To Diff or Not to Diff: That is the question.

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Session Aims

1. Why do we diff?

What are the benefits of manual differentials?

2. When should we diff?

What are the rules around manual diffs?

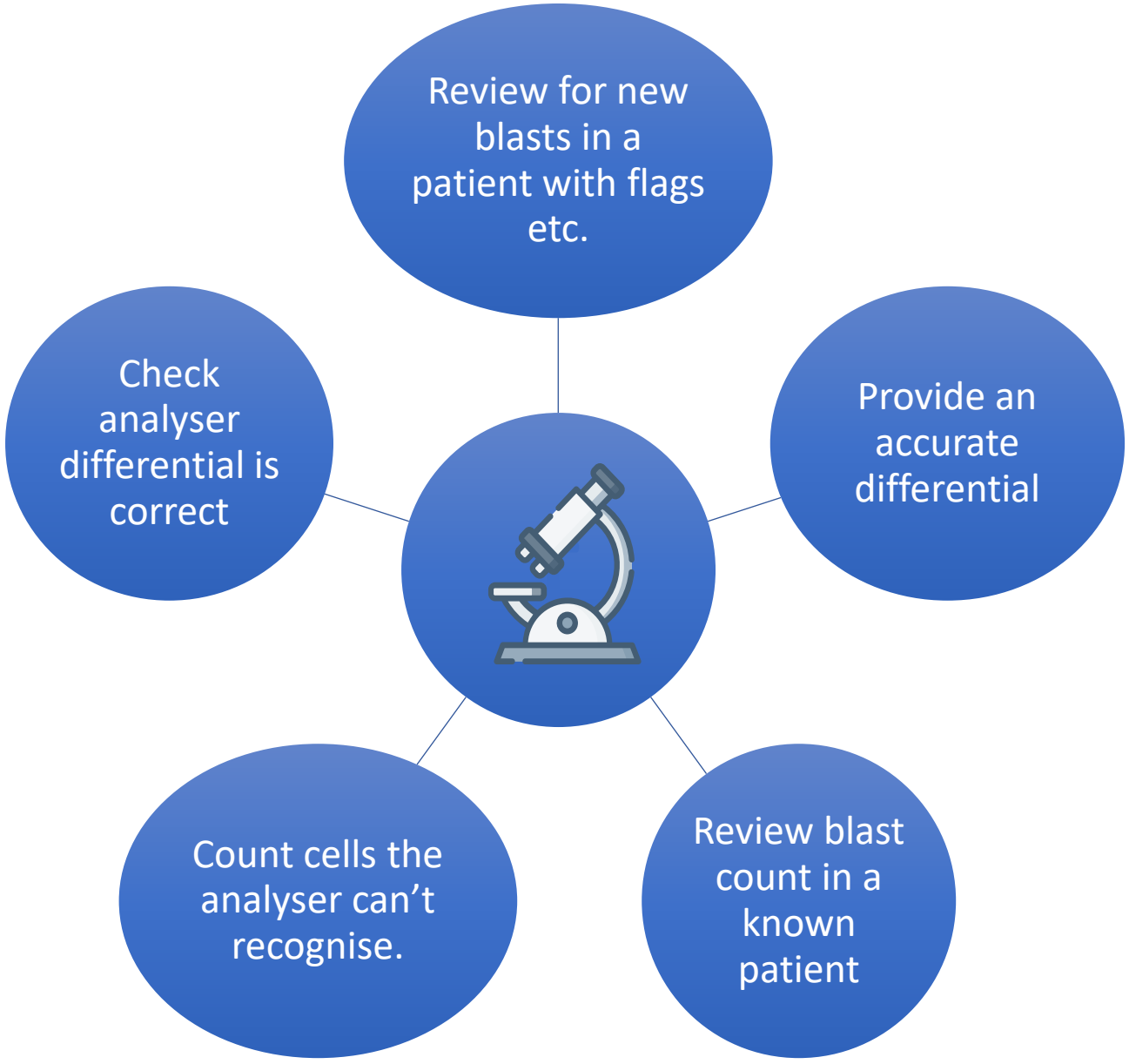
3. Case Studies

Examples for discussion.

4. Tips and Tricks

Things to consider when reviewing results.

Why do we diff?



