

**Central Arkansas Veterans Healthcare System  
Pathology and Laboratory Medicine Service**

**Pathology and Laboratory Medicine Services (P&LMS) Manual**

**John W. Theus, M.D.**  
**Chief, P&LMS**  
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**P&LMS MISSION:** It is the mission of the Pathology and Laboratory Medicine Service to provide our patients and healthcare professionals with timely, accurate analytical data, diagnostic and therapeutic services. State-of-the-art equipment and technology are used to achieve highest customer satisfaction. These services are enhanced through continuous quality improvement, medical education, and research. Successful accreditation by the College of American Pathologists, Joint Commission on Accreditation of Healthcare Organizations, FDA, and the American Association of Blood Banks, is essential.

**P&LMS VISION:** Central Arkansas Veterans Healthcare System Pathology and Laboratory Medicine Service will be a leader in the healthcare community and a center of excellence in both education and research.

### **I. P&LMS DEMOGRAPHICS**

P&LMS provides both clinical and anatomical diagnostic care to acute and long term care medical and surgical inpatients and a large outpatient population, as well as psychiatric and drug rehabilitation care. The clinical laboratory provides on site testing at both facilities of the Central Arkansas Healthcare System. The patient population consists primarily of adult veterans characterized by a very significant number of older males, although the numbers of younger patients and numbers of females are increasing.

### **LABORATORY ACCREDITATION**

The CAVHS Pathology and Laboratory Medicine Services of VISN 16 are accredited and inspected by the following organizations:

1. The College of American Pathologists (CAP).
2. American Association of Blood Banks (AABB).
3. The Food and Drug Administration (FDA).
4. Joint Commission.

### **II. LABORATORY STAFFING AND COVERAGE**

CAVHS Little Rock laboratories are staffed 24 hours a day, 7 days a week; however, laboratory staff and coverage varies at different times during the day and week. P&LMS provides full services Monday through Friday. A limited staff is on duty Saturday, Sunday, and Holidays providing essential services for quality patient care. The laboratory at North Little Rock is staffed Monday through Friday, 0700 to 1600.

A pathologist is on call 24 hours a day for consultation. The On-call resident can be contacted at pager 688-2820.

### **III. REQUESTS FOR LABORATORY TESTS**

Laboratory tests can **ONLY** be performed on a Clinician's order. Verbal orders are not permitted by hospital by-laws, with the exception of life-threatening emergencies. Any unclear orders will be investigated/confirmed with ordering clinician.

Clinical tests can be ordered using the following mechanisms:

- Electronic Order Entry in CPRS
- Computer Downtime Requisition for Laboratory Tests form 10-762 (Contact the lab for forms. Each patient location should keep forms on hand for computer downtime.) and form SF-518 for Blood Bank requests.

Anatomic specimens require a complete and legible Tissue Examination form 515.

Test requisitions for both inpatients and outpatients MUST have the following information on the request.

- (1) Patient's name
- (2) Patient's social security number
- (3) Name of ordering clinician
- (4) Test or tests required
- (5) Date and time of specimen collection if applicable
- (6) Type and/or source of specimen, e.g., urine, sputum, chest fluid, culture of deep wound, etc.

"ADD-ON" tests to specimens already in the laboratory will be honored if specimen is less than 4 hours old and sufficient suitable sample is available. This practice helps reduce unnecessary phlebotomy. "ADD-ON" tests must have an order number when the test is requested. Add-on order numbers are to be called to the appropriate testing section of the clinical laboratory.

Information about specimen collection and reference ranges for tests that are not listed in this manual are available through CPRS using the Tools drop-down menu and clicking on Lab Test Information. Information is also available by calling the laboratory at ext. 54543. Pathology consultation is available 24 hours a day for special test requests and result interpretation. The on-call resident can be contacted at pager 688-2820.

#### **IV. COMPUTER DOWN-TIME**

When the computer is down due to routine preventive maintenance or unexpected power failure and lab test(s) requests are needed during this time, form 10-762 "Computer Downtime Requisition for Laboratory Tests" will be accepted, but must be filled out completely with the following information:

Patient name  
Social Security Number  
Ward location  
Requesting physician  
Test(s) required  
Date and time of collection

Blood Bank requests require a complete and legible Blood or Blood Component Transfusion form SF-518 for each component requested.

The Laboratory will order these test(s) in the computer when the computer becomes available.

#### **V. TURNAROUND TIMES**

**POLICY:** Pathology and Laboratory Medicine Service (P&LMS) will strive to have clinical laboratory results available in CPRS as quickly as possible. Turnaround times are from the time the specimen arrives in the laboratory until results are available in CPRS.

Processing time includes centrifuging and separation of samples into appropriate racks for delivery to each section. Peak workload times can cause slower times of result delivery to caregivers. Other considerations are verification of results that may be questionable or critical. STAT testing will be performed before routine specimens. Specimens that are routine and are already in the process of testing will continue and STATs will be placed in queue behind them. Some analytes require longer testing times than others and this is also considered in turnaround times. Any issues during any time frame will be documented.

**EMERGENCY SPECIMENS** – Turnaround time for a clinical laboratory STAT is 1 hour. EMERGENCY request can only be honored for tests on the approved list (see Page 6).

**ROUTINE SPECIMENS** – The turnaround time for routine testing is 4 hours. Tests that are batched (batch testing is done on certain days and/or times), microbiology testing, molecular and flow cytometry testing from CBOCs and send out testing are excluded from the routine turnaround time.

Turnaround times will be randomly monitored by the Quality Manager. A report on performance of turnaround times will be reviewed with the Chief, Pathology and Laboratory Medicine and section supervisors.

In the event of anticipated testing delays that would impact timely patient care, the section supervisor will notify Chief, P&LMS and appropriate clinical care teams.

## **VI. PHLEBOTOMY SERVICE PROVIDED BY P&LMS**

1. Outpatient phlebotomy in Little Rock Division (requests ordered as Send Patient)  
**1A-101** Hours are Monday – Friday 6:30am – 5:15pm
2. North Little Rock Division (requests ordered as Send Patient)  
**Building 170, room 3F-109** serves as the main OP phlebotomy station.  
Hours are Monday – Friday 7:00am – 3:30pm  
**Building 66 2<sup>nd</sup> floor** Hours 8:00am – 4:00pm
3. **Inpatient phlebotomy in Little Rock Division** (Requests ordered as Lab Collect)  
P&LMS phlebotomists will procure blood from inpatients according to the following schedule. Lab Collect orders must be requested no later than 30 minutes prior to stated pulled time to be included on the laboratory collection list.

Monday – Friday	5:00 AM – Pulled @ 2:30 A.M.
	1:00 PM – Pulled @ 12:30 P.M.
	7:00 PM – Pulled @ 6:30 P.M.
Weekends and	5:00 AM – Pulled @ 2:30 A.M.
Holidays	1:00 PM – Pulled @ 12:30 P.M.
4. **Inpatient phlebotomy in North Little Rock Division** (Requests ordered as Lab Collect)  
P&LMS phlebotomists will procure blood from inpatients according to the following schedule. Ward Collect orders must be requested no later 30 minutes prior to stated pulled time to be included on the laboratory collection list.

Monday – Friday	6:00 am – Pulled at 2:30 A.M.
	1:00 pm – Pulled at 12:30 P.M.
Holidays	7:00 am – 9:30 A.M.

Phlebotomy needs that arise after the collection list computer cutoff time on holidays may be added by contacting the technologist on pager 1129 or by contacting the NOD on pager 1490.

P&LMS phlebotomists at both divisions are NOT responsible for “Emergency” or timed collection orders. Emergency and/or timed collection requests are to be ordered as Ward Collect. If a phlebotomist cannot procure blood from a patient the nurse and/or provider will be notified.

The laboratory phlebotomists will not collect blood samples from IV lines or other indwelling devices, arterial samples, or femoral punctures. These samples should be collected from the attending physician or appropriately trained nursing personnel.

