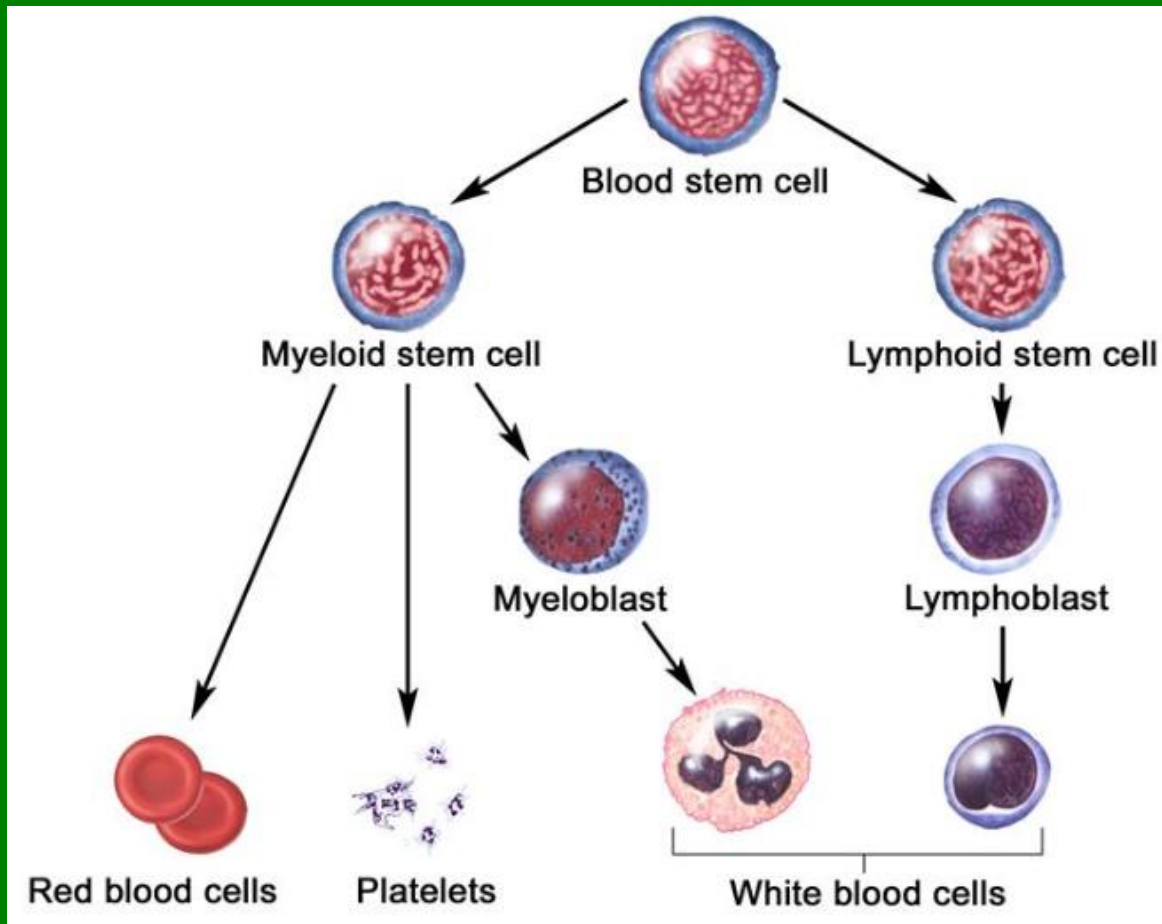


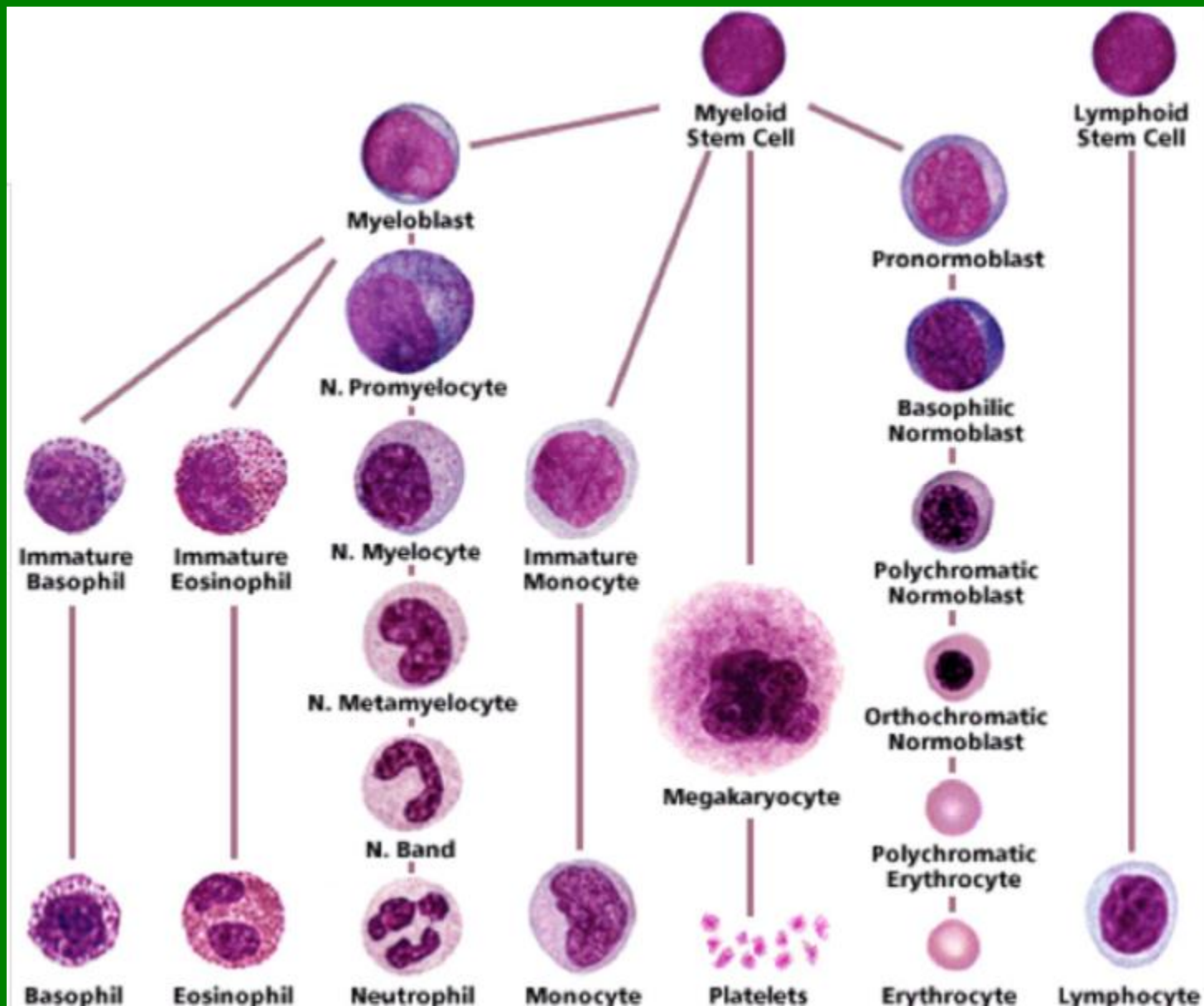
# Hematopoéza

Bourková L., OKH FN Brno

- bílé krvinky – leukocyty – WBC (*White Blood Cells*)
- červené krvinky – erytrocyty – RBC (*Red Blood Cells*)
- krevní destičky – trombocyty – PLT (*Platelets*)

# Kmenové buňky hematopoézy



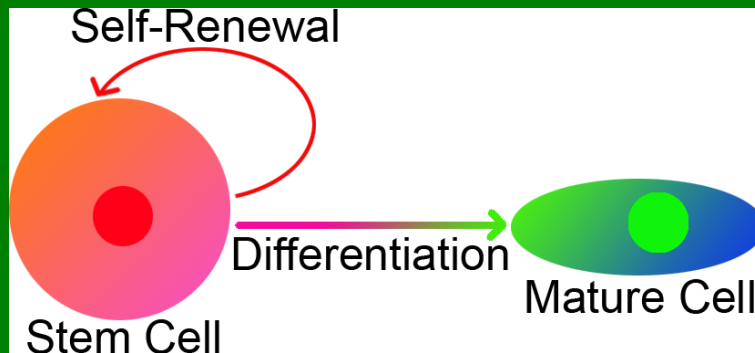


# Hematopoiesis

Proliferative potential

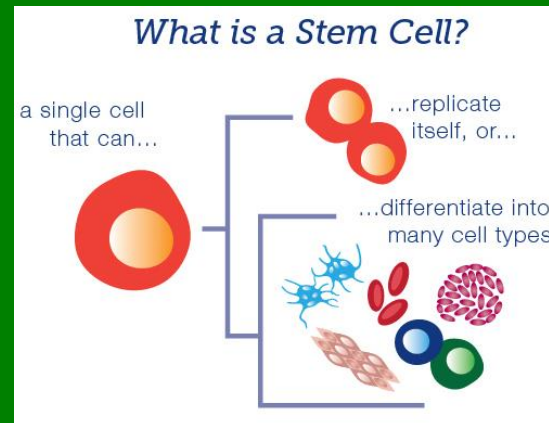


differentiation



# Hematopoetické kmenové buňky

- ❑ v kostní dřeni i periferní krvi ve velmi nízké koncentraci
- ❑ pro svoji podobnost s lymfocyty se nedají morfologicky rozpoznat.
- ❑ morfologicky jsou rozpoznatelné až jejich další vývojová stádia - myeloblast, proerytoblast, megakaryoblast.....
- ❑ kmenové buňky se stanovují např. imunologicky pomocí povrchových antigenů a nebo **funkčními testy**, na základě proliferační aktivity
  - ❑ sebeobnova
  - ❑ diferenciace

