

Normal Bone Marrow Morphology

Emily Glynn

University of Washington

Components of a Bone Marrow Study

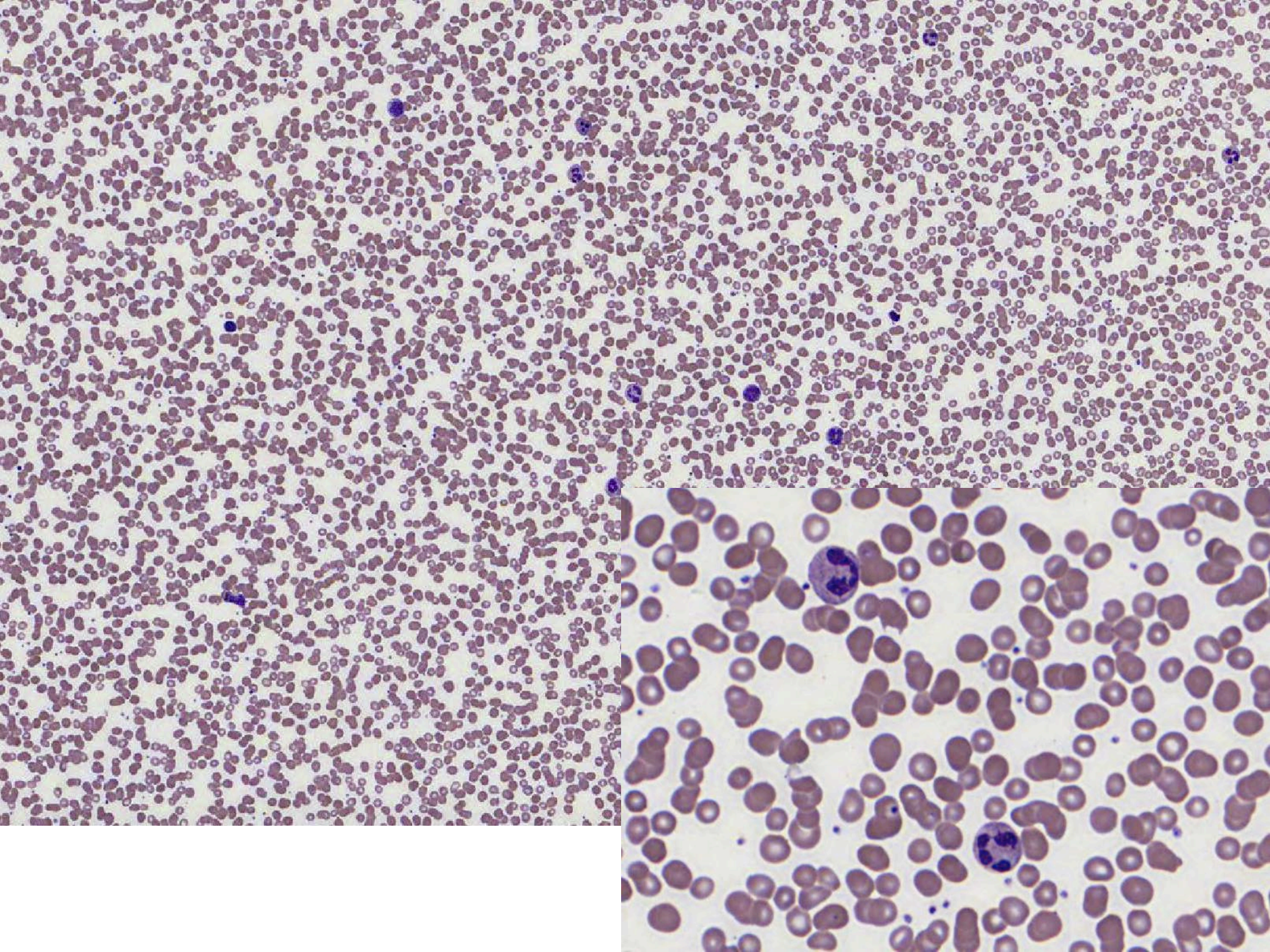
1. Peripheral Blood
2. Aspirate smears or touch preparations
3. Core/Trephine biopsy



1 - Peripheral Blood

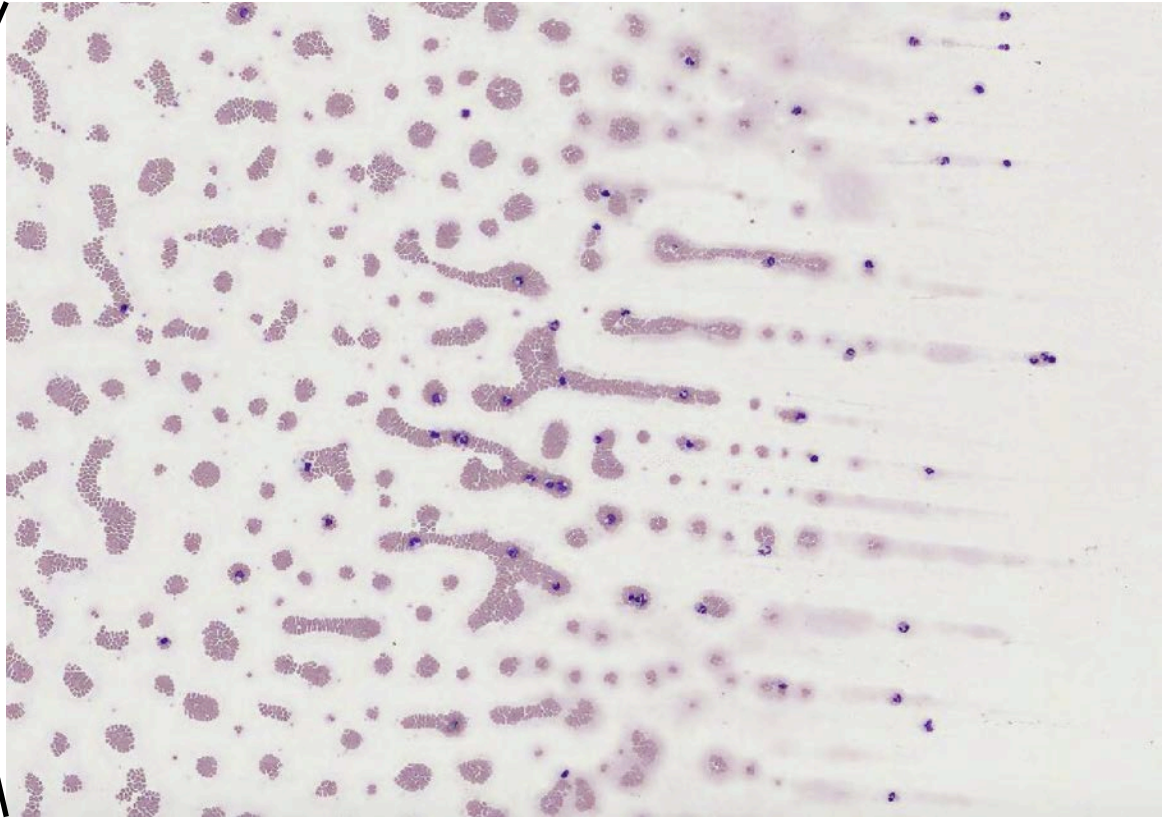
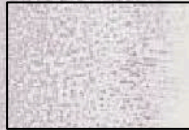
- Wright-stained slides prepared from a smeared drop of peripheral blood
- Used for the assessment of:
 - Cytopenias or cytoses
 - Leukocyte distribution and morphology
 - RBC and platelet morphology
 - Abnormal populations (e.g. circulating blasts or other atypical cells)





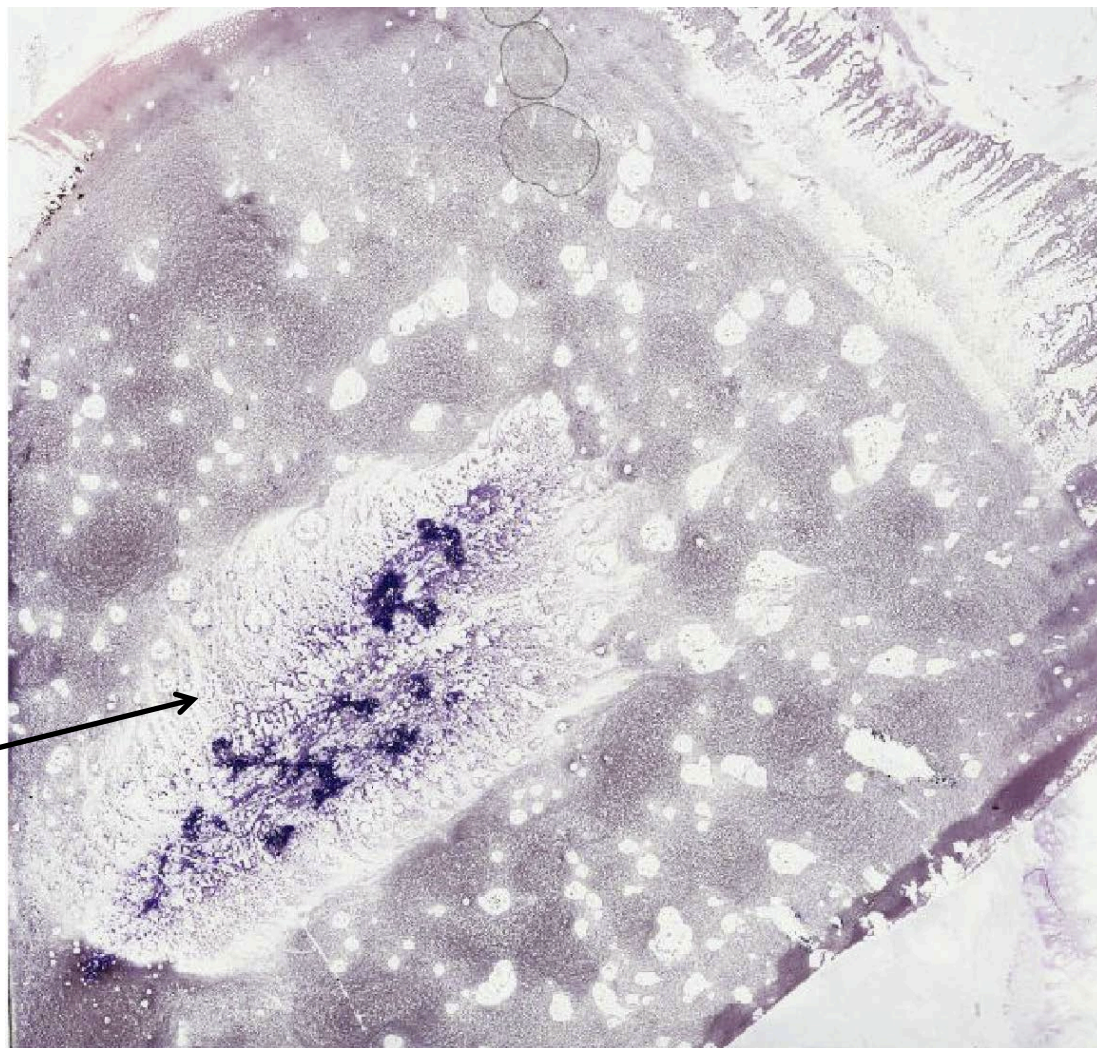
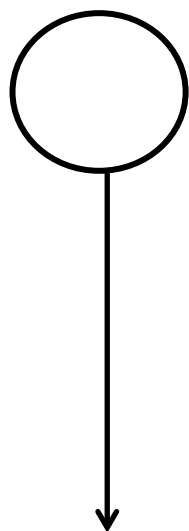
Feathered Edge