## VII. STAT Tests Performed in the Clinical Laboratory

<b>ABO/RH Typing</b>	<b>Blood Gases</b>	<b>CBC</b>
<b>PT</b>	<b>aPTT</b>	<b>Fibrinogen</b>
<b>D-Dimer</b>	<b>BMP</b> (Na, K, Cl, CO <sub>2</sub> , BUN, Glucose, Creatinine, Total Calcium)	<b>Glucose</b>
<b>Drug Screen (Urine)</b>	<b>Pregnancy Test</b>	<b>Troponin I</b>
<b>CK, CK-MB</b>	<b>Ionized Calcium</b>	<b>Amylase</b>
<b>Lipase</b>	<b>Digoxin</b>	<b>Tegretol</b>
<b>Dilantin</b>	<b>Methotrexate</b>	<b>Total Bilirubin</b>
<b>Alkaline Phosphatase</b>	<b>ALT</b>	<b>AST</b>
<b>Acetaminophen</b>	<b>Salicylate</b>	<b>Acetone</b>
<b>Blood Alcohol</b>	<b>Uric Acid</b>	<b>Lactate</b>
<b>Magnesium</b>	<b>Phosphorus</b>	<b>PSA (For Hem-Onc patient awaiting chemotherapy only)</b>

## VIII. PHLEBOTOMY PROCEDURE

### Preparatory Phase

- (1) Assemble equipment
- (2) Check ID against arm band to verify that the full name and full SSN are the same as that on the request slip or preprinted label(s).
- (3) When multiple tubes are to be collected using the following order of draw:

<b>Order of Draw</b>	
<b>CAP COLOR</b>	<b>MAIN TESTS</b>
<b>*Blood cultures</b>	<b>SPS(*must be filled to indicator mark)</b>
<b>*Blue (if using a butterfly, draw 2 blue top tubes)</b>	<b>PT&amp;INR, aPTT, Fibrinogen, Heparin, All Clotting Factors, D-Dimer, Heparin Antibody (*Tube must be filled to indicator mark)</b>
<b>Red</b>	<b>PSA, RPR, ANA, Hepatitis, SPEP, Lithium, RF, Prealbumin, C3, C4, CEA</b>
<b>Green</b>	<b>BMP, Lipid tests, CK, Troponin, TSH, Calcium, Magnesium, Phosphorus, Vancomycin, Dilantin, Digoxin, Gentamycin, Ionized Calcium, Glucose, Creatinine, BUN, Liver Enzymes</b>
<b>Lavender</b>	<b>CBC, Hgb, Hct, Differential, Hgb A1C, Retic, Flow Cytometry, Fluid Cell Counts, Cyclosporin</b>
<b>Lavender/Yellow</b>	<b>BNP, PTH</b>
<b>White</b>	<b>Viral Loads</b>
<b>Pink</b>	<b>Blood Bank Tests (ABO, Rh, Crossmatch, Type &amp; Screen, Coombs)</b>
<b>Grey</b>	<b>Lactate</b>

*Note: Using the correct order of draw eliminates erroneous test results due to carry over of the specimen with anticoagulants present in the tubes.*

- (4). Verify diet restriction when indicated, i.e. fasting blood sugar.
- (5). Explain procedure and cooperation required.

Performance Phase:

- (1) Confirm patient identity using active identification by having the patient state 2 patient identifiers (full name and full Social Security number or full name or date of birth if auditory privacy is not available). If the patient is unable to state 2 identifiers, the staff member will verify name and full Social Security number with lab collection slip.
- (2) Wash hands or cleanse with alcohol foam or gel.
- (3) Assist patient into a semi-Fowler's position. Raise bed to high position, position patient's arm flat on firm surface, lower than heart when possible and place towel under arm, if needed. Apply tourniquet above targeted insertion site.
- (4) Ask patient to close fist.
- (5) Palpate veins to determine best site for venipuncture. Never draw blood specimens from a vein already being used for continuous IV therapy. Antecubital veins are usually best.
- (6) Don gloves on both hands.
- (7) Cleanse site with alcohol pad, in a back and forth motion, allowing alcohol to dry on the site for at least 30 seconds.
- (8) Apply a disposable tourniquet 2 inches above venipuncture site. Tourniquet should be tight enough to impede venous return, but loose enough to allow an arterial flow.
- (9) Venipuncture using needle and syringe.
  - a. Position the syringe and safety needle parallel with the vein selected. Bevel of needle should be up. Hold the skin taut with one hand while holding syringe with the other hand.
  - b. Pierce the skin with the needle and push on into the vein. Puncture skin at a 15 to 30 degree angle. When the needle has entered skin, lower needle until almost parallel with skin. A sensation of resistance will be felt, followed by ease of penetration as the vein is entered. Instruct patient to relax fist when blood begins to flow.
  - c. Withdraw the desired amount of blood to fill all needed tubes into the syringe.
  - d. Release tourniquet. Do not leave in place for more than 3 minutes.
  - e. Instruct patient to open fist.
  - f. Place gauze pad or cotton balls over site and remove needle from vein while applying pressure with pad or cotton ball.
  - g. Hold pressure for 2 to 3 minutes (5 to 10 minutes if patient is on anticoagulant therapy); check for bleeding and apply pressure until bleeding has stopped. Apply adhesive bandage or tape over gauze pad.
  - h. Fill collection tubes. Wipe outside of tube with alcohol pad if contaminated with blood.
  - i. Gently invert tubes to mix blood with anticoagulant and/or clotting agents within tubes.

Venipuncture using evacuated tubes:

- 1. Thread appropriate needle into holder until secure, using needle sheath as wrench.

2. Use sterile blood collection tube.
3. Push stopper of blood collection tube into the needle within the holder up to the recessed guideline on the needle holder. To prevent premature loss of vacuum, do not push tube beyond the guideline.
4. Position needle holder and tube at 15 to 30 degree angle to venipuncture site. Maintain the tube in downward position below the puncture throughout the procedure to insure that any backflow from the tube will not enter the patient's vein.
5. Pierce skin with needle push on into vein.
6. Grasp flange of needle holder, anchoring hand on patient's arm and push tube forward until the blunt end of needle punctures the stopper of the tube.
7. Once blood begins to flow, do not change position of tube until it is withdrawn from the needle.
8. Maintain constant, but slight forward pressure in direction of needle of end of tube to prevent release of shut off valve and stoppage of blood flow.
9. Allow tube to fill until vacuum is exhausted and blood flow ceases or blood has reached the tube fill line of the tube.
10. Remove tube from holder when blood flow ceases.
11. Gently invert tube 5-10 times to mix blood with additives.
12. To obtain additional specimens, insert next tube into holder and repeat procedure steps 6 through 11.
13. Remove tourniquet when collection of all tubes is completed, but no longer than 3 minutes, place dry gauze pad or several cotton balls over phlebotomy site and remove needle. Engage needle safety device on a hard solid surface using one hand technique.
14. Maintain pressure on venipuncture site as above and apply adhesive bandage or tape over gauze pad or several cotton balls.
15. Remove and discard gloves in a regular trash can unless visibly soiled with blood; sanitize hands by washing, using alcohol foam or gel.
16. Position patient for comfort with call light within reach.
17. Dispose of needle/sharps and syringe/holder in rigid, puncture-proof sharps container.
18. Discard disposable supplies appropriately.

**POTENTIAL ADVERSE PATIENT REACTION:** Reactions to phlebotomy are rare, and when they do occur the phlebotomist should be able to recognize the symptoms and provide appropriate care. For these instances, the following measures should be used as a guideline to assist patients in need of special attention. Phlebotomists should keep in mind that special cases may arise from time to time and may warrant additional or differing measures than those mentioned in the procedure.

**Cardiac Difficulties:** If the outpatient's actions suggest that they might be having difficulty breathing or chest pain, provide the following treatment:

- Watch for profuse sweating and change of color in face.
- Ask the patient if he/she is having difficulty breathing
- Ask the patient if he/she is having chest pain
- **DO NOT HESITATE – PAGE THE RAPID RESPONSE TEAM AT 7788.**
- Keep the patient as comfortable as possible with a cool compress to the forehead or back of neck until assistance arrives.
- Be prepared to supply the physician/nurse with the patient's full name, full social security number, and any information that will assist in his/her treatment.



- If blood specimens have been drawn, send them to the Processing Department or appropriate testing department to be run **STAT**. Call the receiving department so that they will anticipate the specimens and process them appropriately.
- If these symptoms occur during the phlebotomy of an **inpatient**, then **DO NOT HESITATE – PRESS THE CALL BUTTON AND PAGE THE RAPID RESPONSE TEAM AT 7788.** Be prepared to supply the medical personnel with any information that will assist in his/her treatment.

