



QBC: Quantitative Buffy Coat analysis

What: Counts blood cell types (many of which related to immune response) and their percentages.

How: By centrifuging (spinning) a tube of blood to separate its cell types into different layers, according to their density.

Why: *An aerial view of health.* Status & risk of anemias, infection, & non-infectious conditions. Often a first pass done to see if more specific tests are needed.



QBC STAR: output measurements

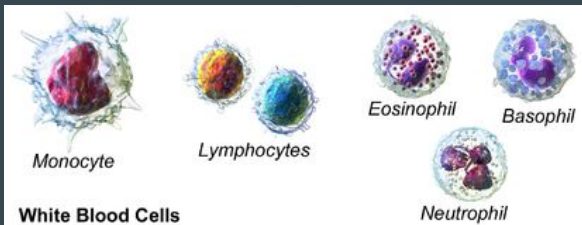
Hematocrit (% RBC)



Hemoglobin (oxygen carrying protein on RBC)

Mean corpuscular hemoglobin count (MCHC)

WBC count (all)



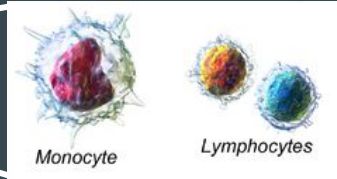
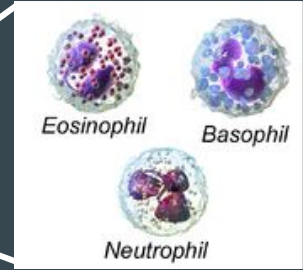
Granulocyte count

Granulocyte %

Lymphocyte/Monocyte count

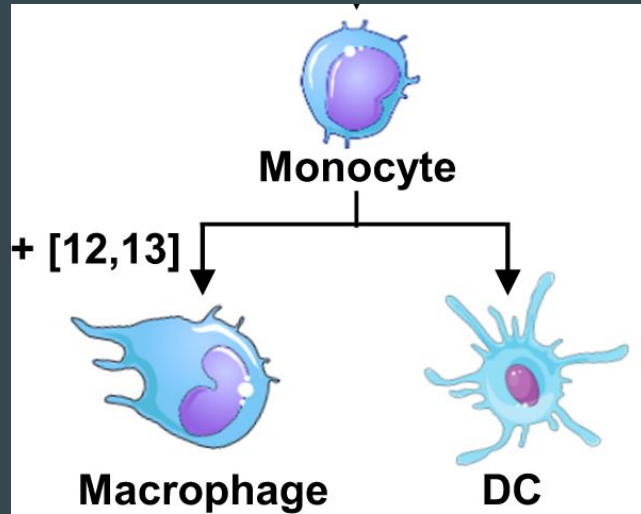
Lymphocyte/Monocyte %

Platelet count



Aside: a reminder of “monocytes” and “lymphocytes”

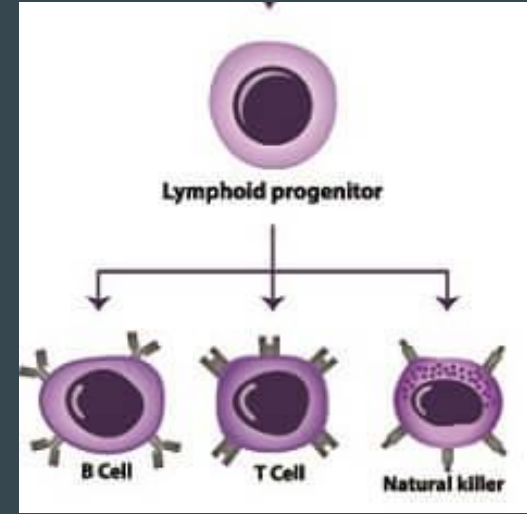
Names based on common progenitors, aka primitive cells within the body that then differentiate into closely related cells.



