CLL SOCIETY

Smart Patients Get Smart Care™

Learning to Decode Your Blood Test Results for CLL

June 29, 2021

10:00 AM PT, 11:00 AM MT,
12:00 PM CT, 1:00 PM ET

This program was made possible by grant support from

CLL SOCIETY

Adaptive biotechnologies™

Bristol Myers Squibb™

Speakers

Welcome: Patricia Koffman
Co-Founder and Communications Director
CLL Society

Moderator: Brian Koffman, MDCM (retired), MS Ed
Executive Vice President and Chief Medical Officer
CLL Society

Speaker: Susan Leclair, PhD, CLS (NCA)
Chancellor Professor Emerita
University of Massachusetts Dartmouth

A QUICK RUN DOWN OF ALL 25,000!

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- Not really
- But I did want to start off by saying this is a BIG subject and we will only look at a few of the more common tests.

- *But first – a word from reality*

Tests live in a real world that is bounded by

Preanalytical Aspects	Analytical Aspects	Post-Analytical Aspects
patient preparation issues	instrumentation	reporting mechanisms (to whom, when)
time of collection	reagent quality	reflex testing protocols
conditions of collection	specificity & sensitivity	presence/absence of interpretation
transport &storage	technique/method	wrong test requested
confounding meds	location	
wrong test requested	patient population.	
fingerstick vs. venous		

Each of these attributes influences the value of the test result – consistency is key.

WHITE CELL VALUES

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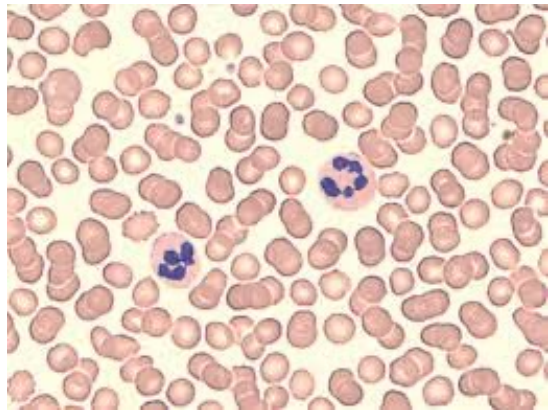
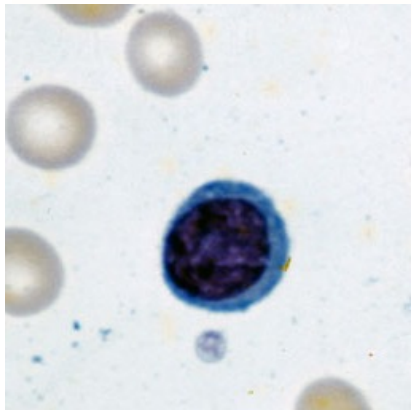
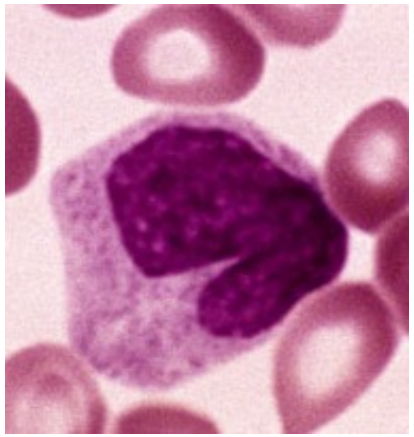
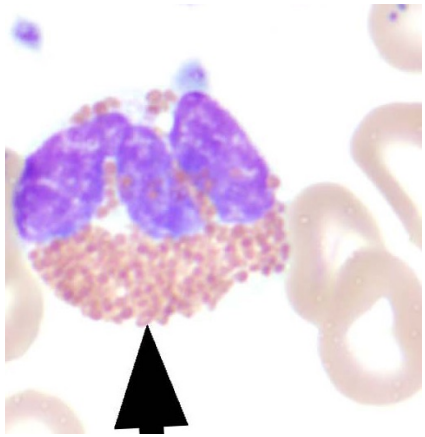
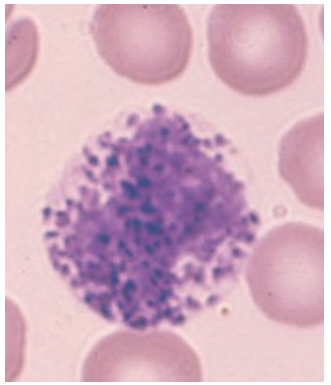
- We do not count white cells.
  - We count nuclei so nucleated red blood cells are counted here – corrected white cell count
  - 5 major cell lines present in the peripheral blood
    - Neutrophils – present all the time
    - Lymphocytes – present all the time
    - Monocytes – present occasionally
    - Eosinophils – present occasionally
    - Basophils – present rarely











WHITE CELL VALUES

CLL SOCIETY

- The number will bounce around all day long in response to your environment.
  - Want your granulocytes to increase?
    - Exercise (walk up the stairs) for a few minutes before getting your blood drawn
      - Half of your granulocytes usually marginate along the walls of the blood vessels. Exercise “shakes” them off putting them into the circulating pool for about 15-20 minutes.
      - Have a panic attack – reaction to stress