**Hematoma:** If the **outpatient** begins to form blood under their skin at the site of phlebotomy provide the following treatment:

- Immediately remove the tourniquet and needle from the patient's arm.
- Place three to four cotton balls or several sterile gauze squares over the venipuncture site and apply firm digital pressure for 3 – 5 minutes with the patient's arm held above their heart. Patient can assist in this procedure if able. An alternative method is to apply a Coban compression bandage on the patient's arm which should be removed after 15-20 minutes.
- Patient should be informed that the possibility of the formation of a dark area of blood under the skin is likely, and that the application of ice to the area for 5 minutes may assist with healing.
- When drawing an **inpatient** the phlebotomist should watch for excessive bleeding. If a hematoma develops and/or bleeding persists longer than five minutes, then **PRESS THE CALL BUTTON** and alert the nurse so that the attending physician can be notified. Continue to apply pressure at the site as long as necessary to stop the bleeding, and inform the patient to leave the bandage on the site for at least 15 minutes.
- A report of the incident should be conveyed to the departmental supervisor and/or service chief.

**Fainting:** If the **outpatient** begins to feel lightheaded or their actions suggest that they might faint, provide the following treatment:

- If the patient is seated place his/her head back or you may also choose to have them place their head between their knees.
- Loosen tight fitting clothing around the neck
- Apply a cool compress to the patient's forehead or the back of the neck
- Administer aromatic spirits of ammonia by inhalation if patient does not respond to initial measures. Test the ammonia on yourself before passing it under the patient's nose, as it may be too strong or too weak. Strong ammonia may injure the nasal membranes; weak ammonia is not effective. The patient should respond by coughing, which elevates the blood pressure and assists in waking the patient.
- Continue to monitor the patient periodically as they recover. Release patient when you feel assured that they are well and able to continue to their next appointment.
- A verbal report of the incident should be conveyed to the departmental supervisor and/or service chief.
- If these symptoms appear in the **inpatient**, then **PRESS THE CALL BUTTON** and alert the nurse. If the patient is seated, allow him/her to lie down on their bed and elevate their legs higher than their head.
- Be prepared to relate to medical personnel any information that might assist in the patient's treatment.

**Nausea and Vomiting:** If the **outpatient** begins to feel nauseous or their actions suggest that they may vomit, provide the following treatment:

- Allow the patient to be as comfortable as possible
- Instruct the patient to breathe slowly and deeply
- Apply a cool compress to the patient's forehead or back of the neck
- Provide a proper receptacle if the patient vomits (lined trash can)
- Give the patient a cup of water to rinse their mouth after vomiting. Stomach acids are harmful to the mouth and gums.
- If the **inpatient** begins to experience these symptoms, **PRESS THE CALL BUTTON** and alert the nurse. If the patient is lying down, turn the patient's head to one side so in cases of emesis the patient's airway will remain open
- Provide a proper receptacle if the patient vomits (lined trash can) for their convenience. Again, be sure the patient's head is turned due to the danger of aspiration.
- Be prepared to relate to medical personnel any information that might assist in the patient's treatment.

**Twitching or Muscular Spasms:** Extremely nervous **outpatients** may hyperventilate, causing faint muscular twitching or spasms of their hands or face. Phlebotomy staff should watch closely for these symptoms during and immediately following phlebotomy.

- Divert the patient's attention by engaging in conversation. This will aid in the interruption of the hyperventilation pattern.
- If patient's symptoms increase, have he/she breathe into a paper bag to slow their breathing.
- If these symptoms occur during or immediately after the phlebotomy of an **inpatient** then **PRESS THE CALL BUTTON** and alert the nurse. Be prepared to relate any information that might assist in the patient's treatment.

**Seizures:** If any patient begins to have seizures **IMMEDIATELY PAGE THE RAPID RESPONSE TEAM AT 7788.**

- Prevent the patient from harming themselves by a self-inflicted injury.
- During severe seizures, the patient may be difficult to restrain.
- If possible, hold the patient in the phlebotomy chair.
- If unable to restrain the patient in the phlebotomy chair, place the patient on the floor.
- Try to prevent injury to the patient and to yourself.
- If blood specimens have been drawn, send them to the Processing Department or appropriate testing department to be run **STAT**. Call the receiving department so that they will anticipate the specimens and process them appropriately
- Be prepared to relate to medical personnel any information that might assist in the patient's treatment.

## **IX. SPECIMEN IDENTIFICATION, LABELING AND TRANSPORT**

Prior to collecting specimen, the identification of the patient **MUST** be verified using two identifiers. Check the patient's wristband verifying that the full name and full SSN are the same as that on the request slip or preprinted label. Date of birth may also be used as an identifier in place of the social security number. If the patient is able, have them verbally recite their identifiers.

All specimens must be labeled with the following information: (See Nursing Policy #22)

- (1) Patient's name
- (2) Patient's social security number

- (3) Date and time of collection
- (4) Phlebotomist's (collector's) initials

For certain types of specimens, additional information is needed before the specimen can be processed. In Cytology and Surgical Pathology, the precise source of the specimen and an abbreviated clinical diagnosis must be on the requesting slip (SF-515, Tissue Examination Form). Microbiology requests should have the source and pertinent history.

**Specimens received with incorrect patient information will be rejected.** The order will be deleted and the ordering location notified.

There will be exceptions when recollection is not possible and information will be corrected, i.e. specimens requiring invasive procedures for collections, bone marrow, CSF, etc. In these cases the physician making the correction will be required to document changes by signing "P&LMS NON-REPLACEABLE SPECIMEN RELABELING FORM."

**Little Rock Division Specimen Delivery** (*regular hours, irregular hours, weekends, and holidays*) Deliver specimens as follows:

- Clinical Specimens: 2D-154 or Station 13 using the Translogic Transport system.
- Anatomic Pathology specimens: 2E-141
- Cytology Specimens: 2D-185

#### **North Little Rock Division Regular Hours Specimen Delivery**

Deliver Specimens to Building 66, 2<sup>nd</sup> floor.

#### **North Little Rock Division Irregular Hours, Weekends, and Holidays**

Emergency specimens and microbiology specimens are transported to Little Rock by taxi. This is the responsibility of the requesting location through the NOD.

All specimens should be transported to the laboratory in a re-sealable plastic biohazard labeled bag along with the proper request slip.

Specimen containers that leak are a safety hazard and will be rejected.

### **CRITICAL RESULT POLICY**

Patient results, whether "**EMERGENCY**" or "**ROUTINE**" defined as critical (listed on the following page) will be verified and the clinical personnel responsible for care notified **WITHIN ONE HOUR** by verbal communication. The individual receiving the critical clinical laboratory value will be required to read back the critical information.

Anatomic pathology specimens diagnosed as first time malignancy will be called to the patient's provider.

## CLINICAL LABORATORY CRITICAL VALUES

### CHEMISTRY

	LESS THAN	GREATER THAN
Protein, Serum		12.0 g/dL
CSF Protein		75 mg/dL
Sodium	124 mmol/L	160 mmol/L
Potassium	2.8 mmol/L	6.0 mmol/L
PO4	1.0 mg/dL	
Glucose	50 mg/dL	400 mg/dL
CSF Glucose	35 mg/dL	
Calcium, Total	6.5 mg/dL	13.0 mg/dL
Calcium, Ionized	0.8 mmol/L	1.6 mmol/L
Magnesium	1.0 mg/dL	4.0 mg/dL

### HEMATOLOGY & COAGULATION

	LESS THAN	GREATER THAN
Hematocrit	21%	60%
Hemoglobin	7 g/dL	20 g/dL
Platelets	$25 \times 10^3/\mu\text{L}$	$1000 \times 10^3/\mu\text{L}$
WBC	$2.5 \times 10^3/\mu\text{L}$	$50 \times 10^3/\mu\text{L}$
WBC (Hematology-Oncology)	800/ $\mu\text{L}$	$75 \times 10^3/\mu\text{L}$
WBC (GI- Interferon/Ribavirin)	$1.5 \times 10^3/\mu\text{L}$	$50 \times 10^3/\mu\text{L}$
aPTT		140 sec
INR		( $\geq$ ) 5.0

### THERAPEUTIC DRUGS & TOXICOLOGY

	LESS THAN	GREATER THAN
Acetaminophen		300 $\mu\text{g/mL}$
Amikacin, trough		10 $\mu\text{g/mL}$
Tobramycin, trough		5 $\mu\text{g/mL}$
Salicylate		50 mg/dL
Lithium		2.0 meq/L
Phenobarbital		50 $\mu\text{g/mL}$
Phenytoin		30 $\mu\text{g/mL}$
Procainamide		12 $\mu\text{g/mL}$
Quinidine		10 $\mu\text{g/mL}$
Theophylline		25 $\mu\text{g/mL}$
Gentamicin, trough		5 $\mu\text{g/mL}$
Digoxin		2.5 ng/mL
Vancomycin, trough		30 $\mu\text{g/mL}$
Amitriptyline		500 ng/mL
Desipramine		500 ng/mL
Doxepin		500 ng/mL
Ethanol		500 mg/dL
Imipramine		500 ng/mL
Nortriptyline		500 ng/mL

### MICROBIOLOGY

- Positive blood cultures
- Positive gram stain on CSF and other body fluids
- Gram stain result on surgical specimens
- Positive CSF Cryptococcal antigen test

### **OTHER MANDATORY NOTIFICATIONS**

Certain other laboratory results, although not considered critical values, must also be verbally communicated to the patient's clinical provider/physician. These notifications will be documented in the same manner as described for critical values.