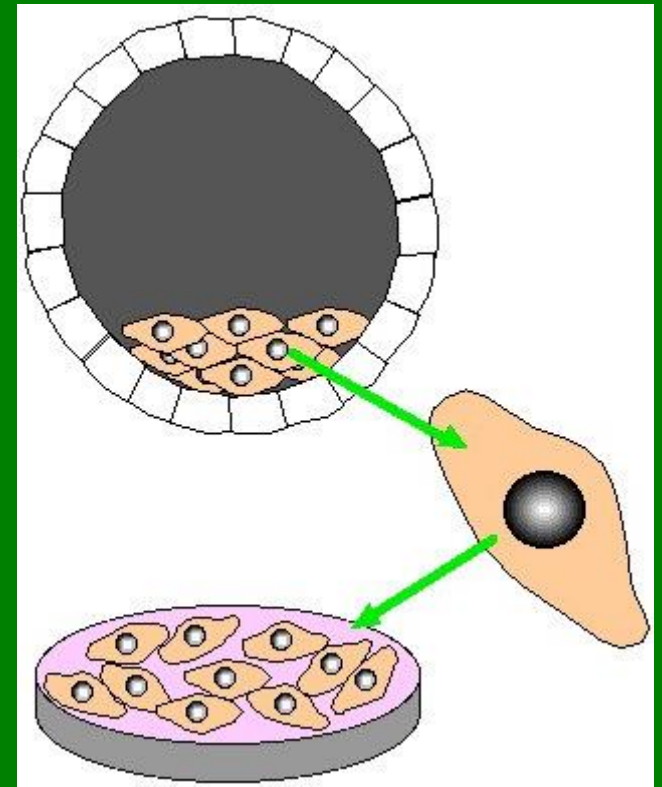
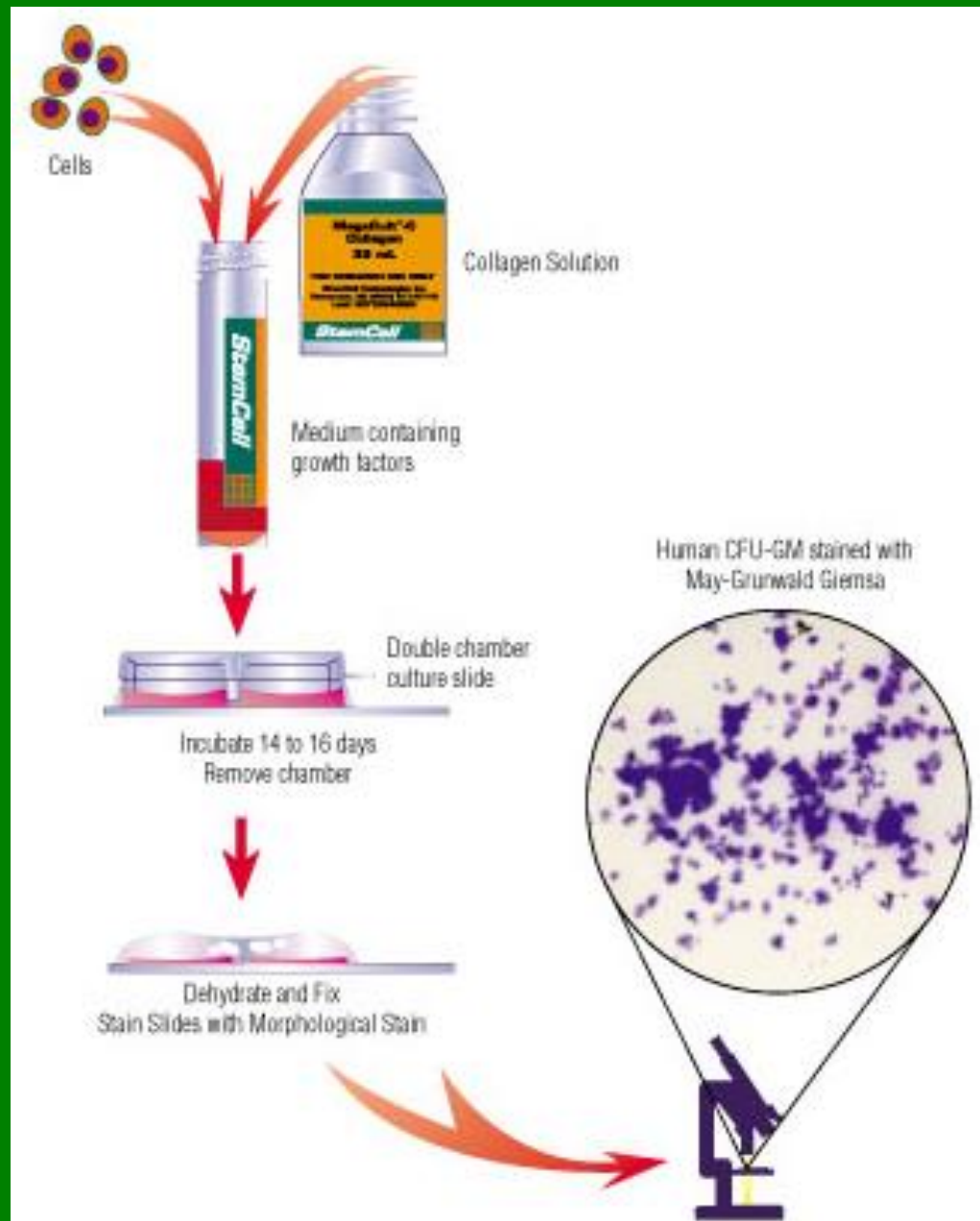




# Pracovní prostředí

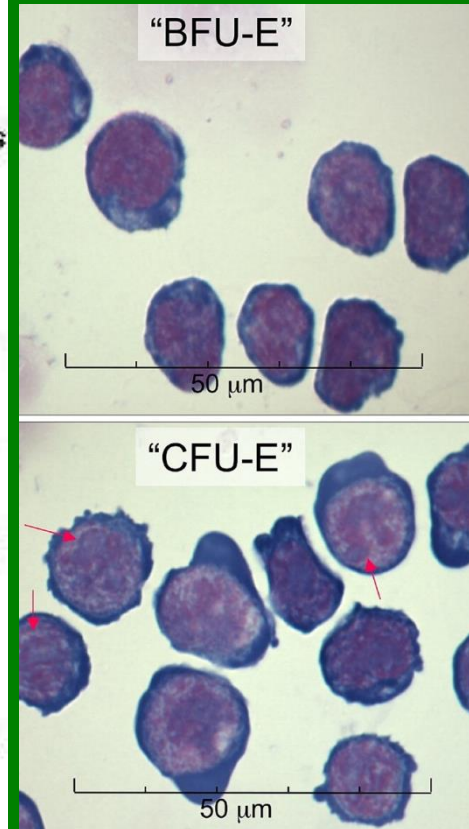
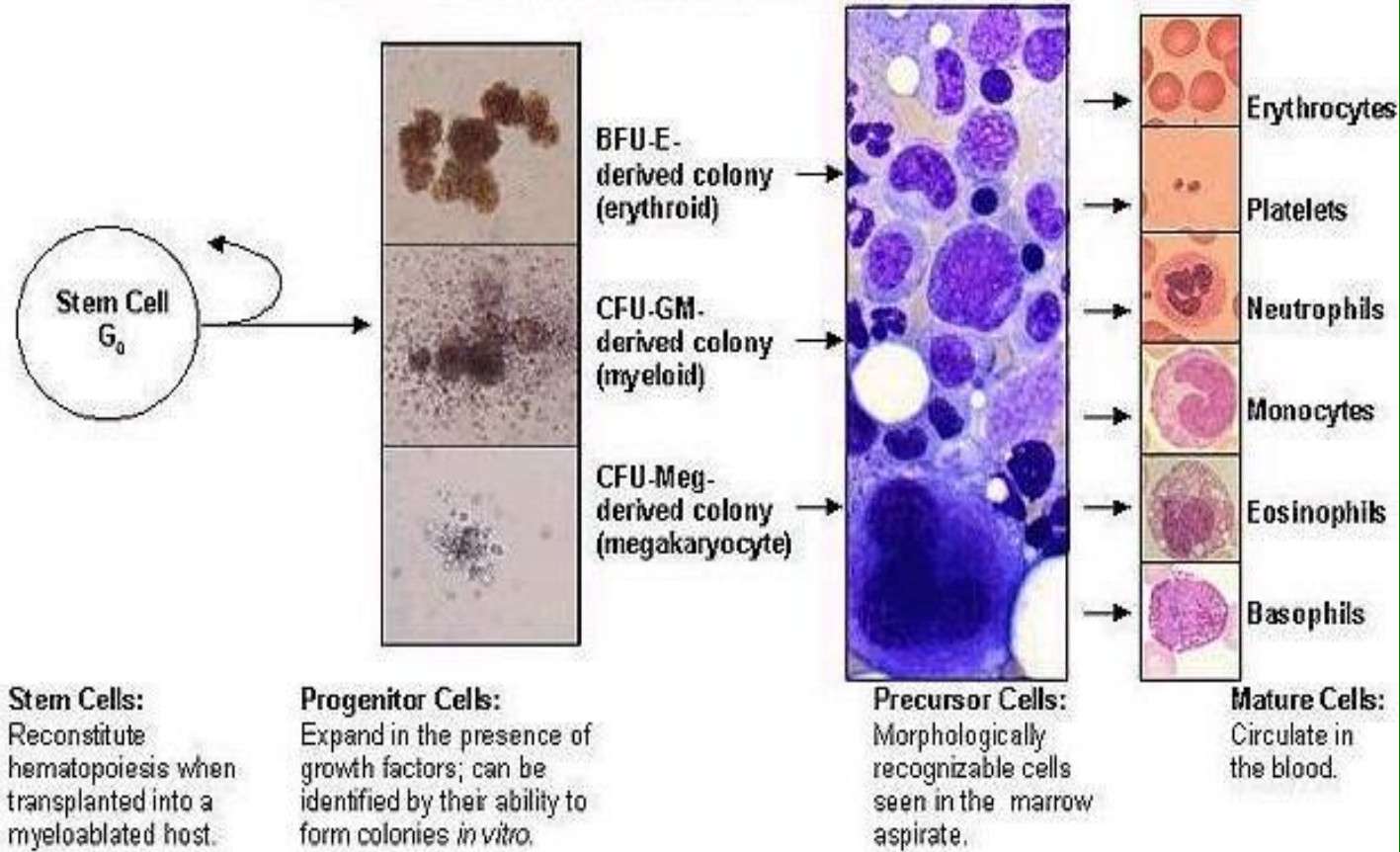


# Tkáňové kultivace

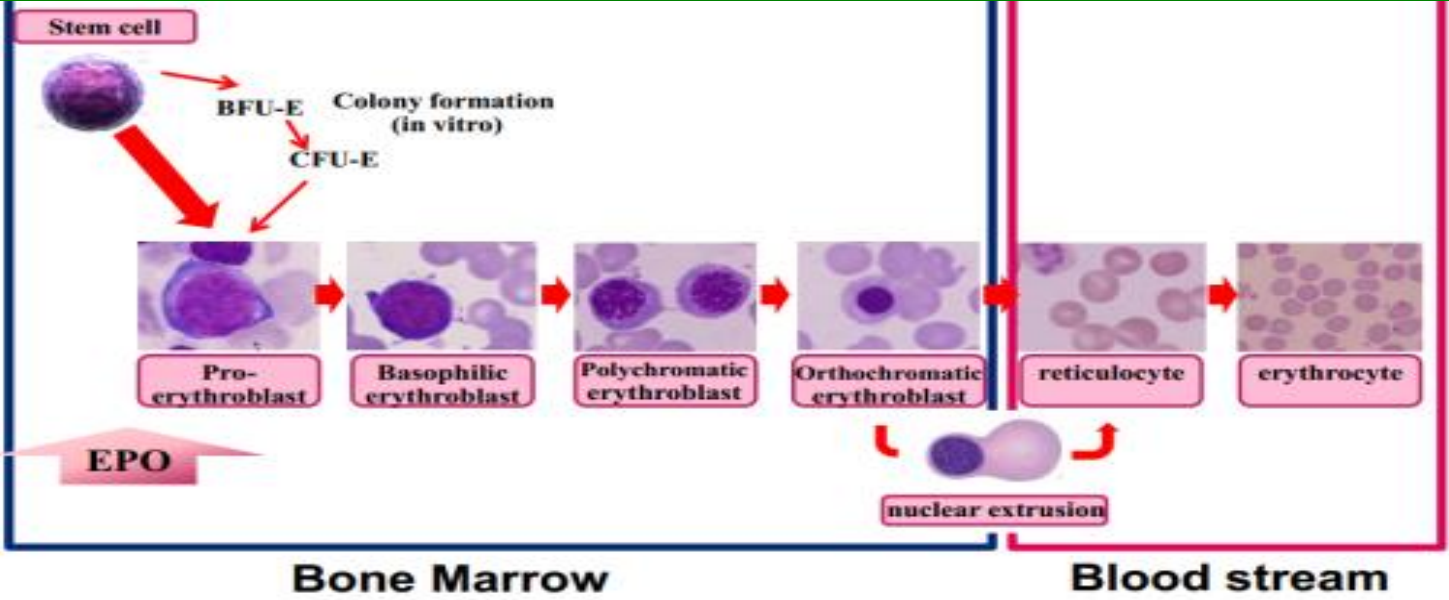
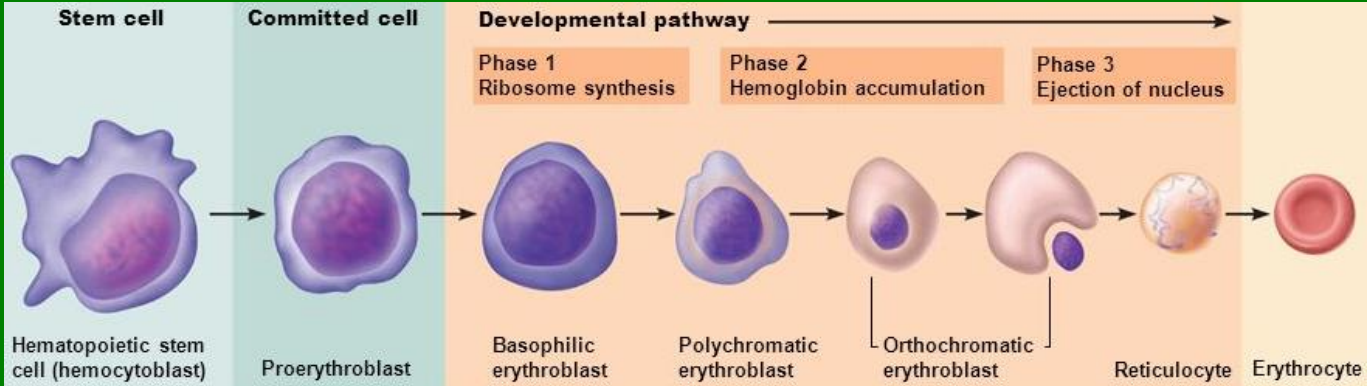
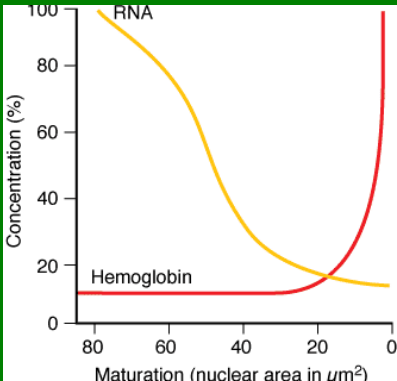




