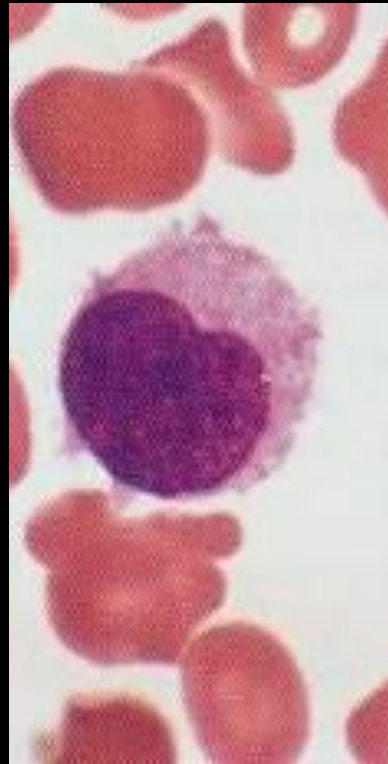
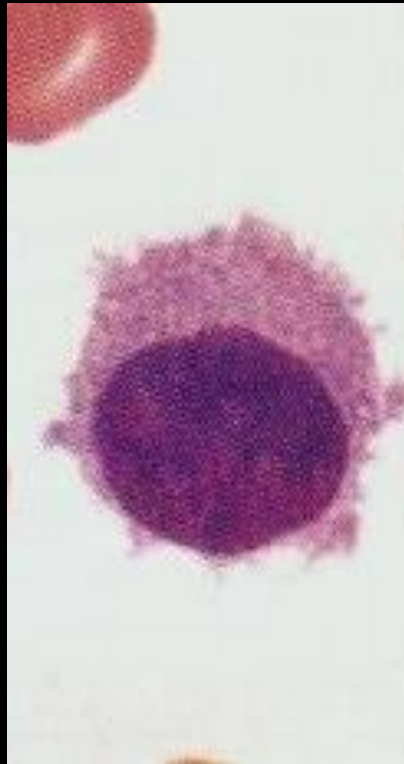
- Small to medium-sized
- Indented (bean-shaped) nucleus
- Homogeneous, spongy, ground-glass chromatin
- Absent or inconspicuous nucleoli
- Cytoplasm: abundant, pale blue, with circumferential “hairy” projections
- Occasional vacuoles or rod-shaped inclusions  
(Ribosome lamellar complexes)

# Hairy Cell Leukemia

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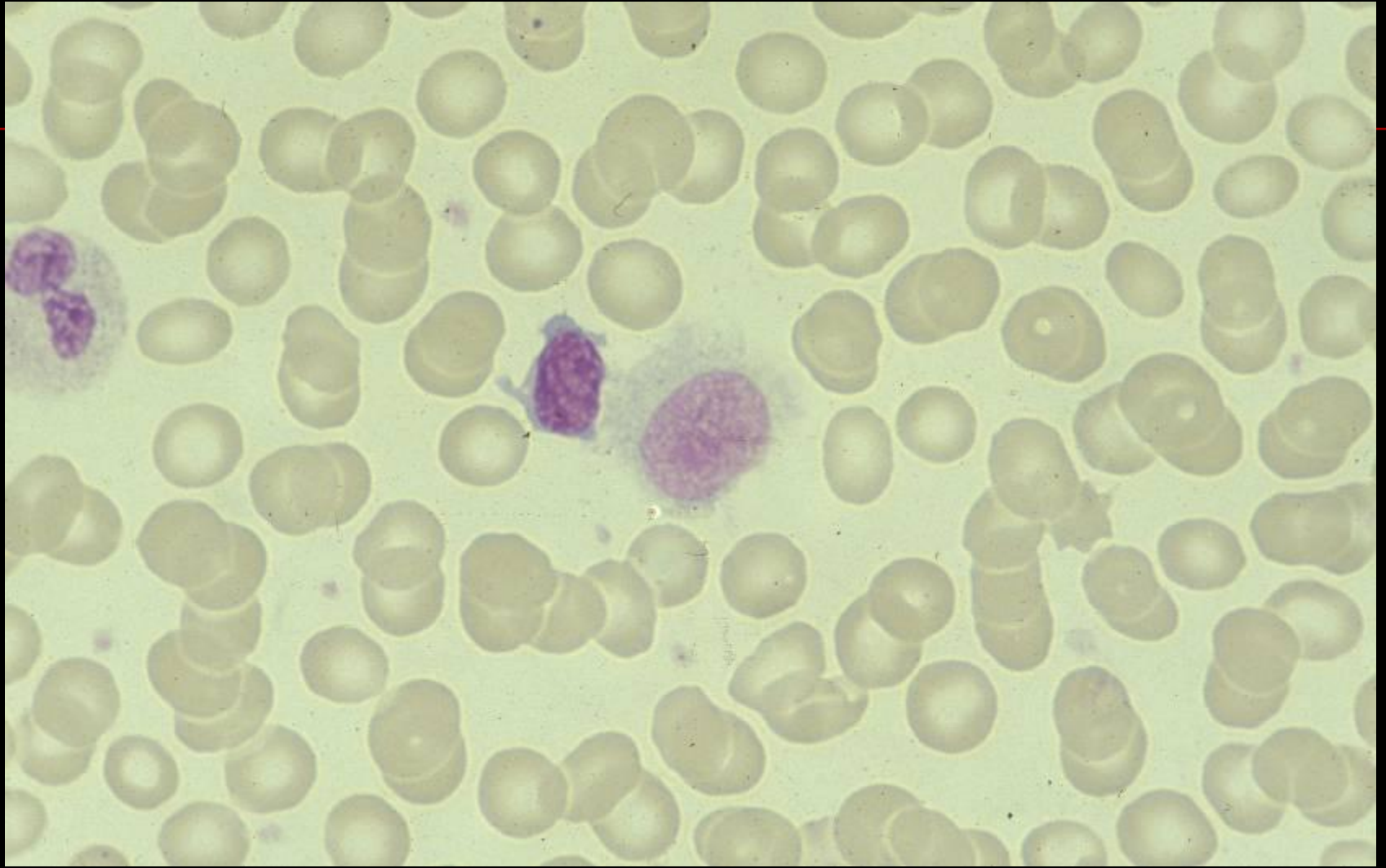


