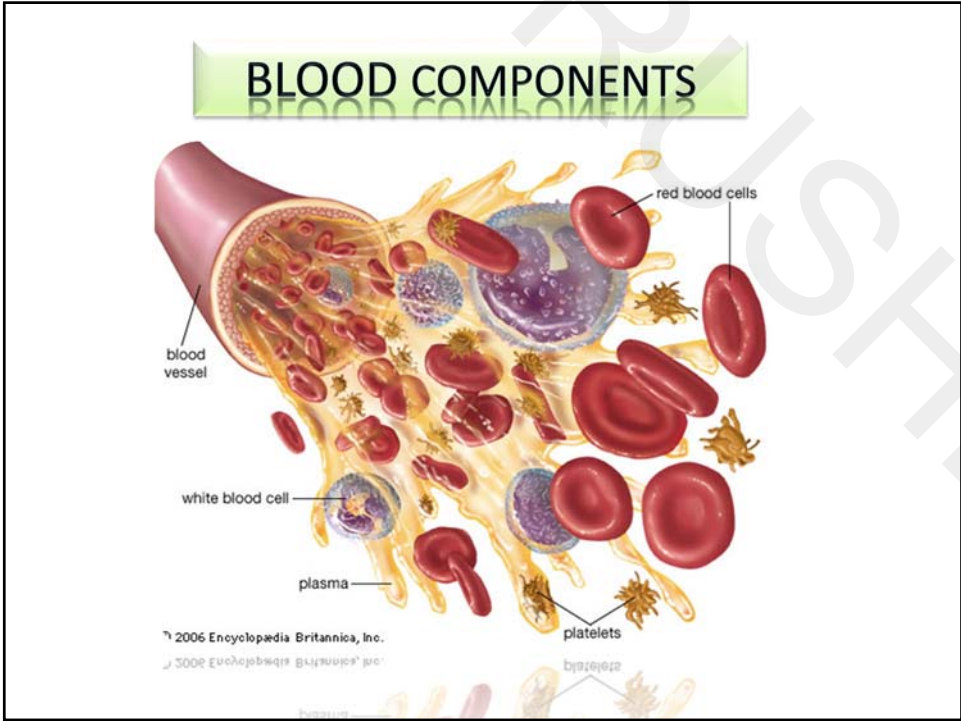


LEUCOCYTES PICTURE

By

Prof. Mahmoud Rushdi
Faculty of Veterinary Medicine
Assiut University
Egypt

www.scholaridea.com



Complete Blood Count (CBC)

TEST	RESULT	UNITS	REF RANGE
WBC	5.2	x 1000/mm ³	3.9 - 11.1
RBC	3.81 L	x 10 ⁶ /mm ³	4.20 - 5.70
HGB	14.5	g/dL	13.2 - 16.9
HCT	41.2	%	38.5 - 49.0
MCV	98 H	fL	80 - 97
MCH	33.7 H	pg	27.5 - 33.5
MCHC	35.3	%	32.0 - 36.0
RDW	11.8	%	11.0 - 15.0
PLT	172	x 1000/mm ³	140 - 390
MPV	7.6	fL	7.5 - 11.5
NEUT %	40.1	%	38.0 - 80.0
LYMPH %	46.1	%	15.0 - 49.0
MONO %	12.9	%	0.0 - 13.0
EOS %	0.6	%	0.0 - 8.0
BASO %	0.3	%	0.0 - 2.0
NEUT, ABS	2085	cells/mm ³	1650 - 8000
LYMPH, ABS	2397	cells/mm ³	1000 - 3500
MONO, ABS	671	cells/mm ³	40 - 900
EOS, ABS	31	cells/mm ³	30 - 600
BASO, ABS	16	cells/mm ³	0 - 125

