510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY
ASSAY AND INSTRUMENT COMBINATION TEMPLATE

A. 510(k) Number: K081930 Abbreviated

B. Purpose for Submission: New hematology analyzer

C. Measurand: CBC, 5-part differential, NRBC, Reticulocyte, RBCs and TNCs in body fluids.

D. Type of Test: Quantitative

E. Applicant: Beckman Coulter, Inc.

F. Proprietary and Established Names:

- Proprietary Name: UniCel® DxH 800 Coulter® Cellular Analysis System
- Established Name: Automated Differential Cell Counter

G. Regulatory Information:

1. Regulation section: 21 CFR 864.5220

2. Classification: Class II

3. Product code: GKZ

4. Panel: Hematology (81)

H. Intended Use:

1. Intended use(s):

   The UniCel® DxH 800 Analyzer is a quantitative, automated hematology analyzer for *in vitro* diagnostic use in screening patient populations found in clinical laboratories. The UniCel® DxH 800 Analyzer provides:

   - A Complete Blood Count (CBC), Leukocyte 5 Part Differential (Diff), Reticulocyte (Retic) and Nucleated Red Blood Cell (NRBC) on whole blood
   - A Total Nucleated Count (TNC) and Red Cell Count (RBC) on Body Fluids (cerebrospinal, serous, and synovial) (BF)

2. Indication(s) for use: same as the Intended use

3. Special conditions for use statement(s): N/A

4. Special instrument requirements: N/A

I. Device Description:

The UniCel® DxH 800 Coulter® Cellular Analysis System is comprised of the analyzer and a suit of analytical reagents that allow for simultaneous quantitative determination of hematological parameters. The system provides automated CBC, leukocyte 5-part differential, reticulocyte analysis, NRBC enumeration, and RBCs and TNCs enumeration in body fluid. The purpose of the DxH 800 analyzer is to separate the normal patient, with all normal system-generated parameters, from patient who needs additional studies of any of these parameters.

J. Substantial Equivalence Information:

1. Predicate device name(s):
   - Coulter® LH 750 Hematology Analyzer
   - Coulter® LH 780 Hematology Analyzer

2. Predicate 510(k) number(s):
   - K011342
   - K061616

3. Comparison with predicate:

Similarities			
Item	Device UniCel® DxH 800	Predicate Coulter® LH 780	Predicate Coulter® LH 750
Intended Use	The UniCel® DxH 800 Analyzer is a quantitative, automated hematology analyzer for *in vitro* diagnostic use in screening patient populations found in clinical laboratories. The UniCel® DxH 800 Analyzer provides: - a CBC, Leukocyte 5 Part Diff, Retic, and NRBC on whole blood - a TNC and RBC on Body Fluids	The Coulter LH 780 Hematology Analyzer is a quantitative, automated hematology analyzer and leukocyte differential counter for i*n vitro* diagnostic use in clinical laboratories. The Coulter LH 780 Hematology Analyzer provides automated Retic analysis and enumeration of NRBCs as well as an automated method for enumeration of RBCs and WBCs in body fluids	The Coulter LH 750 Hematology Analyzer is a quantitative, automated hematology analyzer and leukocyte differential counter for i*n vitro* diagnostic use in clinical laboratories. The Coulter LH 750 Hematology Analyzer provides automated Retic analysis and enumeration of NRBCs as well as an automated method for enumeration of RBCs and WBCs in body fluids
Principle of Measurement	- WBC, RBC, MCV, PLT, and TNC: Aperture impedance - HGB: Spectrophotometric	Same as DxH 800	Same as DxH 800
Sample identification	- Automated barcode reading of cassette and sample tube identifier - Manual keyboard entry of sample identifier	Same as DxH 800	Same as DxH 800
Calibrator	Coulter® S-CAL Calibrator kit	Same as DxH 800	Same as DxH 800
Sample types	- Whole blood	- Whole blood	-Whole blood

Similarities			
Item	Device UniCel® DxH 800	Predicate Coulter® LH 780	Predicate Coulter® LH 750
	- BF	- BF	-BF