        Adrenaline will also take cells away from the marginating pool
      - Be on Steroids

WHITE CELL VALUES

CLL SOCIETY

- Two ways to report white cells by type
  - Circa 1900 – the traditional differential
    - Look at the first 100 random white blood cells you see using a microscope and your own trained eyes.
    - Some people are better than others
    - Some days and better than others
    - If there are 7500 white cells in a microliter of blood and you count 100 of them - report in percentages
      - What are the odds that you will fin what is important?
      - How can you tell which cell line is increased or decreased?
  - Circa – 1980s with the advent of multi-channel instruments
    - Counts the exact number of cells in a specific volume of blood.
    - Count somewhere between 20,000 and 50,000

WHITE CELL VALUES

CLL SOCIETY

- The best differential is the ABSOLUTE differential.
  - Counts the exact number of cells in a specific volume of blood.
  - Percentages cannot tell which cell line is increased or decreased.

White cell count	% neutrophils	% lymphocytes	A.N.C. Absolute neutrophil Count	A.L.C. Absolute lymphocyte count
2.0x10^9/L	63	37	1.2x10^9/L	0.74x10^9/L
4.0x10^9/L	63	37	2.5x10^9/L	1.4x10^9/L
8.0x10^9/L	63	37	5.0x10^9/L	2.8x10^9/L
16.0x10^9/L	63	37	10.0x10^9/L	3.7x10^9/L

WHITE CELL VALUES

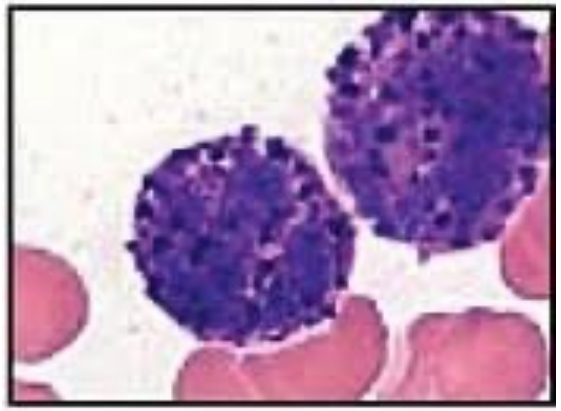
CLL SOCIETY

- Then why use both?
  - Absolute
    - You get a real number of cells by cell line. And there is NO way to confuse which cell line is increased/decreased
  - Percentage
    - There is nothing better to assess the quality of the cells than having someone who knows what they are doing look at them.
  - So doing both gives you a more complete picture of the cells and what they have been doing

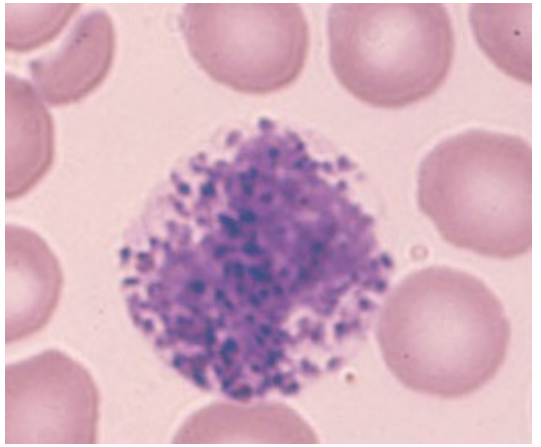
WHITE CELL VALUES

CLL SOCIETY

- For example
- Both of these are the same cell. One is exhausted and on the brink of death itself. No instrument can tell them apart.



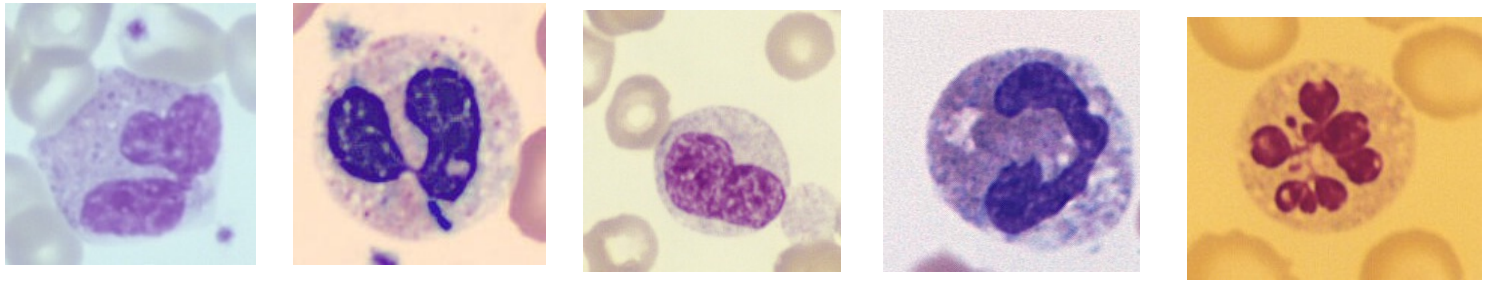
Basophil



WHITE CELL VALUES

CLL SOCIETY

- Is anyone better than another?
  - Neutrophils (once known as granulocytes)
    - Most common cell
    - Exists in the marrow, the two pools in the peripheral blood and in the tissues
    - Phagocytize dead/dying cells and any foreign item (particle or droplet)
    - Incites, controls, and participates in the inflammatory process
    - Determines acute or chronic inflammation
    - Most varied morphology



