




BEYOND A BETTER BOX

Hematology Case Studies

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OBJECTIVES

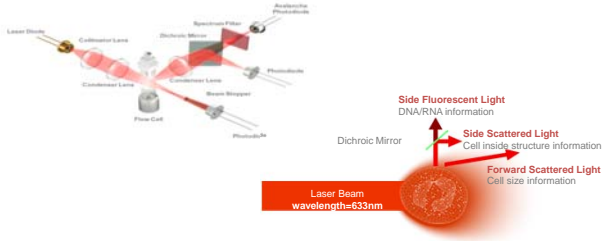
- Discuss how scattergram and histogram pictures can provide insight into abnormal hematology samples
- Utilize case studies to demonstrate how enhanced technologies can benefit the patient and clinician, as well as enhance efficiency in your hematology workflow.

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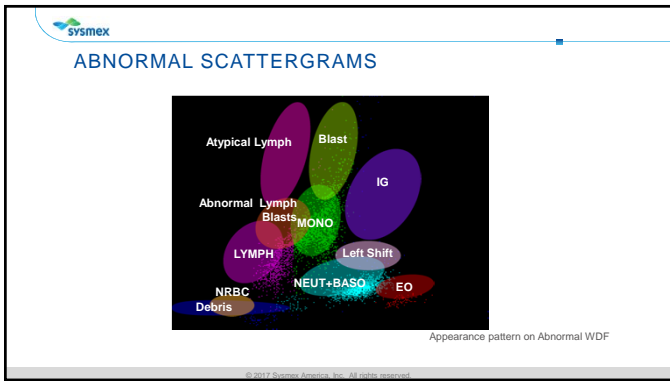


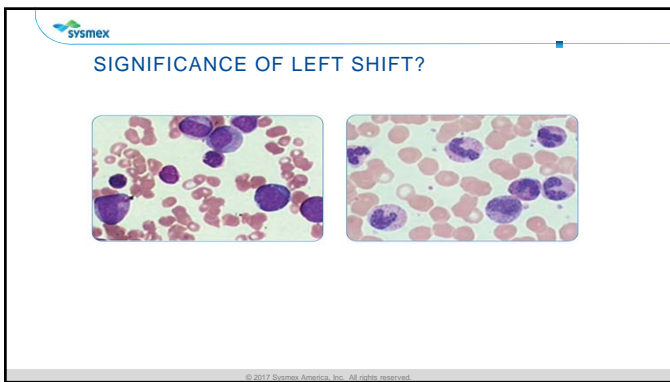
NEXT GENERATION DIAGNOSTICS

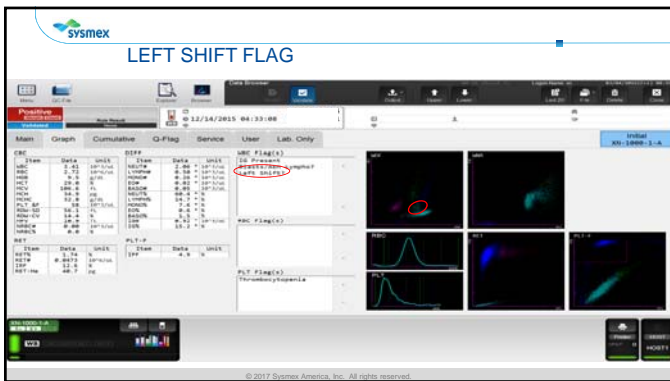
FLUORESCENT FLOW CYTOMETRY



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Immature Grans are shown by the blue arrow and Left Shift is in the red circle.

Close

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INCREASED IG COUNT: POSITIVE SAMPLE

Item	Data	Unit	Item	Data	Unit	ABC Flag(s)
WBC	12.5	10 ⁹ /L	Neutrophils	2.85	%	Neutrophils
HGB	12.5	g/dL	Lymphs	4.5	%	Lymphs
HCT	38.5	%	Monocytes	1.2	%	Monocytes
PLT	150	10 ⁹ /L	Eosinophils	0.5	%	Eosinophils
RDW	13.5	%	Metamyelocytes	4.0	%	Metamyelocytes
RDW-CV	13.5	%	Myelocytes	12.0	%	Myelocytes
RDW-S	13.5	%	Promyelocytes	11.0	%	Promyelocytes
PLT-FL	150	10 ⁹ /L	Blasts	11.0	%	Blasts
PLT-FL-FL	150	10 ⁹ /L				

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INCREASED IG COUNT: POSITIVE SAMPLE

- Manual Diff
 - Neutrophils: 16%
 - Bands: 21%
 - Lymphs: 19%
 - Monocytes: 12%
 - Eosinophils: 1%
 - Metamyelocytes: 4%
 - Myelocytes: 12%
 - Promyelocytes: 11%
 - Blasts: 11%

IG = 27%

Automated IG = 23.4%

WDF

SbC

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CASE STUDY #1

- A 71 y/o female presents to her family practitioner with increasing concerns of persistent fatigue, diffuse pain in her chest and back and "more bruising than normal". She also states that she has experienced recurring sinus and respiratory infections over the past 6 months. Upon examination, the patient was found to have an enlarged liver. Chemistry testing was unremarkable aside from a moderately elevated serum Calcium, Creatinine and Microalbumin level.
- Following is the initial CBC results
 - What concerns do you see