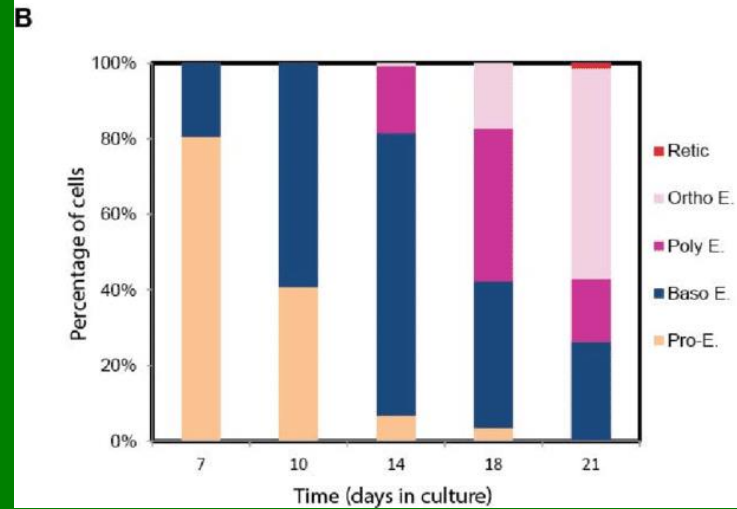
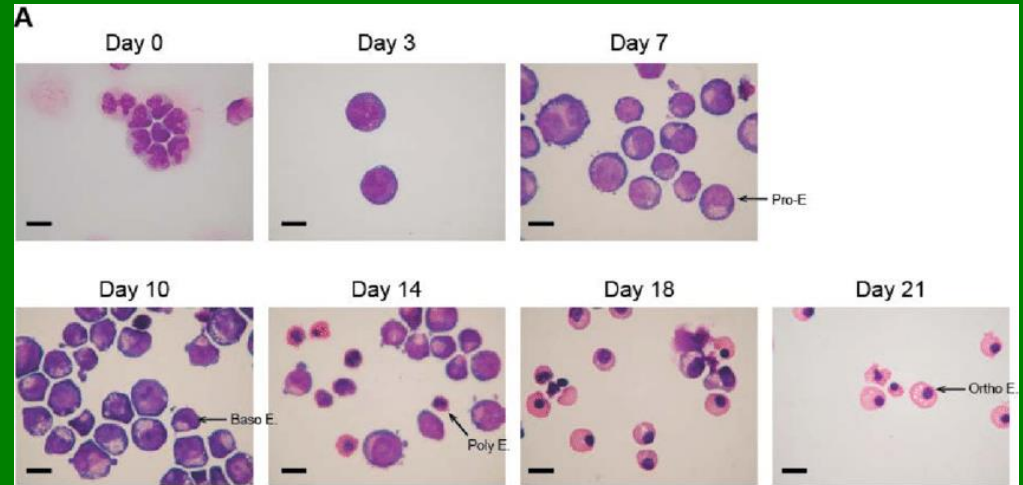
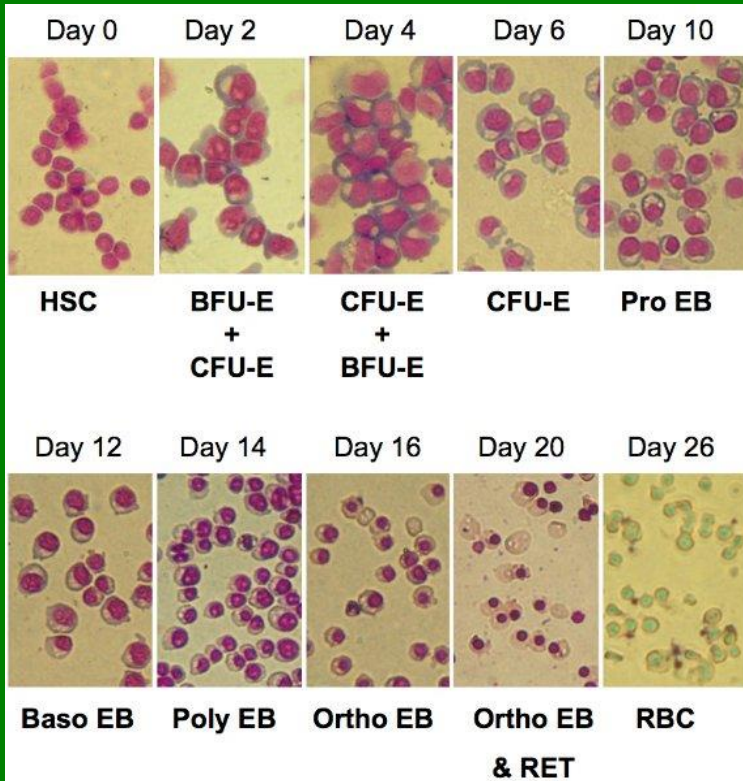
## STEM CELL MODEL OF HEMATOPOIESIS



# Erythropoéza



# Erythropoéza





# Granulopoéza

myeloblast



promyelocyte



myelocyte



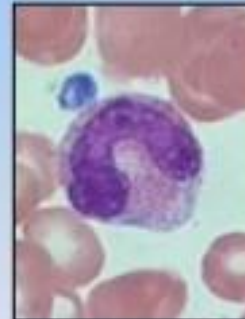
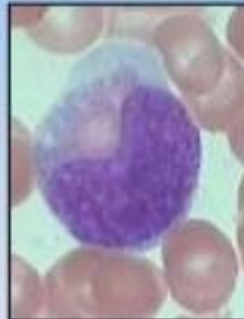
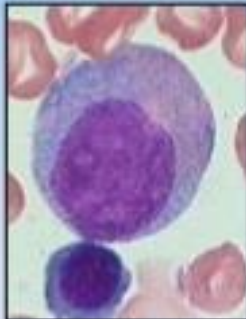
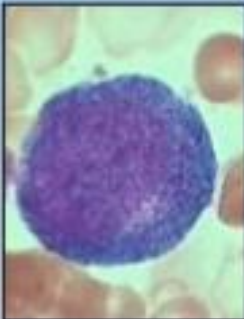
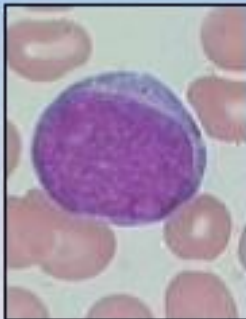
metamyelocyte