WHITE CELL VALUES

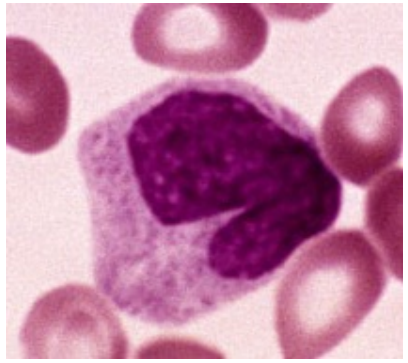
CLL SOCIETY

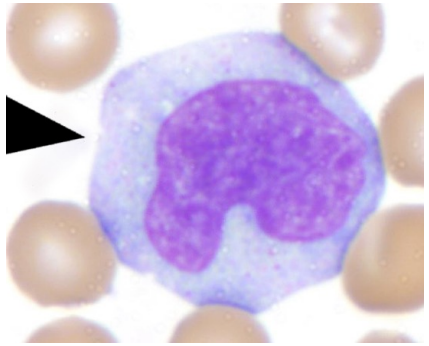
- Is anyone better than another?
  - Neutrophils (once known as granulocytes)
    - Fully functional
      - Polys, segs, PMNs, bands
      - Seen in peripheral blood
    - Minimally functional
      - Metamyelocytes (Meta) and myelocytes (Myelo)
      - Should not be seen in peripheral blood
    - Not functional
      - Promyelocyte (Pro) and Myeloblast (Blast)
      - Must not be seen in peripheral blood

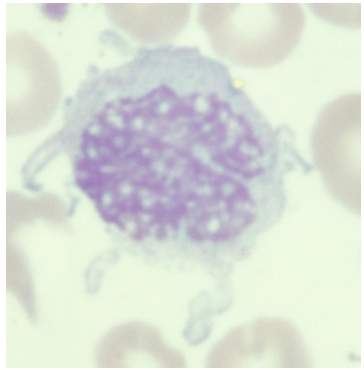
WHITE CELL VALUES

CLL SOCIETY

- Is anyone better than another?
  - Monocytes
    - Usually found in the tissues – uses blood stream to move from one place to another
    - Exists in the marrow, only one pool in the peripheral blood and in the tissues
    - Phagocytize dead/dying cells and any foreign item (particles only)
    - Processes antigens for the T cell to recognize
    - Will be increased after any trauma







WHITE CELL VALUES

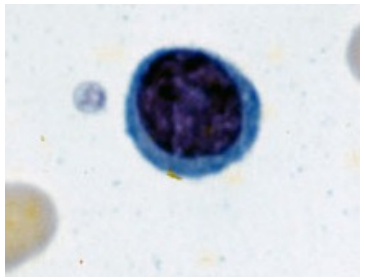
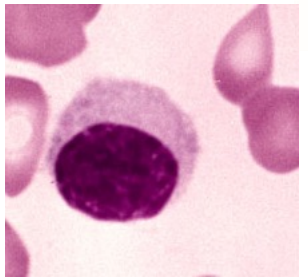
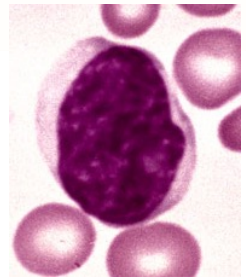
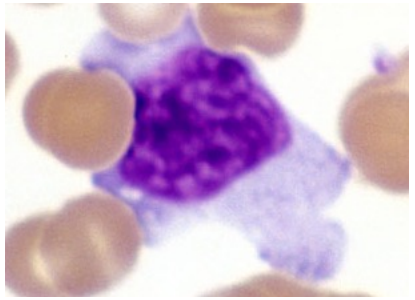
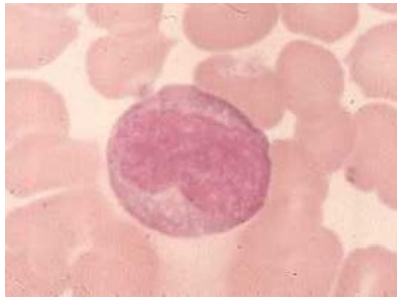
CLL SOCIETY

- Is anyone better than another?
  - Lymphocytes
    - Found in lymph nodes, lymphatics, peripheral blood, and bone marrow
    - Circulate freely between the nodes/lymphatics and the peripheral blood/marrow
    - Cannot be differentiated using light microscopy
    - Could comment on size (small, medium, large)
    - Assumed an unusual looking lymphocytes WAS damaged in some fashion (atypical)
    - Did not have a known function until the mid 1960s (Robert Good – Minnesota – Nobel Prize)
    - Were separated by function – T, B, and NK cells
    - Realized that “atypical” cells were in fact reacting to the presence of a foreign antigen and were defenders not the illness – new Name Reactive Lymphocytes
      - Sadly – many people refuse to update to the correct name – apathy?