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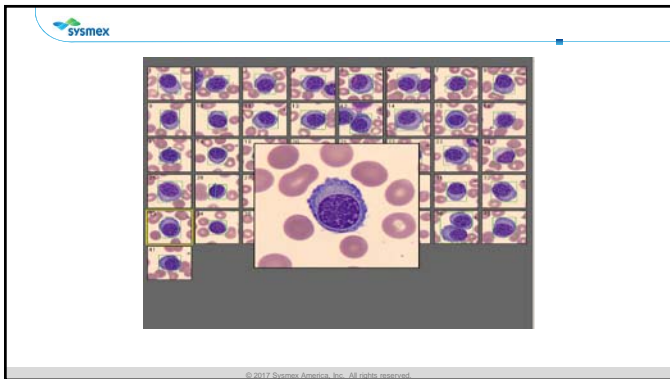
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STUDY #1 IMAGES

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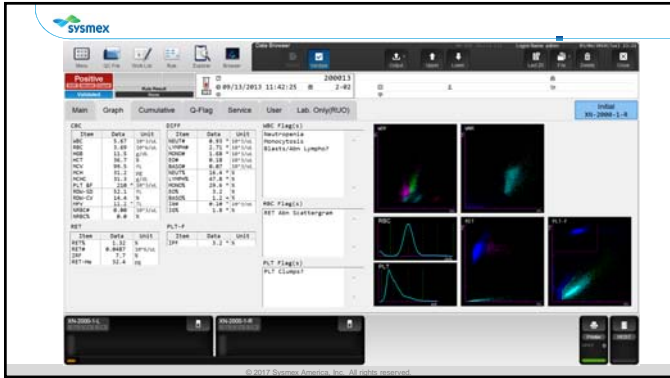
CASE STUDY #1 – DIAGNOSIS?

Plasma Cell Leukemia (PCL)

- ❑ Primary PCL is rare (1 in 1 million population). Secondary PCL affects ~ 4 out of a 100 Multiple Myeloma patients.
- ❑ 1.5x more common in men than in women
- ❑ The causes of PCL are not fully known, but risk factors such as age and exposure to industrial and environmental elements are thought to play important roles.
- ❑ Current treatments for PCL are the same as those for Multiple Myeloma and include chemotherapy drugs, Proteasome inhibitors, steroids and in younger and healthier patients, stem cell transplantation is an option.

CASE STUDY #2

- ❑ A 67 y/o male presented to his family physician for a routine wellness check. The patient states that he has experienced moderate unexplained weight loss and feels more 'run down' than usual.
- ❑ Physical examination reveals swollen lymph nodes and mild bruising on extremities.
- ❑ Following is the initial CBC results
 - ❑ What concerns do you see



Manual Differential

Neutrophils (segs, bands)	24%
Lymphocytes	24%
Atypical Lymphs w/cytoplasmic projections	50%
Monocytes	2%

Absolute lymphocyte count calculated from manual differential: $10.2 \times 10^3/uL$

Flow Cytometry Results

CD19, CD20, CD11c, CD25, CD103, CD123, Kappa light chain positive.
CD10, CD5 antigen negative.

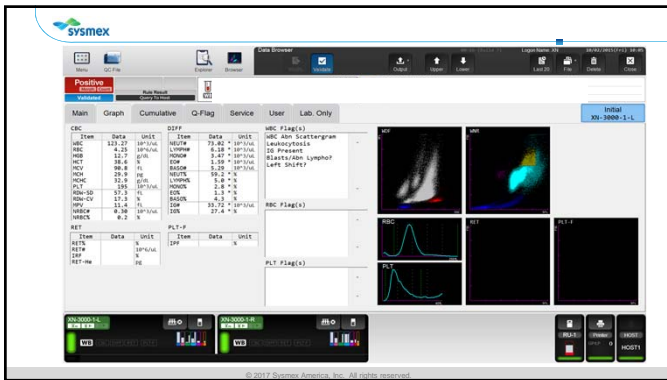
CASE STUDY #2 – DIAGNOSIS?

Hairy Cell Leukemia (HCL)

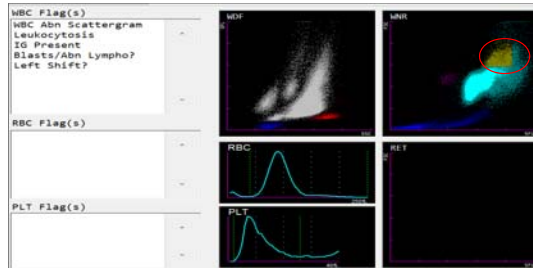
- HCL is a chronic leukemia where the bone marrow produces a surplus of B-lymphocytes, which often present with hair-like, irregular cytoplasmic projections.
- Relatively rare disorder, but one of the most successfully treated of all leukemias (median remission of 15 years).
- HCL is a very indolent disease. Progression is slow and may not be diagnosed after several months or even years of illness.
- Front-line treatment agents for HCL are Pentostatin and Cladribine.

