The Full Blood Count & Haematological Diagnosis

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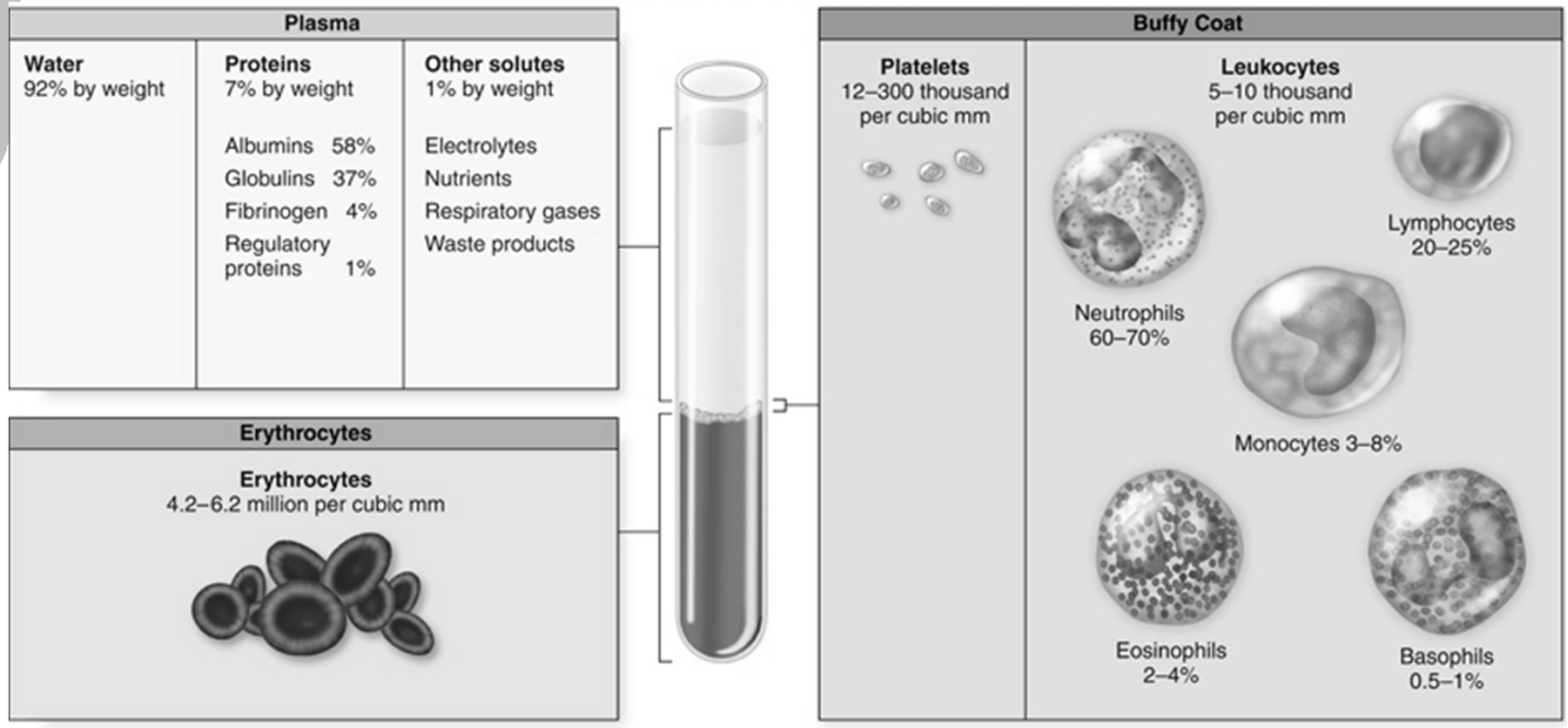
Lecture No	Topic	Lecturer
Lecture 1	FBC and Haematological Diagnosis	Prof Pool
Lecture 2	Nutritional and Haemolytic Anaemias	Dr Potgieter
Lecture 3	Blood Transfusion	Dr Ntabeni
Lecture 4	Hypercoagulability and Thrombophilia	Dr Swart
Lecture 5	Bleeding Tendencies	Dr Nel

Composition of Blood



Classification of Anaemia

Based on mechanism (Pathophysiological)

Based on red cell size (Morphological)

Pathophysiological Classification

A Increased red cell loss (↑ reticulocytes)

- Blood loss
- Haemolysis (increased red cell destruction)

B Decreased red cell production (↓ reticulocytes)