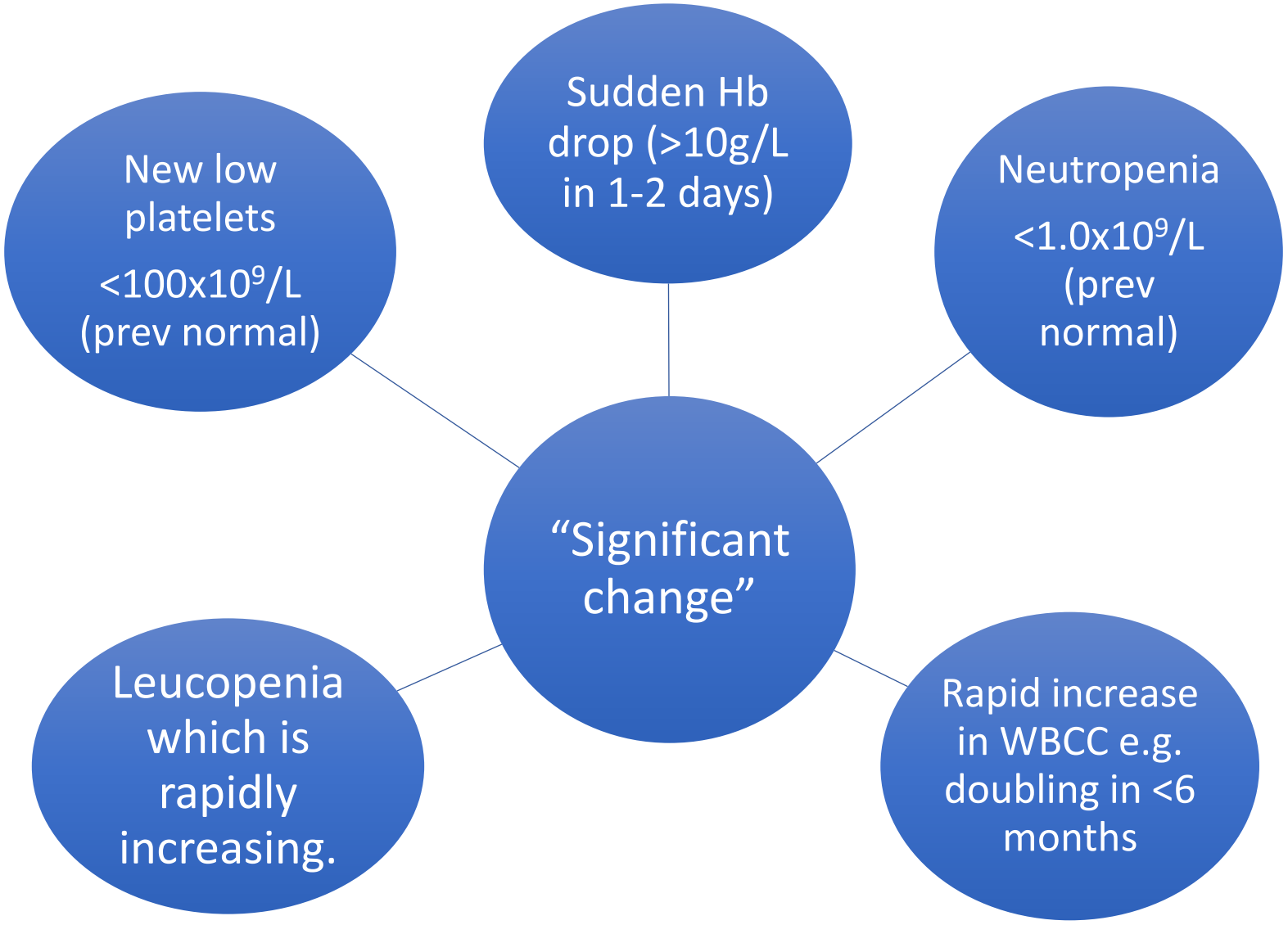
When should we diff? Part 1

Blast Flag 1st occasion	New blasts flags should be checked, and a manual diff completed if abnormal cells ID'd.
Blast flag- known blasts.	Known blasts where the counts have changed significantly or the last diff was >7 days ago.
Diff/Review Flags	Known abnormalities where the counts have changed significantly or the last diff was >7 days ago.
Neutropenia <1.0 (1st occasion)	Perform manual diff if the neutropenia does not appear genuine

When should we diff? Part 2

Neutrophils 1.0-1.5 (subsequent)	Perform manual diff if the neutropenia does not appear genuine.
Leukocytosis	Any leucocytosis e.g. monocytosis >1.5, lymphocytosis >5.0 and white cells >30 may need a manual diff.
Significant changes	Any patient where counts have changed may need a film, if there was a film <7 days ago.

What is a "Significant Change"?



When do we not diff?