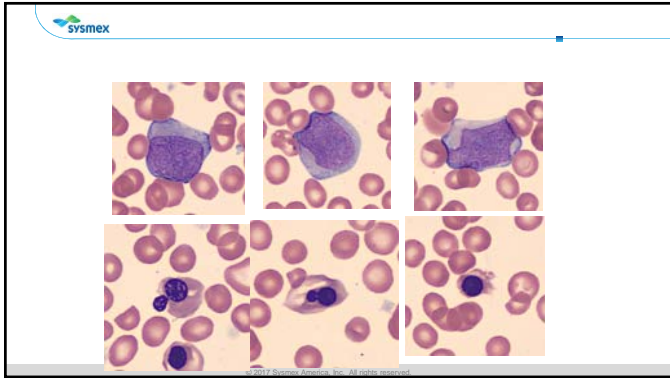
CASE STUDY #3

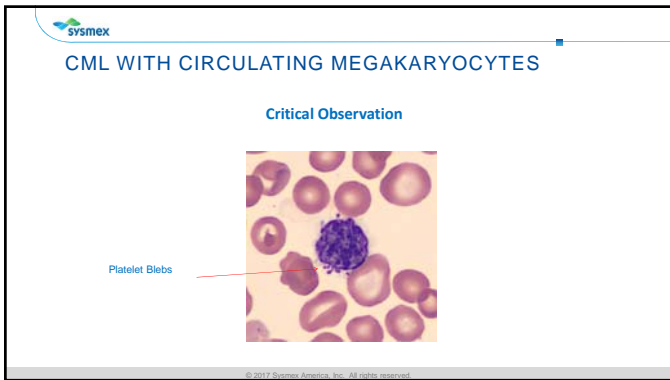
- ☑ A 66 y/o male presents to his family practitioner for a routine check-up.
- ☑ During the examination, the patient states he is feeling generally "ok", but when questioned further admits a recent history of :
 - ☑ Weakness
 - ☑ Fatigue
 - ☑ Extreme night sweats
 - ☑ Moderate weight loss
- ☑ Following is the initial CBC results
 - ☑ What concerns do you see?



INCREASED BASOPHIL COUNT







CASE STUDY #3 – DIAGNOSIS?

Chronic Myelogenous Leukemia (CML)

- ~ 1 person in 555 will get CML in their lifetime
- Occurs mainly in adults
- Slightly more common in men than in women
- Most cases of CML start when a "swapping" of chromosomal material (DNA) occurs between chromosomes 9 and 22. This translocation gives rise to a chromosome 22 that is shorter than normal (Philadelphia Chromosome).
- The swapping of DNA between the chromosomes leads to the formation of an oncogene called *BCR-ABL*. This gene then produces the BCR-ABL protein, which is the type of protein called a *tyrosine kinase*. This protein causes CML cells to grow and reproduce out of control.

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CASE STUDY #3

- ❑ CML is classified into 3 groups or phases that help predict prognosis. These phases are based mainly on the number of myeloblasts that are seen in the blood or bone marrow.

- ❑ **Chronic phase**
 - ❑ Less than 10% blasts in their blood or bone marrow.
 - ❑ Patients usually have fairly mild symptoms (if any).
 - ❑ Most patients are diagnosed in the chronic phase.

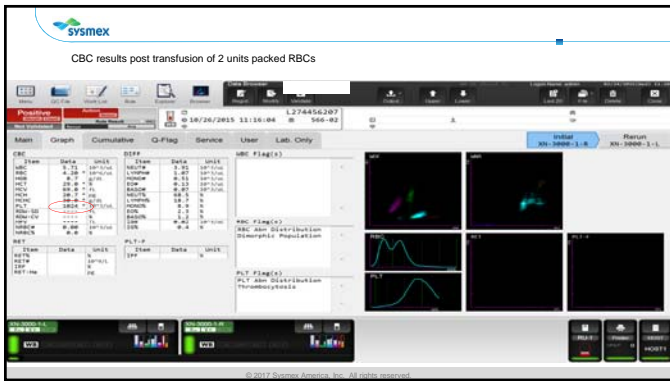
CASE STUDY #3

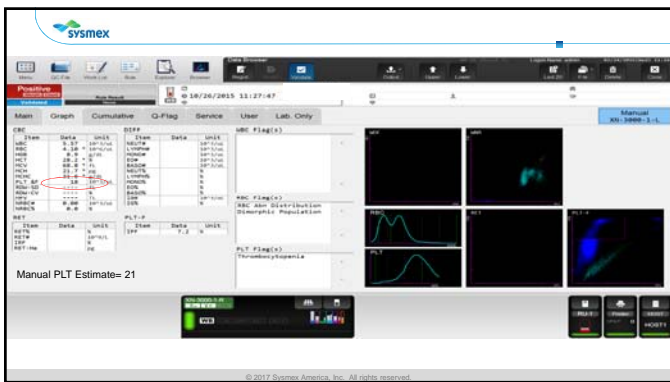
- ❑ **Accelerated phase**
- ❑ Patients are considered to be in accelerated phase if any of the following are true:
 - ❑ The bone marrow or blood samples have more than 10% but fewer than 20% blasts
 - ❑ **High blood basophil count** (basophils making up at least 20% of the white blood cells)
 - ❑ High white blood cell counts that do not go down with treatment
 - ❑ Very high or very low platelet counts that are not caused by treatment

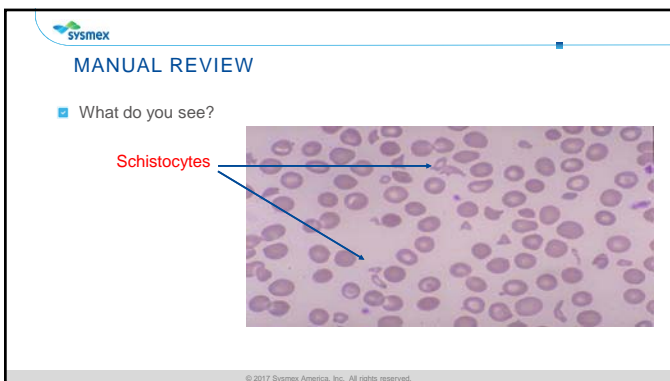
- ❑ **Blast phase (also called acute phase or blast crisis)**
 - ❑ BM and/or blood samples have more than 20% blasts.
 - ❑ The blast cells often spread to tissues and organs beyond the bone marrow.

