The Automated Hematology Analyzer, the Pentra 80

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Abstract

Hematology diagnostics is growing increasingly important as one of the most fundamental types of clinical testing. ABX-Horiba group has been developing and marketing a variety of hematology analyzers based on the key concept of providing "Quick, easy and precise testing". The Pentra 80 is a compact, high-precision CBC + 5-DIFF automatic blood analyzer. The author describe the measurement principles and features, such as the DHSS™ and MDSS™ , and also, present some typical data that show the high performance of this instrument.

1 Introduction

One strong trend outlines the high-end segment of hematology analyzers : the enhanced productivity for the laboratory. The Pentra 80 (Fig.1) is the latest addition to the ABX hematology range of instruments. This automatic CBC + 5-DIFF analyzer is designed to meet the needs of a very wide range of laboratories processing anything from 50 samples/day to 350 samples/day. Although very compact, Pentra 80 includes an automatic sample analyzer (processing up to 80 samples/hour), as well as a workstation managing all the laboratory's hematology workload. With its innovative touch-screen monitor and interactive software, Pentra 80 is particularly user-friendly.

Fig.1   The Automated Hematology Analyzer Pentra 80.

2 Measurement Principles

The ABX Pentra 80 uses the most referenced and complementary ones : impedance for CBC, impedance with cytochemistry (Eosinofix containing the active principle of Sudan black B, and Basolyse) and light absorbance measurement for 5DIFF.

The Pentra 80 has benefited from ABX's wide experience in blood analysis, and includes patented technologies such as Multi-Distribution Sampling System (MDSS™) and Double Hydrodynamic Sampling System (DHSS™) .

2.1 MDSS™ Micro Sampling Technology

The Pentra 80 uses ABX's unique MDSS technology (Fig.2). This technology makes it possible for the product to take in only the minimum amount of sample required for each measurement, and then perform accurate measurements using minimum sample volume. This blood sample is then split in different aliquots within the needle and distributed directly to all specific chambers for the appropriate dilutions.
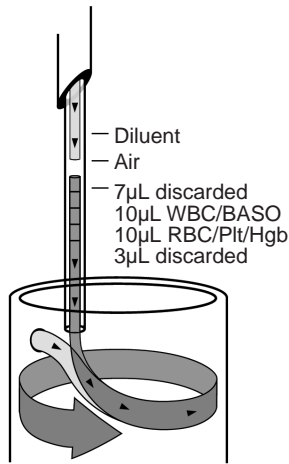
Pretreatment of a sample as follows:
* Sampling : only 53μL whole blood for CBC and DIFF.
* Sample aliquot taken, transferred to analysis chambers. Pre-heated analysis chambers for highly reproducible result.
* Tangential flow reagent dilution for optimal homogenization.

Fig.2   Multi-Distribution Sampling System.

2.2 DHSS™ Technology

The DHSS™ Technology (Fig.3) is ABX's original technology that combines the focused flow impedance method, light absorbance measurement and cytochemistry to measure the cell volume and cellular content in one unique flow cell.
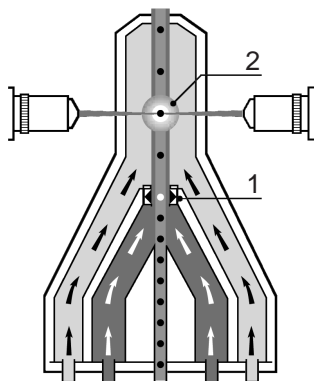
(1) Cytochemistry
The whole blood sample is incubated in a temperature-controlled chamber and enzymatic staining with Chlorazol Black. This reagent specifically stains leukocyte nuclei, granules and membranes.

(2) Cytometry
And the prepared sample is injected into a double hydrofocus cytometer (ABX patent) and analysis of cell complexity with a polychromatic light source.

Fig.3   Double Hydrodynamic Sampling System.