<b>MICROBIOLOGY</b>	
<b>TEST NAME</b>	<b>RESULTS</b>
AFB Culture or Smear	Positive AFB Culture / Smear
M. tuberculosis Culture or PCR	Positive M. tuberculosis Culture / PCR
<b>ANATOMIC PATHOLOGY</b>	
AP Specimens	First Time Malignancy
<b>CHEMISTRY</b>	
Troponin	≥0.5 ng/mL (Communicate to Emergency Department only)

### **ELECTRONIC ALERT NOTIFICATIONS**

The following positive tests have been flagged as critical, prompting an electronic alert to the ordering provider:

Positive Fecal Occult Blood



### **P&LMS Critical Tests**

Critical laboratory tests are those tests that have been determined should be assayed and completed within a specified time frame.

Those that currently are monitored include:

- **Frozen section diagnosis** – The set goal for verbal communication of the diagnosis to the provider is within 20 minutes from receipt of specimen into the lab and within 30 minutes from time of order.
- **Rapid HIV result** - The set goal for verbal communication of the result to the provider is within 60 minutes from receipt of specimen into the lab and within 3 hours from time of order.
- **STAT Urine Pregnancy Test** – The set goal for verbal communication of the result to the provider is within 60 minutes of receipt of specimen into the lab.

**REFLEX TESTING**  
**PATHOLOGY AND LABORATORY MEDICINE SERVICES**

<b>Initial Test</b>	<b>Reflex Criteria</b>	<b>Reflex Test(s)</b>
AFB smear	Positive	MTB PCR
Bilirubin	Total is > 1.5 mg/dl	Bilirubin, Direct
Dipstick Urine	Positive Dipstick Criteria met	Urine Microscopy
CBC with Automated Differential	Pertinent CBC Criteria met	Manual Differential
CK	> 250 IU/L	CK-MB
C. diff Panel	C. diff Antigen Positive and C. diff Toxin Negative	C. diff PCR
Cryptococcal Antigen	Positive (Initial test only)	Cryptococcal antigen titer
Culture, aerobic	Possible anaerobe in broth	Anaerobic culture
Culture Samples	Positive for organism	Identification
Culture Samples	Positive Identification	Susceptibility Studies, based on established protocol
Culture growing an Enterobacteriaceae	Ertapenem MIC>2µg/ml and resistant to cefotaxime, ceftazidime, &/or ceftriaxone	Hodge test for carbapenemase production
ESBL screen	Positive	ESBL confirmation
Hepatitis B Core antibody	Total antibody is reactive	Hepatitis B Core, IgM
Hepatitis B Surface antigen	Positive Screen: >1 and < 5	Hepatitis B surface antigen confirmation
Hepatitis C (HCV) antibody	Positive	HCV viral load and HCV genotype (newly diagnosed patient)
HCV Genotype	No HCV Viral Load w/in 30 days	HCV Viral Load
HFE (gene for hereditary hemochromatosis)	1 <sup>st</sup> mutation (Cys282tyr)	2 <sup>nd</sup> mutation (His63asp)
HIV I/II EIA	Positive	Multispot
HIV Genotype	No HIV Viral Load w/in 30 days	HIV Viral Load
Positive DAT	Elution	Antibody Identification
Positive IAT	DAT if auto control positive; Elution if DAT positive	Antibody Identification
Protein Electrophoresis – serum	Suspect Monoclonal Gammopathy	Total Immunoglobulins (IgG, IgM, IgA, and kappa and lambda free light chains); Immunofixation Electrophoresis on new patients with no previous record
Protein Electrophoresis – urine	Suspect Monoclonal Gammopathy	Immunofixation Electrophoresis on new patients with no previous record

<b>Initial Test</b>	<b>Reflex Criteria</b>	<b>Reflex Test(s)</b>
PSA Screen Test code- SPSA	Total PSA is >4.0 ng/ml and <10.0 ng/ml.	Free PSA
PTT Mixing Study	Abnormal mixing study	Thrombin Time
Syphilis IgG	Reactive	RPR Titer
Rocky Mountain Spotted Fever (RMSF) antibody	Positive EIA	RMSF IFA
Thin Prep Pap Smear	ASC/US or ASC/H Diagnosis	High Risk HPV DNA Test
Calculated LDL	Triglyceride >400 mg/dL	Direct LDL
TSH	< 0.4µIU/ml or > 5.5 µIU/ml	Free T4
Bone Marrow Aspirate	No Reticulocyte, CBC or Differential ordered	Reticulocyte, CBC, Differential

## ANATOMIC PATHOLOGY

### CYTOLOGY

#### **I. General Specimen Collection Techniques**

**ALL SPECIMENS (PREPARED SLIDES AND FLUID SPECIMENS) FOR CYTOPATHOLOGY MUST BE PROPERLY LABELED WITH THE PATIENT'S NAME AND IDENTIFICATION NUMBER**

##### *Fixatives:*

- A. Prepared slides: e.g., Pap smears, FNAs, Bronchial brushings, etc.
1. Spray fix with commercially available spray fixative; or
  2. Immediately immerse slides in 95% ethyl alcohol; or
  3. Rapidly air dry slides (Consult with Pathologist or Cytotechnologist before using this option).

**\*\*NOTE:** It is essential that prepared slides be labeled with the patient's name prior to fixation. Alcohol fixation must be accomplished immediately after the slide is prepared. Even minimal air drying of samples to be stained with Pap stain will alter the cellular detail and compromise specimen quality.

- B. Fluid specimens: Pleural fluid, Peritoneal Fluid, CSF, Urine, etc.
1. Mix the specimen with an equal volume of saccomanno fluid or
  2. Submit the specimen fresh and unfixed **ONLY** when the specimen can be delivered to the laboratory within 2-3 hours; or
  3. Fresh specimens may be refrigerated for up to 12 hours to slow cell degeneration and bacterial growth.

#### **DO NOT SUBMIT SYRINGES WITH NEEDLES ATTACHED**

All specimens submitted to Cytopathology must be accompanied by a **Tissue Examination Form (SF-515)** or equivalent printed electronic doctor's order form (found under Lab Orders in CPRS). The following information **MUST** be provided on the form: **NAME AND TELEPHONE (OR PAGER) NUMBER OF THE SUBMITTING PHYSICIAN, DATE OF COLLECTION, ANATOMIC SITE OF THE SPECIMEN, PREVIOUS/CURRENT THERAPY, AND PERTINENT CLINICAL HISTORY.**

For Gynecological specimens (Pap smears), the **Gynecologic Cytology Form (SF-541)** or equivalent printed electronic doctor's order (found in CPRS under lab order) must accompany the specimen. In addition to the required information listed previously, the **DATE OF LAST MENSTRUAL PERIOD (LMP), AGE, PREGNANCY STATUS, GRAVIDA, PARA AND INFORMATION REGARDING ANY PREVIOUS ABNORMAL CYTOLOGIC EXAMINATION OR GYNECOLOGIC SURGERY** must be included on the SF-541.