CASE STUDY #4

- ❑ A 59 y/o male patient presents to the E.R. with a complaint of increasing weakness, shortness of breath, headache and recent onset of dark-colored urine.
- ❑ The initial CBC result indicates that patient has severe anemia of unknown etiology.
- ❑ Patient is admitted and transfused with 2 units of packed RBCs.
- ❑ The following CBC result is 24 hours post transfusion.
- ❑ What 'issues' do you see with the results?







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CASE STUDY #4 – DIAGNOSIS?

Idiopathic Autoimmune Hemolytic Anemia

- IAHA can be life-threatening because of its sudden onset
- It requires immediate medical attention and hospitalization
- Schistocytes were being counted as platelets by impedance counting

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CASE STUDY #5

- Woman arrives at L&D with contractions.
- Platelet count is 90,000
- Low platelet count complicates decision of placing a labor epidural due to risk of spinal hematoma. (plt cut-offs vary by institution).

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OB PATIENT WITH GIANT PLATELETS

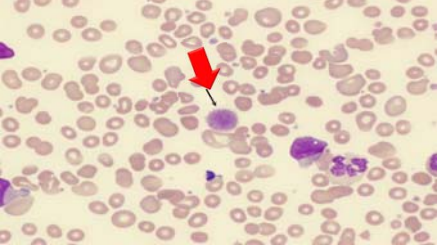
Doc. No. 1122-CFL, Rev 1, June 2014

Manual PLT Estimate= 141,000

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MICROSCOPIC IMAGES OF SLIDE



Doc. No. 1122-CFL, Rev 1,
June 2014

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CASE STUDY #5 - DIAGNOSIS?

Giant Platelets due to Pregnancy

- ☑ Giant platelets are a normal phenomenon in pregnant women
- ☑ Ability to utilize a second platelet methodology easily provided accurate platelet count of 122,000
- ☑ Epidural requires PLT >100,000
- ☑ No delay in epidural order

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CASE STUDY #6 BURN PATIENT

- ☑ A 27 year old male involved in an industrial accident presents at the burn center.
- ☑ He had 2nd and 3rd degree burns over 80% of his body.
- ☑ Initial CBC results showed extremely elevated platelet count.

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PLT MEASUREMENT OVER TIME IN A SEVERE BURN INJURY PATIENT



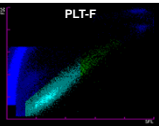
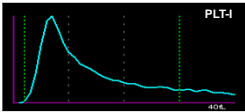
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PLT COUNT OVER TIME IN A BURN PATIENT

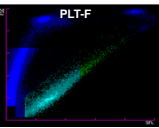
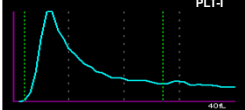
Day 1

PLT	(x10 ⁹ /L)
PLT-I	1118
PLT-F	228
CD61	204

Day 2

PLT	(x10 ⁹ /L)
PLT-I	795
PLT-F	161
CD61	150

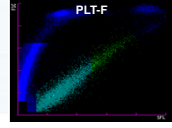
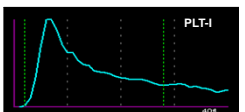
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PLT COUNT OVER TIME IN A BURN PATIENT

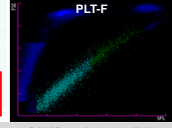
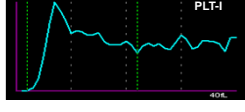
Day 3

PLT	(x10 ⁹ /L)
PLT-I	632
PLT-F	116
CD61	115

Day 4

PLT	(x10 ⁹ /L)
PLT-I	201
PLT-F	54
CD61	51

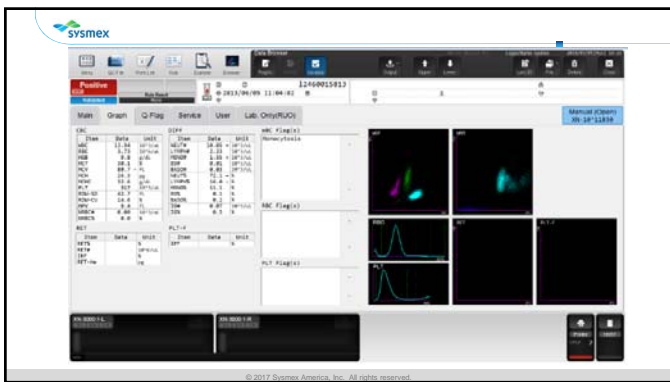



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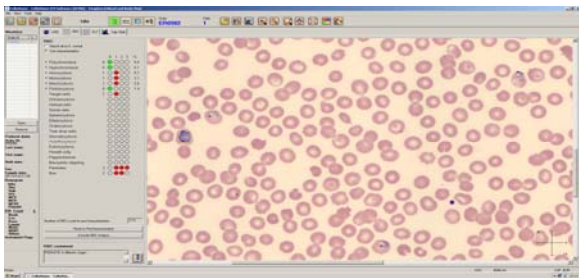
CASE STUDY #7

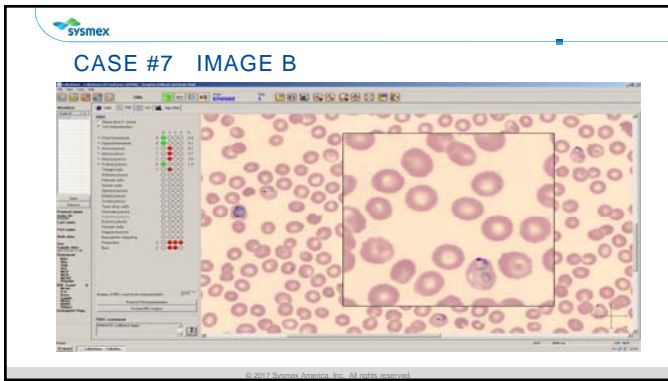
- A 35 year old man went to visit relatives for vacation. Two weeks after his return, he presented to the ER and told them he wasn't feeling well. He told them he had just returned from visiting family. Nothing out of the ordinary.
- He reported high fevers, shaking chills, and flu-like symptoms.
- Upon examination he was found to have an enlarged liver and spleen.