Evaluation of the red blood cells (RBCs) Erythrocytes picture

Mean corpuscular values

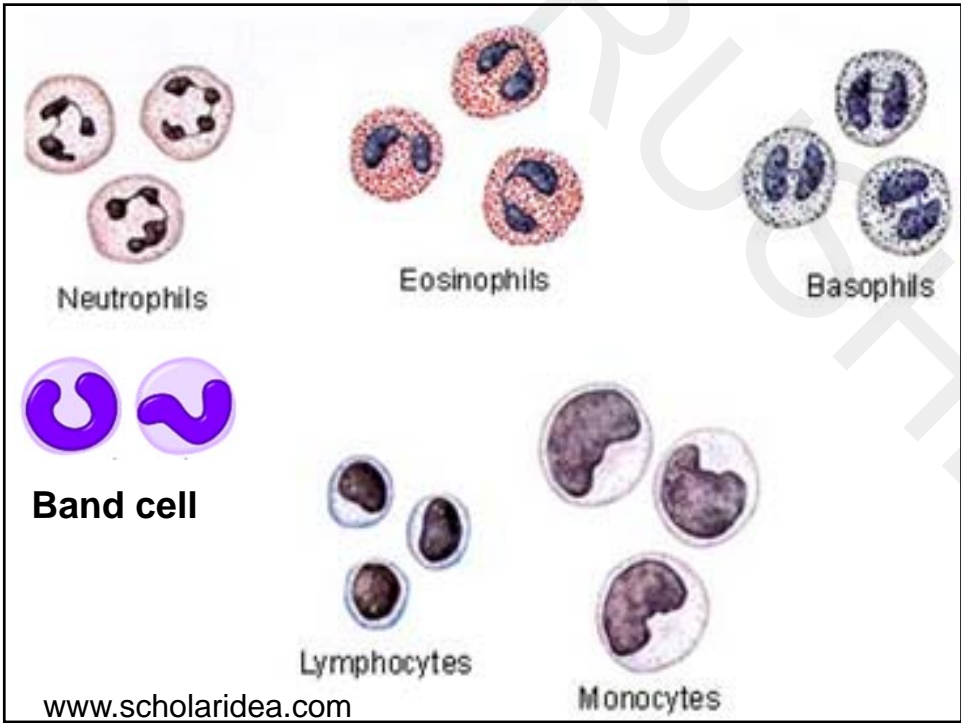
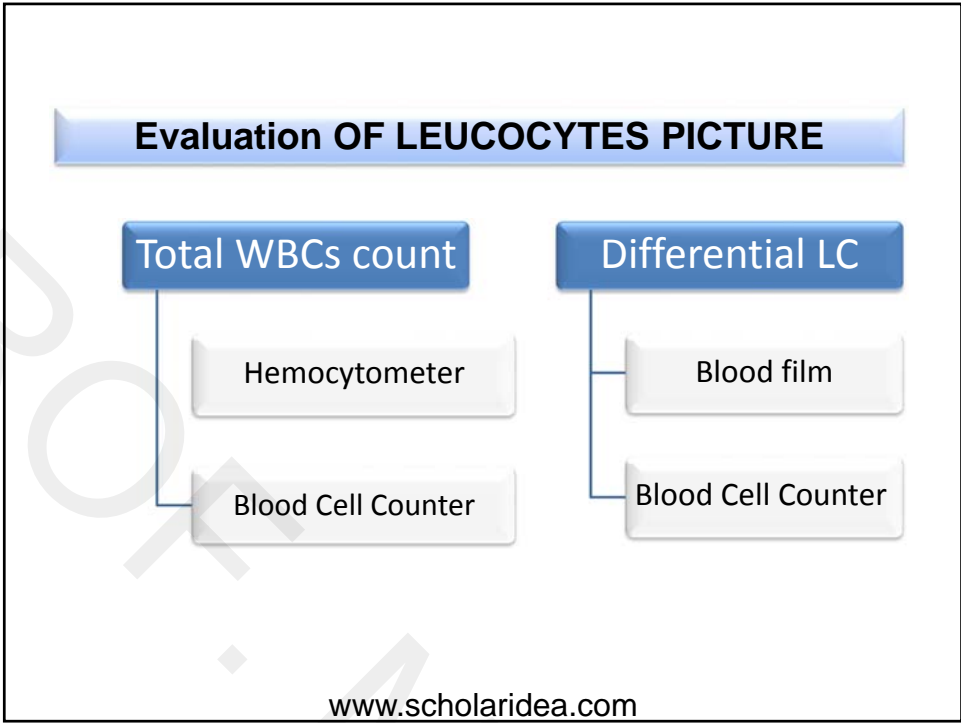
RBCs count