3 Specifications

Improving diagnosis quality and laboratory productivity is a constraint shared by all biologists world-wide. The Pentra 80 is designed to meet these requirements with highly innovative technical specifications.

(1) Measurement parameter & Result processing

The Pentra 80 can measure the complete blood-cell count and differential leukocyte count with 26 parameters. And provide affluent result processing functions (Fig.4).
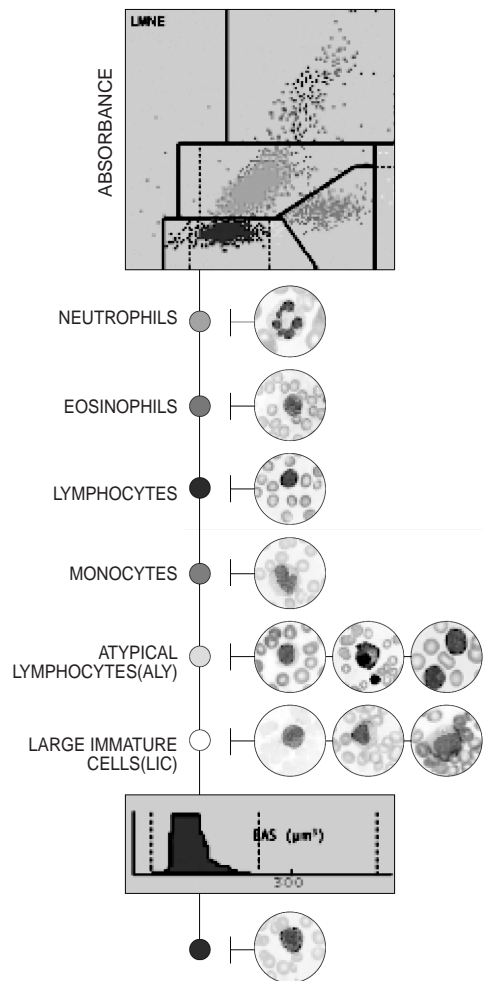
· 26 parameters.
· Histogram of RBC, WBC, PLT.
· Color leukocyte matrix.
· Pathological and morphological alarms.
· Differential leukocyte count by DHSS technology.
· Basophil measurement through specific channel.
· Percentage and absolute value of neutrophils, eosinophils, basophils, lymphocytes and monocytes.
· Determination of 2 additional sub-populations (% and #): Atypical lymphocytes (ALY), Large immature cells (LIC).

Fig.4   Results.

(2) Operability

The Pentra 80 provide high laboratory productivity with user orientated design.

· 80 samples/hour + continuous loading
>>>> Ideal for workloads up to 350 samples/day

· 10-rack capacity (100 tubes) + automatic rerun of abnormal samples
>>>> Immediate testing of pathologic samples without manual reloading.

· Microsampling of 30µL (CBC) or 53µL (CBC + DIFF) in automatic or manual mode
>>> Exceptional results with all sample types, even very small volumes (Pediatrics, Oncology, etc.)

· Can analyse platelet counts up to 5 million/mm³ (Platelets concentrate mode) without predilution
>>> Ideal for Blood Collection Centers and Blood Banks.

· End-over-end rotation of tubes before sampling
>>> Homogenization of samples using reference method.

· Reads barcodes on racks and tubes
>>> 100% accurate sample identification.

4	Internal Evaluation

We have confirmed high performance of the Pentra 80 by following two ways.

4.1 CBC on the Pentra 80 compared to the Pentra 120

An evaluation was conducted to compare the imprecision, carry-over, linearity and accuracy of the CBC parameters on the ABX Pentra 80 and the ABX Pentra 120 hematology cell counter. A data set of 208 samples was collected during the evaluation.

The analytical performances of the ABX Pentra 80 are comparable to the current top-end segment hematology analyzers, Pentra 120. In particular, linearity extension up to 5,000,000 /µl in the platelet concentrate mode high precision standard (very low coefficients of variation in all CBC parameters) (Table 1-a), and excellent accuracy (as demonstrated by the side-by-side comparison with the ABX hematology analyzer, the ABX Pentra 120, with R^2 values mostly higher than 0.95) indicators of the very high analytical quality of the ABX Pentra 80 (Table 1-b).

