Histology — tissues · Lab 4

Blood and bone marrow

When	Monday 16 November 2026, 12:15–14:30
Room	A5/018
Teacher	dr hab. prof. UR Agata Wawrzyniak
Group	Lab group 2
Same day	Lecture 6, 08:00–09:30, A5/4: Blood and haemopoiesis

What the lab covers

Blood: the structure and functions of its cells (erythrocytes, leukocytes, thrombocytes); red bone marrow; haemopoiesis.

How it is graded

- Recognising histological slides
- Attendance
- Two tests (at least 15 single- or multiple-choice questions each, one resit) and a practical in the winter semester
- A correctly completed exercise notebook
- Activity

The final practical exam: 15 slides under the microscope, a minute each, 60% to pass.

Bring: the exercise notebook (it is graded)

In this pack

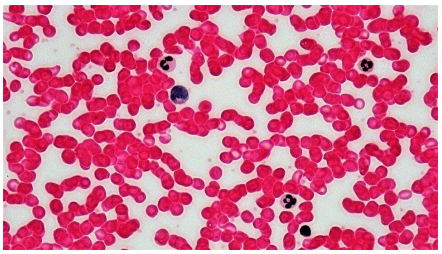
1	Recognising the slides (2)	page 2
2	Practice figures: name each numbered structure (6)	page 4
3	Key points	page 10
4	Light-microscope checklist	page 11
5	Self-test: 9 single-choice questions	page 12
	Answers: practice figures	page 13
	Answers: self-test	page 13

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1 · Recognising the slides

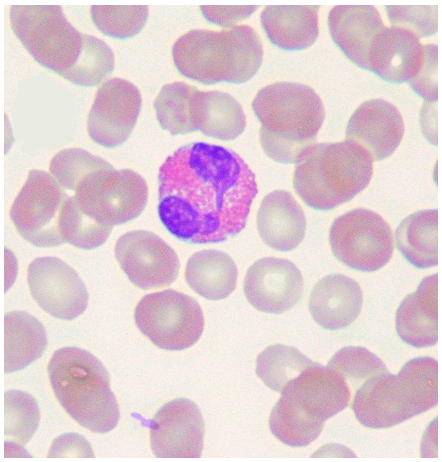
Each tissue as the Slide Box shows it: its slides, how to recognise it, and what not to confuse it with. Test yourself online: medicine.kazimiri.com/semester-1/slides/?lab=4&m=test

Blood smear · rozmaz krwi



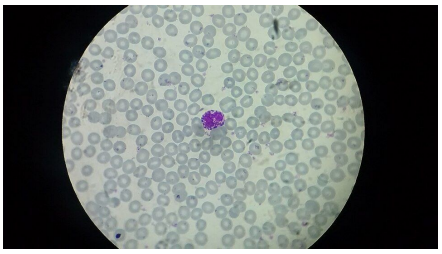
Blood smear (Wright's stain, 400x): red cells, neutrophils with lobed nuclei, and lymphocytes with round dark nuclei.

Berkshire Community College Bioscience Image Library · CC0 · commons.wikimedia.org/wiki/File:Connective_Tissue_Human_Blood_Leukocyte_Survey_(41854907371).jpg



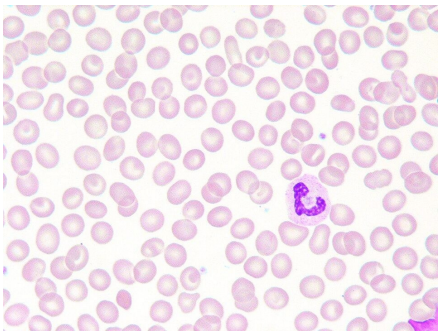
An eosinophil among red cells: a two-lobed nucleus and coarse orange-red granules.

Echinaceapallida · CC BY-SA 4.0 · commons.wikimedia.org/wiki/File:Blood-eosonophil1.jpg



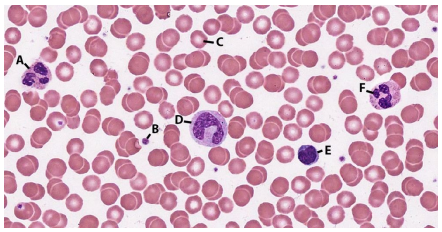
A basophil (May-Grünwald-Giemsa stain): dark purple granules crowd the cell and hide its nucleus.

J3D3 · CC BY-SA 4.0 · commons.wikimedia.org/wiki/File:BasoP.jpg



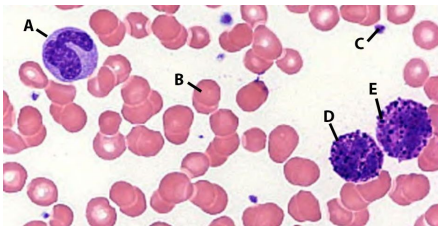
A monocyte, the largest white cell (Wright's stain): a horseshoe-shaped nucleus and pale grey-blue cytoplasm.