Erythrocytes morphology



Packed cell volume

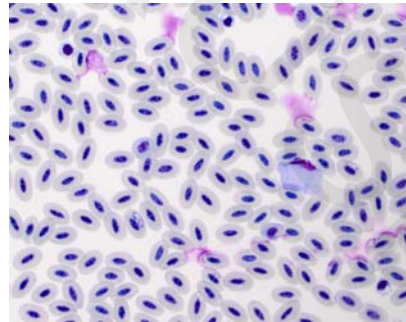
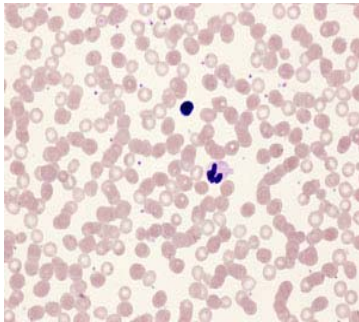
Hemoglobin concentration



The significance of blood smear examination

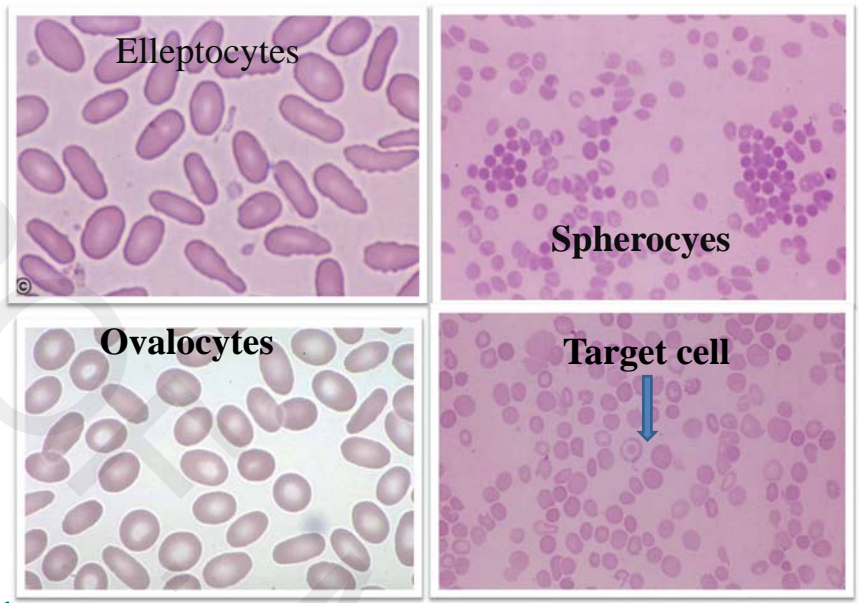
www.scholaridea.com

1. Identification of different animal species.



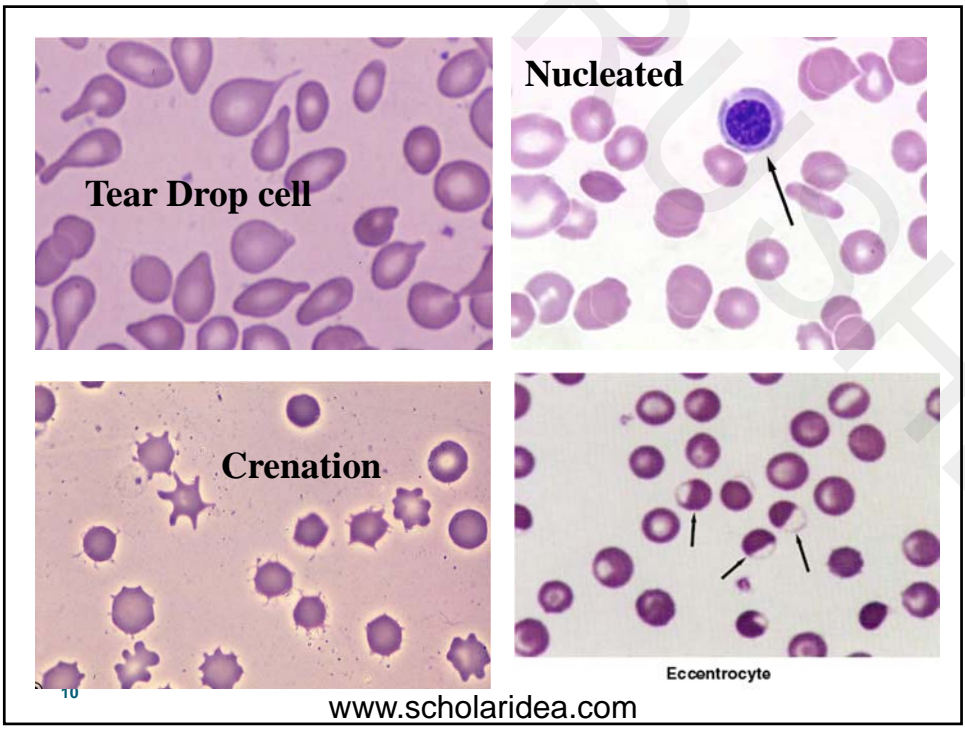
www.scholaridea.com

2. Morphological examination of the erythrocytes and leucocytes.



9

www.scholaridea.com

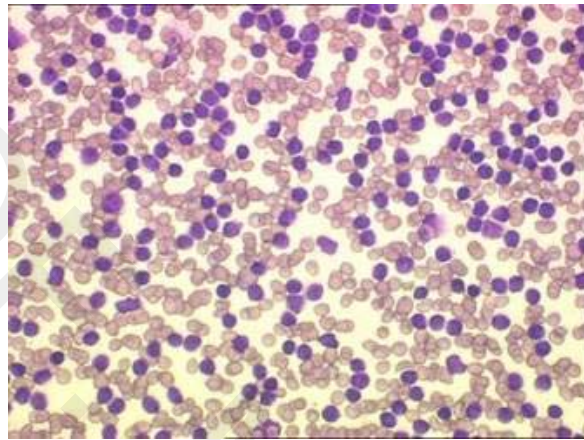


10