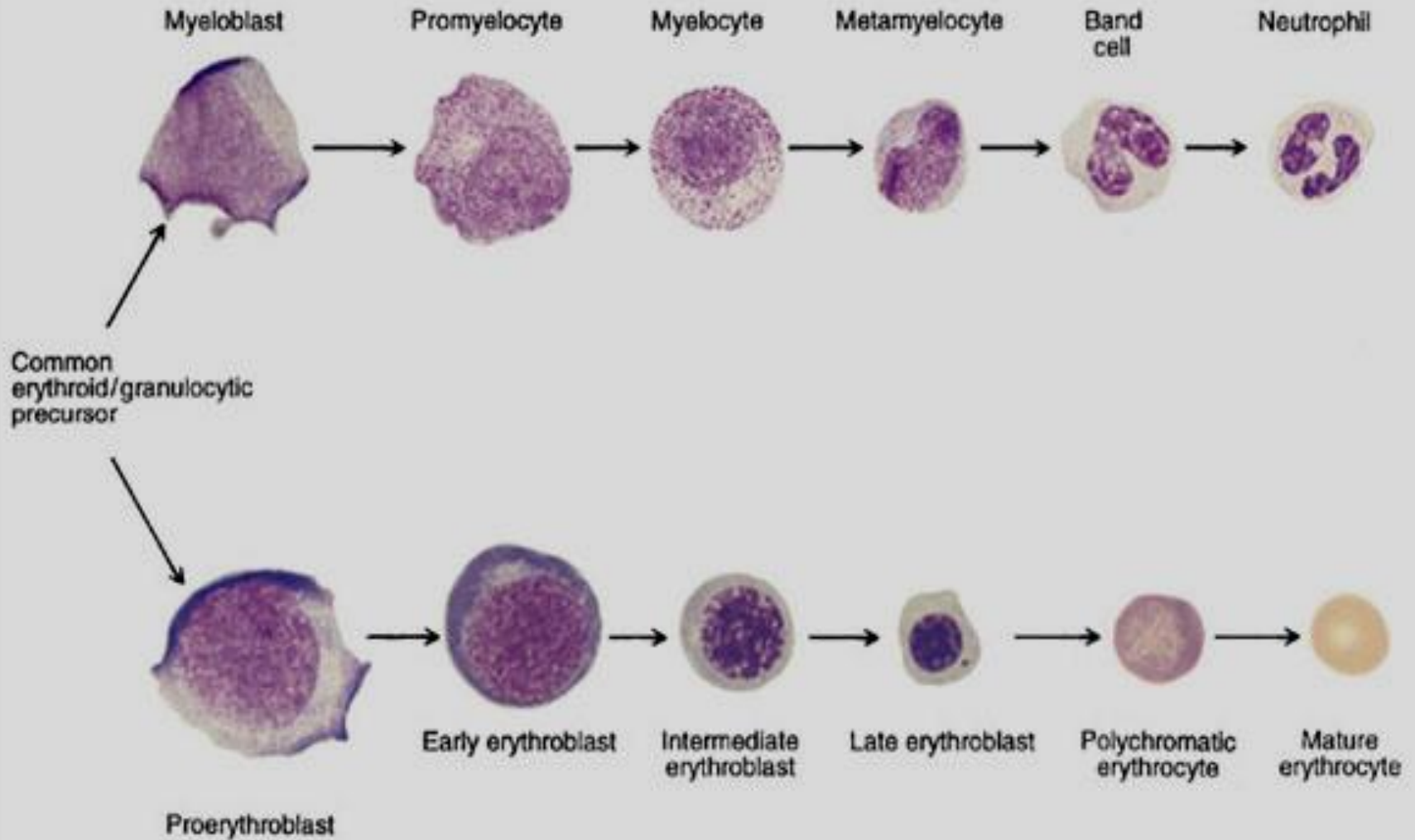


band

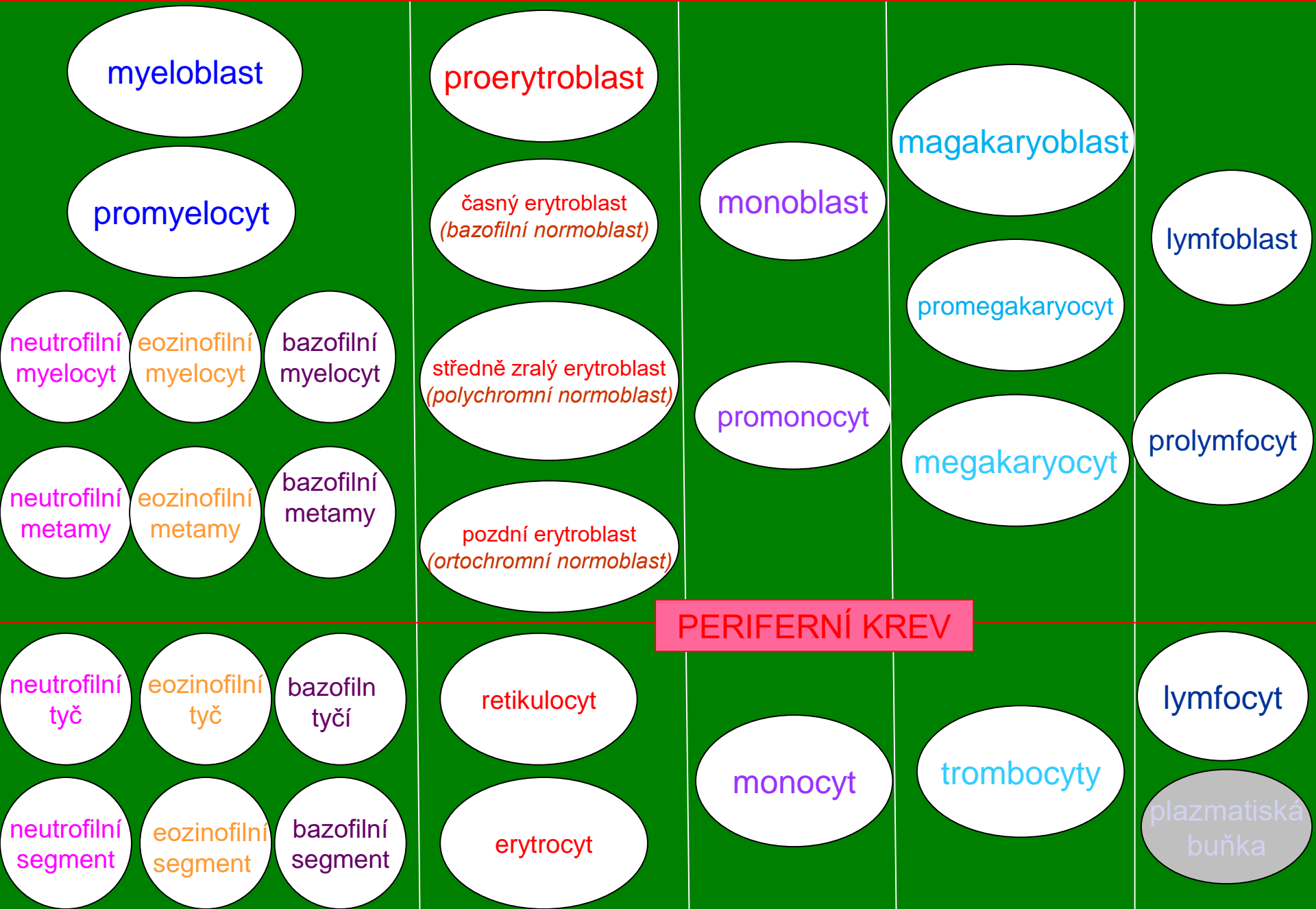


neutrophil





# VÝVOJOVÁ STÁDIA HEMATOPOETICKÝCH BUNĚK





# Poznámka

*Granulocytární elementy (segmentované leukocyty):*

- *primární granulace (nespecifická):*
  - *od promyelocytu*
    - *azurofilní*
- *sekundární granulace (specifická):*
  - *od myelocytu až po segment*
    - *neutrofily*
    - *eozinofily*
    - *bazofily*

# rozdíl velikostí leukocytů

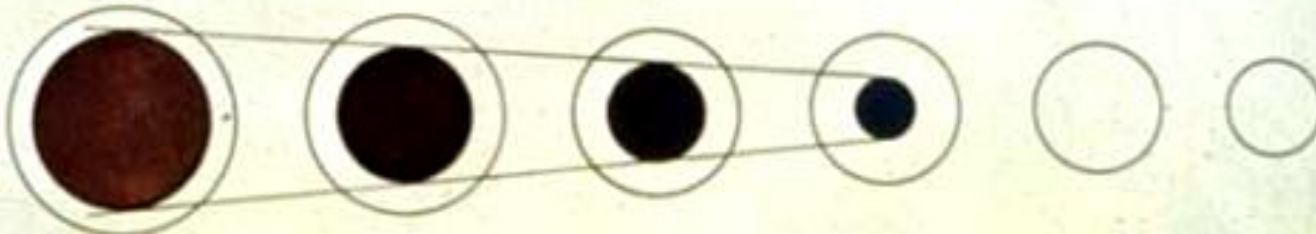


# Sledování buněčných morfologických změn



A Cell size and cytoplasm color

zbarvení, obsah  
cytoplazmy



B Nuclear size and color

velikost, tvar  
jádra



C Nuclear chromatin structure

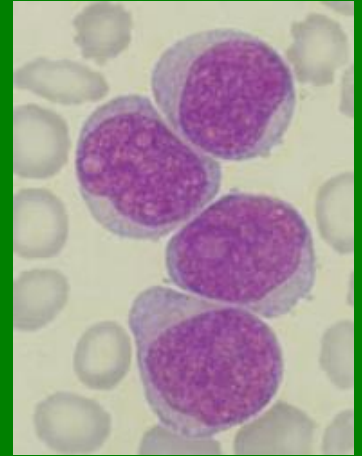
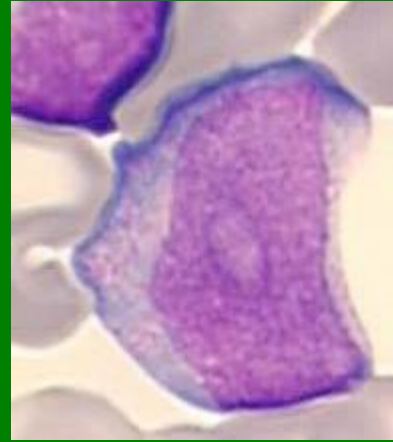
struktura chromatinu,  
jadérka



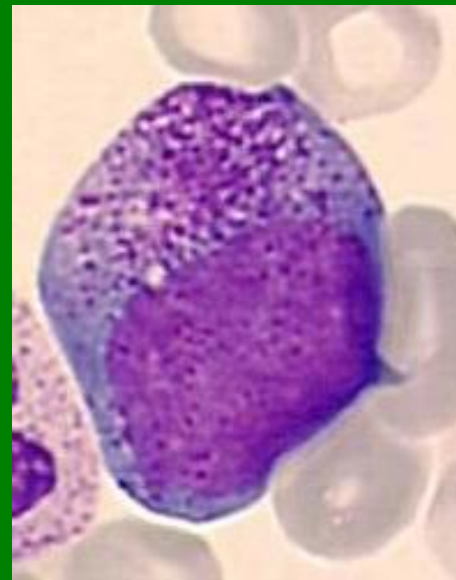
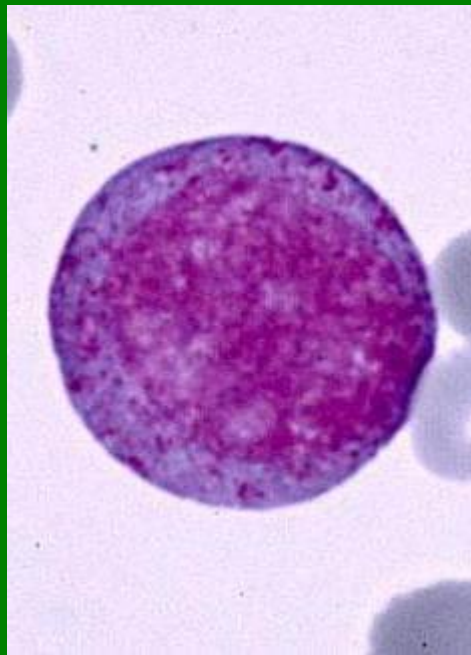
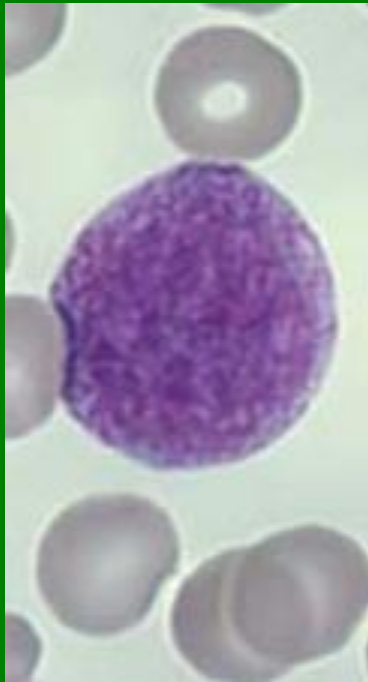
D Composite (Left to right: Rubriblast, Proerythrocyte, Rubricyte, Metarubricyte, Diffusely basophilic erythrocyte, Erythrocyte)

komplexní hodnocení

## Myeloblasty



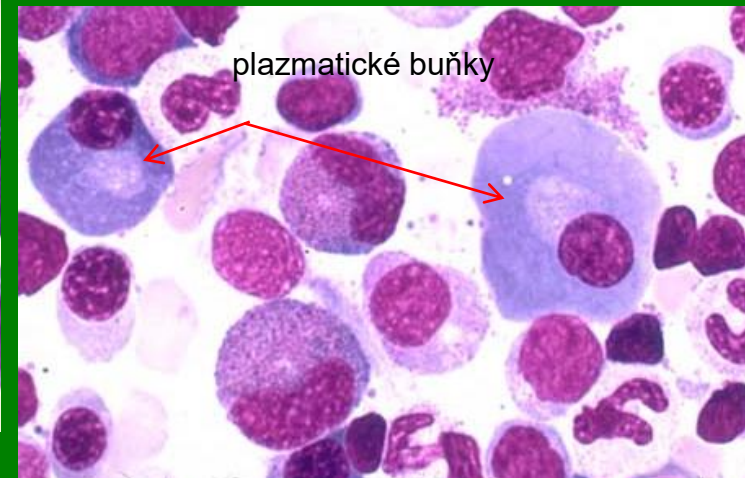
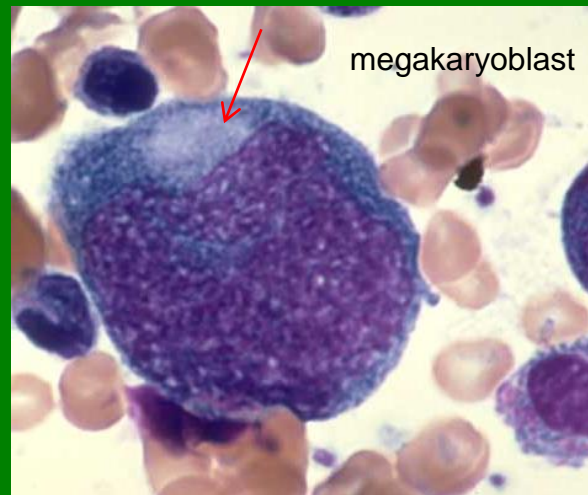
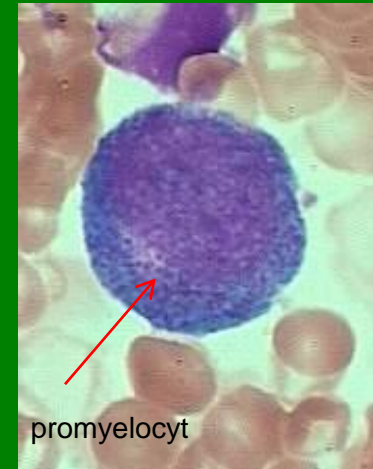
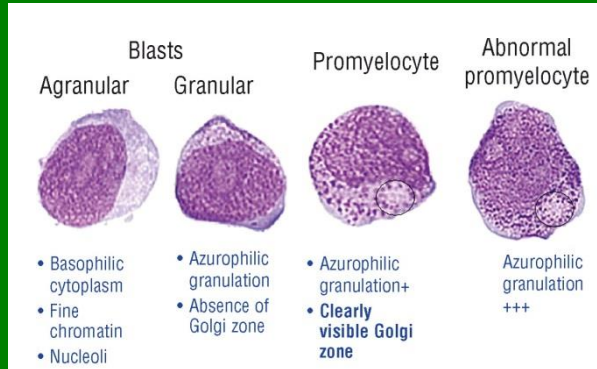
## Promyelocyty



