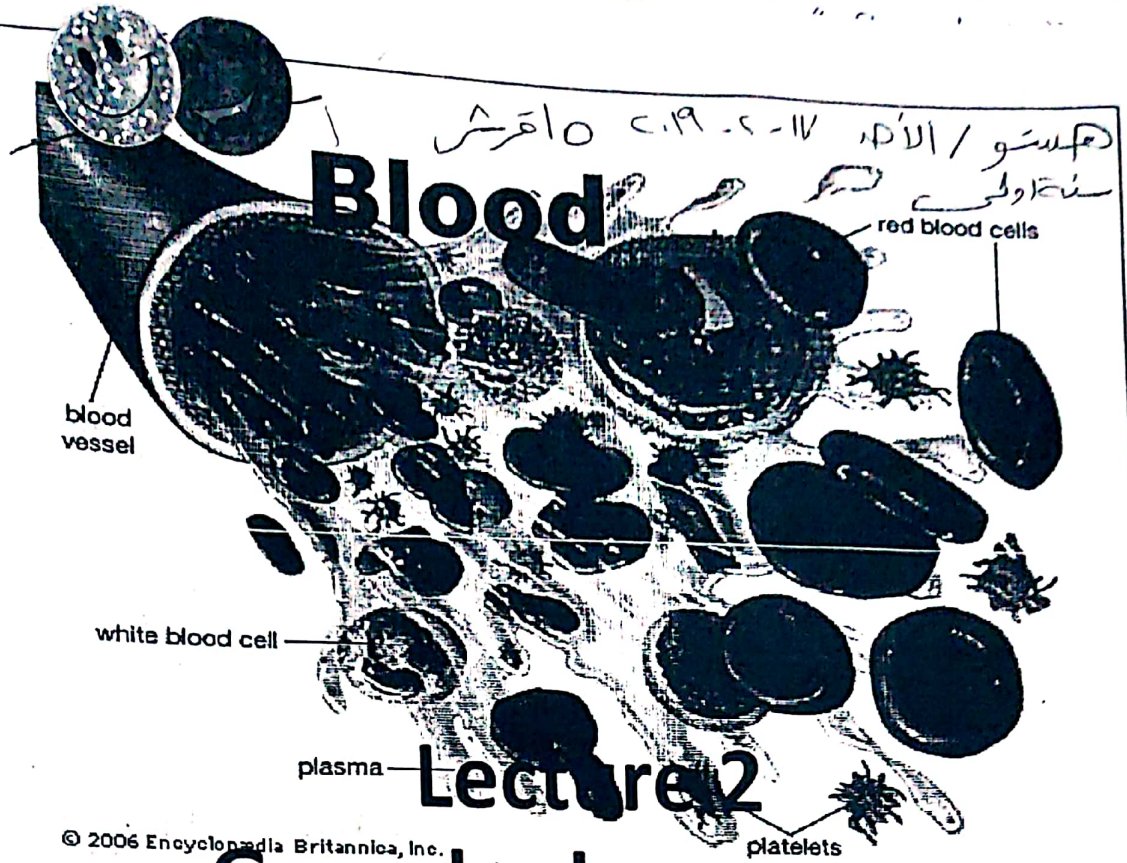


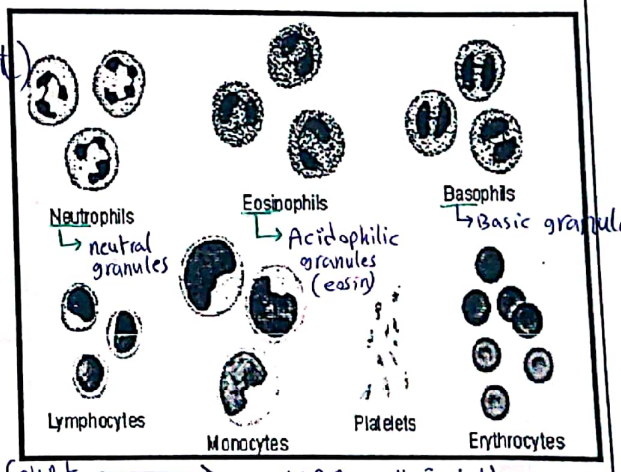
Lecture 2

Granular leucocytes

The formed blood elements

45 % of blood volume

- **Red blood corpuscles** (Total count)
  =Erythrocytes
  (RBCs)
- **Blood platelets** (Total count)
  = Thrombocytes
- **White blood cells**
  =Leukocytes
  (WBCs): Total count + differential Count → بالنسبة لـ WBC



