# WBC mophlogy of PB
# How to distinguish it?

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# A blood smear is an important tool

- in the provision of a differential diagnosis and the indication of further necessary tests
- in the speedy diagnosis of certain specific infections
- in the differential diagnosis of anemia and thrombocytopenia or thrombocytosis
- for definitively evaluating and identifying immature and abnormal cells
- in the identification and characterization of leukemia and lymphoma
- is often used to categorize and/or identify conditions that affect one or more types of blood cells and to monitor those undergoing treatment for these conditions

# 血液抹片檢查所見
# Outline for the examination of a blood smear

**A. 紅血球 Erythrocytes**

**1. 大小 Size**

a. 紅血球大小不均 Anisocytosis
b. 正常紅血球 Normocytes
c. 大紅血球 Macrocytes
d. 小紅血球 Microcytes

**2. 形狀 Shape**

a. 異形紅血球 Poikilocytes
b. 球形紅血球 Spherocyte
c. 靶狀紅血球 Target cells
d. 卵圓形紅血球 Ovalocytes
e. 鐮刀狀紅血球 Sickle cells
f. 淚滴形紅血球 Tear drop cells
g. 破碎狀紅血球 Fragmented cells

**3. 顏色 Color**

a. 正常血色素 Normochromic
b. 低血色素 Hypochromic

**4. 其他異形 Abnormal forms**

a. 嗜多色性 Polychromatophilia
b. 斑點形紅血球 Stippling
c. 卡波氏環 Carbot rings
d. Howell Jolly氏體
e. 有核紅血球NRBC
f. 帶寄生蟲紅血球 Parasitized RBC
g. 緡錢狀形成 Rouleaux formation

**B. Platelets**

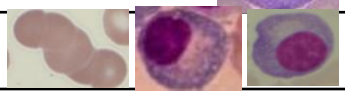
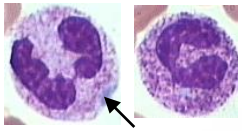
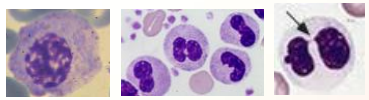
1. 數目的多寡 Estimation of the number
2. 型態的異常 Morphologic abnormalities

**C. Leukocytes**

1. 數目的多寡 Estimation of the number
2. 白血球分類計數 Differential leukocyte count
3. 型態的異常 Morphologic abnormalities
   a. 核多葉形中性白血球(超過5葉)
   b. 毒性型的呈現(如中性白血球的毒性顆粒)
   c. 細胞核變性
   d. 淋巴球細胞質的空泡形成和變性

| 疾病 | 週邊血片所見 |
| --- | --- |
| 遺傳性棘細胞症（α& beta-脂蛋白缺乏症) | Acanthocytes (Spur cells), Poikiocytosis |
| 遺傳性球狀紅血球症(佔20%以上) | Spherocytosis, Polychromasia, Target cells |
| 海洋性貧血特質 | Hypochromasia, Target cells |
| 鐵芽球性貧血Sideroblastic anemia | Pappenheimer body |
| 橢圓性紅血球症(高於25%～50%) | Elliptocytes |
| 嚴重性溶血性貧血或酒精性肝病 | Stomatocytes |
| 急性溶血(如G-6-PD缺乏症) | Blister' cells , Bite cells |
| 鉛中毒 | Basophilic stippling |
| 骨髓纖維化 | Tear drop cells |
| 脾臟功能低下 | Target cells, Acanthocytes, Howell-Jolly body |
| 機械性溶血現象或微血管病性溶血性貧血 | Schistocytes (fragmented rbc ), Burr cells |
| 初發的惡性貧血或葉酸缺乏症 | Macrocytosis, Cabot‘s rings |
| 瘧疾 | Malariae |

RBC具有機械性脆性，即由於碰撞擠壓可引起細胞破裂溶血

| 疾病 | 週邊血片所見 |
| --- | --- |
| 初發的惡性貧血或葉酸缺乏症 | Hypersegmentation  |
| 多發性骨髓瘤或大球蛋白血症 | Rouleaux formation, Plasma cell  |
| 嚴重感染病(如敗血症) | Neutrophilia (N. band↑), Döhle bodies, Toxic vacuolation, granulation  |
| 傳染性單核球症(IM) | Atypical lymphocyte |
| 顆粒細胞缺乏症 | Neutropenia, Lymphocytosis |
| MDS, CML -- Pelger-Huët anomaly | Neutrophil的分葉能力減退，chromatin is extremely clumped and stains very dark  |
| 過敏性反應 | Eosinophilia |
| 急性白血病, 早期 | Blast forms, Auer rod (NLL)  |

為取得較高的各臨床實驗室之同儕間鑑別血球型態的共識率

要先建立一致性的辨識血之六大原則

配合加強教育訓練，及參加與鑑別血球型態相關的能力試驗

CAP Surveys能力試驗

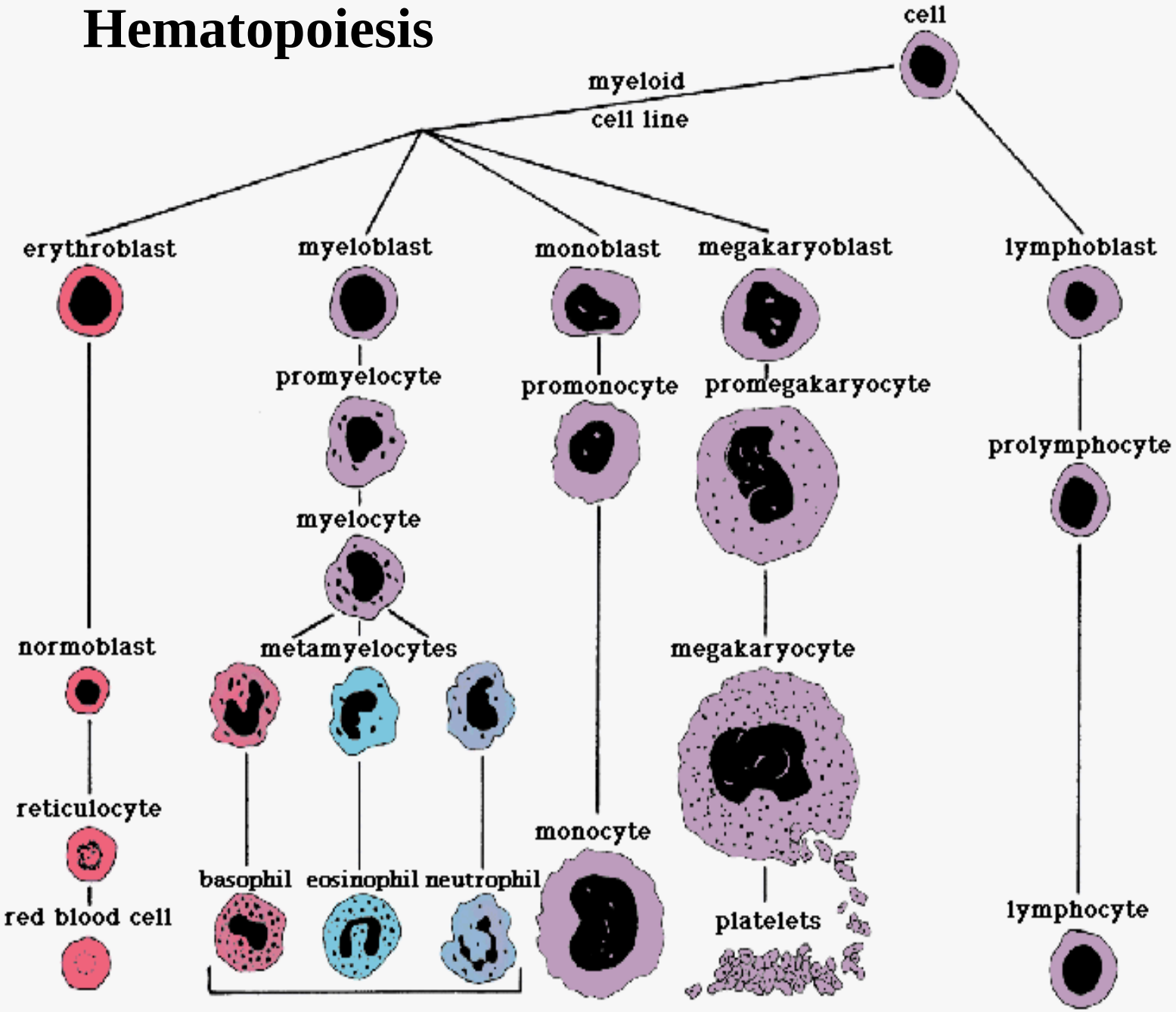
台灣醫事檢驗學會所主辦的
血球型態觀察能力試驗

可與國際間臨床實驗室檢驗數據比對

使檢驗結果均達到較高比例的共識率與正確性

提升血液檢驗品質，以確保病人有完整的醫療照護

# Hematopoiesis




Immature cell
(Young cell)

Morphology

?

Adult cell

# Wright Giemsa stain

* **Alkaline dyes ：**

---- 為陽離子染料，能接受質子，與细胞内酸性成分，如胞核中的DNA、胞質中的RNA、特異性的中性顆粒基質、胞質蛋白等结合

**oxidized methylene blue**

(which dyes acidic cell components )

— residual RNA, cytoplasm, nucleus: blue

**azure B --- 具異染現象metachromasia**

(which dyes basic cell components)

—DNA and primary granule: red and violet

PS : 有些染色劑與組織成份反應後會由正常的藍色變為紅色或紫色，此吸光特性之改變稱為異染現象metachromasia

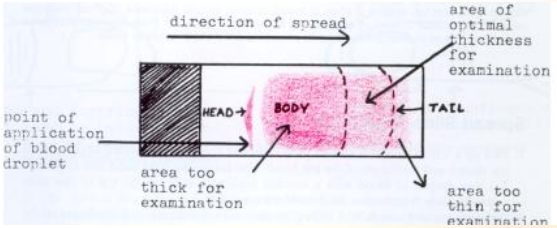
# Wright Giemsa stain

＊**Acidic dye：eosin Y** (which dyes alkaline cell components)
RBC (Hemoglobin) and
eosinophilic granules: orange-red

---- 為陰離子染料，能釋放質子，與细胞的鹼性成分，如血红蛋白、嗜酸性颗粒、胞質中的蛋白質等结合

**此染料可與甲基藍、天青B作對比染色**

## 白血球型態判讀




＊ 人工白血球分類所受的限制：
（1）分類結果會依照血片選擇區域不同而改變
（2）僅計數100顆白血球進行分類，易有統計上的誤差
（3）血液抹片觀察者個人主觀判讀之差異

# Liu's stain ---- 台大劉禎輝教授

＊ 原理

☆ 鹼性染料（Basic dyes）：

例如甲烯基籃（methylene blue）為一種鹼性染料，對細胞內之酸性物質，如細胞核、嗜鹼性性顆粒，可將其染上深藍色，故此酸性物質被稱為嗜鹼性

☆ 酸性染料（Acidic dyes）：

例如伊紅黃（eosin yellow）染料，可對鹼性物質（如eosinophilic granules）染成橘紅色，而此類鹼性物質被稱嗜酸性

☆ 一號苯安藍Azur I ：

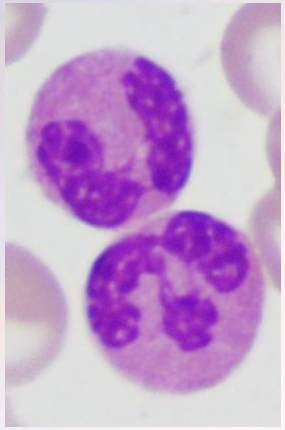
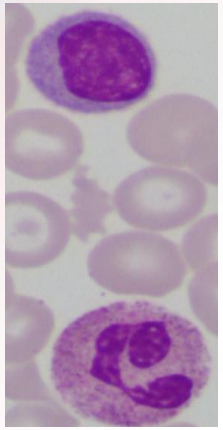
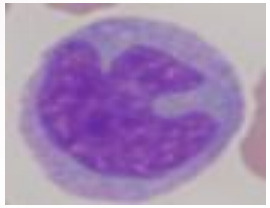
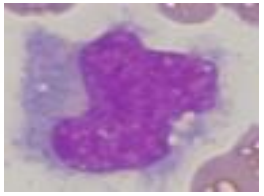
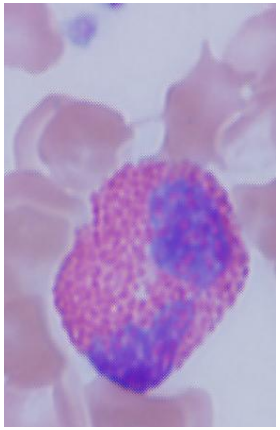
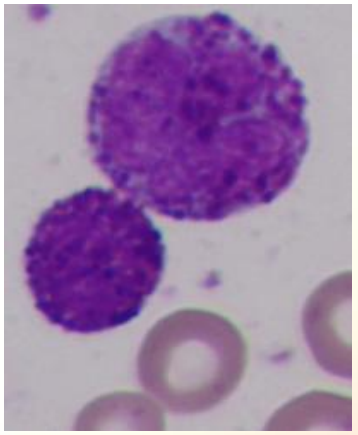
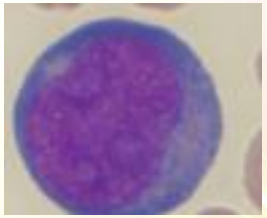
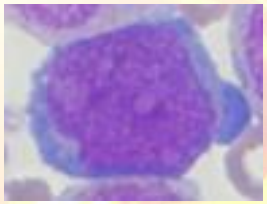
此染料專門染血球的初級或非特異性顆粒呈藍色，而稱為嗜苯安藍顆粒或嗜天青顆粒（Azurophilic / azure granules）。

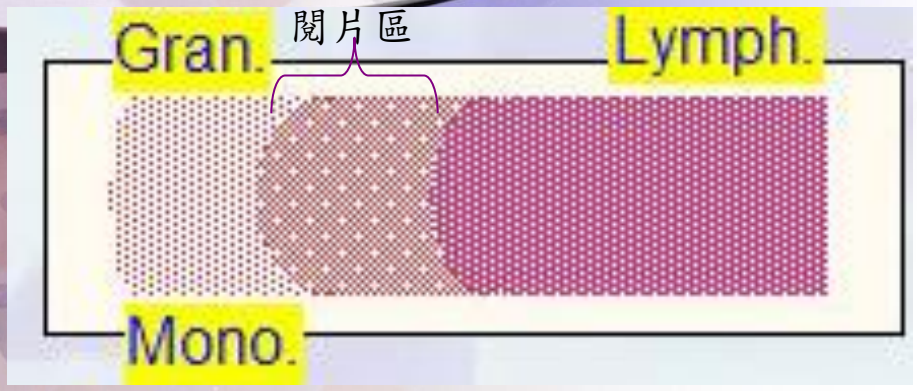
＊ 於1953年發表的一種新的染色技術

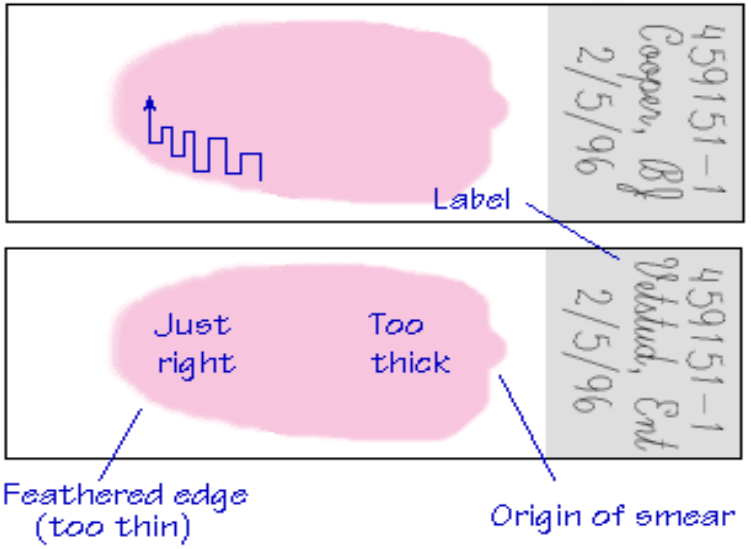
# An optimally Wright's stain smear

最佳

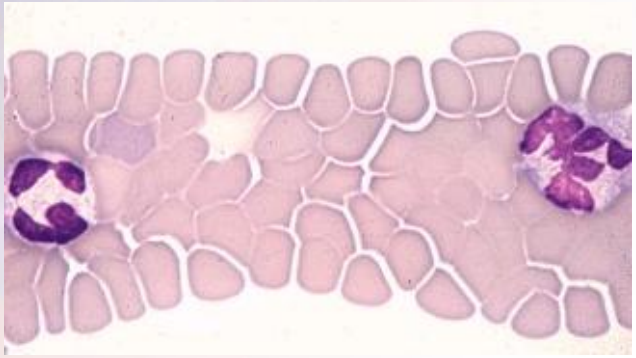
- **RBC ------ reddish pink, deep pink, pink to salmon in color, not grey or blue**
- **Nucleus ------ red-purple to blue purple**
- **Neutrophilic granule ------light purple to  fine reddish purple**
- **Neutrophilic cytoplasm ------pale pink, orange-pink**
- **Eosinophilic granule ------bright red to orange**
- **Basophilic granule ------purple-black to dark blue**
- **Lymphocyte cytoplasm ------sky blue, light blue, some small**
- **Monocyte cytoplasm------pale blue, gray-blue**
- **Monocyte granule------fine reddish**
- **Blast cell ------- deep blue, blue**
- **The area between the cells ------should be clean**



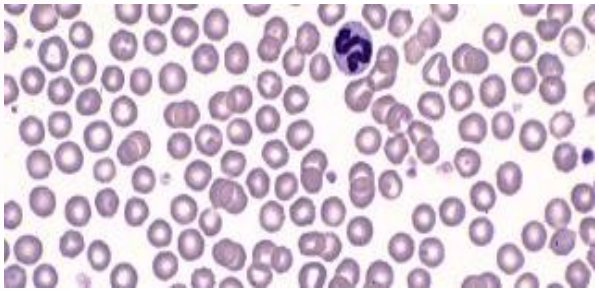



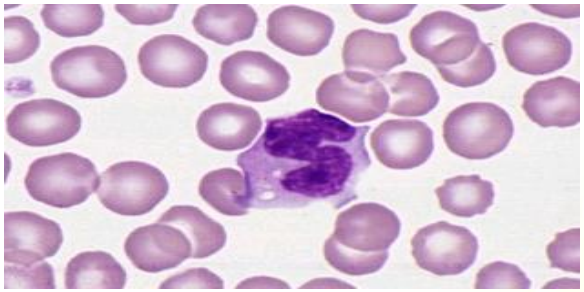

## Feathered edge



WBC distorted and damaged

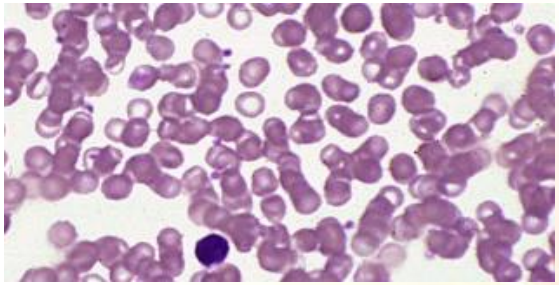
## Just right

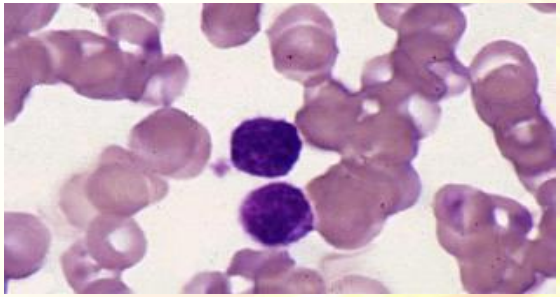




## Too thick

RBC aggregate





# 如何提高白血球型態判讀的正確性

要先了解骨髓內不成熟的細胞與周邊血球細胞間的型態和分佈的差異性

熟悉各類白血球系列在不同的成熟階段中的特殊型態變化

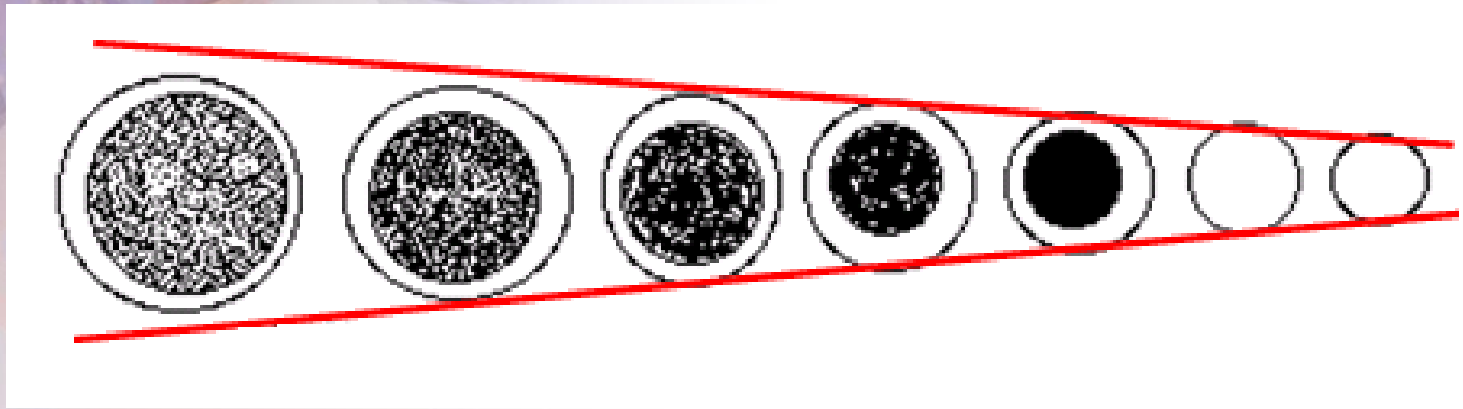
**Immature cell (Young cell)** ⇢ **Morphology ?** ⇢ **Mature cell (Adult cell)**