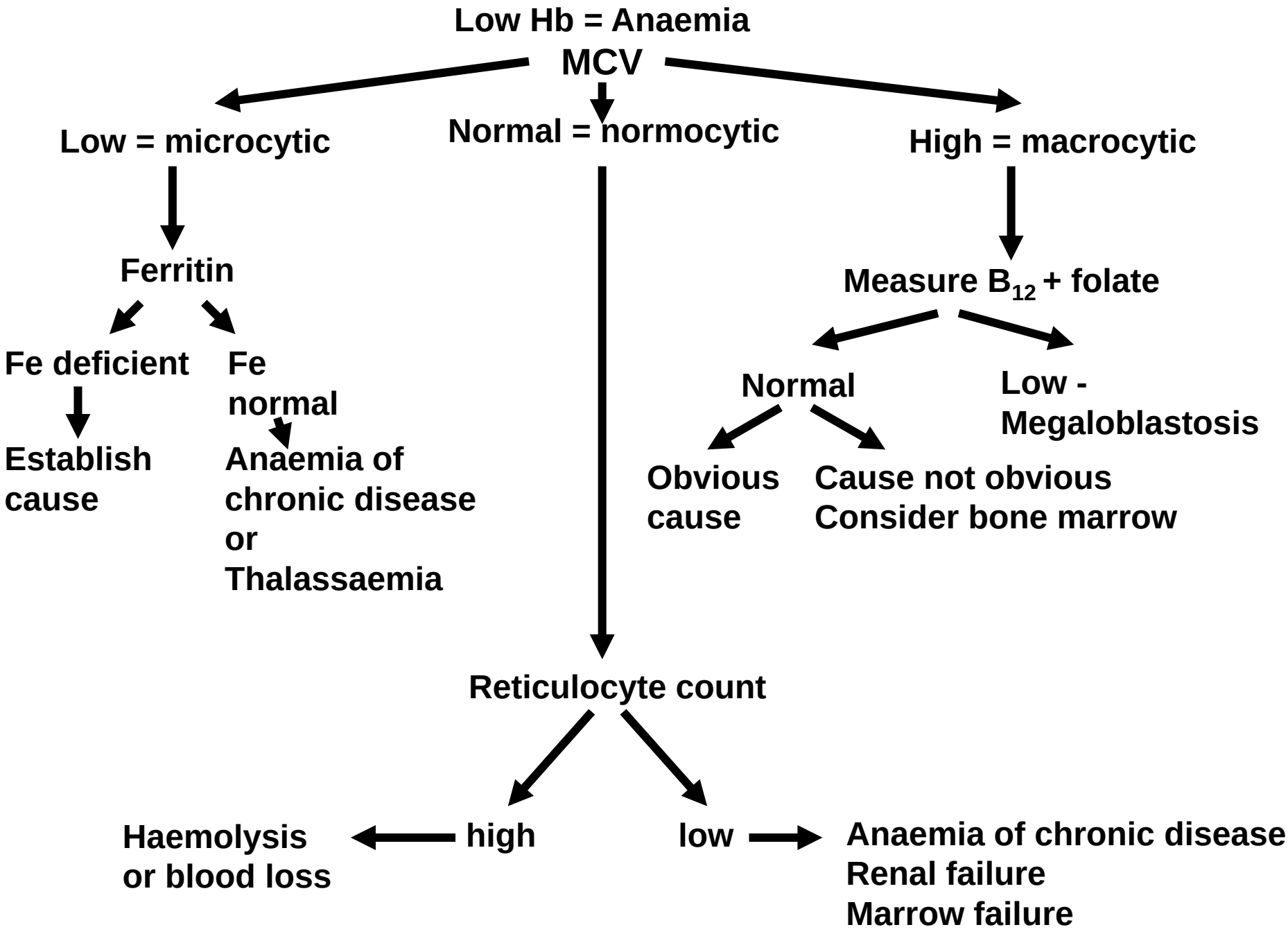
- Stem cell abnormalities (aplasia)
- ↓ erythropoietin (renal failure)
- Defective DNA synthesis (↓B_{12}/folate)
- Defective haemoglobin synthesis (↓Fe, thalassaemia)
- Displacement of normal progenitor cells
  - Malignancy, fibrosis, granulomas