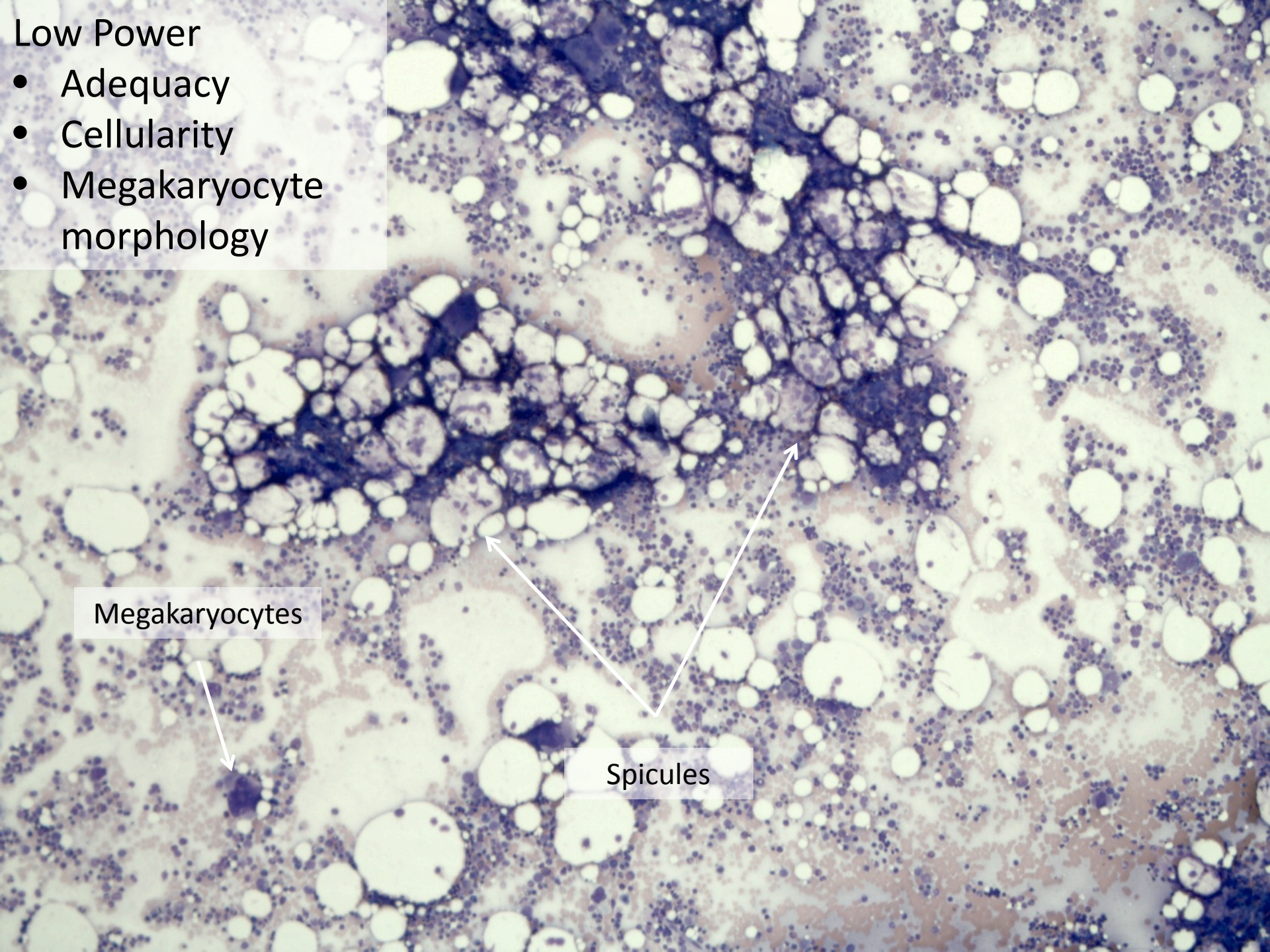
A good place to look for circulating blasts and atypical cells



2 – Aspirate Smears

- Wright-stained cover slips or slides prepared from bone marrow spicules
- Used for assessment of:
 - Study adequacy
 - Rough estimate of cellularity (hypo-, normo-, hyper-)
 - Presence of trilineage hematopoiesis and maturation
 - Myeloids, erythroids, and megakaryocytes
 - Morphology
 - Enumeration
 - Myeloids, erythroids, lymphocytes, plasma cells, blasts
 - Myeloid to erythroid ratio
 - Abnormal populations
- Assessment of storage iron and ring sideroblasts should be reserved for the aspirate





Low Power

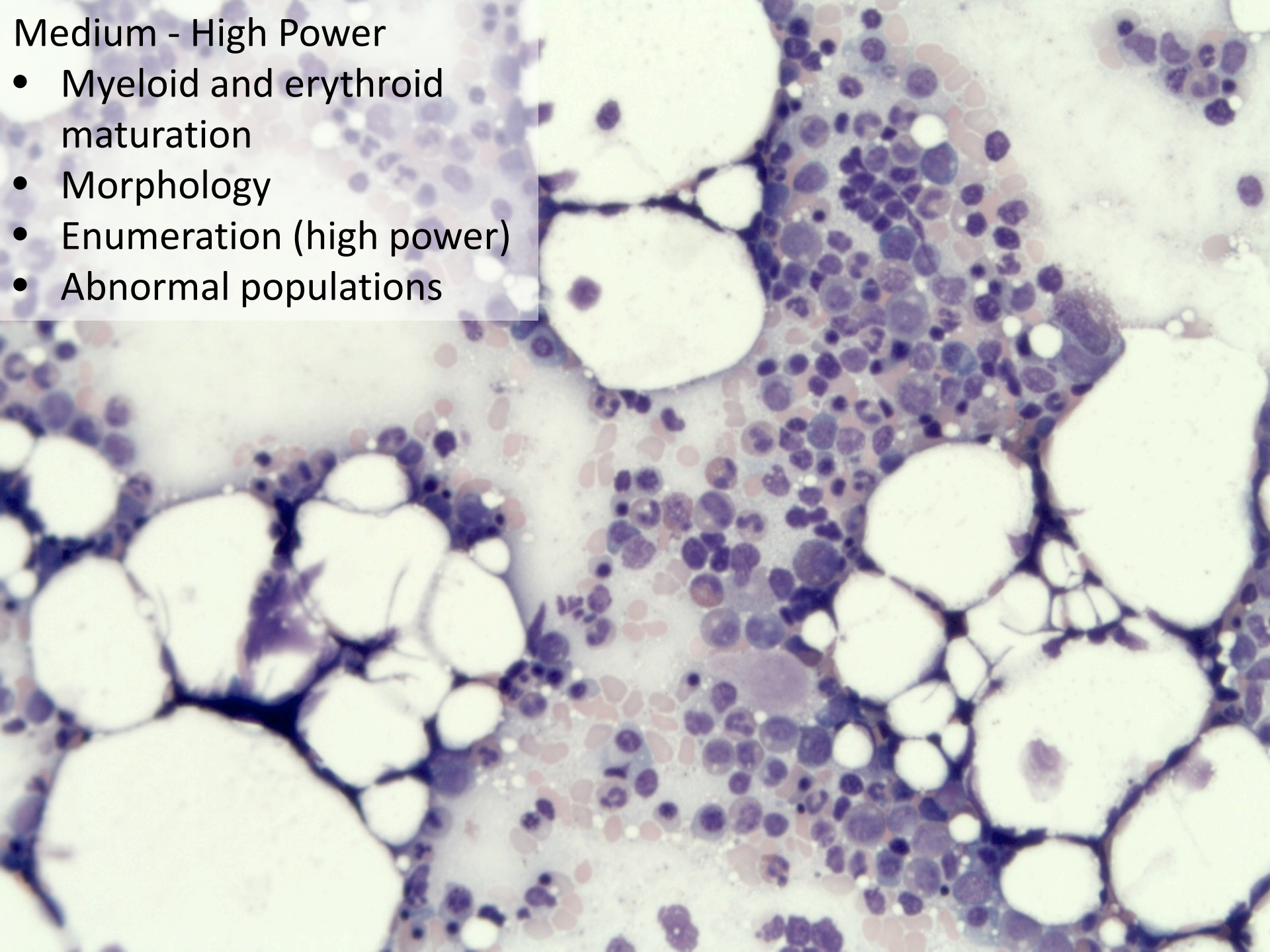
- Adequacy
- Cellularity
- Megakaryocyte morphology

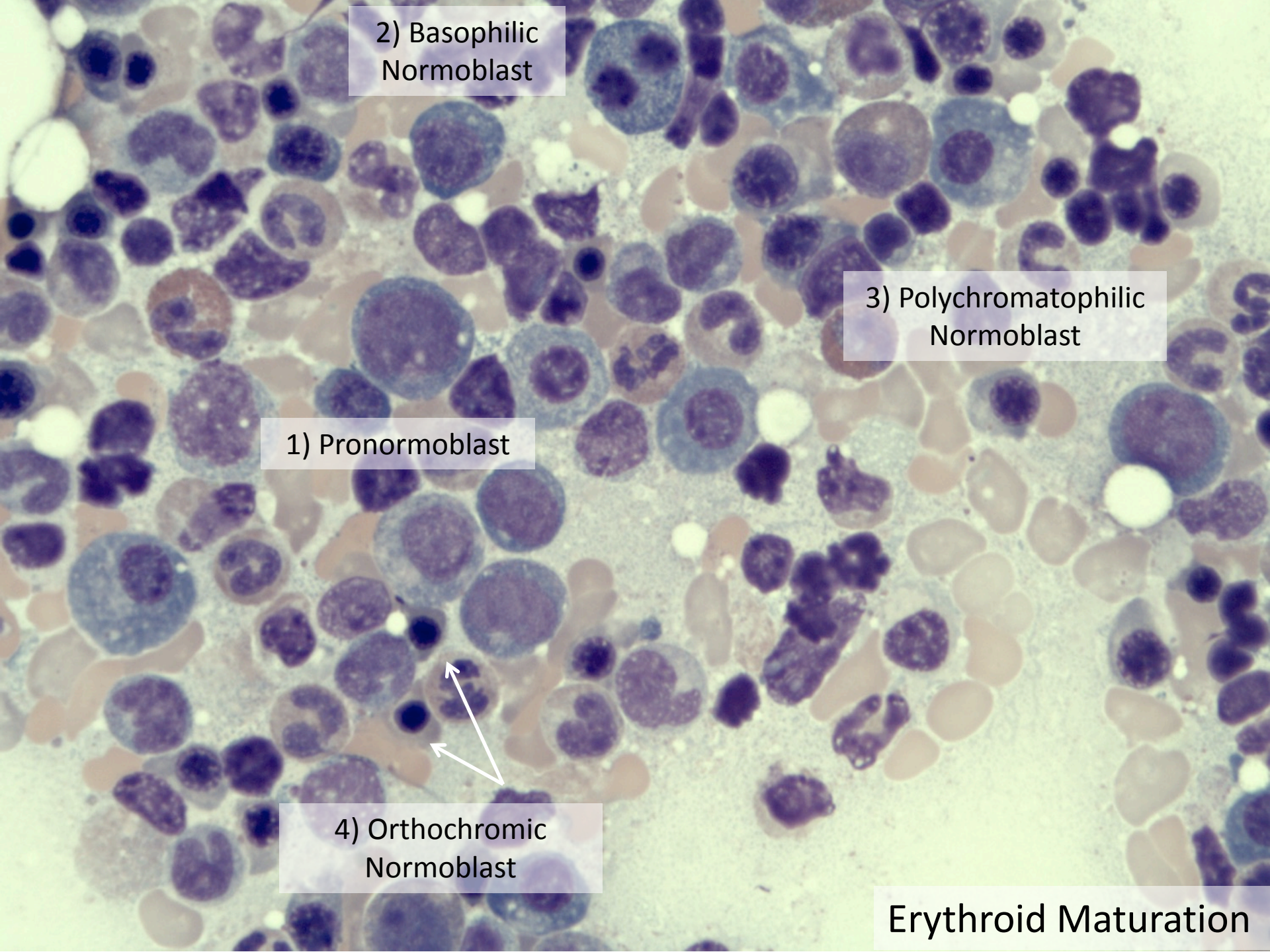
Megakaryocytes

Spicules

Medium - High Power

- Myeloid and erythroid maturation
- Morphology
- Enumeration (high power)
- Abnormal populations