www.scholaridea.com

3. Carrying out the Differential leucocyte count.

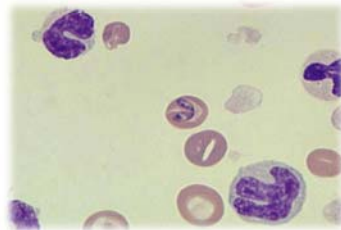
4. Diagnosis of leukemia.



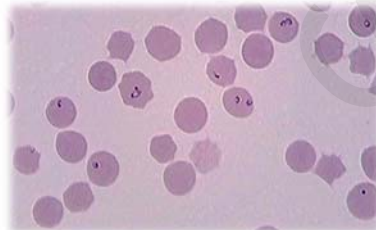
www.scholaridea.com

5. Diagnosis of blood parasites.

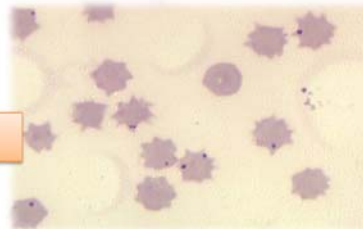
Babesia Spp.



Theileria Spp

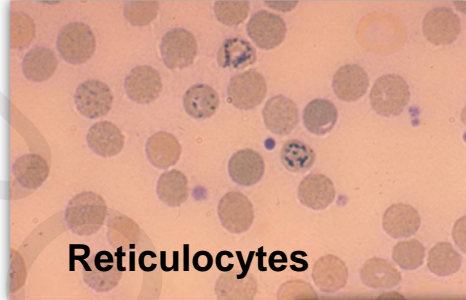


Anaplasma Spp

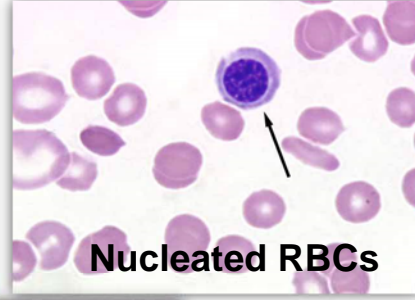


6. Diagnosis of bacterial diseases.

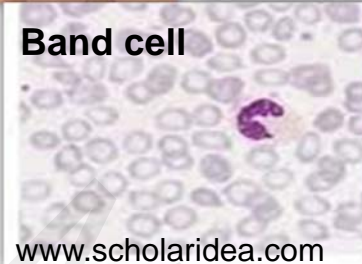
7. Prognosis of disease.