Echinaceapallida · CC BY-SA 4.0 · commons.wikimedia.org/wiki/File:Blood-monocyte.jpg



Real blood smear: neutrophils, a monocyte and a lymphocyte among red cells and platelets.

Jennifer Lange; micrographs: Virginia Commonwealth University · CC BY-NC-SA 4.0 · med.libretexts.org/Bookshelves/Anatomy_and_Physiology/Human_Anatomy_(Lange_et_al.)/16%3A_Cardiovascular_System_-_Blood/16.06%3A_Anatomical_Atlas_-_Blood



Real blood smear (1000x): a monocyte and two basophils among red cells and platelets.

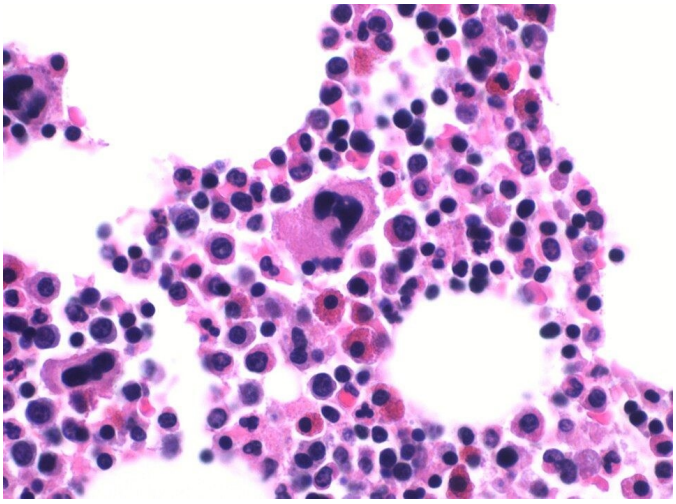
Jennifer Lange; slide: Regents of the University of Michigan Medical School · CC BY-NC-SA 4.0 · med.libretexts.org/Bookshelves/Anatomy_and_Physiology/Human_Anatomy_(Lange_et_al.)/16%3A_Cardiovascular_System_-_Blood/16.06%3A_Anatomical_Atlas_-_Blood

How to recognise it

- Erythrocytes: pink discs with no nucleus and a pale centre, about 7.5 µm across.
- Neutrophil: a nucleus of 3-5 lobes and pale, fine granules (the commonest white cell).
- Eosinophil: a two-lobed nucleus and large orange-red granules.
- Basophil: dark purple granules that hide the nucleus (the rarest).
- Lymphocyte: a round dark nucleus filling the cell, a thin rim of blue cytoplasm; about the size of a red cell.
- Monocyte: the largest; a kidney- or horseshoe-shaped nucleus and grey-blue cytoplasm. Platelets: small purple fragments.

Don't confuse with: A lymphocyte and a monocyte: check the size and the shape of the nucleus.

Red bone marrow · szpik kostny czerwony



Red bone marrow: blood-forming cells of every line, with a megakaryocyte (the giant cell with a lobed nucleus) in the middle.