WHITE CELL VALUES

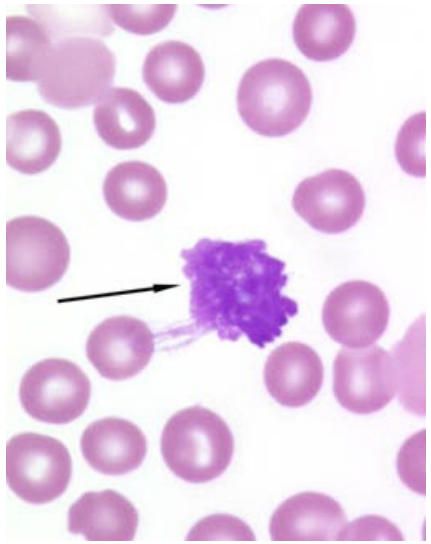
CLL SOCIETY

- Lymphocytes
  - Small lymphocytes
    - Usually B cells
    - Resting from any action so can be naïve or memory
  - Medium lymphocytes
    - Can be T, B or NK cells
    - If it has granules, more likely to be t or NK
  - Large lymphocytes
    - Can be T or NK
  - Reactive lymphocyte
    - If B cell, than larger cytoplasm for antibody production
    - If T or NK cell, less cytoplasm and more granules

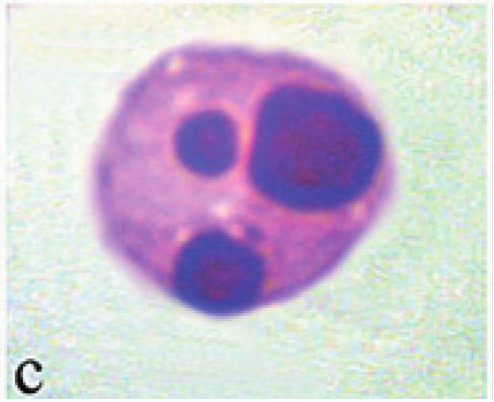






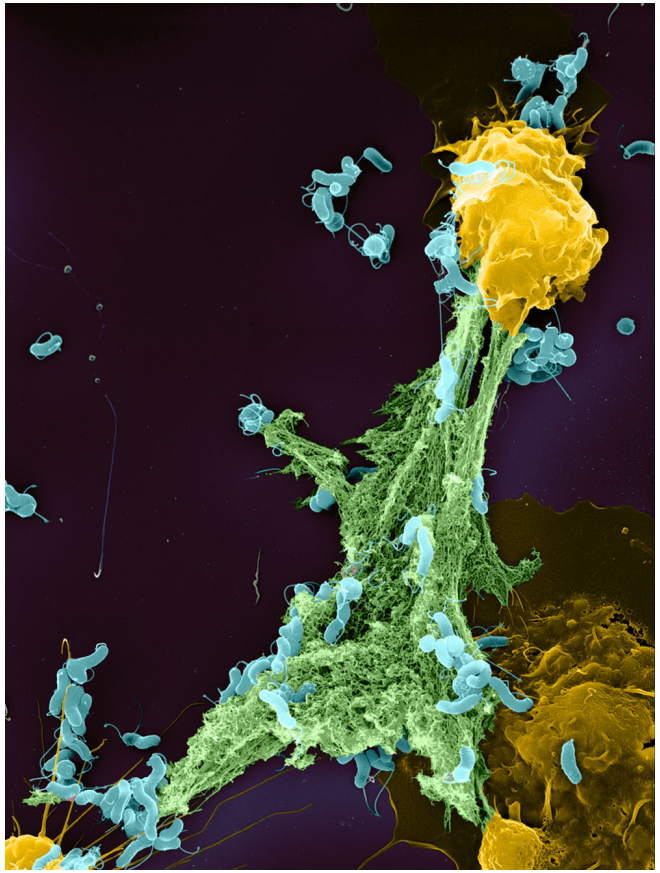
WHITE CELL VALUES

- Smudge cell
  - Can be any cell line
  - Usually
    - A cell that is very fragile and cannot withstand the collection and processing.
      - Frequently seen in CLL



    - A cell that has died in the course of some reaction/inflammatory response etc.
      - If a monocyte or neutrophil, can just have died if in a circle.
      - If a neutrophil, then it is called a neutrophil trap or net. The cell has exploded itself in order to make the largest area filled with protein braking or killing enzymes.





