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| Purpose | The purpose of this procedure is to provide instructions in performing Automated Body Fluid Cell Count using Beckman Coulter DxH 800 Analyzer |

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| Principle | The DXH 800 Body Fluid Application is a procedure for obtaining in vitro quantitative determination of total nucleated cells (TNC) and erythrocytes (RBC) in cerebral spinal fluid (CSF), serous fluids (e.g. pericardial, peritoneal, and pleural), and synovial fluids(laboratory has opted to perform synovial fluids manually).The body fluid is aspirated into the DXH 800 Analyzer via the single tube module and is diluted in separate WBC and RBC Baths. The Coulter Method of counting cells is used to detect and measure changes in electrical resistance when a cell, suspended in a conductive diluent, passes through a small aperture. Each suspended cell acts as an insulator. As the cell passes through the aperture, it momentarily increases the resistance of the electrical path between two submerged electrodes, one located on each side of the aperture. The resistance generates an electrical pulse. The accumulation of electrical pulses are channelized, processed for coincidence correction, and multiplied by a calibration factor, yielding the TNC and RBC counts. |

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| Workplace Safety | All laboratory employees are expected to maintain a safe working environment and an injury-free workplace. Laboratory employees are responsible for their own safety, the safety of others and adhering to all departmental and medical center safety policies and procedures.* For standard precautions and safety practices in the laboratory; see **Safety Practices**, specifically, but not limited to, equipment safety, proper body mechanics, sharps exposure and proper use of personal protective equipment (PPE).
* For Universal Body Substance precautions, see **Universal Body Substance Precautions**, specifically, but not limited to, exposure to body fluids.
* For proper hand-washing, see **Hand washing Policy**, specifically, not limited to, proper hand-washing.
* For proper infection control, see **Infection Control**, specifically, but not limited to, proper use of gloves.
* For proper handling of regular and infectious waste, see **Handling of Regular and Infectious Waste**, specifically, but not limited to, proper disposal of regular and biohazardous waste.
* For proper cleaning of work area, see **Cleaning Work Areas**.
* For proper handling of chemicals and reagents, see the Chemical Hygiene Plan.
* For proper storage and disposal of chemical hazardous waste, see **Storage & Disposal of Chemical Hazardous Waste**.

All laboratory employees are expected to maintain a safe working environment and an injury-free workplace. Laboratory employees are responsible for their own safety, the safety of others and adhering to all departmental and medical center safety policies and procedures. |

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| SPECIMEN  | **Specimen Type:**The following specimen types are supported by the DXH 800 Analyzer Body Fluids Application:* CSF
* Serous Fluids (e.g. pericardial, peritoneal, pleural), and Thoracentesis
* Gastric/Abdominal and Ascites Fluid

***Note: Synovial/Joint Fluids) and BAL will be performed manually and should not be loaded in the instrument.*** Cell counts are performed on EDTA anticoagulated specimens. CSF Cell counts maybe performed on non-anticoagulated specimens as long as the specimen is not clotted. |
| SPECIMEN VOLUME | * 1mL EDTA anticoagulant lavender top tube.
* Minimum volume required for testing is 250μL
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| SPECIMEN STABILITY & STORAGE | CSF and Body Fluids must be processed as soon as possible and within 1 hour after received in the laboratory. Following analysis, samples are stored in the refrigerator. Cell counts may be performed on held tubes, up to 24 hours, but these cell counts are not considered reliable.  |

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| CSF SPECIMEN HANDLING | The cell count and diff should be performed on the last tube drawn, either Tube #3 or Tube #4 unless specified **by the physician.** Tube #1 may be contaminated by blood as a result of the puncture itself and should not be used for cell counts. Chemistry tests are generally run on Tube #1. Tube #2 is typically reserved for microbiology. If only one tube is submitted for testing and multiple tests are required, including microbiology, the tube should be taken first to microbiology to allow them to aseptically remove a small sample for their use. Upon receipt of fluid, transfer a small portion of the fluid, aseptically, into a plain tube (no anticoagulant required). If an insufficient amount of fluid is available for all tests requested, call the attending physician to request a priority of testing.  |

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| BODY FLUID HANDLING | If only one tube is submitted for testing and multiple tests are required, including microbiology, the tube should be taken first to microbiology to allow them to aseptically remove a small sample for their use. Upon receipt of fluid which has not been anticoagulated, transfer a small portion of the fluid, aseptically, into an EDTA tube. If an insufficient amount of fluid is available for all tests requested, call the attending physician to request a priority of testing.  |