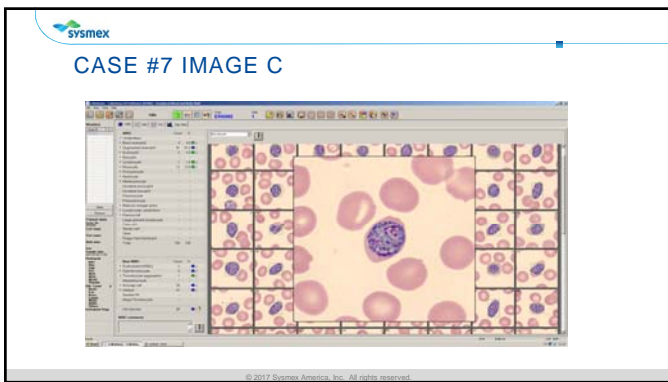
Did anyone ask him where his family lived?



CASE #7 IMAGE A








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CASE STUDY #7 – DIAGNOSIS?



Plasmodium Vivax

- Malarial parasites work by digesting red cell proteins and making the RBC membrane less deformable, causing hemolysis, increased splenic clearance, and anemia.
- P. Vivax makes up 16% of cases reported in US
- Not found in West Africa as no Duffy Antigen, which is required for entry in to the RBC.
- Characterized by:
 - Low to Normal Platelet Count
 - Anemia
 - White blood cell (WBC) counts during malaria are generally characterized as being low to normal, a phenomenon that is widely thought to reflect localization of leukocytes away from the peripheral circulation and to the spleen and other organs, rather than actual depletion or stasis.
 - In P.Vivax it is common to see more than one stage in the life cycle at the same time in the Peripheral Blood.

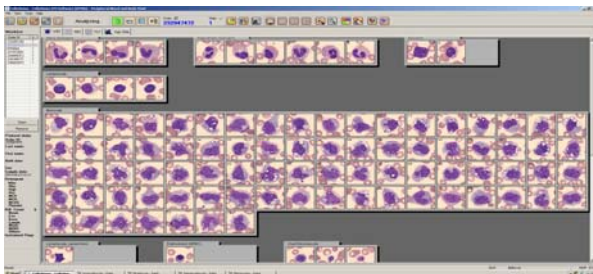
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CASE STUDY #8

- A 38 year old; HIV positive man presented at the clinic with a chronic cough, bloody sputum, fever, night sweats and recent weight loss.
- The MD ordered chest films as well as bacterial, fungal, and AFB cultures on the sputum.
- CBC values were unremarkable except for a WBC count of 17.2



CASE # 8 CELL IMAGES



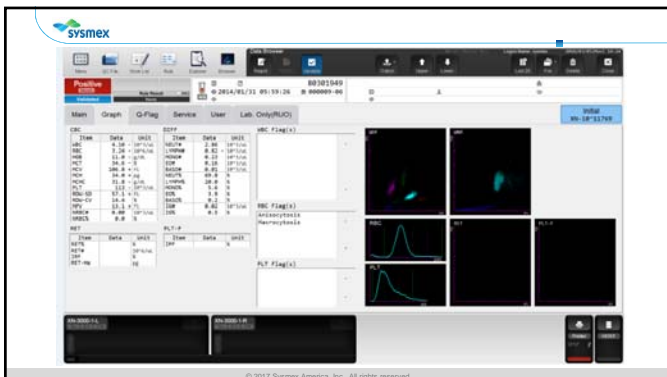
CASE STUDY #8 – DIAGNOSIS?