2) Basophilic Normoblast

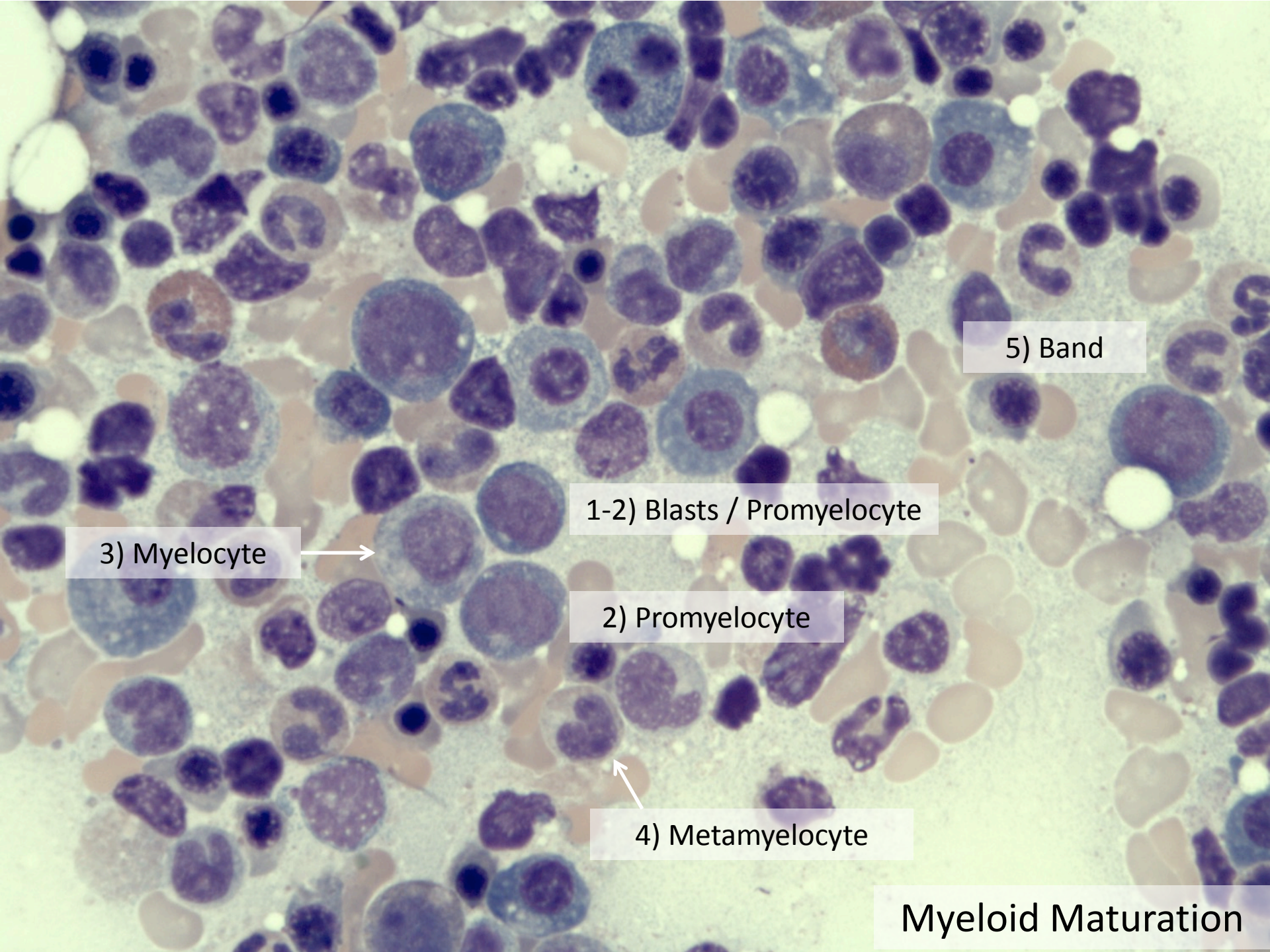
This image shows a dense population of erythroid precursors at different stages of maturation. The cells are stained with hematoxylin and eosin (H&E). The nuclei are stained dark purple, and the cytoplasm and surrounding tissue are stained pink. The cells vary in size and nuclear appearance, from large, immature forms to smaller, more mature ones. The labels are placed in semi-transparent boxes over the corresponding cell types.