C Multi-factorial

- Anaemia of chronic disease
- HIV

Morphological Classification

- Hypochromic, microcytic anaemia (↓MCV,↓MCH)
  - Fe dediciency
  - Anaemia of chronic disease
  - Thalassaemia
  - Lead poisoning (rare)
  - Sideroblastic anaemia (rare)
- Normochromic, normocytic anaemia (N MCV, N MCH)
  - Anaemia of chronic disease
  - Acute blood loss
  - Chronic renal failure
- Macrocytic anaemia (↑MCV)
  - Megaloblastic (oval macrocytes, hypersegmented neutrophils)
    - Vit B_{12}/Folate deficiency
  - Non-megaloblastic (round macrocytes)
    - Reticulocytosis
    - Liver disease
    - Alcohol
    - Drugs
    - Pregnancy
    - Hypothyroidism
    - Myelodysplasia


Low Hb = Anaemia
MCV
Low = microcytic
Normal = normocytic
High = macrocytic
Ferritin
Measure B_{12} + folate
Fe deficient
Fe normal
Normal
Low - Megaloblastosis
Establish cause
Anaemia of chronic disease or Thalassaemia
Obvious cause
Cause not obvious Consider bone marrow
Reticulocyte count
Haemolysis or blood loss
high
low
Anaemia of chronic disease
Renal failure
Marrow failure

Anaemia of chronic disease

- Develops after 2 months
- Hb = 7-11 g/dl
- Non – progressive
- Well tolerated

- **Pathogenesis**
- RBC lifespan reduced by 20 –30%
- Iron transfer block (reduced release from macrophages)
- Decreased EPO production in response to anaemia
- Impaired response to EPO by erythroid precursors

- **Laboratory Features**
- Initially normocytic, later microcytic
- Inappropriately raised ferritin (acute phase reactant)