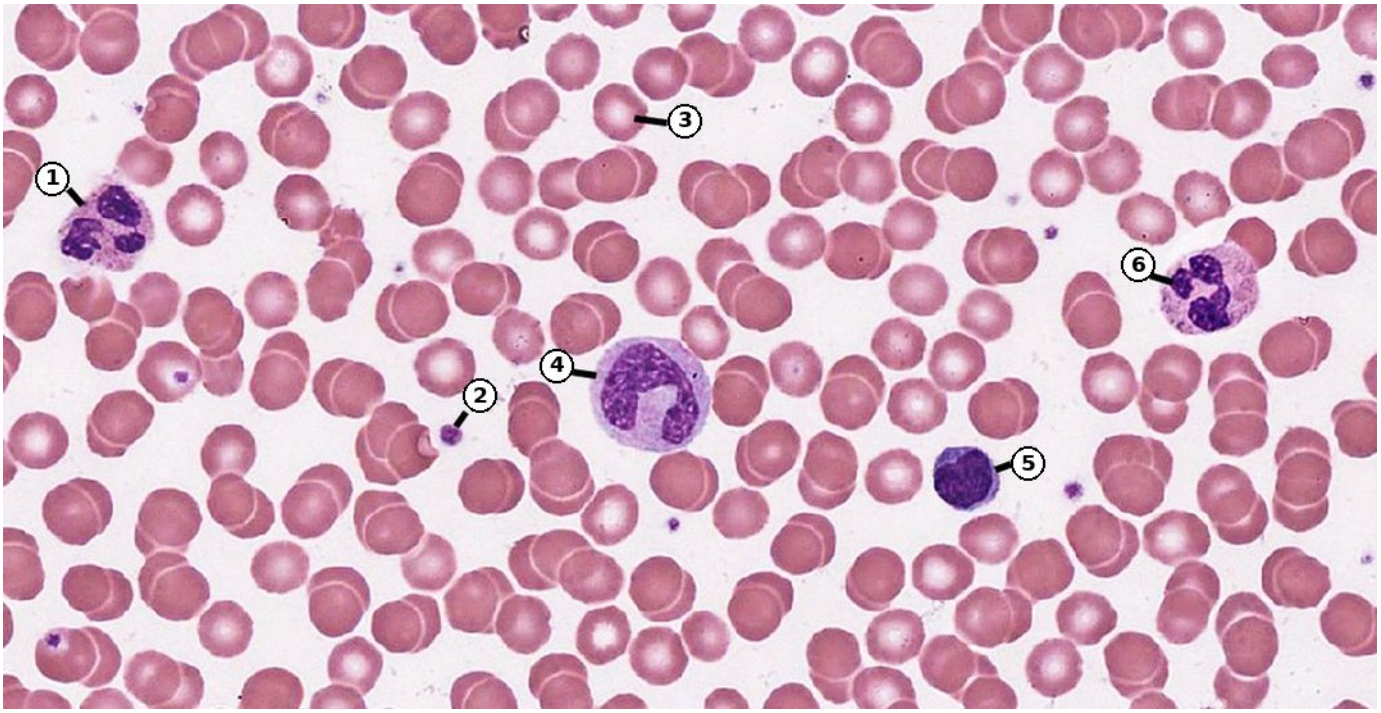
Mikael Häggström , M.D · CC0 · commons.wikimedia.org/wiki/File:Trilineage_hematopoiesis_(original).jpg

How to recognise it

- Densely packed blood-forming cells of every line and stage, between fat cells and sinusoids.
- Megakaryocytes: giant cells with a big lobed nucleus, the source of platelets.
- Bony trabeculae may border the marrow.

Don't confuse with: Lymph node: its lymphocytes are all alike and form nodules; marrow is mixed and has megakaryocytes.

A real blood smear (i)