(Dendritic Cell)

Roles: phagocytosis and antigen presentation

Both macrophages & dendritic cells present antigen to T helper cells

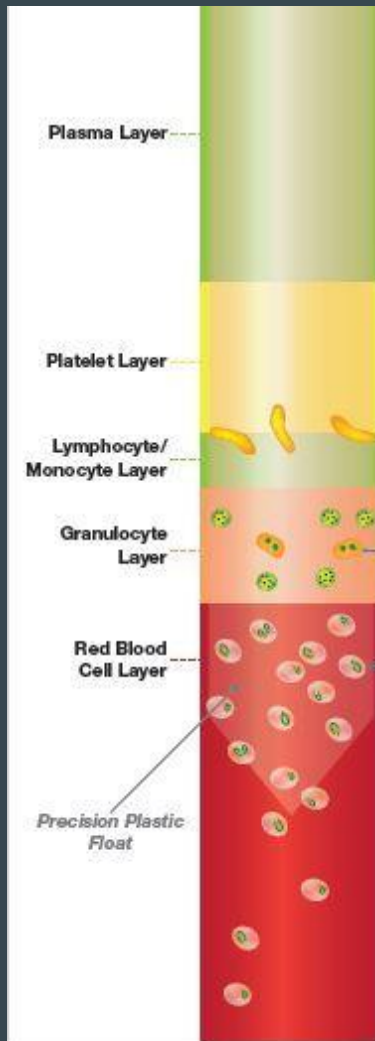


Trigger customized immune responses to pathogen type

All differentiated lymphocytes have some *memory* for antigens. B and T cells long lived with long-term memory, NK cells active in innate immune response with short memory.

QBC method of measurement

During high speed centrifugation, cell types divide by their density.



- Hematocrit (RBC), granulocyte, lymphocyte, monocyte, & platelet counts directly measured from width of cell layers.
- Hemoglobin measured from depth of float within red blood cells (directly related to density of RBC)
- MCHC - function of hematocrit and hemoglobin ($\text{Hgb}/\text{Hct} * 100$)

*sidenote: “Plasma” is the liquid portion of blood with no cells but lots of proteins. Makes up ca. 55% of blood volume and is 95% H_2O . “Serum” is plasma after the coagulant proteins are removed, e.g. fibrinogen.

QBC cont'd

Expected Values

The following table provides normal ranges reported in the literature.^{11, 13} Offices or laboratories may choose to develop normal hematology ranges based on the characteristics of their patient population.

Parameter	Range
Hematocrit Males (%)	42.0 – 50.0
Hematocrit Females (%)	36.0 – 45.0
Hemoglobin Males (g/dL)	14.0 – 18.0
Hemoglobin Females (g/dL)	12.0 – 16.0
MCHC (g/dL)	31.7– 36.0
Platelet Count (x10 ⁹ /L)	140 – 440
WBC (x10 ⁹ /L)	4.3 – 10.0
Granulocyte Count (x10 ⁹ /L)	1.8 – 7.2
Lymphocyte/Monocyte Count (x10 ⁹ /L)	1.7 – 4.9



QBC STAR: significance

Hematocrit (Hct)

- low levels \approx anemia
- high levels \approx dehydration, bone marrow disorder

Hemoglobin (Hgb)

- low levels \approx anemia
- high levels \approx lung or heart disease

Mean corpuscular hemoglobin count (MCHC, $\text{Hgb}/\text{Hct} * 100$)

- Helps differentiate anemia resulting from low production (Hct) vs. low function (Hgb) of red blood cells

WBC count -

- low levels \approx greater risk of infection
- high levels \approx current infection

Granulocyte count & %

- low \approx anemia, leukemia
- high \approx infection, blood cell cancer, autoimmunity

Lymphocyte/Monocyte count & %

- low \approx low lympho/high mono \approx autoimmunity, certain infections like HIV
- high \approx high lympho/low mono \approx acute viral infections

Platelet count

- low \approx immune thrombocytopenia \approx easy bruising & heavy bleeding
- high \approx acute infection, certain anemias \approx easy blood clotting