Reticulocytes



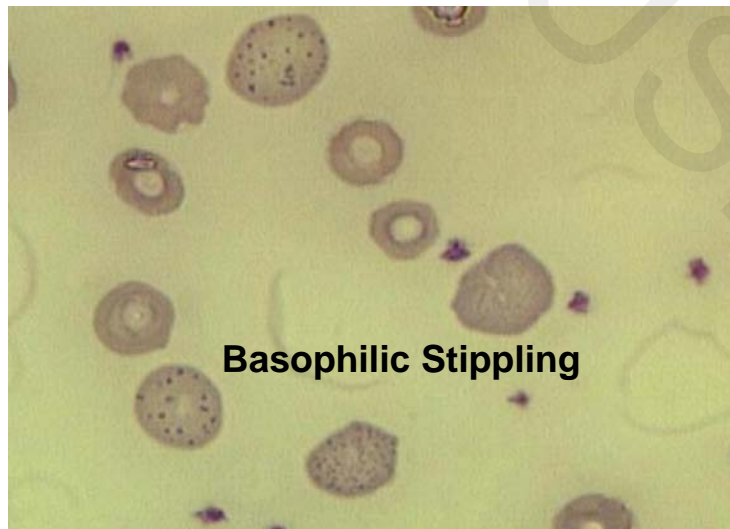
Nucleated RBCs



Band cell

www.scholaridea.com

8. Diagnosis of toxicity with some heavy metals like lead.

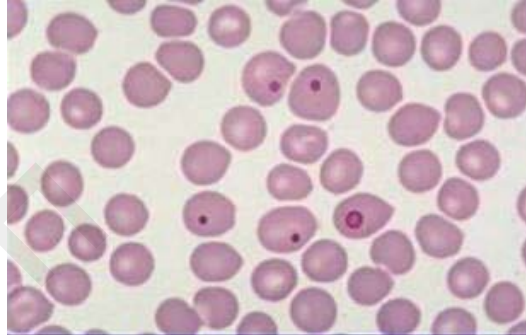


Basophilic Stippling

www.scholaridea.com

9. Estimation of the type and degree of anemia.

10. Diagnosis of some viral diseases (Canine Distemper).



www.scholaridea.com

11. Indirect method for bone marrow Evaluation

12. Indirect method for counting of platelets.

The platelets per oil immersion field on a stained blood smear are counted and compared with the number of red or white cells. For example, the number of platelets per 100 white blood cells multiplied by the total white count is an estimate of the platelet count.

www.scholaridea.com

INTERPRETATION OF LEUCOCYTES PICTURE

1. Leucocytosis.

2. Leucopenia.

3. Neutrophilia.

4. Neutropenia.

5. Lymphocytosis.

6. Lymphopenia

7. Eosinophilia

8. Eosinopenia

9. Basophilia.

10. Basopenia

11. Monocytosis

12. Monocytopenia

www.scholaridea.com

1. Leucocytosis

Means increase the total leucocytic count above the normal upper limit specific for each animal species / unit volume of blood. It is either **physiological or pathological**.

a. Physiological leucocytosis

Causes:

Age of the animal

Breed or species of the animal

www.scholaridea.com

a. Physiological leucocytosis

Muscular exercise and apprehension

Stage of pregnancy

Estrus

Stage of digestion

b. Pathological leucocytosis

Causes:

- Generalized infection such as (Pasteurellosis, leptospirosis and salmonellosis).
- Localized infection caused by bacteria such as *Staphylococcus*, *Streptococcus* and *Corynebacteria Spp.*

www.scholaridea.com

Pathological leucocytosis

- Rapidly growing neoplasm.
- Sudden haemolysis of the erythrocytes.
- Leukaemia and trauma.

