



Virtual Microscopy Interlaboratory Study 2025-1

Haematology Report

2025 December 4

CONTENT

1	<i>Organisers</i>	3
2	<i>The study</i>	3
3	<i>Participants</i>	3
3.1	Geographic origin of participants	4
3.2	Number of participants	4
4	<i>Assessment of blood smear quality by participants</i>	8
5	<i>Determination of the assigned value and statistical processing procedure</i>	10
5.1	Assigned value	10
5.2	Statistical processing procedure (Participants results analysis)	11
6	<i>Sample 1a</i>	11
6.1	Clinical case	11
6.1.1	Information presented to participants for the blood smear examination	11
6.1.2	Observation (additional post-survey information)	11
6.2	Assigned values	12
6.3	Results of participants	14
6.3.1	WBC counting	14
6.3.2	Morphological characteristics	17
6.3.3	Final interpretation	17
6.3.4	Diagnosis	17
7	<i>Sample 1b</i>	19
7.1	Clinical Case	19
7.1.1	Information presented to participants for the blood smear examination	19
7.1.2	Observation (additional post-survey information)	19



Virtual Microscopy Interlaboratory Study 2025-1

7.2	Assigned values	20
7.3	Results of participants	22
7.3.1	WBC Counting	22
7.3.2	Morphological characteristics	24
7.3.3	Final interpretation	24
7.3.4	Diagnosis	25
<i>Appendix I – CBC counting - graphical representation</i>		27
<i>Appendix II – Morphological characteristics selected for the survey ILS H2025-1a</i>		29
<i>Appendix III – Morphological characteristics selected for the survey ILS H2025-1b</i>		31



Virtual Microscopy Interlaboratory Study 2025-1

1 Organisers

Albarede, Stéphanie¹ and Albe, Xavier² and van Hellemond, Jaap J. ⁴ and Juhos, István³ and Rádóczy Fehér, Nikolett³

1. Centre Toulousain pour le Contrôle de qualité en Biologie clinique (CTCB), Toulouse, France
2. Virtual Microscopy Working Group, European Organisation for External Quality Assurance Providers in Laboratory Medicine (EQALM), Switzerland.
3. University of Szeged, Szeged, Hungary
4. Dept. Med Microbiology & Infectious Diseases, Erasmus MC University Medical Center Rotterdam, the Netherlands

On behalf of the EQALM Virtual Microscopy Working Group steering committee in cooperation with the EQALM Working Groups Infection Diagnostics and Performance Specifications

2 The study

Name: **EQALM VM Interlab Study 2025-1 - Haematology**

Started: **May 14, 2025**

Closed: **September 8, 2025**

3 Participants

All EQALM members were invited to participate in this Interlaboratory Study. In total, **11 EQA providers** representing **10 countries** participated:

1. **BP** – Biologie Prospective, Villers-lès-Nancy, France
2. **CTCB** – Centre Toulousain pour le Contrôle de qualité en Biologie clinique, Toulouse, France
3. **CROQALM** – Croatian Centre for Quality Assessment in Laboratory Medicine, Zagreb, Croatia,
4. **CSCQ** – Quality Control Center Switzerland, Chêne-Bourg, Switzerland
5. **EQUALIS**, Uppsala, Sweden,
6. **IEQAS** – Irish External Quality Assessment Scheme, Dublin, Ireland
7. **ÖQUASTA** – Austrian Association for Quality Assurance and Standardization of Medical and Diagnostic Tests, Vienna, Austria,
8. **PNAEQ** – Instituto Nacional de Saúde Doutor Ricardo Jorge, Programa Nacional de Avaliação Externa da Qualidade, Lisbon, Portugal
9. **PNCQ** – Programa Nacional de Controle de Qualidade, Rio de Janeiro, Brasil



Virtual Microscopy Interlaboratory Study 2025-1

10. **QC** – QualiCont In Vitro Diagnostic Quality Control Nonprofit Ltd., Szeged, Hungary

11. **VEQ-CRC** – Centro Regionale di Coordinamento della Medicina di Laboratorio - Ospedale Niguarda, Milano, Italy

3.1 Geographic origin of participants



Figure 1. Geographical overview over countries from which EQA providers participated in the Interlaboratory study.

3.2 Number of participants

For the **survey ILS H2025-1a**, a total of **1167 participants** have either submitted results (n=711) or viewed the virtual slide without entering any result (Table 1). The number of corresponding laboratories was 560.

Among them, **465** individual participants **reported full results** (Table 2). The criteria for the validation of full results reporting were:

- providing of a final interpretation or a diagnosis of hematologic deviations
- and providing lymphocytes counting

Participants' results are considered incomplete if they have entered at least one result but do not match the criteria for full results reporting.



Virtual Microscopy Interlaboratory Study 2025-1

For the **survey ILS H2025-1B**, a total of **1188 participants** have either submitted results (n=733) or viewed the virtual slide without entering any result (Table 3). The number of corresponding laboratories was 611. Among them, **669** individual participants **reported full results** (Table 4).

EQA providers	ILS H2025-1a		
	Individual visitors	Participating laboratories*	Individual participants with results**
BP	221	130	87
CROQALM	205	77	167
CSCQ	97	27	81
CTCB	132	58	68
EQUALIS	13	3	11
IEQAS	11	4	2
ÖQUASTA	73	30	40
PNAEQ	30	19	17
PNCQ	110	110	30
QC	44	30	30
VEQ-CR	231	72	178
Total	1167	560	711

*For PNCQ participants, affiliations were blinded; therefore, the number of laboratories equals the number of individual visitors. Excluding these participants, the total number of laboratories is 450.

** At least one result.

Table 1. Number of visitors and participants – Blood smear 1a



Virtual Microscopy Interlaboratory Study 2025-1

EQA providers	ILS H2025-1a		
	Individual participants with results*	Individual participants with full results	Individual participants with incomplete results
BP	87	58	29
CROQALM	167	132	35
CSCQ	81	42	39
CTCB	68	39	29
EQUALIS	11	6	5
IEQAS	2	1	1
ÖQUASTA	40	23	17
PNAEQ	17	12	5
PNCQ	30	22	8
QC	30	16	14
VEQ-CR	178	114	64
Total	711	465	246

**At least one result*

Table 2. Distribution of participants according to the type of results returned– Blood smear 1a



Virtual Microscopy Interlaboratory Study 2025-1

EQA providers	ILS H2025-1b		
	Individual visitors	Participating laboratories*	Individual participants with results**
BP	154	94	86
CROQALM	206	76	162
CSCQ	110	28	84
CTCB	102	45	65
EQUALIS	15	4	10
IEQAS	7	4	2
ÖQUASTA	77	32	43
PNAEQ	33	20	17
PNCQ	192	192	46
QC	50	35	36
VEQ-CR	242	81	182
Total	1188	611	733

*For PNCQ participants, affiliations were blinded; therefore, the number of laboratories equals the number of individual visitors. Excluding these participants, the total number of laboratories is 419.