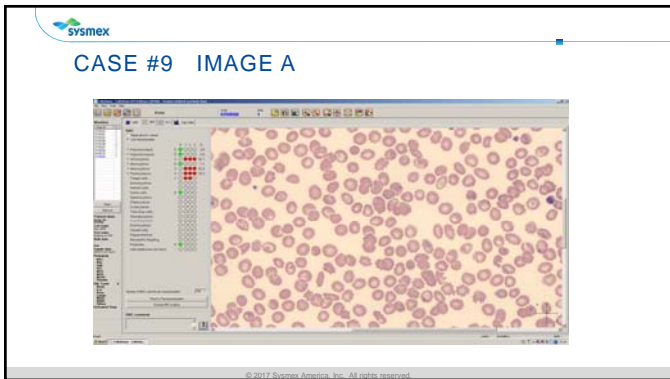
Monocytosis

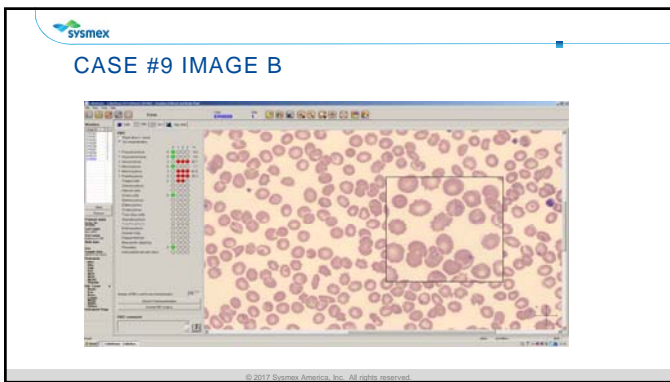
- Monocytosis itself is not a disease, but a symptom.
- Inflammatory conditions such as infection or autoimmune disturbances are primary causes of monocytosis. Some of the common types of infection that might lead to this condition include tuberculosis, syphilis and Rocky Mountain spotted fever. Autoimmune disorders such as lupus or rheumatoid arthritis might also lead to monocytosis.
- Some blood disorders might lead to a high number of monocytes as well.
 - In this particular case, Tuberculosis was the diagnosis

CASE STUDY #9

- 53 year old woman from Connecticut, no recent travel
- Fatigue, malaise, loss of appetite
- Occasional fever
- Elevated ESR
- Liver function tests: Elevated TBil, LDH, and liver transaminases








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CASE STUDY #9 – DIAGNOSIS?

Babesiosis

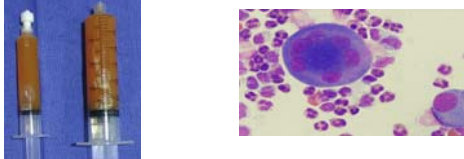
- **Where do most of the cases of babesiosis occur in the United States?**
 - Tickborne transmission of *B. microti* primarily occurs in the Northeast and upper Midwest, particularly in parts of New England, New York State, New Jersey, Wisconsin, and Minnesota. In the Northeast, babesiosis occurs in both inland and coastal areas, including off-shore islands such as Nantucket and Martha's Vineyard (Massachusetts); Block Island (Rhode Island); and Shelter Island, Fire Island, and eastern Long Island (New York State).
- **Other possible ways of becoming infected with *Babesia* include:**
 - Receipt of a contaminated blood transfusion (no tests have been licensed yet for donor screening); or
 - Transmission from an infected mother to her baby during pregnancy or delivery.
- The Centers for Disease Control and Prevention have issued a warning about babesiosis. According to the CDC the illness is transmitted through blood transfusions and has infected at least 122 people since 2000. This was released on Sept. 7, 2011.



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BODY FLUIDS.....OH NO!

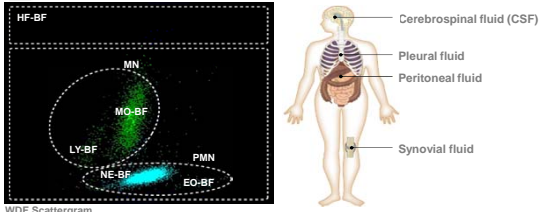


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WHAT TYPES OF BODY FLUIDS ARE APPROVED?

Body fluid mode (target species)



WDF Scattergram

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WHAT ARE YOU GETTING IN THE BODY FLUID COUNT

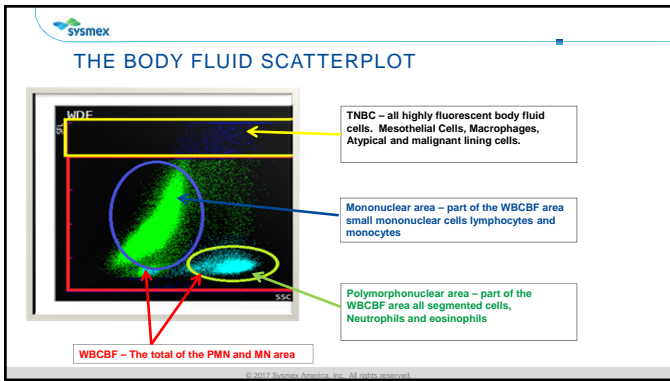
WBC		
Item	Data	Unit
WBC-BF	0.120	10 ³ /ul

RBC		
Item	Data	Unit
RBC-BF	0.000	10 ⁶ /ul

WBC Differential		
Item	Data	Unit
PMN#	0.097	10 ³ /ul
PMN%	80.8	%
PMN%	19.2	%
TC-BF#	0.250	10 ³ /ul

- WBC Count
- RBC Count
- 2-part Differential
- TNC – Total Nucleated Cells

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SOME SUGGESTIONS

- Synovial fluids are often too viscous to be properly aspirated.
 - Add Hylauronidase

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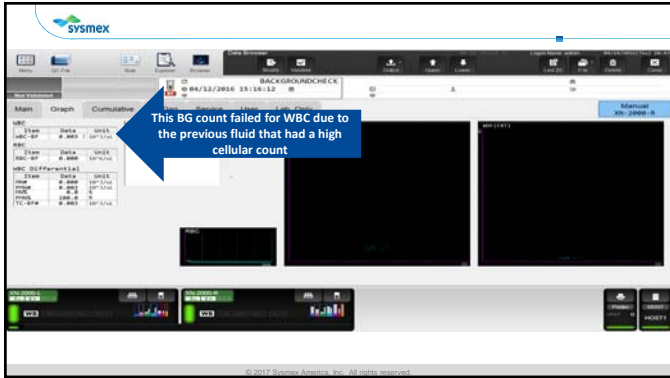
BACKGROUND CHECK