Stable counts, <7 days since last film	Disorders such as MDS, CML or myelofibrosis may have blasts, but are often stable and low numbers, so do not need a diff.
Leucopenia	Patient's with total white cell counts of $<1.0x10^9/L$ do not need regular differentials unless something else changes.
CLL	CLL patient's with stable counts does not need a manual differential, even if their last film was >7 days ago.

Case Study 1: Presentation

A 3 year old child presents to CAUQ with the following:

- Jaundice
- Haematuria

They have no historical results. An FBC is sent to the lab, and the following results were generated.

Case Study 1: Presenting FBC

14/02/2023 14:02 Blood

Request Reason : Jaundiced, haematuria. NO

HB	93	g/L	(115 to 135)	Auth
WBC	16.2	10*9/L	(5.0 to 14.5)	Auth
PLT	204	10*9/L	(150 to 410)	Auth
RBC	3.23	10*12/L	(3.90 to 5.30)	Auth
HCT	0.269	L/L	(0.340 to 0.400)	Auth
MCV	83.4	fL	(75 to 87)	Auth
MCH	28.8	pg	(25.0 to 33.0)	Auth
MCHC	346	g/L	(315 to 345)	Auth
RDW	12.8		(11.6 to 14.0)	Auth
MPV	9.5	fL	(7.5 to 11.2)	Auth
Neutrophils	12.1	10*9/L	(1.5 to 8.0)	Auth
Lymphocytes	3.2	10*9/L	(2.0 to 8.0)	Auth
Monocytes	0.7	10*9/L	(0.2 to 1.0)	Auth

Would you do a film/differential?

Case Study 1: FBC Day 2

15/02/2023 09:45 Blood

Request Reason : febrile illness, haemolysis process ? cause.

HB	44	g/L	(115 to 135)	Auth
WBC	13.9	10*9/L	(5.0 to 14.5)	Auth
PLT	183	10*9/L	(150 to 410)	Auth
RBC	1.47	10*12/L	(3.90 to 5.30)	Auth
HCT	0.119	L/L	(0.340 to 0.400)	Auth
MCV	81.0	fL	(75 to 87)	Auth
MCH	30.0	pg	(25.0 to 33.0)	Auth
MCHC	371	g/L	(315 to 345)	Auth
RDW	13.0		(11.6 to 14.0)	Auth
MPV	9.2	fL	(7.5 to 11.2)	Auth
Neutrophils	7.8	10*9/L	(1.5 to 8.0)	Auth
Lymphocytes	4.5	10*9/L	(2.0 to 8.0)	Auth
Monocytes	1.3	10*9/L	(0.2 to 1.0)	Auth

Would you do a film/differential?

Case Study 1: Repeat FBC

Test	Date	19/02/2023	19/02/2023	u/k	17/02/2023	16/02/2023	15/02/2023	14/02/2023
	Time	16:28	06:41	u/k	01:08	06:30	09:45	14:02
	Spec	HQ938414H	HQ942155G	HQ942125Y	HQ935809V	HQ935668R	HQ933783D	HQ931200A
		H	H	H	H	H	H	H
HGB		79	71	80	68	45	44	93
WBC		29.4	32.1	49.2	38.9	20.4	13.9	16.2
PLT		118	82	91	94	123	183	204
RBC		2.46	2.29	2.55	2.08	1.40	1.47	3.23
HCT		0.228	0.208	0.224	0.179	0.121	0.119	0.269
MCV		92.6	90.6	88.0	85.9	86.1	81.0	83.4
MCH		32.0	31.0	31.3	32.9	31.9	30.0	28.8
MCHC.		345	342	356	383	370	371	346
RDW		15.3	15.6	15.7	16.0	17.8	13.0	12.8
MPV		9.6	10.3	9.7	9.1	8.6	9.2	9.5
NEU		17.6	21.5	^34.4	^23.9	12.0	7.8	12.1
LYM		10.0	8.5	^11.8	^12.1	6.4	4.5	3.2

When would you do another film/differential?

A. When the WBCC >30

B. When the Lymph count >5.0

C. >7 days after the 1st film

D. You wouldn't.

Case Study 1: Conclusion

The patient has increased myeloid precursors including occasional blasts, and some atypical lymphocytes, likely associated with severe infection.

The patient's haemolysis is the most significant feature, however, a high white cell count could represent the disorder driving the haemolysis.

Case Study 2: Presentation

A 31 year old male, with known Acute Myeloid Leukaemia (AML), presents to the haematology outpatient department for preclinic bloods.

An FBC is sent, and the following results are generated.