Differences			
Item	Device UniCel® DxH 800	Predicate Coulter® LH 780	Predicate Coulter® LH 750
Quality Control Techniques	- Daily Instruments Check - Commercial Controls - Delta Checks - Patient Controls - XB Analysis - Inter-laboratory Quality Assurance Program - Extended QC & XM Analysis	Same as DxH 800	Same as LH 780 without Extended QC & XM Analysis
Principle of Measurement	VCSn technology: VCS technology with additional Light Scatter measurements - Diff, Retic: VCSn technology - NRBC: Direct measurement in dedicated channel using VCSn technology	- Diff, Retic: VCS technology using Aperture impedance (DC), Conductivity (RF), Laser Light Scatter - NRBC: Combined used of aperture impedance and VCS technology	Same as LH 780
IVD Parameters	WBC, RBC, HGB, HCT, MCV, MCH, MCHC, RDW, RDW-SD, PLT, MPV, NE%, LY%, MO%, EO%, BA%, NE#, LY#, MO#, EO#, BA#, NRBC%, NRBC#, RET%, RET#, IRF, MRV, TNC in BF	Same as DxH , except TNC is reported as WBC	Same as LH 780 without RDW-SD
Sampling mechanism	- Manual: open and closed - Automated: closed, 5 position cassette, maximum load capacity 20 cassettes	- Manual: open - Automated: closed, 12 position cassette, maximum load 12 cassette	Same as LH 780
Sample aspiration volume	- Automatic, manual, and predilute: 165 µL - Fixed dilution: 1:5	- Automatic: 300 µL - Manual: 200 µL - Predilute: 200 µL – customer defined dilution factor in the range of 1:1 to 1:5	Same as LH 780
Sample identification	Manual barcode scanning of sample tube identifier (single tube station or handheld scanner)	Manual barcode scanning of sample tube identifier (handheld scanner)	Same as LH 780
Quality controls and calibrators	- Coulter® 6C Cell Control - Coulter® Latron CP-X Control - Coulter® Retic-X Cell Control - Coulter® LIN-X Linearity Control - Coulter® Body Fluid Control	- Coulter® 5C Cell Control - Coulter® 5C Latron Primer and Latron Control - Coulter® Retic-C Cell Control - Coulter® LIN-C Linearity Control	Same as LH 780
Service	ProService Remote Diagostics	ProService Remote	Same as LH780

Differences			
Item	Device UniCel® DxH 800	Predicate Coulter® LH 780	Predicate Coulter® LH 750
diagnostics	plus enhanced On-board System diagnostics and system monitoring	Diagnostics	
Throughput	- CBC, CBC/Diff: ≥100 samples per hour - CBC/Diff/NRBC: ≥90 samples per hour - Any cycle with Retic: ≥45 samples per hour	- CBC, CBC/Diff: >110 samples per hour - CBC/Diff/Retic: >45 samples per hour	Same as LH 780
Reagents	- Coulter® DH Diluent - Coulter® DH Diff Pak - Coulter® DH Retic Pak - Coulter® DH Cell Lyse	- Coulter® Isoton Diluent - Coulter® LH Series Pak - Coulter® LH Series Retic Pak - Coulter® Lyse S III Lytic Agent - Coulter® Lyse S 4 Lytic Agent - Coulter® LH Series Diluent	Same as LH 780

K. Standard/Guidance Document Referenced (if applicable):

Class II Special Controls Guidance Document: Premarket Notifications for Automated Differential Cell Counters for Immature or Abnormal Blood Cells; Final Guidance for Industry and FDA

L. Test Principle:

CBC analysis is based on the established Coulter Principle and Hemoglobinometry. The Coulter method counts and sizes cells by detecting and measuring changes in electrical resistance, when a cell suspended in a conductive liquid passes through a small aperture. The system counts the individual cells and provides cell size distribution. Hemoglobin is measured photometrically at 525 nm.