1- Granular leucocytes (specific granules)
(neutrophils, eosinophils, basophils)

has ((non specific azurophilic granules)) ← lysosomal hydrolytic enzymes

2- Agranular leucocytes
(lymphocytes, monocytes)

Stains of blood film
Giemsa's / Leishman's
= methylene blue+ eosin
- ▶basophilic **(violet)** → (methylene blue)
- ▶eosinophilic **(pink)** → (eosin)
- ▶azurophilic **(red purple)** ← mix of methylen + eosin

Difference between RBCs & WBCs

RBCs 7.5 µm	WBCs
• **4-5.5**million/micro-liter/ mm3	• **4000-11000**/micro-liter
• **Biconcave**	• **Rounded**
• **No nuclei. / no** organelles (only cell membrane)	• **(nuclei**+ organelles)
• Contain **hemoglobin**	• **No hemoglobin**
• **Life span=120 days**	• From **days** to **years** → memory cells
• **No ameboid** movement	• **Amoeboid** movement
• **Function : carry O2&CO2**	• **Defense** & immunity

-Filled with (Hemoglobin)

- days , month , years → يتحول لـ memmory cells

> if RBCs escape circulation it would be pathological.

Leukocytes (WBCs)

Normal total Count and every type has differential count.

4000-11,000 / mm³ blood.

I-Granular leukocytes:

1-Neutrophils. 60-70-%

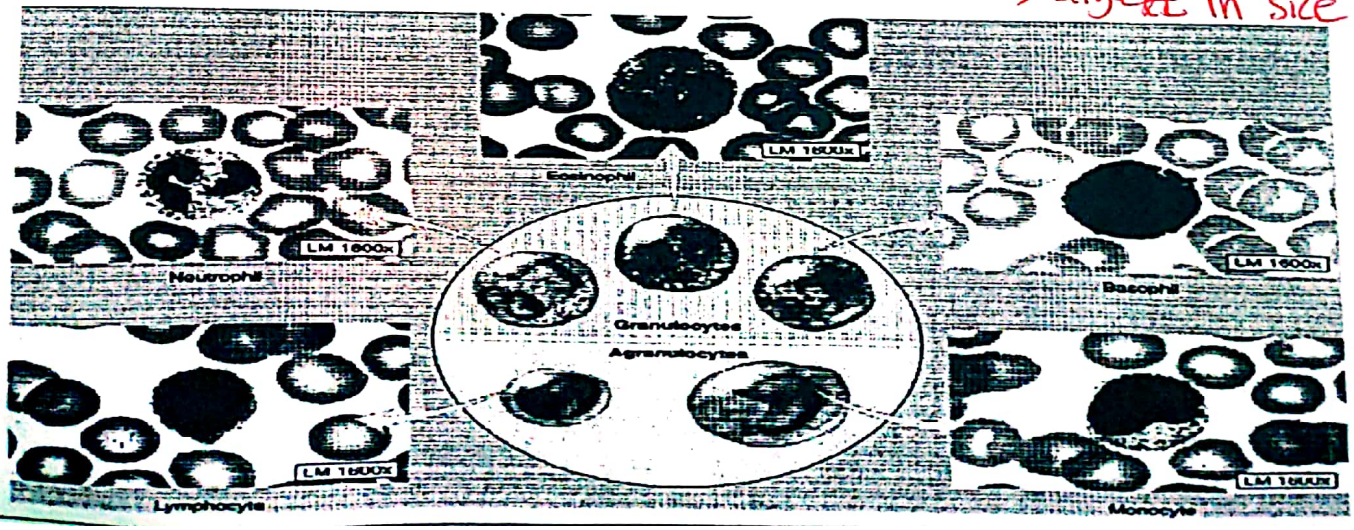
2-Eosinophils. 1-4% → acidophilic granules

3-Basophils. 1/2- 1% → Basophilic granules.