依據辨識血白血球的六大原則

做出適當性的鑑別結果

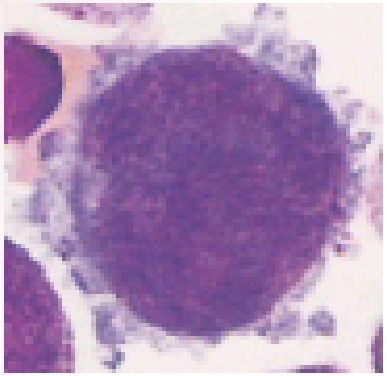
# Young cell ⋯⋯▶ Adult cell

## （1）Cell size:



| 性質 | 成熟的變化 |
|---|---|
| 細胞Size | 由大漸漸變小 |

**Exception:**



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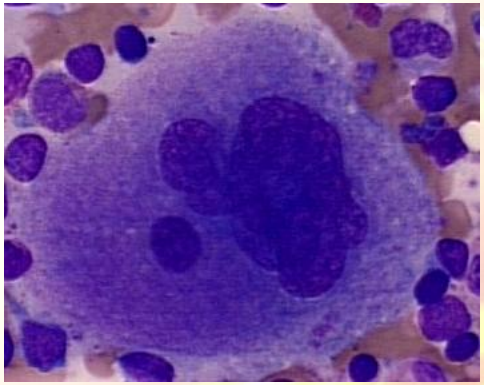
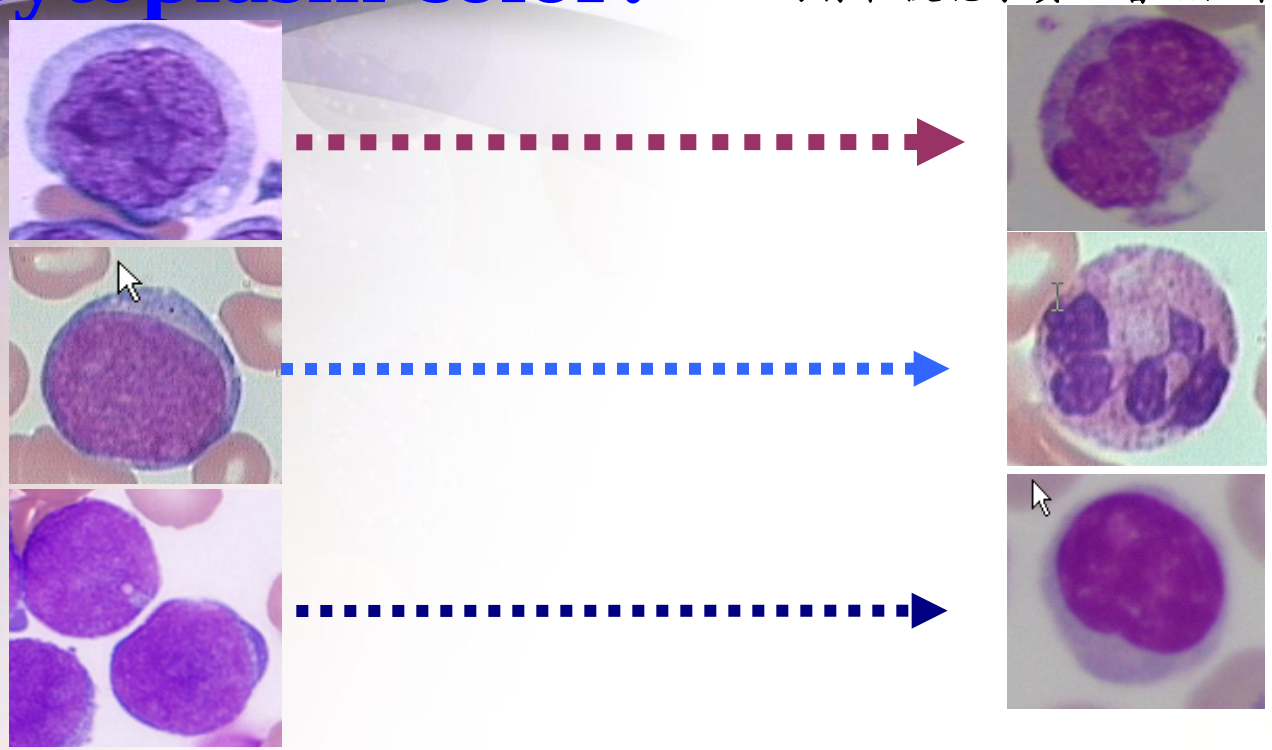


# Young cell ⇢ Adult cell

## （2）Cytoplasm color: RNA的存在使胞漿質呈嗜鹼性染色



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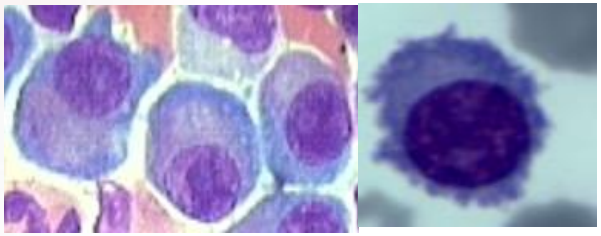
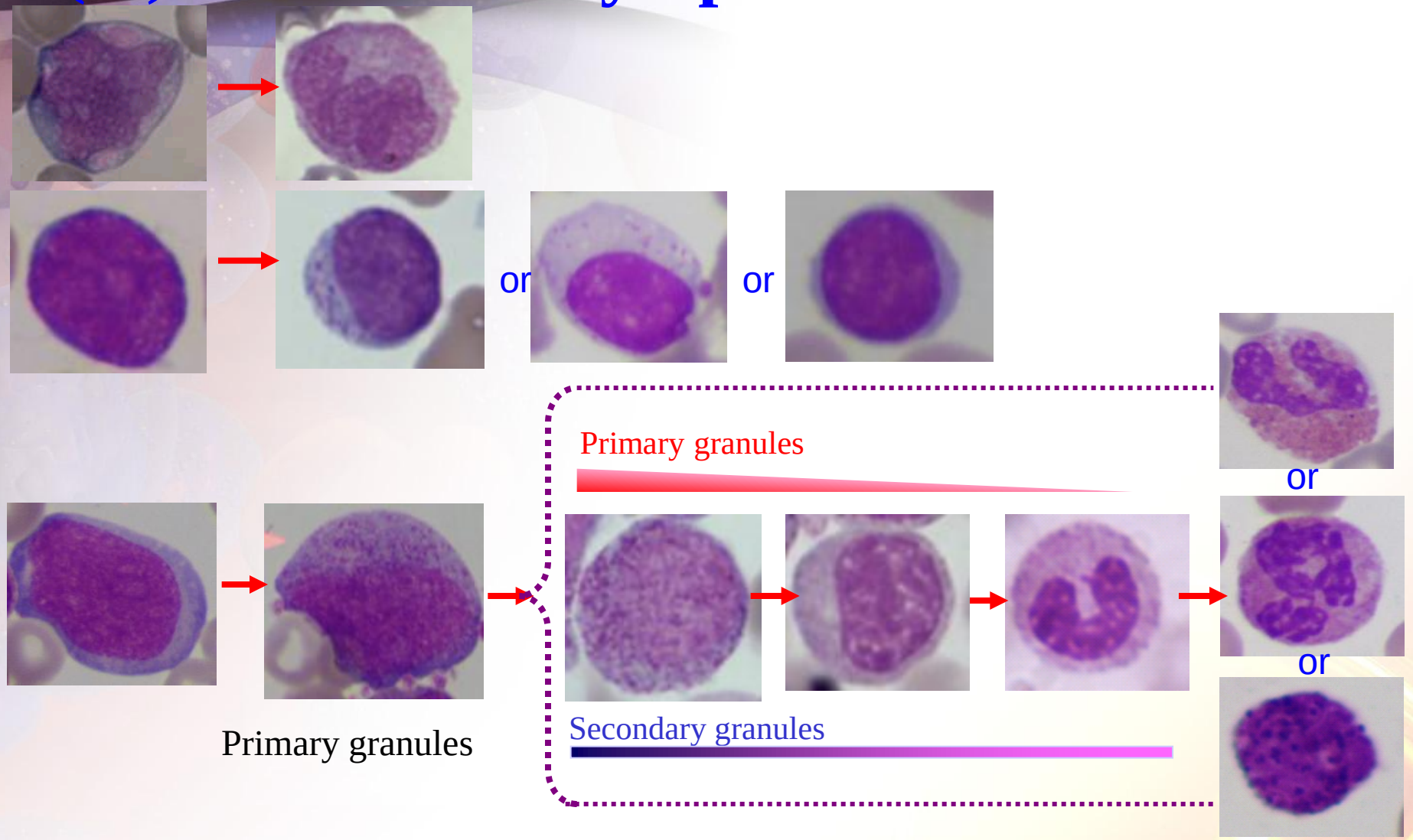


| 性質 | 成熟的變化 |
|---|---|
| 細胞質的顏色 | WBC：深藍→淡藍 或 深藍→粉紫 |

# Young cell ·····▶Adult cell

## （3）Granule of cytoplasm:




| | |
|---|---|
| 細胞質的顆粒 | 由多顆變少數或消失 |

# Contents of human leukocytic granules

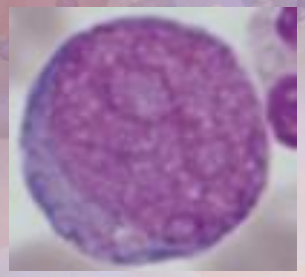
Primary granules ----- Acid phosphatase, Lysozyme, Elastase, Cathepsin G, $\alpha_1$-Antitrypsin, Cathepsin B,β-Glucuronidas, Heparin binding protein, Ubiquitin protein, Peroxidase

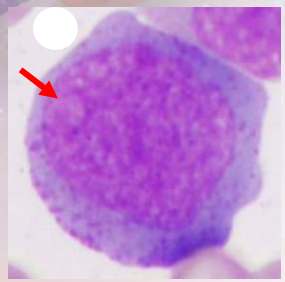
Secondary granules --- **Lactoferrin**, CD66a,b ,Cytochrome $b_{558}$, TNF receptor, Fibronectin receptor, Vitronectin receptor, u-PA receptor, Lysozyme, β-microglobulin, Collagenase, Gelatinase, Rap1,2 Protein kinase C inhibitor, Sialidase, CD11b, Vitamin $B_{12}$-binding protein, Cationic protein, **Alkaline phosphatase** **Major basic protein**, Peroxidase acid phosphatase, Histaminase, Acryl sulfatase, $PGE_2$ Histamin, Heparin, Neutral protease, Charcot-Leyden protein, Chondroitin sulfate

**Tertiary granules** ----- CD11b, Laminin receptor, **Gelatinase**, **Collagenase, Phosphatase**, Lysozyme, Acetyltransferase

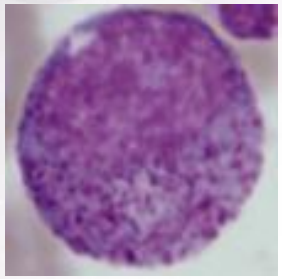
# Young cell ⋯⋯▶ Adult cell

## （4）Nucleus shape and Nucleolus:

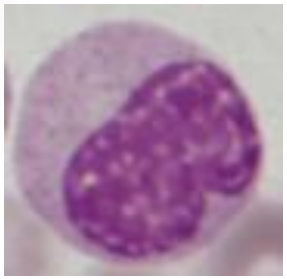




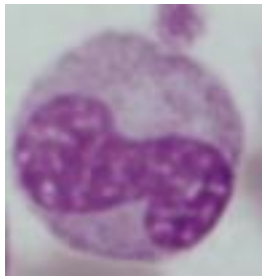
Light red-purple

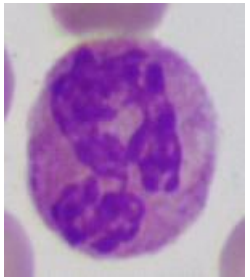


Red-purple



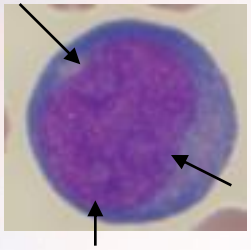
Light blue-purple





Deep blue-purple

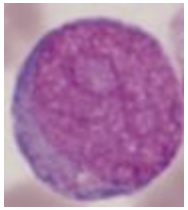
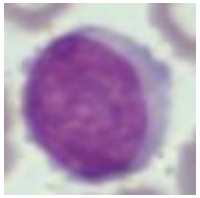
| 性質 | 成熟的變化 |
|---|---|
| 細胞核的形狀 | 圓或卵圓→內凹→變細→分葉 |
| 細胞核的顏色 | 紅紫→藍紫 |



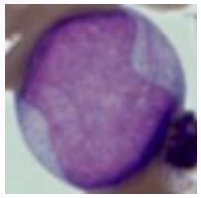
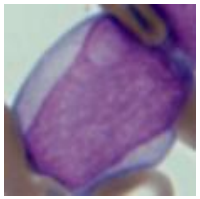
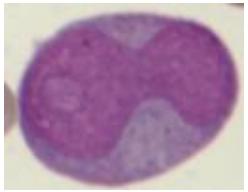
Nucleolus --- color : blue to pink
(acidophilic-basophilic)

# Nucleus shape

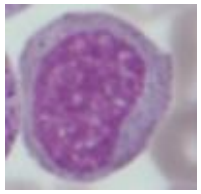
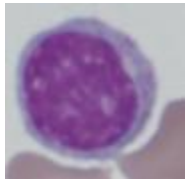
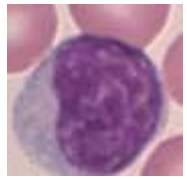
Round or oval ----- young cell , lymphocyte

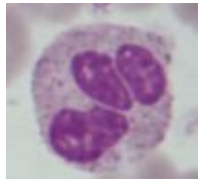
Leukemic states ----- more indentation

Kidney-shaped ----- metamyelocyte , lymphocyt

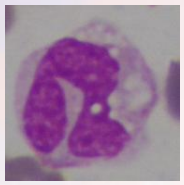
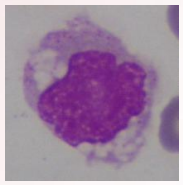
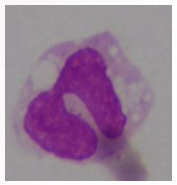
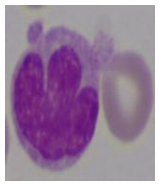
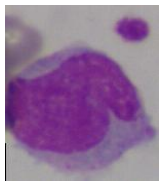
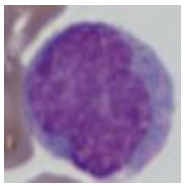
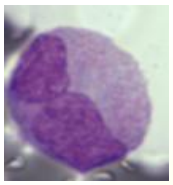




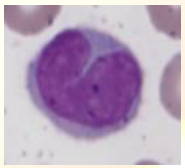
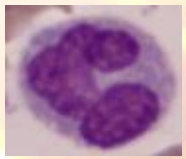
Band form ----- neutrophil



Distinct nuclear lobes ----- neutrophil

Multiple shape ----- monocyte

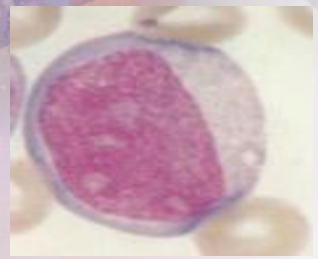
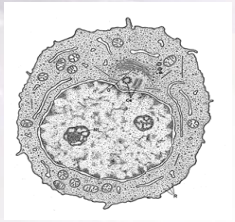








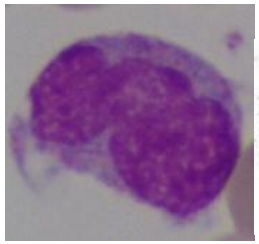
# Young cell ⋯⋯▶ Adult cell

## （5）Chromatin of nucleus:

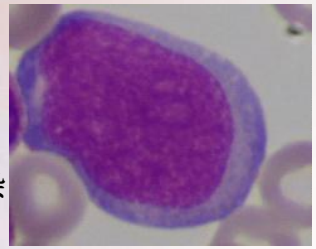
Minimal, very fine, (纖細的), irregular network of strands and granules
細微散開的染色質

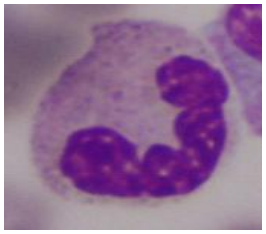
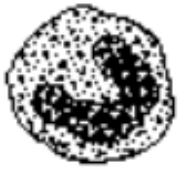
reticular pattern



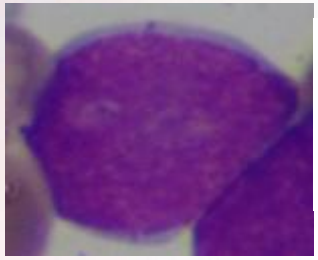

Loose meshwork, no agg.
細且均勻分佈的染色質



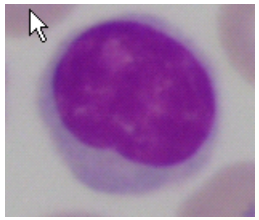

Coarsely granula

Fine
比myeloblast較粗的細網狀



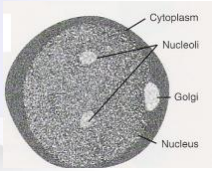

Coarse, dense, Condensed clumped
核質高度聚集成塊

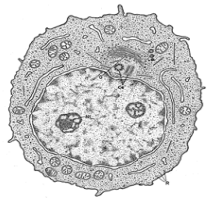



染色質的分佈是能反映出該細胞的轉錄活性之不同程度

| 性質 | 成熟的變化 |
|---|---|
| 核染色質 | 由細變粗(各系列各具有不同的特徵) |

**Young cell** -------- Loose meshwork



呈展開現象而成疏鬆狀，染色淡

Reticular pattern very fine

Fine (irregular network )

Finely stippled granular

---

**Adult cell** -------- Coarse granular

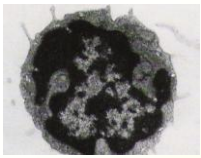
愈粗著色愈暗

**clear area and dense area**

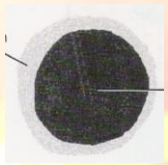
Moderate loose mesh

peripherally clumped chromatin

Dense homogenous



Condensed clumped



# 染色質（Chromatin；核染質）

＊ 真核細胞的核染質位在細胞核內，是由DNA與蛋白質組合成的複合物，也是構成染色體的結構

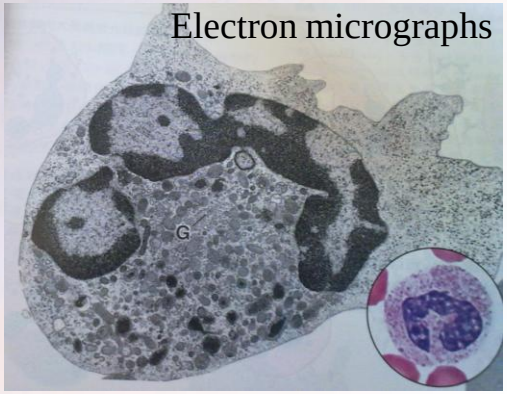
＊ 染色質有兩種類型，分別是真染色質與異染色質

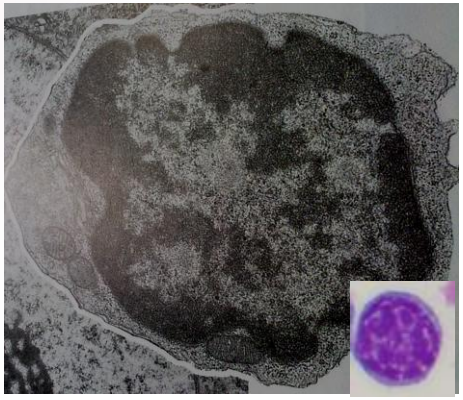
異染色質（Heterochromatin）是DNA內一種緊密組合的結構，轉錄作用在其中受到限制，**為相當緻密的深染物質**，故其受到染色之後的顏色較深，可見其結構較為緊密，為嗜鹼性的團塊

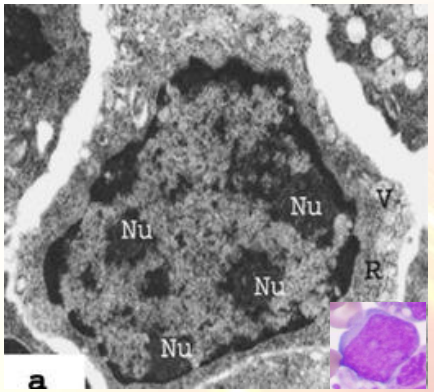
異染色質一般分佈於細胞核的邊緣地帶，緊靠著核膜包被

真染色質(或正染色質euchromatin)則主要位於細胞核的中央，在染色之後則較淡，為染色質均勻散佈之型式(成鬆散狀)，在細胞分裂時才會纏繞收縮，此區的基因具有轉錄的作用

＊ DNA中的磷酸基是造成染色質嗜鹼特性之主因



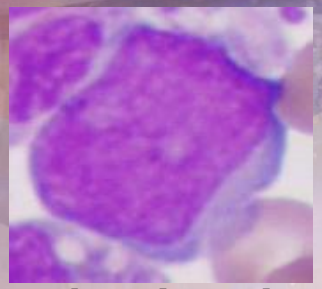






Nu : Nucleolus

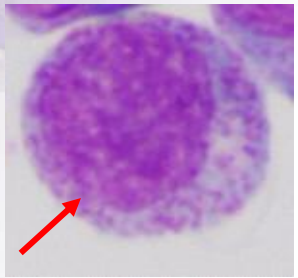
副染色質(para-chromatin): 位於细胞核内，染色較淺、呈淡紅色或不著色的稱為副染色質，其不含DNA

# Chromatin of nucleus --- Myelocytic series

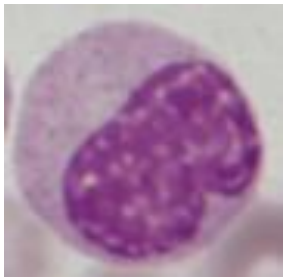


Light red-purple;
fine meshwork,
no aggregation

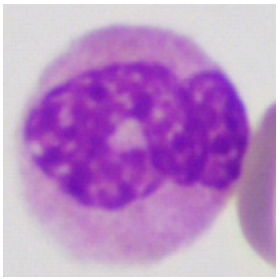
Light red-purple;
fine meshwork,
slight aggregation