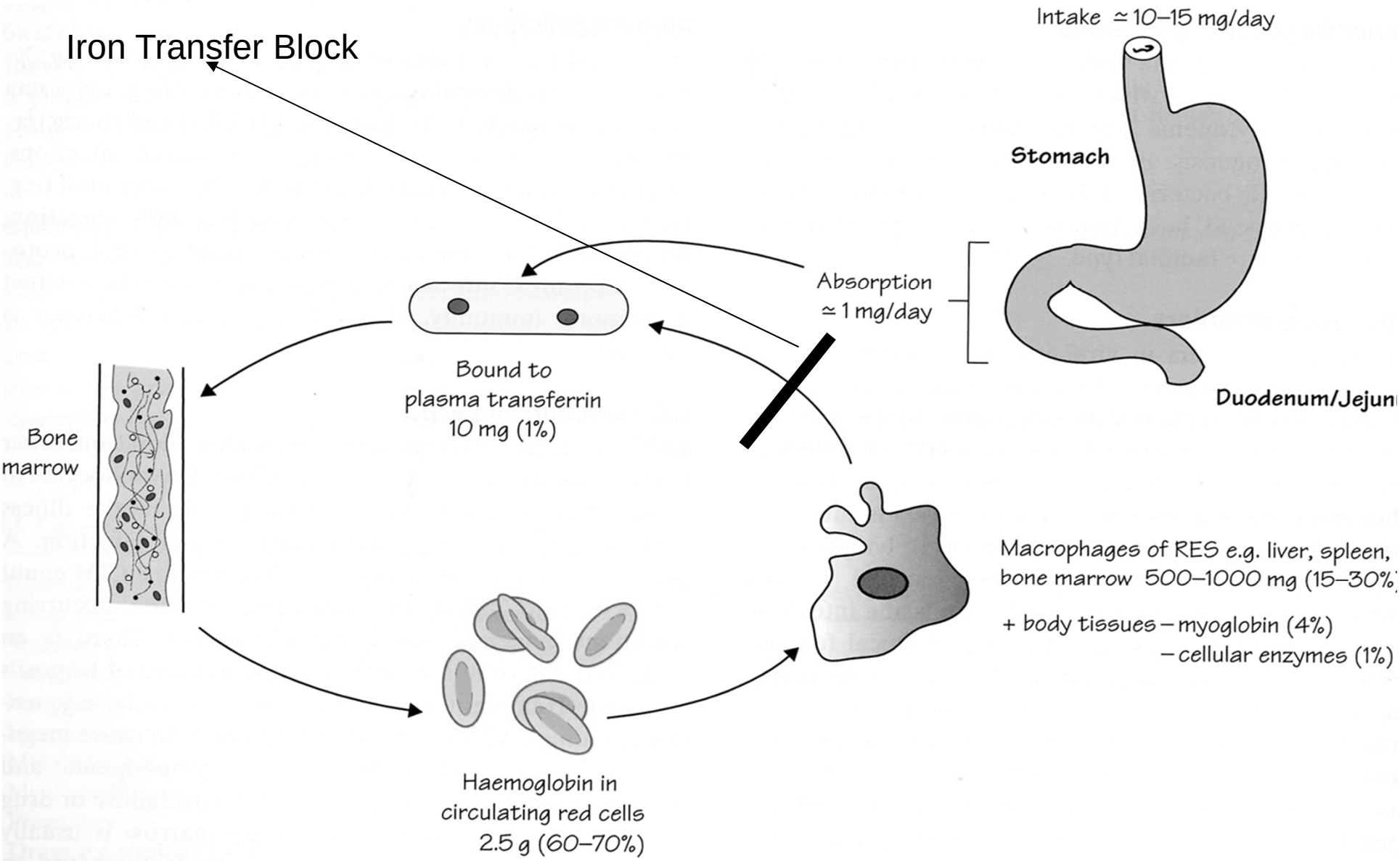


Figure 9.1 Haematology at a Glance

Causes of Reticulocytosis

- Haemorrhage
- Haematinic therapy
- Erythropoietin therapy
- Haemolysis

Haemolysis

Increased red cell production

reticulocytosis
erythroid hyperplasia

Increased red cell destruction

LDH (lactate dehydrogenase)
raised serum bilirubin
haptoglobins reduced or absent

Specific red cell changes

spherocytes
fragments

Haemolytic anaemia

Inherited (Intrinsic)

Membrane

Hereditary spherocytosis, elliptocytosis

Haemoglobin

Sickle cell anaemia, thalassaemia

Enzymes

G-6-PD, pyruvate kinase deficiency

Acquired (Extrinsic)

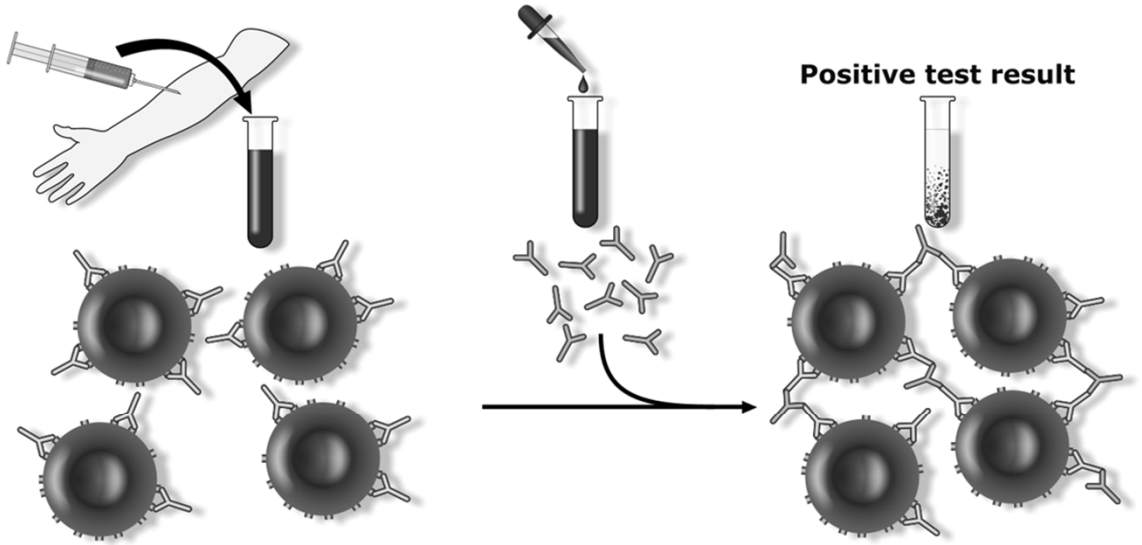
Immune

Autoimmune, allo-immune

Non-immune

Fragmentation, infection, PNH

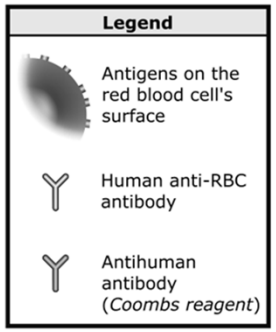
Direct Coombs test / Direct antiglobulin test