II-Agranular leukocytes:

1- lymphocytes.20-30%

2- Monocytes. 3-8% → largest in size

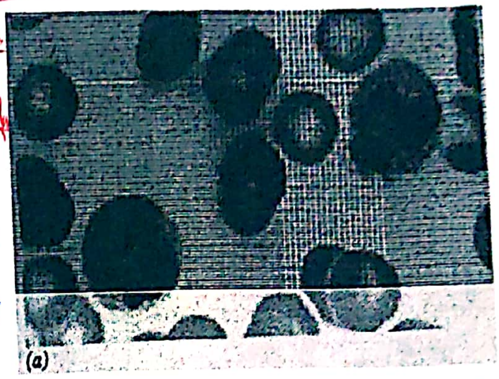


Non-nucleated cell ⟶ RBCs ((after maturation))
* Binucleated cell ⟶ 25% of liver cells
* Multinucleated cells ⟶ Skeletal muscles

1-Neutrophils= Microphage (polymorphnuclear leucocytes (Most numerous)
-pus cell

Differential count 60-70%
Diameter=10-12 microns
- **Shape:** rounded — Binuclear cells (dome shape cells in Transitional epithelium) → liver cells

* First line of defense.


(a)

LM:

Nucleus : **multilobulated.** (نواة واحدة مقسمة)
2-8 lobes — كل ما كانت زادت ال loops mature

Barr body ?? Condensed chromatin inactive X- Chromosome in females

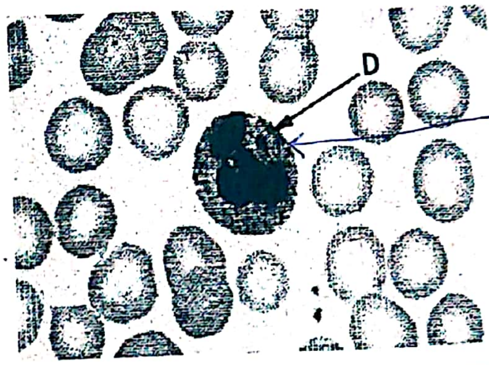
Cytoplasm: contains

1- specific granules

(neutral & small) granules

2- non specific:

azurophilic granules (few & large ,stained by azure)



Barr Body

when infection ⟶ تتقطع من ال Endothelium (Transcytosis) ⟶ تخرج Collagenase, Lysosomal hydrolytic enzymes ⟶ destruction for infections ⟶ death of neutrophils ((pus cell))

EM of Neutrophils

- **Shape:** irregular. When active (pseudopodia)
- **Cytoplasm:**
- Few organelles.

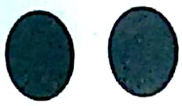
➢**Granules:**

- 1- Specific.
- 2- non specific (Azurophilic)

1- specific granules

- Small
- Numerous
- Rice grain appearance
- Functional enzymes e.g.
- Collagenase → destroy collagen.

2- azurophilic granules



- Large
- few
- Dense
- Lysosomal hydrolytic enzymes.

* Neutrophils don't actully phagocytose. They release their hydrolytic enzymes to destroy the Pathogen so, we call them microphage

Neutrophils(polymorphs)

- **Functions**

1- **Phagocytosis & destruction** of micro-organisms in the C.T. How…?

Chemotaxis(1)→ migration(2) → (3) phagocytosis → (4) killing of bacteria by phagocytins (**specific secondary granules**) →

digestion by lysosomal enzymes (**1ry, azurophilic granules**) → death of neutrophils (pus cells)

2- **Attraction of monocytes** to the site of infection.

3- **Production of pyrogens** & **pus**

4- **Stimulation of bone marrow** to form new neutrophils

- **Life span: 1- 4 days in** *blood*
  - ▶▶ CT
- The first line of defense. *first line ((destruction)) لسبب بعدما تروح على infection site وتقضي عليه*
- **Pus cells**
- **Secretion of cytokines:**

➢**Chemotaxis** (انجذاب كيميائي)