** At least one result.

Table 3. Number of visitors and participants – Blood smear 1b



Virtual Microscopy Interlaboratory Study 2025-1

EQA providers	ILS H2025-1b		
	Individual participants with results*	Individual participants with full results	Individual participants with incomplete results
BP	86	76	10
CROQALM	162	156	6
CSCQ	84	78	6
CTCB	65	56	9
EQUALIS	10	9	1
IEQAS	2	2	0
ÖQUASTA	43	36	7
PNAEQ	17	14	3
PNCQ	46	40	6
QC	36	35	1
VEQ-CR	182	167	15
Total	733	669	64

** at least one result

Table 4. Distribution of participants according to the type of results returned– Blood smear 1b

4 Assessment of blood smear quality by participants

The **quality of staining** was rated as **unacceptable by 1.8%** of laboratories for **slide 1a** and by **3%** of laboratories for **slide 1b** (Figure 2).

The three figures (Figs. 2, 3 and 4) do not highlight any dissatisfaction from any specific country that could suggest different staining procedures. Indeed, for the high rates of dissatisfaction on slide 1b (CROQALM 7.5% and ÖQUASTA 8.6%), we note that the rates are much lower for slide 1a (4% and 0% respectively).



Virtual Microscopy Interlaboratory Study 2025-1

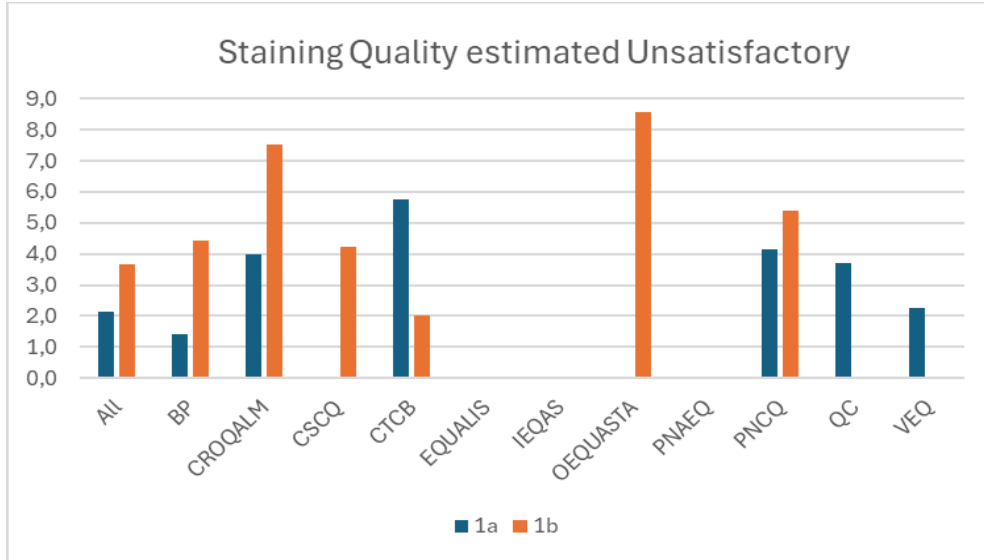


Figure 2. percentage of participants dissatisfied with the staining quality

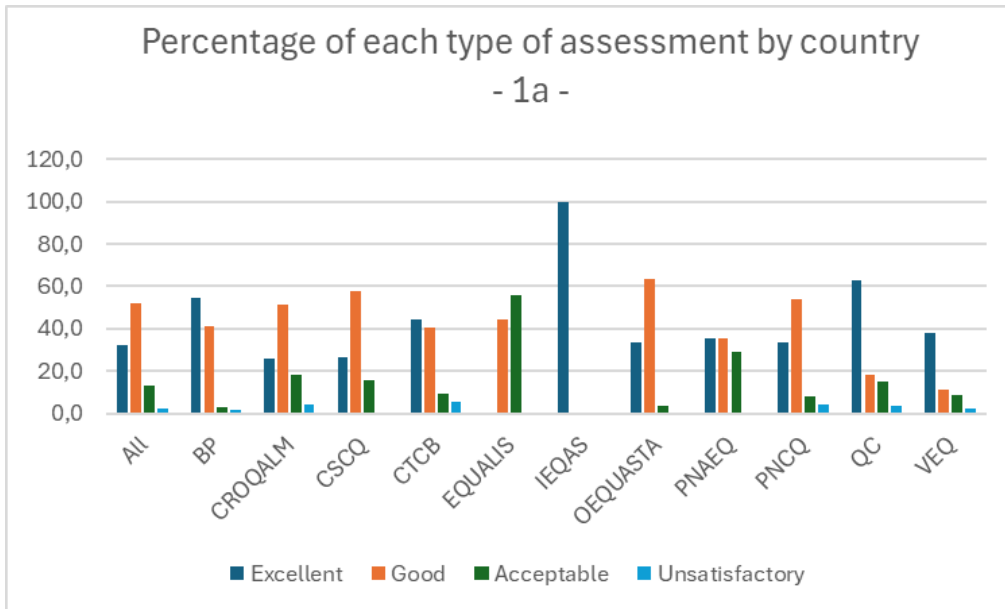


Figure 3. Evaluation of staining quality by participants for sample 1a



Virtual Microscopy Interlaboratory Study 2025-1

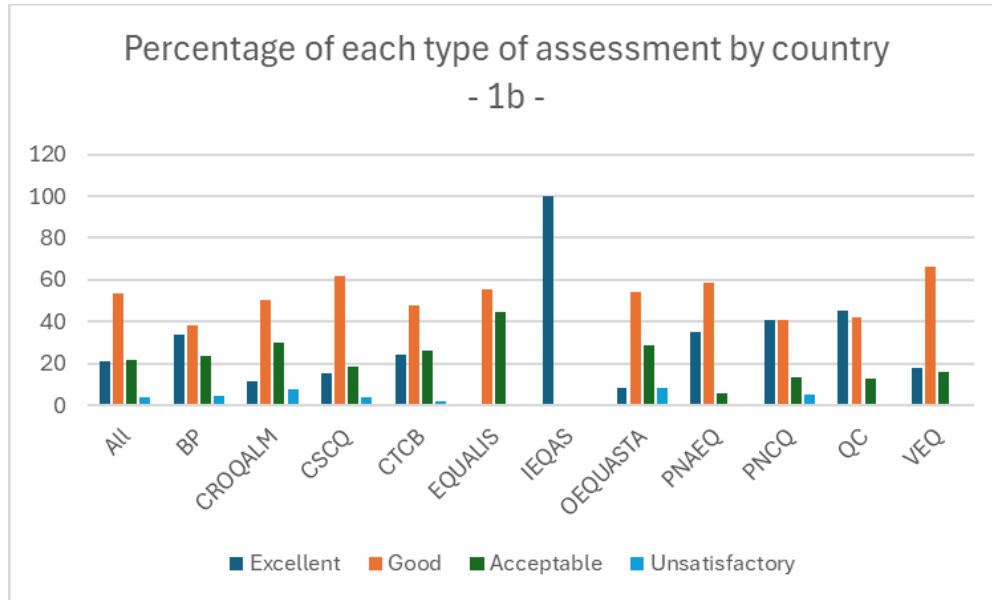


Figure 4. Evaluation of staining quality by participants for sample 1b

5 Determination of the assigned value and statistical processing procedure

5.1 Assigned value

The digital images are examined by 9 experts. The expected value, the consensus of the experts, is compared with all additional tests performed on the patient myelogram, genetic testing, etc.) before being defined as the assigned value.

For the quantitative results, the medians of results expert are used.

Affiliation of experts:

- *Institut Universitaire du Cancer de Toulouse - Oncopole (France)*
- *Pole de Biologie – CHU Purpan – Toulouse (France)*
- *Clinique Pasteur Toulouse - France*



Virtual Microscopy Interlaboratory Study 2025-1

5.2 Statistical processing procedure (Participants results analysis)

Quantitative statistical processing is performed according to Algorithm A on an iterative scale of standard NF ISO 13528 (Appendix C). The following statistical processing procedure is used:

- Elimination of outliers using a method based on the median (Med) and the weighted median absolute deviation (MADe). These are simple positional estimators, suitable for any data set and independent of extreme values. Values are retained or excluded based on the interval:
 - o $Med - a \cdot MADe < x_i < Med + a \cdot MADe$
 - o $a = \text{coefficient based on previous data experience} = 5$
- Determination of robust parameters from the remaining values by applying Algorithm A described in standard NF ISO 13528:
 - o $x^* = \text{robust mean (Moy } r)$
 - o $s^* = \text{robust standard deviation (ET } r)$

The analysis of qualitative responses is a count by type of response.

6 Sample 1a

6.1 Clinical case

6.1.1 Information presented to participants for the blood smear examination

The patient was **50 years old** and was seen in consultation as part of the therapeutic monitoring of a **haematological malignancy known for 5 years**.

Hb = 7.7 g/dL; MCV = 98.1 fL; Plt = 25 G/L; WBC = 53 G/L

6.1.2 Observation (additional post-survey information)

This was a patient seen in consultation for hairy cell leukaemia, which had been known. This patient had undergone several courses of treatment (including pentostatin NIPENT® and cladribine LITAK®) and a splenectomy a few years earlier. After periods of remission, he presented with hyperleukocytosis with blast cells and bicytopenia. Given the presence of the BRAFV600E mutation, the patient was eligible for treatment with the targeted inhibitor vemurafenib (ZELBORAF®). His blood count returned to normal within a few weeks. At the time



Virtual Microscopy Interlaboratory Study 2025-1

of diagnosis a few years earlier, the patient presented with leukopenia, monocytopenia and a Hairy cell percentage of 16% in his blood count. It was therefore not a variant of Hairy cell leukaemia. He became hyperleukocytic with a high percentage of Hairy cells at relapse.

6.2 Assigned values

WBC counting: The **values assigned** for cell counting are presented in Table 5.

	Experts Median (%)
Hairy cells	97
Lymphocytes	2
Neutrophils	1
Eosinophils	0
Basophils	0
Monocytes	0

Table 5. assigned values for the CBC counting – **sample 1a**

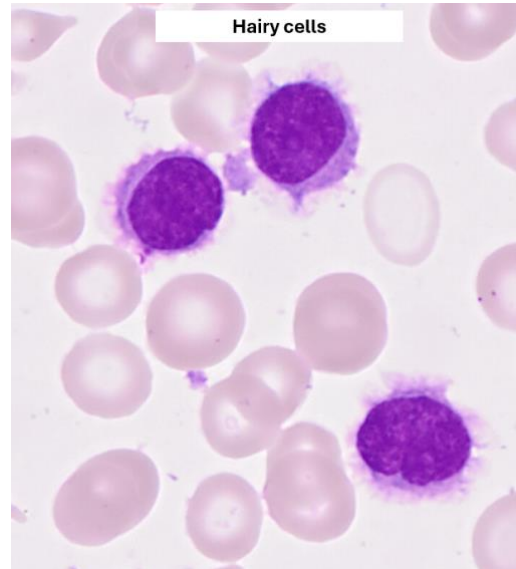
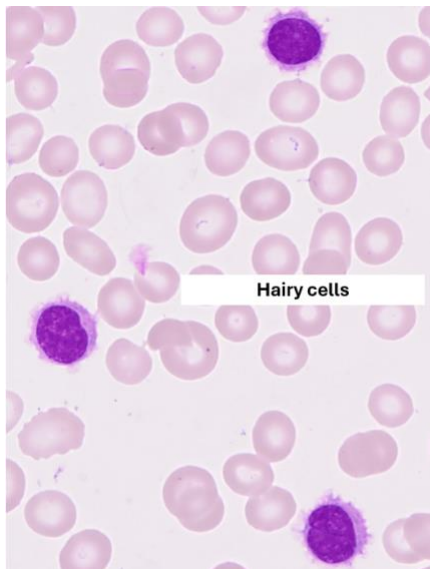
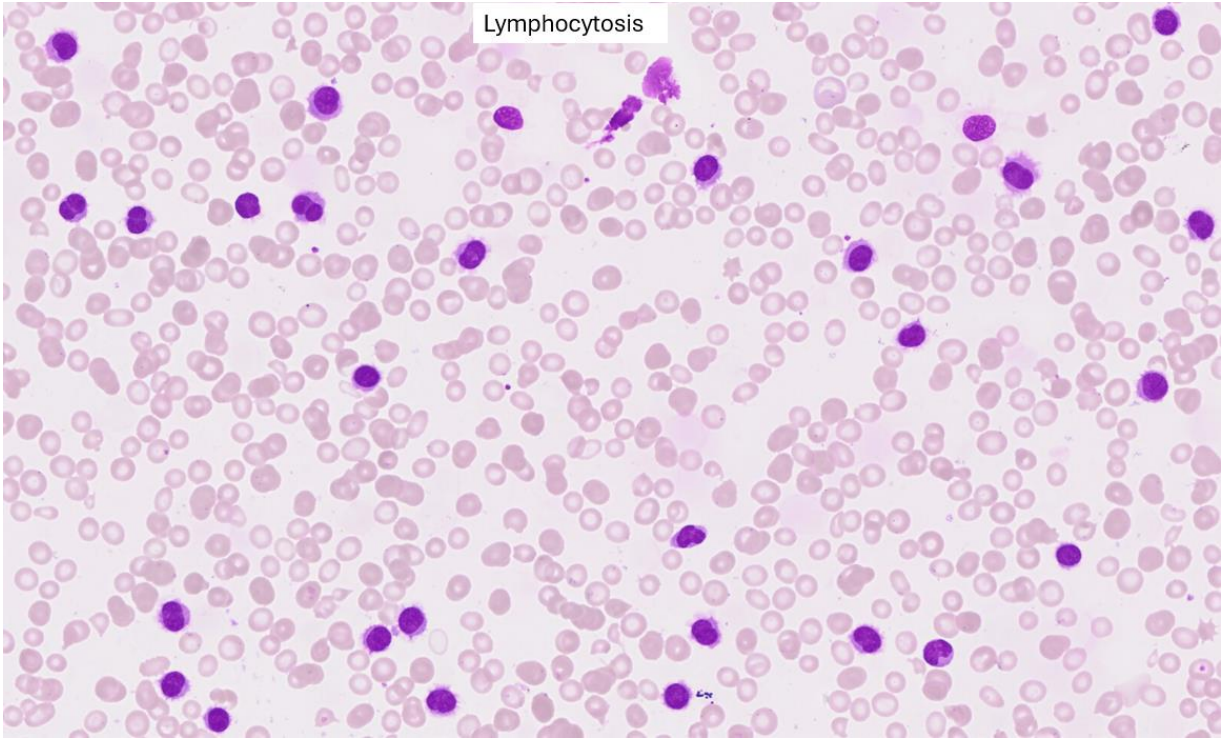
Morphological features: anisopoikilocytosis