# Hairy Cell Leukemia



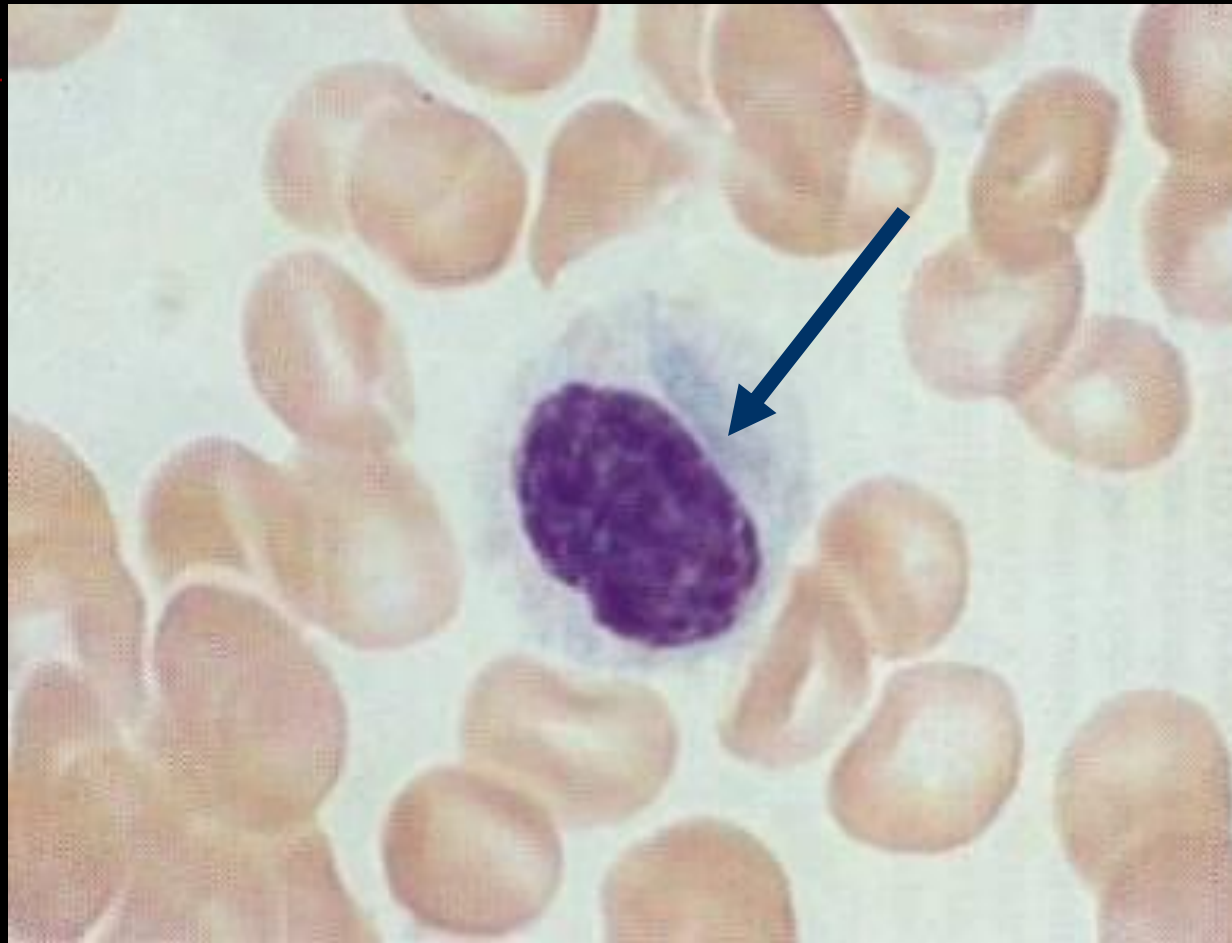


## Hairy Cell Leukemia



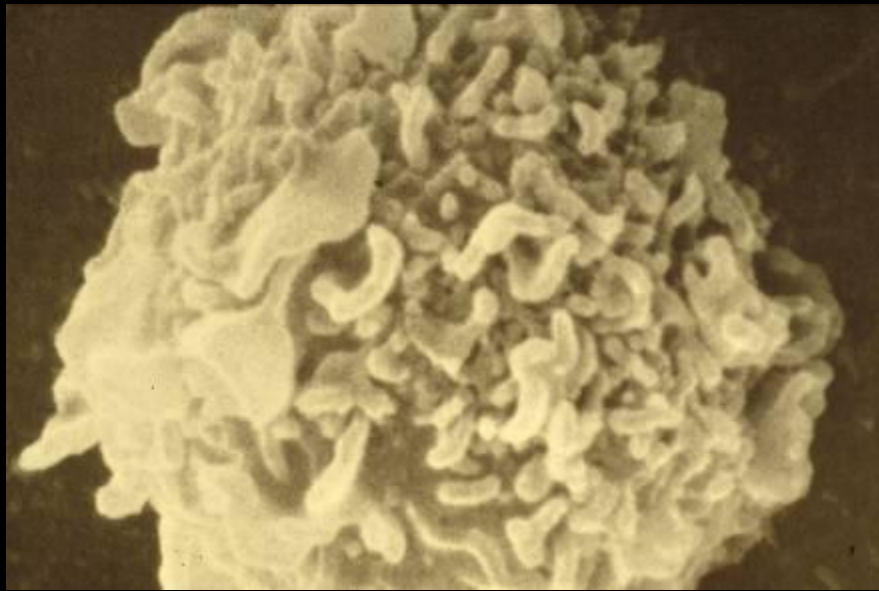
# Hairy Cell Leukemia

Ribosome lamellar complexes



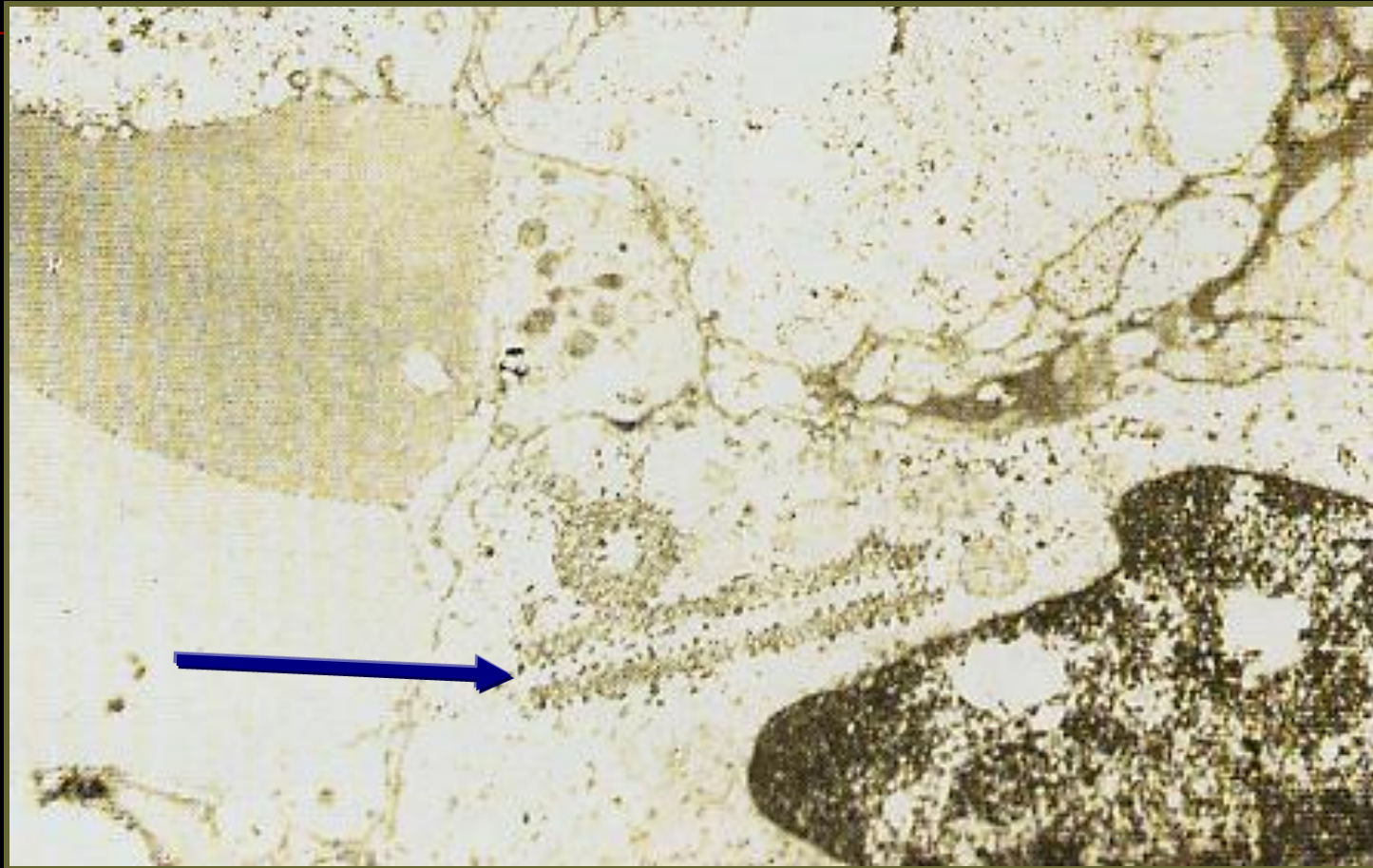
# Hairy Cell Leukemia: EM

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# Hairy Cell Leukemia: EM

Ribosome lamellar complexes





# Hairy Cell Leukemia: EM

Ribosome lamellar complexes



# Hairy Cell Leukemia

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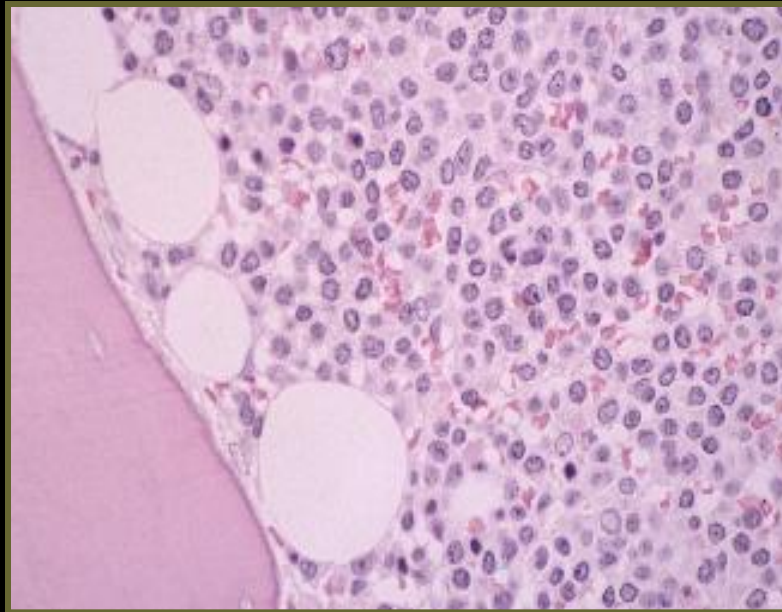
## Morphology:

### BM:

- Interstitial and patchy infiltrate
- Characteristic “fried-egg” appearance
- Variable degrees of reticulin fibrosis
- Granulocytic hypoplasia
  - Myelosuppressive cytokine production
  - Decreased growth factors