➢**bone marrow stimulation**

٢٠١٦ ٧

Abnormal neutrophil count

- **Neutrophilia:** *زيادة في العدد*

=in **acute** pyogenic **Pus** =acute inflammations e.g.: *because of*

❖Appendicitis *التهاب الزائدة الدودية*

❖Tonsillitis *(التهاب اللوز)*

- **Neutropenia:** *نقص في العدد*

❖TB *(Tuberculosis)* → *Cause suppresion to Bone marrow*

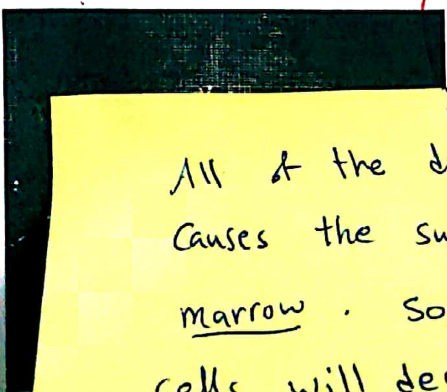
❖Influenza → *affect lung*

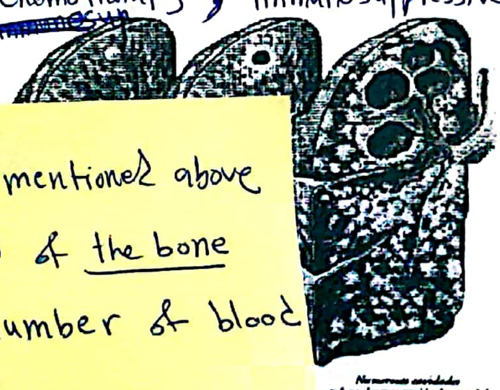
❖Measles *الحصبة*

** cortison*

** chemotherapy , immunosuppressive drug*

** Radio therapy*





All of the diseases mentioned above causes the supression of the bone marrow. So the number of blood cells will decrease.

Also, medications can cause decrese blood cell number, as Cortison

2-Eosinophils

* has Acidophilic granules.

Differential count : 1- 4% → if more than this (adult → in allergy, child → in parasitic)

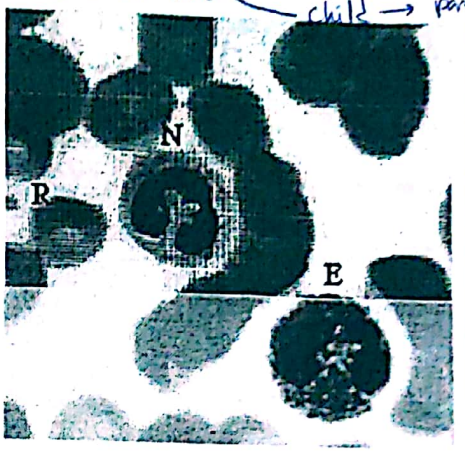
- **Diameter 12-15** microns. most large
- **Shape:** rounded

L.M :

*Nucleus: bilobulated with thick chromatin thread (horse shoe). → C shaped

**Cytoplasm contains large specific acidophilic granules.

*Few azurophilic granules



2-Eosinophils

for allergy / parasitic infection

E.M:

Multilobed nucleus

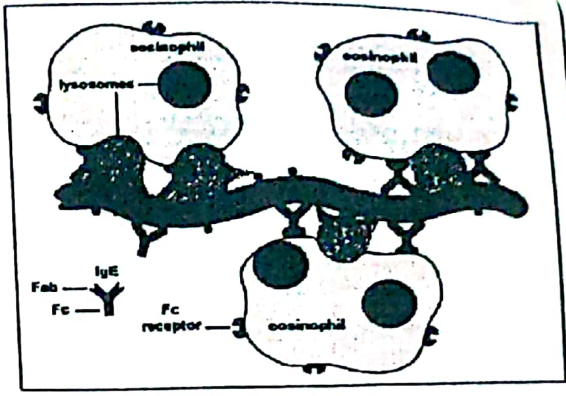
Cytoplasm contains also glycogen, some mitochondria, rER, & sER

- Specific granules with crystalloid dense cores contain many hydrolytic enzymes.
- Few non specific granules (primary lysosomes)

- **1- specific granules**
- large
- ovoid
- crystalloid core
- Functional proteins & enzymes
- Histaminase
- Eosinophil peroxidase

- **2- azurophilic granules**
- Small
- spherical
- Lysosomal hydrolytic enzymes → For destruction

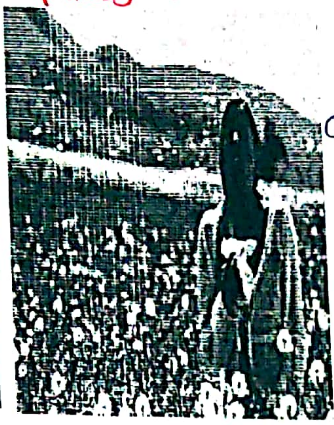
Eosinophils



Function of Eosinophils

- Migrate to mucosa of GIT, respiratory, genito-urinary& skin.
- ▼ ▼ regulation of allergic reactions.
- Parasitic infestation. (Not phagocytic)

by secretion of histaminase , peroxidase
then hydrolytic enzymes
to destroy parasytes.