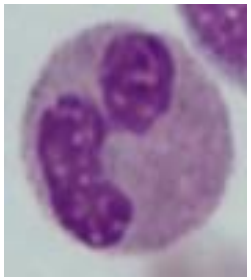


Red-purple;
fine chromatin,
slight agg or
granular pattern

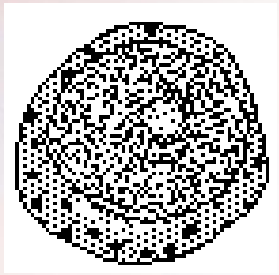


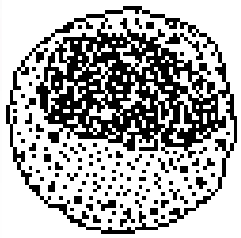
Light blue-purple;
oxyphilic chromatin
easy distinguishable

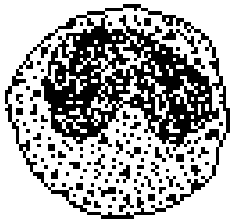


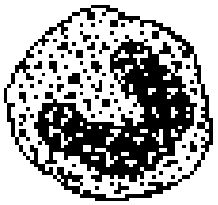


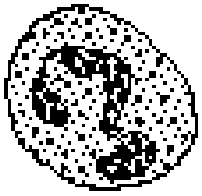
Deep blue-purple;
coarsely granular







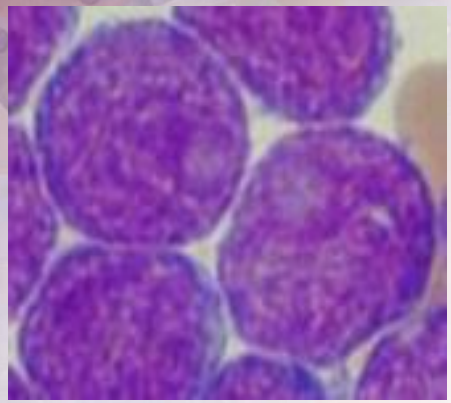




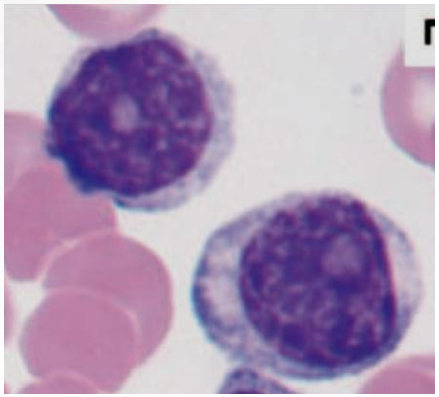
| 性質 | 成熟的變化 |
|---|---|
| 核染色質 | 由細變粗(各系列各具有不同的特徵) |

# Chromatin of nucleus --- Lymphocytic series

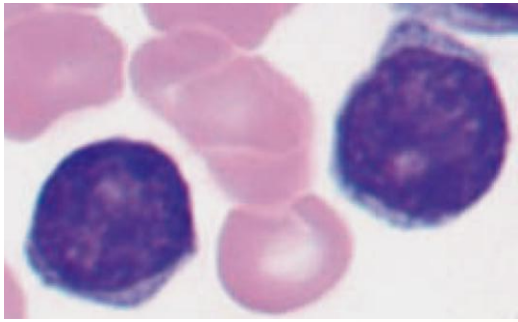
**Lymphoblast ----------> Prolymphocyte ----------> Lymphocyte**



稀疏的
sparse red-purple chromatin, finely stippled to slightly coarse nuclear chromatin



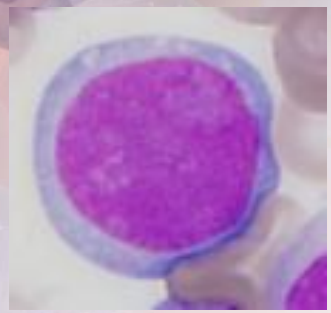
Blue-purple chromatin finely stippled to slightly coarse nuclear chromatin



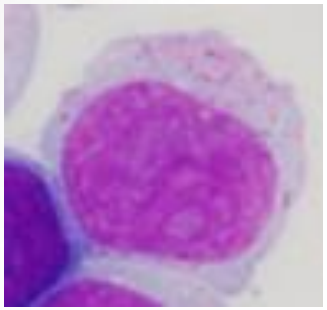
Coarse blue-purple chromatin

| 性質 | 成熟的變化 |
|---|---|
| 核染色質 | 由細變粗(各系列各具有不同的特徵) |

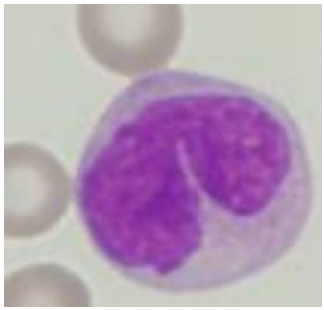
# Chromatin of nucleus --- Monocytic series



**Pale red-purple finely reticular or irregular network of strands and granules nuclear chromatin,**



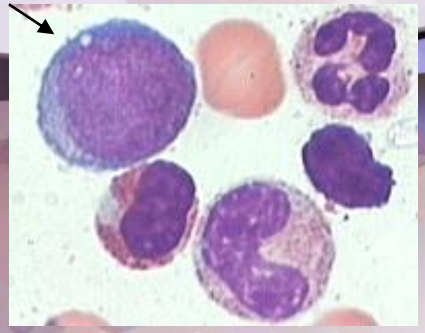
**stippled or lacy chromatin**
絲帶的



**Blue-purple chromatin network consists of coarse, loose, linear threads**

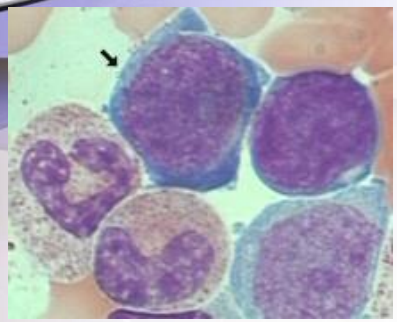
| 性質 | 成熟的變化 |
| --- | --- |
| 核染色質 | 由細變粗(各系列各具有不同的特徵) |

**Erythroblast or Pronormoblast**

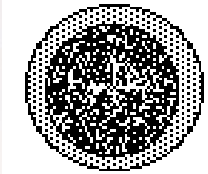


核為淡紫色、小泡狀及顆粒性核染質微凝聚

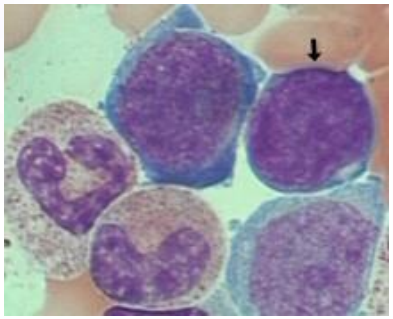
**Basophilic normoblast**

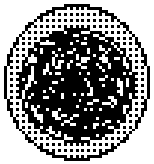


核為暗紫色、較大的顆粒性核染質凝聚，偶呈輪狀，無核仁

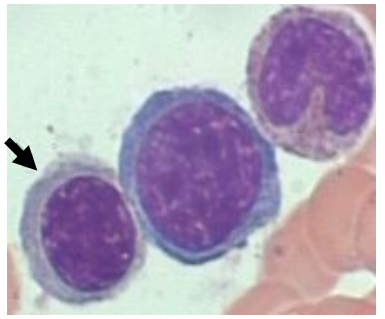


**Basophilic normoblast**

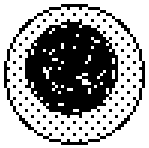




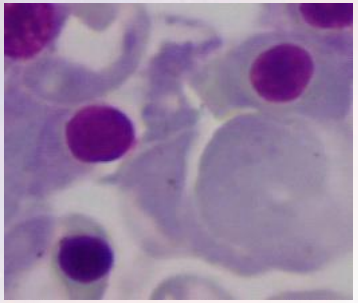
**Polychromatophilic normoblast**



核為紫黑色、核染質粗糙而凝聚

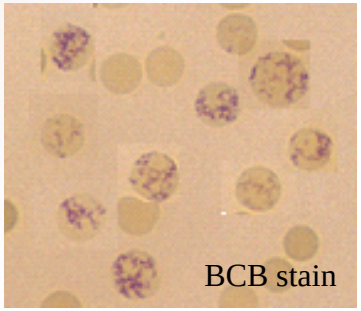


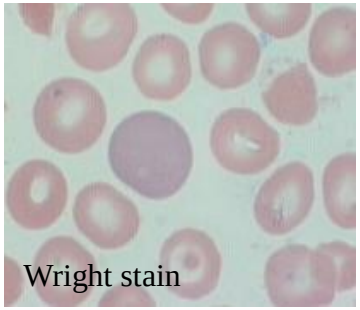
**Orthochromatic normoblast**



核為黑暗而均質性、核染質凝縮及無構造的塊質(緻密核)

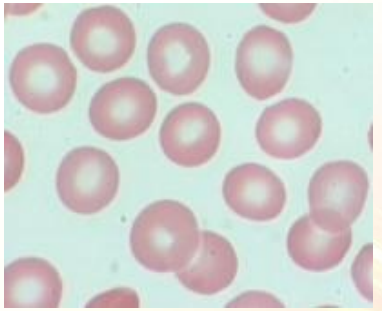
**Reticulocyte**




Polychromasia

**Mature RBC**

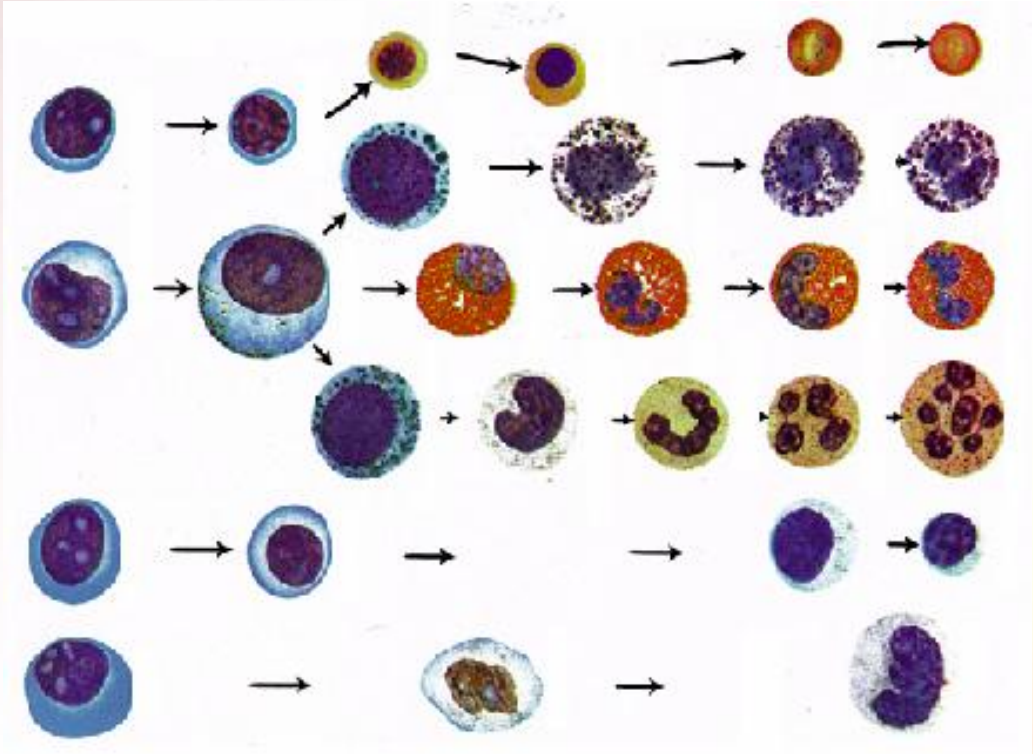


Young cell ⋯⋯▶ Adult cell

（6）N/C ratio:

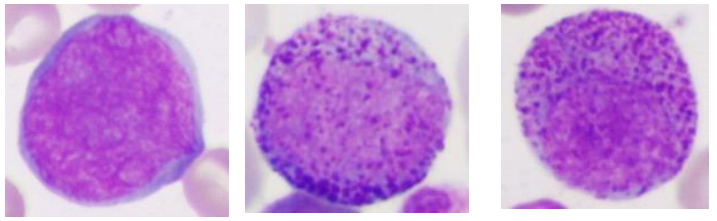
Large ⋯⋯⋯⋯⋯⋯▶ Small

| 性質 | 成熟的變化 |
| --- | --- |
| 細胞質的含量 | 由少漸漸增加 |
| 核質比(N/C ratio) | 比例減少 |

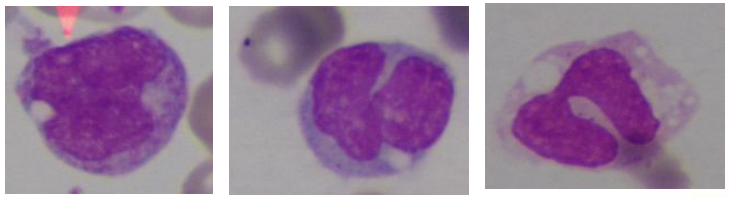


# N/C ratio: Nucleus : Cytoplasm

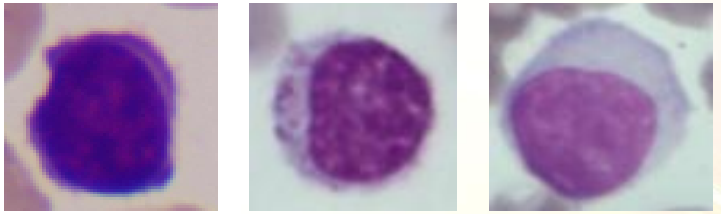
Young cell ---- 5:1 or 4:1 or 3:1 or 2:1



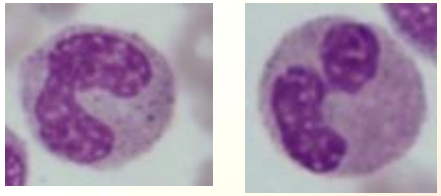
Monocyte ---- 2:1 or 1:1



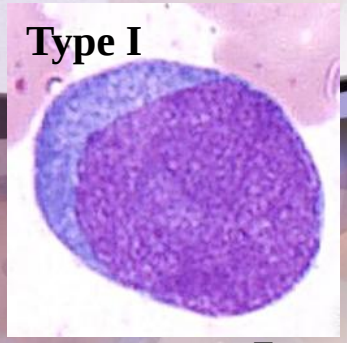
Lymphocyte --- 4:1 or 3:1

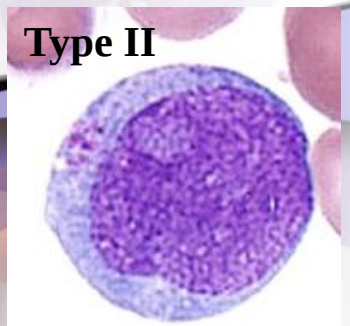


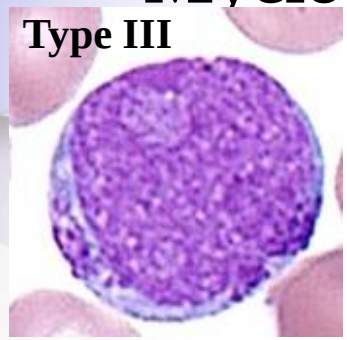
Neutrophil ---- 1:1

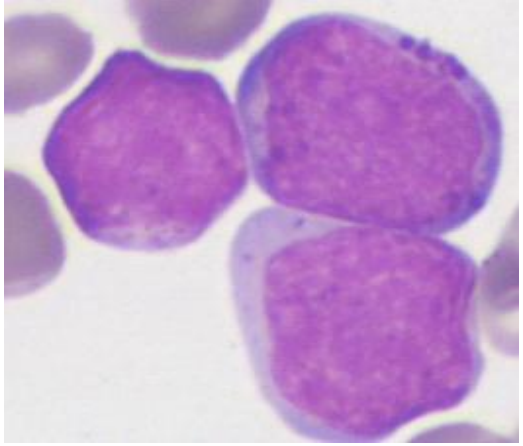


# Myeloblast

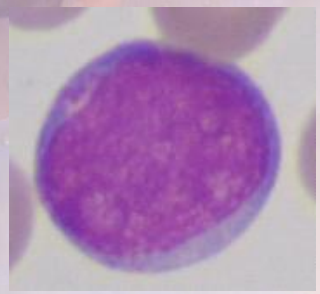


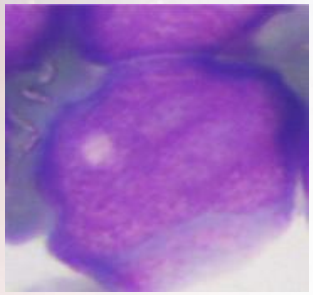



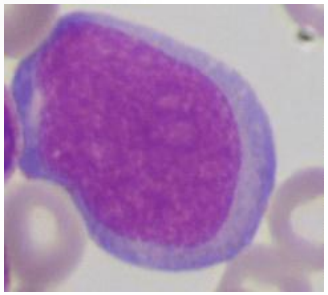



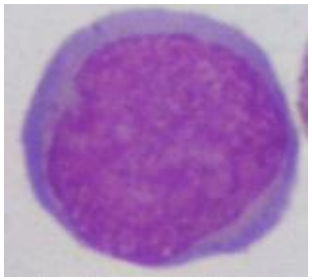



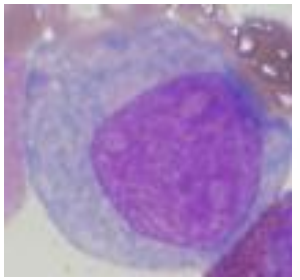
From : imagebank.hematology.org

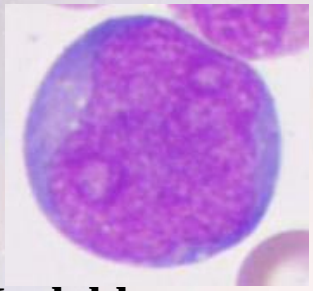


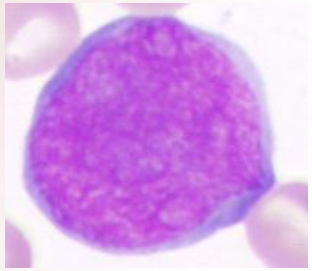


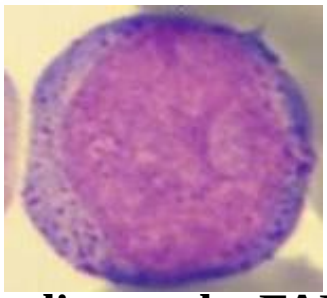


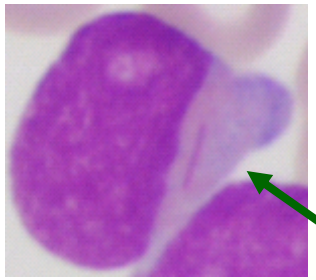


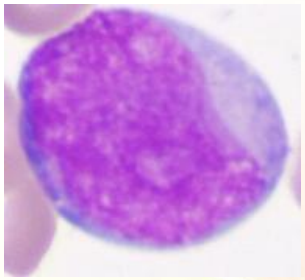












**Myeloblasts are subclassified into (according to the FAB classification) :**

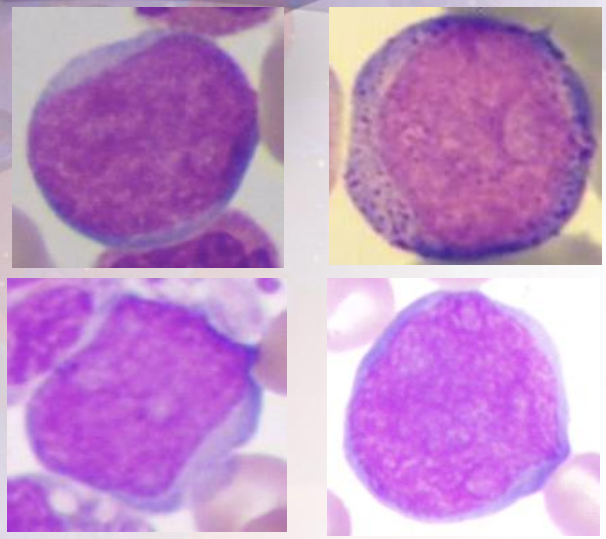
Type I myeloblasts : Type I blasts lack cytoplasmic granules, but possess prominent nucleoli

Type II myeloblasts : are very similar to Type I, except small azurophilic granules are scattered in the cytoplasm

Type III myeloblasts : Type III blasts have more than 20 azurophilic cytoplasmic granules with the characteristics of promyelocytes, occurs most characteristically in M2 AML.