3) Polychromatophilic Normoblast

1) Pronormoblast

4) Orthochromic Normoblast

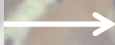
Erythroid Maturation



5) Band

1-2) Blasts / Promyelocyte

3) Myelocyte

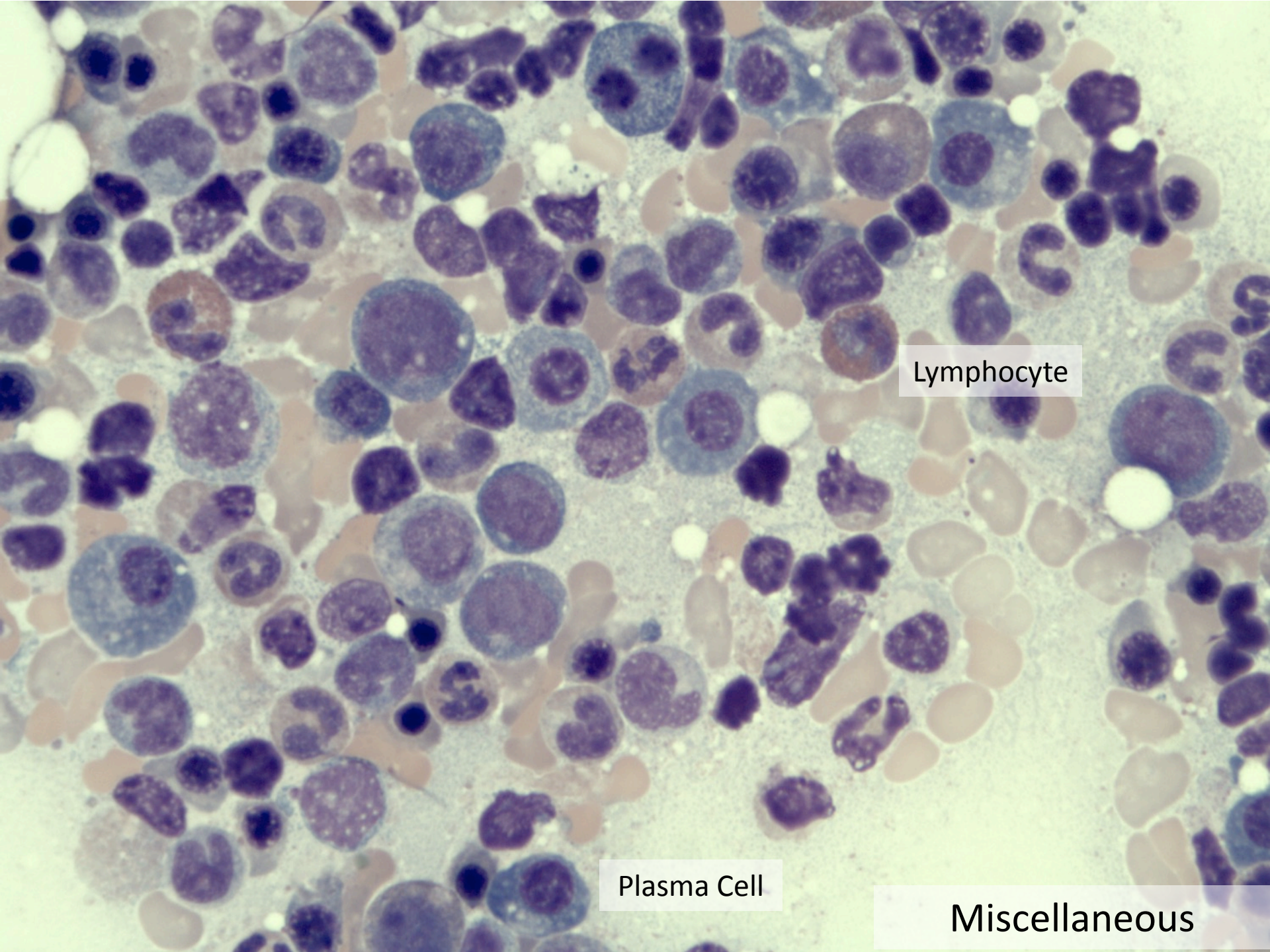


2) Promyelocyte

4) Metamyelocyte



Myeloid Maturation



Lymphocyte

Plasma Cell

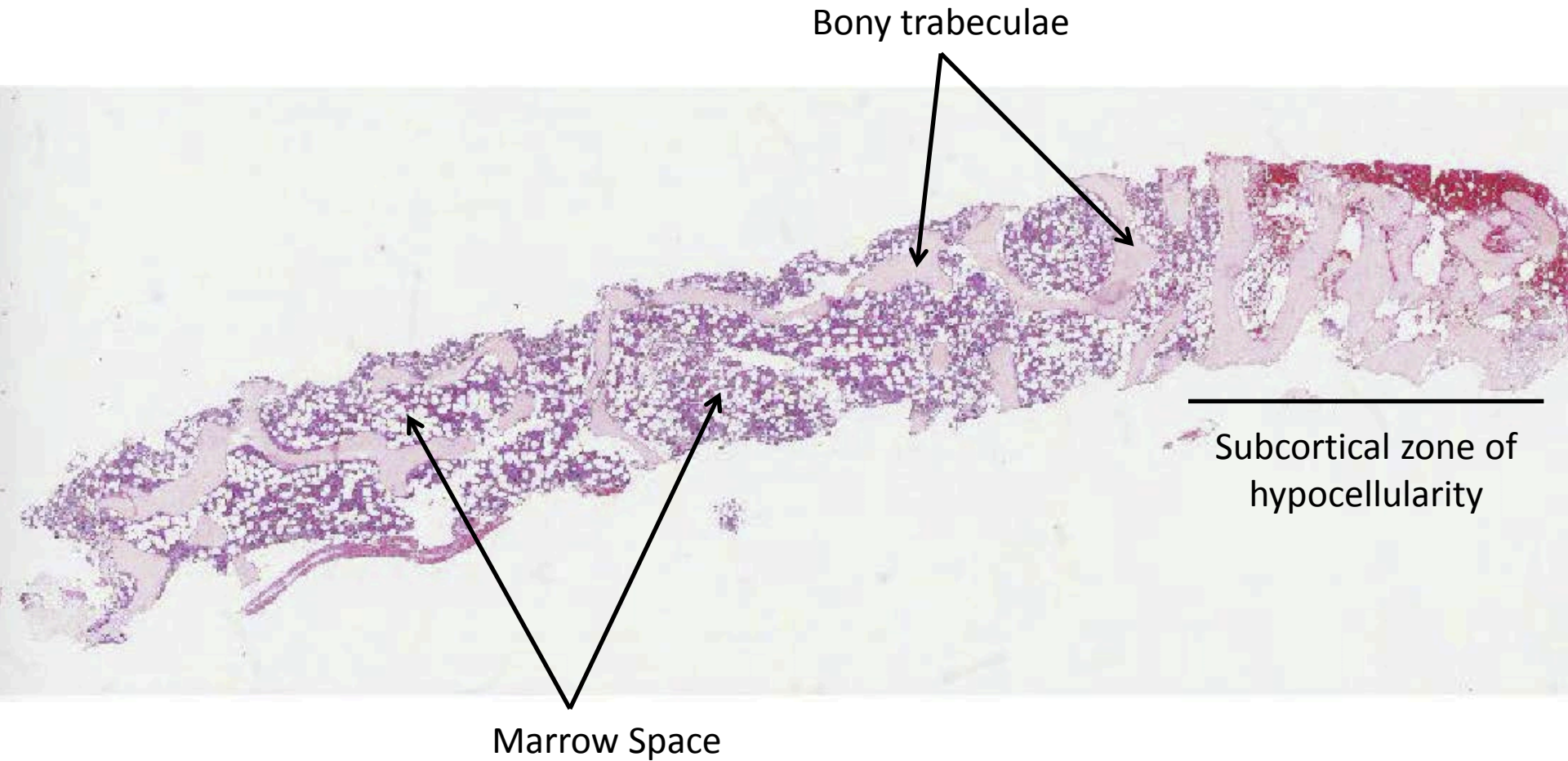
Miscellaneous

2 – Aspirate Smears Summary

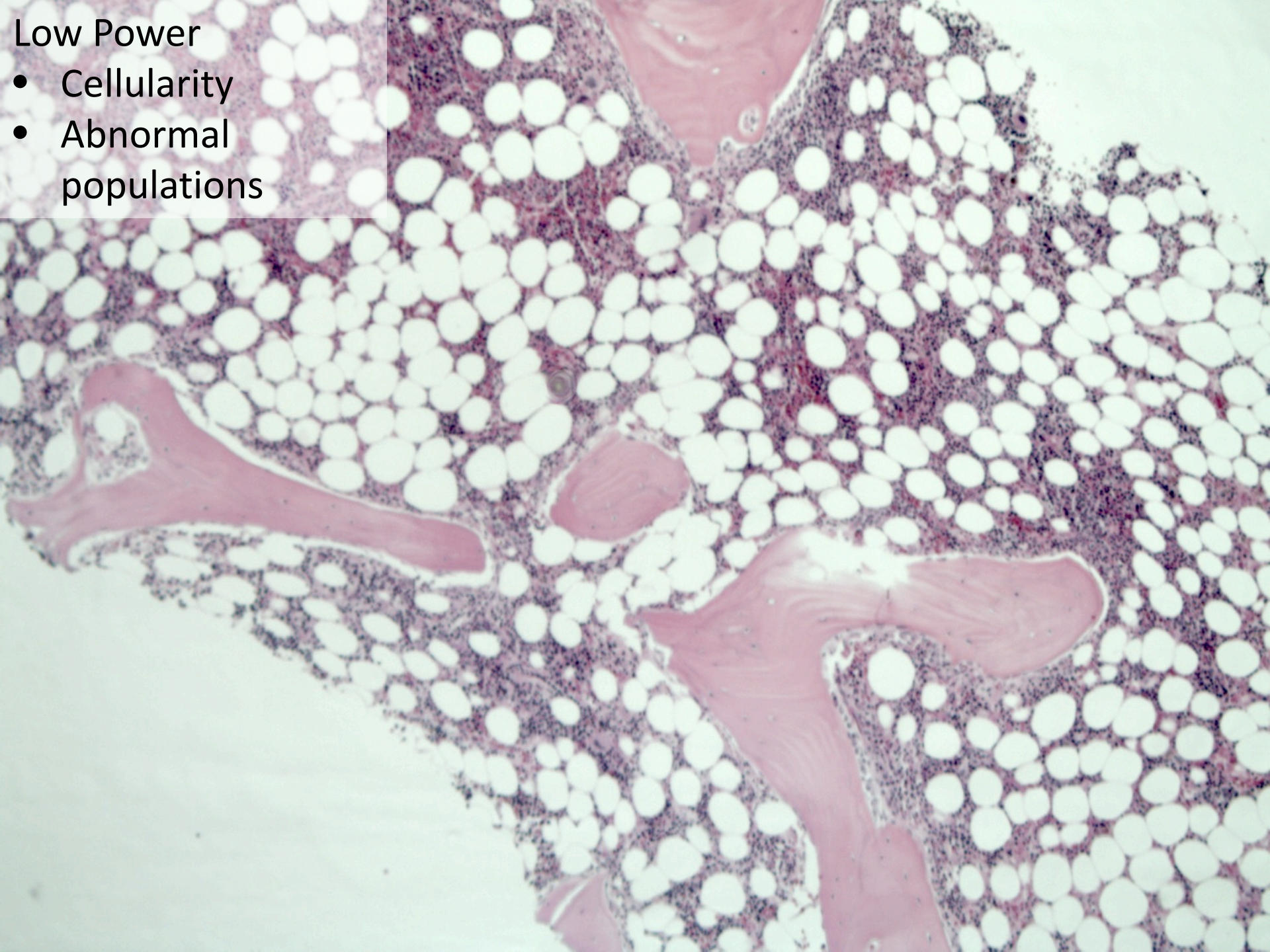
- Low Power
 - Assess study adequacy
 - Rough estimate of cellularity
 - Identify megakaryocytes and assess morphology
 - Overtly abnormal populations
- Medium to High Power
 - Assess myeloid and erythroid maturation and morphology
 - Enumeration
 - Identify abnormal populations that are more subtle

3 – Core Biopsy

- The bone marrow core is decalcified, fixed in formalin, paraffin-embedded, thinly sectioned and stained with hematoxylin and eosin.
- Used for the assessment of:
 - More precise estimate of cellularity
 - Marrow architecture
 - Marrow fibrosis
 - Abnormal populations that were inaspirable



An adequate core biopsy should be at least 1.5 cm in length and contain at least 10 inter-trabecular areas