1 _____ **2** _____

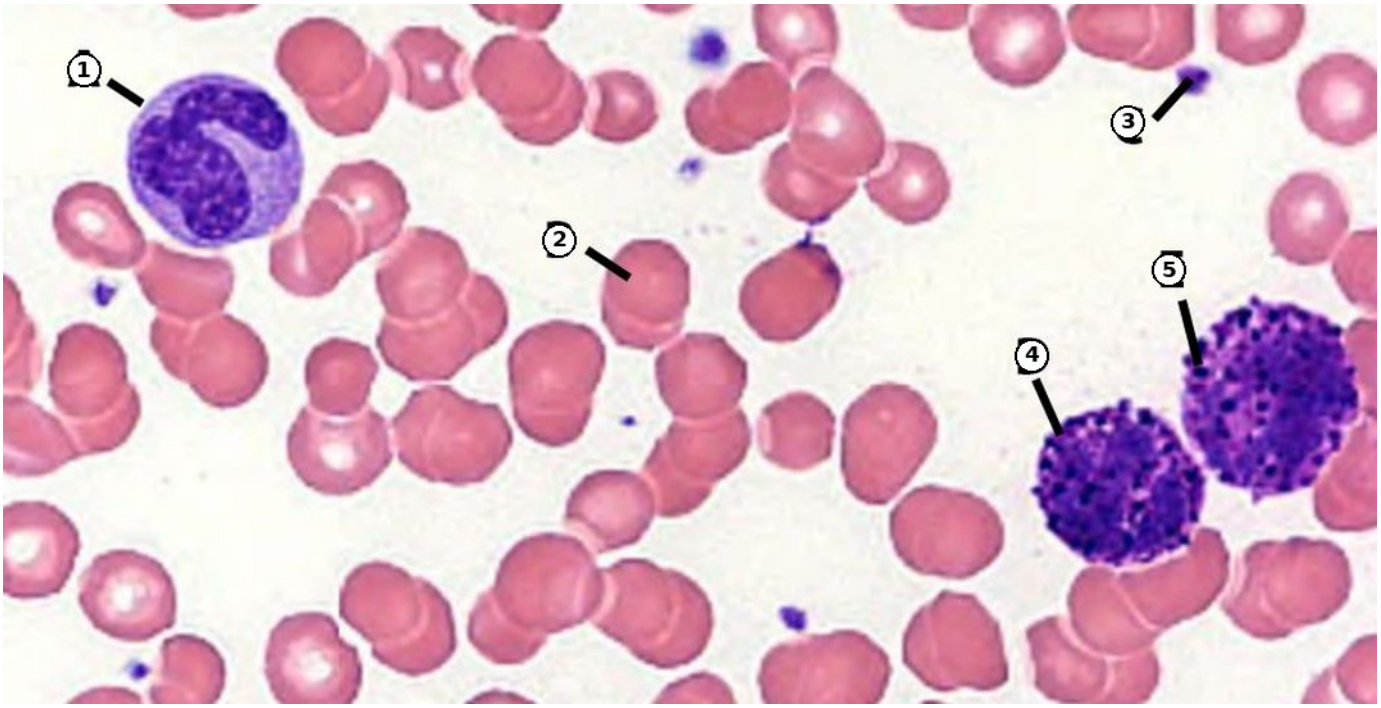
3 _____ **4** _____

5 _____ **6** _____

Practise online: medicine.kazimiri.com/semester-1/label/?map=subj-histology-02e6ab5727

Credit: Jennifer Lange; micrographs: Virginia Commonwealth University · CC BY-NC-SA 4.0 ·
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A real blood smear (ii)



1 _____ **2** _____

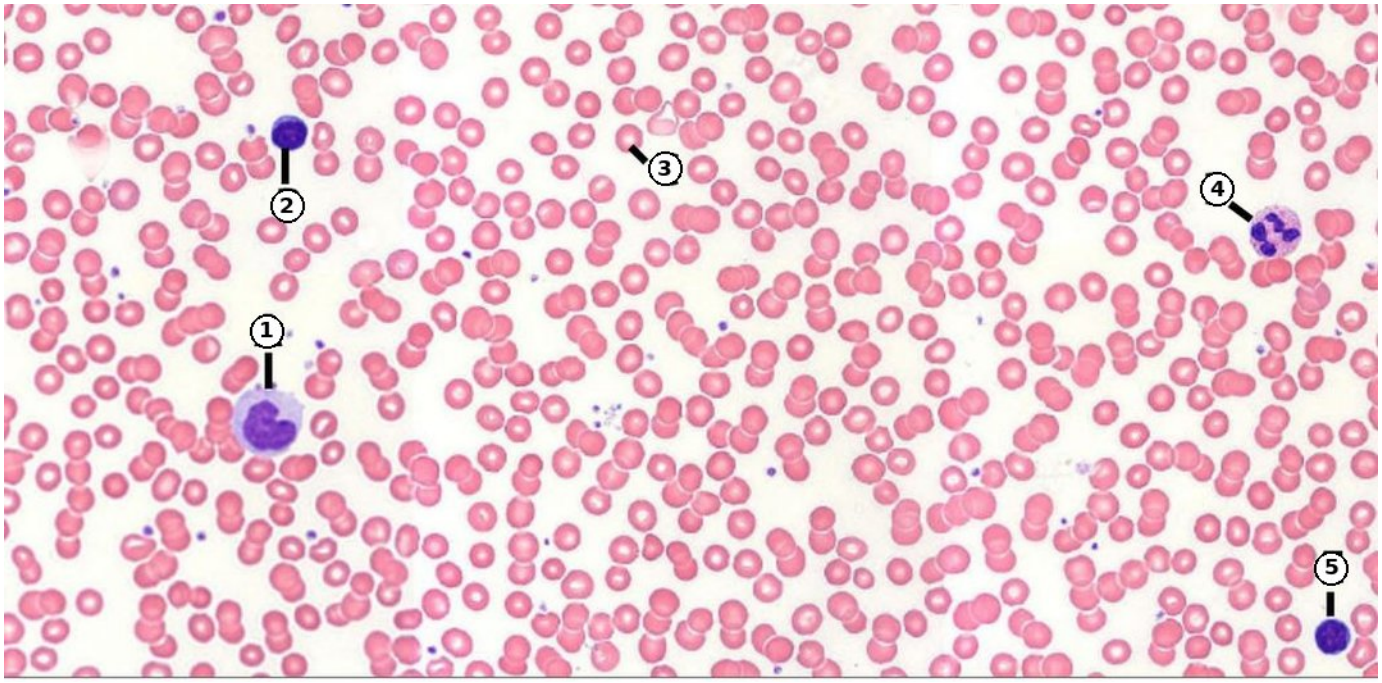
3 _____ **4** _____

5 _____

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A real blood smear (iii)