2. Leucopenia

Decrease the total leucocytic count below the minimum normal limit specific for each animal species.

www.scholaridea.com

2. Leucopenia

Causes:

- A. Degeneration, depression, depletion and destruction of the bone marrow**
- B. Viral infection:** Such as canine distemper, infectious canine hepatitis and swine influenza.
- C. Bacterial endotoxins:** Endotoxins of gram-negative bacteria are located at or in the cell wall and are released on autolysis of the bacteria as *Escherichia coli* endotoxins. Endotoxins resulted in a decrease in lymphocytes and neutrophils

www.scholaridea.com

2. Leucopenia

- D. Overwhelming bacterial infection:** Bacterial toxemia and septicemia.
- E. Cachetic and debilitated states.**
- F. Physical agents** such as x rays
- G. Chemical agents:**
 - Antibiotics as chloramphenicol, penicillin and streptomycin.
 - Analgesics
 - Inorganic chemicals: Lead, benzene, bismuth, mercury.

www.scholaridea.com

NEUTROPHILIA

Neutrophilia means increase the number of neutrophils in the circulation over about $10^9 / l$ in monogastric animals and about $4 \times 10^9/l$ in ruminants.

Causes

As leucocytosis

www.scholaridea.com

NEUTROPENIA

Neutropenia means decrease the number of neutrophils in the circulation under about $4 \times 10^9 / l$ in monogastric animals and about $1 \times 10^9/l$ in ruminants.

Causes

As leucopenia except viral infection

www.scholaridea.com

LYMPHOCYTOSIS

Lymphocytosis means increase the number of lymphocytes in the circulation over about $6 \times 10^9 / l$ in monogastric animals and about $9 \times 10^9/l$ in ruminants.

Causes

1. Recovery from viral infection.
2. Following vaccination.
3. Hypoadrenocorticism.
4. Decrease level of ACTH.
5. Lymphoid leukaemia.

www.scholaridea.com

LYMPHOPENIA

Lymphopenia means decrease the number of lymphocytes in the circulation under about $1 \times 10^9 / l$ in monogastric animals and about $3 \times 10^9/l$ in ruminants.

Causes

- Hyperadrenocorticism in stress, steroid therapy.
- Acute viral infection as canine distemper, canine hepatitis and infectious feline enteritis.
- Ionizing radiation or immunosuppressive drugs.

www.scholaridea.com

EOSINOPHILIA

Eosinophilia means increase the number of eosinophils in the circulation over about $1 \times 10^9 / l$.

Causes

- Allergy.
- Parasitic infection.
- Adrenocortical insufficiency.
- Granulocytic leukaemia.

www.scholaridea.com

EOSINOPENIA

Eosinopenia means decrease the number of eosinophils in the circulation under about $0.1 \times 10^9 / l$.

Causes

- Stress.
- After administration of ACTH or corticoids as a therapeutic measure.
- Hyperactivity of adrenal gland.

www.scholaridea.com

BASOPHILIA

Basophilia means increase the number of basophils in the circulation over about $0.5 \times 10^9 / l$.

Causes

- Adrenocortical insufficiency.
- Basophilic granulocytic leukemia.
- Hypothyroidism.

BASOPENIA

Basopenia means decrease the number of circulating basophils. Since it is quite normal to find no basophils at all in a blood film, the theoretical possibilities of Basopenia are not worth considering in clinical situation.

www.scholaridea.com

MONOCYTOSIS

Monocytosis refers to an increase the number of circulating monocytes above about $0.5 \times 10^9 / l$.