# Myelocytic series

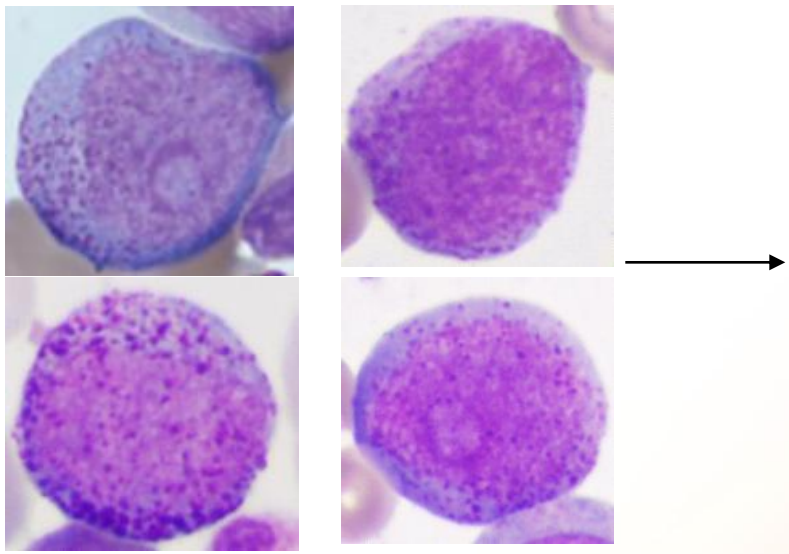
## Myeloblast



核染色質呈均質性纖細網狀，
核仁明顯(透亮)，胞質
為淡藍色或色不均勻感
，無顆粒有時可見有少許
azure顆粒

Size : 15-20 um

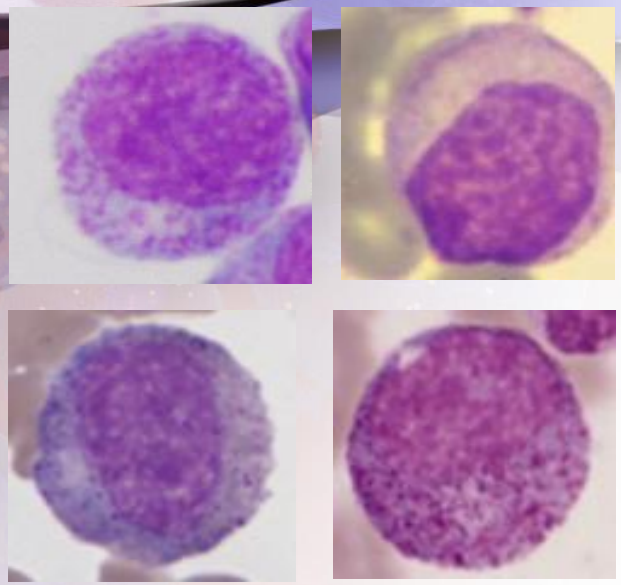
## Promyelocyte



Promyelocyte 比Myeloblast稍大，
azure顆粒也較多，胞質的藍色
還殘留，核染色質已不纖細，
有稍微凝集之狀，仍可見核仁

**Size : 14-25 um**

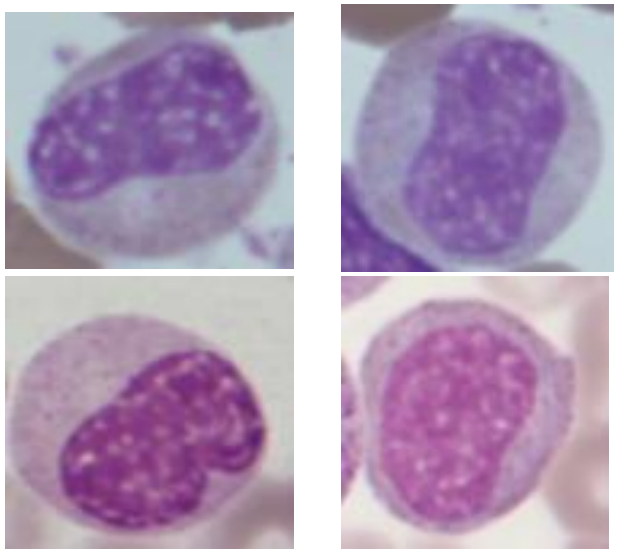
## Myelocyte



胞質還稍帶有藍色或失去嗜鹼性，核染色質粗糙(中度聚集)，常看不見核仁

Size : 15-18 um

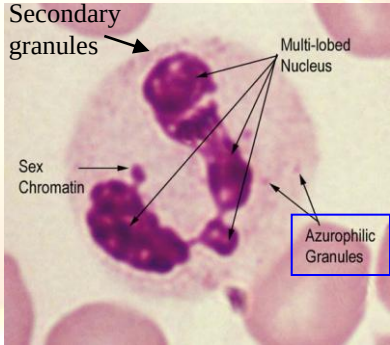
## Metamyelocyte



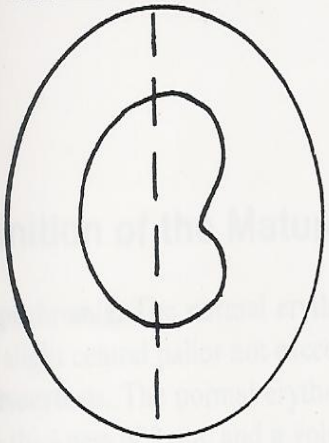
胞質已失去藍色調，胞核稍微凹入或呈腎形，核染色質濃縮不均且粗糙

Size : 12-16 um

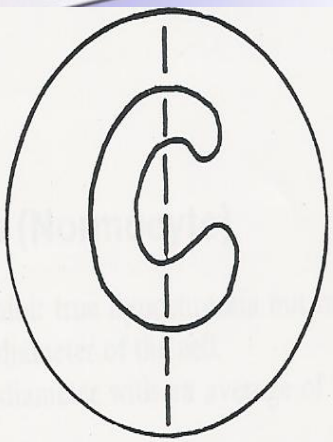
| | Primary granules (azurophilic granules) | Secondary granules (specific granules) |
|---|---|---|
| **Myeloblast** | +, - | - |
| Promyelocyte | 4+ | - |
| Myelocyte | 2+ | 4+ |
| Metamyelocyte | 1+ | 3+ |
| Band form | 1+ | 3+ |
| Neutrophil | 1+ | 3+ |
| Eosinophil | 1+ | 3+ |
| Basophil | 1+ | 3+ |



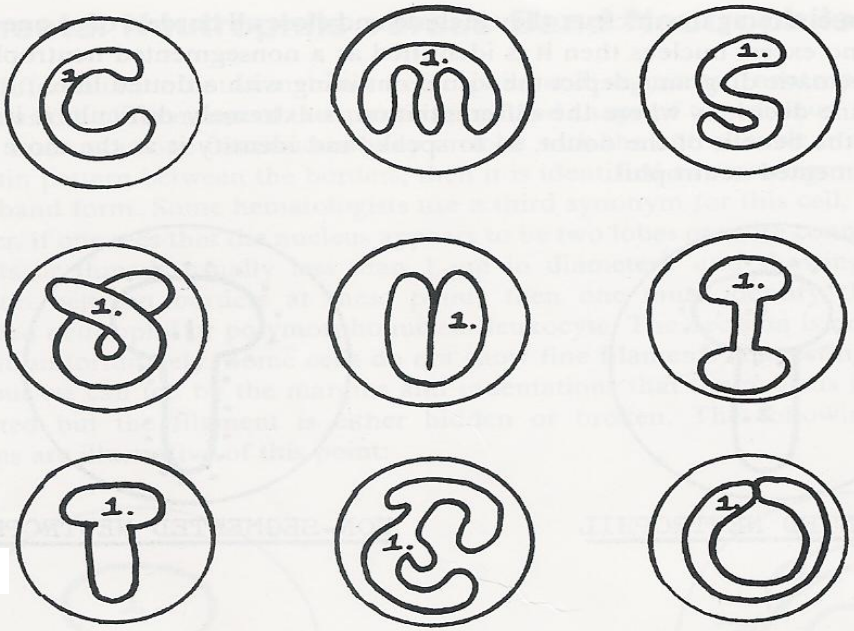

＊ 細胞愈成熟時，特異性顆粒變得愈不突出及愈小



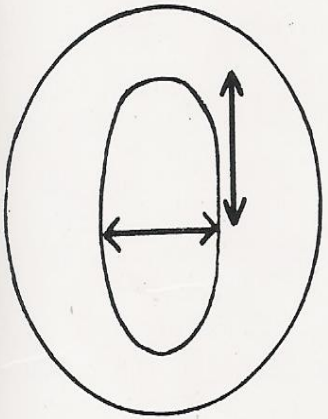
INDENTED NUCLEAR FORM
OF METAMYELOCYTE



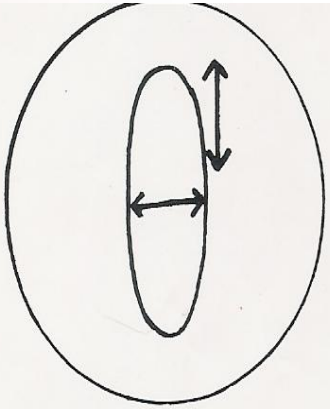
INDENTED NUCLEAR FORM
OF NON-SEGMENTED CELL



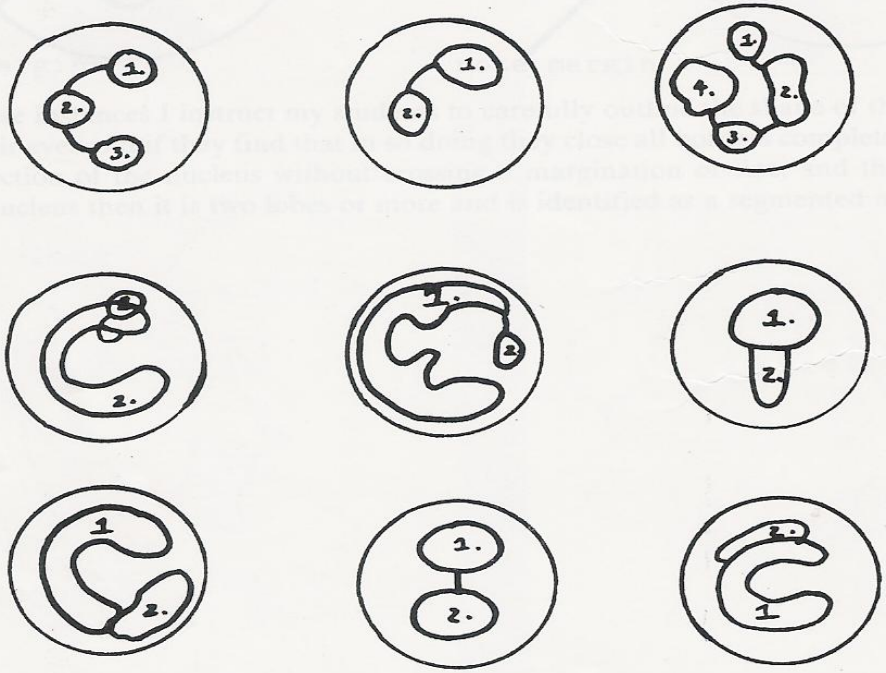
ABOVE: NON-SEGMENTED NEUTROPHILS



OVAL NUCLEAR FORM
OF METAMYELOCYTE



OVAL NUCLEAR FORM
OF NON-SEGMENTED CELL



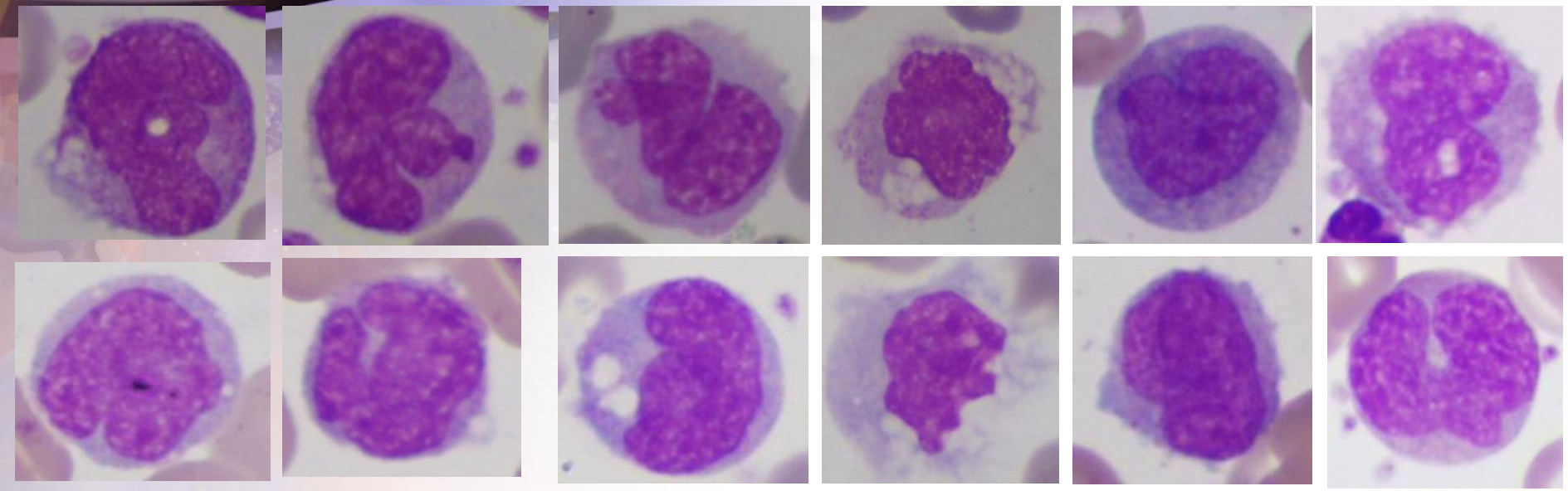
# Eosinophil

細胞核大都為2葉，3葉的較少，其胞核比Neut. Seg較肥大，呈卵圓形或腎形，且兩葉核大小略同，胞質內含有橘紅色大小相同的顆粒，當轉動細調節輪時可以感覺顆粒在閃爍

# Basophil

* 比Neutrophil稍小，細胞邊圍有暈狀感，胞質的染色看起來較髒，胞核邊緣不清楚；核染色質如粘土，並無chromatin/para-chromatin之顯著對比
* 粗而黑且相當大的basophilic granules，顏色很深，即使是覆蓋於細胞核上的顆粒也清晰可見，有時顆粒被溶解而形成空泡
* Nucleus 裂成多葉，但其分葉常呈碎裂或出芽狀，有時因其內顆粒又大又多，會遮住細胞核而無法看出其形狀

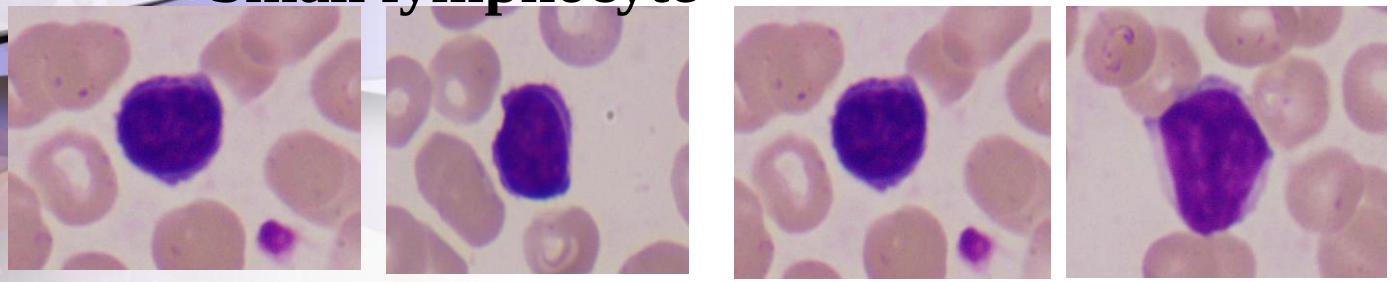
# Monocyte



為正常血液中最大的白血球，其胞核型態的特徵明顯，為多種形態(馬蹄形、圓形、腎形等)，有時會有不規則分葉的傾向或呈複雜凹凸狀。核染起來的顏色較不平均染色質結構極為鬆散，由於細絲交織而成網狀，塊狀染色質交錯其間，其無核仁細胞質邊緣呈圓形但有時為不整形，其內含有azure顆粒或空泡，比lymphocyte的顆粒微細且淡染

# Small lymphocyte

| Small |
| --- |
| 8-10 um |
| round |

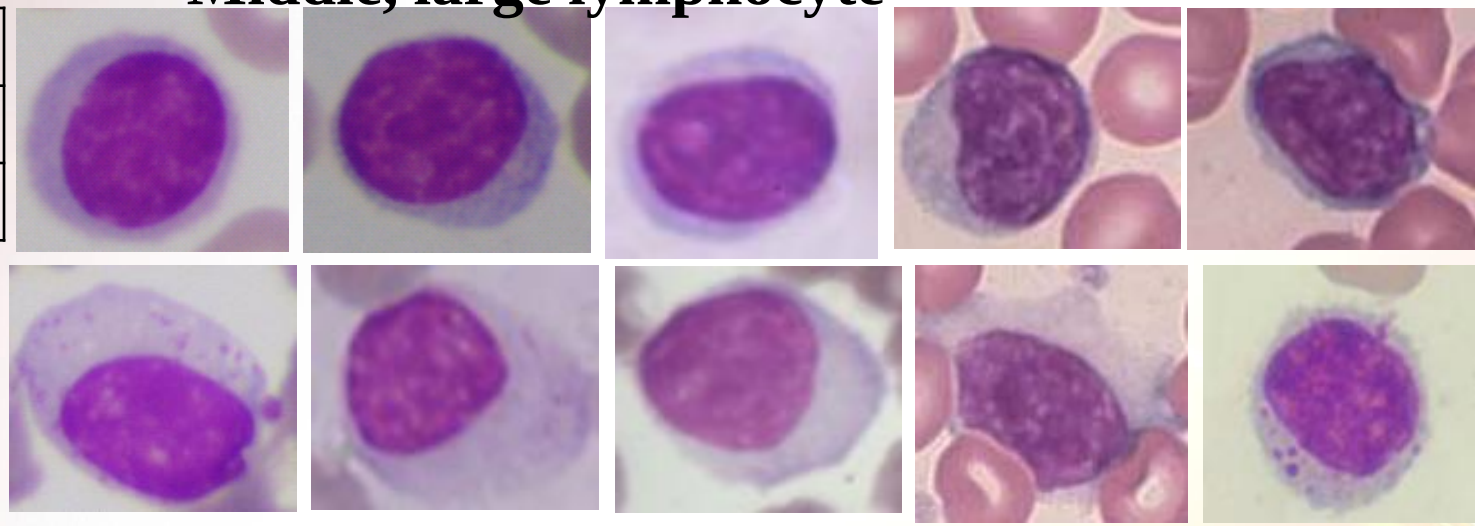


小的淋巴球：細胞質狹窄，為澄清的藍色，胞核呈圓形色濃染，
而核質網狀構造不清楚

# Middle, large lymphocyte

| Medium |
| --- |
| 10-12 um |
| round |

| Large |
| --- |
| 12-16um |
| round |

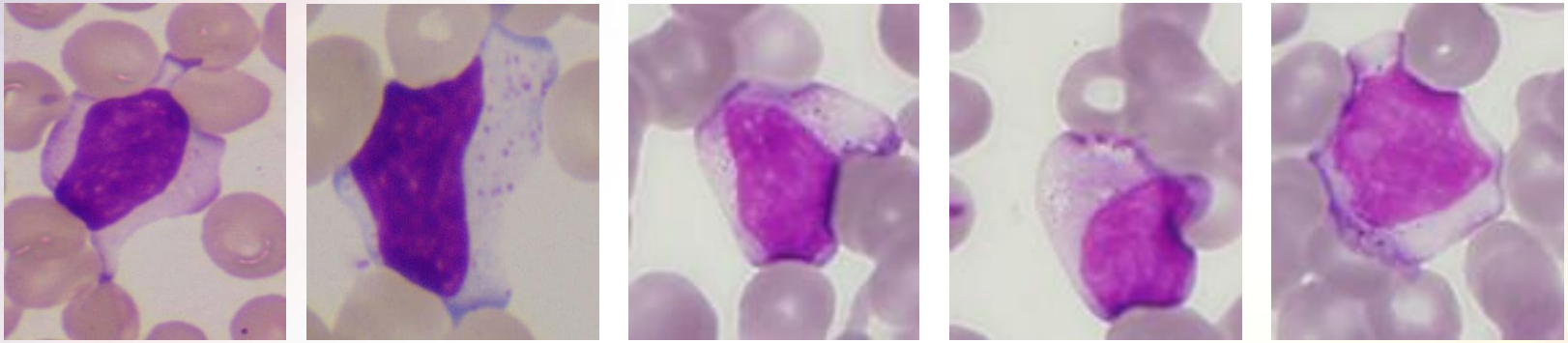


形略橢圓，為成熟細胞。偶而出現嗜天青顆粒（鮮紅色，大且量少）
及空泡（vacuole）。核深染且顏色較均勻；染色質chromatin呈團塊濃染，
結構緊密、聚集，無核仁但偶而可見核仁痕跡。

大的淋巴球：
細胞質豐富，比淡藍色稍藍，有數個紫紅色的azure顆粒，核質網濃密而粗大

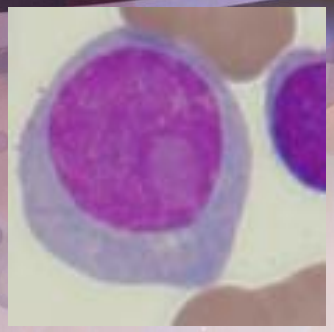
# Large granular lymphocytes

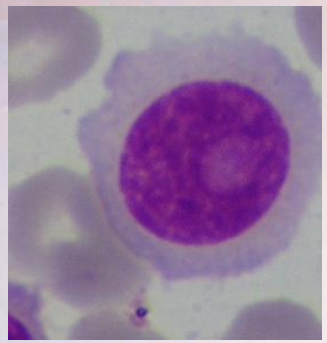
* Large granular lymphocyte ( Natural killer cell ) :細胞質著色最淺，最透明
* LGL with the nucleus of a small lymphocyte but abundant cytoplasm and fine or coarse azurophilic granules
* Large granular lymphocytic leukemia (LGL) affects adults and is rare in children, etiology being unknown

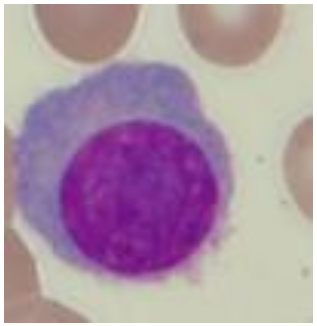


T lymphocytes : 60-80 %, from thymus
B lymphocytes : 20-30 %, from bone marrow
Nk cells : 5-10 %

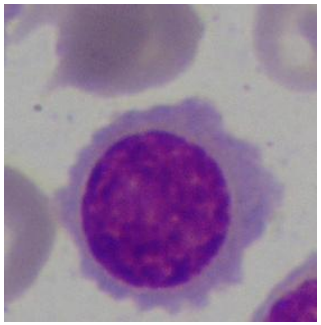
# Plasmablast ⋯⋯▶ Plasmacyte

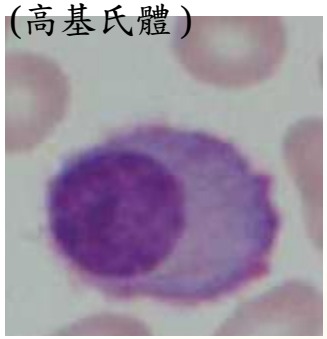







核週暈,核週光圈
(高基氏體)