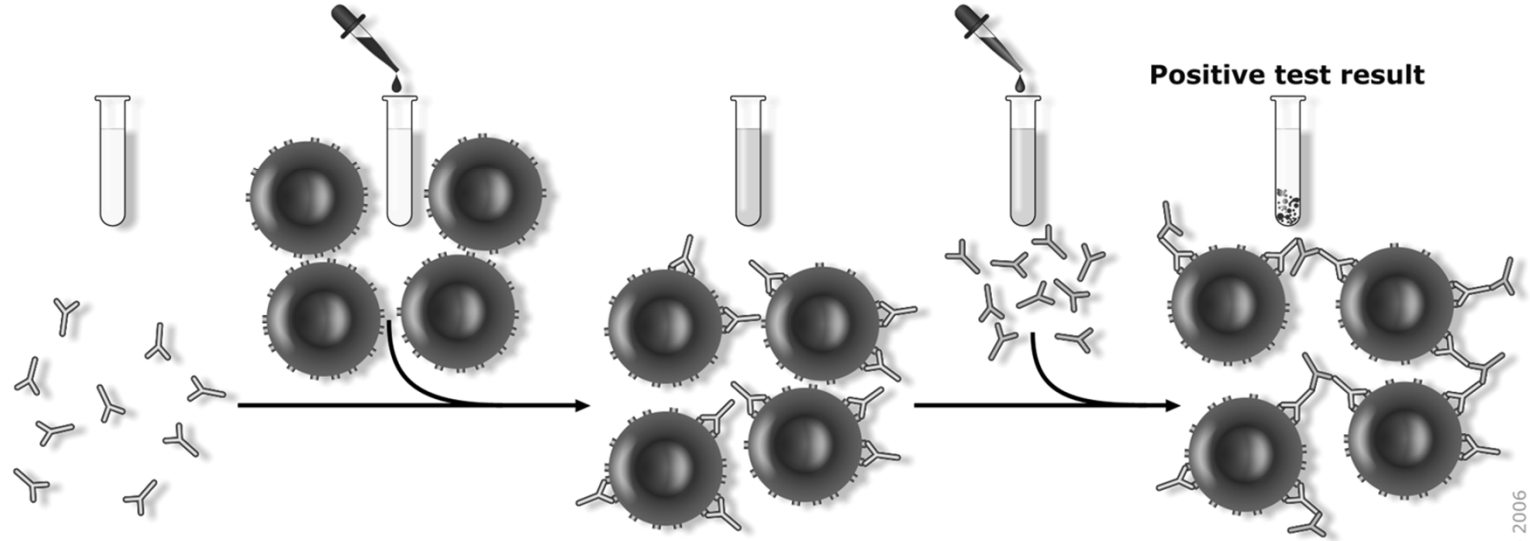
Blood sample from a patient with immune mediated haemolytic anaemia: antibodies are shown attached to antigens on the RBC surface.

The patient's washed RBCs are incubated with antihuman antibodies (*Coombs reagent*).

RBCs agglutinate: antihuman antibodies form links between RBCs by binding to the human antibodies on the RBCs.



Indirect Coombs test / Indirect antiglobulin test



Recipient's serum is obtained, containing antibodies (Ig's).