Abnormal Eosinophil Count

- **Eosinophilia:**
  - ➢ **Allergic** reactions e.g. bronchial asthma, urticaria. rhinitis / conjunctivits
  - ➢ **Parasitic** infestations e.g. Bilharziasis.
- **Eosinopenia:**
  - ➢ Steroid therapy. Bone marrow depression.

بتقلل تمنع الEosinophils

3-Basophils

Mast cell of the blood

Secrete Histamene
secrete heparine

Differential count : ½ - 1%

Size : 10 microns

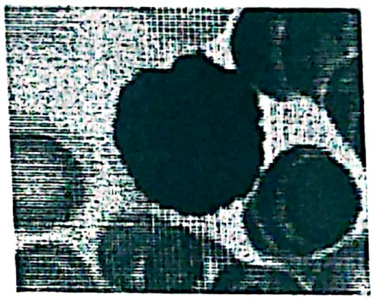
Shape : Rounded

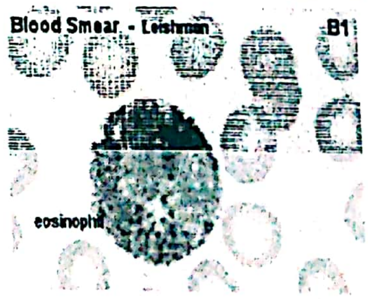
LM:

➢**Nucleus:**

❖Bilobed, (S-shaped)

❖**obscured by** deep blue granules

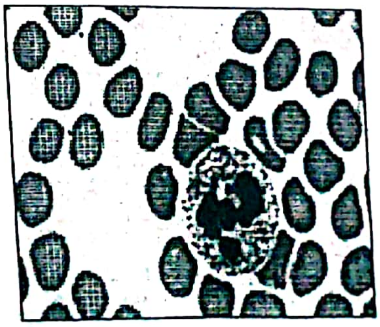




➢**Cytoplasm:**

❖abundant deep blue granules.

❖**Metachromasia.** by ~~toluidine blue~~ toluidine blue
because of heparin
it's stained with toluidine blue
and appear as → red color



Basophils

E.M.

*Bilobed S shape nucleus

*Multiple large specific granules

*Few lysosomes (nonspecific granules).

Mitochondria, ribosomes, glycogen in cytoplasm.

1- specific granules

- large
- coarse
- Functional histamine, heparin

allergy — Anticoagulant

2- azurophilic granules

Few

- Lysosomal hydrolytic enzymes.

Eosino

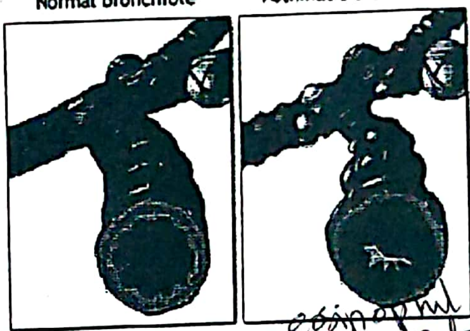
allergy cells: ① mast cells (Baso philis) ② Basophils → have receptors immunoglobulin E

Functions

Spasm (bronchioles) — Vasodilatation — Histamine — (edema) → hypotension. If severe ((Anaphylactic)) shock

wheezy chest

Normal bronchiole — Asthmatic bronchiole



- Secretion of histamine which initiates allergic reactions. ((Systemic Allergy))
- Secretion of heparin which is a natural anti-coagulant.
- Secretion of eosinophil chemotactic factor to limit allergic reaction.

eosinophil chemotactic factor

- **=Mast cell of blood:= hypersensitivity reaction**
- **1- heparin: anticoagulant**
- **2- histamine:** (anaphylaxis)