The DxH 800 housed a flow cell in a Multi Transducer Module which produced three measurement signals: volume, conductivity, and light scatter. Differential, NRBC, and Reticulocyte analysis is based on the VCSn technology using Aperture Impedance, Conductivity, Laser Light Scatter (multiple angles). In the flow cell, a direct current measures cell volume, high-frequency current senses cellular content, light scatter characterizes the size and refractivity of the cells.

M. Performance Characteristics (if/when applicable):

1. Analytical performance:

   a. Precision/Reproducibility: Precision study was performed in accordance with CLSI

EP05-A2, Evaluation of Precision Performance of Quantitative Measurement Methods. Acceptance criteria were met as defined in the performance specifications described in the Instructions for Use.

b. Linearity/assay reportable range: Linearity study was performed in accordance with Class II Special Controls Guidance Document: Premarket Notifications for Automated Differential Cell Counters for Immature or Abnormal Blood Cells; Final Guidance for Industry and FDA. Linearity was performed on whole blood (WBC, RBC, HGB, and PLT), Body Fluid (WBC and RBC). All results met specifications as described in the Instructions for Use.

c. Traceability, Stability, Expected values (controls, calibrators, or methods): N/A

d. Detection limit: N/A

e. Analytical specificity: N/A

f. Assay cut-off: N/A

2. Comparison studies:

a. Method comparison with predicate device: Normal and clinical samples were analyzed on the test instruments and compared against predicate devices or reference methodologies. Specimens giving non-numeric results and system alarms were excluded from the data analysis. Accuracy testing was performed in accordance with:

- CLSI H20-A2, Reference Leukocytes Differential Count (Proportional) and Evaluation of Instrumental Methods. Approved Standard.
- CLSI EP9-A, Method Comparison and Bias Estimation Using Patient Samples; Approved Guideline

Accuracy was performed on whole blood for CBC, Differential, Reticulocyte, NRBC parameters, and on Body Fluids for TNC and RBC count. Acceptance criteria were met as defined in the performance specifications described in the Instructions for Use.

b. Matrix comparison:

- A comparison of the performance of venous whole blood and capillary whole blood specimens was performed. Test results are as follows:

				95% Confidence Limits			95% Confidence Limits		Mean		
Parameter	n	Correlation	Intercept	Lower	Upper	Slope	Lower	Upper	Venous	Capillary	Units
WBC	29	0.963	0.573	-0.12	1.27	0.978	0.87	1.09	6.28	6.71	x10^3/uL
RBC	29	0.940	0.324	-0.34	0.99	0.972	0.83	1.11	4.75	4.94	x10^6/uL
HGB	29	0.917	1.849	-0.39	4.08	0.908	0.75	1.06	14.26	14.80	g/dL
MCV	29	0.994	-0.852	-4.74	3.03	0.995	0.95	1.04	87.43	86.15	fL
PLT	29	0.936	-34.627	-73.77	4.51	1.047	0.89	1.20	247.37	224.48	x10^3/uL
MPV	29	0.944	1.478	0.41	2.54	0.891	0.77	1.01	8.59	9.13	fL
RDW	29	0.960	-0.169	-1.71	1.37	1.010	0.89	1.13	13.27	13.23	CV%
RDW-SD	29	0.964	-5.252	-10.17	-0.33	1.113	0.99	1.23	40.72	40.05	fL
NE%	25	0.978	0.995	-3.91	5.90	0.966	0.88	1.05	56.65	55.58	%
LY%	25	0.974	1.488	-1.52	4.50	0.968	0.87	1.06	30.75	31.46	%
MO%	25	0.949	1.573	0.52	2.63	0.864	0.75	0.98	9.11	9.38	%
EO%	25	0.979	0.039	-0.21	0.29	0.992	0.91	1.07	2.78	2.81	%
BA%	25	0.333	0.551	0.28	0.82	0.309	-0.05	0.66	0.70	0.77	%
NRBC%	27	0.567	0.045	-0.04	0.13	0.30	-0.23	1.24	0.10	0.09	%
RET%	25	0.954	0.078	-0.09	0.25	0.856	0.74	0.97	1.44	1.34	%
MRV	28	0.898	24.299	7.69	40.90	0.784	0.63	0.94	107.13	108.29	fL
IRF	28	0.790	0.078	-0.01	0.17	0.831	0.57	1.09	0.34	0.36	N/A