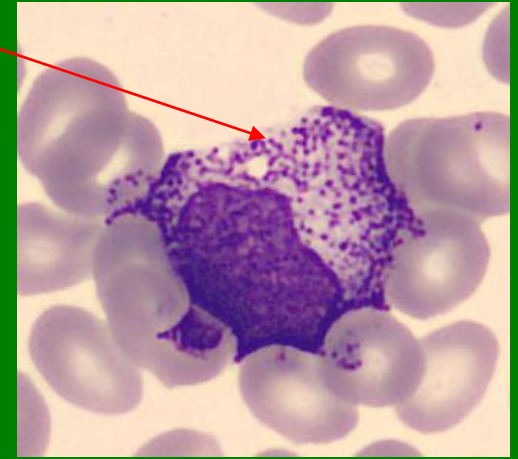
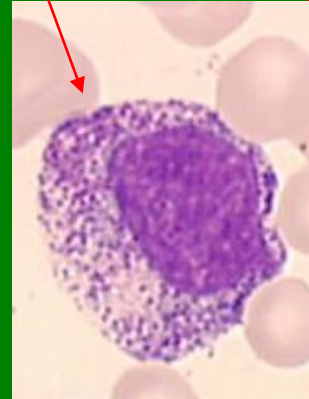
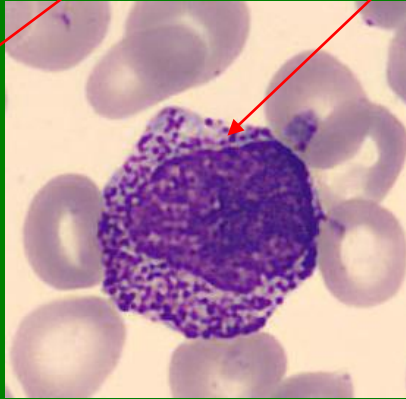
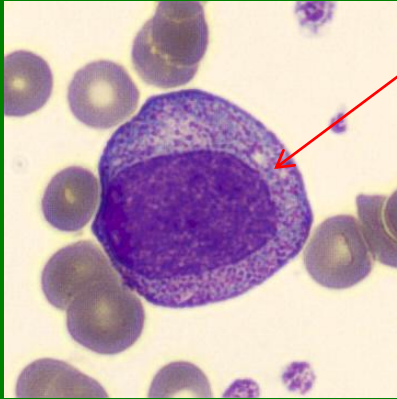


# Perinukleární projasnění

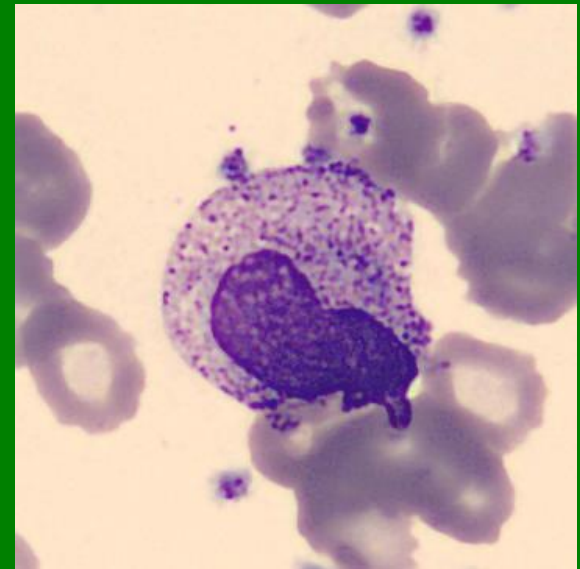
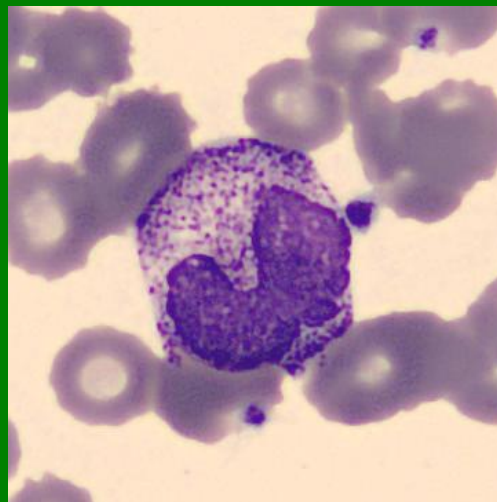
Golgiho zóna (návaznost na jádro přes endoplazmatické retikulum)



# Myelocyty – Ne (*nezralé* - jadérko, *zralé* – bez jadérka)

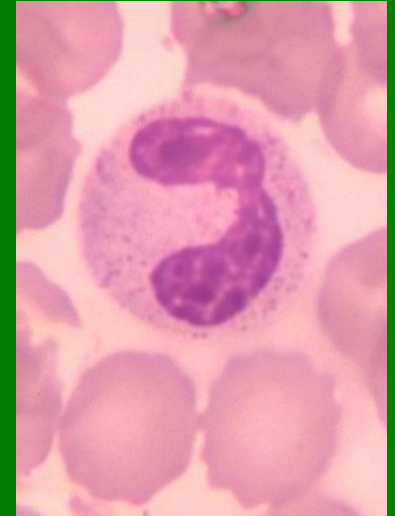
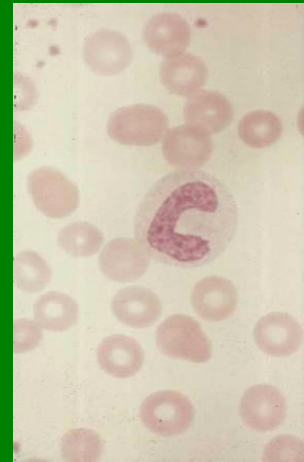


# Metamyelocyty - Ne

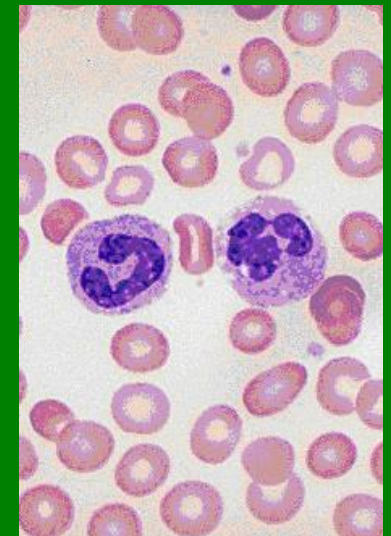




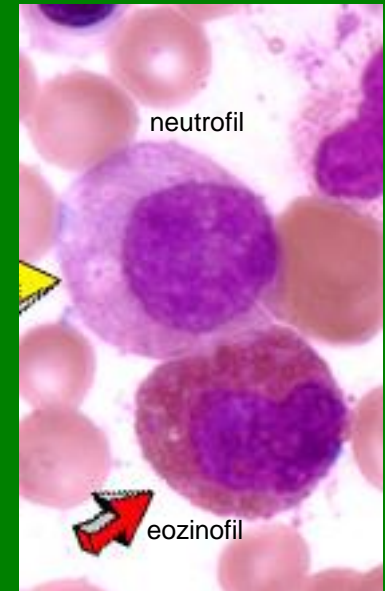
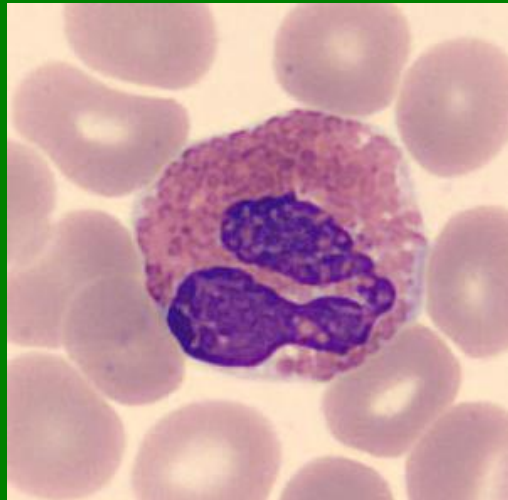
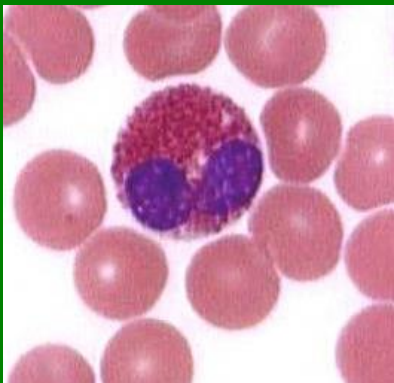
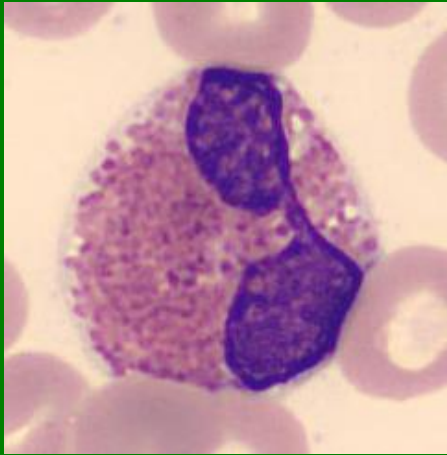
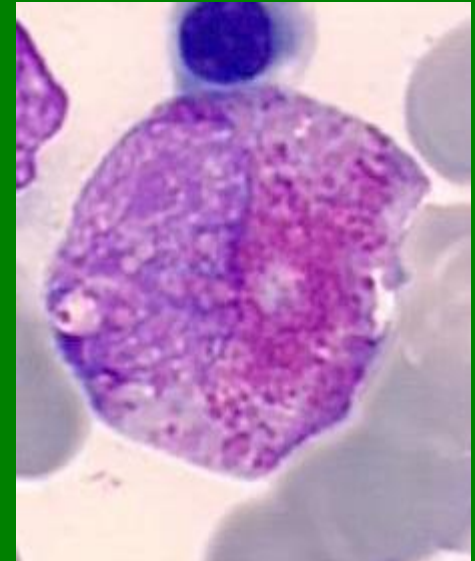
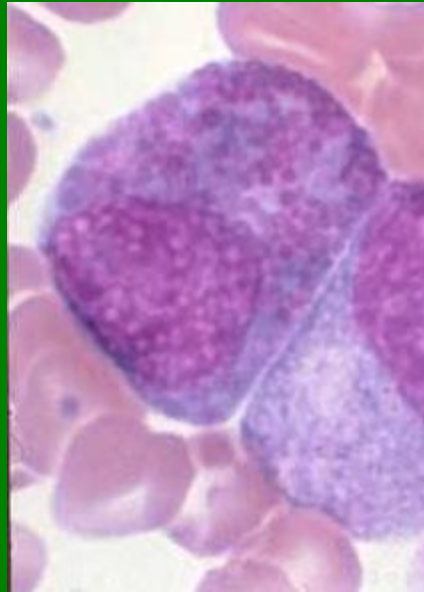
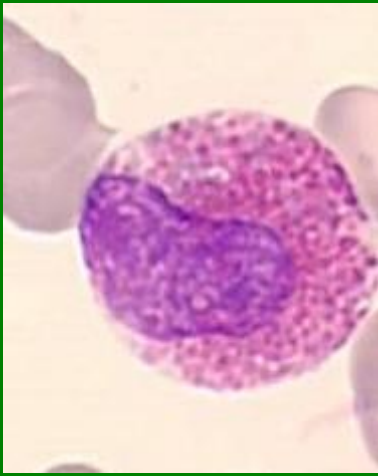
**Tyč – Ne** (rozdíl mezi nejširším a nejužším tvarem jádra je  $1/3$  až  $1/2$ )