Final interpretation: not normal blood

Diagnosis: Hairy cell leukemia



Virtual Microscopy Interlaboratory Study 2025-1





Virtual Microscopy Interlaboratory Study 2025-1

6.3 Results of participants

The table 6 shows the final interpretation and diagnosis distribution according to the EQA providers for the survey ILS H2025-1a.

	H2025-1a	Participants with final interpretation and/or diagnosis	Final interpretation	Diagnosis	Final interpretation only
1	BP	86	66	85	1
2	CROQALM	165	146	143	22
3	CSCQ	77	63	73	4
4	CTCB	65	47	62	3
5	EQUALIS	9	8	8	1
6	IEQAS	2	1	2	0
7	ÖQUASTA	39	34	39	0
8	PNAEQ	17	13	17	0
9	PNCQ	28	25	28	0
10	QC	30	27	30	0
11	VEQ-CR	178	139	178	0
Total	Total	696	569	665	31

Table 6. Distribution of response types – **sample 1a**

6.3.1 WBC counting

The **results of participants** for cell counting are presented in Table 7. It should be noted that many participants did not give a total cell count of exactly 100% (lower or higher percentages were provided).



Virtual Microscopy Interlaboratory Study 2025-1

	Participants Median* (%)
Hairy cells + villous lym.	94
Neutrophils	2
Lymphocytes	2
Eosinophils	0
Basophils	0
Monocytes	0

Table 7. Participant's median for blood smear 1-a

Note that the results for hairy cells and villous lymphocytes were pooled =

- **532 participants** counted **hairy cells**
- **89 participants** counted **villous lymphocytes**
- **66 participants** reported **0% for both cell types**

The medians of participants listed in the Table 7 are comparable to those of experts. However, there was considerable variability in the results: errors in entering results (reversing entries between cells, total count not equal to 100%, etc.) and errors in identifying cells.

Surprisingly, **15 participants did not count any abnormal cells**, and 1 participant classified the hairy cells as myelocytes (52%) and metamyelocytes (45%). Among participants who did not detect any hairy cells or villous lymphocytes:

- 23 classified these cells as atypical lymphocyte
- 5 as blast
- 4 as lymphoma cell
- 4 as Sezary cell
- 1 as plasma cell
- 1 as lymphoplasmocyte
- 1 as reactive lymphocyte

3 laboratories have reported the same rate (90%) for hairy cells and blasts, probably for not having to choose for fear of getting an incorrect result.



Virtual Microscopy Interlaboratory Study 2025-1

The graphical representation of the data after outlier's elimination is shown in Appendix I.

The Figures 5,6 and 7 show the statistical analysis results of the main cells.

Neutrophils -1a	N	Min	Max	Mediane	MAD	MADe	Med-5MADe	Med+5MADe
Before outlier's elimination	674	0	51	2	1	1.4826	-5.413	9.413
After outlier's elimination	670	0	9	2	1	1.4826	-5.413	9.413

Figure 5. Statistical analysis on neutrophils results – Sample 1a

Hairy cells / Villous lymphocytes-1a	N	Min	Max	Mediane	MAD	MADe	Med-5MADe	Med+5MADe
Before outlier's elimination	687	0	187	93	4	5.9304	63.348	122.652
After outlier's elimination	598	67	100	94	4	5.9304	64.348	123.652

Figure 6. Statistical analysis on hairy cells / Villous lymphocytes results – Sample 1a

Lymphocytes -1a	N	Min	Max	Mediane	MAD	MADe	Med-5MADe	Med+5MADe
Before outlier's elimination	679	0	99	2	2	2.9652	-12.826	16.826
After outlier's elimination	604	0	16	2	2	2.9652	-12.826	16.826

Figure 7. Statistical analysis on hairy cells / Villous lymphocytes results – Sample 1a



Virtual Microscopy Interlaboratory Study 2025-1

6.3.2 Morphological characteristics

Red cells: 482 participants reported the **anisocytosis** and **293 reported Poikilocytosis**

White cells:

- **563 participants reported** the presence of hairy cells. Among them, **54 did not count them**, and half of these also did not count villous lymphocytes or atypical lymphocytes.
- **128 participants reported** the presence of **villous lymphocytes**. Among them, **48 did not count them** but 34 of these gave a percentage of hairy cells (32 participants) or atypical lymphocytes (4 participants)

Numerous other comments were made. They are listed in the tables in Appendix II.

6.3.3 Final interpretation

The rate of correct answers is good: 98% of participants concluded **“not normal blood”** (Table 8).