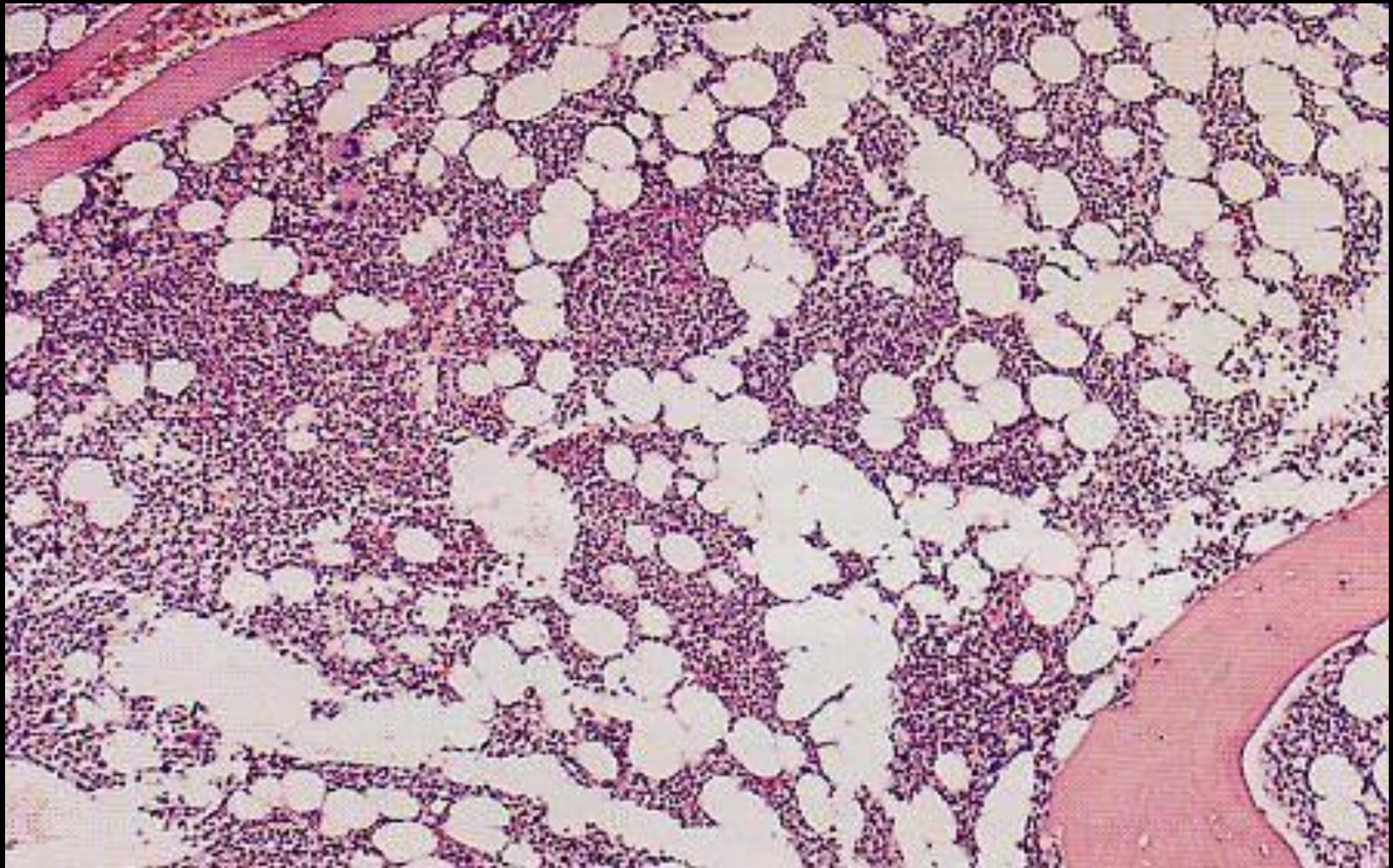
# Hairy Cell Leukemia

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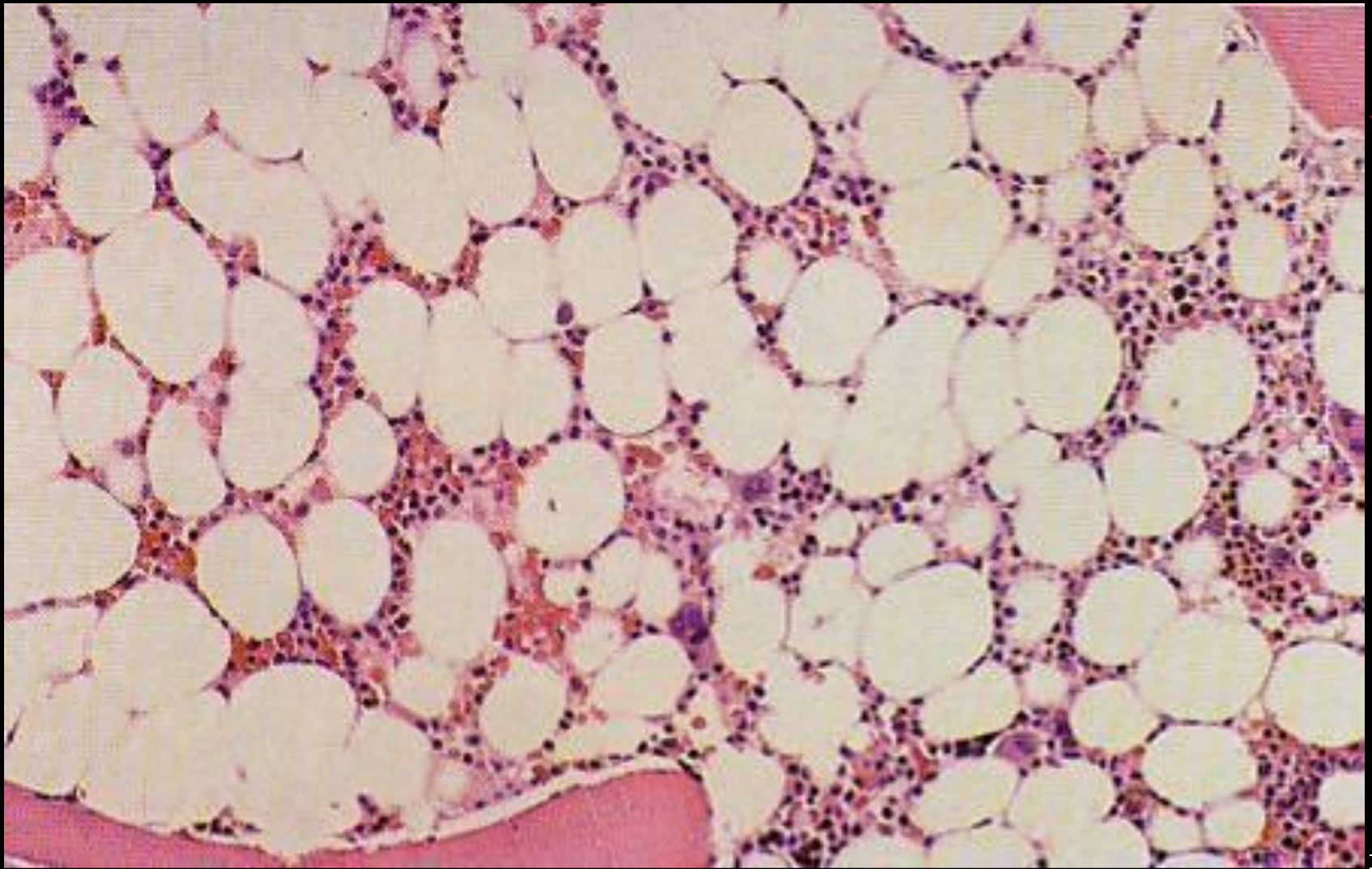


## Hairy Cell Leukemia: BM

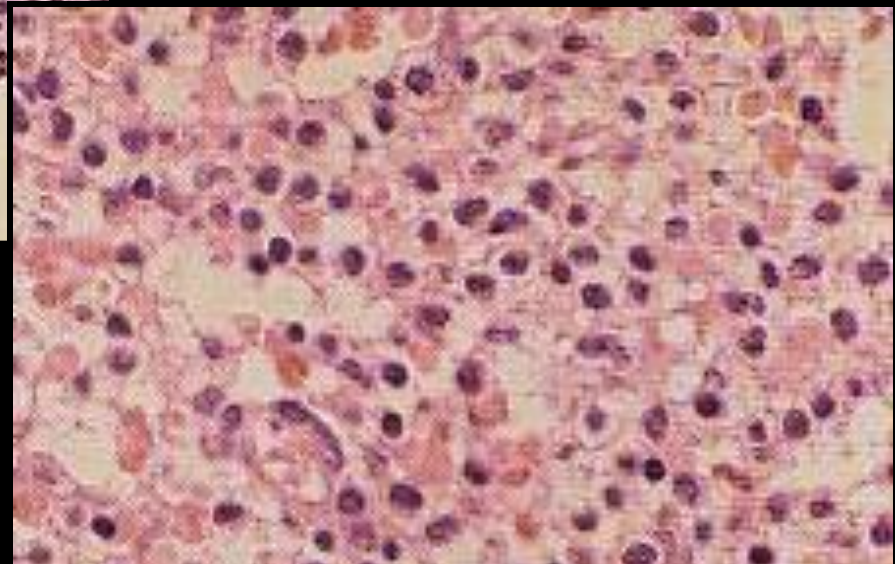
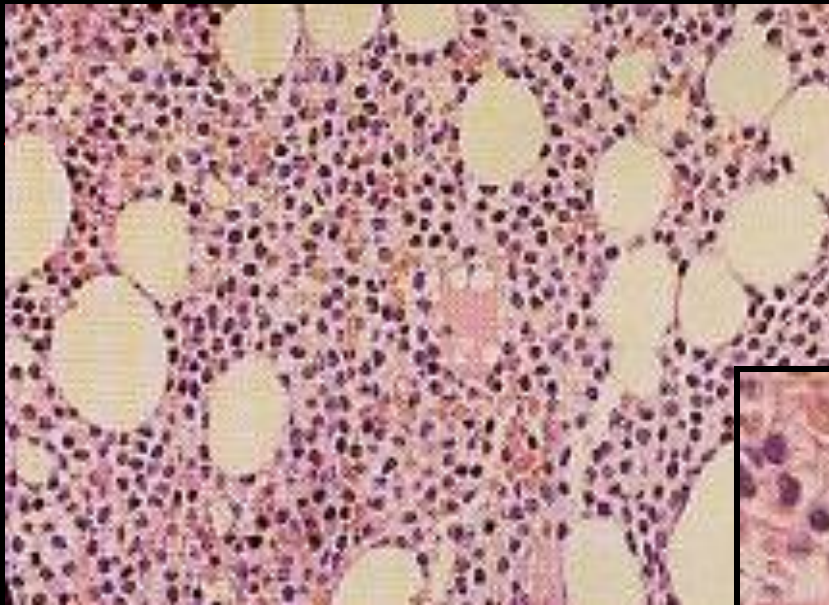




## Hairy Cell Leukemia: BM

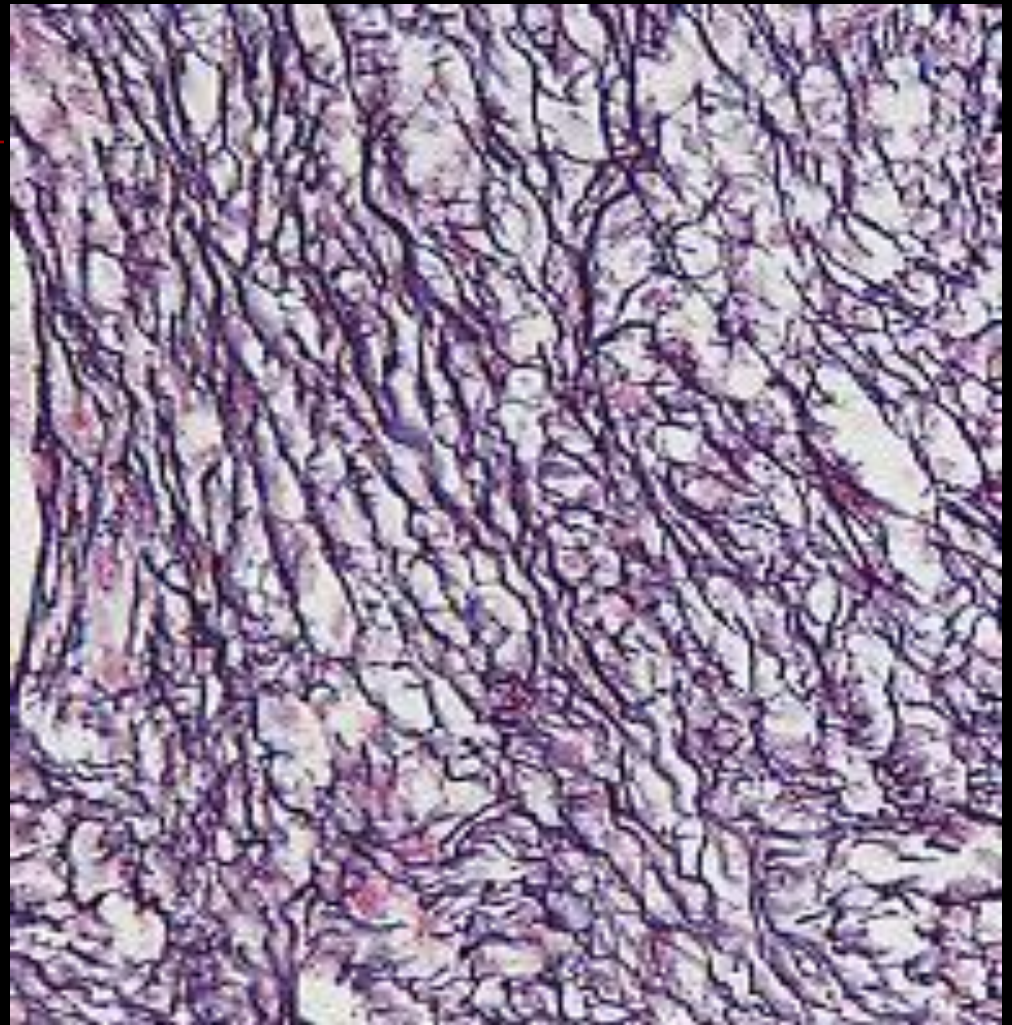
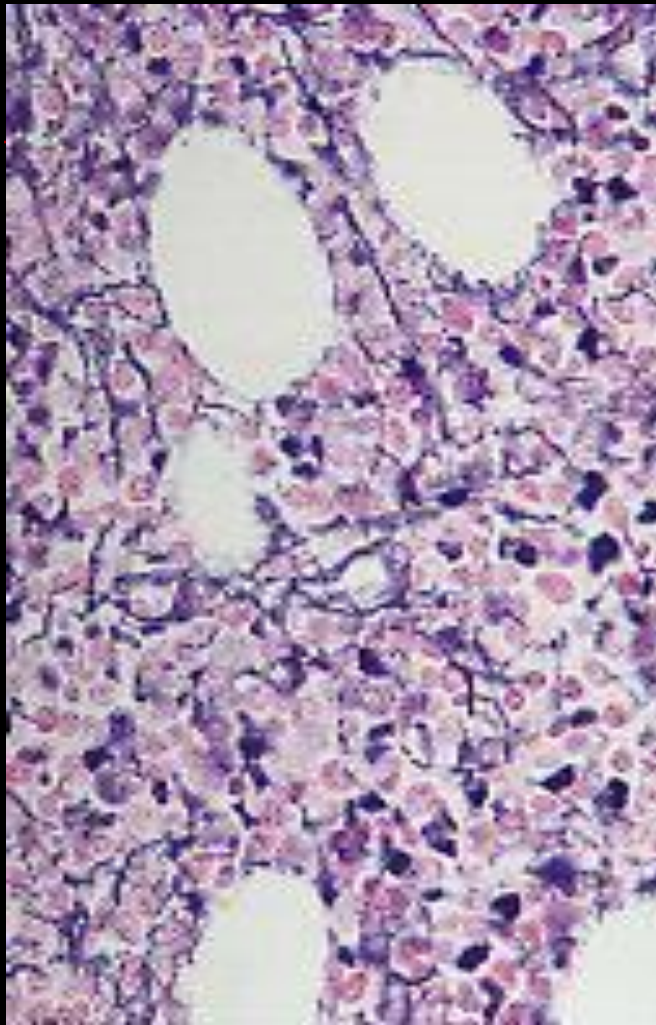