1 _____ **2** _____

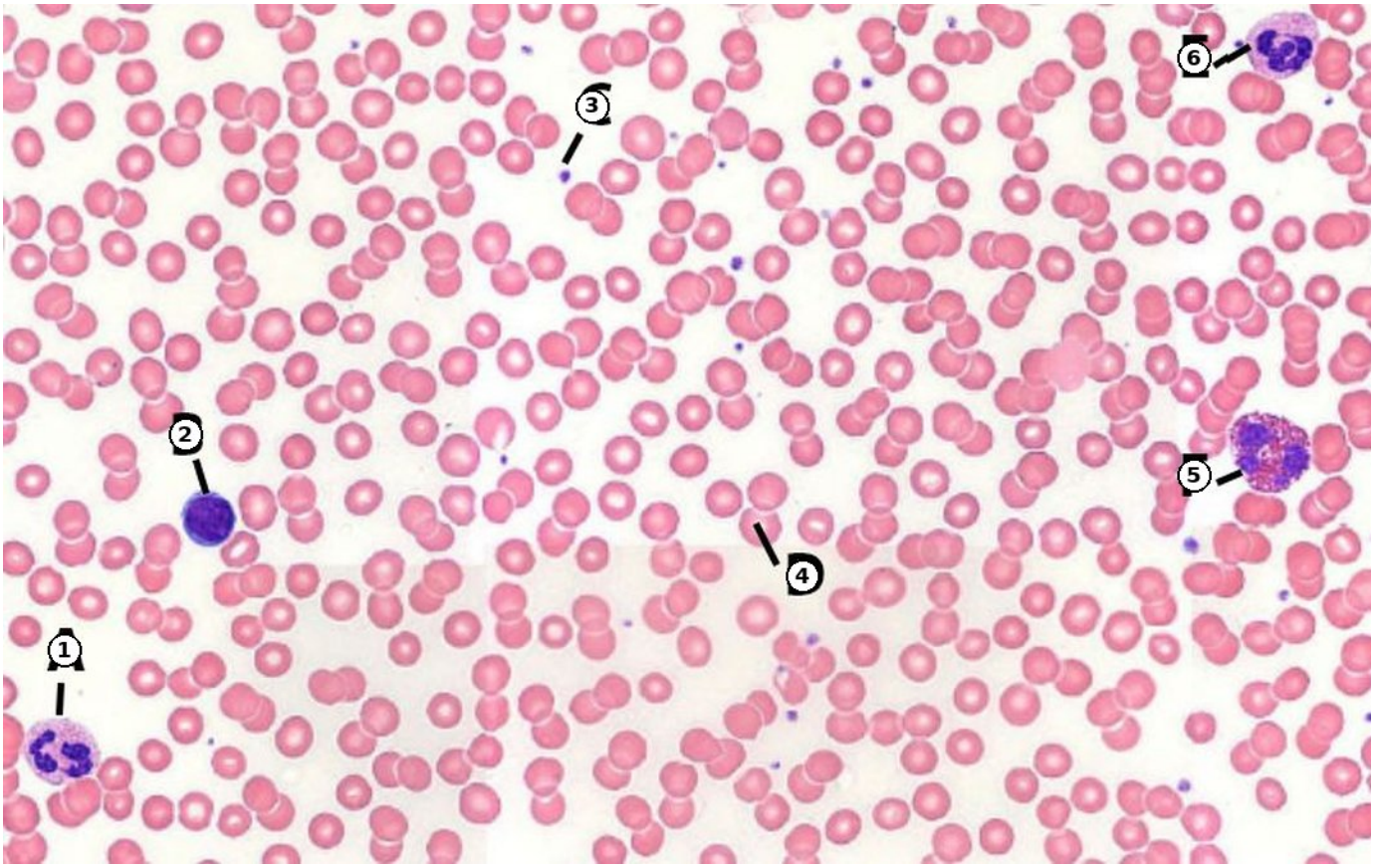
3 _____ **4** _____

5 _____

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A real blood smear (iv)