PLATELETS

CLL SOCIETY

- The number will bounce around all day long in response to your environment.
  - When performed manually – very difficult so the accepted range is +/- 50,000.
  - When performed by instrument, the accepted range is = +/- 20,000
  - As the instruments got better, the acceptable range has moved from 150 – 500 to 150 – 450 to 130 – 400 to even smaller ranges for some facilities (150 – 350)

PLATELETS

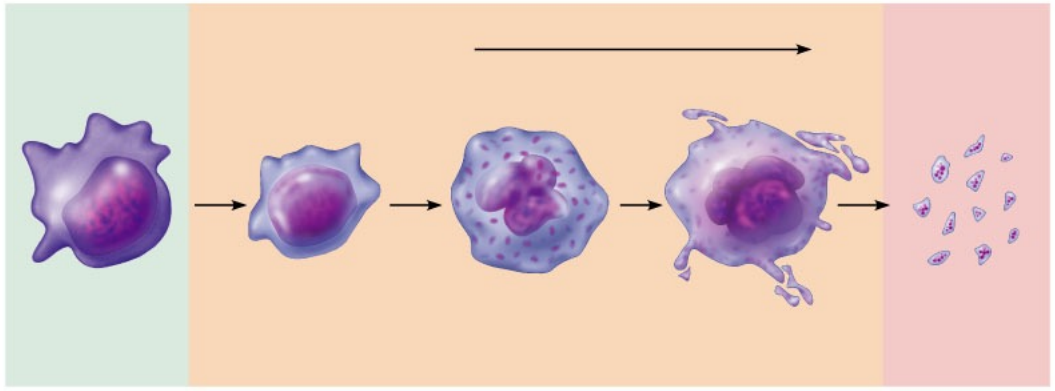
CLL SOCIETY

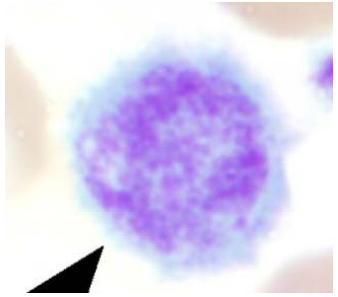
- PDW – platelet distribution width
  - Similar to the RDW
  - Mathematical description of size variation
  - Do we care?
    - Partially
      - Larger platelets suggest some type of inflammation, overuse, or drug response
      - Smaller platelets suggest deficiencies similar to microcytic red cells (iron, B_6, hypothyroidism)
  - Why not?
    - The most important things about platelets is their function. We have a few, not very precise tests for platelets because their function is in such a complex situation we cannot replicate it – size of capillary damage, type of damage (smooth vs. ragged), integrity of vessel walls, signaling from localized cells, eternal conditions (heat/cold, pressure, etc.)

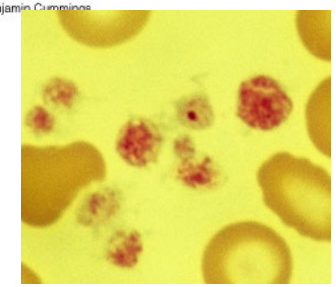
PLATELETS

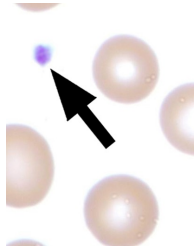
CLL SOCIETY

- Bone marrow cell – megakaryocyte, get larger and then breaks off pieces of the cytoplasm
  - Those pieces then need to reorganize themselves
  - Large platelets are usually not well organized and function less efficiently



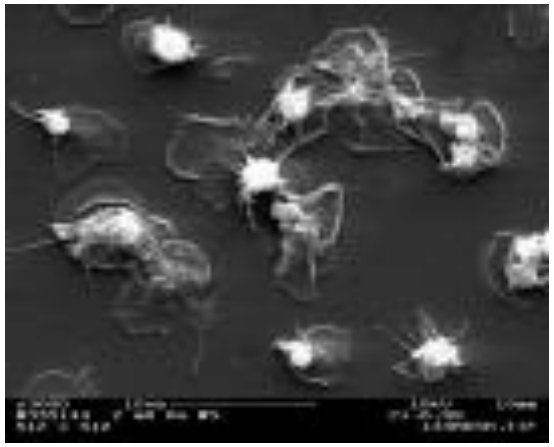






PLATELETS

- When not stimulated
  - Platelets are small disc shaped pieces of cytoplasm
  - When stimulated, they wring themselves out like a sponge, spreading contents into the area.
    - Their protrusions interlace forming a lattice structure.
    - They ADHERE to damaged walls.
    - Once “laced” they AGGREGATE and tighten
    - Other Contents are stimulants for the clotting process.
  - Platelet lack or lessened function is seen in
    - Small blood vessel bleeding (gums, mucous membranes, skin, etc.
    - Not big clots
  - Drugs – aspirin, clopidogrel, ticagrelor, ticlopidine