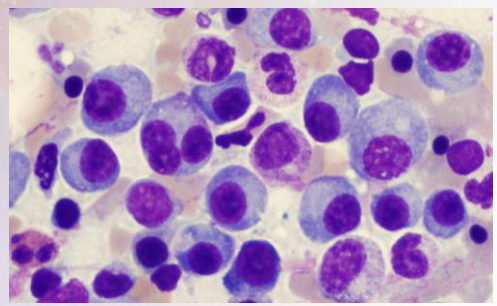
Size : 16-18 um，胞質為灰藍色
核為淡的紅紫色、位於中心或偏位，
核染質: fine stippled
Perinuclear clear zone

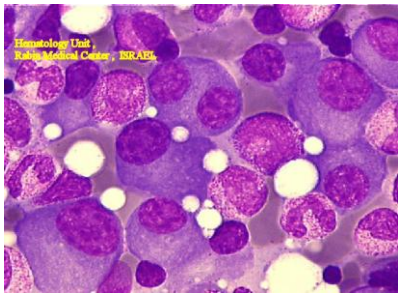
Size : 8-20 um，胞質為嗜鹼性藍色
核為藍紫色、常居偏位，核週圍有暈圈，核染質粗且凝聚在核的邊緣，或可見nodular chromatin，
具有清楚的稀疏副染色質
some multinucleated

* Plasma B cells are lymphocytes that participate in humoral immunity by producing antibodies in response to antigen stimulation

# 多發性骨髓瘤Multiple myeloma, MM (Myeloma, plasma cell myeloma, or as Kahler‘s disease ）

＊是一種漿細胞不正常增生，致使侵犯骨髓的一種惡性腫瘤






## Plasma cell leukemia (PCL)

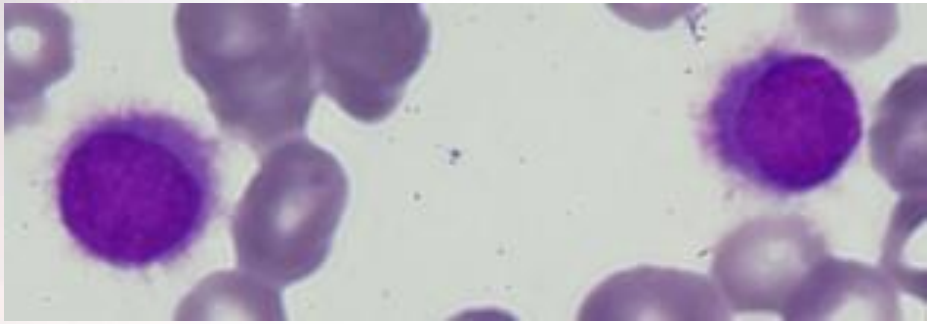
＊ is a rare but aggressive form of lymphoproliferative disorder characterized by malignant plasma cells in the bone marrow and peripheral blood

＊ The WHO criterion for diagnosis of PCL is that plasma cells constitute more than 20% of cells in the peripheral blood

# Hairy cell (HC)毛樣(髮狀)細胞

＊ 其特點是惡性成熟B 細胞，直径10～25μm，胞質淡藍至灰藍色，常有細小和毛髮(茸毛狀)突起的淋巴細胞

＊ The cell has a mature chromatin pattern



# 淋巴瘤Lymphoma

＊ 是指周邊淋巴組織的T或B細胞腫瘤

＊ **此惡性腫瘤細胞Lymphoma cell可能具有正常、主要的淋巴細胞的型態特徵**，但更常見其形態和外表型態特徵是正常B或T細胞曝露於抗原後進行的活化或變形的不同階段中的某一種細胞

Peripheral blood can helps to further purify the body of disease

↓

An outpatient

Gaining information for diagnosis by asking the patient –symptoms, History

The doctor may recommend a number of diagnostic tests
to learn more about patient,s condition

A blood test used to evaluate your overall health and detect a wide range of disorders

--- **Complete blood count (CBC) and differential count**

WBC, Hb, Platelet count

Normal

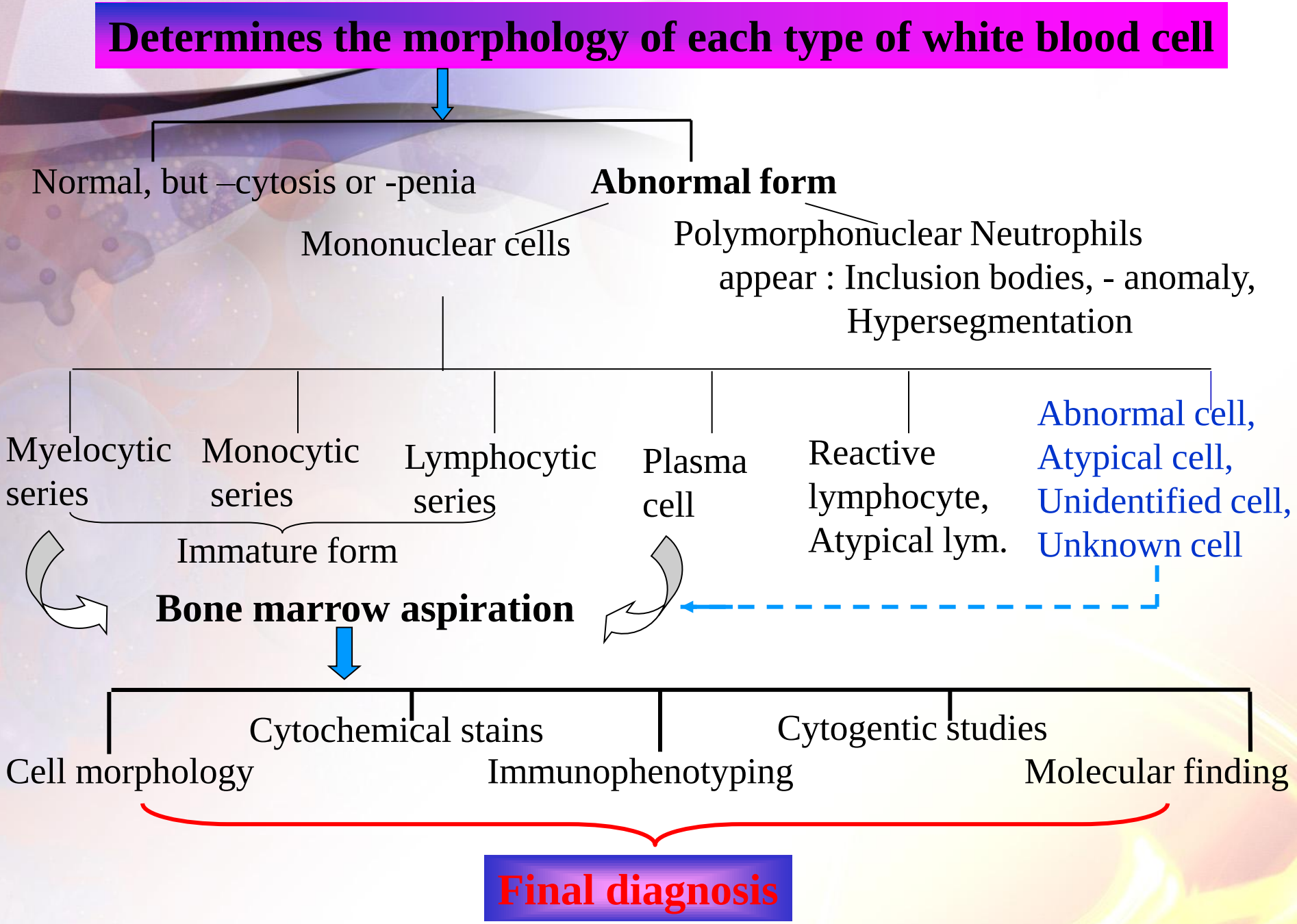
High or Low

Differential count

Abnormal

Normal

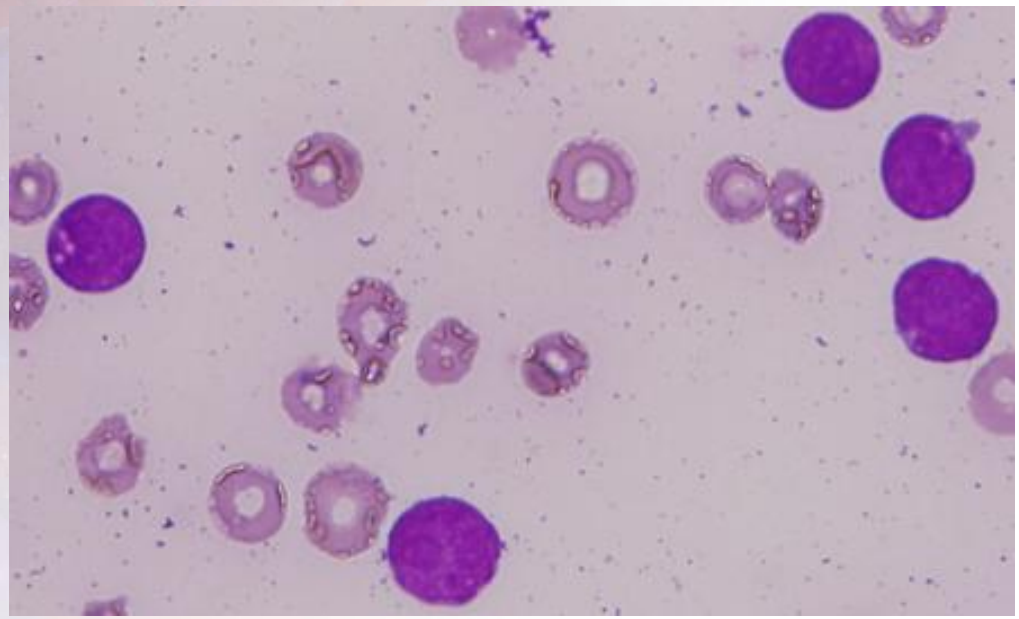
**Determines the number of each type of white blood cell, present in the blood**

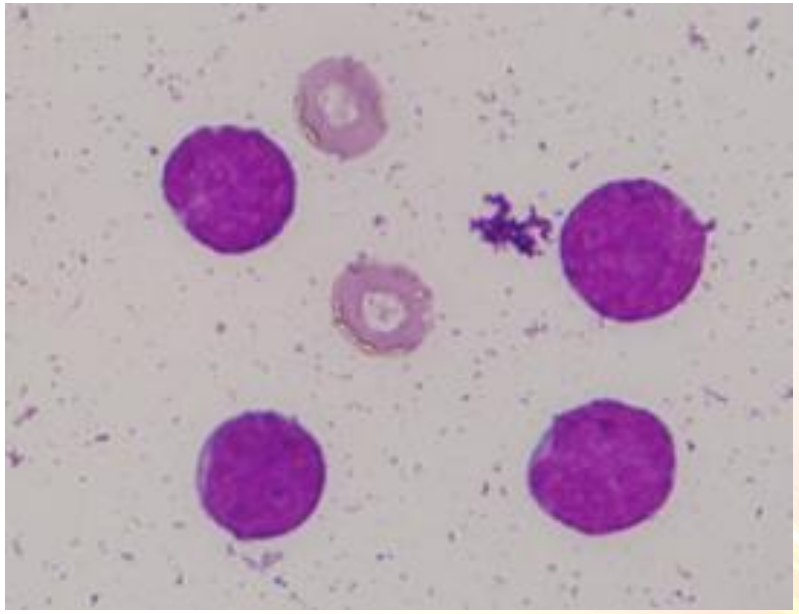

Determines the morphology of each type of white blood cell
Normal, but –cytosis or -penia
Abnormal form
Mononuclear cells
Polymorphonuclear Neutrophils
appear : Inclusion bodies, - anomaly,
Hypersegmentation
Myelocytic series
Monocytic series
Lymphocytic series
Plasma cell
Reactive lymphocyte, Atypical lym.
Abnormal cell, Atypical cell, Unidentified cell, Unknown cell
Immature form
Bone marrow aspiration
Cytochemical stains
Cytogentic studies
Cell morphology
Immunophenotyping
Molecular finding
Final diagnosis

# Case 1 – U.29-ped

∗ Laboratory data of blood routine include:
WBC : 133400 /uL
HGB : 4.0 g/dL
Pl count：84000 /uL
DC : Blast : 92 %

**1. Cell size**
**2. Cytoplasm color**
**3. Granule of cytoplasm**
**4. Nucleus shape and Nucleolus**
**5. Chromatin of nucleus**
**6. N/C ratio**





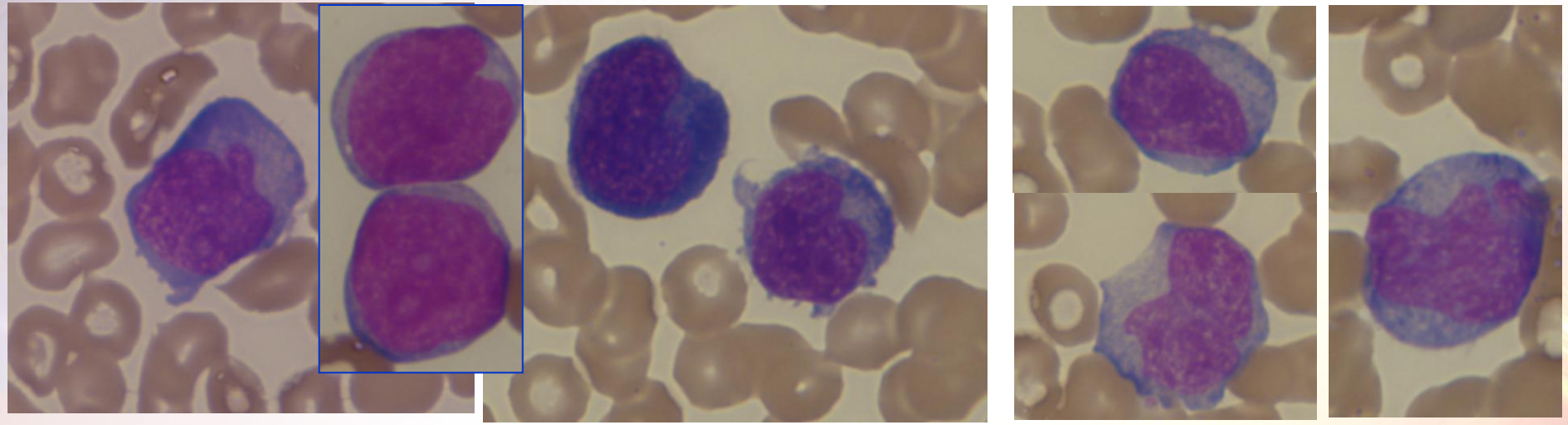
**Final diagnosis : ALL**

# Case 2 – U.265

∗ Laboratory data of blood routine include:

WBC : 28200 /uL
RBC : 5.51 M/CUMM
HGB : 16.5 g/dL
HCT : 48.5 %
MCV : 84.1 CUU
Pl count： 212000 /uL
DC : Atypical lymphocyte : 19 %, Lymphocyte : 69 %

**1. Cell size**
**2. Cytoplasm color**
**3. Granule of cytoplasm**
**4. Nucleus shape and Nucleolus**
**5. Chromatin of nucleus**
**6. N/C ratio**



**Final diagnosis : Atypical lymphoid hyperplasia**

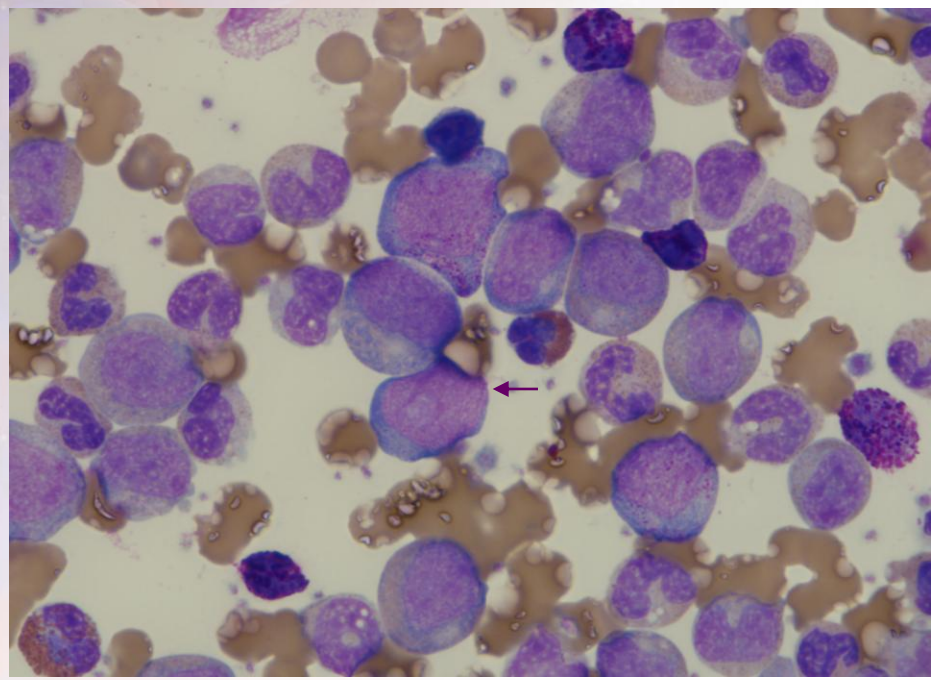
# Case 3 – 02-479

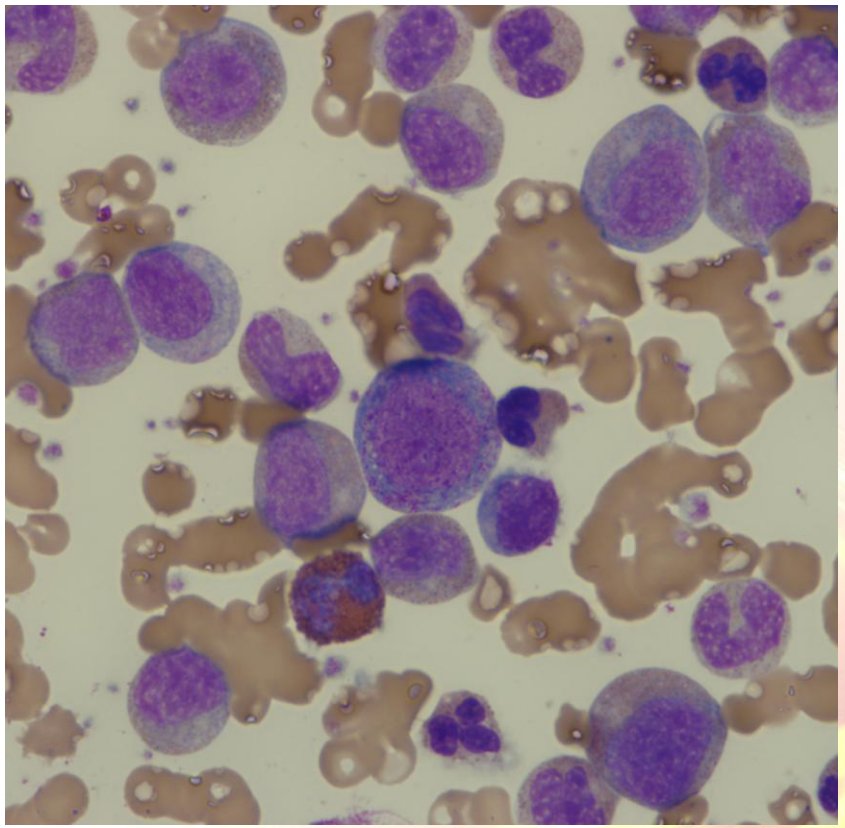
∗ Laboratory data of blood routine include:

WBC : 433300 /uL
RBC : 2.94 M/CUMM
HGB : 10.2 g/dL
HCT : 29.9 %
MCV : 101.7 CUU
Pl count : 498000 /uL

DC : Blast : 5%, promyelo : 20%, myelo : 16%, mate : 6%, Eosin : 3%, Baso : 4 %

**1. Cell size**
**2. Cytoplasm color**
**3. Granule of cytoplasm**
**4. Nucleus shape and Nucleolus**
**5. Chromatin of nucleus**
**6. N/C ratio**





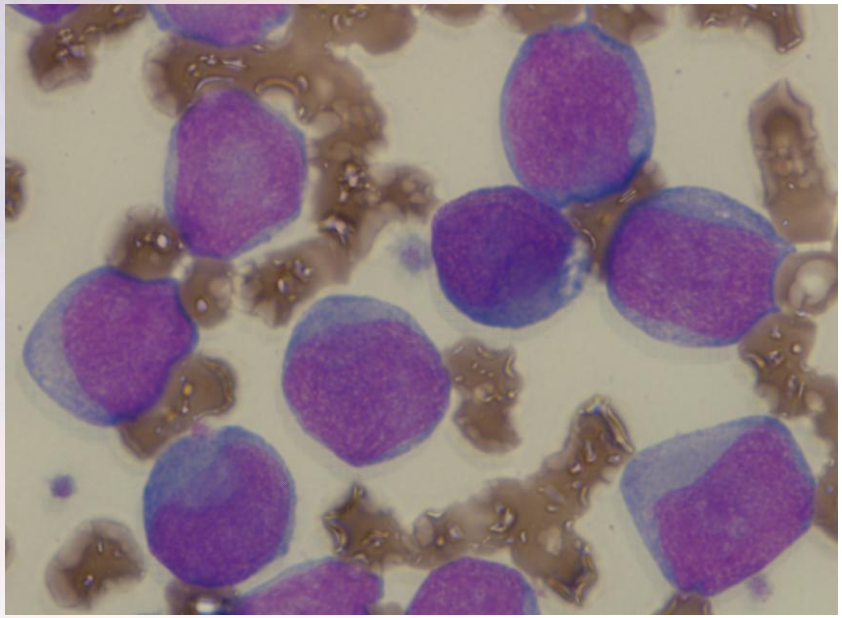
**Final diagnosis : CML**

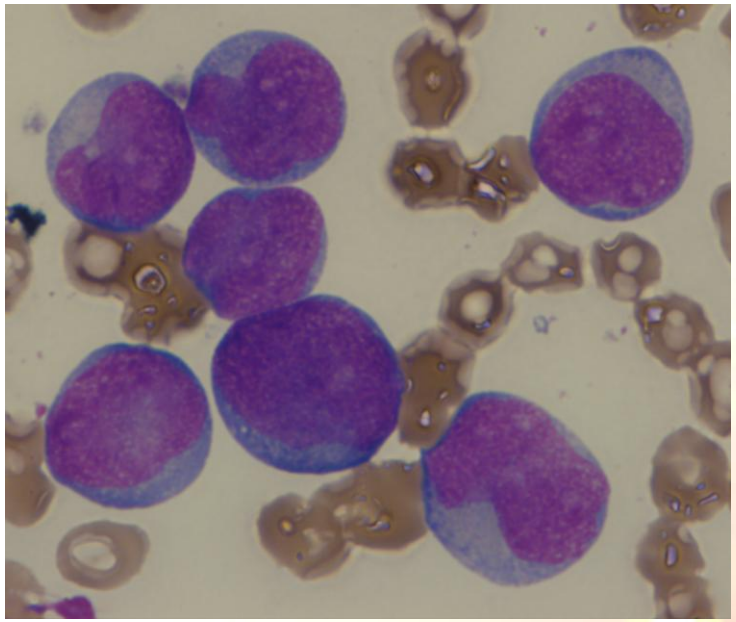
# Case 4 – U-292

∗ Laboratory data of blood routine include:

WBC : 205100 /uL
RBC : 2.91 M/CUMM
HGB : 9.6 g/dL
HCT : 27.8 %
MCV : 95.9 CUU
Pl count：91000 /uL
DC : Blast : 93 %

**1. Cell size**
**2. Cytoplasm color**
**3. Granule of cytoplasm**
**4. Nucleus shape and Nucleolus**
**5. Chromatin of nucleus**
**6. N/C ratio**





**Final diagnosis : Acute myeloblastic leukemia**

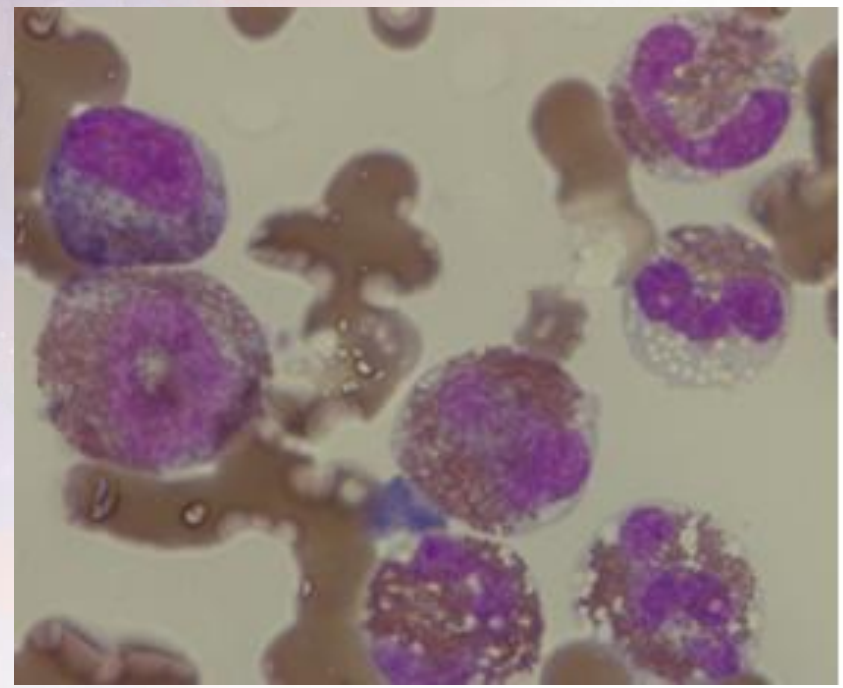
# Case 5 – U-298

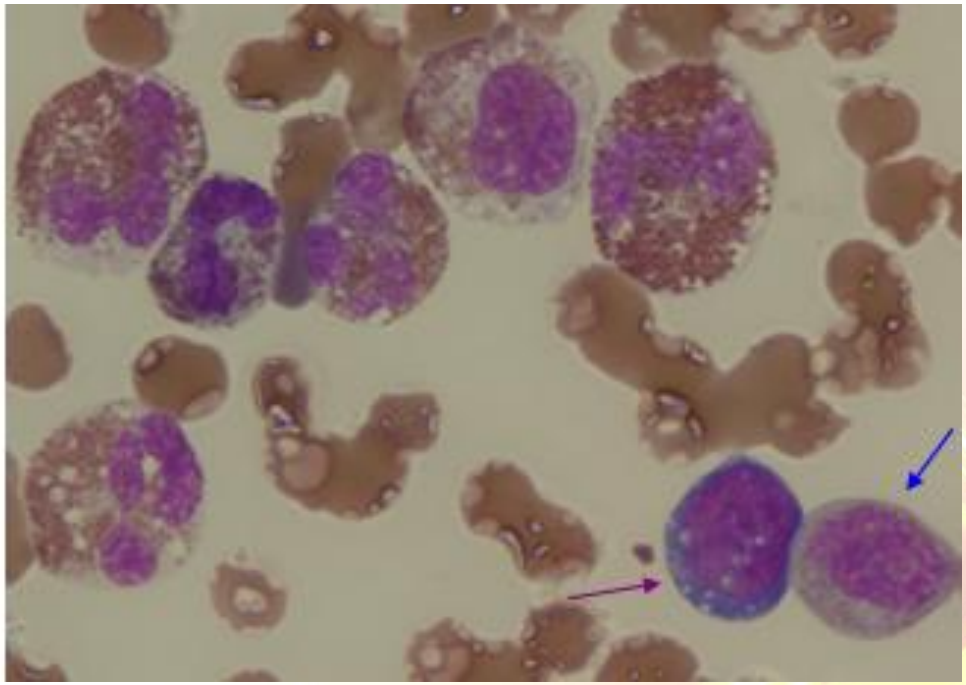
∗ Laboratory data of blood routine include:

WBC : 101400 /uL
RBC : 2.72 M/CUMM
HGB : 9.7 g/dL
HCT : 27.0 %
MCV : 99.3 CUU
Pl count：24000 /uL

**1. Cell size**
**2. Cytoplasm color**
**3. Granule of cytoplasm**
**4. Nucleus shape and Nucleolus**
**5. Chromatin of nucleus**
**6. N/C ratio**

DC : Blast : 2 %, Eo myelo : 4 %, Eo mate : 2 %, Eosin : 83 %, Neut. mye : 3 %





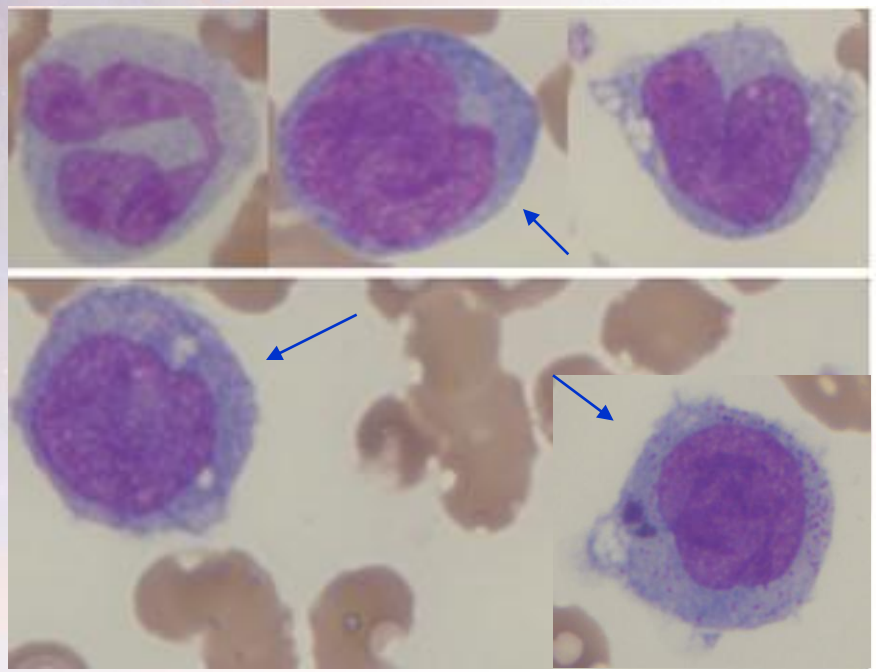
**R/O diagnosis : Acute eosinophilic leukemia**

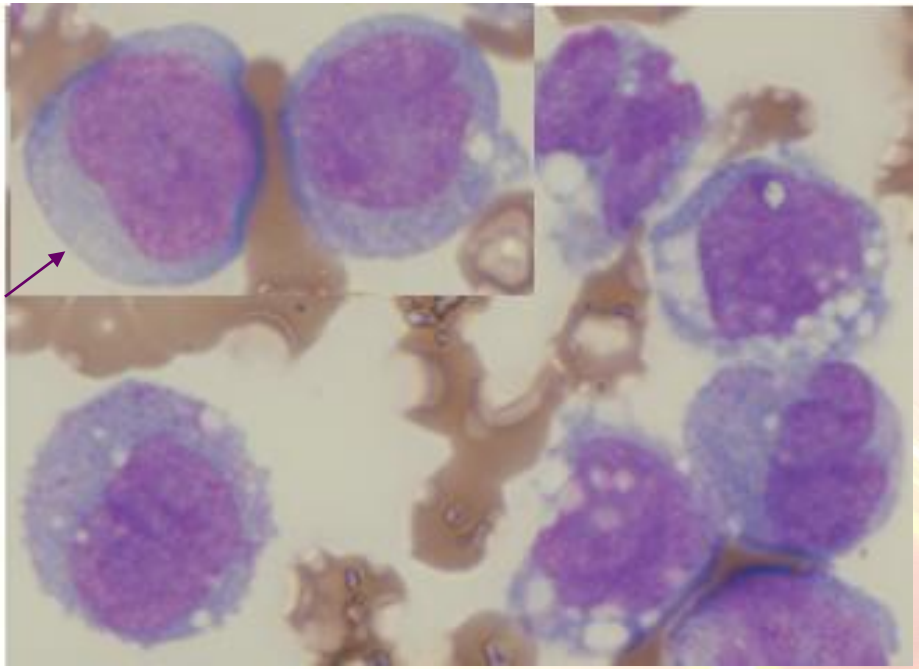
# Case 6 – U-282

∗ Laboratory data of blood routine include:

WBC : 20100 /uL
RBC : 2.97 M/CUMM
HGB : 8.9 g/dL
HCT : 26.3 %
MCV : 88.4 CUU
Pl count：88000 /uL
DC : Blast : 4 %, Promonocyte : 7 %, Monocyte : 69 %

**1. Cell size**
**2. Cytoplasm color**
**3. Granule of cytoplasm**
**4. Nucleus shape and Nucleolus**
**5. Chromatin of nucleus**
**6. N/C ratio**





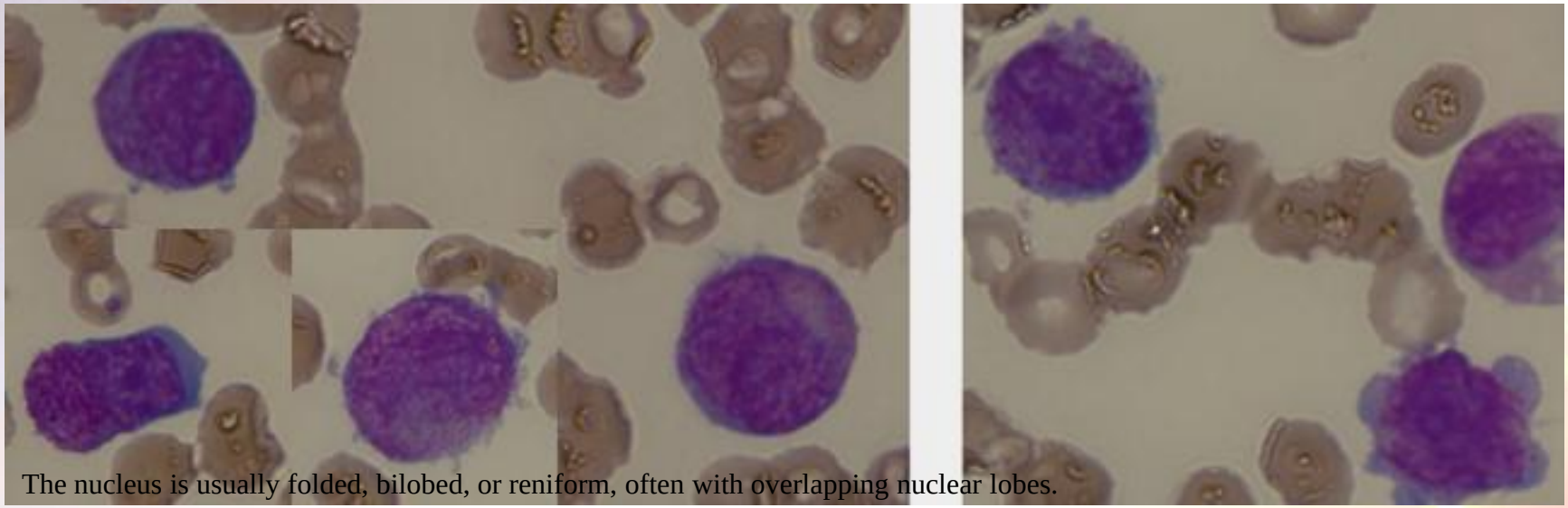
**Final diagnosis : Acute monocytic leukemia**

# Case 7 – U-294

∗ Laboratory data of blood routine include:

WBC : 17000 /uL
RBC : 2.15 M/CUMM
HGB : 6.4 g/dL
HCT : 19.0 %
MCV : 88.5 CUU
Pl count：20000 /uL
DC : Blast : 3 %, Promyelo : 79 %, myelo : 2 %

**1. Cell size**
**2. Cytoplasm color**
**3. Granule of cytoplasm**
**4. Nucleus shape and Nucleolus**
**5. Chromatin of nucleus**
**6. N/C ratio**



The nucleus is usually folded, bilobed, or reniform, often with overlapping nuclear lobes.

**Final diagnosis : Acute promyelocytic leukemia**

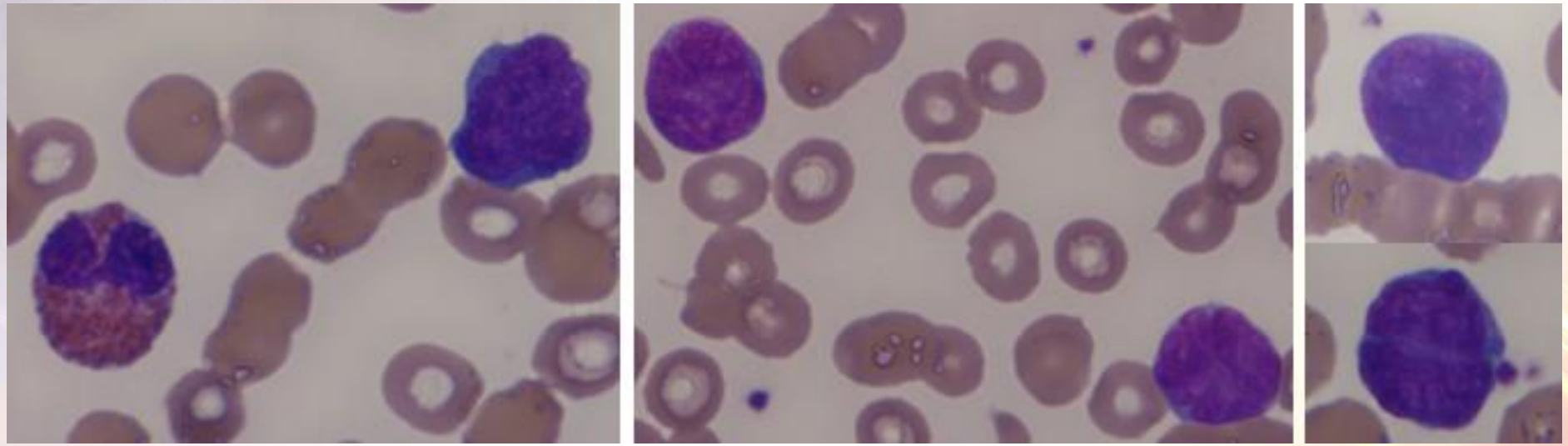
# Case 8 – U-269

∗ Laboratory data of blood routine include:

WBC : 7500 /uL
RBC : 4.27 M/CUMM
HGB : 14.3 g/dL
HCT : 41.9 %
MCV : 97.3 CUU
Pl count：187000 /uL

**1. Cell size**
**2. Cytoplasm color**
**3. Granule of cytoplasm**
**4. Nucleus shape and Nucleolus**
**5. Chromatin of nucleus**
**6. N/C ratio**

DC : Abnormal cell : 18 %, Atypical lymphocyte: 3 %, Lymphocyte : 38 %



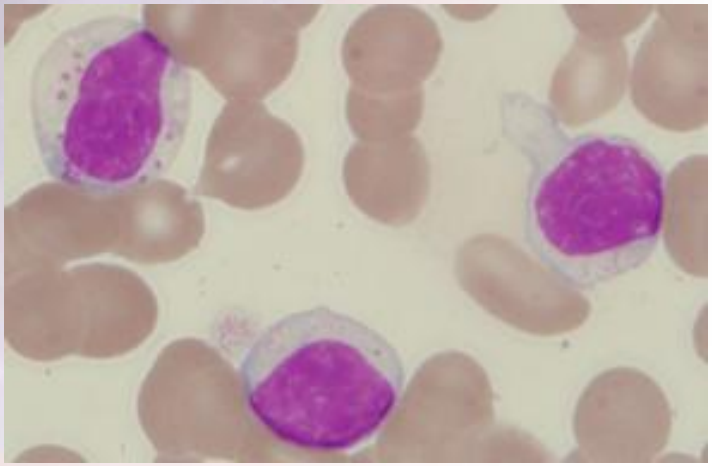
**Final diagnosis : Diffuse large B cell lymphoma**

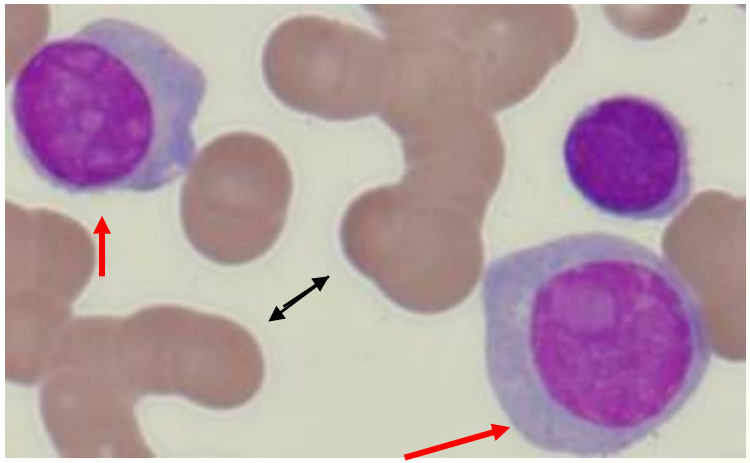
# Case 9 – U.89

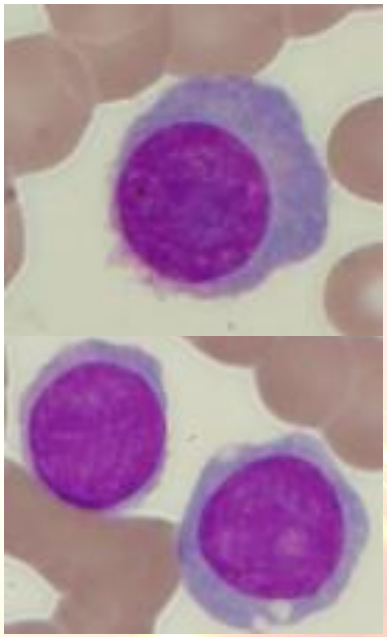
∗ Laboratory data of blood routine include:

WBC : 14300 /uL
RBC : 3.07 M/CUMM
HGB : 10.1 g/dL
HCT : 31.1 %
MCV : 101.3 CUU
Pl count：33000 /uL
DC : Plasma cell : 31 %, Blast : 10 %, Lymphocyte : 43 %

**1. Cell size**
**2. Cytoplasm color**
**3. Granule of cytoplasm**
**4. Nucleus shape and Nucleolus**
**5. Chromatin of nucleus**
**6. N/C ratio**





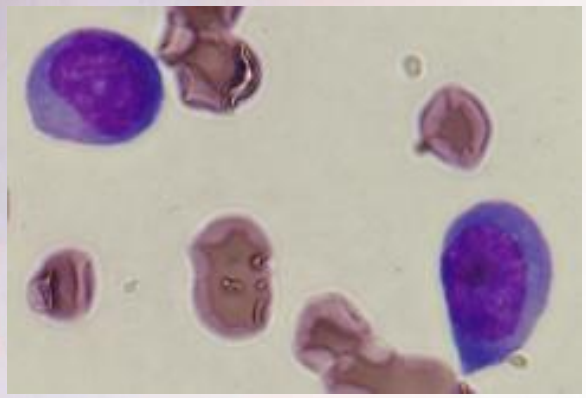


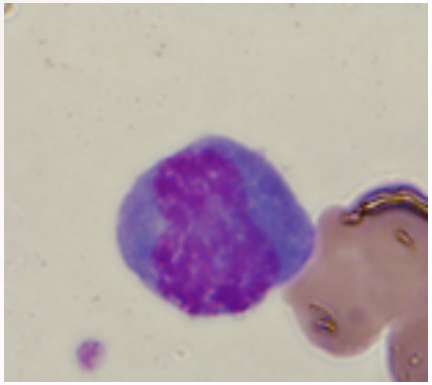
**Final diagnosis : Plasma cell leukemia**