1 _____ **2** _____

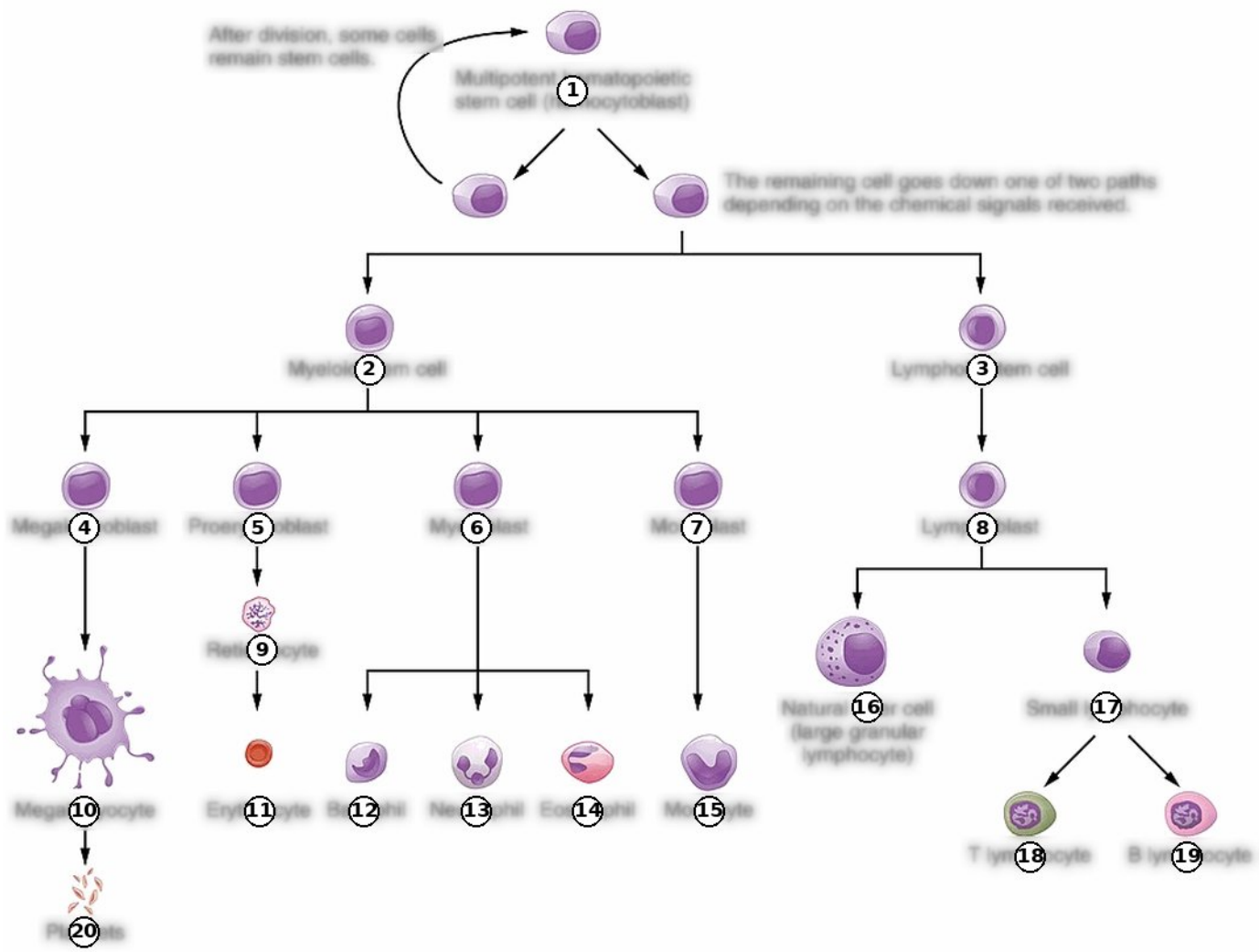
3 _____ **4** _____

5 _____ **6** _____

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How every blood cell descends from one



