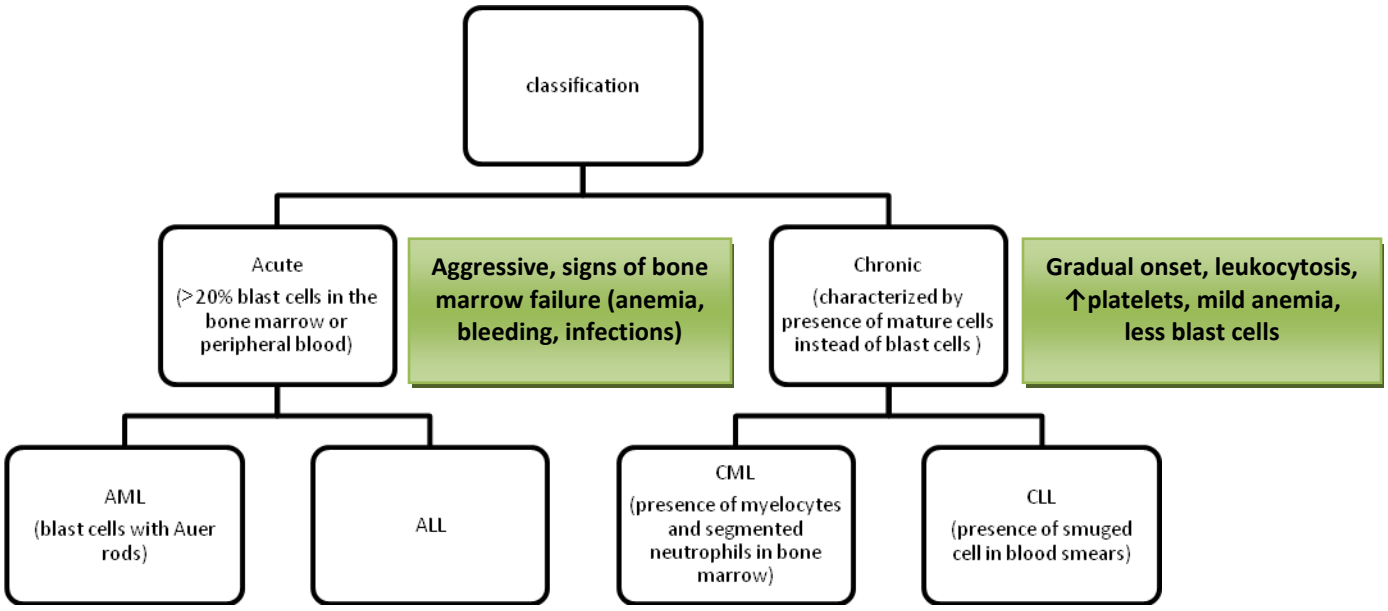
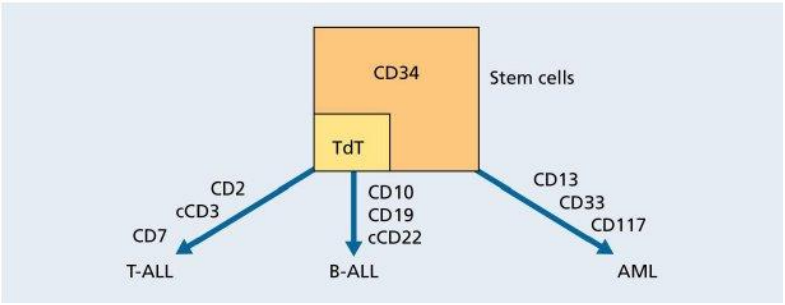
- **Benefits gained from knowing the classification of leukemia?**
  - Treatment.
  - Prognosis.
  - Estimating Minimal Residual Disease (MRD) after induction of remission. MRD is very small numbers of malignant cells remaining in the blood or bone marrow after starting the treatment (less than 0.01%) ---> and they are detected by:
    - ✓ **Flow cytometry** : looking for specific antigens presented on the cells.
    - ✓ **PCR**: used to detect molecular abnormalities.



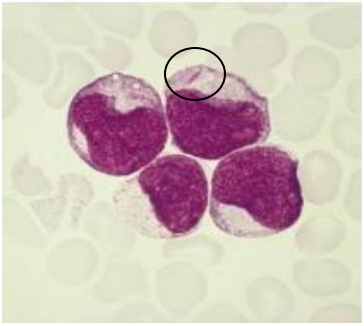
- **Note**: blast cells are large cells, with fine homogenous chromatin and characterized by the presence of punched-out nucleoli.
- **Identifying the cell lineage by:**
  - **Morphology & cytochemistry:**
    - ✓ *AML*: myeloperoxidase (+), Sudan black (+)
    - ✓ *ALL*: PAS (+).
  - **Immunological markers (detecting surface antigens which are recognized as molecular markers):**
    - ✓ *Flow cytometry*: is very useful to differentiate Acute Lymphoblastic Leukemia (ALL).