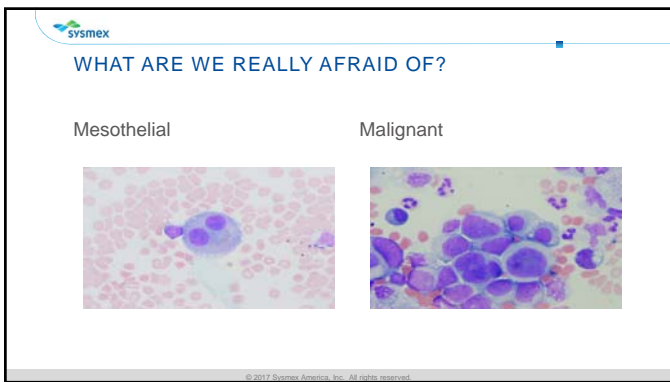
08/12/2013 08:16:41

WBC BG Counts acceptable $\leq 1.000 \times 10^3$

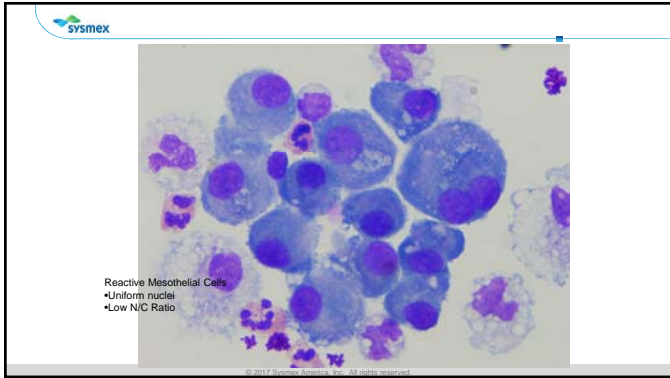
RBC BG Counts acceptable $\leq 1.000 \times 10^6$

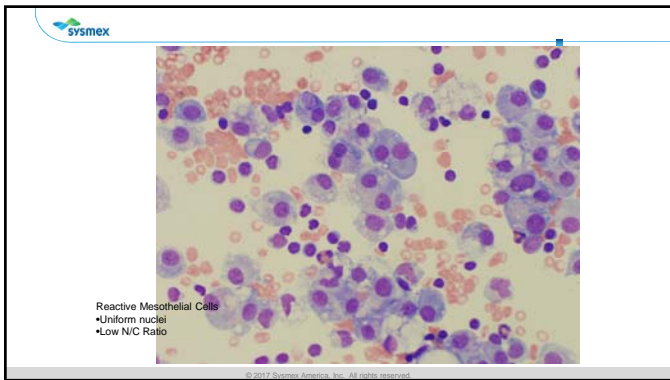
WBC-BF counts that exceed 1.000×10^3 and/or RBC-BF counts that exceed 1.000×10^6 will automatically activate an auto-rinse after the count is reported. This eliminates carry-over of the next specimen.