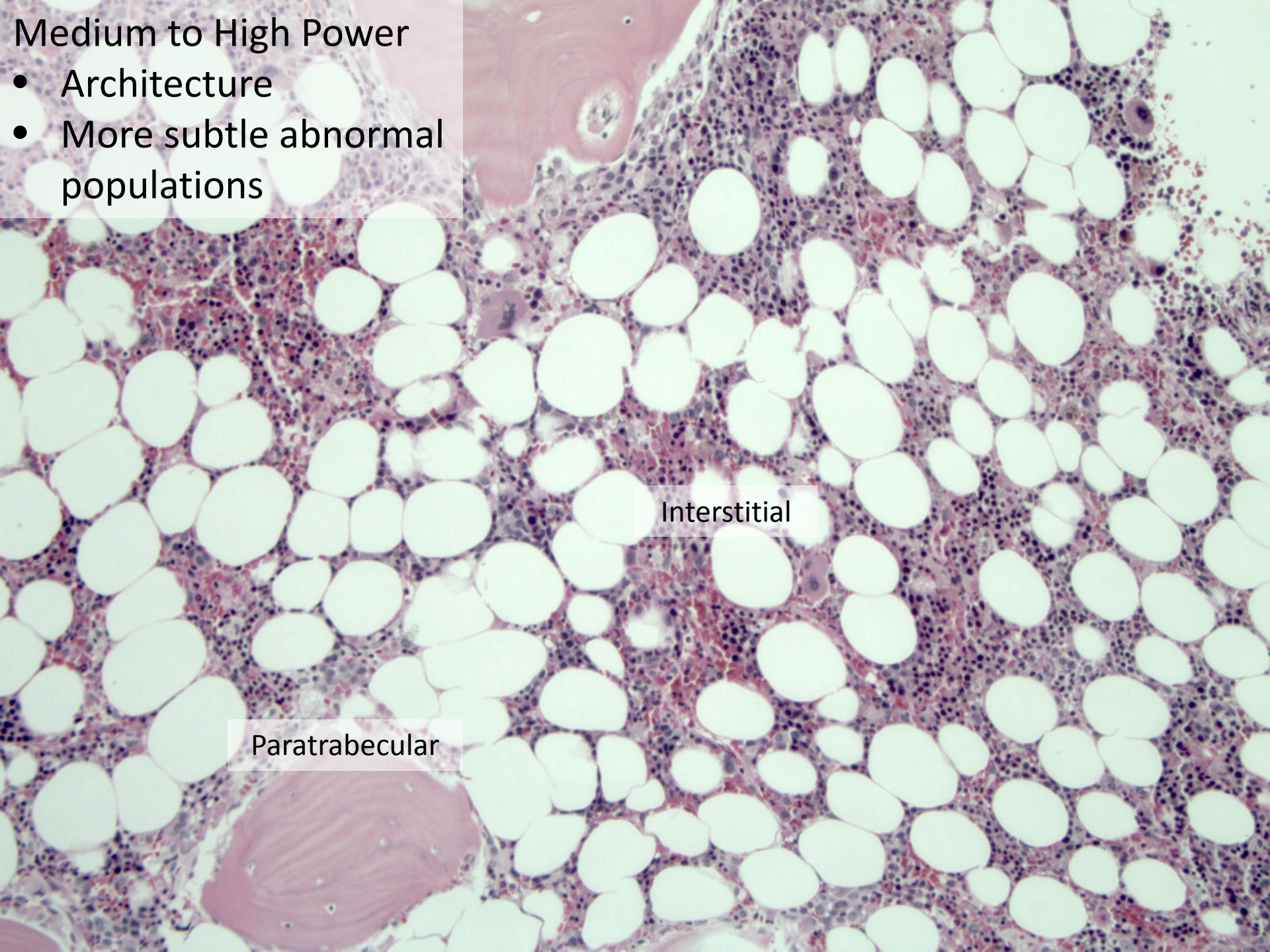


Low Power

- Cellularity
- Abnormal populations

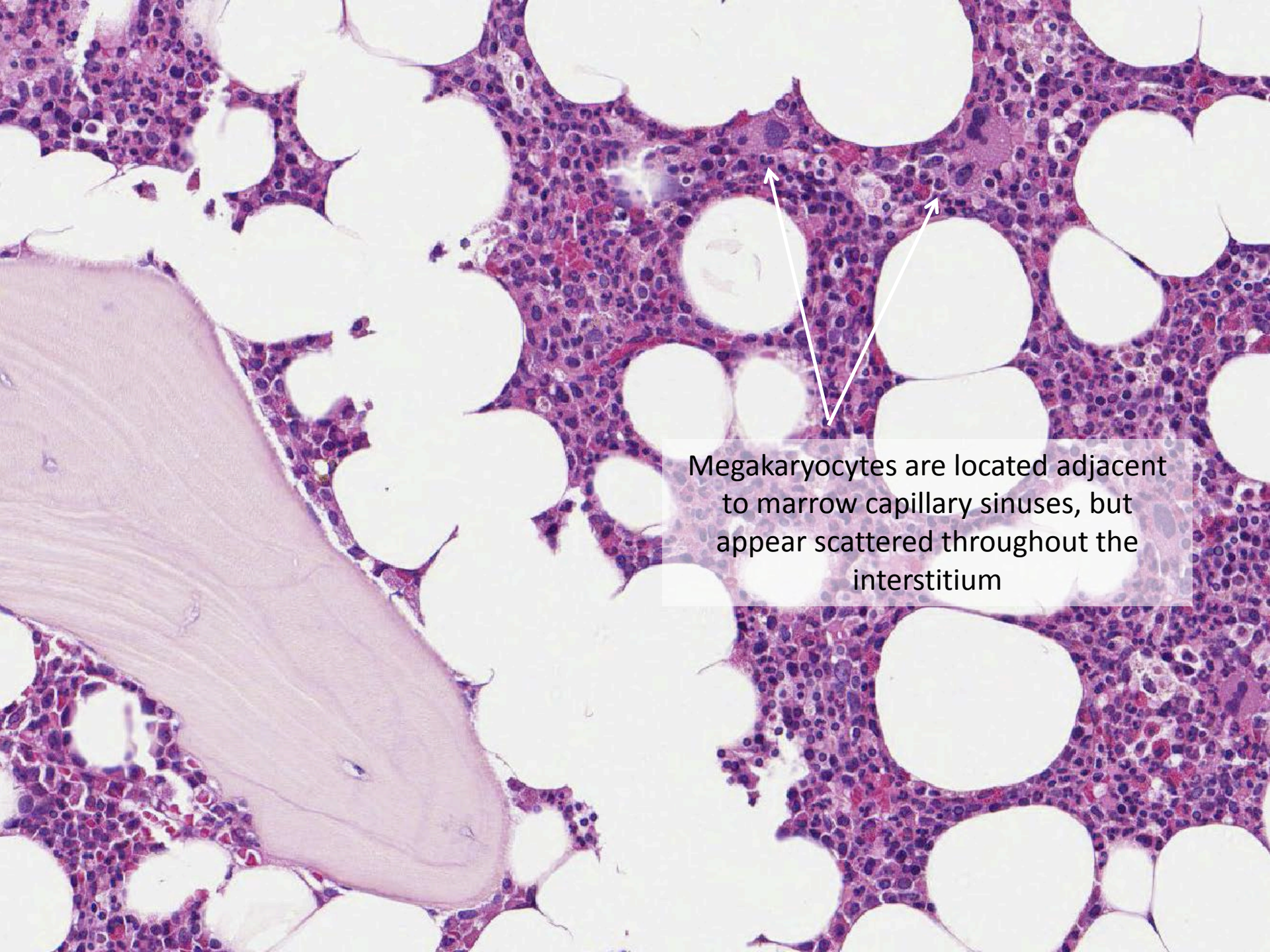
Medium to High Power

- Architecture
- More subtle abnormal populations

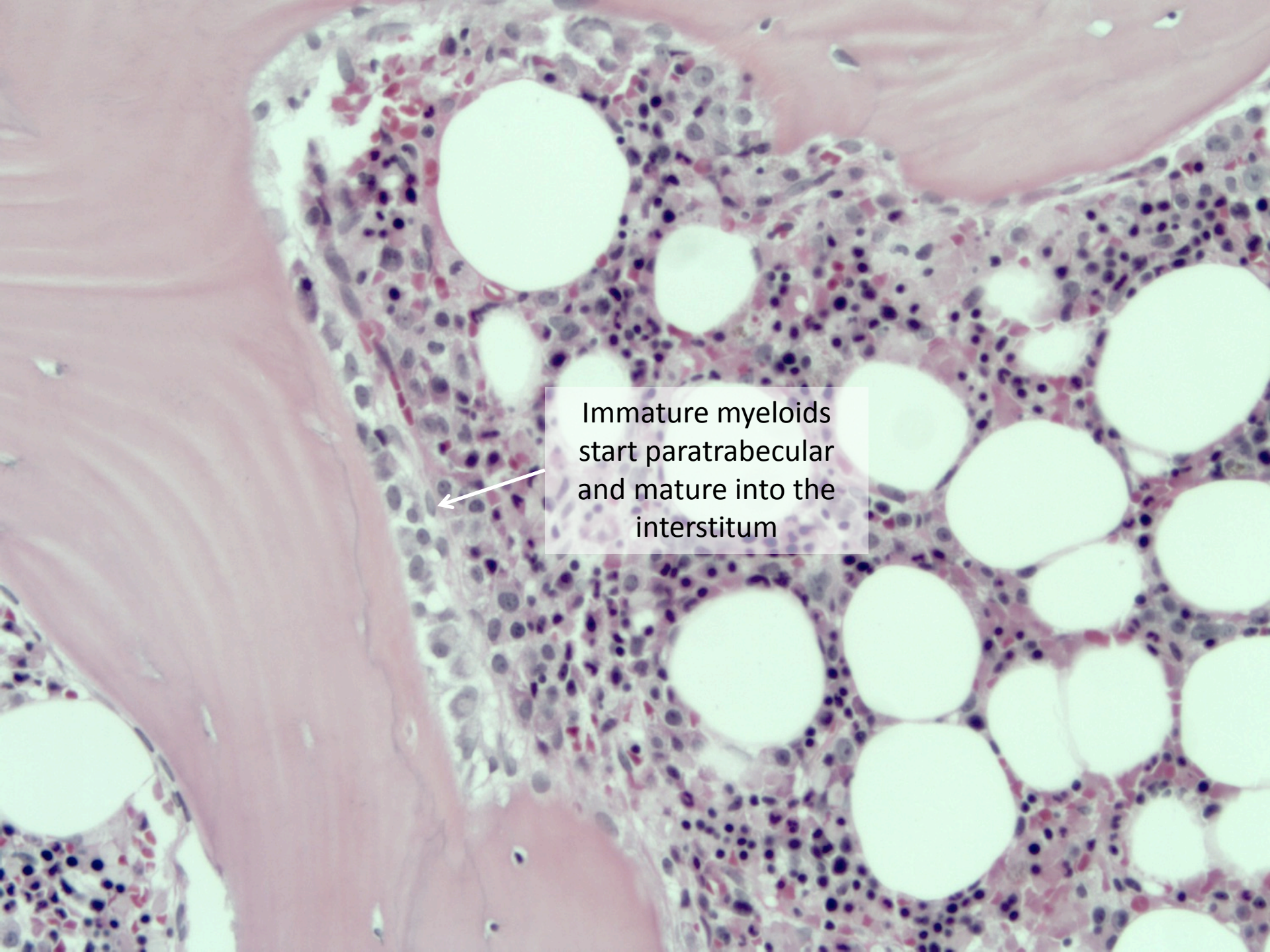


Interstitial

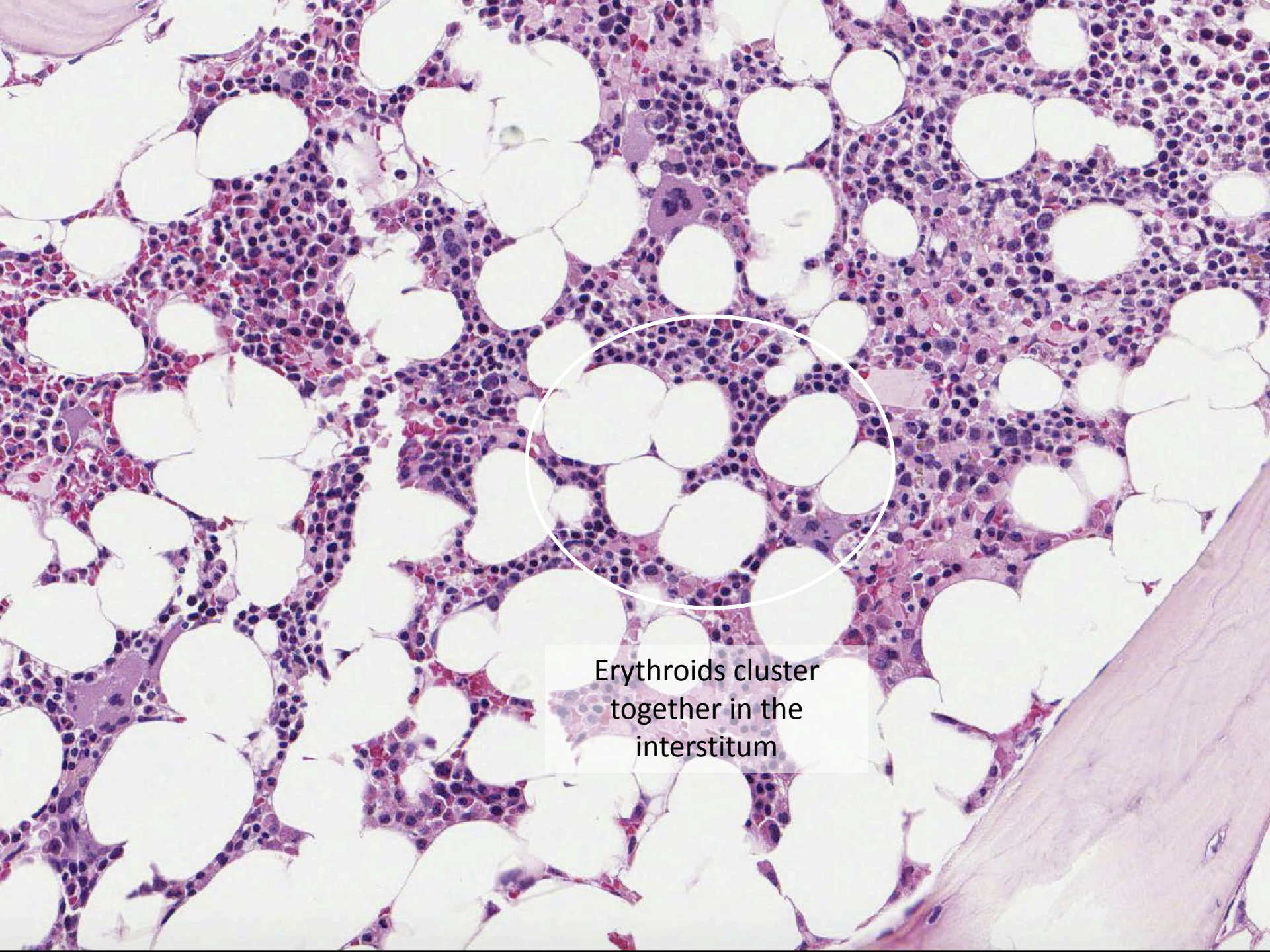
Paratrabeccular



Megakaryocytes are located adjacent to marrow capillary sinuses, but appear scattered throughout the interstitium