#### **II. Specific Specimen Collection Techniques**

- A. Ascites – See “Body Cavity Fluids”
- B. Aspiration Cytology – See “Fine Needle Aspirates” (FNA)
- C. Body Cavity Fluids (Pleural, Peritoneal, Pericardial) – The fluid is collected into a clean, dry container which need not be sterile and sent as soon as possible to the



Cytology Lab, Room 2D-185, during normal business hours (7:00 a.m. – 4:30 p.m., Monday through Friday). After Normal Business Hours, (nights, weekends, and holidays) the specimens must be sent to the Processing Lab, Room 2D-157. Cytology fixative is NOT required IF the specimen is to be processed within 12 hours. If processing is delayed, the specimen should be mixed with an equal volume of Saccomanno (green) fluid. Formalin must NEVER be added to body fluids, as it interferes with staining quality. NOTE: If a large volume of fluid is collected, only a Representative Portion of the Fluid should be submitted to the laboratory, up to 200 ml. Denote the total volume of fluid collected on the Standard Form SF515, submit a representative portion, and discard the remaining portion in a biohazard container. Cytology specimen containers can be obtained from the Cytology Lab, Room 2D-185, or the Histology Lab, Room 2E-138.

- D. Breast – See “Fine Needle Aspirate” (FNA)
- E. Bronchial washing – Bronchial washings are collected by instilling 3 to 5 ml of normal saline solution through the bronchoscope and reaspirating the resulting material. Bronchial washings must be delivered to the Cytology laboratory as soon as possible after collection. If delayed for 1 hour or more, fresh, unfixed specimens should be refrigerated. If processing is to be delayed for more than 3 hours, all of the material collected must be fixed with an equal volume of saccomanno fluid.
- F. Bronchial brushing – Immediately after the brush is removed from the bronchoscope, place in fixative for delivery to Cytology Laboratory. Brush can be fixed with Saccomanno (green) fluid or normal saline.
- G. Cerebrospinal fluid – The volume of the sample has considerable bearing on diagnostic accuracy; the larger the sample, the better the results. If several samples are obtained, the second or third sample should be used for cytology. Fresh, unfixed specimens should not be refrigerated and submitted to the laboratory immediately. The addition of an equal amount of saccomanno fluid to the sample is recommended if a delay in delivery and/or processing is anticipated. If there is a clinical history or suspicion of hematopoietic disease, an unfixed sample is preferable and the clinician should inform the personnel of the Cytology laboratory.
- H. Cervical Smears – See “Pap Smears”
- I. Colonic – See “Gastrointestinal Specimens”
- J. Cystoscopic of Catheterized Urine – See “Urine”
- K. Endocervical Smears - See “Pap Smears”
- L. Fine Needle Aspirate (FNA) – For superficial masses, the attending pathologist is available to perform the aspirates. Arrangements can be made by calling the Pathology office at 76431 or 76428.
  - 1. **Solid Lesions:** prepare direct smears on clean (non-frosted) glass slides and **immediately** immerse them in 95% ethyl alcohol or spray fix. In certain clinical settings it may be preferable to rapidly air-dry some or all of the slides. After the slides have been prepared, rinse the needle and syringe with 95% ethyl alcohol and submit the fluid and the prepared slides to the Cytology laboratory for evaluation
  - 2. **Cystic lesions and Nipple discharge specimens:** Use the method described below under “Handling of Fluids Obtained by Aspiration.” Personnel of the Cytopathology Department offer assistance for radiographically directed aspirates. Contact the Cytology Department at ext. 56448, 56449 or 56506 for scheduling information.
- M. Gastrointestinal – (Colonic, Duodenal, Esophageal, Gastric, etc.)
  - 1. **Brushings:** See “E. Bronchial Brushing” Above.

2. **Washings:** Mix the specimen with an equal volume of saccomanno fluid unless the specimen is to be processed immediately.
- N. Lymph Node Aspirates – See FNA. Discuss with the pathologist before the aspirate is performed to determine which slide preparation method is best for the specific clinical setting in question.
- \*\*\*NOTE: Immunophenotypic studies by flow cytometry and/or immunoperoxidase can be performed on FNA material. Consult the Cytopathology department personnel for further assistance.
- O. Pap Smears – (Cervical Endocervical or Vaginal)
1. **Traditional Pap Smears:** One or two slides may be submitted. Material must be collected from the squamo-columnar junction for optimal evaluation of the uterine cervix. The material is smeared onto labeled, clean (non-frosted) glass slides and immediately spray fixed or immersed into 95% ethyl alcohol. SLIDES THAT ARE NOT PROPERLY LABELED WITH THE PATIENT'S NAME WILL BE REJECTED.
  2. **ThinPrep Pap Smears:** A broom-type-sampling device is required to obtain an adequate sample for ThinPrep Cytology. Insert the central bristles of the broom into the endocervical canal deep enough to allow the shorter bristles to fully contact the ectocervix. Push gently, and rotate the broom in a clockwise direction five times. Rinse the broom in the PreservCyt Solution vial by pushing the broom into the bottom of the vial ten times, forcing the bristles apart. As a final step, swirl the broom vigorously to further release material. Cap the vial tightly. Record the patient's name and identification number on the vial. Place the vial in a biohazard transport bag and deliver to the Cytology laboratory. (A videotape is available in the Cytopathology Department to further clarify the collection process for the ThinPrep Test).
  3. **Hormonal Evaluation:** gently obtain material from the upper third of the lateral vaginal wall. Prepare slides and fix as noted above. The slide must be identified as to the origin. The LMP must be submitted  
**\*\*NOTE:** A maturation index cannot be given in the presence of endocervical elements, an inflammatory process, pre-neoplastic changes, or carcinoma.  
Precaution: Do not use lubricants in examining the patient before the specimen is taken or on any instrument used to obtain the specimen. It is not recommended that specimens be taken within 24 hours after douche, or 6-8 weeks after biopsy, curettage, cone biopsy, or cauterization. Do not take specimens before 6 weeks post-partum. **Not indicating the above conditions may impede correct interpretation of the specimen.** Please provide all pertinent clinical information on the request slip including: date of last menstrual period, age, use of IUD, or hormonal therapy.
- P. Sputum – Three separate specimens, obtained on consecutive days, early in the morning, is the preferred specimen. The specimens should be transported to the lab as soon as possible. Fresh, unfixed sputum is the specimen of choice. If processing is to be delayed, an equal volume of Saccomanno fixative may be added.
- Q. Salivary Glands – See FNA
- R. Thyroid – See FNA
- S. Urine – Multiple voided urine specimens are invaluable in assessing the status of the lower urinary tract. Catheterized urine is acceptable. The specimen type (voided, instrumented, or catheterized) **MUST** be noted on the Tissue Examination Form. Urine specimens may be processed fresh or pre-fixed. If processing is delayed for more than 2 hours, the specimen should be fixed with Saccomanno fluid. There must be sufficient fixative added to insure proper fixation. This requires a mixture of

approximately equal volumes of specimen and fixative. Mix the specimen with the fixative thoroughly. Refrigerate the specimen if processing will be delayed 8 hours or more.

### **GUIDELINES FOR SPECIMEN ADEQUACY**

- A. The term “**non-diagnostic**” is generally used to indicate that a non-gynecologic specimen is inadequate.
- B. **Sputum** specimens are considered inadequate if less than three (3) pulmonary macrophages are noted per medium power field. In addition, if the presence of food particles obscures the observation of the cells, the specimen is considered inadequate. Less than optimal sputa are described as “diluted with saliva.”
- C. **Fine Needle Aspiration** specimens are considered to be inadequate when less than 12 clusters of the tissue to be investigated are present per slide. However, if a total of more than 30 cell clusters is found to be distributed over as many as ten (10) different smears, this can be considered to be adequate.
- D. **Urine** specimens and **Cerebrospinal fluid** specimens as well as **Effusions** from body cavities are rarely considered to be inadequate except due to errors in fixation or preparation. Red blood cells present in Cerebrospinal fluid usually indicate traumatic rachicentesis and are of unreliable diagnostic value. Transudate effusions may have few cells present, which may be considered non-diagnostic.
- E. **Brushing** specimens (bronchial, GI, etc.) are considered to be inadequate when less than ten (10) clusters of cells per slide are present.
- F. **Cervical/Vaginal** specimens. The following are definitions and criteria for specimen adequacy provided by The 2001 Bethesda System for Reporting Cervical/Vaginal Cytological Diagnoses.

**Unsatisfactory for Diagnosis:** Indicates that the specimen is unreliable for the detection of cervical epithelial abnormalities.