**Segment - Ne**

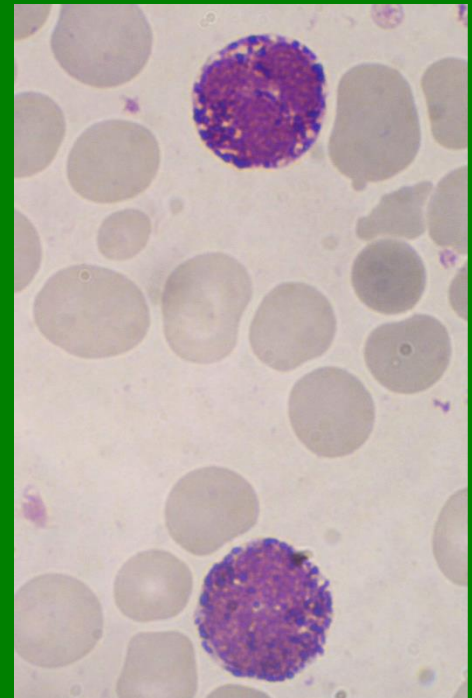
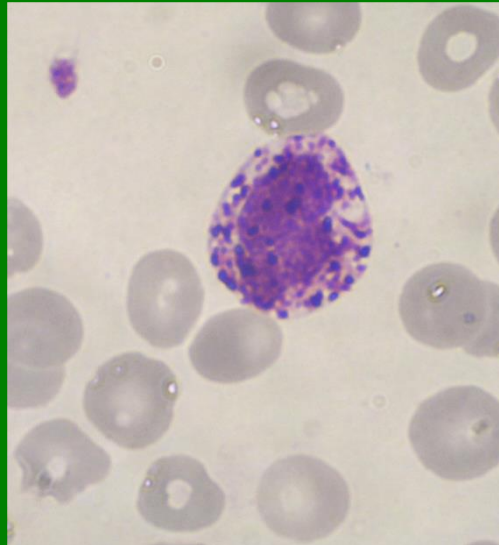
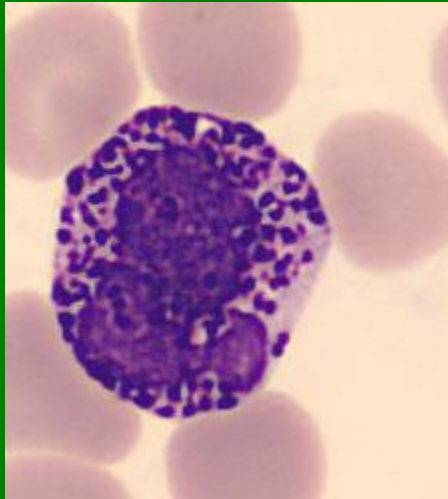
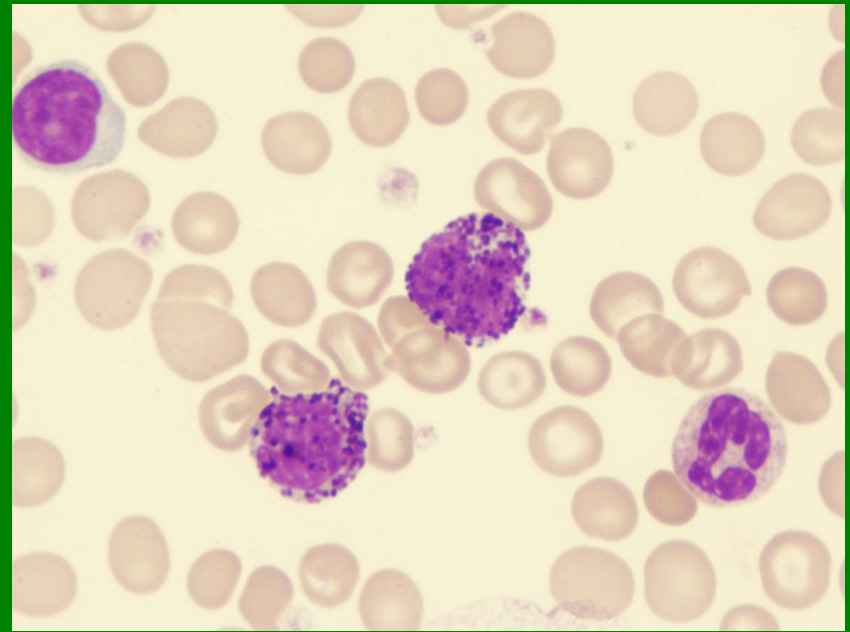
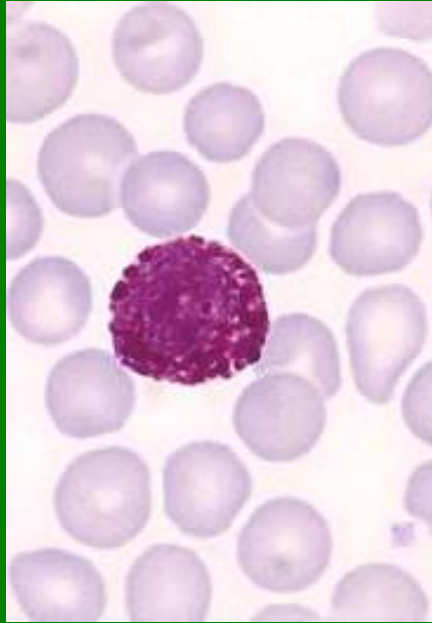
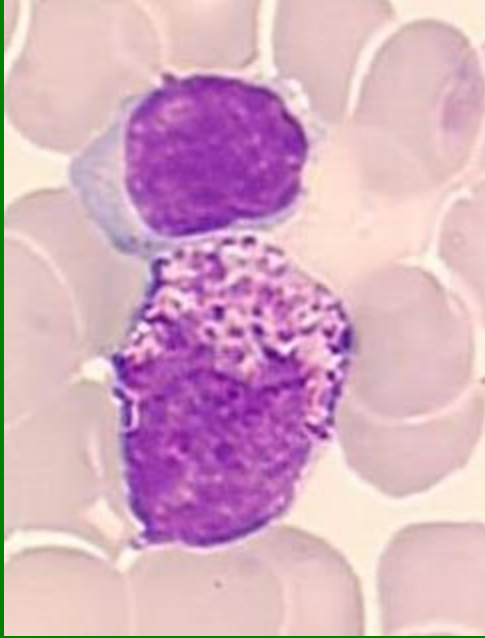


# Eozinofily

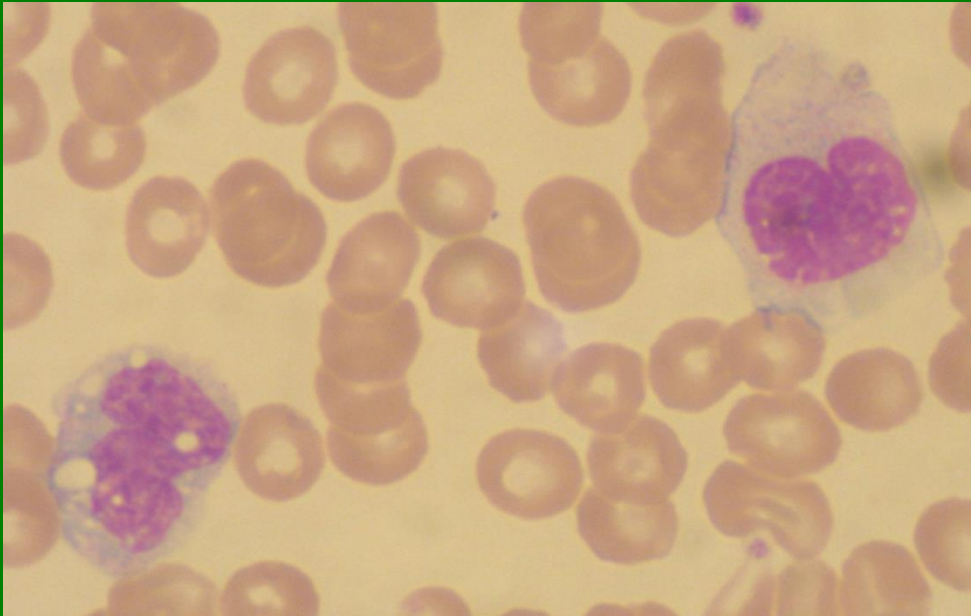
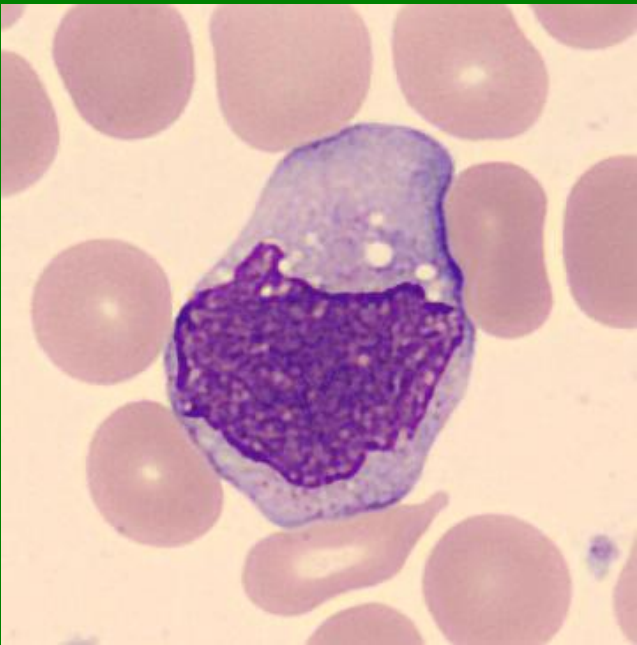
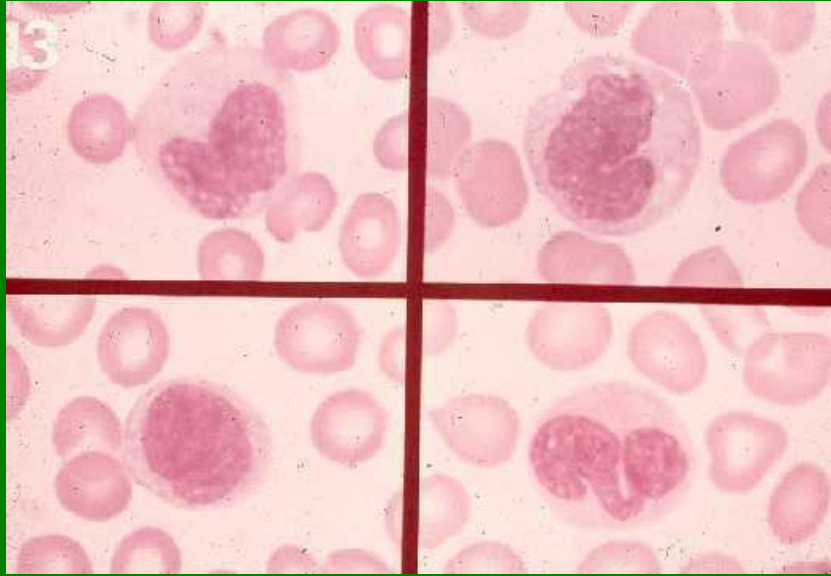
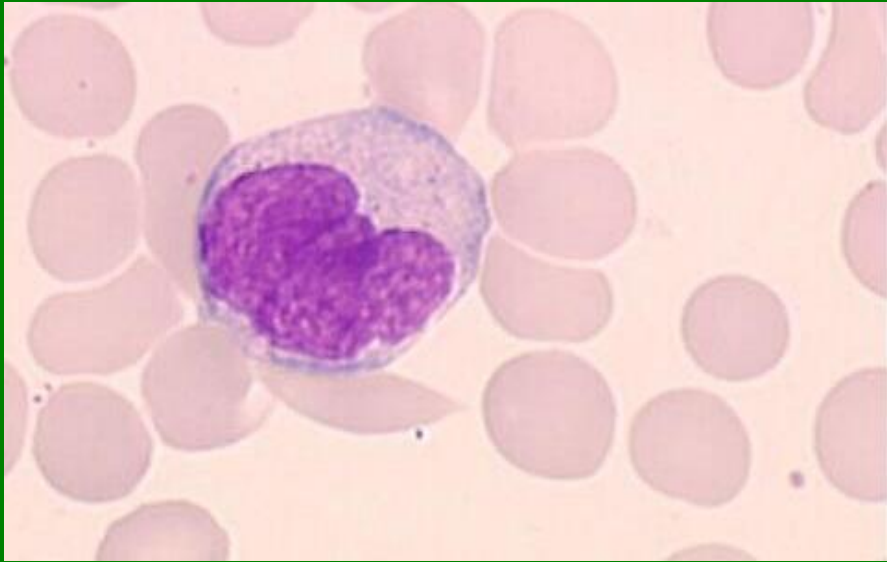