1 _____ **2** _____ **3** _____

4 _____ **5** _____ **6** _____

7 _____ **8** _____ **9** _____

10 _____ **11** _____ **12** _____

13 _____ **14** _____ **15** _____

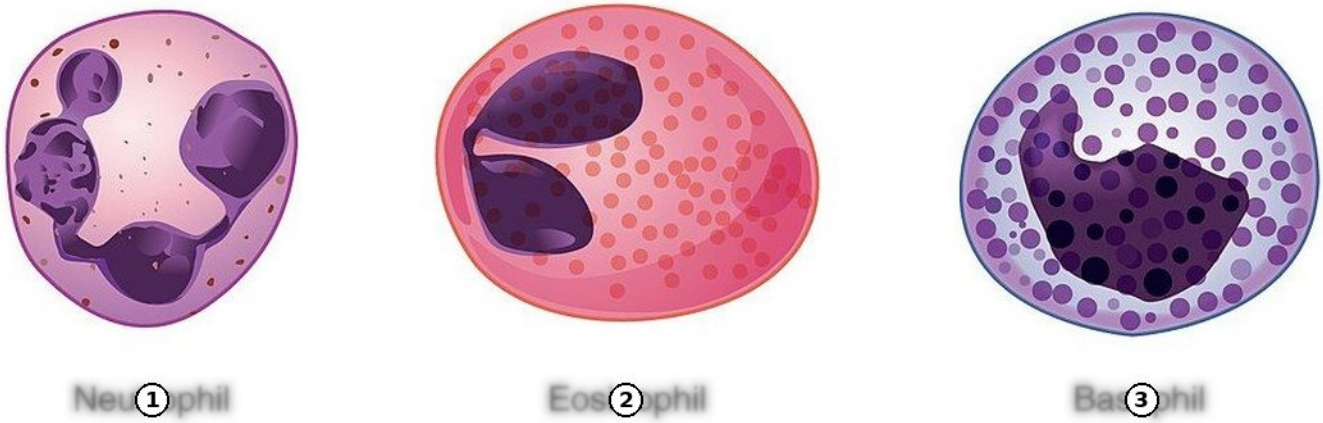
16 _____ **17** _____ **18** _____

19 _____ **20** _____

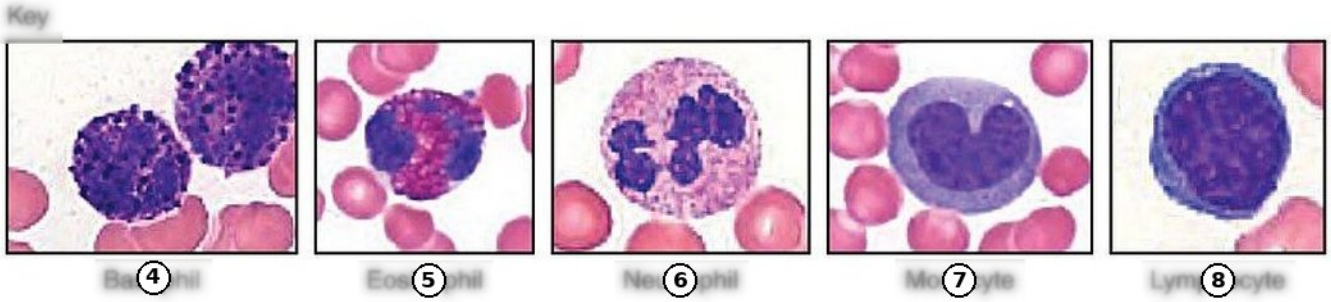
Practise online: medicine.kazimiri.com/semester-1/label/?map=subj-histology-f86d6a35f7
Credit: OpenStax College · CC BY 3.0 · commons.wikimedia.org/wiki/File:1902_Hemopoiesis.jpg

The white blood cells, drawn and on real smears

Drawn



Real blood smears (light microscope)



1 _____ **2** _____

3 _____ **4** _____

5 _____ **6** _____

7 _____ **8** _____

Practise online: medicine.kazimiri.com/semester-1/label/?map=subj-histology-pair-leukocytes

Credit: Drawn: OpenStax College (CC BY 3.0); Real blood smears: OpenStax College (CC BY 3.0); combined for this drill · CC BY 3.0 · commons.wikimedia.org/wiki/File:1907_Granular_Leukocytes.jpg https://commons.wikimedia.org/wiki/File:1916_Leukocyte_Key.jpg

3 · Key points

The site's key points for these classes, word for word.

Lab 4 · Blood and bone marrow

Blood and haemopoiesis

- Erythrocytes: biconcave, no nucleus, about 7.5 µm, live about 120 days. Platelets come from megakaryocytes.
- White cells: neutrophils 50-70%, lymphocytes 20-40%, monocytes 2-8%, eosinophils 1-4%, basophils under 1%.
- Haemopoiesis moves from the yolk sac to the liver (and spleen) to the bone marrow; erythropoietin comes from the kidney.
- Plasma is about 55% of blood: water, proteins (albumin, globulins, fibrinogen), electrolytes, nutrients and hormones. Serum is plasma without the clotting factors.
- The biconcave red cell has a large surface for gas exchange and folds through capillaries narrower than itself; with no nucleus or mitochondria, it lives on glycolysis.
- Neutrophil: 3-5 nuclear lobes, faint granules, first into acute inflammation. Eosinophil: bilobed, bright red granules (parasites, allergy). Basophil: blue-black granules with histamine. Lymphocyte: a round nucleus in a thin rim of cytoplasm. Monocyte: the largest, kidney-shaped nucleus; in tissues it becomes a macrophage.
- Platelets (150-400 × 10^9/L, living about 10 days) are fragments of megakaryocytes with granules that start clotting.
- Every blood cell comes from a haematopoietic stem cell, through myeloid and lymphoid progenitors. A red cell loses its nucleus at the orthochromatic erythroblast stage and becomes a reticulocyte, about 1% of the red cells in blood.
- Growth factors: erythropoietin (kidney), thrombopoietin (liver), G-CSF and GM-CSF for granulocytes. Red marrow fills all bones in a child; in adults it stays in flat bones, vertebrae and the ends of long bones, and the rest turns to fatty yellow marrow.