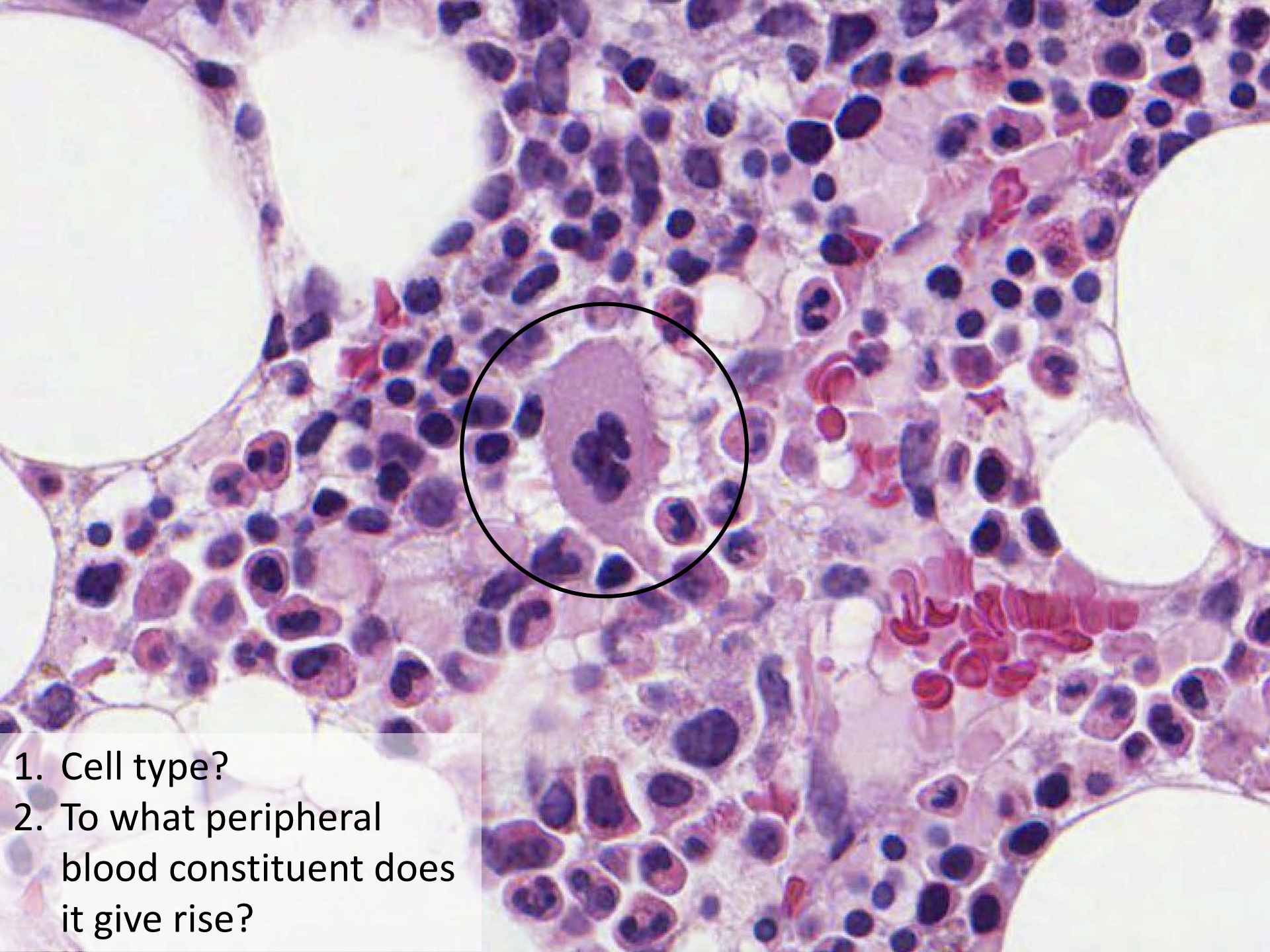


Immature myeloids
start paratrabecular
and mature into the
interstitium

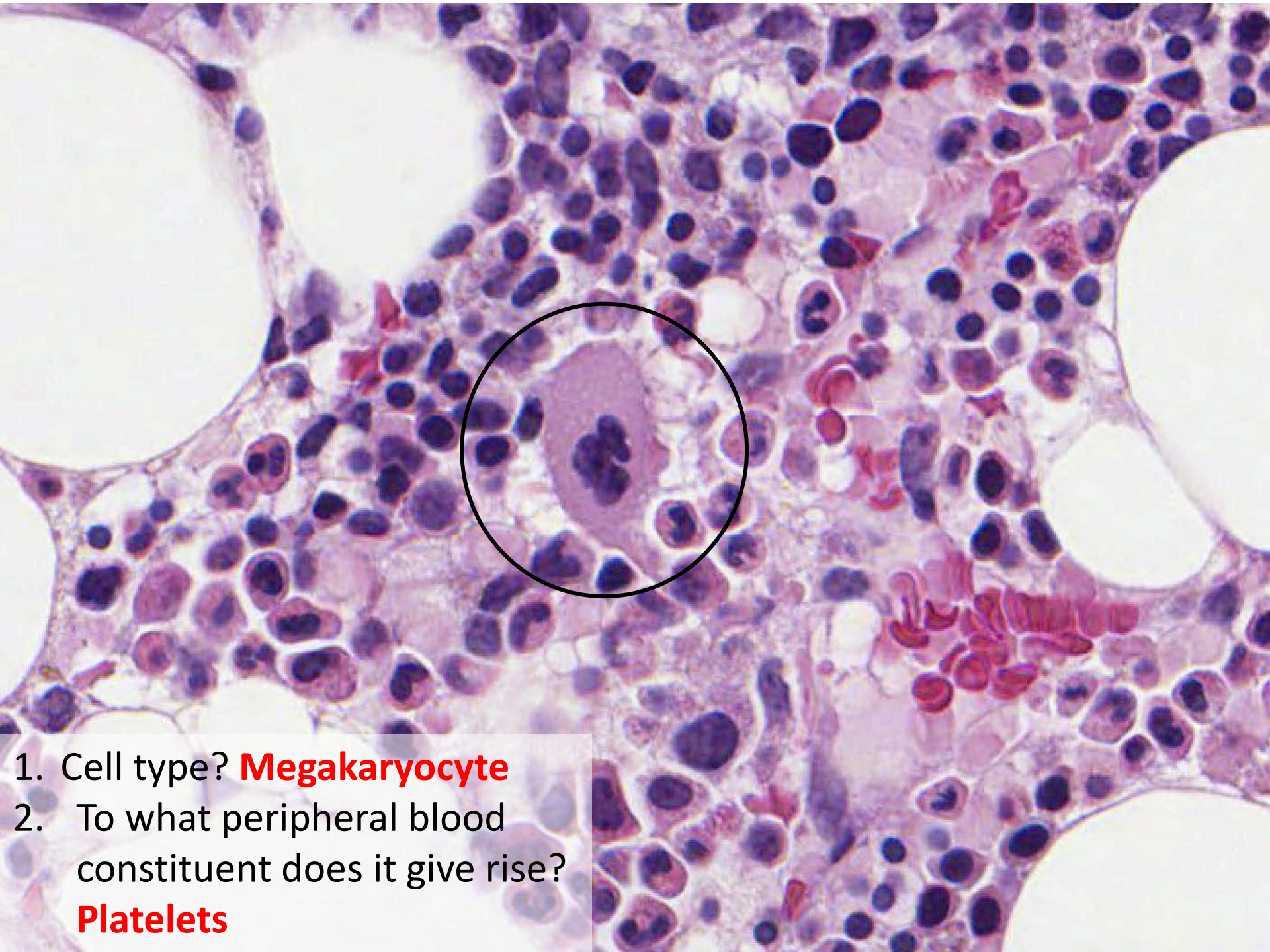


Erythroids cluster
together in the
interstitium

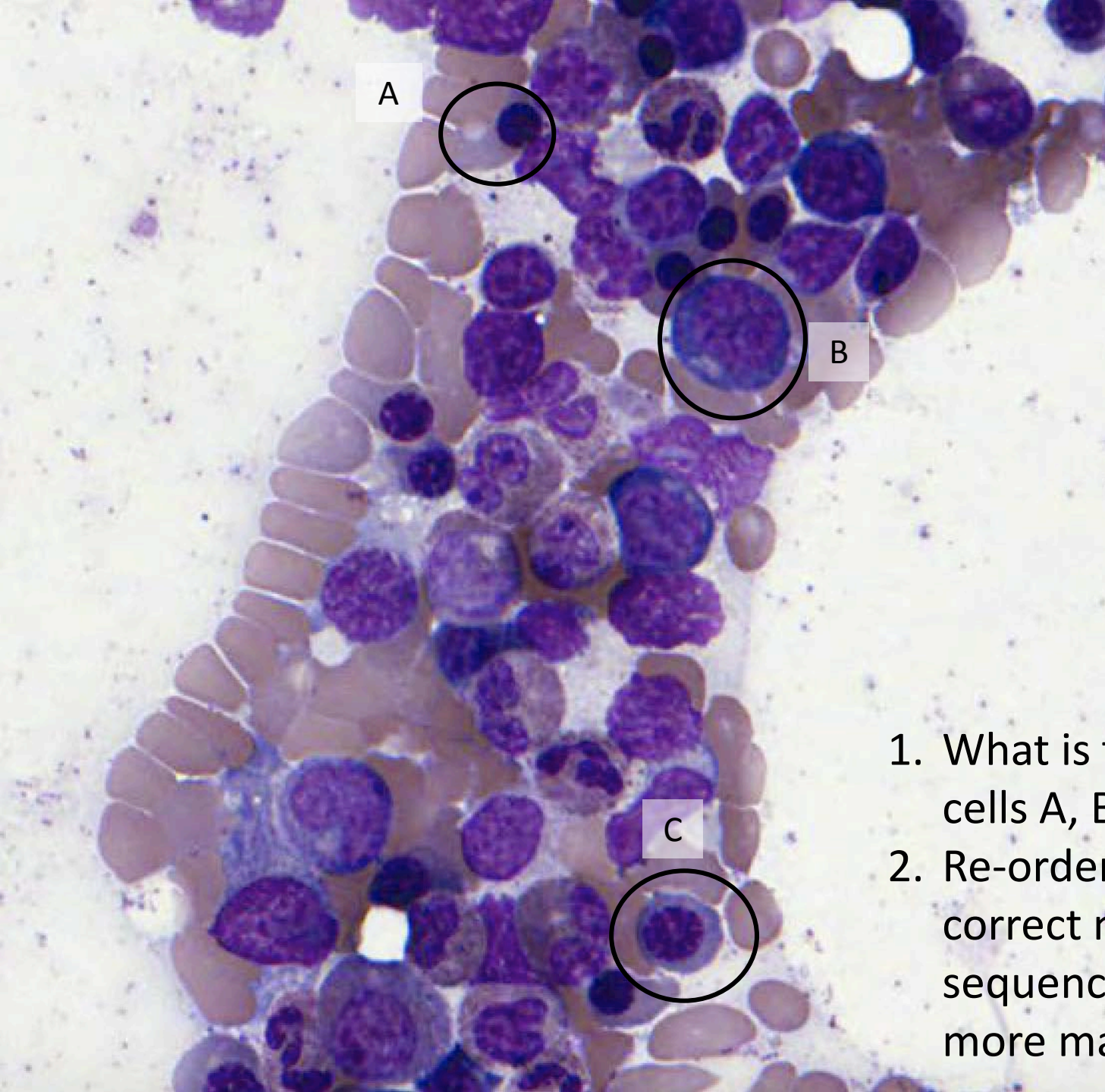
Questions!