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| SPECIMEN REJECTION | **CSF***Due to the invasive nature of collection; CSF cell counts will not be rejected by laboratory staff for specimen integrity or labeling errors. However, if the specimen is labeled improperly the laboratory staff will request label correction within the laboratory from the collector before releasing test results.* **BODY FLUIDS***Body fluid specimens submitted for cell count testing must be free of clots. Most serous fluids will clot, therefore a portion of each body fluid with this potential should be anticoagulated immediately. If small fibrin clots are detected, perform test manually and include a comment in report stating that results may not be accurate due to fibrin clot formation.**If specimen is completely clotted do not perform the cell count. Notify nursing staff or provider that the specimen is clotted. Always use sterile technique when handling body fluid specimens.**Due to the invasive nature of collection; Body Fluid cell counts will not be rejected by laboratory staff for labeling errors. However, if the specimen is labeled improperly the laboratory staff will request label correction within the laboratory from the collector before releasing test results.* |

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| MATERIALS & EQUIPMENT | * DXH 800 Analyzer
* EDTA Tubes(for Body Fluids)
* Plain test tubes(for CSF)
* DxH Diluent
* Wooden Applicator Sticks
* Coulter Body Fluid Control
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| QUALITY CONTROL | It is the policy of the laboratory to perform a minimum of 2 levels of Beckman Coulter Body Fluid Controls on each shift. Perform control level 1 & 2 in AM, level 1 & 3 in PM, and level 2 & 3 night shift. Controls are stable according to manufacturer package insert.*Note: Refer to* ***Beckman Coulter Unicel DxH 800 Quality Control LAMC-PPP-0277*** *for instructions when performing Quality Control for Automated Body Fluid.* |

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| PROCEDURE | **CSF GROSS EXAMINATION** |

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| Step | Action |
| 1. | Note physical appearance: normal CSF is crystal clear. Color should be evaluated by holding the sample beside a tube of dis­tilled water and a clean white paper. Bloody specimens should be centrifuged to observe for xanthochromasia (pale pink to pale orange or yellow color).Report the appearance as: clear, hazy, cloudy or bloody and colorless or xanthochromic. |
| 2. | Note the volume of the CSF. If the volume is </= 2mL and additional tests have been ordered, contact the Provider. Ask the Provider to list the tests desired in order of priority due to the limited amount of specimen submitted. Contact a supervisor if needed.***NOTE: Perform manual count for specimen with visible fibrin and blood clots. Report TNC, RBC and differential and note clots present in comments***. |
| 3. | If CSF is clear and colorless, perform manual count first. Automated counts will most likely be less than the reportable range of the DXH800. |

 **BODY FLUID GROSS EXAMINATION**

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| Step | Action |
| 1. | Note physical appearance. Appearance may be described as Clear, Bloody, Clotted, Cloudy, Hazy, and Slight Hazy.***NOTE: Perform manual count for specimen with visible small fibrin clots or possible presences of debris. Report TNC, RBC, and differentials and note clots present in comments.*** |

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| INSTRUMENT PROGRAMING |  |

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| DILUENT BACKGROUND CHECK- Pre run – It is required to perform a diluent background check to check for any carryover that might affect the Body Fluid run *after switching from CBC mode to BF mode(single presentation).* |
| Step | Action |
|  | Ensure the instrument is set up for the appropriate test.The SPM must be online to run samples. You can view the status of the SPM in the System Status Screen. |
|  | Select the **Single-tube Presentation** icon at the top of any screen to display theSingle-tube Presentation dialog box. |

**INSTRUMENT PROGRAMING** (continued)

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| Step | Action |
|  | Select **Dispense Diluent**. The instrument will prompt “You have requested to dispense some diluent select OK to continue or Cancel to cancel the request.” Select **OK**. |
|  | Place a blank EDTA tube into the correct Single-tube position. |
|  | After the DxH800 has finished dispensing diluent, the instrument will prompt “Do you want to dispense more diluent in the same tube?”Select **NO.** |
|  | Type ***“Pre-run Blank”*** in the **Specimen Identifier** field. The system will prompt “Test order not found for specimen identifier blank, CD default test order assigned. Select OK to view/edit the test order.” Select **OK**. |
|  | Change the **Specimen Type** to the corresponding sample body fluid type; CSF, pleural, peritoneal, or pericardial. The system will prompt “In order to change the specimen type, the following panels must be removed; CD. Select OK to change the specimen type and to remove the panels. Select **OK**. |
|  | Select **BFC** from **Available Panels**. |
|  | Select **Add** to move BFC from available panel list to selected panel list. |
|  | Select **Submit** when finished. Follow the system prompts to run the diluent blank. |
|  | After the SPM cycles the samples, remove the tube from the single tube station and review the sample results at the System Manager. |
|  | The Diluent Blank results must be:* TNC ≤ 20 cells/mm³
* RBC ≤ 1000 cells/mm³