Case Study 2: Presenting FBC

10/08/2022 08:20 Blood				
HB	92	g/L	(130 to 170)	Auth
WBC	19.7	10*9/L	(4.0 to 11.0)	Auth
PLT	17	10*9/L	(150 to 410)	Auth
RBC	3.08	10*12/L	(4.50 to 5.50)	Auth
HCT	0.273	L/L	(0.400 to 0.500)	Auth
MCV	88.8	fL	(83 to 101)	Auth
MCH	30.0	pg	(27.0 to 32.0)	Auth
MCHC	338	g/L	(315 to 345)	Auth
RDW	15.5		(11.6 to 14.0)	Auth
MPV	7.3	fL	(7.5 to 11.2)	Auth
Neutrophils	0.8	10*9/L	(2.0 to 7.0)	Auth
Lymphocytes	4.2	10*9/L	(1.0 to 3.0)	Auth
Monocytes	14.6	10*9/L	(0.2 to 1.0)	Auth
Eosinophils	0.1	10*9/L	(0.00 to 0.5)	Auth
BAS	0.0	10*9/L	(0.0 to 0.1)	Auth

Would you do a film/differential?

Case Study 2: FBC History

Test	10/08/2022 08:20 HQ911687M H	02/08/2022 11:17 HQ908127F H	27/07/2022 13:48 HQ794291B H	21/07/2022 08:28 HQ774564C H	18/07/2022 08:46 HQ774572W H	01/06/2022 11:15 HQ950763K H
HGB	92	79	74	88	93	89
WBC	19.7	4.6	1.8	2.6	1.6	1.7
PLT	17	16	39	10	14	32
RBC	3.08	2.63	2.49	2.94	3.13	2.49
HCT	0.273	0.232	0.219	0.258	0.273	0.258
MCV	88.8	88.4	87.9	87.7	87.4	103.5
MCH	30.0	30.2	29.7	29.8	29.7	36.0
MCHC.	338	342	338	339	339	347
RDW	15.5	15.6	14.9	14.7	14.5	18.5
MPV	7.3	8.3	8.0	8.1	7.7	9.4
NEU	0.8	0.7	0.8	0.9	0.6	0.1
LYM	4.2	1.5	0.6	1.5	0.9	1.5
MON	14.6	2.3	0.4	0.2	0.1	0.0

Does this change your opinion?

Case Study 2: Repeat Bloods

A film was reviewed, and a manual differential was not done. The patient was seen again 5 days later with the following results:

15/08/2022 11:11 Blood
Request Reason : AML.

HB	79	g/L	(130 to 170)	Auth
WBC	27.7	10*9/L	(4.0 to 11.0)	Auth
PLT	15	10*9/L	(150 to 410)	Auth
MCHC	333	g/L	(315 to 345)	Auth
RDW	15.7		(11.6 to 14.0)	Auth
MPV	9.9	fL	(7.5 to 11.2)	Auth
Neutrophils	^0.4	10*9/L	(2.0 to 7.0)	Auth
Lymphocytes.....	2.2	10*9/L	(1.0 to 3.0)	Auth
Monocytes	^24.1	10*9/L	(0.2 to 1.0)	Auth

What would you do?

A. No film as previous film was <7 days ago

B. No film, phone and HQ.

C. Repeat film/diff

Case Study 2: Conclusion

The patient has a blast count of $25.2x10^9/L$ and a monocyte count of $0.0x10^9/L$. This represents a relapse of his known disease.

It is important to do a manual differential on known leukaemia patients with sudden increase in White cells, as this may represent a relapse.

Case Study 3

A 61 year old female presents to her GP with the following clinical symptoms:

- Fatigue
- Easy Bruising

She has no known comorbidities, and does not drink or smoke. A FBC sample is sent to the lab.

Case Study 3: Presenting FBC

28/01/2021 08:45 Blood

Request Reason : bruising ++. NONE

HB	115	g/L	(120 to 150)	Auth
WBC	7.4	10*9/L	(4.0 to 11.0)	Auth
PLT	4	10*9/L	(150 to 410)	Auth
RBC	3.67	10*12/L	(3.80 to 4.80)	Auth
HCT	0.333	L/L	(0.360 to 0.460)	Auth
MCV	90.6	fL	(83 to 101)	Auth
MCH	31.3	pg	(27.0 to 32.0)	Auth
MCHC	346	g/L	(315 to 345)	Auth
RDW	15.3		(11.6 to 14.0)	Auth
MPV	10.0	fL	(7.5 to 11.2)	Auth
Neutrophils	^0.6	10*9/L	(2.0 to 7.0)	Auth
Lymphocytes.....	2.8	10*9/L	(1.0 to 3.0)	Auth
Monocytes	^3.8	10*9/L	(0.2 to 1.0)	Auth

Flag S

Comments :

Variant LY

MO Blast

LY Blast

Would you do a film/differential?