- 1. Lack of patient identification on the specimen and/or requisition.
- 2. A technically unacceptable slide is defined as: one that is broken and cannot be repaired, or cellular material that is inadequately preserved.
- 3. Scant squamous epithelial component (well-preserved and well-visualized squamous epithelial cells spread over less than 10% of the slide surface).
- 4. Obscuring blood, inflammation, thick areas, poor fixation, air drying artifact, contaminant, etc., which precludes interpretation of approximately 75% or more of the epithelial cells.

**\*\*If abnormal cells are detected, the specimen is never categorized as unsatisfactory.**

**Satisfactory for Evaluation but Limited By..**

- 1. Lack of pertinent clinical information (age and LMP minimum).
- 2. Partially obscuring blood, inflammation, thick areas, poor fixation, air drying artifact, contaminant, etc., which precludes interpretation of 50% to 75% of the epithelial cells.
- 3. Lack of endocervical/transformation zone component in a patient with a cervix.

**Satisfactory for Evaluation:** indicates that the specimen has all of the following:

- 1. Appropriate labeling and identifying information.
- 2. Relevant clinical information.

3. Adequate numbers of well-preserved and well-visualized squamous epithelial cells.
4. An adequate endocervical/transformation zone component (from a patient with a cervix): as a minimum, two clusters of well-preserved endocervical and/or squamous metaplastic cells, each cluster composed of a minimum of five (5) appropriate cells, are required.

### **REJECTION OF IMPROPER CYTOLOGY SPECIMENS**

#### **Gross Examination:**

- A. Specimens will be examined for correct and adequate identification, external cleanliness, timely submission, clotting, appropriate fixation, and correctly prepared requisition slips.
- B. Cytologic specimens should be accepted and examined only if requested by a physician and collected in accordance with written instructions regarding proper collection techniques. Improper specimens will be referred to the pathologist for final determination as to whether the specimen will be processed or rejected.
- C. The Cytology laboratory will inform the originator of the specimen if the specimen is to be rejected with a detailed explanation. The incident will be recorded on the "Rejected Specimen Log Sheet."

#### **Microscopic Examination:**

- A. On microscopic examination, the pathologist may judge a preparation to be "unsatisfactory" or "limited." This judgment will be made on the basis of the number of cells present for examination, the types of cells present (i.e., lack of representative cell types for a given site, contamination by cells of extraneous origin, or the presence of obscuring inflammation or blood), cellular distortion due to poor or improper fixation.

A formal, numbered cytology report will be generated with the interpretation noting the "limited by" or "unsatisfactory" state of the specimen. This report will be circulated, as all cytology reports, to the chart to be included as a part of the permanent record. Thus, the attending physician is notified of the "unsatisfactory" or "limited" specimen via the routine pathology report process with a hard copy available in the chart and the report available for review via the computer system locations and are viewable by computer upon verification.

## **HISTOLOGY**

PHONE: 76482

### **SURGICAL PATHOLOGY SPECIMENS**

1. All specimens will be fixed in 10% buffered formalin. Bottles containing formalin may be obtained from the Histopathology section, Room 2E-141.

- a. **SURGICAL TISSUE & TRANSFER SLIDES**

All surgical tissue specimens and surgical transfer slides will be submitted with Tissue Examination Form SF-515 to Room 2E-141. (The Histopathology Section will not be accountable for specimens submitted without a properly filled out label or for specimens left in other laboratories).

- b. **BIOPSIES**

Submit properly labeled, with above requisition form. They will be read out the following work day.

2. **FROZEN SECTIONS**

Tissues for frozen sections from the surgical suite will be transported to Room 2E-141. Other tissues for frozen sections from individual wards or clinics will be transported directly to Room 2E-141. All tissues submitted must be properly labeled and with a SF-515. Scheduling will expedite the results. Call Ext. 76438 for information pertaining to, or the results of, frozen sections.

## **BLOOD BANK**

### **GENERAL INFORMATION**

#### **Specimen Requirements**

Patient specimens for pretransfusion testing, including patients with autologous or directed donations, must have a blood specimen collected and tested within 72 hours of an intended red cell transfusion. Specimens must meet the following requirements:

1. The tube must be labeled in the presence of the patient with:
  - a. Patient's first and last name.
  - b. Full Social Security Number (SSN)
  - c. Signature of the phlebotomist
  - d. Date and time of collection

A new patient sample must be collected if any of the above information is omitted from the patient specimen. **NOTE:** A second specimen collected at a separate time will be requested if patient requires blood transfusions and the patient does not have an ABO/RH test on record. This is a Joint Commission and CAP Patient Safety requirement.

2. Plasma or platelet transfusions do not require a current blood specimen, provided patient has more than one CAVHS ABO/Rh test on record and the most recent testing is within 14 days.
3. Printed copy of the providers CPRS order signed by the phlebotomist must accompany specimens collected by the wards.

#### **Type and Crossmatch vs. Type and Screen**

A type and screen order (TAS) includes a determination of the patient's blood type and the presence of any atypical antibodies. It does not include crossmatching. If red blood cell units are needed, the Blood Bank will be able to crossmatch units using the patient's type and screen specimen. Red blood cell products must be requested in the CPRS Blood Bank Orders (VBEC) Menu.

Type and screen orders are preferred for surgery patients whose procedures historically do not require transfusion on patients not meeting transfusion criteria. Red cell units can be readily available in an emergency. A type and screen should be ordered for patients who may need a red cell transfusion in the next 72 hours, but whose current hemoglobin and hematocrit values exceed recommended transfusion criteria.

#### **Surgery Patients**

See Memorandum No. 113-4, Pre-operative Blood Orders for information and the recommended maximum surgical blood order schedule.

#### **Emergency Release**

In an emergency situation, red blood cells may be requested prior to the completion of pretransfusion testing. Notify the Blood Bank that emergency released blood is needed. If patient's blood specimen is unavailable or if there is no time to collect and determine the patient's ABO-Rh type, group O red cell units, Rh negative/positive will be released. If there is a Blood Bank specimen collected from the patient in the past 72 hours, type specific red blood cell units will be issued without crossmatching. An emergency release form, available from the

Blood Bank or from the ward, must be signed by the requesting provider. This form should be signed before products are released, but may be signed later, but not more than 24 hours after the request was made. A specimen should be collected and sent to the Blood Bank as soon as possible so that compatibility testing can be performed and the patient can be given group specific blood products.

### **Circular of Information**

Information regarding blood products can also be found in the "CIRCULAR OF INFORMATION FOR THE USE OF HUMAN BLOOD AND BLOOD COMPONENTS," which can be viewed on the CAVHS Website/Department/Pathology and Laboratory Medicine Service/Circular of Information for Blood Bank. Printed copies are also available upon request from the Blood Bank.

## **HOW TO REQUEST BLOOD BANK DIAGNOSTIC TESTS AND BLOOD PRODUCTS**

### **Blood Bank Orders will be electronic through CPRS. Verbal orders will not be accepted unless an emergency exists.**

Requests will be initiated by a provider. Orders must be placed in CPRS before any testing may proceed. If the transfusion of blood or blood components is desired, a separate Nursing order must be placed indicating the type of product, number of units, and when products are needed. The Blood Bank Orders (VBEC) dialog box contains a link to the Nursing Administration menu:

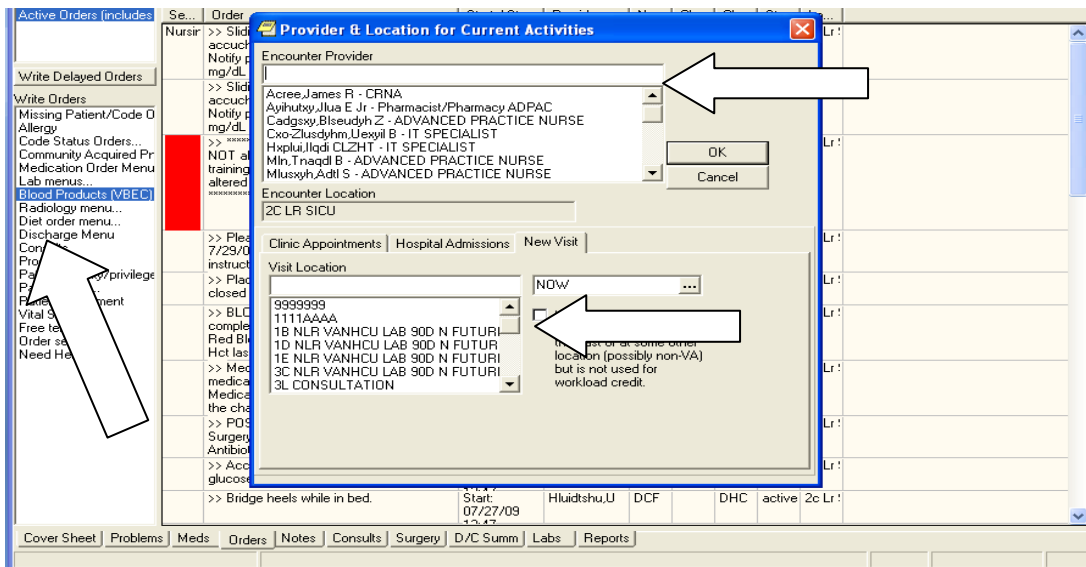
To order a transfusion or diagnostic tests in CPRS:

1. Logon to CPRS using your VistA user name and verify code.
2. Type in the patient name in the patient selection box when the **Patient Selection** dialog window opens. Click **OK** after selecting your patient.
3. Click on the **Orders** tab at the bottom of the CPRS window.