If results are not acceptable, run diluent again and then take corrective action if still not acceptable.***Note: The Results will have – Flags indicating that the results are below the measuring range.*** |
|  | Review and sign diluent blank print out as “Acceptable” and file print out with Patient results in Body Fluid Patient and Diluent Blank bin for documentation. |

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| **INSTRUMENT PROGRAMING** (continued) |
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| Patient Run – Automated CSF/BF Cell Count |
| Step | Action |
|  | Transfer sample in a 4.0 ml test tube, CSF sample can be transferred in a plain tube (no anti-coagulate required) while all other Body Fluids will be transferred in a 4.0 ml EDTA tube. Label sample tube with extra accession sticker generated(accession sticker includes the Name, MRN, and test order).  |
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 | Place the sample tube on the bar-code reader platform of the Single-tube Presentation Station with the bar code facing the SPM to allow the Single-Tube Presentation Bar-code Reader to scan the specimen label.orType the **Specimen Identifier** and press (ENTER).orScan the bar code with the handheld scanner. Move the cursor to the end of the ID field by touching the end of the ID or using the mouse to click at the end of the ID. Then, press (ENTER). The system will prompt “Test order not found for specimen identifier blank, CD default test order assigned. Select OK to view/edit the test order.”  Select **OK**. |
|  | Change the **Specimen Type** to the corresponding sample body fluid type; CSF, pleural, peritoneal, or pericardial. The system will prompt “In order to change the specimen type, the following panels must be removed; CD. Select OK to change the specimen type and to remove the panels. Select **OK**. |
|  | Select **BFC** from **Available Panels**. |
|  | Select **Add** to move BFC from available panel list to selected panel list. |
|  | Select **Submit** when finished. Follow the system prompts to run the sample. |
|  | After the SPM cycles the samples, remove the tube from the single tube station and review the sample results at the System Manager. Generate result print out and See “Interpretation and Reporting of Results” section of this procedure to interpret and report results in the LIS. |
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 | Result print out will be filed along with the Pre-run Diluent Check print out in the ***BODY FLUID Cell Count Results and diluent blank bin*** for documentation***.*** |

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| REFERENCE RANGE | **CSF** RBC = NoneTNC = 0-5 cells/mm3**BODY FLUIDS**RBC = < 500 cells/mm3TNC = ≤ 9 cells/mm3 |

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| Analytical Measuring Range of DXH800 | **RBC = 1000 – 5.6 M cells/ mm**3**TNC = 20 – 66,000 cells/mm**3 |

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| INTERPRETATION & REPORTING RESULTS OUTSIDE ANALYTICAL MEASURING RANGE |  |
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| CSF AND BODY FLUIDS |
| RBC | TNC |
| If result is… | **ACTION** | If result is… | **ACTION** |
| < 1000 cells/mm3 | perform manual cell count instead | Result is < 20 cells/mm3 | perform manual cell count instead |
| > 5.6 M cells/mm3 | perform a manual dilution **and rerun in the instrument following *dilution analysis section* next page** | > 66,000 cells/mm3 | perform a manual dilution **and rerun in the instrument following *dilution analysis section* next page** |

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| Dilution analysis for Automated CSF/BF Cell count |