1a - Interpretation	
Not Normal Blood	559 (98%)
Normal Blood	3
No interpretation	7
<i>Total</i>	<i>569</i>

Table 8. Final interpretation given by the participants – Sample 1a

6.3.4 Diagnosis

85.7% of participants proposed the assigned value (Table 9): Hairy-cell leukaemia. **9 proposed an acceptable diagnosis** (Splenic lymphoma with villous lymphocytes or Splenic marginal zone lymphoma). **3 laboratories** proposed the diagnosis “Sickle cell disease” or “Heterozygous thalassemia”: this is **probably a sample mix-up**.



Virtual Microscopy Interlaboratory Study 2025-1

1a- Assigned value = Hairy-cell leukaemia	
Proposed diagnosis	n Lab
Hairy-cell / Villous Lymphocytes 94%	
Hairy-cell leukaemia	569
Splenic lymphoma with villous lymphocytes	55
Other lymphocytes disease	
Chronic lymphocytic leukemia	13
Splenic marginal zone lymphoma	5
non-Hodgkin lymphoma	4
Mantle cell lymphoma	3
Sézary disease	2
acute lymphoid leukaemia (ALL)	2
Diffuse large B-cell lymphoma	1
Plasma cell leukaemia	1
Persistent polyclonal B-cell lymphocytosis (PPBL): with binucleated lymphocytes	1
Hemoglobinopathy	
Sickle cell disease	2
Heterozygous thalassemia	1
Other	
Acute leukaemia	1
Secondary thrombocytopenia	1
No diagnosis	
Proposed diagnosis not on the list	3
<i>Total of participants</i>	
	664

Table 9. Diagnosis proposed by the participants – **Sample 1a**



Virtual Microscopy Interlaboratory Study 2025-1

7 Sample 1b

7.1 Clinical Case

7.1.1 Information presented to participants for the blood smear examination

The patient was a **23-year-old man** seen in a specialized internal medicine consultation for monitoring of a **haematological disorder**.

The results of the blood count were as follows: **Hb = 10.9 g/dL; MCV = 80.3 fL; Plt = 499 G/L; WBC = 9 G/L**

7.1.2 Observation (additional post-survey information)

The patient was a 23-year-old man from Ivory Coast who was seen in a specialized internal medicine consultation for follow-up of his sickle cell disease. He had a severe homozygous SS form of the disease, as he had experienced multiple vaso-occlusive crises, numerous chest syndromes, and stays in intensive care. Complications also included chronic leg ulcers and early pulmonary arterial hypertension. He had received multiple transfusions, with a baseline hemoglobin level of 6.5 g/dL. He had no history of thromboembolism. He has two siblings, a sister and a brother, who are AA (normal hemoglobin, unaffected) and parents who are AS (heterozygous sickle cell trait). Treatment with manual and then automated exchange transfusions was quickly initiated upon his arrival in France two years ago. He is currently taking aspirin (100mg/day) and folic acid. On the day of his consultation, he is well and has come in for a blood exchange transfusion, which is perfectly tolerated and reduces his hemoglobin S level by half (from 55% to 27%)



Virtual Microscopy Interlaboratory Study 2025-1

7.2 Assigned values

WBC Counting

The values assigned for cell counting are presented in Table 10.

	Experts Median (%)
Neutrophils	49
Eosinophils	1
Basophils	0
Lymphocytes	39
Monocytes	11

Table 10. assigned values for the CBC counting – sample 1b

Morphological features:

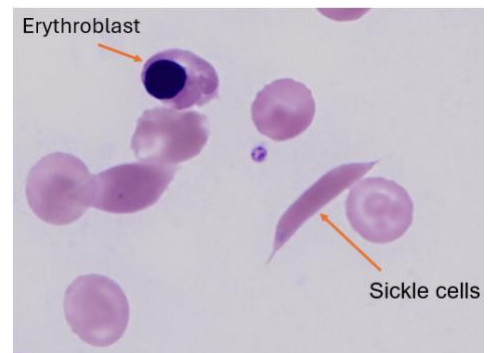
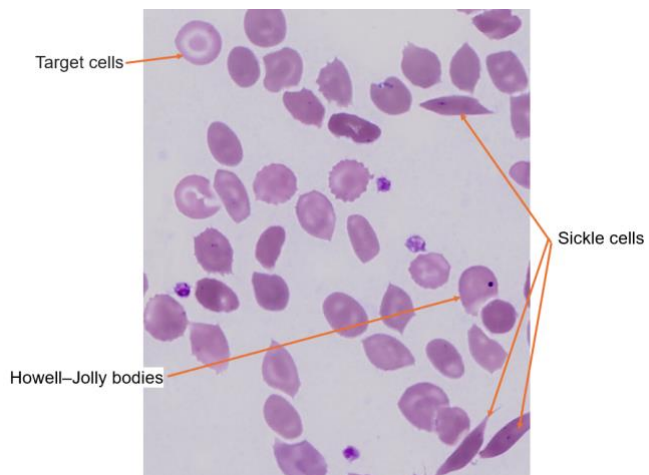
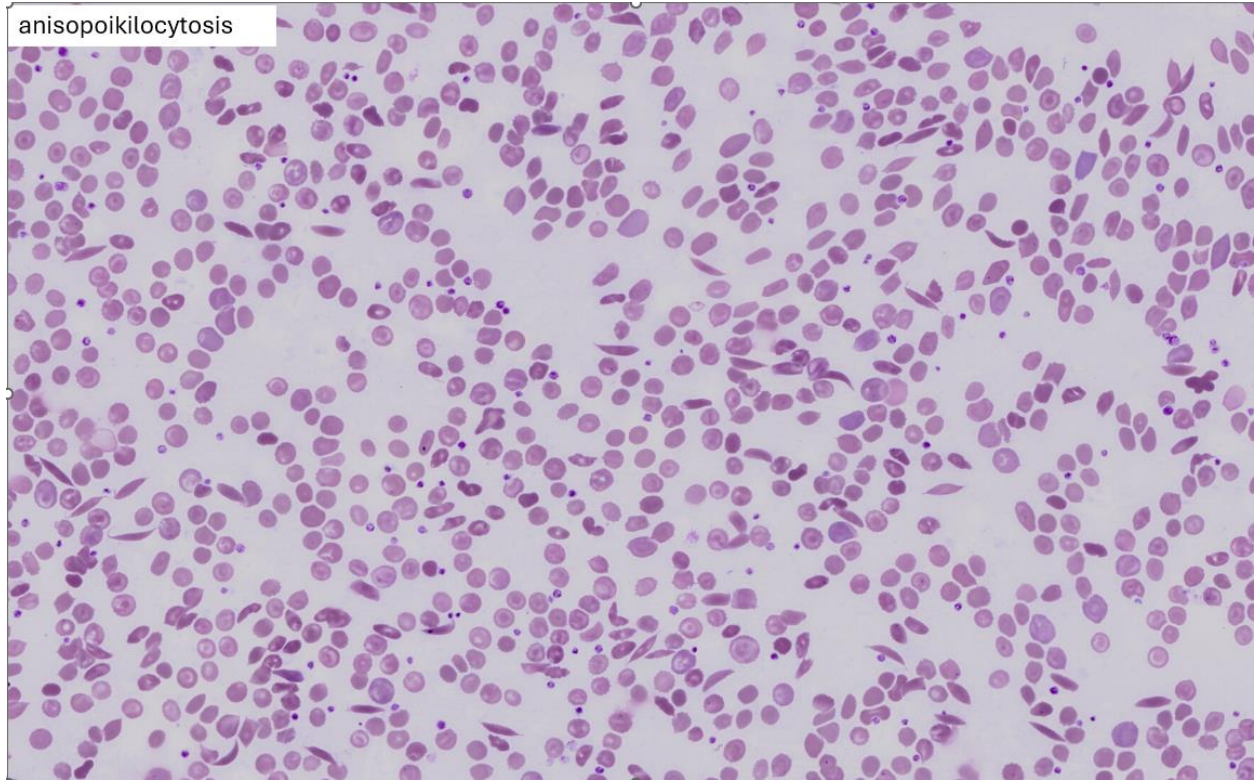
- Sickle cells
- Howell–Jolly bodies
- target cells (Codocytes)
- anisopoikilocytosis