- A comparison of the performance of whole blood and pre-dilute specimens was performed. Pre-dilute mode provides only CBC results. Test results are as follows:

				95% Confidence Limits			95% Confidence Limits		Mean		
Parameter	n	Correlation	Intercept	Lower	Upper	Slope	Lower	Upper	Whole Blood	Pre-Dilute	Units
WBC	57	0.999	-0.341	-0.60	-0.08	1.079	1.07	1.09	14.856	15.690	x10^3/uL
RBC	57	0.999	-0.010	-0.06	0.05	1.043	1.03	1.06	3.67	3.82	x10^6/uL
HGB	57	0.999	0.165	0.03	0.30	1.041	0.01	1.03	10.95	11.57	g/dL
MCV	57	0.996	-2.686	-4.87	-0.50	1.004	0.98	1.03	90.42	88.11	fL
PLT	57	0.998	3.127	-3.39	9.64	1.003	0.99	1.02	281.69	285.70	x10^3/uL
MPV	57	0.940	0.349	-0.43	1.12	0.924	0.83	1.01	8.47	8.18	fL
RDW	57	0.995	-0.625	-1.08	-0.17	1.005	0.98	1.03	16.86	16.31	CV%
RDW-SD	57	0.991	-1.054	-2.90	0.79	0.964	0.93	1.00	52.38	49.44	fL

3. Clinical studies:

   a. *Clinical Sensitivity:* Analysis of normal and clinical samples was performed for internal validation.

   b. *Clinical specificity:* Analysis of normal and clinical samples was performed for internal validation.

   c. *Other clinical supportive data (when a. and b. are not applicable):* N/A

4. Clinical cut-off: N/A

5. Expected values/Reference range:

   Reference range was established in accordance with CLSI C28-A2, How to Define and Determine Reference Intervals in the Clinical Laboratory, Approved Guideline. Whole blood samples were collected from 273 donors (133 males and 140 females) from the Beckman Coulter blood donor program. Reference intervals for each parameter were calculated using 95% confidence limits. Reference intervals for Overall, Male, and Female were listed in the Instructions for Use.

N. Instrument Name: UniCel® DxH 800 Coulter® Cellular Analysis System

O. System Descriptions:

1. Modes of Operation:

   - Single tube station: open and closed vial sampling for whole blood and body fluid, open vial sampling for pre-dilute whole blood:
   - Automated cassette: closed vial sampling for whole blood

2. Software:

   FDA has reviewed applicant's Hazard Analysis and software development processes for this line of product types:

   Yes __X__ or No ____

3. Specimen Identification: Barcode and manual key board entry

4. Specimen Sampling and Handling: Open tube, pierced cap

5. Calibration: Coulter commercial calibrator, whole blood

6. Quality Control: Coulter commercial control materials

P. Other Supportive Instrument Performance Characteristics Data Not Covered In The "Performance Characteristics" Section above:

1. Whole blood sample age and storage: Two sets of specimens from donors were collected. For each specimen tested, a set of sample tubes was stored at controlled room temperature (18-26º C) and another set was stored refrigerated (2-8º C).

   Room temperature samples were analyzed at t = 1.5, 8, 16, 24, and 32 hours. Refrigerated samples were analyzed at t = 1.5, 8, 16, 24, 32, 48, 56, 64, and 72 hours. Reticulocyte parameter was analyzed up to 72 hours, NRBC parameter to 24 hours, using t=1.5 room temperature as reference. WBC differential flagging ability was evaluated on the specimens up to 32 hours at room temperature and 72 hours refrigerated.