# Hairy Cell Leukemia: BM





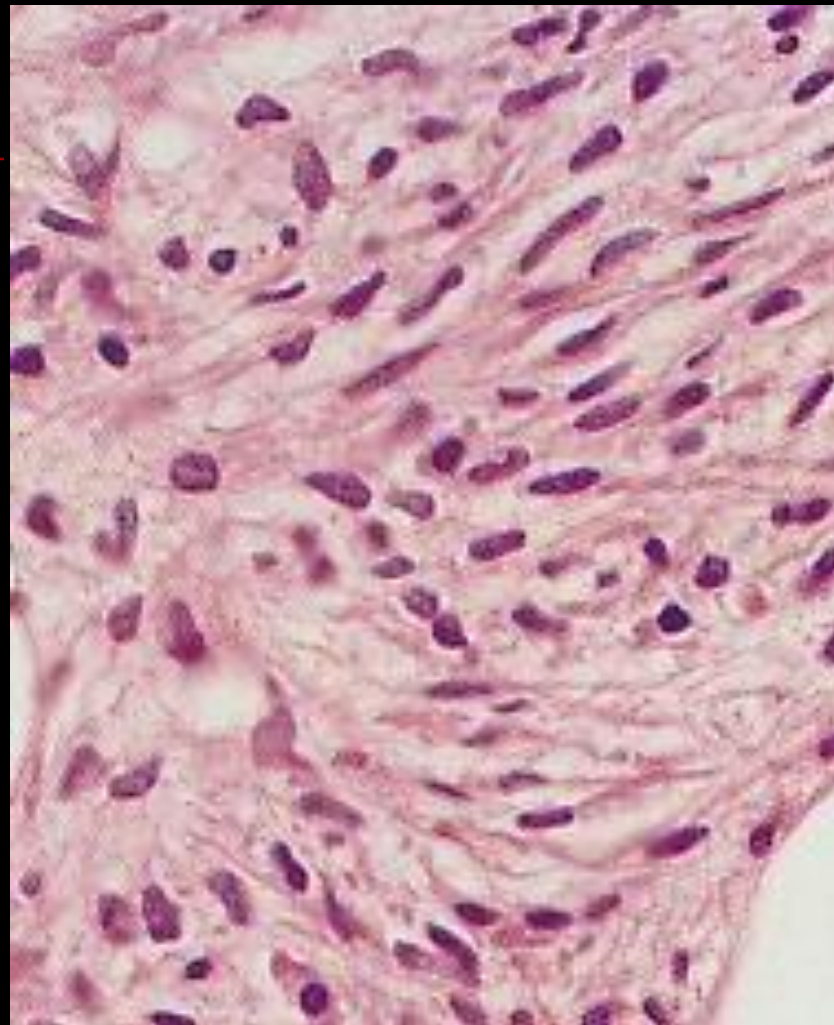
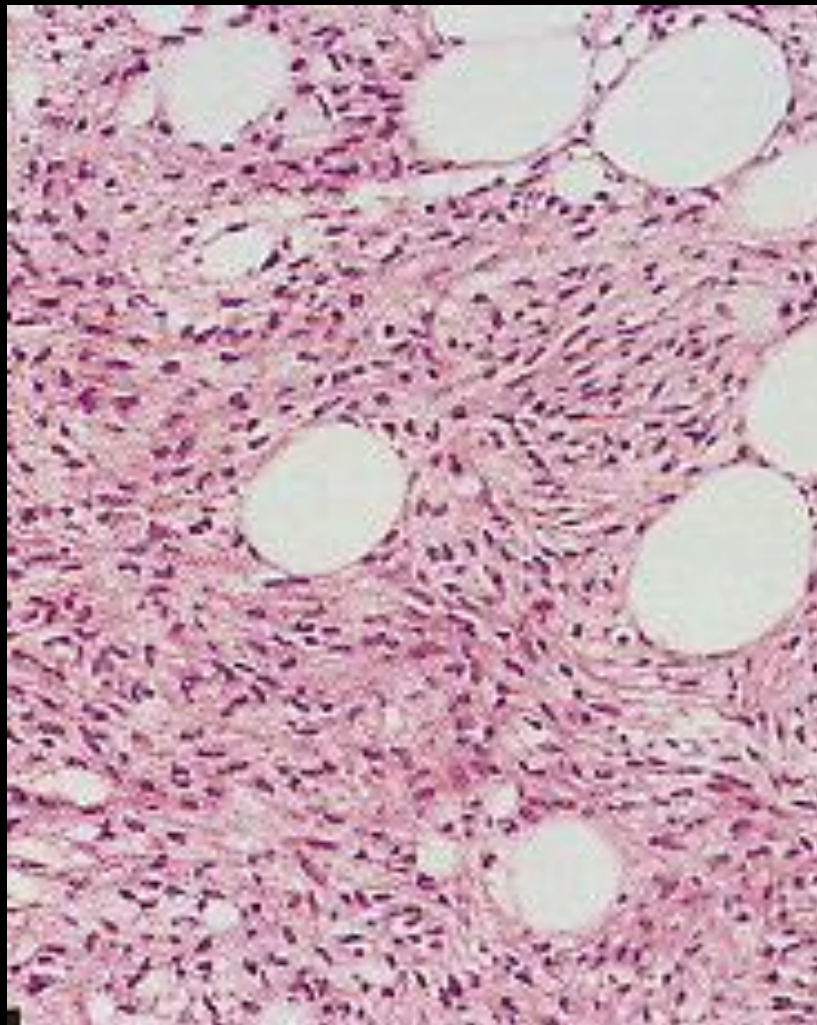
# Hairy Cell Leukemia Reticulin





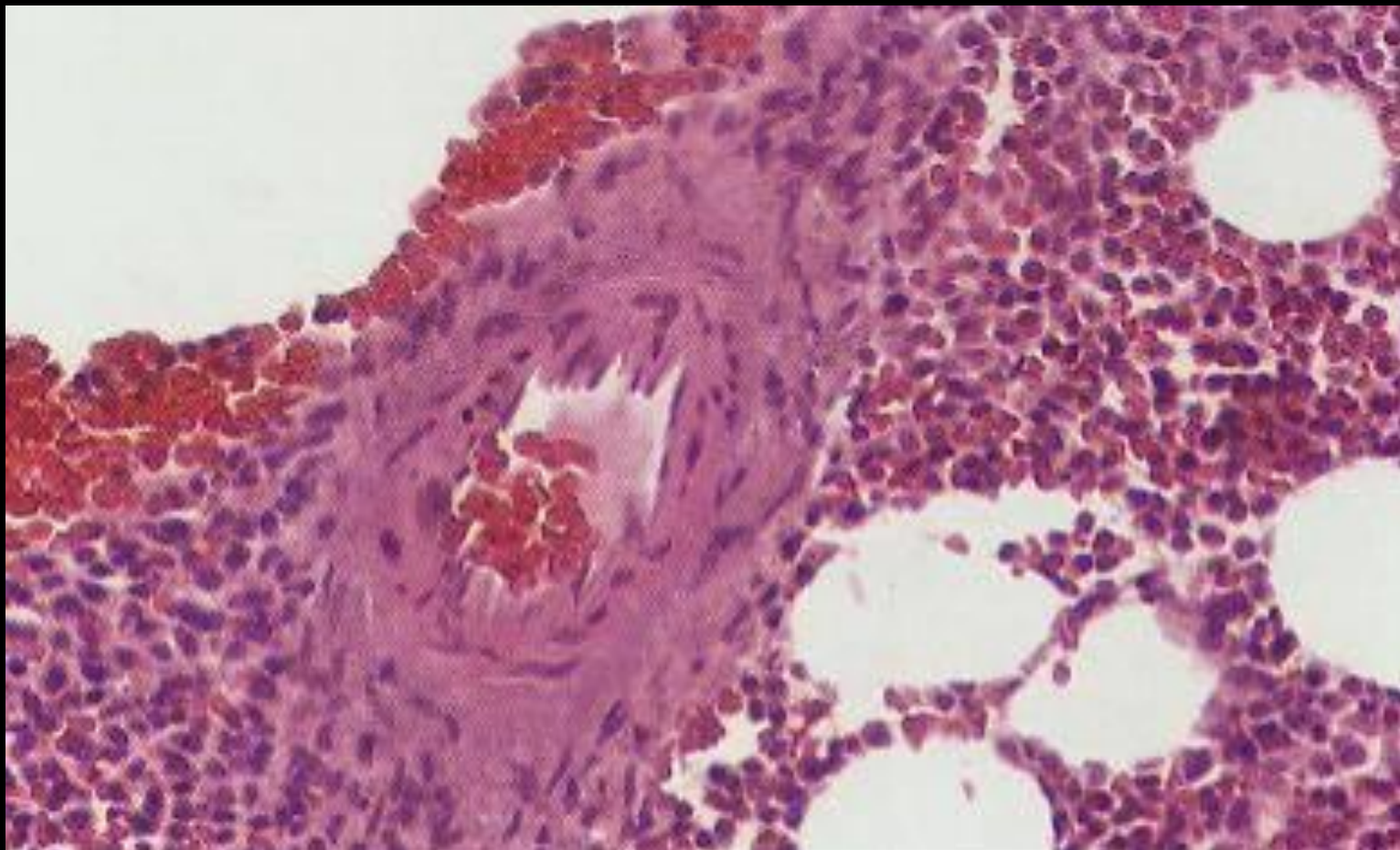
# Hairy Cell Leukemia

Spindle cell variant



# Hairy Cell Leukemia

BM: perivascular mast cells



# Hairy Cell Leukemia

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## Morphology:

### -Spleen:

Infiltrate red pulp cord

White pulp atrophic

RBC lakes

-Liver: sinusoidal and portal infiltrates

-LN: paracortical, sparing of follicles



# Hairy Cell Leukemia

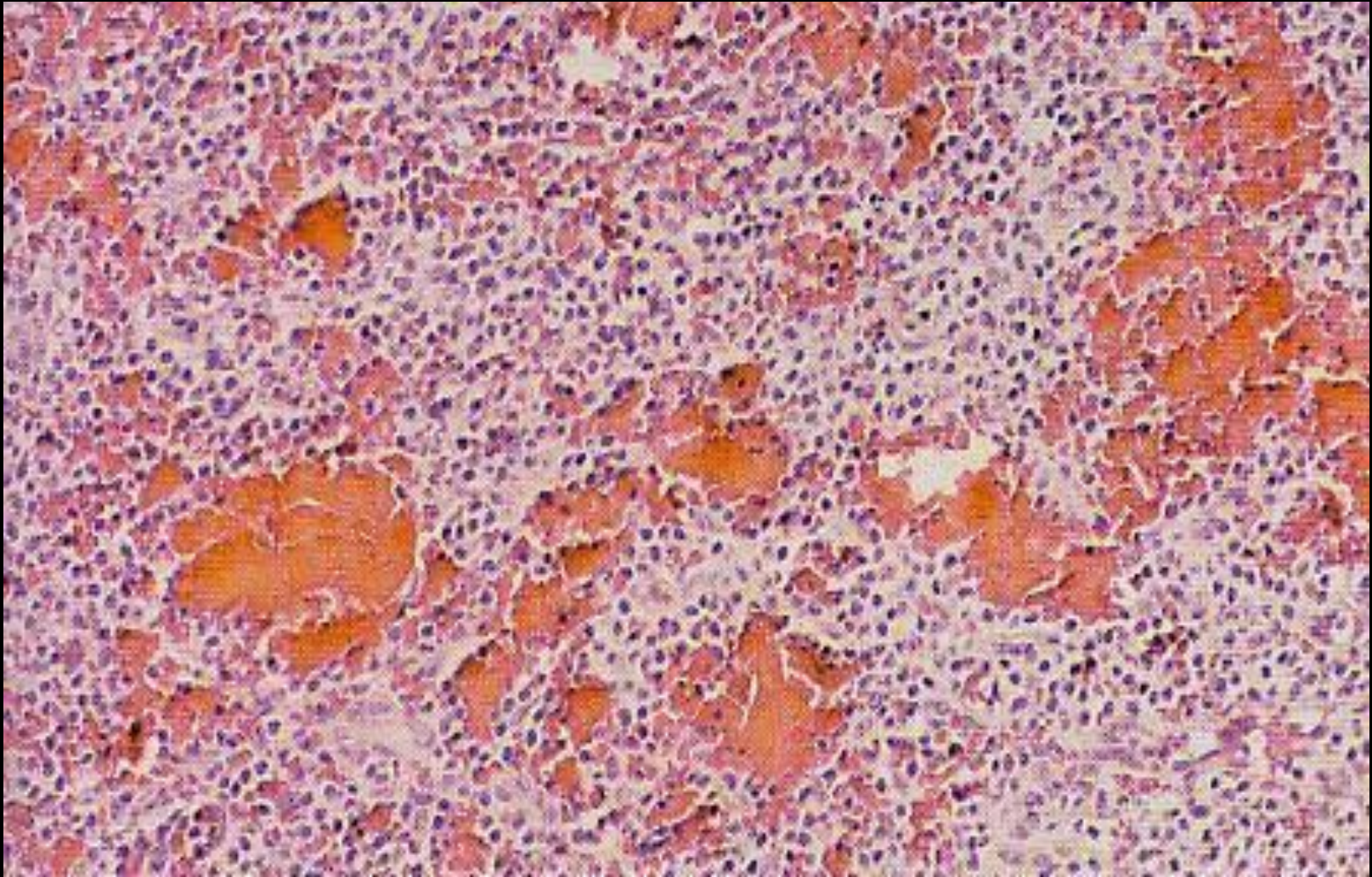
Spleen





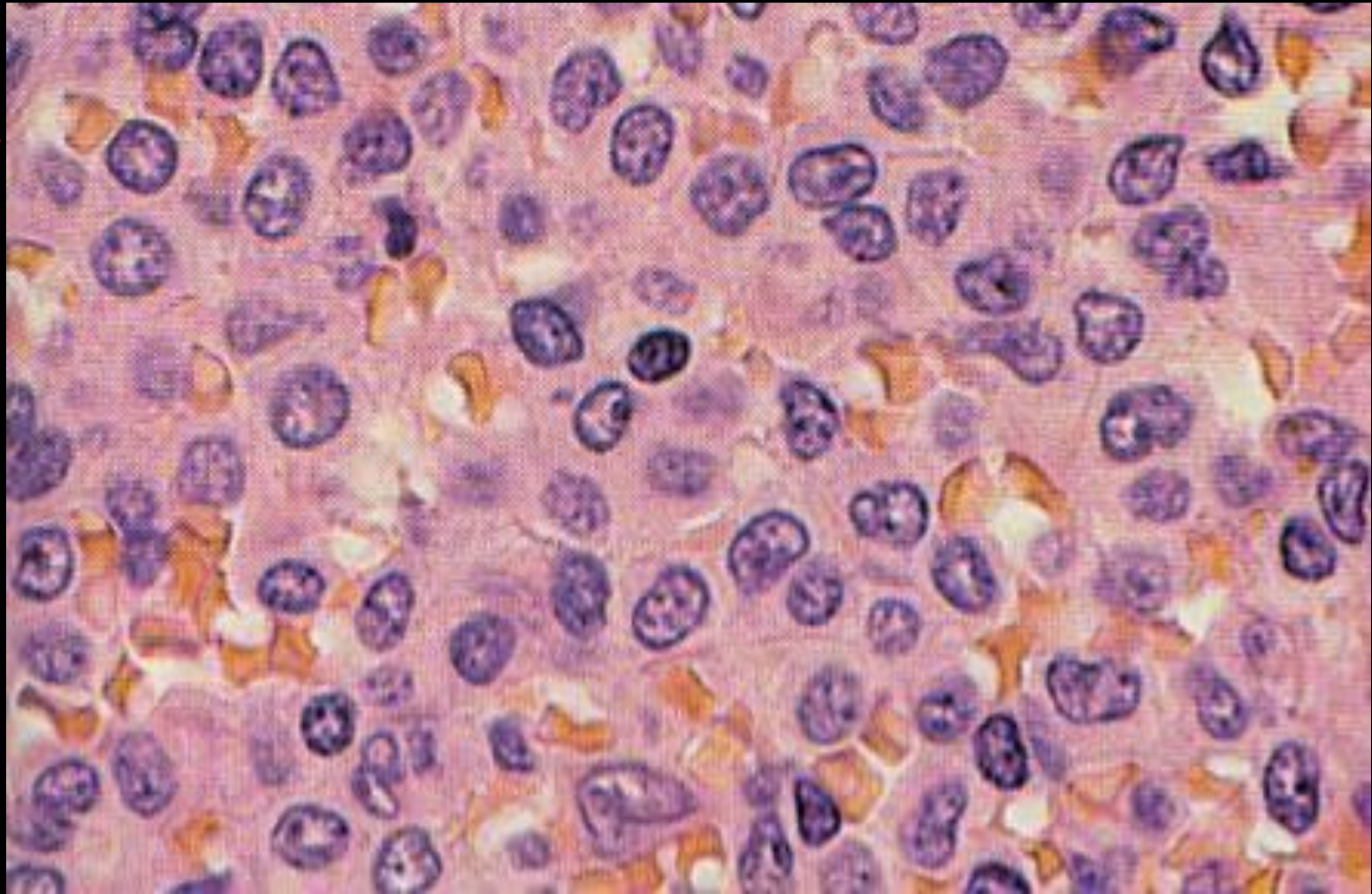
# Hairy Cell Leukemia

Spleen: red cell lakes

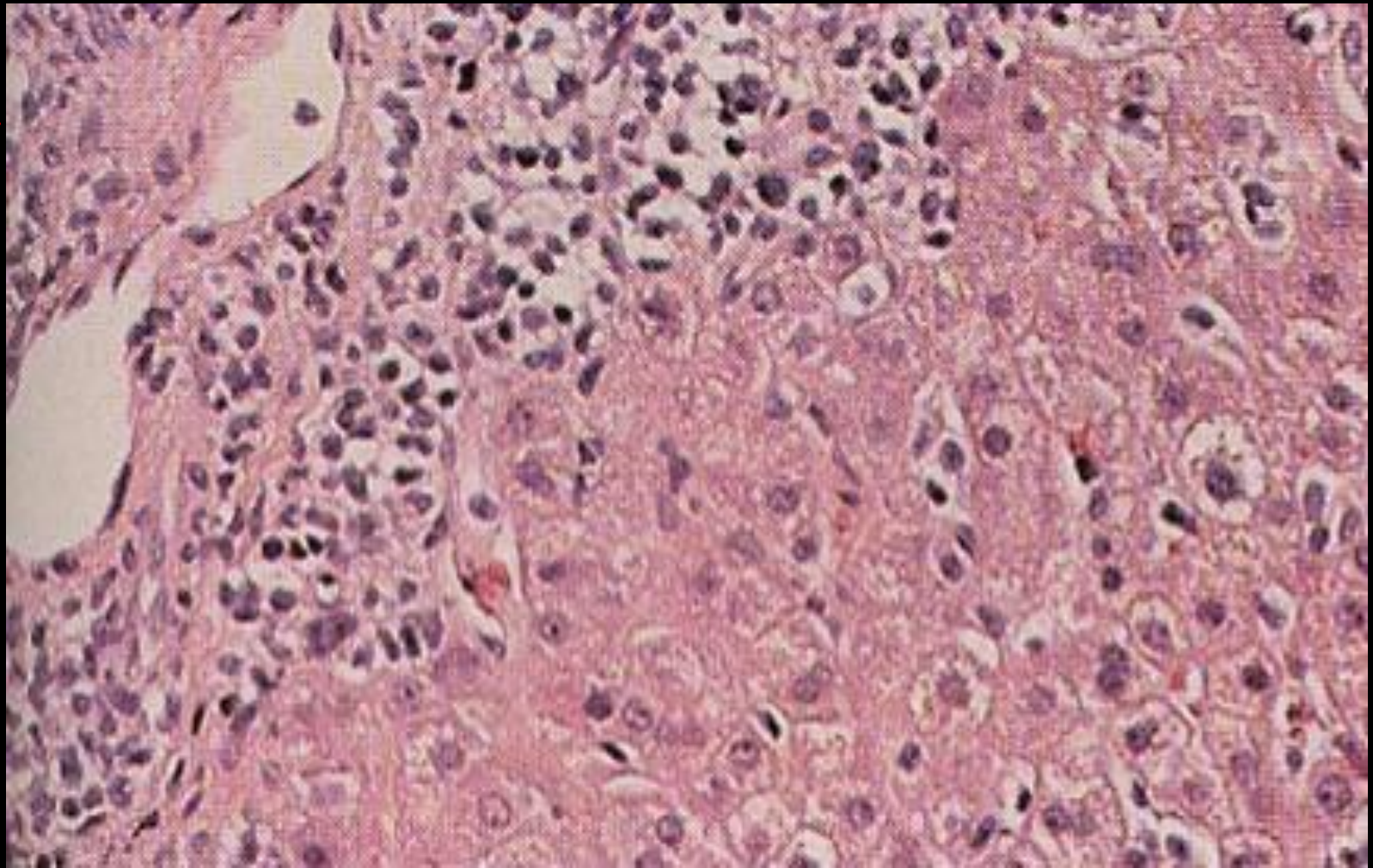




## Hairy Cell Leukemia: Spleen



## Hairy Cell Leukemia: Liver





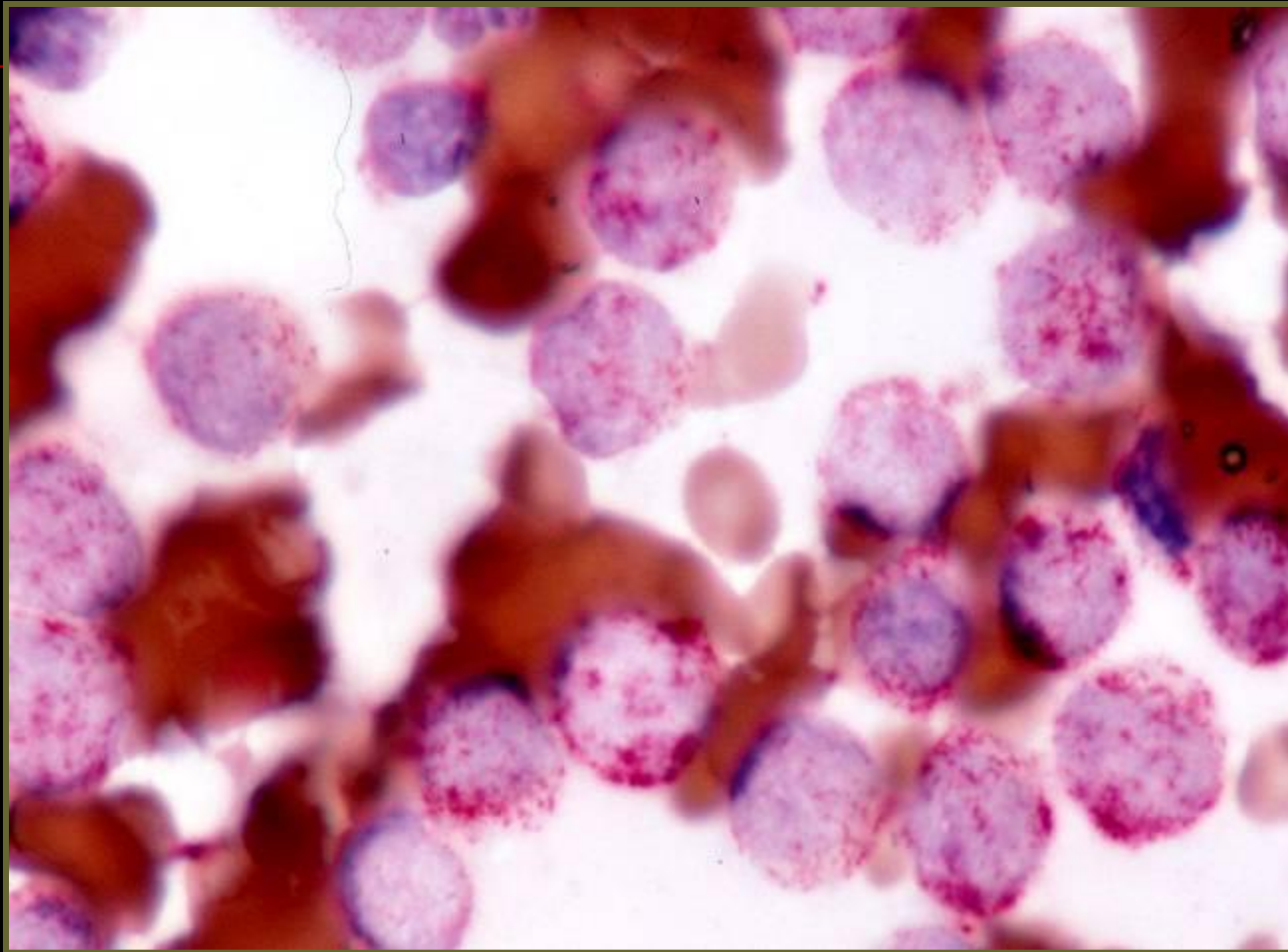
# Hairy Cell Leukemia

TRAP