Final interpretation: not normal blood

Diagnosis: Sickle cell disease



Virtual Microscopy Interlaboratory Study 2025-1





Virtual Microscopy Interlaboratory Study 2025-1

7.3 Results of participants

The Table 11 shows the final interpretation and diagnosis of haematologic deviations distribution according to the EQA providers for the survey ILS H2025-1b.

	H2025-1b	Participants with final interpretation and/or diagnosis	Final interpretation	Diagnosis of haematologic deviations	Final interpretation only
1	BP	86	68	86	0
2	CROQALM	159	144	128	31
3	CSCQ	84	75	82	2
4	CTCB	61	44	60	1
5	EQUALIS	9	7	9	0
6	IEQAS	2	1	2	0
7	ÖQUASTA	41	35	41	0
8	PNAEQ	17	14	17	0
9	PNCQ	43	39	42	1
10	QC	36	34	36	0
11	VEQ-CR	180	153	180	0
Total	Total	718	614	683	35

Table 11. Distribution of response types – **sample 1b**

7.3.1 WBC Counting

Many laboratories have reported counts that are very far from 100%, even when considering the other types of cells that they have incorrectly identified (blasts, etc.). We are considering improving the input system to block validation if the count is not equal to 100.

The medians of participants are listed in table 12 These medians are comparable to those of experts. This count did not present any particular difficulty.



Virtual Microscopy Interlaboratory Study 2025-1

Participants Median* (%)	
Neutrophils	49
Eosinophils	2
Basophils	0
Lymphocytes	36
Monocytes	11

Table 12. participant’s median for blood smear 1-b

The graphical representation of the data after outlier’s elimination is shown in Appendix I.

The number of results returned for **lymphocytes** is lower than the number of results for neutrophils because **some participants classified them elsewhere** (blasts, lymphoplasmocytes, etc.).

322 laboratories reported the presence of erythroblasts at a rate of **between 1 and 8%** (median 2%). However, **372 did not see erythroblasts**. This distribution of responses is consistent with the responses of the experts.

Descriptive statistics are presented in Figures 8, 9, 10 and 11.

Neutrophils -1b	N	Min	Max	Mediane	MAD	MADe	Med-5MADe	Med+5MADe
Before outlier’s elimination	694	23	92	49	4	5.9304	19.348	78.652
After outlier’s elimination	691	23	74	49	4	5.9304	19.348	78.652

Figure 8. Statistical analysis on neutrophils results – Sample 1a

Eosinophils -1b	N	Min	Max	Mediane	MAD	MADe	Med-5MADe	Med+5MADe
Before outlier’s elimination	694	0	46	2	1	1.4826	-5.413	9.413
After outlier’s elimination	691	0	9	2	1	1.4826	-5.413	9.413

Figure 9. Statistical analysis on eosinophils results – Sample 1a



Virtual Microscopy Interlaboratory Study 2025-1

Lymphocytes -1b	N	Min	Max	Mediane	MAD	MADe	Med-5MADe	Med+5MADe
Before outlier's elimination	677	10	88	36	4	5.9304	6.348	65.652
After outlier's elimination	675	10	60	36	4	5.9304	6.348	65.652

Figure 10. Statistical analysis on lymphocytes results – Sample 1a

Monocytes -1b	N	Min	Max	Mediane	MAD	MADe	Med-5MADe	Med+5MADe
Before outlier's elimination	694	0	43	11	3	4.4478	-11.239	33.239
After outlier's elimination	690	0	28	11	3	4.4478	-11.239	33.239

Figure 11. Statistical analysis on monocytes results – Sample 1a

7.3.2 Morphological characteristics

Regarding the characteristics corresponding to the assigned value:

- **93% of participants reported sickle cells.**
- 64% of participants reported target cells
- 35% of participants reported Anisocytosis
- 32% of participants reported Poikilocytosis
- **20% of participants reported Howell-Jolly bodies**

We asked the laboratories to select only the three most important characteristics in terms of diagnostic guidance. Some participants deviated from this rule and submitted more (15 laboratories submitted the five characteristics cited by the experts). The choice should have focused on sickle cells and Howell-Jolly bodies but only 20% of participants reported this morphological anomaly that indicates poor spleen function. **Is there a failure to recognize Howell-Jolly bodies? It seems that there is a need for training.**

Numerous other comments were made. They are listed in the tables in Appendix III.

7.3.3 Final interpretation

The rate of correct answers is good: 97% of participants concluded “not normal blood” (Table 13).

Input errors are suspected: among the seven ‘normal blood’ responses, four participants suggested a pathological diagnosis (3 sickle cell disease and 1 hairy cell leukaemia.)



Virtual Microscopy Interlaboratory Study 2025-1

1b - Interpretation	
Not Normal Blood	594 (97%)
Normal Blood	7
No interpretation	13
<i>Total</i>	<i>614</i>

Table 13. Final interpretation given by the participants

7.3.4 Diagnosis

92% of participants correctly diagnosed sickle cell disease and **96% mentioned haemoglobinopathy** (Table 14), 7 participants mentioned a hereditary hemolytic anemia. Two participants appear to have reversed the results with sample 1a (hairy cell leukaemia).