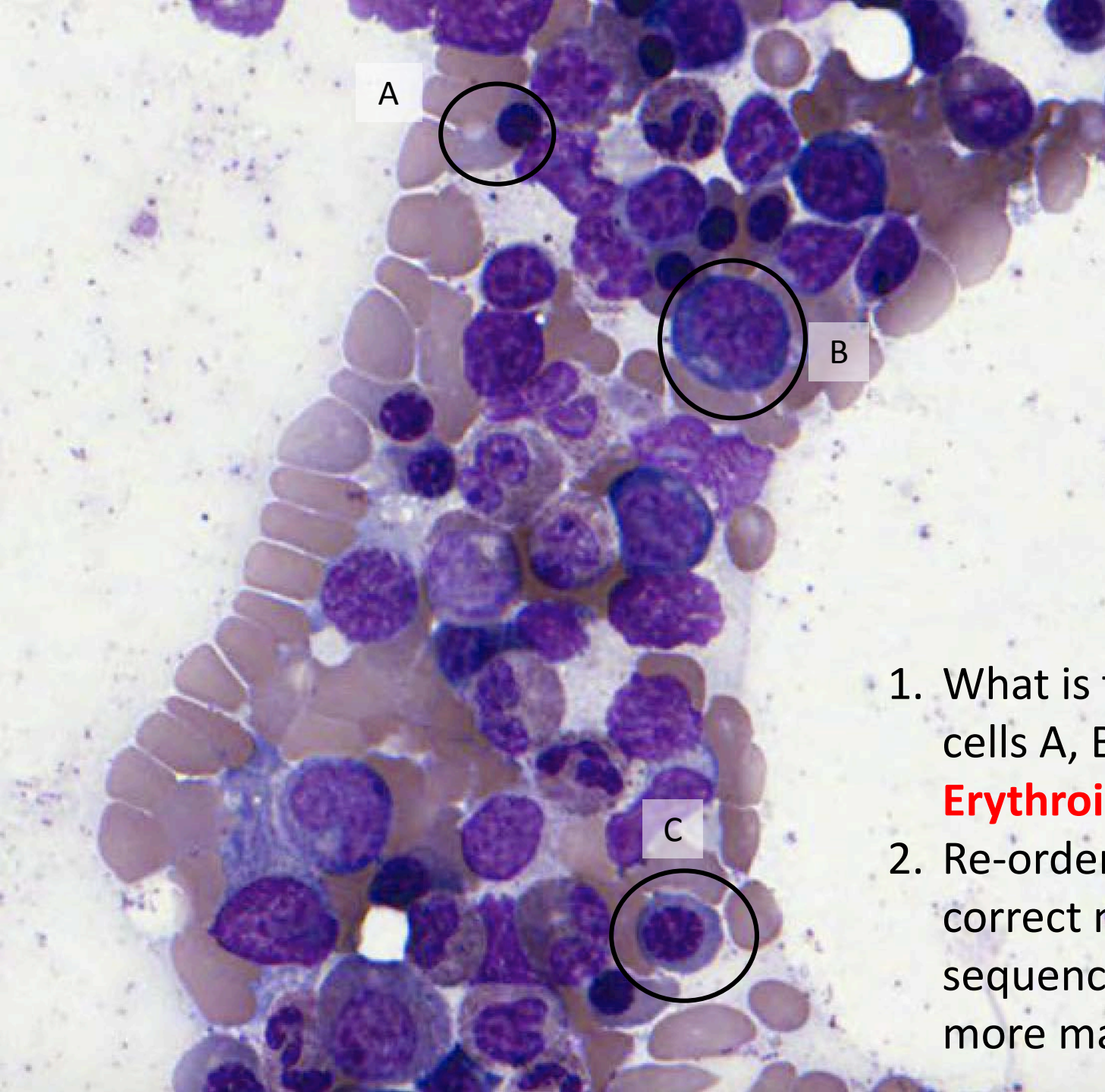
1. Cell type?
2. To what peripheral blood constituent does it give rise?



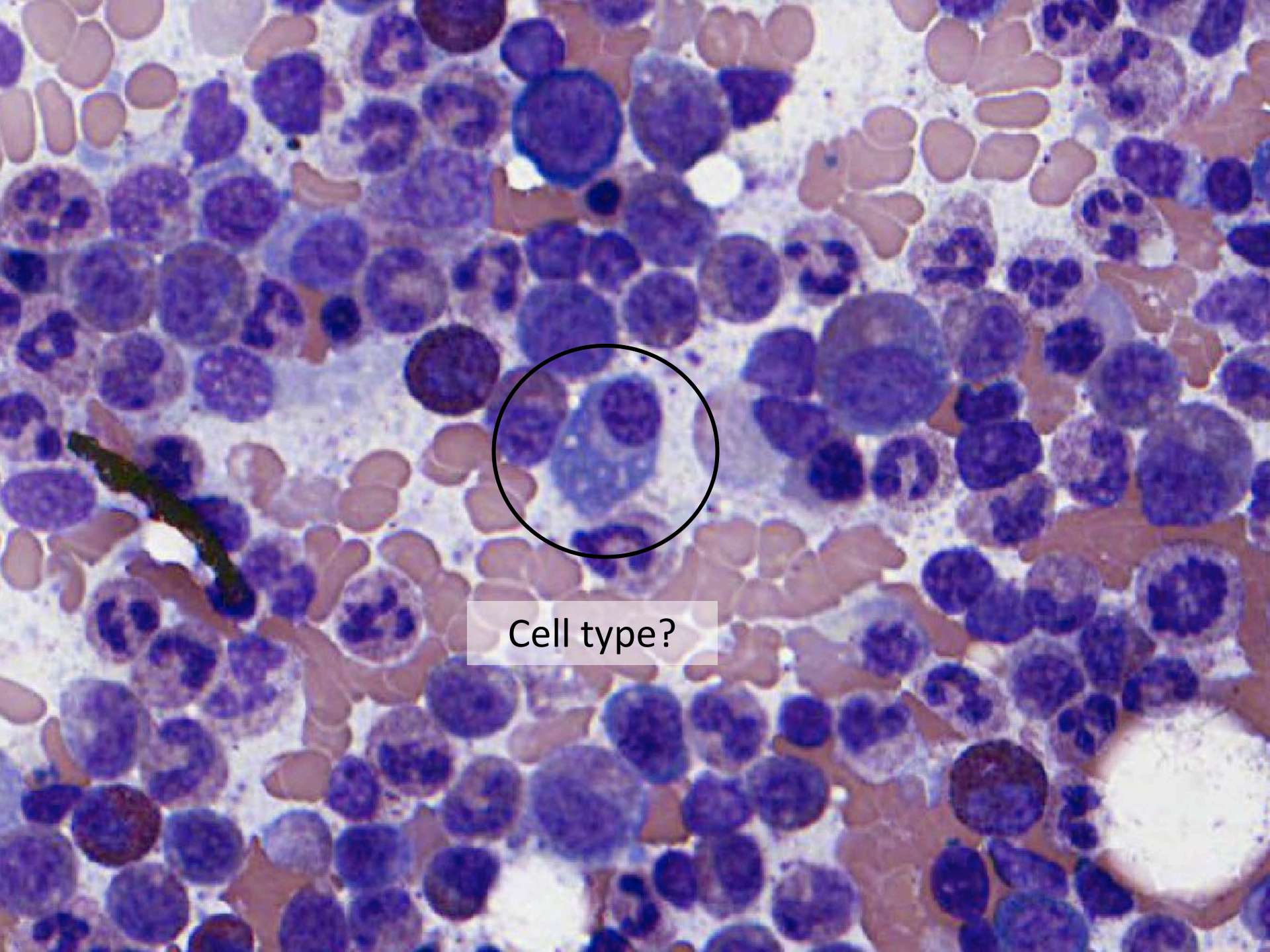
1. Cell type? **Megakaryocyte**
2. To what peripheral blood constituent does it give rise?
Platelets



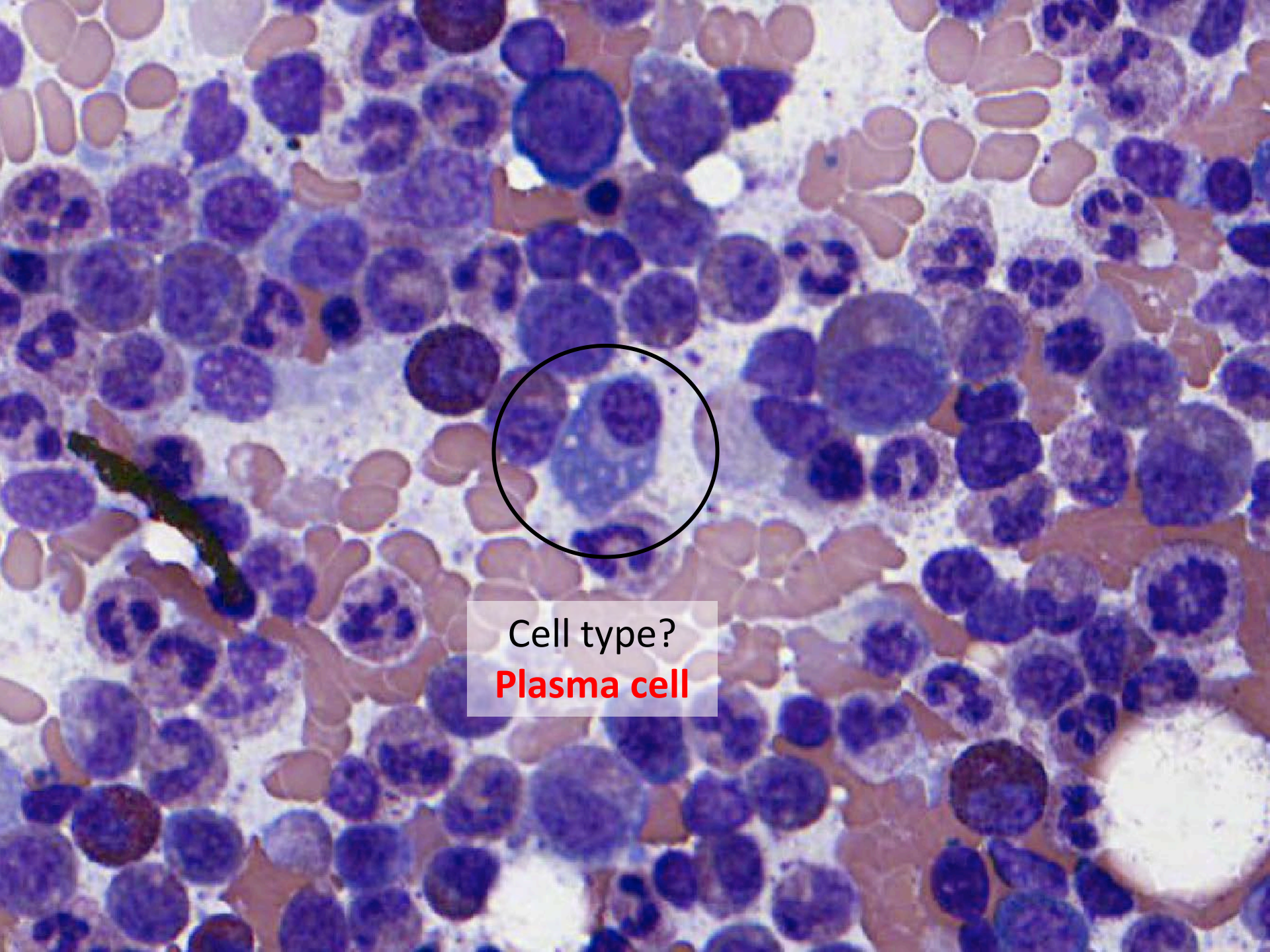
1. What is the lineage of cells A, B, and C?
2. Re-order cells in the correct maturational sequence from least to more mature