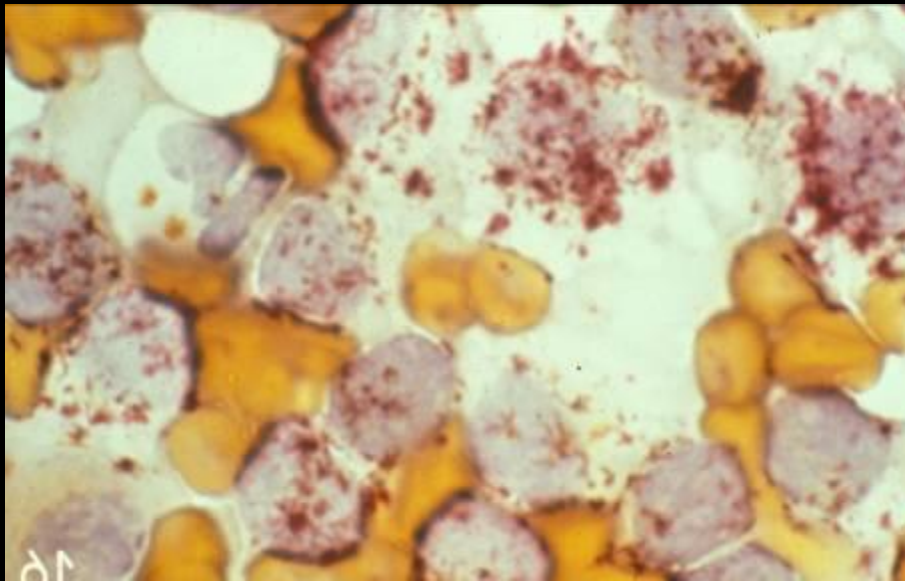
# Hairy Cell Leukemia

TRAP stain



# Hairy Cell Leukemia

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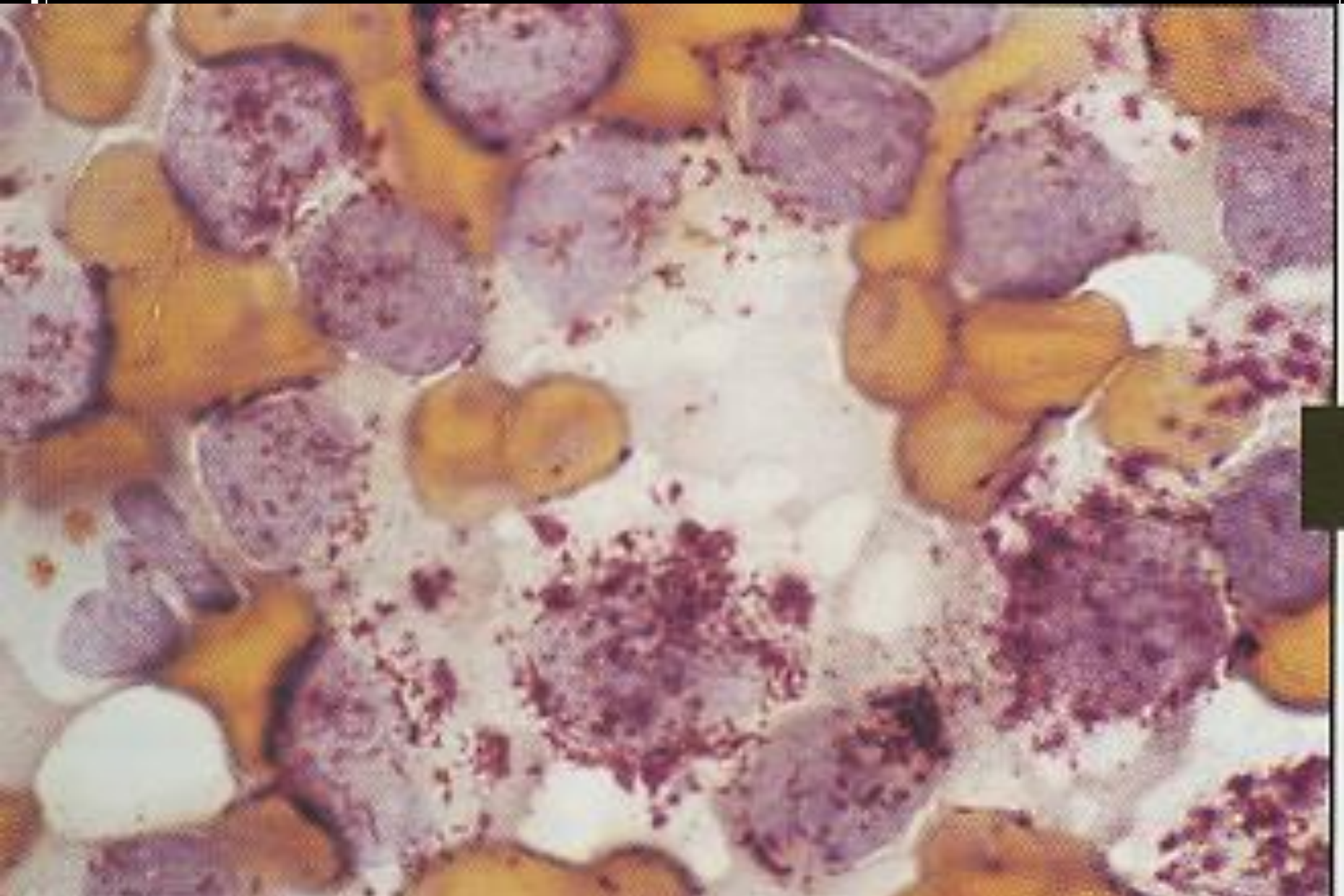


**TRAP stain**



# Hairy Cell Leukemia

TRAP



# Hairy Cell Leukemia

## Immunophenotype:

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### Positive:

-Surface SIg: M, +/- D, G, A

-CD19, CD20, CD79a, CD22

-CD11c, CD25, CD103, FMC7

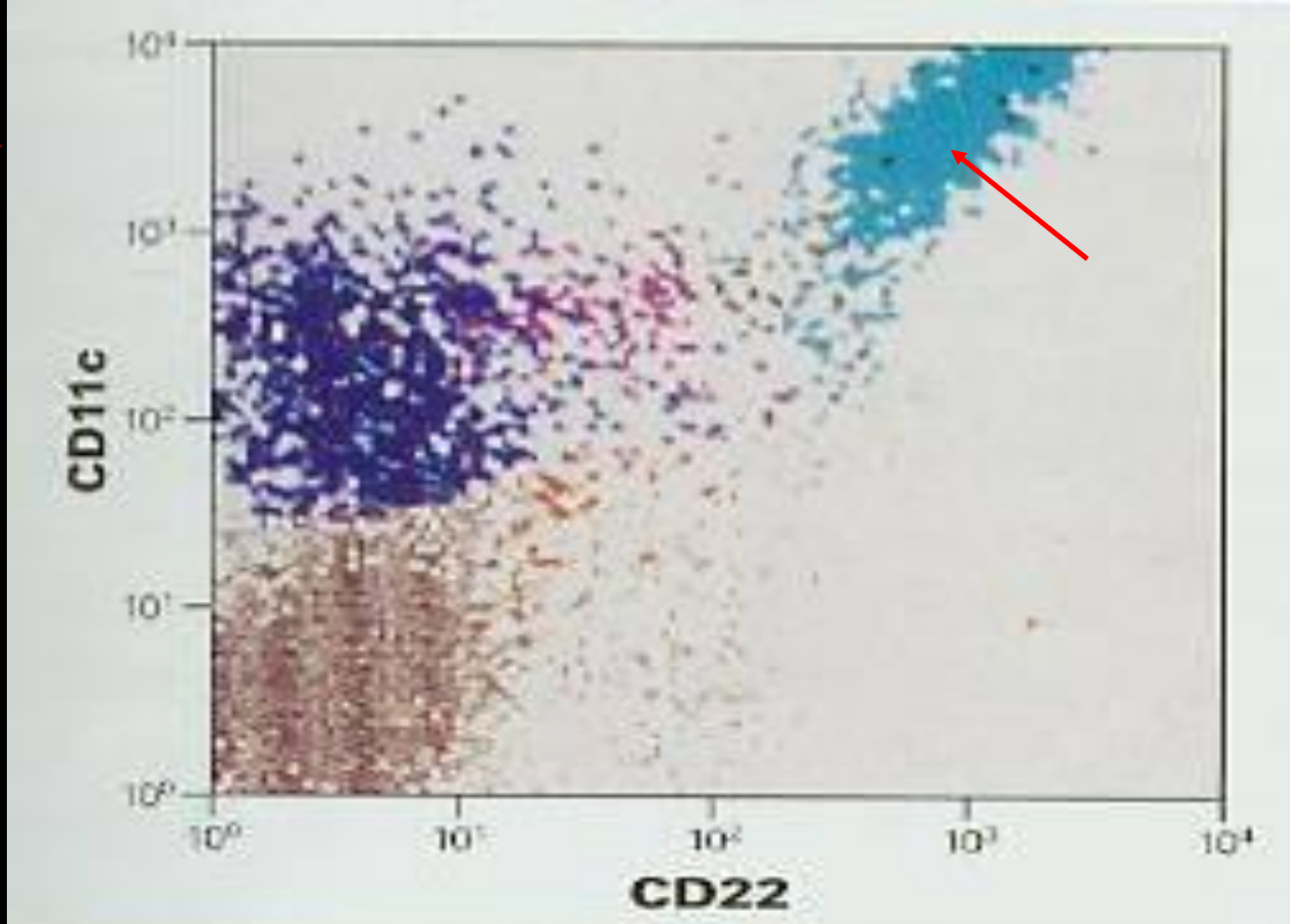
Tissue sections: DBA.44: strong (nonspecific)