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PLATELETS

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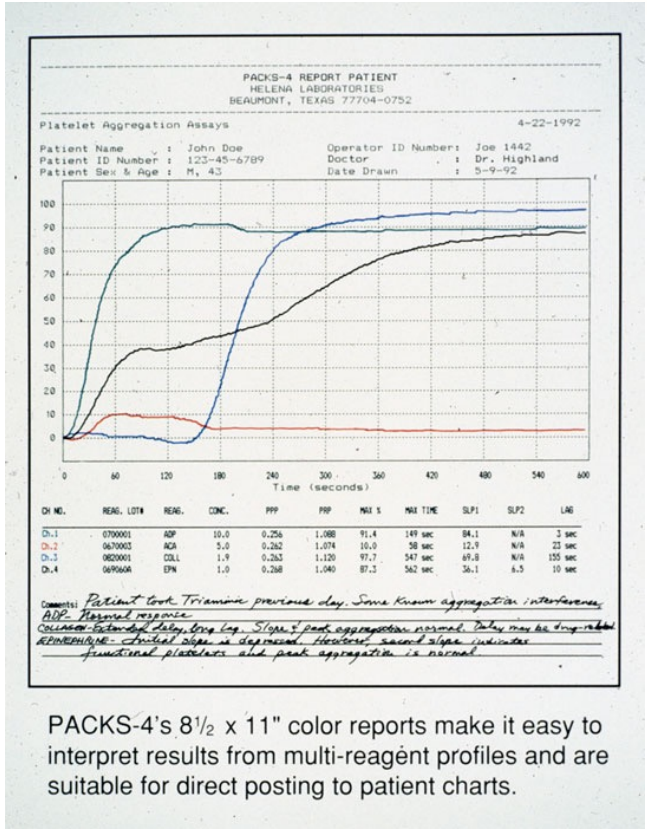
- Anti- Platelet Drugs
  - Aspirin usually low dose (81mg) but can be 325mg.
  - Clopidogrel – Plavix
  - Ticagrelor – Brilinta
  - Prasugrel (Effient)
  - Dipyridamole/aspirin (Aggrenox)
  - Ticlopidine (Ticlid)
  - Eptifibatide (Integrilin)

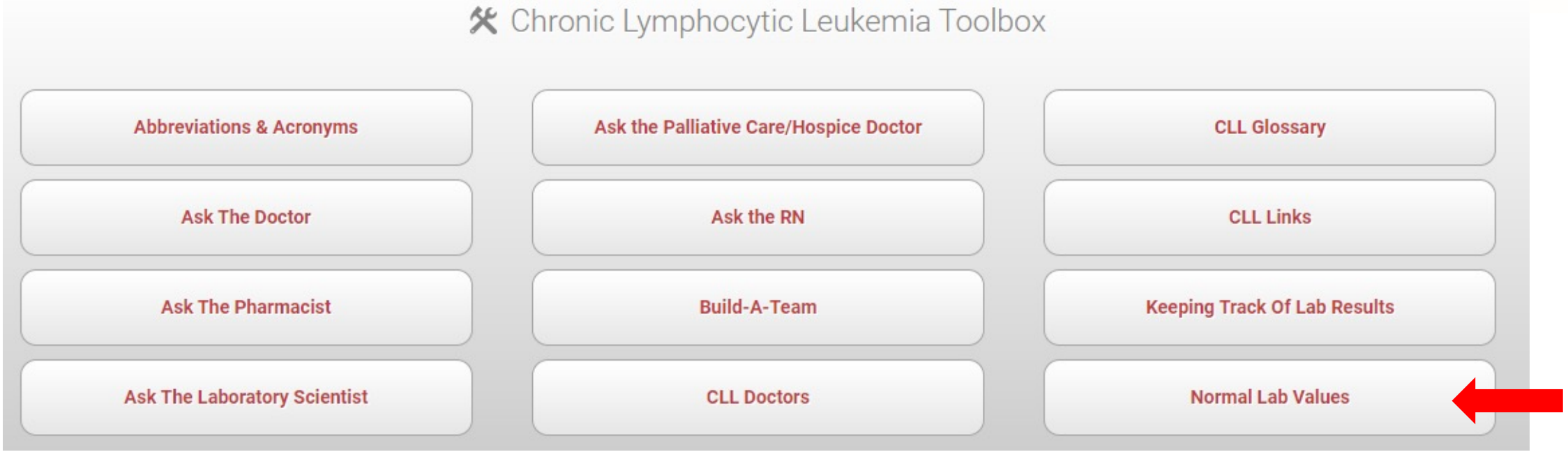


PACKS-4's 8½ x 11" color reports make it easy to interpret results from multi-reagent profiles and are suitable for direct posting to patient charts.

Normal Lab Values

Find Information on CLLSOCIETY.ORG

CLL SOCIETY



Normal Lab Values

CLL SOCIETY

Complete Blood Count (CBC)

Test Acronym	Meaning	Normal Range Values (Male)	Normal Range Values (Female)
WBC	Number of white blood cells	3.5-10.5 x 109/L	3.5-10.5 x 109/L
RBC	Number of red blood cells	4.7 to 6.1 million cells/mcL	4.2 to 5.4 million cells/mcL
HGB	Hemoglobin level	13.8-17.2 g/dL	12.1-15.1 g/dL
HCT	Hematocrit	40.7-50.3%	36.1-44.3%
MCV	Mean corpuscular volume	80-100 fL	80-100 fL
MCH	Mean corpuscular hemoglobin	27-31 pg	27-31 pg
MCHC	Mean corpuscular hemoglobin concentration	32-36 g/dL	32-36 g/dL
RDW	Red cell distribution width	11.8-15.6%	11.9-15.5%
PLT	Number of platelets	150-450 x 109/L	150-450 x 109/L