Donor samples are stable up to:

- 24 hours at room temperature and 48 hours at refrigerated temperature for WBC, RBC, HGB, MCV, RDW%, RDW-SD, PLT, MPV, NE%, LY%, MO%, EO%, BA%
- 24 hours at room temperature and refrigerated temperature for NRBC%
- 24 hours at room temperature and 72 hours at refrigerated temperature for RET%, MRVfL, and IRF

2. Sample stability on pre-dilute whole blood: Specimens collected from donors were stored at controlled room temperature (18-26º C) and tested at t = 0, 15, 30, 45, and 60 minutes after dilution to verify pre-diluted sample stability. The pre-dilute samples are stable up to one hour as specified in the Instructions for Use.

3. Sample storage on body fluid: Per established literature, the Instruction for Use recommends that the body fluid samples should be stored at room temperature and analyzed within one hour of collection.

4. Carryover study:

   a. Whole blood CBC (WBC, RBC, HGB, and PLT), Diff, and Retic: carryover was determined by analyzing three normal whole blood samples, followed by 3 diluent samples.

   b. Body Fluid: carryover was evaluated by analysis of a normal blood followed by a diluent sample analyzed as a body fluid. Carryover is assessed by achieving background count on the diluent.

   The results for whole blood and body fluid met the acceptance criteria as stated in the specification in the Instructions for Use.

5. Mode to mode comparison study: Twenty five specimens collected from normal donors were analyzed as closed vial and open vial specimens. The results are follows:

				95% Confidence Limits			95% Confidence Limits		Mean		
Parameter	n	Correlation	Intercept	Lower	Upper	Slope	Lower	Upper	Closed Vial	Open Vial	Units
WBC	25	0.9982	0.135	-0.04	0.30	0.974	0.95	1.00	6.435	6.404	x10^3/uL
RBC	25	0.9936	0.136	-0.10	0.37	0.973	0.93	1.02	4.83	4.84	x10^6/uL
HGB	25	0.9912	1.213	-0.22	0.65	0.985	0.95	1.02	13.72	13.73	g/dL
Hct	25	0.9882	0.810	-1.89	3.51	0.980	0.91	1.05	41.14	41.15	%
MCV	25	0.9927	2.152	-2.22	6.52	0.974	0.92	1.03	85.29	85.22	fL
MCH	25	0.9863	1.166	-0.80	3.13	0.959	0.89	1.03	28.46	28.45	Pg
MCHC	25	0.8949	1.929	4.83	8.69	0.943	0.74	1.15	33.35	33.38	g/dL
PLT	25	0.9906	-0.288	-16.56	16.11	1.011	0.95	1.07	265.03	267.81	x10^3/uL
MPV	25	0.9913	0.671	0.22	1.12	0.919	0.87	0.97	8.53	8.51	fL
RDW	25	0.9344	1.568	-0.43	3.57	0.879	0.73	1.02	13.82	13.72	CV%
RDW-SD	25	0.8766	10.782	3.58	17.99	0.731	0.56	0.90	41.58	41.16	fL
Neut %	25	0.9877	-0.837	-4.97	3.30	1.019	0.95	1.09	59.27	59.53	%
Lymph %	25	0.9809	-1.013	-3.67	1.65	1.031	0.94	1.12	29.54	29.44	%
Mono %	25	0.8794	0.530	-1.24	2.30	0.923	0.71	1.14	8.02	7.93	%
Eos %	25	0.9756	-0.073	-0.37	0.22	1.022	0.92	1.12	2.49	2.48	%

Baso %	25	0.7909	0.080	-0.11	0.27	0.796	0.53	1.06	0.68	0.62	%
NRBC %	25	0.8899	0.017	-0.02	0.05	0.752	0.59	0.92	0.15	0.13	%
Retic %	25	0.9112	0.187	-0.04	0.42	0.849	0.68	1.01	1.35	1.33	%
MRV	25	0.9584	-0.467	-14.0	13.07	1.009	0.06	0.88	104.32	104.75	fL
IRF	25	0.8569	0.069	-0.01	0.59	0.801	0.59	1.01	0.36	0.36	N/A

Q. Proposed Labeling:

The labeling is sufficient and it satisfies the requirements of 21 CFR Part 809.10.

R. Conclusion:

1. The submitted information in this premarket notification is complete and supports a substantial equivalence decision.