44-49 min

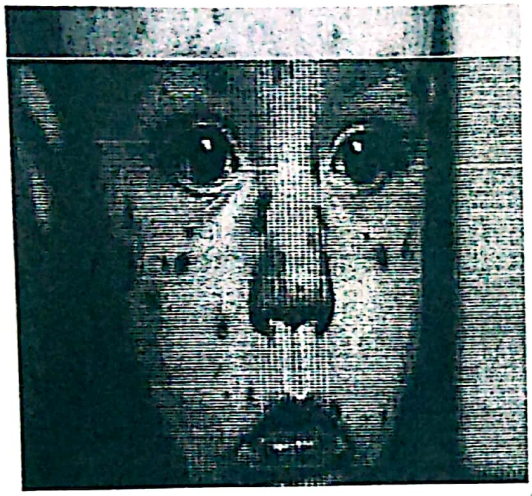
If antigen enters body it will face ① macrophage ② Lymphocyte ③ Neutrophils

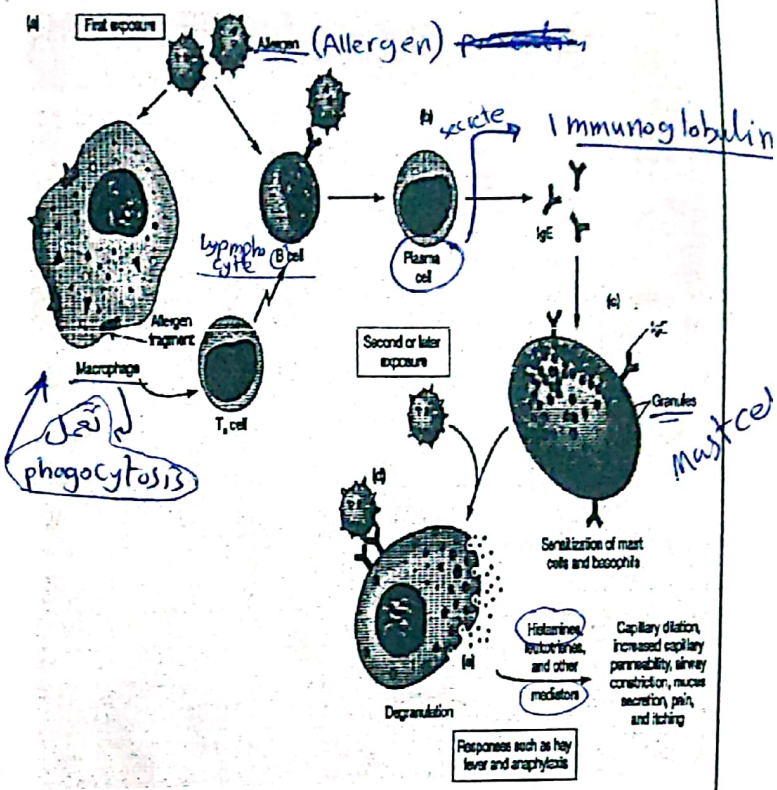
Scanned by CamScanner

Basophils are responsible for releasing Histamine in a systemic allergic rxn.

Basophils abnormal count

- **Basophilia:**
  - viral infections as small pox and chicken pox.
  - Systemic allergy.





allergy أعراض ال

① edema, redness
② itching
③ spasm in bronchi

	Neutrophils	Eosinophils	Basophils mast cell of the blood.
Number	60-70% of leukocytic count	1-4% of leukocytic count	0-1% of leukocytic count
Size	10-12 µm in diameter	larger than neutrophils (12-15 µm in diameter,	(10 µm) in diameter,
Shape	spherical in shape + Neutral granules	spherical in shape + Acidophilic granules	spherical in shape (basophilic) specific granules with heparin and histamine
Structure	multi-lobed nucleus human females may have inactivated second X chromosome (Barr body drum stick	bi-lobed nucleus C-shape or	S-shape lobed nucleus, obscured by basophilic granules
Life span	lifespan 1-4 days in circulation;	several days Up to week	1-2 weeks
Function	first line of defense against any invading micro-organism	• Kill parasites, • associated with allergic reactions	Basophils are responsible for the release of Histamine in systemic allergic reaction
Abnormality	Neutrophilia: i.e. abnormal increase in the number of neutrophils. This is observed in acute inflammations e.g. appendicitis, tonsillitis.	Eosinophilia: i.e. abnormal increase in the number - Allergic reactions e.g. asthma, urticaria - Parasitic infections e.g.	Basophilia in systemic allergic reaction