# Bazofily

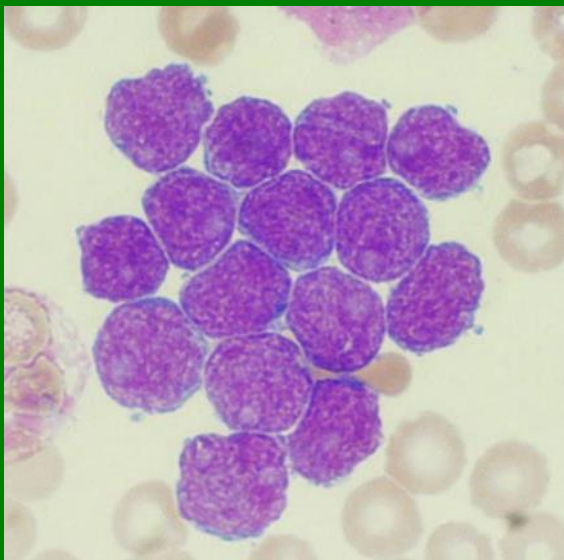


# Monocyty

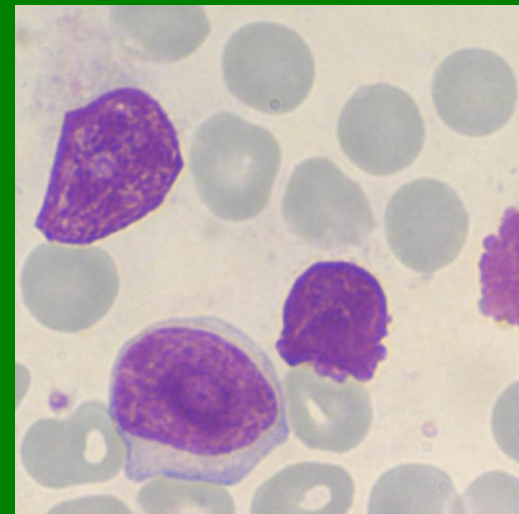
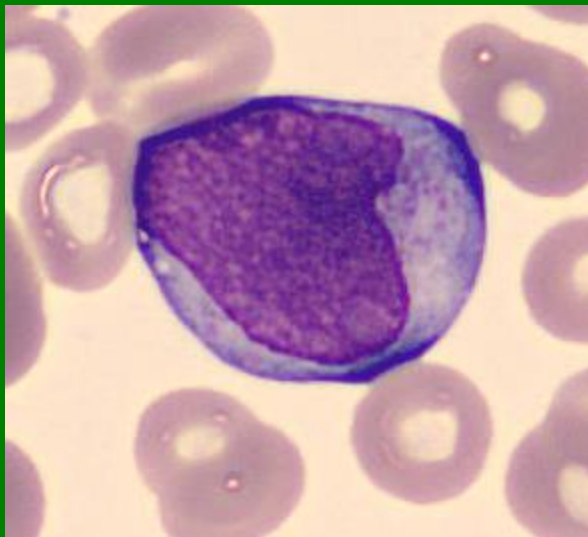




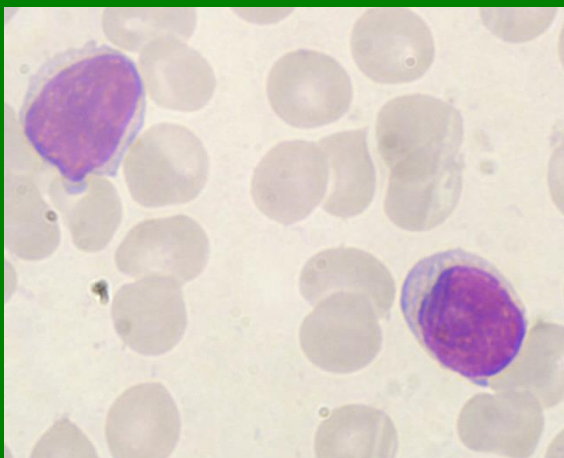
**Lymfoblasty**



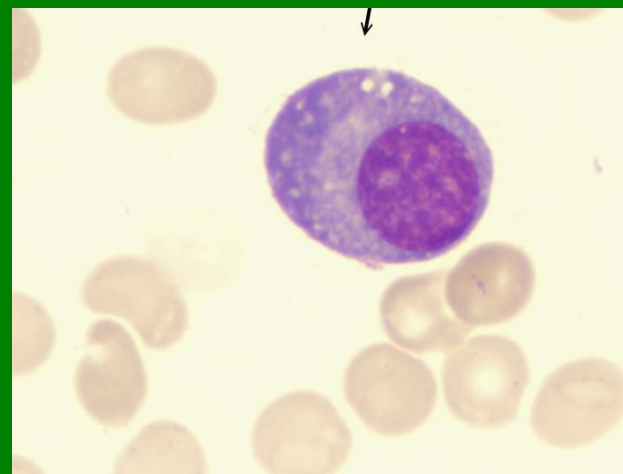
**Prolymfocyt**



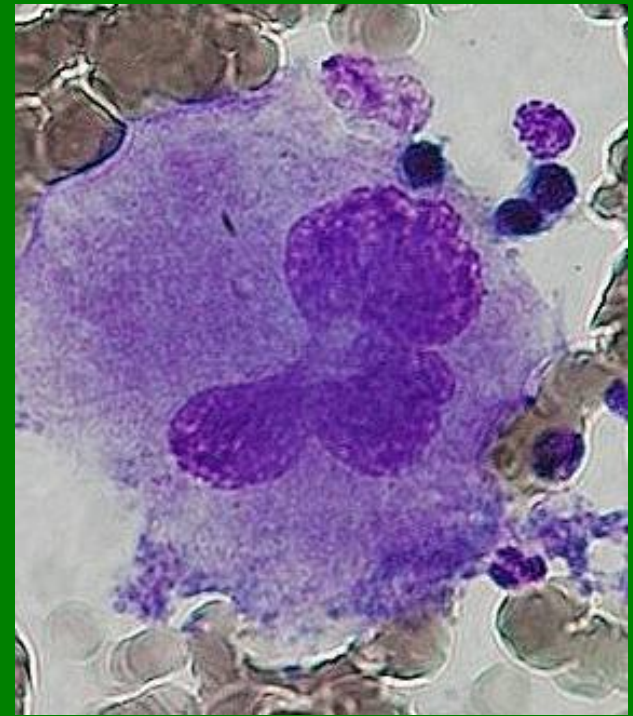
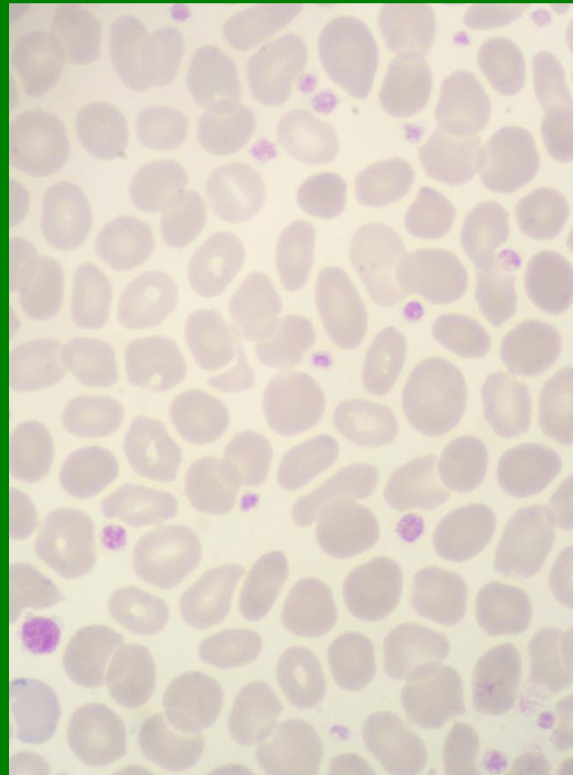
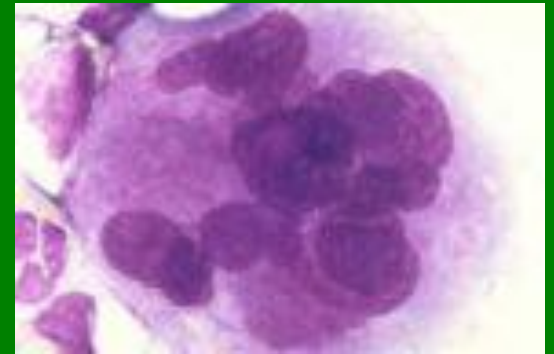
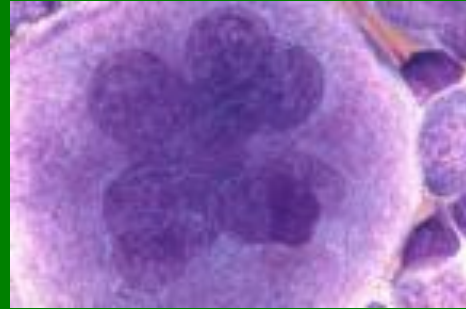
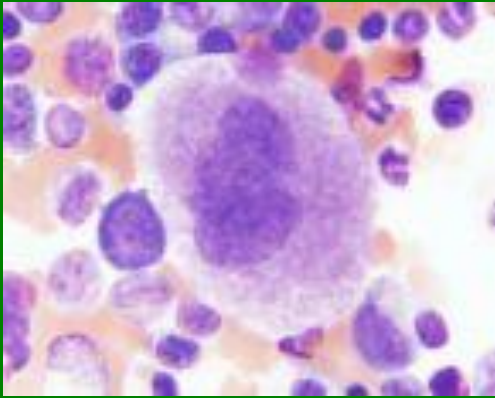
**Lymfocyty**