Normal Lab Values

CLL SOCIETY

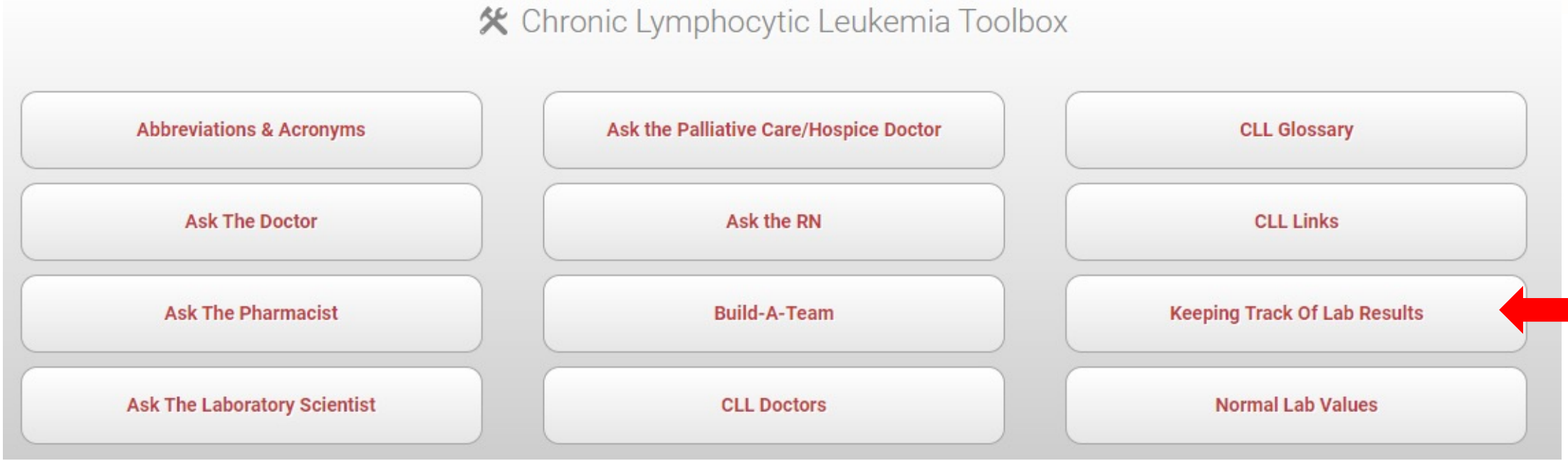
White Blood Cell Differential (Diff)

Test	Meaning	Normal Range Values
Neuts.%	Percentage of Neutrophils	40% to 60%
Lymphs%	Percentage of Lymphocytes	20% to 40%
Monos.%	Percentage of Monocytes	2% to 8%
Eos.%.	Percentage of Eosinophils	1% to 4%
Baso.%	Percentage of Basophils	0.5% to 1%
Neuts.# (ANC)	Absolute Neutrophil Count	1.70-7.00 x 109/L
Lymphs# (ALC)	Absolute Lymphocyte Count	1.00-4.80 x 10^9/L
Monos#	Number of Monocytes	0.30-0.90 x 109/L
Eos#	Number of Eosinophils	0.05-0.50 x 109/L
Baso#	Number of Basophils	0.00-0.30 x 109/L