Causes

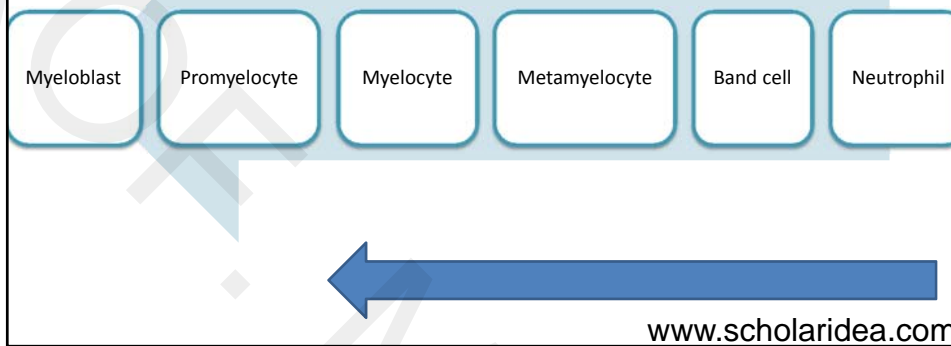
- Chronic diseases.
- Monocytic leukaemia.
- Listeriosis in swines.
- Hyperadrenocorticism.
- ACTH and corticoid treatment in dog, cow and cat.

www.scholaridea.com

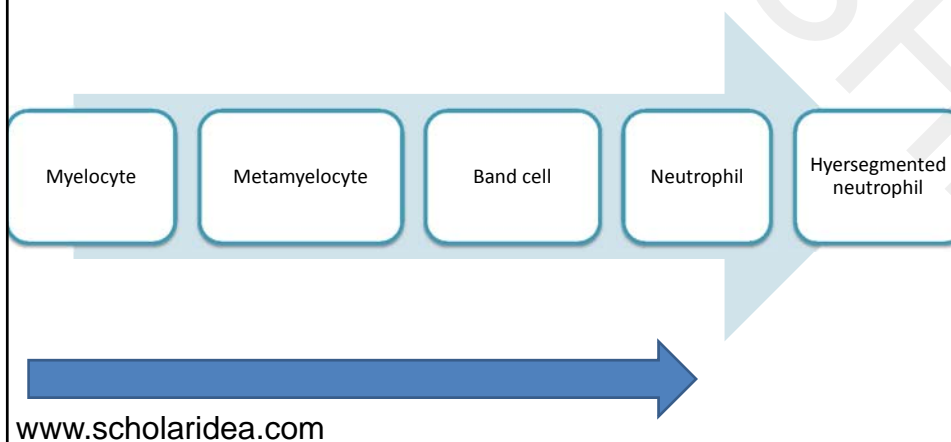
SCHILLING INDEX

It is an index used for classification of neutrophils depending on maturation of neutrophils.

Shift to the left



Shift to the right



Shift to the left

Shift to the left is used to denote an increase in the number of immature neutrophils in the peripheral circulation i.e. more than 7 % band cells.

- a. Regenerative shift to the left:** This shift is characterized by a leucocytosis, neutrophilia and with the appearance of immature neutrophilic granulocytes in peripheral blood, it is either:
1. A slight shift to the left: It is limited to the occurrence of band neutrophils.
 2. A moderate shift to the left: It includes both band and metamyelocyte neutrophils.
 3. A marked left shift: Would bring myelocytes and progranulocytes into peripheral blood

Prognosis: Good prognosis.

www.scholaridea.com

b. Degenerative shift to the left

- There is normal, low or falling total leucocytic count accompanied by moderate to marked shift to the left.
- This alteration is a result of inability of bone marrow to mature cells in response to infection and as a result increase the number of immature forms appear in the blood which show toxic changes.
- A degenerative left shift is common in septicemia.
- Toxic neutrophils are considered abnormal cells and are present in the blood as a reflection of toxic condition.

www.scholaridea.com

Toxic neutrophils appear as:

- Signs of toxaemia are seen in neutrophils in diseases accompanied by depression of granulopoiesis.
- Appear in acute inflammatory diseases as peritonitis, pericarditis, mastitis and metritis.
- The appearance of blue black granules.
- The presence of vacuoles located in the cytoplasm along the periphery of the cell.
- Toxic granulation results from precipitation of the basophilic ground substance to form blue black granules.

www.scholaridea.com

LEUKAEMOID REACTION

- A blood picture exhibiting a marked leucocytosis with a considerable number of immature WBCs. It is similar to left shift of the regenerative type in which there is an extreme leucocytosis simulating that observed in leukemic leukaemia.
- Leukaemoid reaction indicates extreme Leucocytosis. With severe left shift to metamyelocyte and myelocytes but no signs of hemopoietic neoplasia and indicate severe inflammation.

www.scholaridea.com