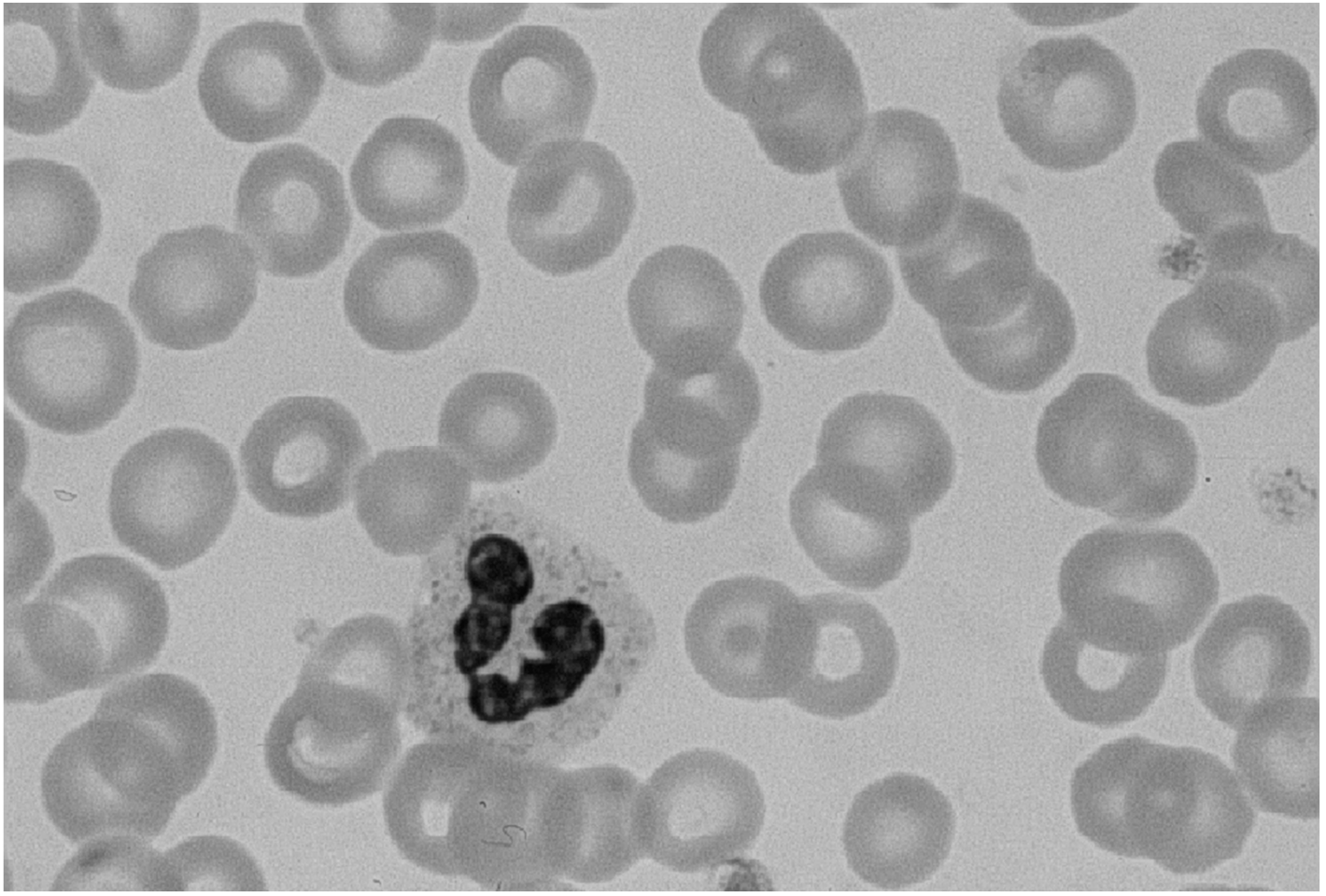
Donor's blood sample is added to the tube with serum.

Recipient's Ig's that target the donor's red blood cells form antibody-antigen complexes.

Anti-human Ig's (*Coombs antibodies*) are added to the solution.

Agglutination of red blood cells occurs, because human Ig's are attached to red blood cells.

Neutrophil



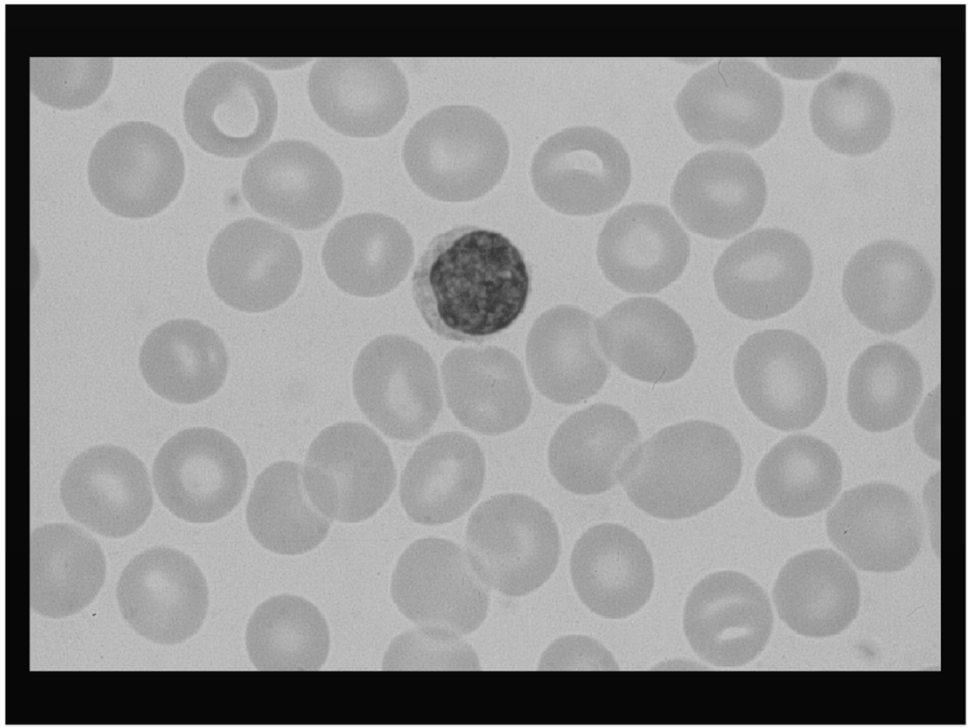
Neutrophil leucocytosis

- Bacterial infection
- Tissue necrosis
- Metabolic disorders
- Neoplasms
- Acute haemorrhage or haemolysis
- Steroid therapy
- Myeloproliferative disease