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| Dilution Analysis for Automated CSF/BF Cell count |
| Step | Action |
|  | Perform a manual dilution with the lowest ratio possible to get a result within the AMR of the instrument (e.g. 1:2, 1:4...) in a 4.0 ml plain tube. ***Use the dispensed diluent blank that passed Pre-run diluent check as your diluent***. Label tube using a new accession sticker that includes the Name, MRN, and test order with a note of dilution ratio performed. |
|  | Under **Single-tube Presentation,** Enter accession number following “X” plus dilution factor of the diluted sample (e.g. 21809400001**X2** for 1:2 ratio). |
|  | Press enter to edit orders, default order will be CDR. Edit Orders by selecting correct specimen type adding BFC as test order to be performed. |
|  | Review and click Submit to accept orders. |
|  | Follow the system prompts on when to load diluted sample, make sure diluted sample was properly mixed before loading. |
|  | After the SPM cycles the samples, remove the tube from the single tube station and review the sample results at the System Manager. Generate result print out and See “Interpretation and Reporting of Results” section of this procedure to interpret and report results in the LIS.  |
|  | Instrument result will have to be multiplied by the dilution factor used:*e.g. 1:2 ratio = instrument cell count result X(multiplied by) 2* |
|  | Result print out will be filed along with the Pre-run Diluent Check print out in the ***BODY FLUID Cell Count Results and diluent blank bin*** for documentation***.******See section Result Reporting for verifying result in LIS.*** |

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| FLAGS & CODES | Partial aspirate and presence of bubbles are the common codes that may encounter performing body fluid mode; whole blood flags and codes are used as appropriate. Note that body fluid-specific R flagging indicates that patient results are below the reportable range. Refer to the DXH 800 System Help for detailed instructions regarding Flags and Codes. |

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| SUSPECT MESSAGES | The only Suspect Message used by the Body Fluids Application is Cellular Interference: |

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| Message | Action |
| **Abnormal TNC Pattern** | Confirm abnormalities by performing a manual hemocytometer cell count. |

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| RESULTS REPORTING CSF |  |
| Step | Action |
| 1. | Results are entered in the LIS using manual entry.  |
| 2. | Results to be entered are:* RBC and TNC Auto
* Volume (mL)
* Xanthochromia
* Color
* Appearance
* TNC Differential

Perform 5 part differential; enter percent for:1. Segs pct
2. Lymphs pct
3. Monos pct
4. Eos pct
5. Basos pct
* Comment: Describe unidentified / immature cells
* Follow local policy for abnormal cells seen
* Macro
* Meso

**Note: For more detailed information see procedure Body Fluid Analysis LAMC-PPP-0292** |

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| RESULTS REPORTING BODY FLUID |  |
| Step | Action |
| 1. | Results are entered in the LIS using manual entry.  |
| 2. | Results to be entered are:* RBC and TNC Auto
* Appearance (clear, bloody, clotted, cloudy, hazy, and slight hazy)
* TNC Differential

Perform 5 part differential; enter percent for:1. Segs pct
2. Lymphs pct
3. Monos pct
4. Eos pct
5. Basos pct
* Macro
* Meso
* Comments: Describe unidentified cells / immature cells
* Follow local policy for abnormal cells

**Note: For more detailed information see procedure Body Fluid Analysis LAMC-PPP-0292** |

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| LIMITATIONS | **All Fluids*** Clotted specimens may lead to misleading or erroneous results. Visually inspect all specimens for clots.
* Improperly mixed specimens may lead to misleading or erroneous results.
* Cellular debris may lead to misleading or erroneous results.
* Interpret results in light of the total clinical presentation of the patient, including clinical history, data from additional tests, smear review, and other appropriate information.
* Delays in processing may lead to misleading or erroneous results.

**CSF*** Low levels of albumin and lipids in cerebrospinal fluid may accelerate cell lysis, leading to decreased manual counts and an apparent lack of correlation.
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| REFERENCE | COULTER® UniCel DxH 800 Instructions for Use. Beckman Coulter, Inc. Miami, Fl. March 2009.Todd-Sanford. Clinical Diagnosis of Laboratory Methods 18th Edition.Davidson and Henry, M.D. Brays Clinical Laboratory Methods 7th Edition. p. 512 |

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| Controlled Documents | The following controlled documents support this procedure.

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| **Document Number** | **Document Name** |
| LAMC-PPP-0123 | Safety Practices |
| LAMC-PPP-0127 | Infection Control |
| LAMC-PPP-0128 | Universal Body Substance Precaution |
| LAMC-PPP-0129 | Handling of Regular and Infectious Waste |
| LAMC-PPP-0130 | Cleaning Work Areas |
| LAMC-PPP-0132 | Hand-washing Policy |
| LAMC-PPP-0134 | Storage and Disposal of Chemical Hazardous Waste |
| LAMC-PPP-0292 | Body Fluid Analysis |
| LAMC-PPP-0277 | Beckman Coulter Unicel DxH 800 Quality Control |

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| Author(s) | Alvin Castillo |