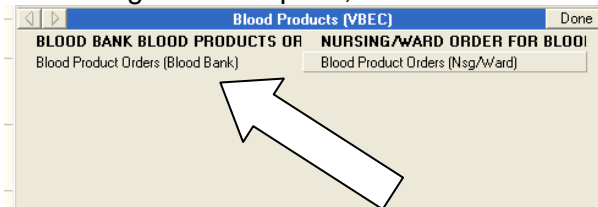
View Orders	Active Orders (includes Pending & Recent Activity) - ALL SERVICES							
Se...	Order	Start / Stop	Provider	Nu...	CL...	Ch...	St...	Lo...
Nursing	>> Sliding scale insulin, accucheck/glucose AC&HS. Notify provider if blood sugar less than 70 mg/dL or greater than 400 mg/dL.	Start: 12/03/09 08:22	Mxytby,S				active	2c Lr
Write Delayed Orders	>> Sliding scale insulin, accucheck/glucose AC&HS. Notify provider if blood sugar less than 60 mg/dL or greater than 400 mg/dL.	Start: 08/13/09 10:36	Aibdyt,Z				active	2c Lr
Write Orders	>> ***** DO NOT alter this record, it is used for formal training of BCMA. If these orders are altered it will affect the class. ***** "Flagged"	Start: 08/13/09 10:28	Aibdyt,Z				active	2c Lr
Missing Patient/Code 0	>> Please d/c foley at 6:00 AM on 7/29/09. Once foley removed, please instruct patient on clean intermittent	Start: 07/28/09 20:10	Hluidtshu,U	DHC		DHC	active	2c Lr
Allergy	>> Place Foley, record residual, connect to closed drainage, maintain per SOP.	Start: 07/28/09 06:33	Hluidtshu,U	DHC	GC	DHC	active	2c Lr
Code Status Orders...	>> BLOOD PRODUCTS ORDER Please call SF-518 for 2 unit(s) of RBCs and Transfuse Now right 33.7 but down to 29.3 this	Start: 07/28/09 06:33	Hluidtshu,U	DHC	GC	DHC	active	2c Lr
Community Acquired Pr	>> Medication Reconciliation - All medications (including Non VA medications) have been reconciled with the admission. Medication	Start: 07/27/09 15:50	Gxuiky,L	DCF	KIZ	DHC	active	2c Lr
Medication Order Menu	>> P... OP ANTIBIOTICS started at 1000. Not given in PACU	Start: 07/27/09 12:25	Hluidtshu,U	AZJ		DHC	active	2c Lr
Lab menus...	>> A... checks AC & HS, call M.D. for glucose >200 or <60.	Start: 07/27/09 12:45	Hluidtshu,U	DCF		DHC	active	2c Lr
Blood Products (VBEC)	>> Bridge heels while in bed.	Start: 07/27/09 12:45	Hluidtshu,U	DCF		DHC	active	2c Lr
Radiology menu...								
Diet order menu...								
Discharge Menu								
Consults								
Procedure...								
Patient activity/privilege								
Patient Care...								
Patient Movement								
Vital Signs...								
Free text								
Order sets								
Need Help?								

4. Scroll down the left hand side window of **Write Orders** until you see **VBEC**

**Blood Bank** and click on this. The **Provider & Location for Current Activities**(ward or clinic) dialog window opens. Select the **Encounter Provider** and **Visit Location** from the scroll down bars. Click **OK**.



- On the dialog box that opens, click on **Blood Bank Blood Products Order**.



- The **Blood Component and Diagnostic Test Order Form** opens. It defaults to the **Patient Information** tab. Click on **Blood Bank Orders**.



7. If only a test is needed, select from the drop down menu under the Diagnostic Tests menu:

**Blood Component and Diagnostic Test Order Form**

Patient Information | Blood Bank Orders | Lab Results

Personal Quick Orders

**Blood Components** Quantity\*

Modifiers

Date/Time Wanted\*

Urgency\* Surgery

Reason for Request\* Comment

Transfuse  
Hold for QR  
Hold until MD gives order

**Diagnostic Tests**

Collection Type\* Lab Collect

Collection Date/Time\* Next scheduled lab collection

\* Indicates a required field

**Selected Components and Tests**

Test/Component	Qty	Modifiers
----------------	-----	-----------

Remove  
Remove All

Accept Order  
Quit

The selected test(s) will appear in the **Selected Components and Tests** window.

- **ABO/Rh**
  - **Antibody Screen,**
  - **Direct Antiglobulin Test**
  - **Transfusion Reaction Workup**
  - **Type and Screen** *NOTE: Do not select Antibody Screen as a substitute for a Type and Screen*
8. Enter the
- Date/Time Wanted in the field **Date/Time Wanted\***.
  - Collection Type in the field **Collection Type**
  - Collection Date and Time in the field named **Collection Date/Time\***

**Blood Component and Diagnostic Test Order Form**

Patient Information | Blood Bank Orders | Lab Results

Personal Quick Orders

**Blood Components** Quantity\*

Modifiers

Date/Time Wanted\*

Urgency\* Surgery

Reason for Request\*

Comment

Transfuse  
Hold for OR  
Hold until MD gives order

**Diagnostic Tests**

Collection Type\*

Lab Collect

Collection Date/Time\*

Next scheduled lab collection

\* Indicates a required field

**Selected Components and Tests**

Test/Component	Qty	Modifiers

Remove

Remove All

Accept Order

Quit

9. If **Blood Components** are required,
  - Select the appropriate blood component from the drop down menu under **Blood Components** menu.
  - Enter the quantity of the component required in the field named **Quantity\***.
  - Enter any component modifiers that might be needed from the drop down menu.
  - Repeat this step as necessary for each type of component required.

**Blood Component and Diagnostic Test Order Form**

Patient Information | Blood Bank Orders | Lab Results

Personal Quick Orders

**Blood Components** Quantity\*

RED BLOOD CELLS  
FRESH FROZEN PLASMA  
PLATELETS  
CRYOPRECIPITATE  
WHOLE BLOOD  
OTHER

Modifiers

Date/Time Wanted\*

Urgency\* Surgery

Reason for Request\*

Comment

Transfuse  
Hold for OR  
Hold until MD gives order

**Diagnostic Tests**

Collection Type\*

Lab Collect

Collection Date/Time\*

Next scheduled lab collection

\* Indicates a required field

**Selected Components and Tests**

Test/Component	Qty	Modifiers

Remove

Remove All

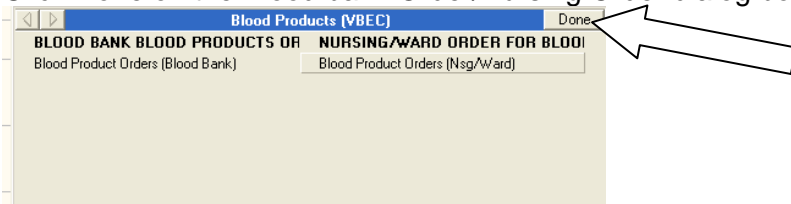
Accept Order

Quit

10. Enter the Urgency in the field named **Urgency\***
  - If The urgency is Pre-Op You must select the patient's surgery from the list of surgical procedures in the drop down menu under **Surgery\***