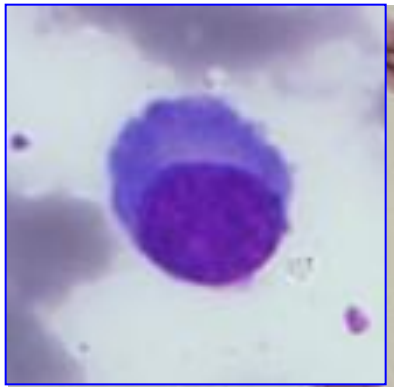
# Case 10 – U.109

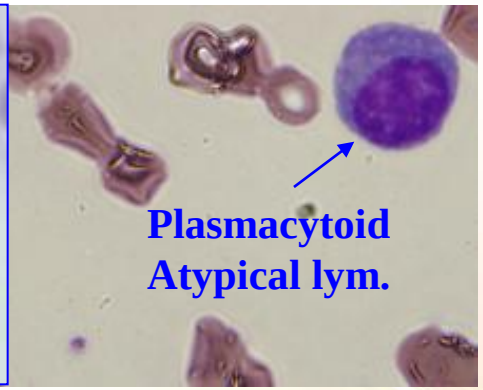
1. **Cell size**
2. **Cytoplasm color**
3. **Granule of cytoplasm**
4. **Nucleus shape and Nucleolus**
5. **Chromatin of nucleus**
6. **N/C ratio**

∗ Laboratory data of blood routine include:
WBC : 7600 /uL,
HGB : 5.3 g/dL
Pl count：33000 /uL
DC : Atypical lymphocyte : 17 %, Lymphocyte : 43 %









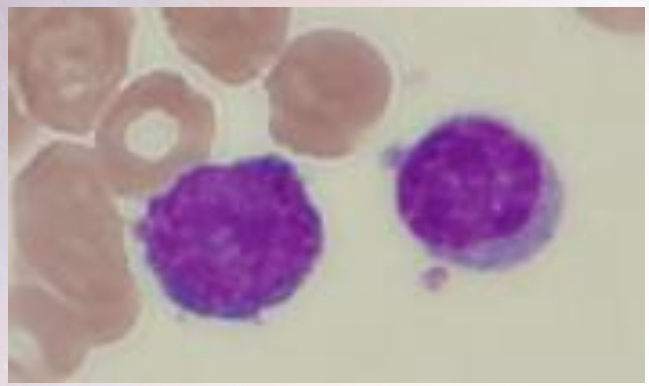
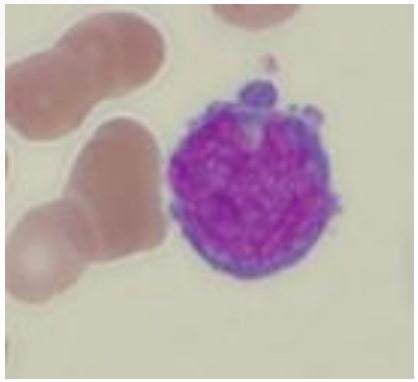
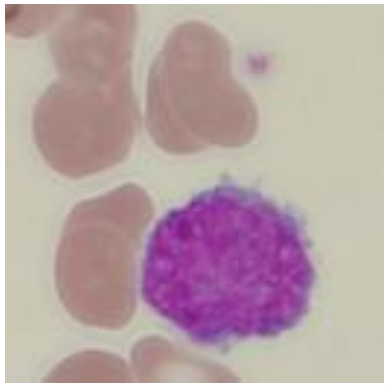
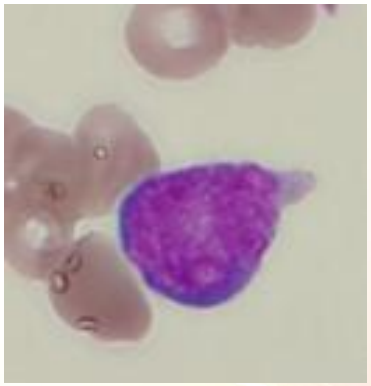

Rouleaux formation

**Final diagnosis : Multiple myeloma**

# Case 11 – U.122

∗ Laboratory data of blood routine include:
WBC : 6300 /uL,
HGB : 8.5 g/dL
Pl count : 19200 /uL
DC : Blast : 35 %, Lymphocyte : 43 %

**1. Cell size**
**2. Cytoplasm color**
**3. Granule of cytoplasm**
**4. Nucleus shape and Nucleolus**
**5. Chromatin of nucleus**
**6. N/C ratio**

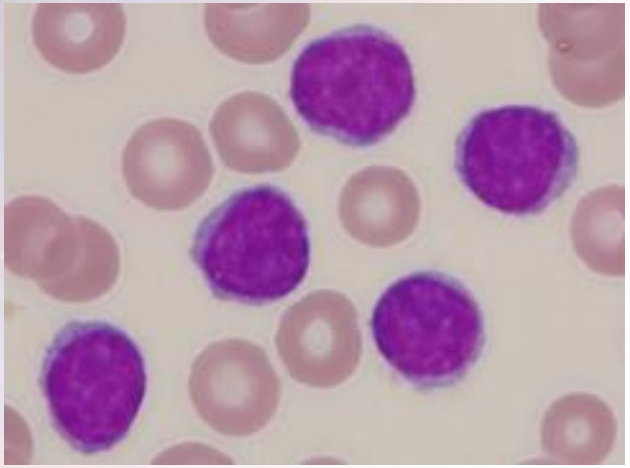
**Final diagnosis : Precursor B lymphoblast leukemia**

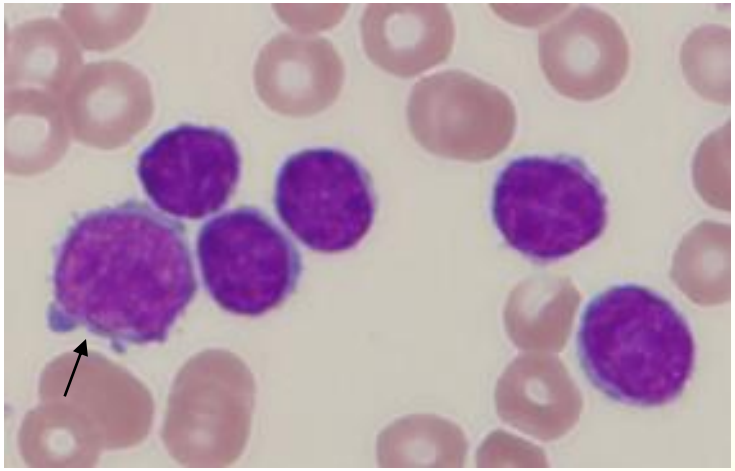
# Case 12 – U.181

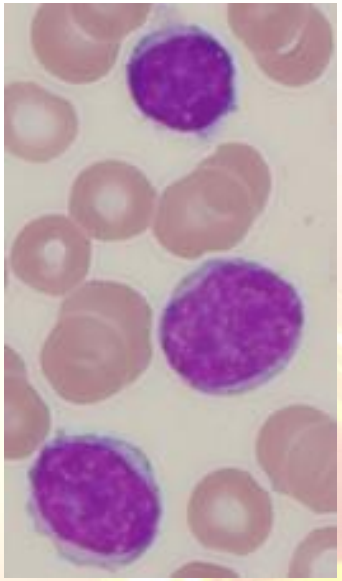
∗ Laboratory data of blood routine include:

WBC : 267000 /uL
RBC : 3.60 M/CUMM
HGB : 10.4g/dL
HCT : 33.6 %
MCV : 93.5 CUU
Pl count：219000 /uL
DC : Lymphocyte : 92 %, Blast : 1 %

**1. Cell size**
**2. Cytoplasm color**
**3. Granule of cytoplasm**
**4. Nucleus shape and Nucleolus**
**5. Chromatin of nucleus**
**6. N/C ratio**







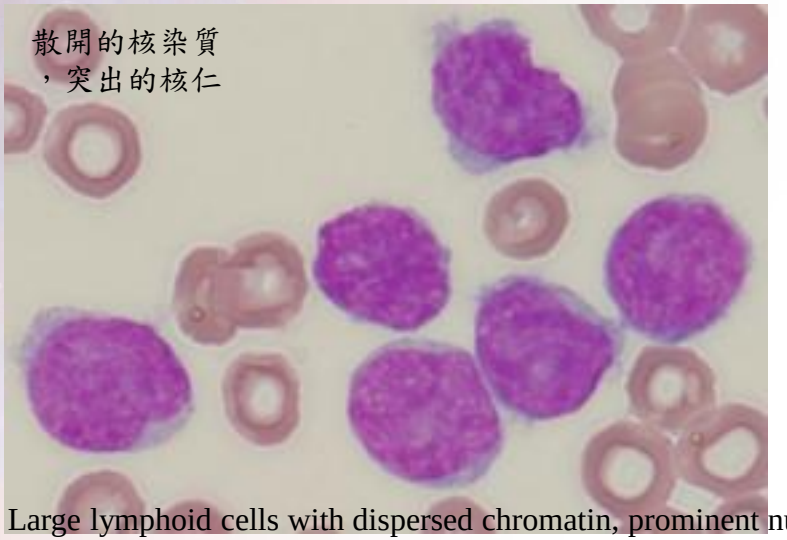
**Final diagnosis : CLL with B phenotyping**

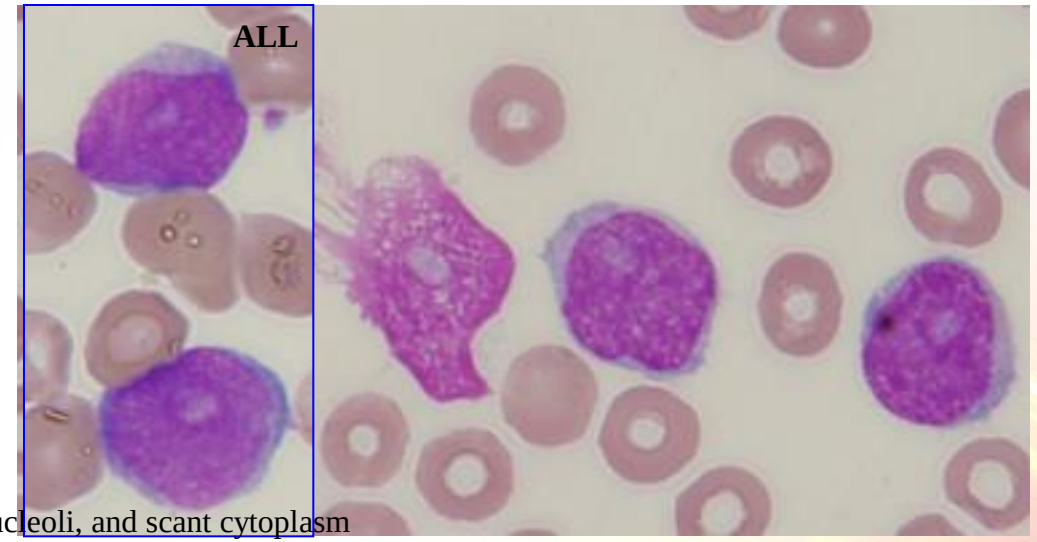
# Case 13 – U. 199

∗ Laboratory data of blood routine include:

WBC : 193000 /uL
RBC : 2.50 M/CUMM
HGB : 8.8 g/dL
HCT : 27.9 %
MCV : 109.0 CUU
Pl count：63000 /uL
DC : Abnormal cell : 30 %, Lymphocyte : 57 %

**1. Cell size**
**2. Cytoplasm color**
**3. Granule of cytoplasm**
**4. Nucleus shape and Nucleolus**
**5. Chromatin of nucleus**
**6. N/C ratio**




Large lymphoid cells with dispersed chromatin, prominent nucleoli, and scant cytoplasm

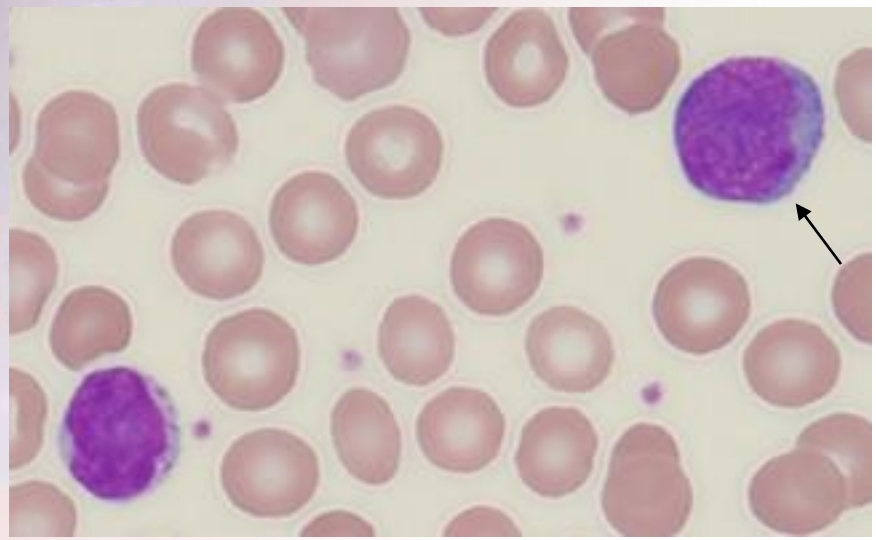
**Final diagnosis : Mantle cell lymphoma**

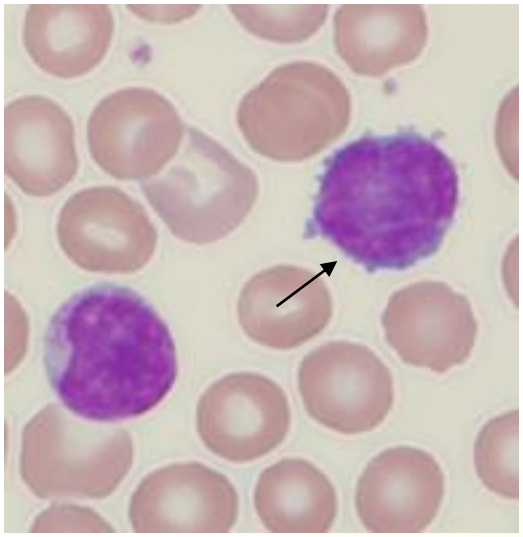
# Case 14 – U. 182

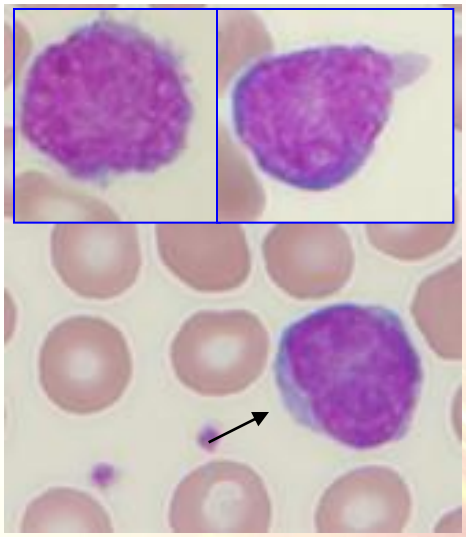
∗ Laboratory data of blood routine include:

WBC : 27400 /uL
RBC : 4.10 M/CUMM
HGB : 12.5 g/dL
HCT : 37.9 %
MCV : 92.4 CUU
Pl count：394000 /uL
DC : Abnormal cell : 17 %, Lymphocyte : 38 %

**1. Cell size**
**2. Cytoplasm color**
**3. Granule of cytoplasm**
**4. Nucleus shape and Nucleolus**
**5. Chromatin of nucleus**
**6. N/C ratio**







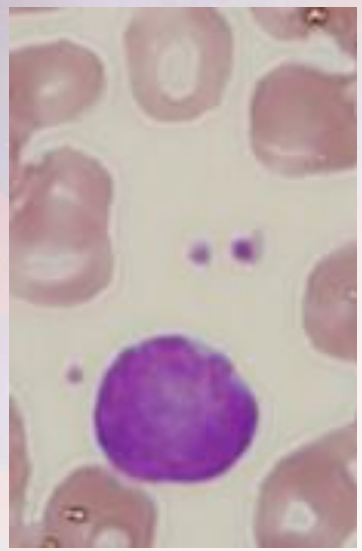
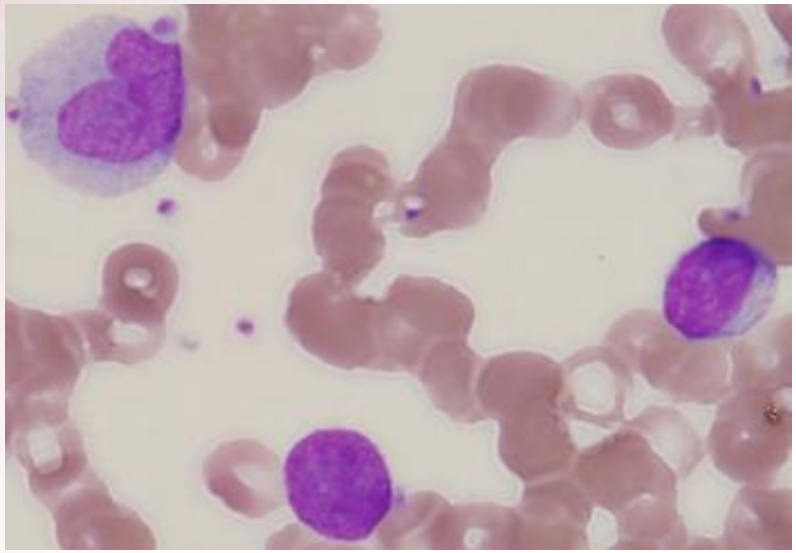
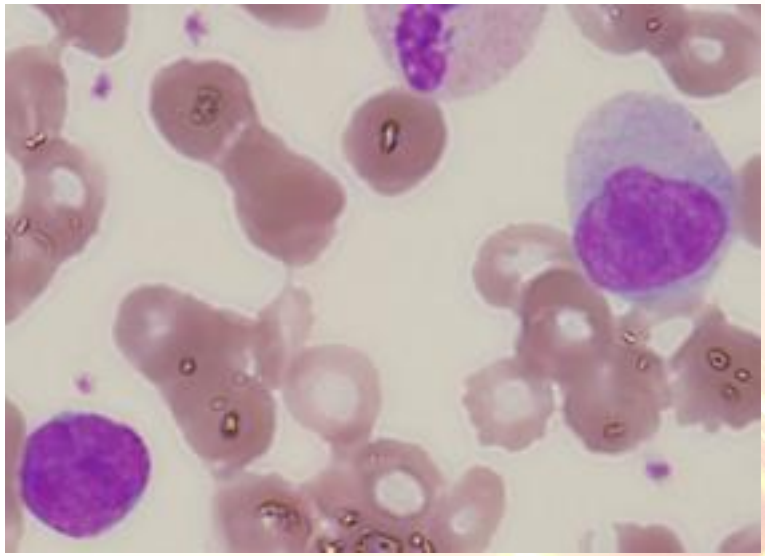
**Final diagnosis : T cell lymphoma**

# Case 15 – U. 192

∗ Laboratory data of blood routine include:

WBC : 15000 /uL
RBC : 3.91 M/CUMM
HGB : 10.2g/dL
HCT : 31.6 %
MCV : 80.9 CUU
Pl count：329000 /uL
DC : Abnormal cell : 15 %, Lymphocyte : 31 %

**1. Cell size**
**2. Cytoplasm color**
**3. Granule of cytoplasm**
**4. Nucleus shape and Nucleolus**
**5. Chromatin of nucleus**
**6. N/C ratio**

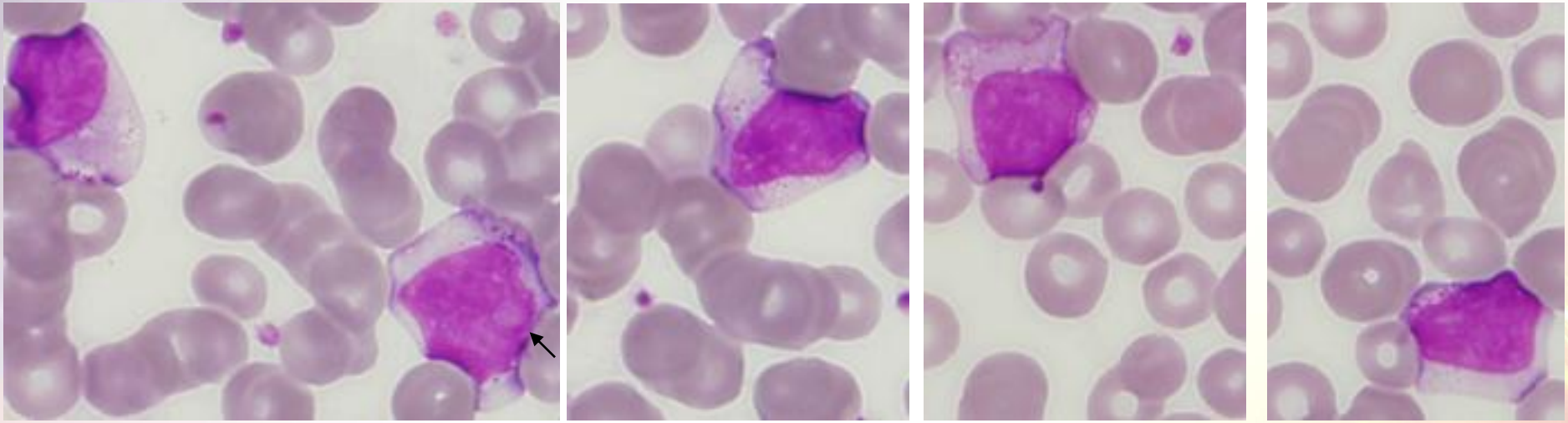
**Final diagnosis : Mantle cell lymphoma, Leukemia change**

# Case 16 – C 31

∗ Laboratory data of blood routine include:

WBC : 15730 /uL
RBC : 5.20 M/CUMM
HGB : 14.2 g/dL
HCT : 44.4 %
MCV : 85.4 CUU
Pl count：187000 /uL
DC : Large granular lymphocyte : 77 %

**1. Cell size**
**2. Cytoplasm color**
**3. Granule of cytoplasm**
**4. Nucleus shape and Nucleolus**
**5. Chromatin of nucleus**
**6. N/C ratio**



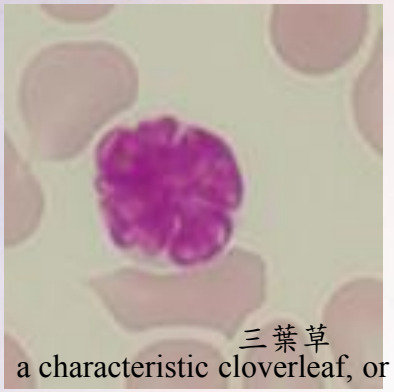
**Final diagnosis : NK cell leukemia**

# Case 17 – C. 34

∗ Laboratory data of blood routine include:
WBC : 87000 /uL,
HGB : 10.1 g/dL
Pl count：172000 /uL
DC : Abnormal cell : 18 %, Lymphocyte : 41 %

cloverleaf or flower form

**1. Cell size**
**2. Cytoplasm color**
**3. Granule of cytoplasm**
**4. Nucleus shape and Nucleolus**
**5. Chromatin of nucleus**
**6. N/C ratio**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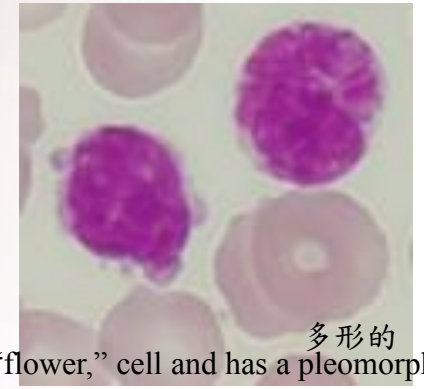
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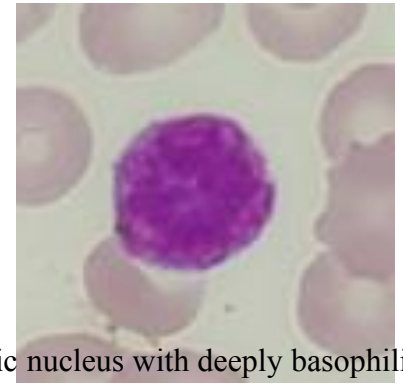
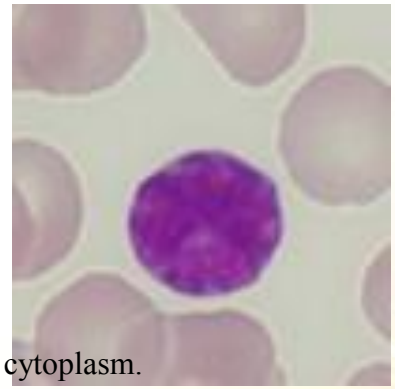




a characteristic cloverleaf, or “flower,” cell and has a pleomorphic nucleus with deeply basophilic cytoplasm.