Neutropenia

- Decreased Production
  - *General bone marrow failure*
    - **Aplastic anaemia, myelodysplasia, acute leukaemia, chemotherapy**
  - *Specific failure of neutrophil production*
    - **Congenital, cyclical, drug induced**
- Increased Destruction
  - *General*
    - **Hypersplenism**
  - *Specific*
    - **Auto-immune**

Lymphocyte



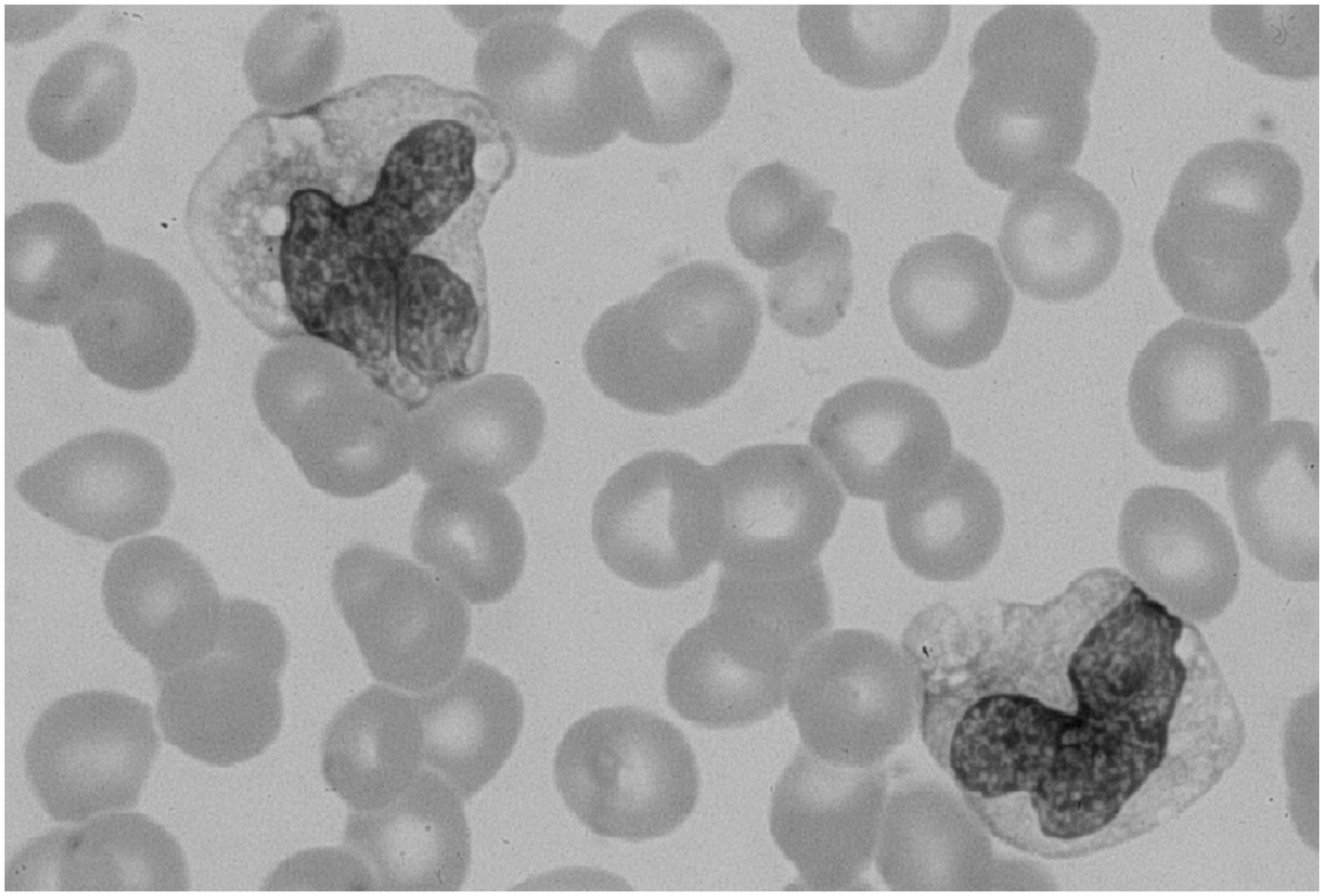
Lymphocytosis

- Infection (viral, bacterial)
- Lymphoproliferative disease

Lymphopenia

- Inherited and acquired immunodeficiency
- Irradiation
- Acute stress (trauma, surgery, burns)
- Drugs (ATG, steroids)
- Auto-immune disease e.g. SLE