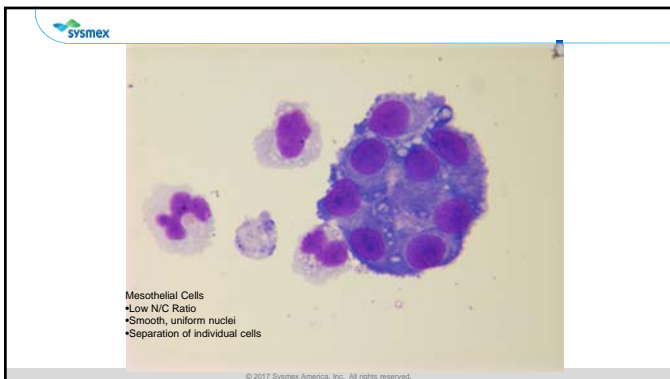


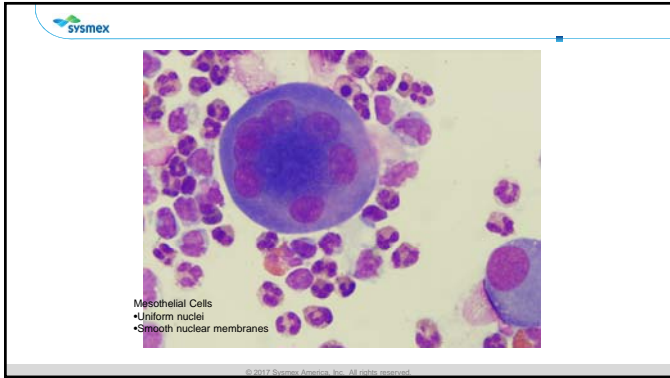


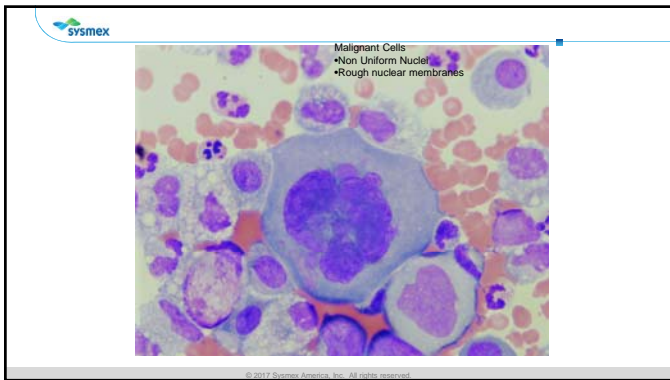


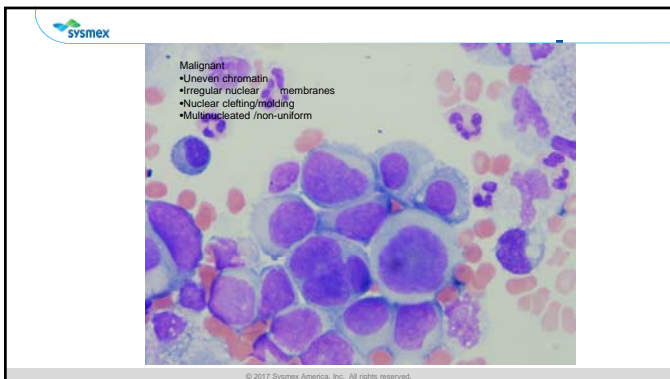


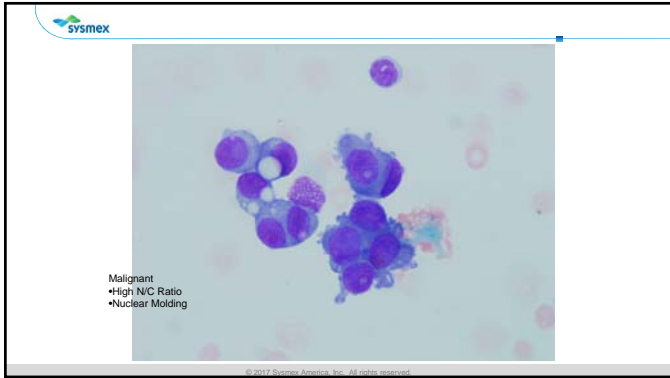


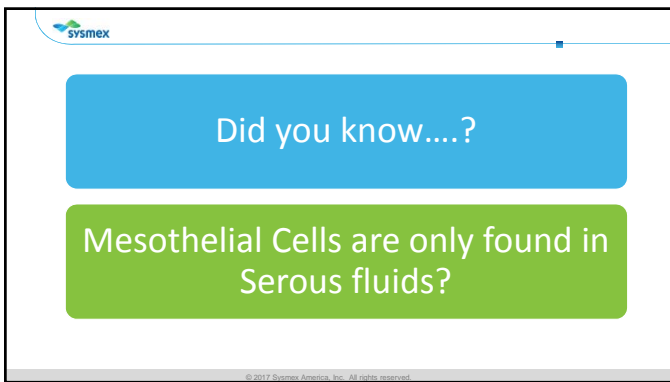


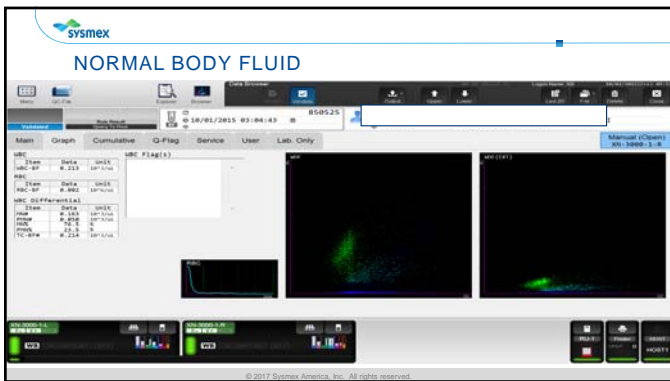


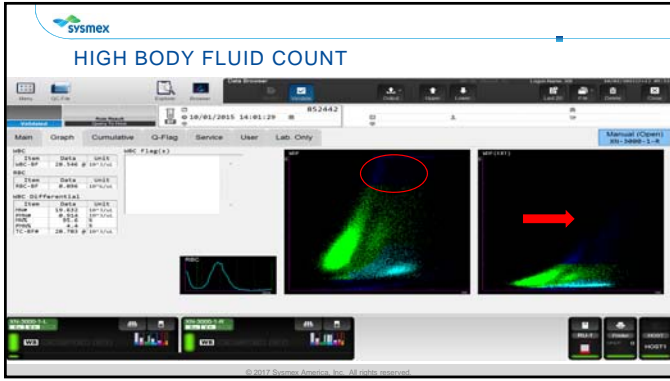






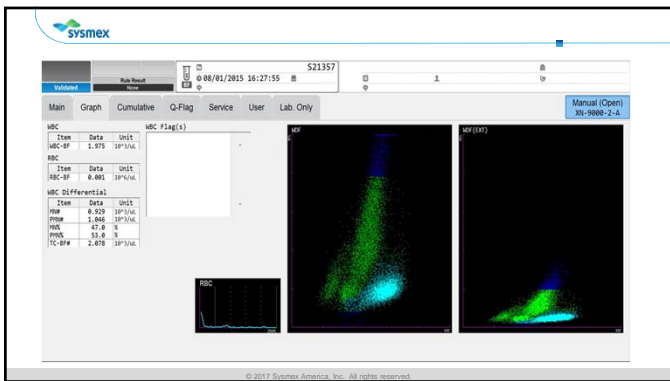




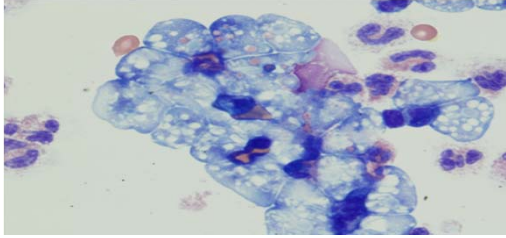


BODY FLUID CASE STUDY

- A child presented in the ER with headache, fever and vomiting. He had recently been swimming in a pond.
- It was determined that a collection of CSF was indicated.



MICROSCOPIC IMAGE



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BEYOND A BETTER BOX

Thank You