66 participants noted the presence of sickle cell for the morphological characteristics without giving the expected diagnosis. 3 of these participants signified that the diagnosis is not in the proposed list and **35 of them gave a different diagnosis:**

- 12 Hemoglobinopathy (unspecified)
- 14 Thalassemia
- 6 hereditary hemolytic anemias
- 1 Autoimmune hemolytic anemia
- 1 malaria
- 1 Whooping cough

The question is **why did participants who saw sickle cells fail to make a diagnosis or make an approximate or incorrect diagnosis?** We can suspect data entry errors in some cases, or non-responses or vague responses for fear of making mistakes (have we emphasized the educational aspect of this study enough?). It is also possible that the diagnosis is never requested in the programs of some EQA providers and that this has confused them. Indeed, **21 of the 28 non-responses to the diagnosis come from the same EQA provider.**



Virtual Microscopy Interlaboratory Study 2025-1

Assigned value = Sickle cell disease	
Proposed diagnostic	n Lab
Hemoglobinopathy	
Sickle cell disease	626 (92%)
Hemoglobinopathy (unspecified)	18
Heterozygous thalassemia	13
Homozygous thalassemia	3
Other red cells pathologies	
Other hereditary hemolytic anemias	7
Mechanical hemolytic anemia (schizocytic)	1
Hereditary spherocytosis	1
Hereditary elliptocytosis	1
Autoimmune hemolytic anemia	1
Acanthocytosis	1
abnormalities related to a microbial infection	
Malaria	2
Haemolytic-uraemic syndrome	1
Reactive lymphocytosis	1
Whooping cough	1
No diagnosis	
Proposed diagnosis not on the list	3
Leukaemia	
Hairy-cell leukaemia	2
Atypical chronic myeloid leukemia	1
Total of participants	683

Table 14. Diagnosis given by participants for blood smear 1b

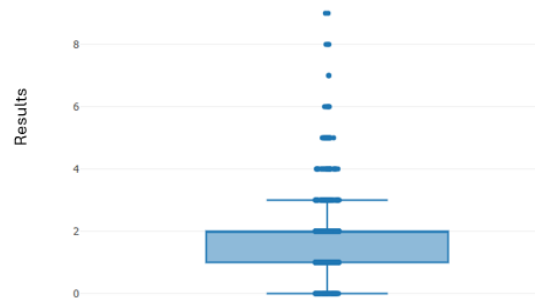
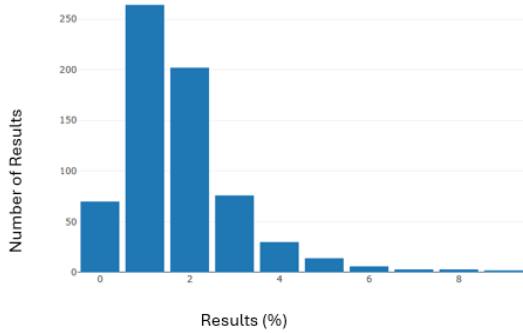


Virtual Microscopy Interlaboratory Study 2025-1

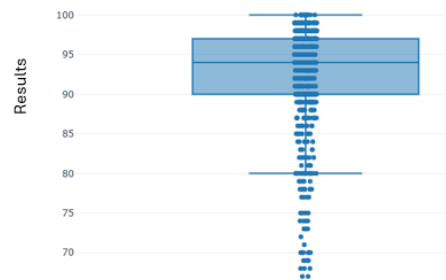
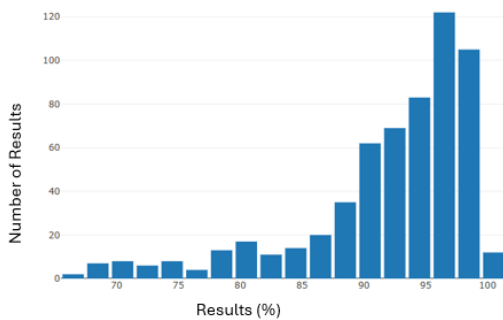
Appendix I – CBC counting - graphical representation of results after elimination of outliers

Sample 1a

Neutrophils -1a



Hairy cells/Villous lymphocytes-1a

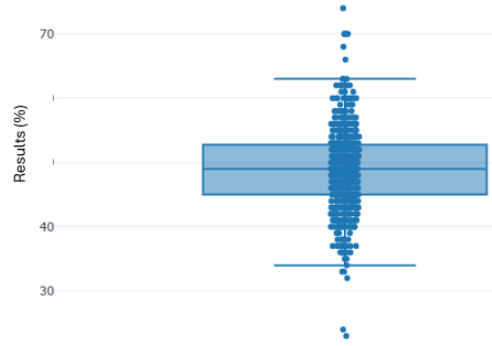
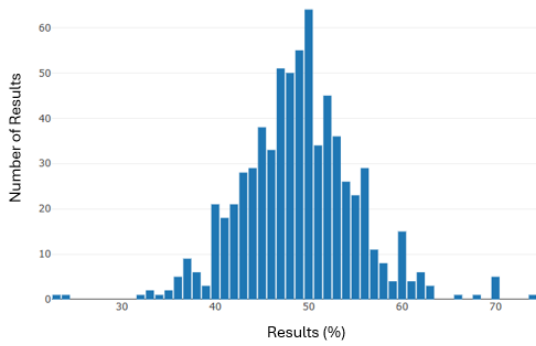




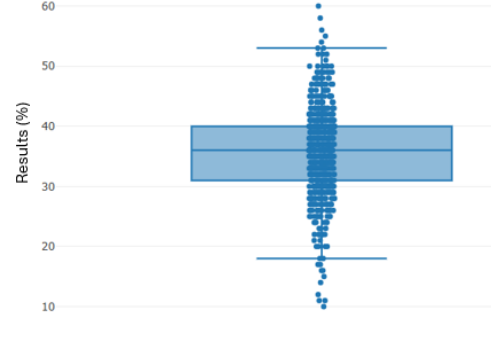
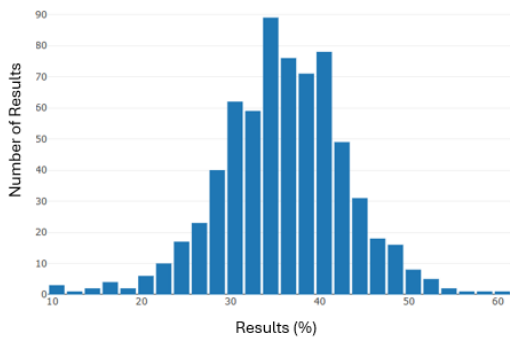
Virtual Microscopy Interlaboratory Study 2025-1

