



## 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

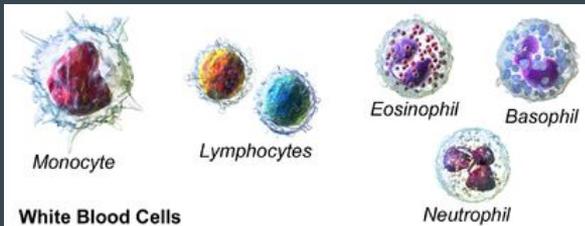
Hematocrit (% RBC)



Hemoglobin (oxygen carrying protein on RBC)

Mean corpuscular hemoglobin count (MCHC)

WBC count (all)



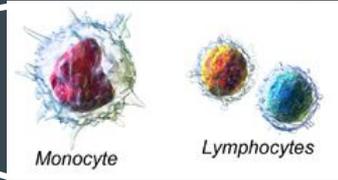
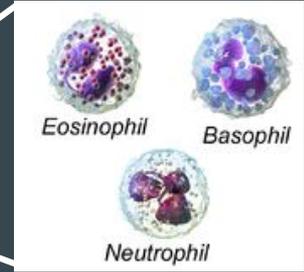
Granulocyte count

Granulocyte %

Lymphocyte/Monocyte count

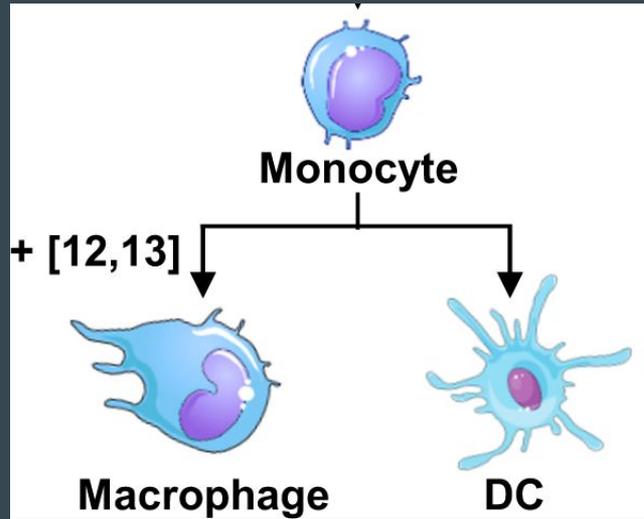
Lymphocyte/Monocyte %

Platelet count



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

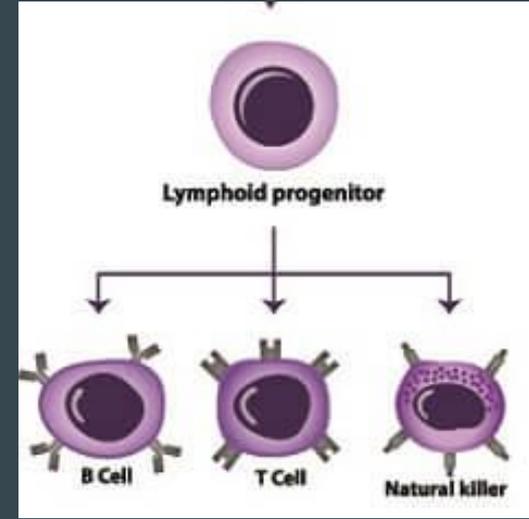
Names based on common progenitors, aka primitive cells within the body that then differentiate into closely related cells.



(Dendritic Cell)

**Roles: phagocytosis and antigen presentation**

Both macrophages & dendritic cells present antigen to T helper cells

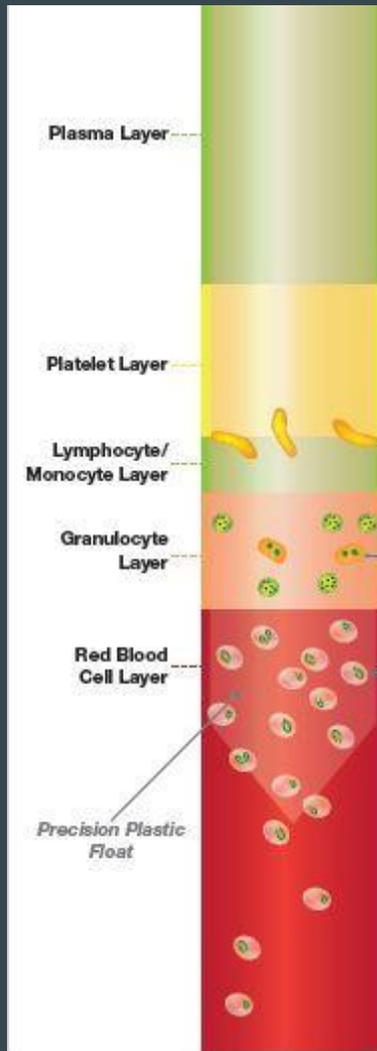


**Trigger customized immune responses to pathogen type**

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%  $\text{H}_2\text{O}$ . “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.<sup>11, 13</sup> 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 <sup>9</sup> /L)	140 – 440
WBC (x10 <sup>9</sup> /L)	4.3 – 10.0
Granulocyte Count (x10 <sup>9</sup> /L)	1.8 – 7.2
Lymphocyte/Monocyte Count (x10 <sup>9</sup> /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