Case Study 3: Presenting FBC

The patient had a manual differential, resulting in a blast count of $3.6x10^9/L$.

The patient had a bone marrow, genetics and flow cytometry testing, and was diagnosed with Acute Promyelocytic Leukaemia (APML)

The patient was admitted, and had daily bloods sent to the laboratory.

Case Study 3: Repeat FBCs

Test	Date	31/01/2021	30/01/2021	30/01/2021	29/01/2021	29/01/2021	28/01/2021	28/01/2021
	Time	06:35	18:10	06:22	18:23	08:30	16:44	08:45
	Spec	HQ845830PH	HQ845588SH	HQ845003LH	HQ844630QH	HQ841967ZH	HQ841462LH	HQ836651RH
HGB		89	90	98	100	107	111	115
WBC		9.8	11.7	16.7	19.3	19.6	9.0	7.4
PLT		36	22	34	9	16	4	4
RBC		2.80	2.91	3.18	3.26	3.40	3.53	3.67
HCT		0.255	0.265	0.290	0.298	0.309	0.322	0.333
MCV		91.0	91.2	91.1	91.4	90.9	91.3	90.6
MCH		31.9	30.9	30.9	30.6	31.5	31.5	31.3
MCHC.		350	338	339	334	347	345	346
RDW		15.3	15.4	15.4	15.0	15.0	14.9	15.3
MPV		8.5	7.9	7.9	7.8	7.5	9.4	10.0
NEU						^0.9		^0.6
NEUT			1.5			0.6		0.5

When would you repeat the film?

A. No film as previous film was <7 days ago

B. Everyday

C. When the white cell count became high

Case Study 3: More FBCs!

Date	06/02/2021	04/02/2021	03/02/2021	03/02/2021	02/02/2021	01/02/2021	01/02/2021
Time	06:28	04:30	16:10	06:30	06:30	20:30	08:05
Spec	HQ862138SH	HQ856271TH	HQ911264TH	HQ853203NH	HQ849211YH	HQ849198SH	HQ846445ZH
Test							
HGB	80	77	81	80	87	83	87
WBC	42.2	60.4	71.0	61.3	41.1	24.6	16.1
PLT	30	27	37	36	46	50	60
RBC	2.65	2.49	2.60	2.55	2.79	2.69	2.77
HCT	0.244	0.233	0.240	0.235	0.258	0.247	0.251
MCV	92.0	93.5	92.4	92.2	92.5	91.8	90.8
MCH	30.3	31.0	31.1	31.2	31.2	30.9	31.3
MCHC.	329	331	336	338	337	337	345
RDW	15.7	16.2	15.7	15.9	15.4	15.5	15.3
MPV	8.1	8.0	8.5	8.8	7.8	8.0	8.3
NLR			NLRE				
ANRB	^0.0	^0.0	^0.0	^0.1	^0.1		^0.0

When would you repeat the film?

A. 04/02/2021, as this is >7 days since previous film

B. Everyday

C. When the white cell count >30x10^9/L

Case Study 3: Conclusion

Despite treatment, this patient's WBCC varies widely. In APML this is associated with a condition called "differentiation syndrome."

In the case of APML, it is useful to do a differential every day, as this helps determine if the patient is responding to management strategies, and to ensure they are not neutropenic.

Tips and Tricks: Deciding to Diff

Think about the FBC.	Think about all of the values when deciding if the FBC has changed.
Know the last diff.	Has is been >7 days? What did they see on that film diff?
Don’t leave the analyzer diff	If you choose not to make a film, make sure you delete the analyser differential.
If in doubt- diff!	There’s no harm in doing a diff! If it’s the same as the analyser, it just means we don’t have to do it again!

Tips and Tricks: Doing the Diff

1 blast =/= differential	If you see one blast, one promyelocyte etc, you don't have to a diff, just remember to mention it!
Is it a blast? Don't call it atypical!	If you think you see a blast, call it that! Try to avoid "atypical cells" if you can as doctors don't know what this means.
Everything is on a spectrum!	Cells are in the process of development, so may not be textbook examples. Consider the features they have e.g. granules or size, and make your decision using that rationale

Thanks for Listening

Any Questions?

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