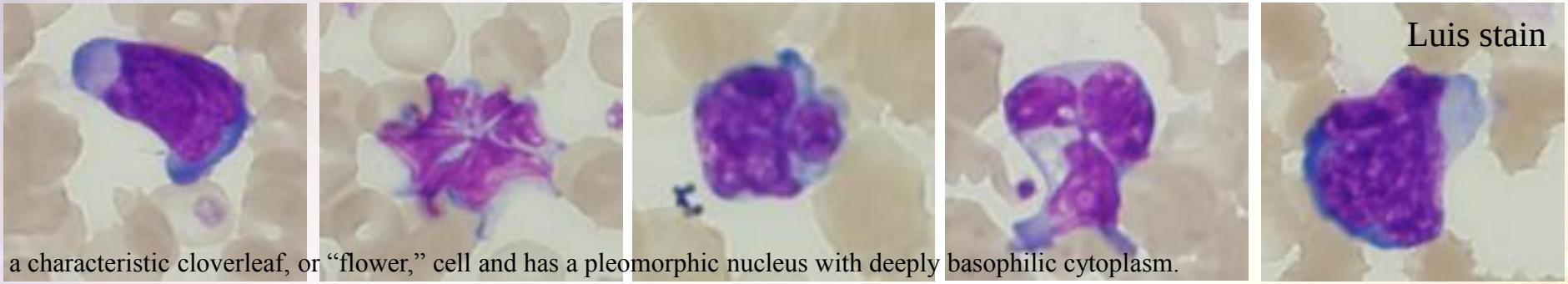
**Final diagnosis : Adult T-cell leukemia/lymphoma**

# Case 18 – TUH -1

∗ Laboratory data of blood routine include:

WBC : 16880 /uL
RBC : 3.64 M/CUMM
HGB : 11.8 g/dL
HCT : 35.0%
MCV : 96.2 CUU
Pl count：39000 /uL
DC : Abnormal lymphoid cell : 45 %, Lymphocyte : 11 %

**1. Cell size**
**2. Cytoplasm color**
**3. Granule of cytoplasm**
**4. Nucleus shape and Nucleolus**
**5. Chromatin of nucleus**
**6. N/C ratio**




a characteristic cloverleaf, or “flower,” cell and has a pleomorphic nucleus with deeply basophilic cytoplasm.

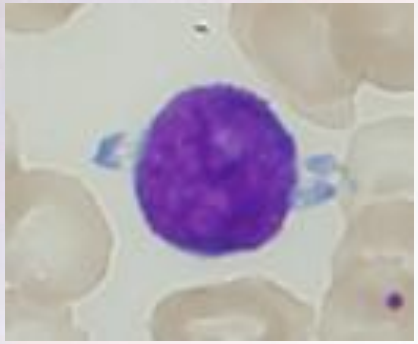
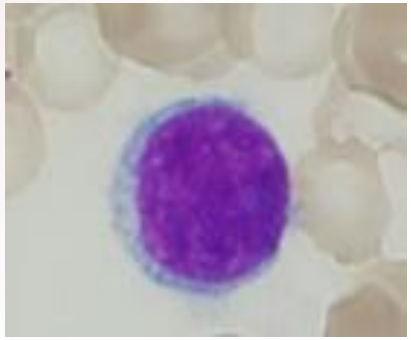
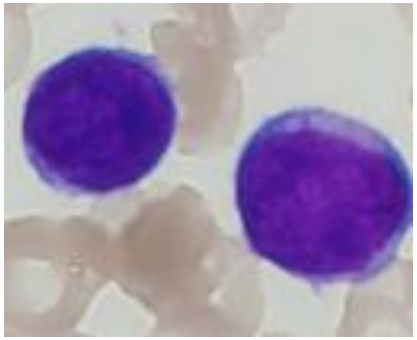
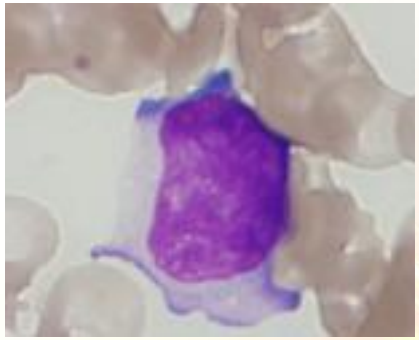
**Final diagnosis : Adult T-cell leukemia/lymphoma**

# Case 19 – TUH -983

∗ Laboratory data of blood routine include:

WBC : 6710 /uL
RBC : 2.74 M/CUMM
HGB : 9.1g/dL
HCT : 25.5 %
MCV : 93.1 CUU
Pl count：57000 /uL
DC : Abnormal lymphoid cell : 60 %, Lymphocyte : 29 %

**1. Cell size**
**2. Cytoplasm color**
**3. Granule of cytoplasm**
**4. Nucleus shape and Nucleolus**
**5. Chromatin of nucleus**
**6. N/C ratio**

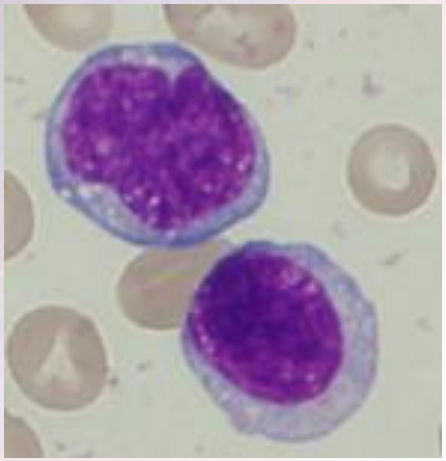
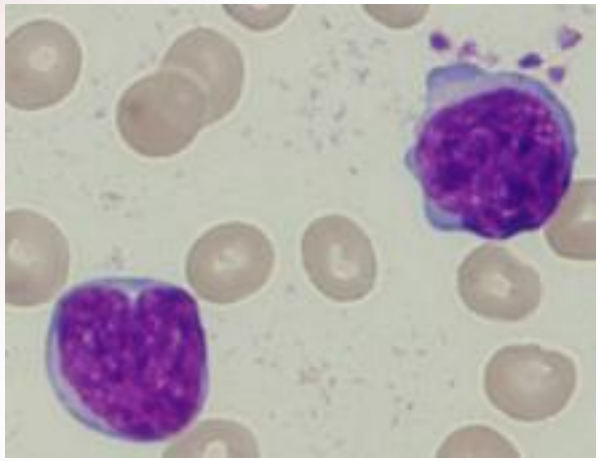
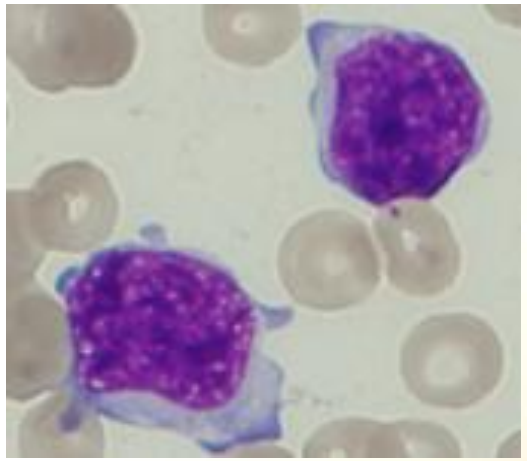
**Final diagnosis : Lymphoma**

# Case 20 – TUH -2

∗ Laboratory data of blood routine include:

WBC : 17680 /uL
RBC : 3.40 M/CUMM
HGB : 10.0 g/dL
HCT : 32.0 %
MCV : 94.1 CUU
Pl count：111000 /uL
DC : Abnormal lymphoid cell : 67 %, Lymphocyte : 8 %

**1. Cell size**
**2. Cytoplasm color**
**3. Granule of cytoplasm**
**4. Nucleus shape and Nucleolus**
**5. Chromatin of nucleus**
**6. N/C ratio**

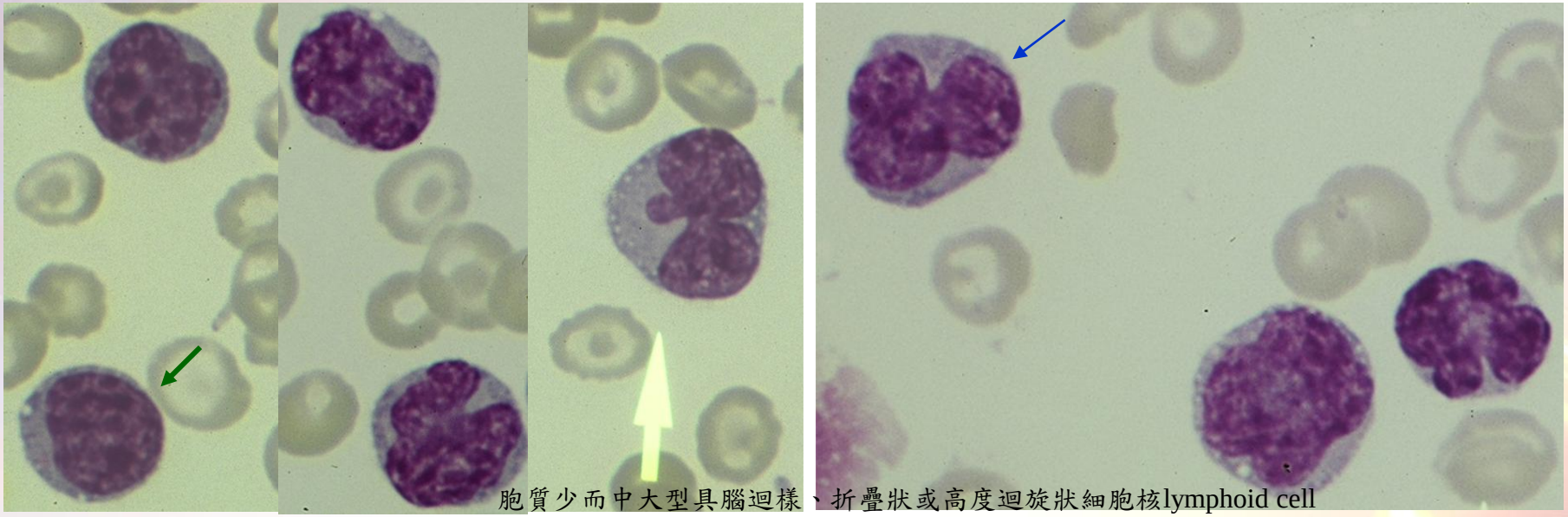
**Final diagnosis : Mature large B cell lymphoma**

# Case 21 –C 43

∗ Laboratory data of blood routine include:

WBC : 270000 /uL
RBC : 3.28 M/CUMM
HGB : 6.7 g/dL
HCT : 23.7 %
MCV : 72.3 CUU
Pl count：92000 /uL
DC : Atypical cell : 58 %, Lymphocyte : 32 %, monocyte : 4 %

**1. Cell size**
**2. Cytoplasm color**
**3. Granule of cytoplasm**
**4. Nucleus shape and Nucleolus**
**5. Chromatin of nucleus**
**6. N/C ratio**



胞質少而中大型具腦迴樣、折疊狀或高度迴旋狀細胞核lymphoid cell

**Final diagnosis : Sezary syndrome (Cutaneous T-cell lymphoma)**

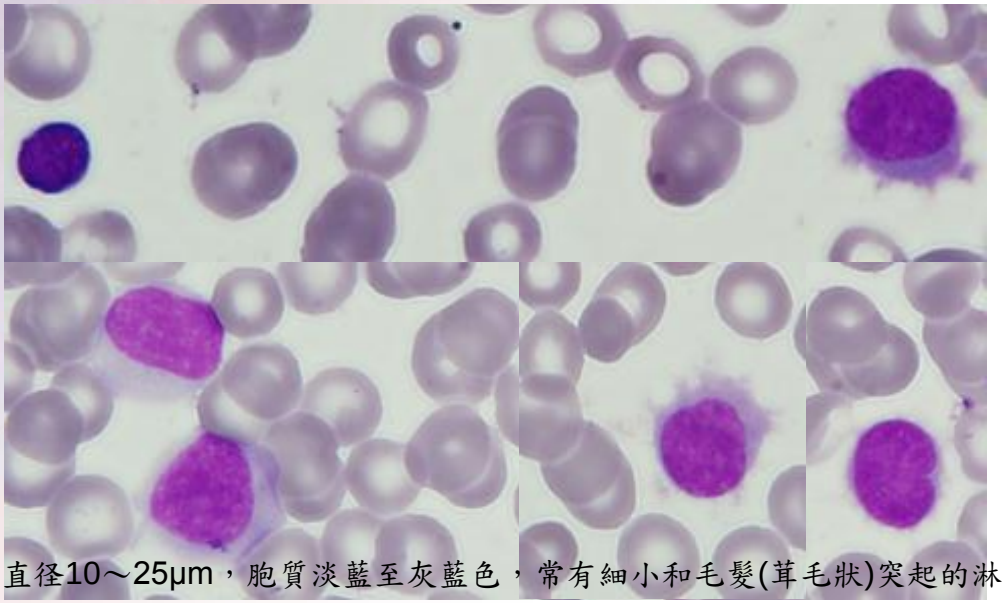
# Case 22 – C 36

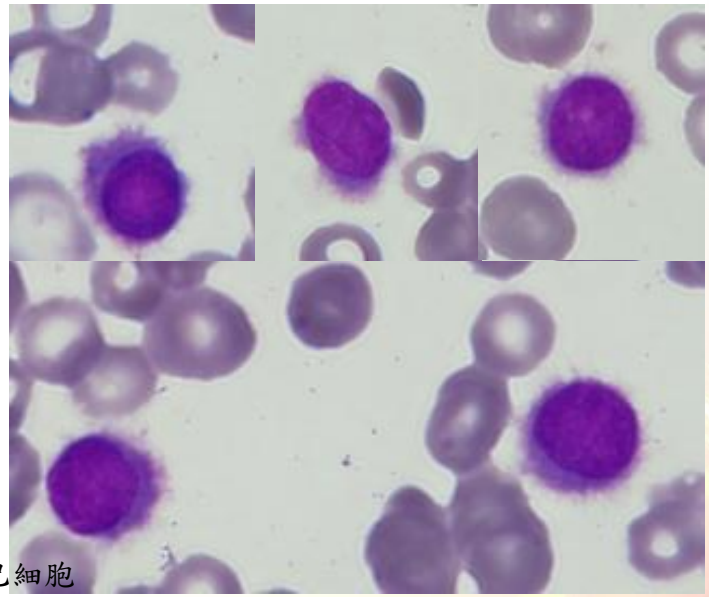
＊ Laboratory data of blood routine include:

WBC : 8500 /uL
RBC : 3.98 M/CUMM
HGB : 11.7 g/dL
HCT : 35.9 %
MCV : 90.2 CUU
Pl count：52000 /uL

**1. Cell size**
**2. Cytoplasm color**
**3. Granule of cytoplasm**
**4. Nucleus shape and Nucleolus**
**5. Chromatin of nucleus**
**6. N/C ratio**

DC : Lymphocyte : 37 %, Atypical cell (Like hairy cell form) : 40 %





直径10～25μm，胞質淡藍至灰藍色，常有細小和毛髮(茸毛狀)突起的淋巴細胞

**Final diagnosis : Hairy cell leukemia**

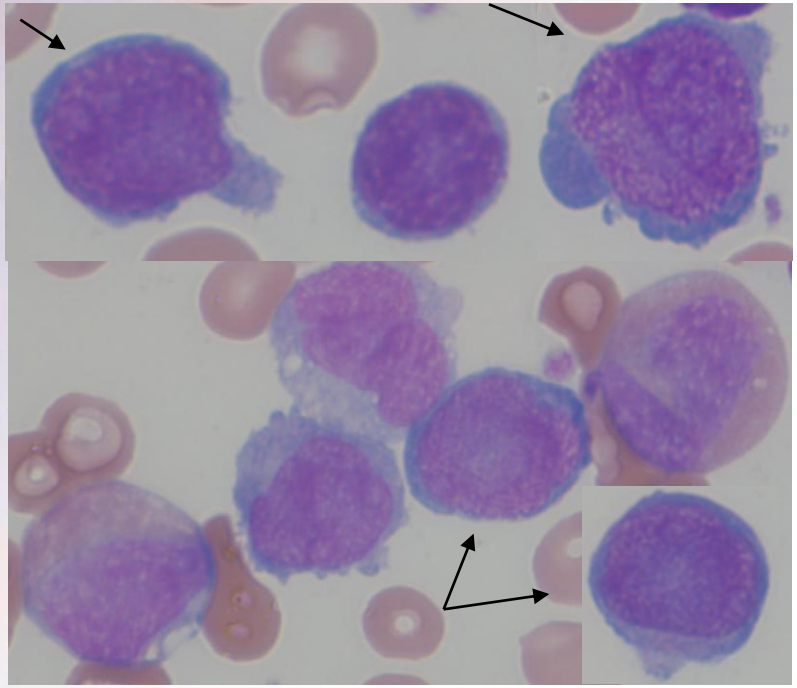
# Case 23 –040015

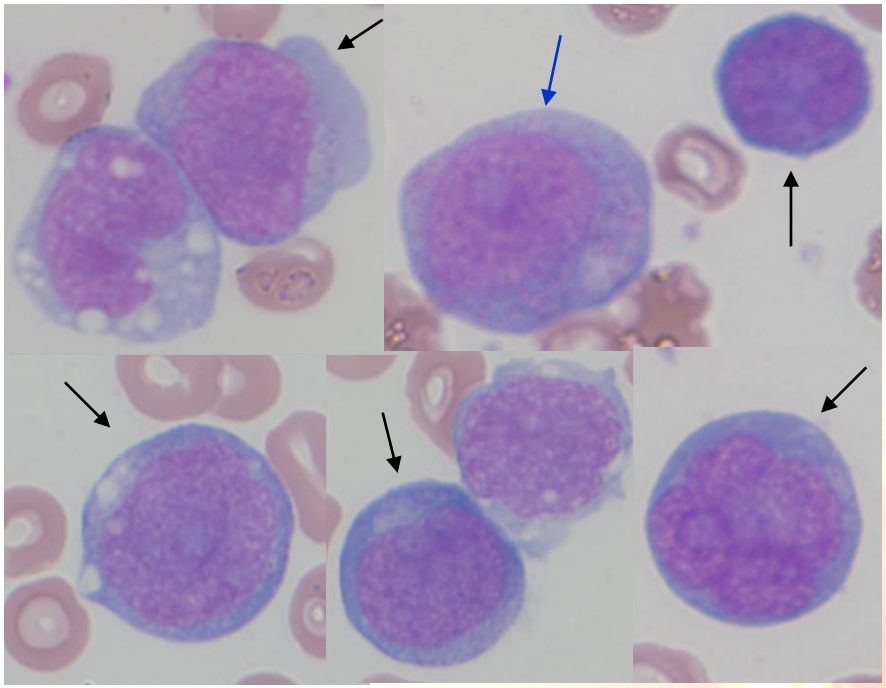
∗ Laboratory data of blood routine include:

WBC : 89100 /uL
RBC : 1.88 M/CUMM
HGB : 7.1 g/dL
HCT : 20.2 %
MCV : 107.5 CUU
Pl count：268000 /uL

DC : Blast : 15 %, promyelo- : 5 %, myelo- : 11 %, meta : 3 %, monocyte : 29%

**1. Cell size**
**2. Cytoplasm color**
**3. Granule of cytoplasm**
**4. Nucleus shape and Nucleolus**
**5. Chromatin of nucleus**
**6. N/C ratio**





**Suspicious mixed phenotype acute leukemia** (AML, B-ALL)

# Thanks for your attention.