### Negative:

-CD5, CD10, CD23, CD79b

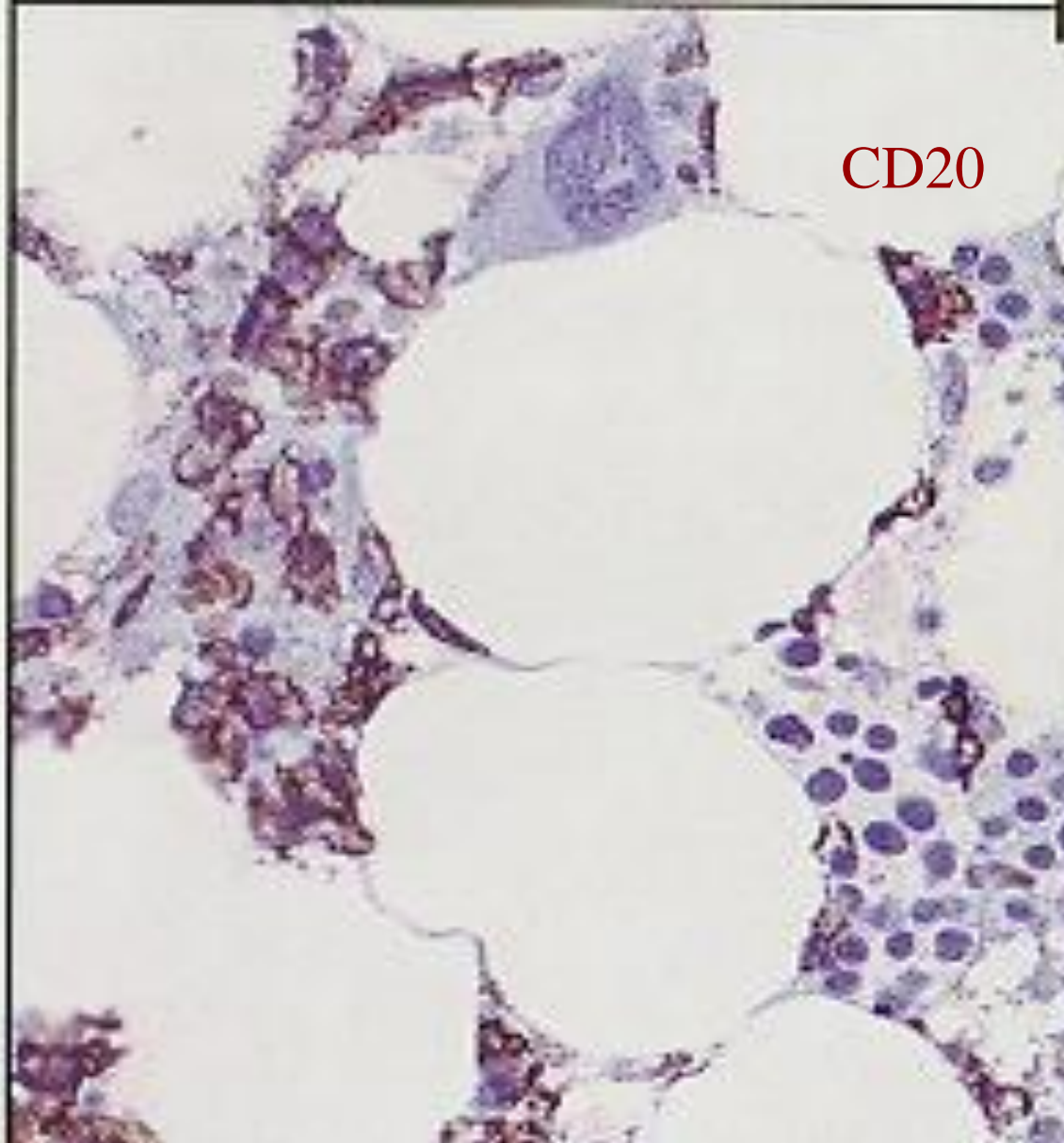
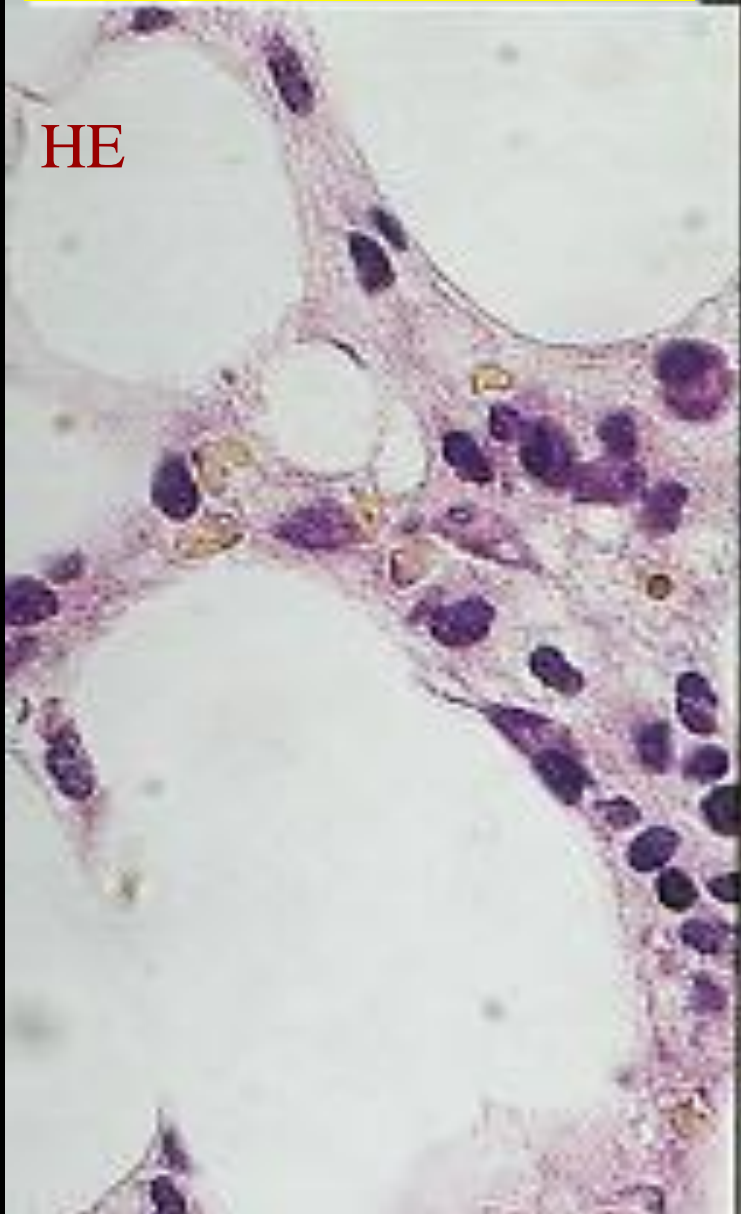
# Hairy Cell Leukemia