Sample 1b

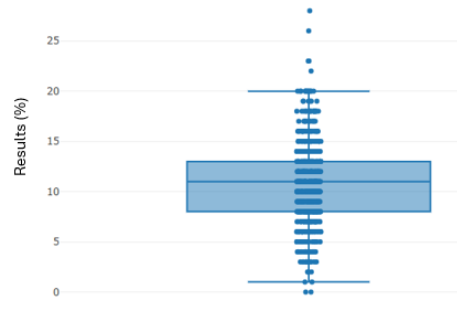
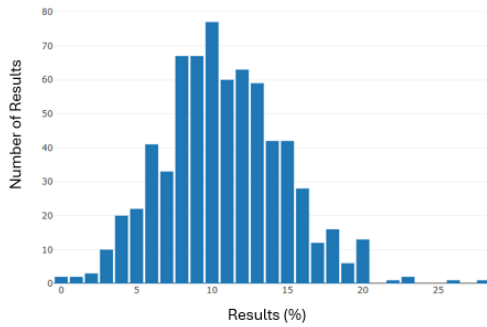
Neutrophils -1b



lymphocytes -1b



Monocytes -1b





Virtual Microscopy Interlaboratory Study 2025-1

Appendix II – Morphological characteristics selected for the survey ILS H2025-1a

Morphological parameter : red cells	Number of selections
Anisocytosis 4.1.	484
Poikilocytosis 4.1.	293
Schistocyte 4.1.	171
Howell-Jolly bodies 4.1.	169
Hypochromic 4.1.	130
Target cell 4.1.	109
Normal general RBC morphology 4.2.	71
Anisochromia 4.1.	48
Acanthocyte (spur cell) 4.1.	42
Polychromasia 4.1.	40
Macrocyte 4.1.	38
Microcyte 4.1.	28
Tear drop cell (dacriocyte) 4.1.	26
Elliptocyte 4.1.	19
Ovalocyte 4.1.	18
Spherocyte 4.1.	14
Echinocyte (burr cell) 4.1.	12
Bite cell 4.1.	12
Stomatocyte (mouth cell) 4.1.	10
Pappenheimer bodies 4.1.	9
Basophilic stippling/punctate basophilia 4.1.	7
Sickle cell (drepanocyte) 4.1.	4
Dimorphic/double population 4.1.	4
Hyperchromia 4.1.	4
Heinz bodies 4.1.	2



Virtual Microscopy Interlaboratory Study 2025-1

Morphological parameter : WBC	Number of selections
Hairy cell 3.1.	563
Atypical lymphocyte 3.1.	191
Villous lymphocyte 3.1.	128
Gumprecht nuclear shadow (smear/smudge cell) 3.1.	112
Monomorphic lymphocytosis 3.1.	39
Banded neutrophils 3.2.	27
Toxic granulations 3.2.	18
Reactive lymphocyte 3.1.	16
Normal general WBC morphology 3.4.	14
Centrocyte 3.1.	9
Polymorphic lymphocytosis 3.1.	8
Sézary cell 3.1.	6
Pleomorphic lymphocyte 3.1.	5
Large granular lymphocyte (LGL) 3.1.	4
Lymphoplasmocyte 3.1.	4
Pelger-Hüet anomaly (hypossegmented neutrophil) 3.2.	3
Hypogranular neutrophil 3.2.	3
Atypical plasma cell 3.1.	2
Auer rod (myeloblast) 3.3.	2
Cytoplasmic inclusions 3.1.	1
Lymphocytes agglutination 3.1.	1
Hypersegmented neutrophils 3.2.	1

Morphological parameter : Platelets	Number of selections
Thrombocytopenia 5.1.	362
Normal general platelet morphology 5.2.	269
Platelet anisocytosis 5.1.	118
Giant platelet 5.1.	53
Hypogranular platelet 5.1.	20
Micromegakaryocyte 5.1.	5
Thrombocytosis 5.1.	4
Megakaryocyte nuclei 5.1.	1
Platelet aggregates 5.1.	1



Virtual Microscopy Interlaboratory Study 2025-1

Appendix III – Morphological characteristics selected for the survey ILS H2025-1b

Morphological parameter : red cells	Number of selections
Sickle cell (drepanocyte) 4.1.	683
Target cell 4.1.	466
Anisocytosis 4.1.	259
Poikilocytosis 4.1.	233
Polychromasia 4.1.	170
Howell-Jolly bodies 4.1.	148
Echinocyte (burr cell) 4.1.	47
Hypochromic 4.1.	31
Schistocyte 4.1.	31
Anisochromia 4.1.	27
Pappenheimer bodies 4.1.	24
Acanthocyte (spur cell) 4.1.	22
Spherocyte 4.1.	16
Elliptocyte 4.1.	14
Macrocyte 4.1.	11
Tear drop cell (dacriocyte) 4.1.	11
Basophilic stippling/punctate basophilia 4.1.	11
Hyperchromia 4.1.	9
Microcyte 4.1.	8
Ovalocyte 4.1.	8
Dimorphic/double population 4.1.	6
Stomatocyte (mouth cell) 4.1.	4
Heinz bodies 4.1.	4
Bite cell 4.1.	3
Normal general RBC morphology 4.2.	3
Cabot rings 4.1.	2



Virtual Microscopy Interlaboratory Study 2025-1

Morphological parameter : WBC	Number of selections
Normal general WBC morphology 3.4.	417
Toxic granulations 3.2.	203
Reactive lymphocyte 3.1.	116
Large granular lymphocyte (LGL) 3.1.	72
Atypical lymphocyte 3.1.	56
Banded neutrophils 3.2.	44
Vacuoles 3.2.	40
Gumprecht nuclear shadow (smear/smudge cell) 3.1.	37
Stimulated lymphocyte (hyperbasophil) 3.1.	22
Polymorphic lymphocytosis 3.1.	15
Hypersegmented neutrophils 3.2.	14
Cytoplasmic inclusions 3.1.	9
Pleomorphic lymphocyte 3.1.	7
Pelger-Huet anomaly (hyposegmented neutrophil) 3.2.	7
Döhle bodies 3.2.	7
Villous lymphocyte 3.1.	5
Hairy cell 3.1.	5
Monomorphic lymphocytosis 3.1.	5
Hypogranular neutrophil 3.2.	3
Lymphoplasmocyte 3.1.	2
Atypical plasma cell 3.1.	1
Auer rod (myeloblast) 3.3.	1

Morphological parameter : Platelets	Number of selections
Giant platelet 5.1.	411
Platelet anisocytosis 5.1.	329
Thrombocytosis 5.1.	241
Normal general platelet morphology 5.2.	148
Micromegakaryocyte 5.1.	12
Megakaryocyte nuclei 5.1.	12
Platelet aggregates 5.1.	6
Thrombocytopenia 5.1.	4
Hypogranular platelet 5.1.	3
Grey platelets 5.1.	1