4 · Using the light microscope: checklist

- ☐ Carry the microscope with both hands, one on the arm and one under the base. Lamp at minimum before switching on.
- ☐ Start with the lowest-power objective (4× or 10×) clicked into place. Slide coverslip up, label to the side, held in the mechanical stage.
- ☐ Centre the section over the light with the naked eye first.
- ☐ Watching from the side, raise the stage close to the objective with the coarse focus. Then, looking through the eyepieces, focus by moving the stage AWAY from the objective. Set the eyepiece distance for your eyes.
- ☐ Light: lamp brightness and the condenser's aperture diaphragm. Close the diaphragm for more contrast, open it for more resolution.
- ☐ Higher power: turn the nosepiece; at 40× use the fine focus only.
- ☐ Oil immersion (100×), only when the teacher allows it: a drop of oil on the coverslip, swing in the 100× objective, fine focus only. Never let the 40× objective touch the oil. Wipe oil off the lens and the slide with lens paper afterwards.
- ☐ Total magnification = objective × eyepiece (40 × 10 = 400×). The light microscope resolves about 0.2 µm.
- ☐ At the end: lowest objective in place, stage down, slide out, lamp at minimum and off, dust cover on.

5 · Self-test: 9 single-choice questions

From the site's Histology — tissues quiz (Blood and haemopoiesis). One answer is right in each; circle it. Give yourself about a minute a question. The answers are on the last page.

1. Megakaryocytes give rise to:

A platelets
B erythrocytes
C neutrophils
D lymphocytes

2. Serum differs from plasma in lacking:

A fibrinogen and the clotting factors used up in clotting
B albumin
C glucose
D water

3. The cell with bright red granules, raised in parasitic infections and allergy, is the:

A eosinophil
B neutrophil
C basophil
D monocyte

4. The largest white cell, with a kidney-shaped nucleus, is the:

A lymphocyte
B neutrophil
C monocyte
D basophil

5. Basophil granules contain:

A major basic protein
B haemoglobin
C immunoglobulins
D histamine and heparin

6. A red blood cell lives about:

A 10 days
B 120 days
C 30 days
D a year

7. Reticulocytes are:

A platelet precursors
B young red cells still holding ribosomes
C mature lymphocytes
D dying neutrophils

8. In adults, blood cells are made in the:

A liver
B red bone marrow
C spleen
D yellow bone marrow

9. The commonest white cell in normal adult blood is the:

A lymphocyte
B monocyte
C neutrophil
D eosinophil

Answers · practice figures

Figure 1 · A real blood smear (i)

1 Neutrophil
2 Platelet
3 Red blood cell (erythrocyte)
4 Monocyte
5 Lymphocyte
6 Neutrophil

Figure 2 · A real blood smear (ii)

1 Monocyte
2 Red blood cell (erythrocyte)
3 Platelet
4 Basophil
5 Basophil

Figure 3 · A real blood smear (iii)

1 Monocyte
2 Lymphocyte
3 Red blood cell (erythrocyte)
4 Neutrophil
5 Lymphocyte

Figure 4 · A real blood smear (iv)

1 Neutrophil
2 Lymphocyte
3 Platelet
4 Red blood cell (erythrocyte)
5 Eosinophil
6 Neutrophil

Figure 5 · How every blood cell descends from one

1 Haematopoietic stem cell
2 Myeloid stem cell
3 Lymphoid stem cell
4 Megakaryoblast
5 Proerythroblast
6 Myeloblast
7 Monoblast
8 Lymphoblast
9 Reticulocyte
10 Megakaryocyte
11 Erythrocyte
12 Basophil
13 Neutrophil
14 Eosinophil
15 Monocyte
16 Natural killer cell
17 Small lymphocyte
18 T lymphocyte
19 B lymphocyte
20 Platelets

Figure 6 · The white blood cells, drawn and on real smears

1 Neutrophil
2 Eosinophil
3 Basophil
4 Basophil
5 Eosinophil
6 Neutrophil
7 Monocyte
8 Lymphocyte

Answers · self-test

1 A platelets — They are the giant cells of the red marrow.

2 A fibrinogen and the clotting factors used up in clotting — Serum is what is left after blood clots: fibrinogen and the factors used up in clotting are gone.

3 A eosinophil — Eosinophils have a bilobed nucleus and red granules of major basic protein, which attack parasites.

4 C monocyte — Monocytes leave the blood to become macrophages.

5 D histamine and heparin — Like mast cells, basophils release histamine and heparin; major basic protein is the eosinophil's.

6 B 120 days — After about 120 days old red cells are removed, mostly by macrophages in the spleen.

7 B young red cells still holding ribosomes — Erythrocytes newly out of the bone marrow keep ribosomal RNA for a day or two; they are about 1% of the red cells in blood.

8 B red bone marrow — The fetal liver and spleen make blood for a time; after birth, the red marrow does.

9 C neutrophil — Neutrophils are about 50-70% of white cells; lymphocytes 20-40%.