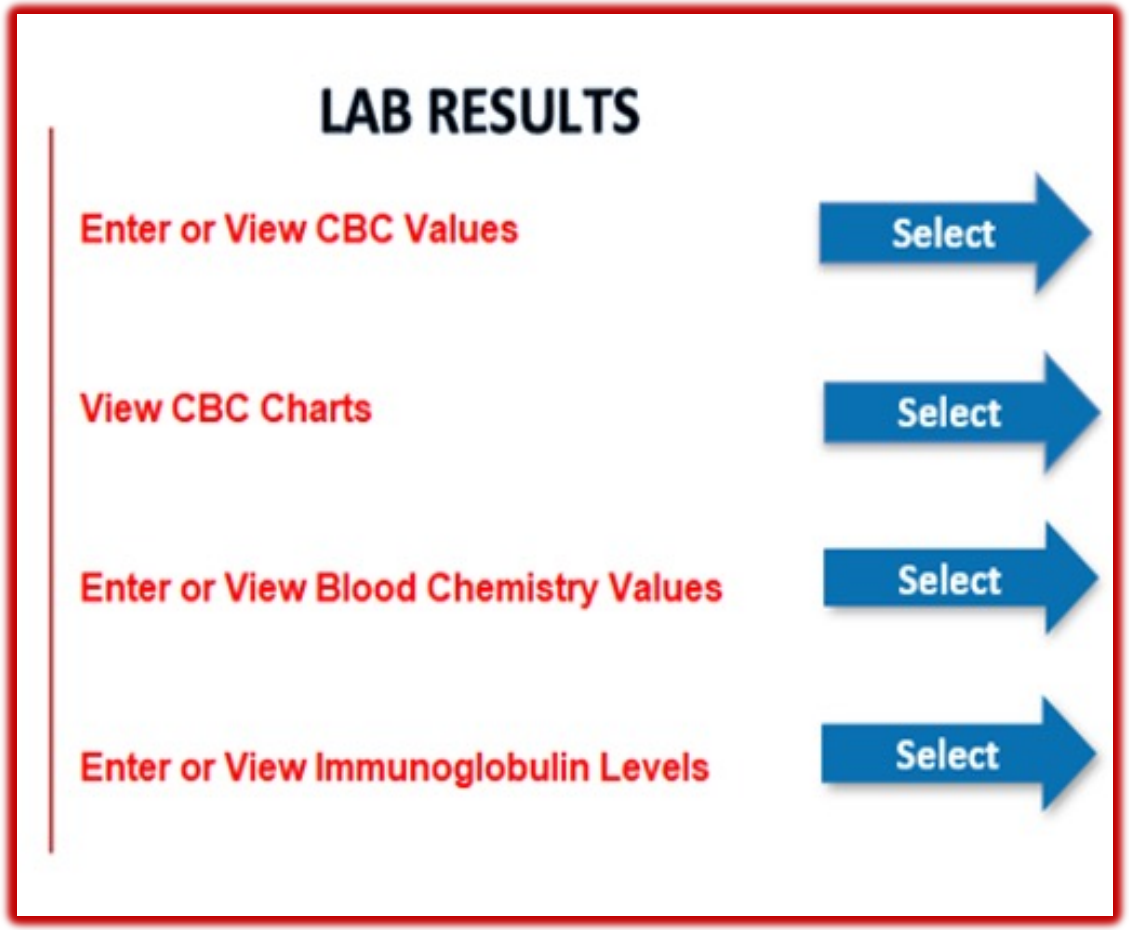
Keeping Track of Your Lab Results

Download the Template to Keep Track of Your Lab History

CLL SOCIETY

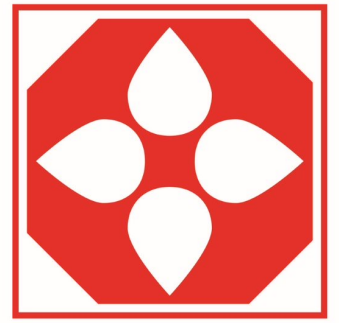


Keeping Track of Your Lab Results



Allows for a broader view of your long-term *trending* history for all key CLL lab components (CBC, Absolute Lymphocytes, and more)

Example Lab Tracking Form



Jane Doe

HOME CHARTS

Click on a ?
for additional help information

CBC Information

Date	WBC	RBC	HGB	HCT	Platelets	Percent Lymphs	Absolute Lymphs	Percent Neuts	Absolute Neuts	MCV	MCH	MCHC	RDW	MPV	NOTES
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Range=>	3.5-10.5	4.2-6.1	12.1-17.2	36-50	150-450	28-55%	0.85-4.1	25-70%	1.5-7.8	80-100	28-32	32-36	11%-15%	7.5-11.5	
1/1/15	5.5	4.2	12.1	36.0	150.0	28.0%	0.85	25.0%	1.5	80.0	28.0	32.0	11.0%	7.5	
5/1/15	6.0	7.0	18.0	50.0	154.0	60.0%	0.90	26.0%	3.0	82.0	33.0	37.0	20.0%	11.0	
1/1/16	7.6	6.0	15.0	45.0	170.0	40.0%	0.95	25.0%	4.2	81.5	28.0	32.0	11.0%	7.5	
5/1/16	5.5	4.2	12.1	36.0	155.0	28.0%	1	25.0%	3.0	81.0	33.0	37.0	11.0%	8.4	
1/1/17	11.0	7.0	18.0	50.0	160.0	60.0%	0.9	27.0%	1.5	80.0	28.0	34.3	12.0%	8.5	
5/1/17	9.0	6.0	15.0	45.0	220.0	40.0%	2.00	26.0%	2.0	82.0	33.2	36.0	13.4%	9.2	
1/1/18	5.5	4.2	12.1	36.0	235.0	28.0%	2.15	28.0%	3.2	83.0	28.0	42.0	11.0%	7.5	
5/1/18	11.0	7.0	18.0	50.0	215.0	60.0%	3.10	30.0%	3.4	84.5	33.1	35.7	14.0%	8.8	
1/1/19	9.0	6.0	15.0	45.0	320.0	40.0%	3.15	31.0%	4.4	92.0	32.4	37.3	12.4%	9.2	
5/1/19	5.5	4.2	12.1	36.0	220.0	28.0%	2.99	32.0%	4.2	81.0	33.0	34.0	13.2%	9.9	
5/1/20	11.0	7.0	18.0	50.0	245.0	60.0%	4.10	28.5%	5.0	84.2	31.2	33.4	14.5%	7.6	
7/1/20	9.0	6.0	15.0	45.0	260.0	40.0%	3.99	33.0%	5.1	82.0	29.4	33.0	12.2%	8.2	

HOME | CBC | CBC Charts | Blood Chemistry | Immunoglobulins

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Audience Questions & Answers

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