Flow



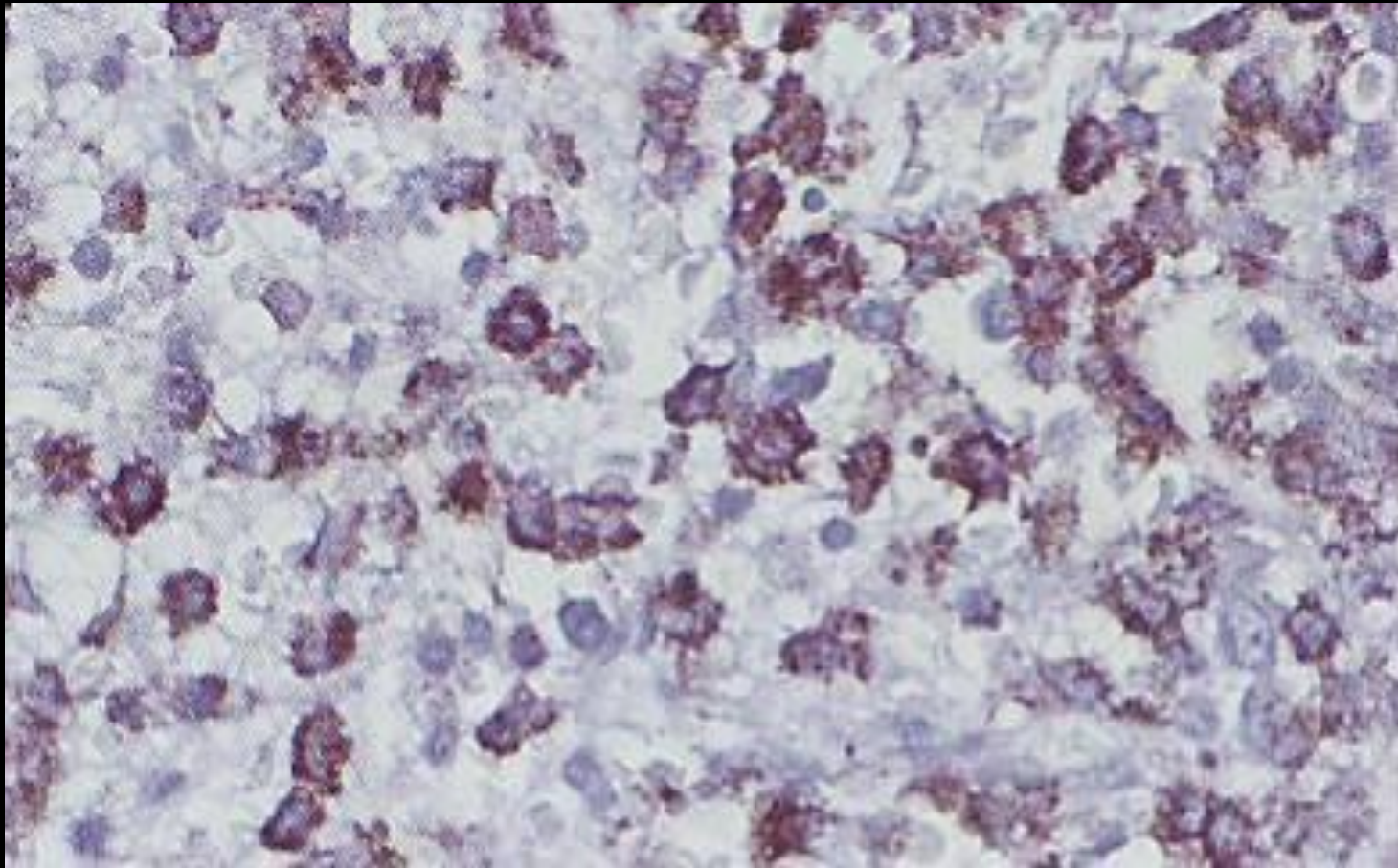


# Hairy Cell Leukemia



# Hairy Cell Leukemia

DBA.44

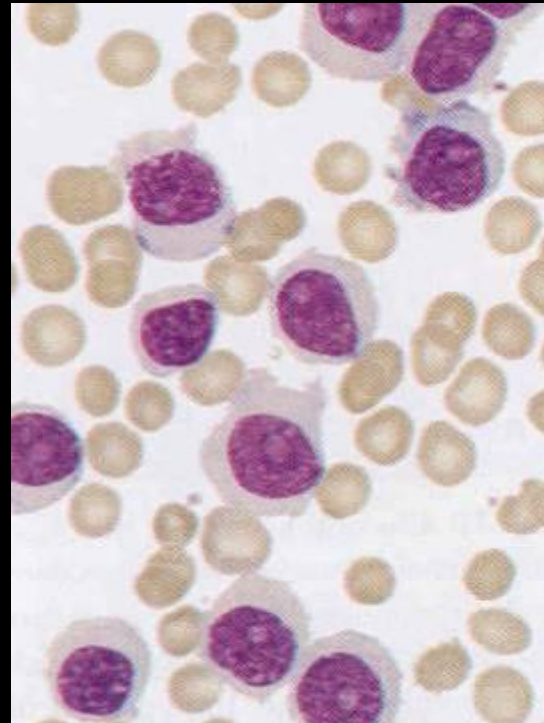
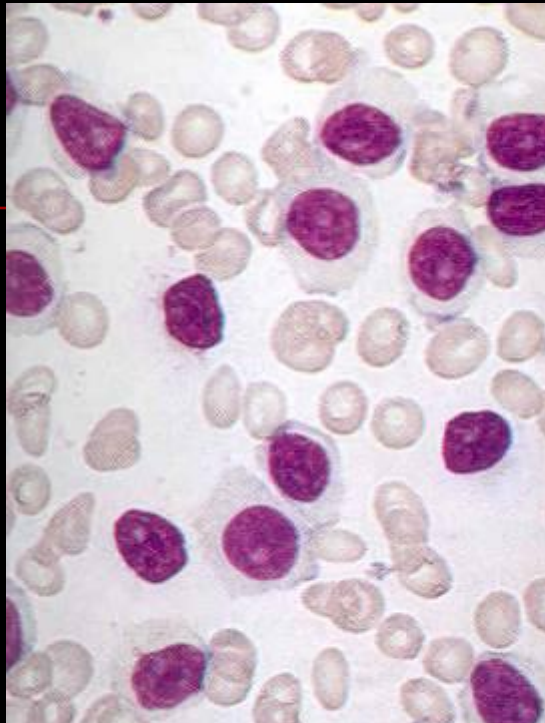


## Hairy Cell Leukemia

### Hairy cell variant:

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- Rare, similar to HCL in BM and Spleen
- Hairy projections with prominent nucleoli
- High WBC (50 k)
- No monocytopenia
- Lack: CD25, sometimes CD103, often TRAP(-)
- Poorly response to HCL therapy
- Older age: mean 70y/o



Hairy cell variant: elevated WBC count; Hairy projections with prominent nucleoli; CD 25(-) and TRAP(-)



# Hairy Cell Variants

## ■ Japanese variant

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- Leukocytosis
- CD11c+, CD22+, CD103+/-,
- CD25-, TRAP -
- CD10+, CD5+ (50%)

## ■ Prolymphocytoid variant

- Leukocytosis without neutropenia or monocytopenia
- High N/C ratio, more prominent nucleoli
- Immunophenotype intermediate between PLL and HCL
  - FMC7+, CD11c+, CD103 (in 1/3 of cases)
  - CD25-
- TRAP (+), localized to one pole of cell

# Hairy Cell Variants

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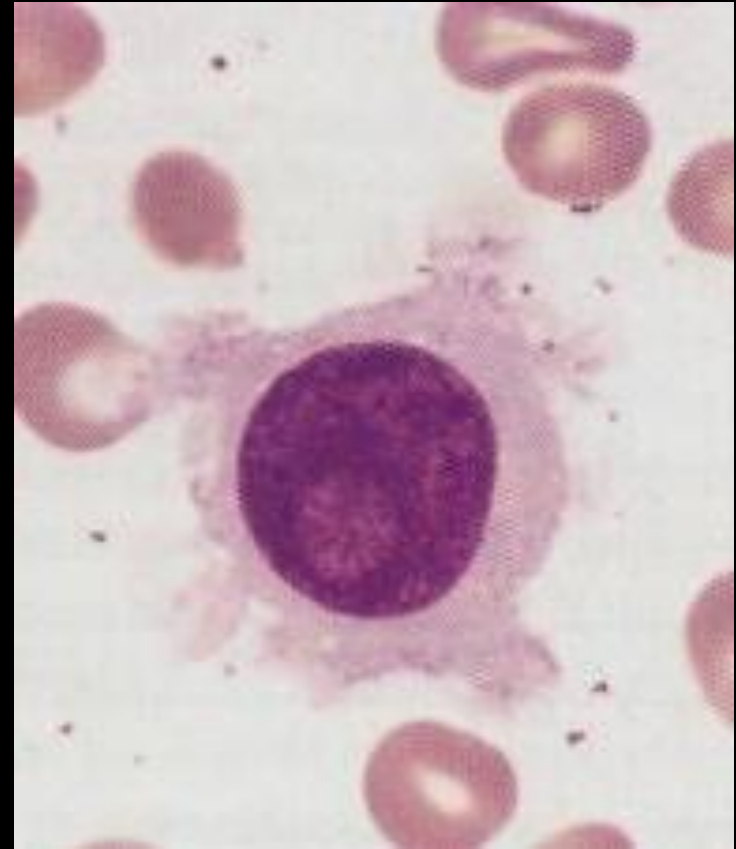
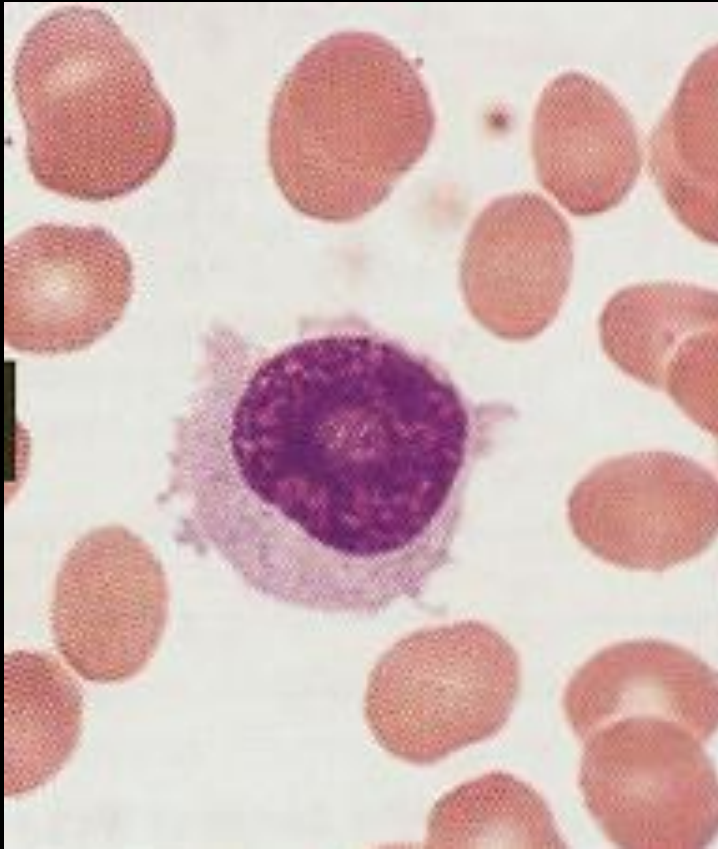
## ■ Blastic variant

- Report of 3 elderly patients with pancytopenia and splenomegaly
- TRAP (+) B cells with villous projections and blastic features
- Involvement of splenic red pulp
- Prominent adenopathy
- Prominent nucleoli and granules
- CD11c(+), CD25(+), TRAP (+)

# Hairy Cell Leukemia

Blastic variant

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# Hairy Cell Leukemia

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## Genetics:

- Ig heavy and light chain genes are rearranged
- Ig variable region genes mutated
- Post-germinal center cell origin



## Hairy Cell Leukemia

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# Cytogenetics and oncogenes:

- No specific cytogenetic abnormality
- Cyclin D1 overexpressed 50-70%
- No t(11;14) or BCL1 rearrangement

## Hairy Cell Leukemia

# Prognosis and predictive factors:

-Cause of death: infection, rare transformation

-Treatment :

-Purine nucleoside analogues: treatment of choice

CR 75-90%,

4 year survival: 80%

-Deoxycoformycin (Pentostatin)

-2-Chlorodeoxyadenosine (2 CdA)

-Splenectomy: if symptomatic

-Interferon-alfa 2b: CR 5-30%

# Differential Diagnosis

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- CD11c+ CLL
  - May have hairy projections (aged blood)
  - More clumped chromatin
  - TRAP (-)
  - CD5+, weak expression of sIg and CD11c+
  - CD103-
  - Typically involves splenic white pulp

# Differential Diagnosis

- Splenic marginal zone lymphoma with or without villous lymphocytes
  - Cytopenias, splenomegaly and minimal lymphadenopathy
  - Patients older than in HCL
  - Smaller cells with more clumped chromatin, less cytoplasm
  - Short villous projections concentrated at one pole
  - TRAP (-), CD22+, FMC-7+, CD11c (1/2)
  - 25% CD25+, CD103+
  - \*Involves white pulp of spleen

# Differential Diagnosis

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## ■ B-PLL

- Leukocytosis
- Nodular or diffuse BM infiltrate
- TRAP can be positive (usually weak)
- CD79b+, CD22+, FMC-7+
- Usually CD11c, CD25 negative
- Variable CD5
- White pulp +/- red pulp