**Plazmatická buňka**

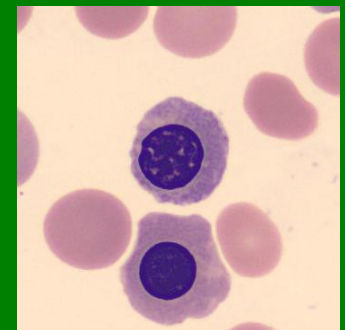
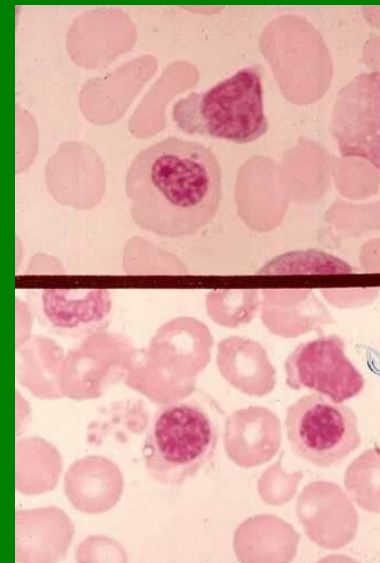
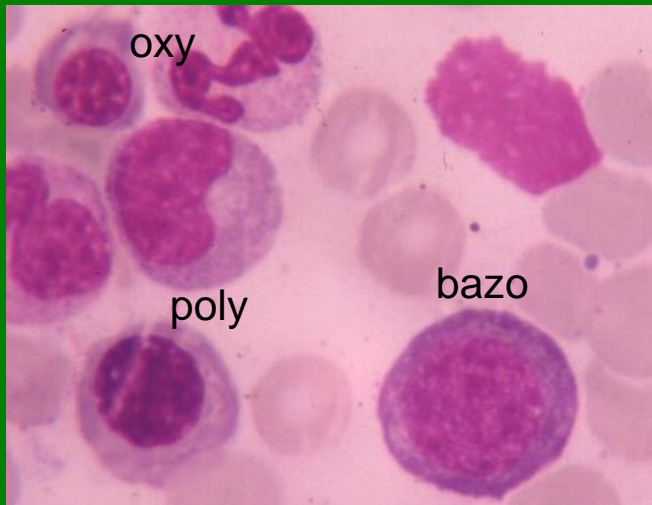
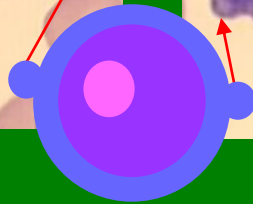
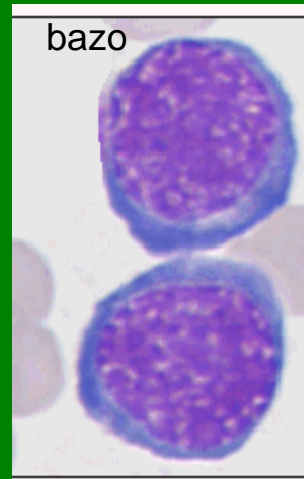
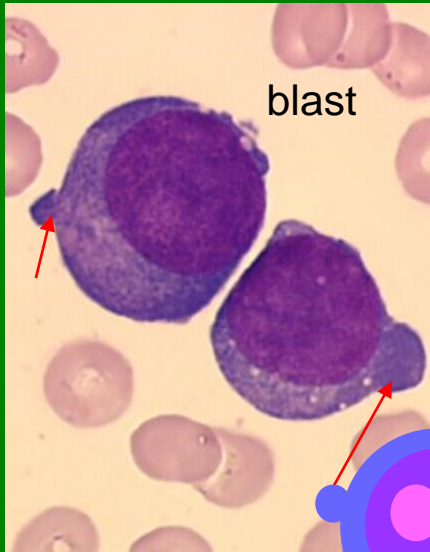


# Megakaryocyty, PLT



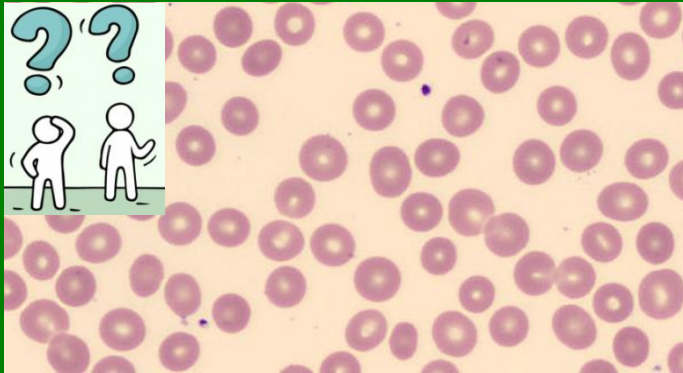


# NRBC

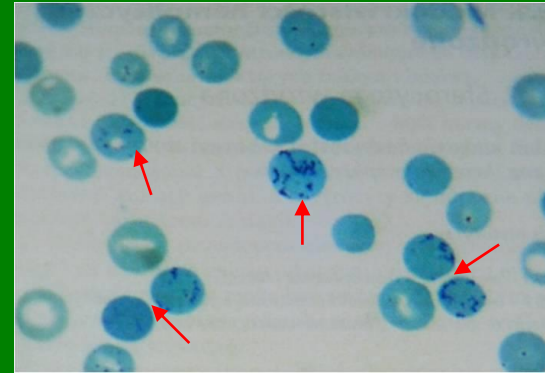


# Retikulocyty

RBC/Retic?



Retic

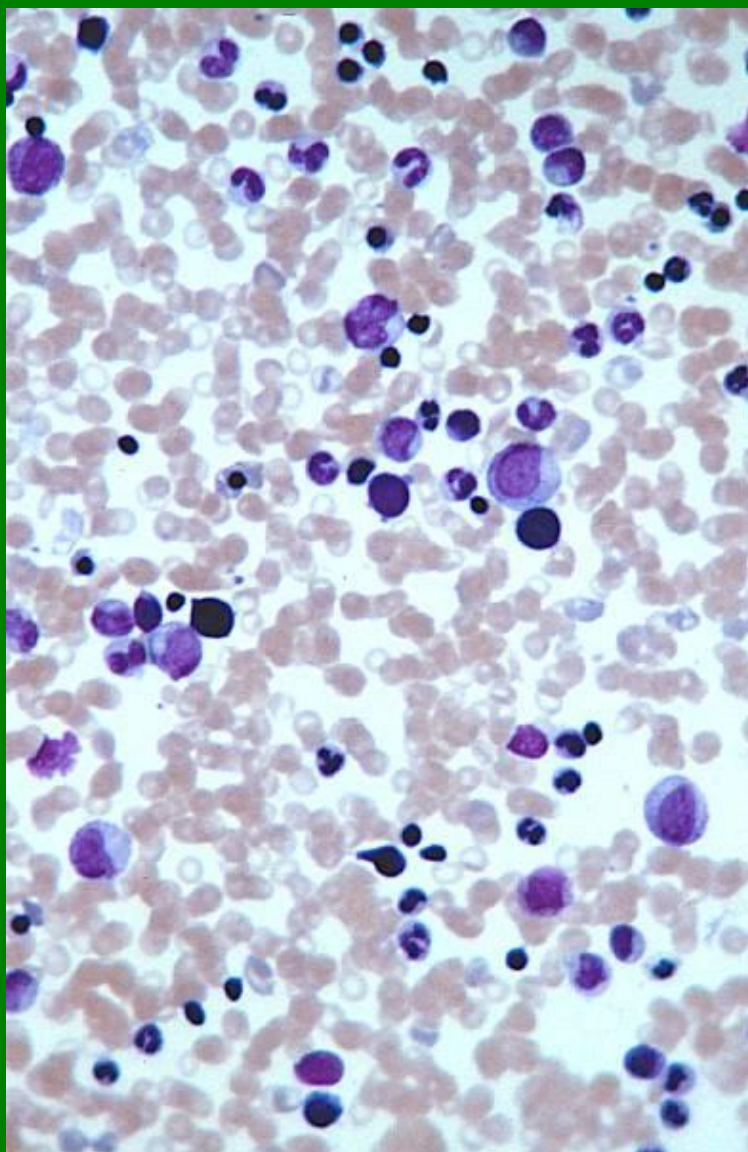


- větší než normocyty
- obsahují zbytky RNA v buněčných organelách (ribozomy, endoplazmatické retikulum)
- proto ještě může docházet k syntéze hemoglobinu
- průkaz speciálním barvením  
(nelze prokázat běžným panoptickým barvením)

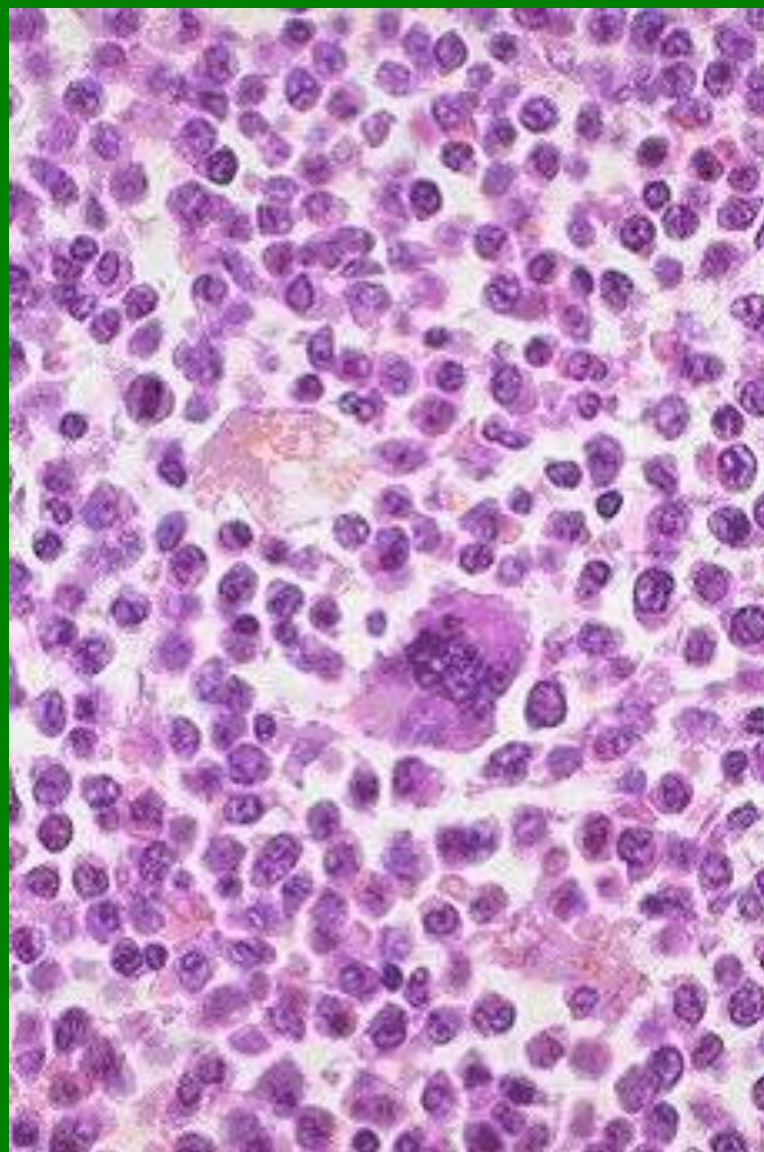


# Kostní dřeň – buněčnost

normální



vysoká



# Fyziologické zastoupení jaderných buněk

## ❑ kostní dřeň

- Proerytroblast: 0 - 2%
- Erytroblast bazofilní: 1 – 3%
- Erytroblast polychromní: 2 – 20%
- Erytroblast ortochromní: 2 – 15%
- ❖ Červená řada – celkem: 15 – 38%
- Myeloblast: 0 – 3%
- Promyelocyt: 0 – 7%
- Myelocyt neutrofilní: 5 – 20%
- Metamyelocyt neurofilní: 5 – 20%
- Tyč neutrofilní: 5 – 25%
- Segment neutrofilní: 5 – 25%
- Eozinofily celkem: 0 – 5%
- Bazofily: 0 – 1%
- ❖ Granulocytární řada celkem: 50 – 70%
- Žírná buňka: 0 – 0,2%
- Lymfocyt: 5 – 20%
- Plazmatická buňka: 0 – 3%
- Monocyt: 0 – 3%

**Poměr: (Granulocyty + Monocyty) : Erytrocyty**  
**1,5 : 1 – 5 : 1 (ženy); 1,5 : 1 – 4,2 : 1 (muži)**

## ✓ periferní krev - leukocyty

- Neutrofilní segmenty: 47 – 70%
- Neutrofilní tyče: 0 – 4%
- Lymfocyty: 20 – 45%
- Monocyty: 2 – 10%
- Eozinofily: 0 – 5%
- Bazofily: 0 – 1%

### Referenční meze:

<https://labsekce.hematology.cz/referencni-meze/>