1. What is the lineage of cells A, B, and C?
Erythroid
2. Re-order cells in the correct maturational sequence from least to more mature. **B, C, A**

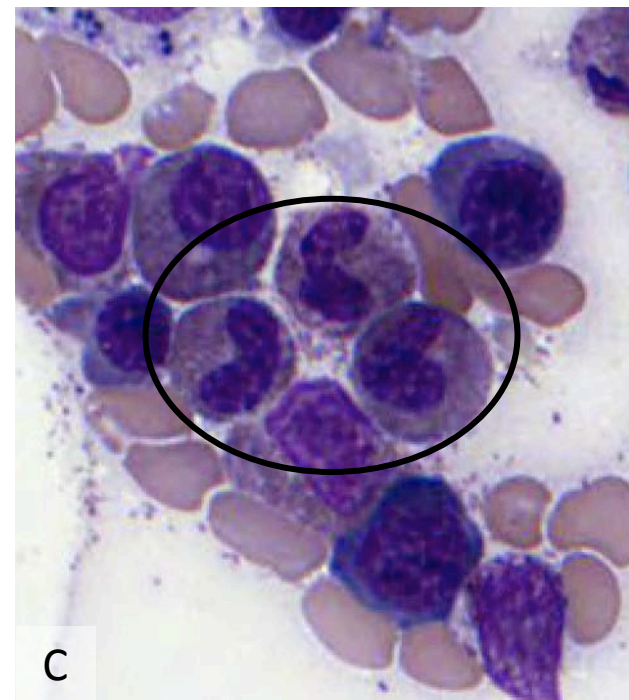
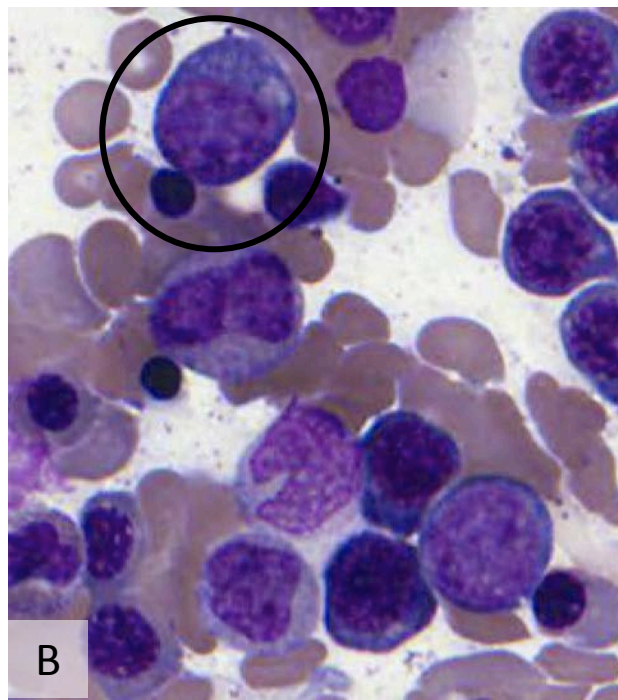
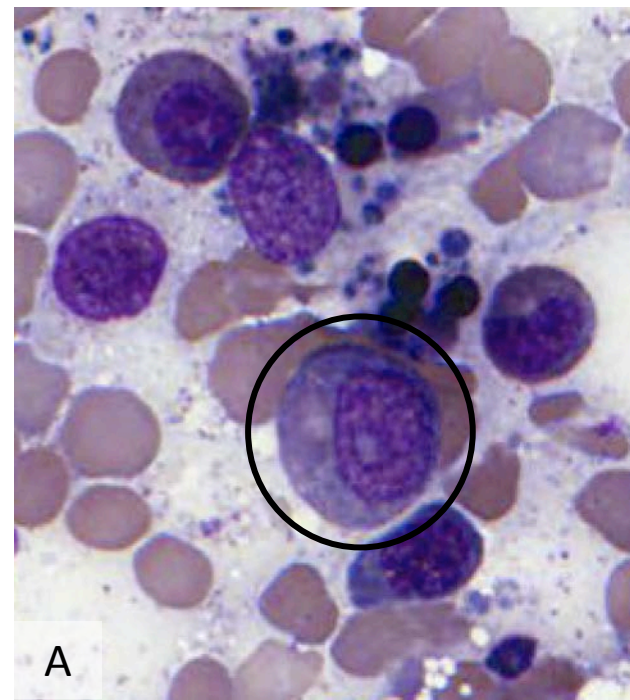


Cell type?

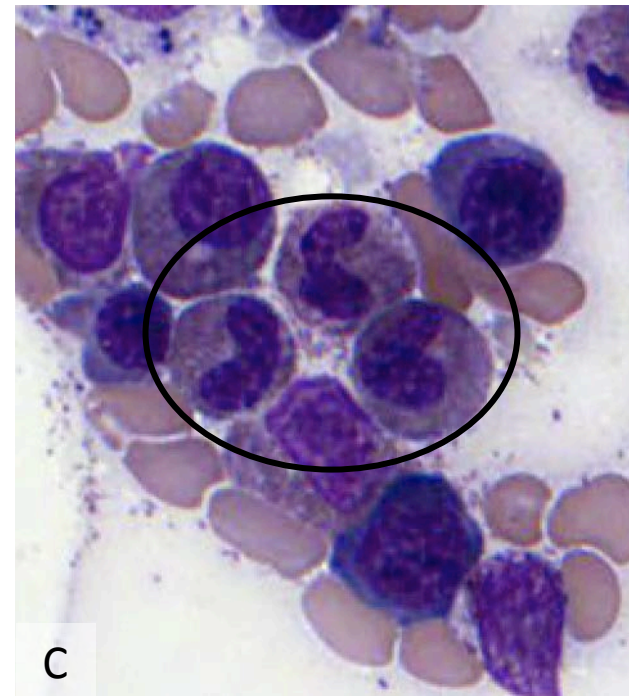
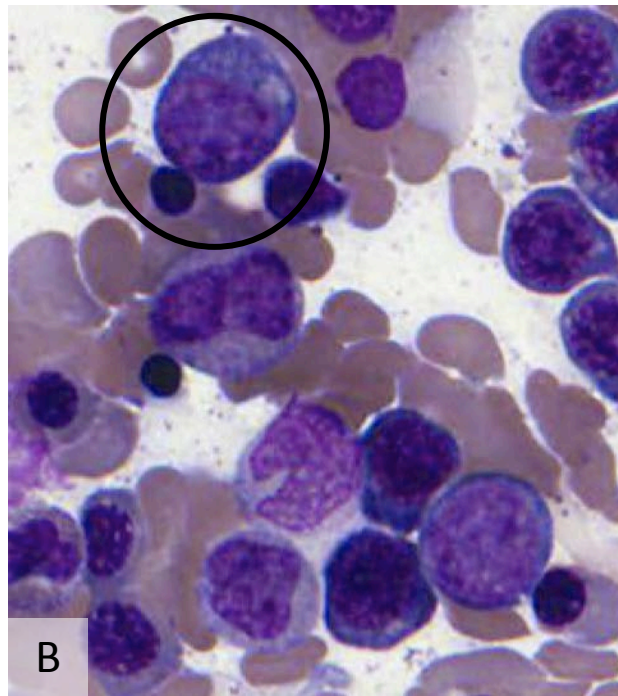
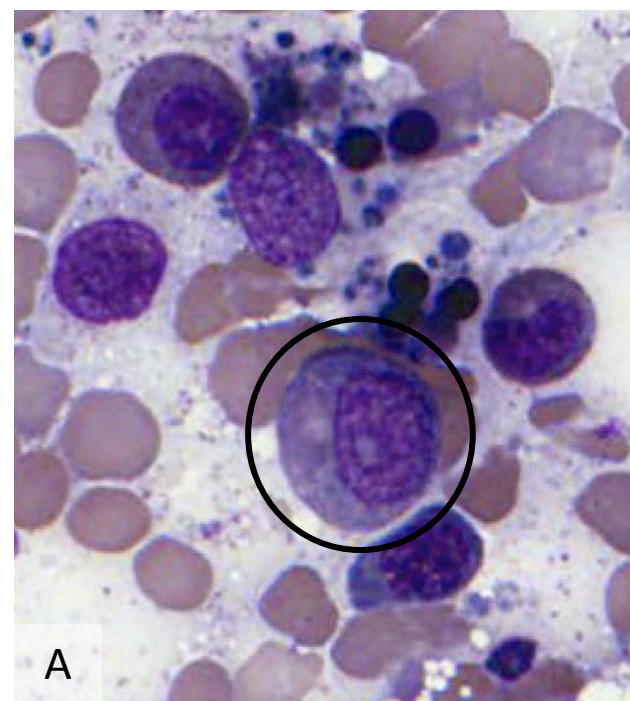


Cell type?

Plasma cell



1. What is the name of cells A, B, and C?
2. Lineage?
3. Re-order cells in the correct maturational sequence from least to more mature.



1. What is the name of cells A, B, and C? **A – Myelocyte, B – Promyelocyte, C – Metamyelocyte**

1. Lineage? **Myeloid**

1. Re-order cells in the correct maturational sequence from least to more mature. **B, A, C**

Summary

- In general, a bone marrow study is composed of the following complementary components:
 - Peripheral blood
 - Aspirate smear/touch preparations
 - Core biopsy
- The three hematopoietic lineages are myeloids, erythroids, and megakaryocytes
- Knowledge of normal marrow morphology, distribution, and maturational sequence is important for identifying abnormalities

Questions?