The results of this evaluation indicate that the Pentra 80 can provide CBC parameters results with accuracy and precision.

Parameter	Linearity range
WBC	400 - 120,000/mm³
RBC	300,000 - 800,000/mm³
HGB	1,30 - 24g/dl
HCT	2 - 67%
PLT in whole blood in platelet concentrate	 10,000 - 1,900,000/mm³ 15,000 - 5,000,000/mm³

Table1 a) The linearity range of the Pentra 80 CBC parameter.

n=208	WBC	RBC	HGB	HCT	MCV	MCH	PLT
Range	1,490 -47,050	1,49 -5,68	5,69 -17,52	15,84 -51,47	62 -108,5	20,11 -38,7	23 -770
R²	0,99	0,99	0,99	0,97	0,95	0,96	0,98

Table1 b) Ranges and coefficients of correlation of th main CBC parameters for the 208 samples.

4.2 Leukocyte Differential Comparison of Pentra 80 to the Manual Slide Review

An evaluation was conducted to compare the performance of the leukocyte differential on the Pentra 80 to the manual slide review with 400 cell differential count.

Correlation Studies between Pentra 80 5part DIFF parameters and the microscope examination display excellent coefficients of correlation for neutrophils (R >0,95) and lymphocytes (R>0,95) as shown in Fig.5-a and Fig.5-b respectively.
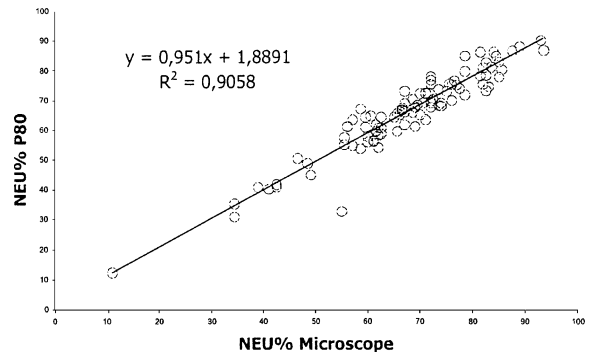

Fig.5 a) Accuracy of the Pentra 80 Leukocyte, Formulae of the regression lines with the corresponding coefficients of determination for Neutrophils.
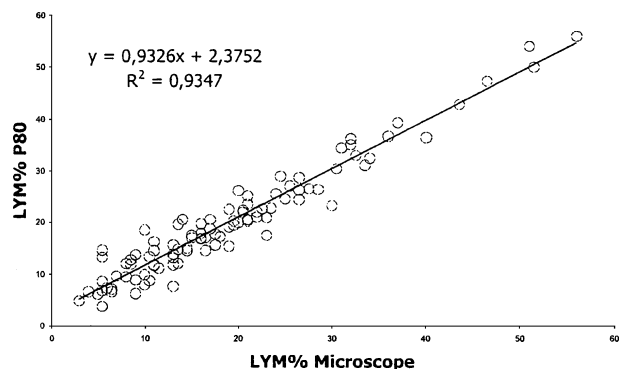

Fig.5 b) Accuracy of the Pentra 80 Leukocyte, Formulae of the regression lines with the corresponding coefficients of determination for Lymphocytes.

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The results indicate that the Pentra 80 can competently identify leukocyte subpopulations and morphological abnormalities. This confirms that the ABX Pentra 80 is a reliable and capable hematology analyzer.

5 | Conclusion

The compact Pentra 80 hematology analyzer can provide five-part differential white blood cell analysis, contributing to the utilization of real-time testing.

Furthermore, with micro-sampling and quiet operation, these products have been designed not only for clinicians, but with the patient's quality of life in mind as well. We hope that this product will continue to make further contributions to the field of medical treatment.

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