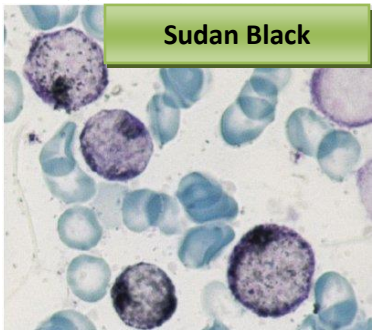
    - ✓ *Immunohistochemistry*.
  - **Cytogenetics:**
    - ✓ *Karyotyping*: example---> detecting Ph chromosome in CML. (t 9,22).
    - ✓ *PCR & FISH (to detect molecular abnormalities)*. Example---> BCR-ABL1 Fusion gene.

Acute Myeloblastic Leukemia (AML)

- **It is characterized by** the presence of more than 20% blast cells in the bone marrow or peripheral blood (it is difficult to differentiate between blast cell of AML & ALL).



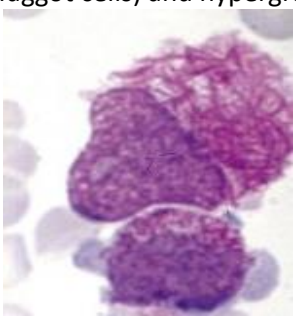
- **Therefore, cytochemistry will be done:**
  - Myeloperoxidase (+) & Sudan black (+) for AML.



To confirm the diagnosis, **flow cytometry is done:**

- CD13, CD33, CD117 (in addition to glycophorin & CD41).

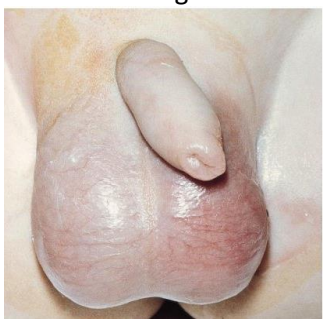
- **Promyelocytic leukemia:**
  - T (15,17) ---> PML-RAR
  - **Morphology**: multiple Auer rods (faggot cells) and hypergranular



  - **Clinical features & complications**: thrombocytopenia + DIC & hemorrhagic syndrome.
  - **Treatment**: ATRA-therapy.

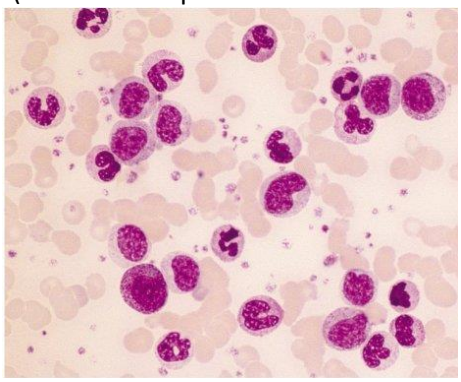
Acute Lymphoblastic Leukemia

- **It characterized by** the presence of blast cells which are difficult to differentiate from those blast cells of AML. Therefore, **cytochemistry is done** which will reveal (PAS: +) stain. **Flow cytometry is also done:**
  - **B-cell**: TdT, CD10, CD19, CD22 (clonal rearrangement of immunoglobulin genes).
  - **T-cell**: TdT, CD2, CD3, CD7 (clonal rearrangement of TCR gene).
- ALL causes meningeal syndrome + testicular swelling.



Chronic Myelocytic Leukemia (CML)

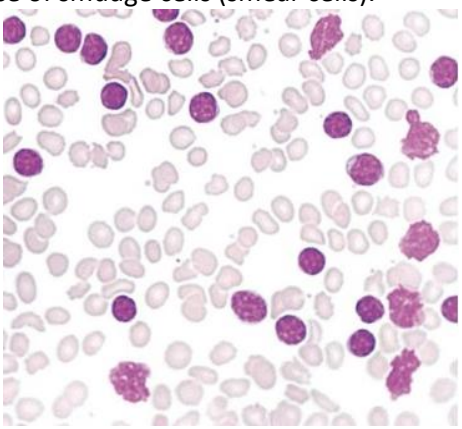
- **Characterized by** the presence of granulocytes at different stages of development in the bone marrow and peripheral blood (blast cell will present but less than 5%).



- **Lab tests will show**: ↑WBCs, ↑platelets, ↓HB (mild normocytic normochromic anemia) & presence of basophils.
- **Clinical features**: manifestations of hypermetabolism, splenomegaly, gout (hyperurecemia), less common manifestations include: priapism & visual disturbances.
- **Cytogenetics**: t(9,22) ---> lead to the formation of Ph chromosome (BCR-ABL1 fusion gene) which has increased tyrosine kinase activity leading to enhanced cell proliferation and preventing apoptosis.
- **Treatment**: Imatinib (which is a tyrosine kinase inhibitor).

Chronic lymphocytic leukemia (CLL)

- **Characterized by** the presence of smudge cells (smear cells).



- **Lab tests**: lymphocytosis.
- **Diagnosed by flow cytometry**: presence of CD5, CD19 and CD23.
- **Clinical features**: lymphadenopathy