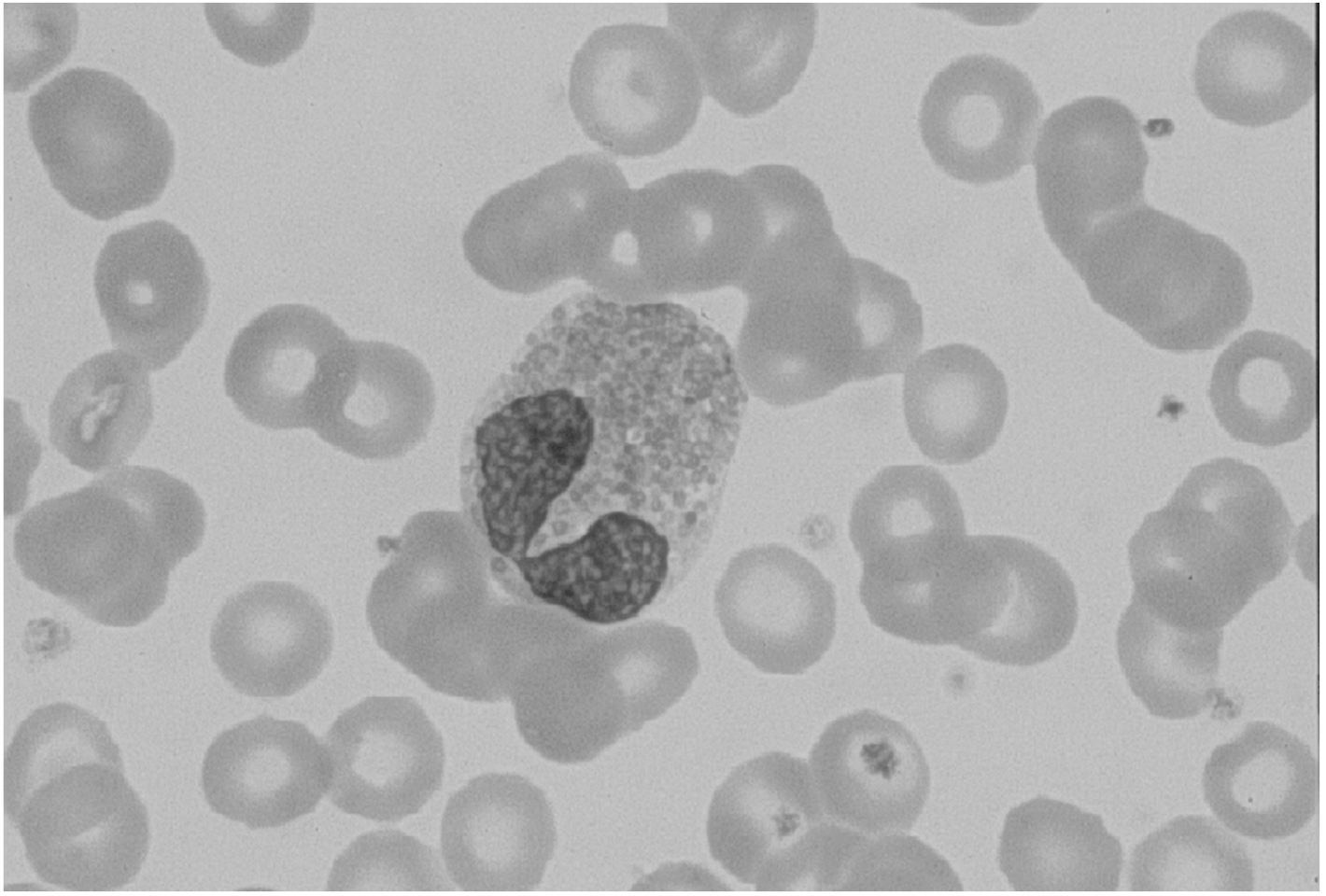
Monocyte



Monocytes

- Largest white cells in blood
- Circulate for 20-40 hours then enter tissues
- Remain in tissues for days or months
- Often increased in chronic infections such as TB

Eosinophil



Eosinophils

- Red orange staining cytoplasmic granules
- Increased with allergy, parasitic infestation & chronic skin disease