- If The urgency is ASAP, Routine or STAT, Select a reason for the order from the drop down list under **Reason for Request\***

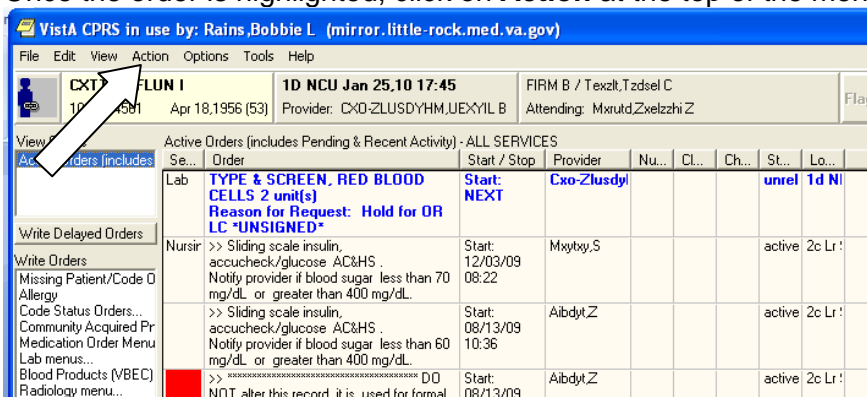
- Enter comments if appropriate under the free text section named **Comment**.
- When you are satisfied that the order is complete, click on the **Accept Order** button.  
*Note – a warning may appear that notifies you that a separate order to transfuse is required. Click OK.*
- Click Done on the Blood bank Order/Nursing Order dialog box.



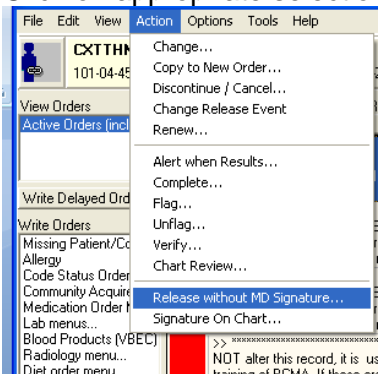
- The order should appear on the **CPRS Active Orders** page at the top and in blue text. Highlight the order by clicking on it with your mouse.



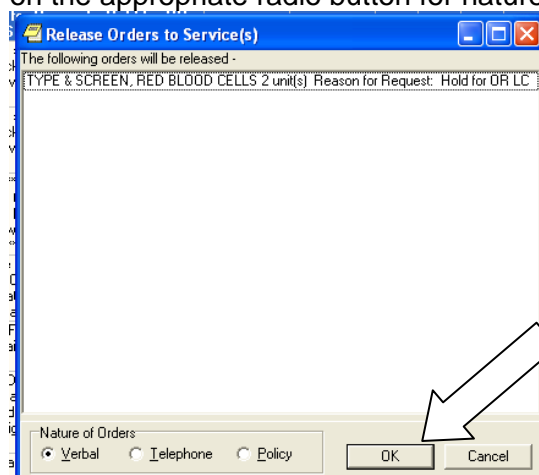
- Once the order is highlighted, click on **Action** at the top of the menu bar.



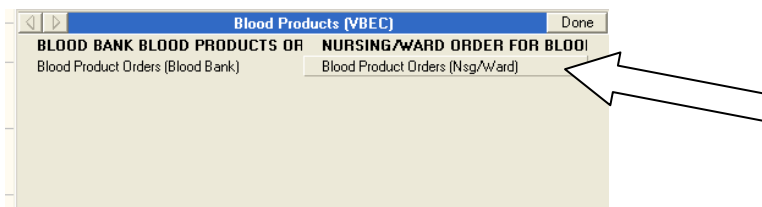
- Click on appropriate selection to **sign or release the order**.



17. The Release **Orders to Service(s)** screen appears. Highlight the pending order. Click on the appropriate radio button for nature of the orders. Click on **OK**.



18. **Nursing/Ward for Blood Products:** If Transfusion is desired -Return to VBEC dialog box and select Blood Product Orders (Nsg/Ward)



19. Lab Orders signed go to VISTA and VBECS; Nursing orders do not.

## **HOW TO FILL OUT THE SF-518 DURING COMPUTER DOWNTIMES**

During Computer Downtime, Blood Bank will use the SF-518 Forms. Orders will be entered in CPRS/VBECS by Blood Bank staff when service is restored.

**COMPONENT REQUESTED (Check one):** Mark the box beside the component that has been requested. Fill in the number of units needed for platelets and cryoprecipitate.

**VOLUME REQUESTED (If applicable):** Most of the blood products have a standard volume, so this is usually left blank.

**REMARKS:** Record any special instruction (e.g., autologous units, irradiated, CMV negative, platelet crossmatch, HLA match required).

**TYPE OF REQUEST (Check ONLY If Red Blood Cell Products are requested)**

**TYPE AND SCREEN:** This is usually ordered for patients who are going to have a surgical procedure, which rarely requires a blood transfusion. This is done so that the Blood Bank will have a specimen available to do a STAT crossmatch, if necessary. Orders should be marked on the SF-518 as a TYPE AND SCREEN and ordered in the computer.

**CROSSMATCH:** Check this box if there is an order for red blood cells to be transfused or for surgery. The Type and Crossmatch and the Type and Screen are two separate orders. Do not check both boxes.

Normally type specific components are issued, therefore the patient's ABO/Rh must be determined before components can be thawed or pooled. Call the Blood Bank when these orders are written. Blood Bank staff will check patient's transfusion record. A Type and Screen order may be indicated. Platelets, FFP, and cryoprecipitate are not crossmatched and do not require a type and screen if one has been done within the last 14 days.

**DATE REQUESTED:** Record the date the order was made.

**DATE AND HOUR NEEDED:** If the order is for surgery, fill in the day of surgery. The specimen for these orders will be drawn the day before surgery. If the order is for transfusion today, put today's date and what time the blood is needed. If the order is STAT or ASAP, write it in this space.

**REQUESTING PHYSICIAN (Print legibly):** This information will be entered in the computer when the components are requested by Blood Bank personnel.

**DIAGNOSIS OR OPERATIVE PROCEDURE:** This information is required to provide appropriate blood inventories.

The collection information should be filled out by the person drawing the specimen, prior to bringing the specimen to the Blood Bank.

### **HOW TO COLLECT THE SPECIMEN**

1. Print a copy of the CPRS Blood Bank Lab Order, obtain tube labels with the patient's first and last name and full social security number before attempting to collect a blood specimen.
2. Ask patient to state his/her full name and full social security number (SSN) and compare stated name and SSN to the information on the labels.
3. Compare the first and last name and full SSN on tube label with patient armband. Do not draw a specimen from a patient who is not wearing an armband or if there is any discrepancy in the information.
4. Draw blood in a pink top tube.
5. Place label on tube. The label must have the patient's first and last name and full SSN. If you do not have a preprinted label, the patient's full name, full social security number, and date must be written on the tube.
6. Compare full name and full social security number on the copy of the CPRS Lab Order with the full name and social security number on the patient armband.
7. Sign the tube and include date and time of specimen collection. Sign the copy of the CPRS Lab Order. Signature must be readable.
8. Take the specimen and a copy of CPRS Lab Order to the Blood Bank.

9. Patient specimens and forms lacking correct patient/phlebotomist collection identification will not be accepted.

### **ISSUE OF BLOOD AND BLOOD COMPONENTS**

When blood products are ready for transfusion, the Blood Bank will call the ward. Please keep phone calls to the Blood Bank at a minimum. Please note that some blood products have limited expiration dates once prepared. Thawed Cryoprecipitate will expire in four hours. Frozen Plasma once thawed will expire in four hours at room temperature or 5 days if stored in the Blood Bank refrigerator. Blood and blood components will be issued in the computer system **before** leaving the Blood Bank. Emergency releases and computer down times are the only exceptions permitted.

### **WARD ISSUE**

A printed copy of the CPRS Provider's Order for transfusion with the patient's full name and social security number must be used any time blood or blood components are issued. This is to ensure that the blood requested will be issued to the right patient. Products will not be released without this information.

For hospital locations validated for transport in the pneumatic tube system, the ward must notify the Blood Bank by telephone (76452) when a blood product is needed and send a printed copy of the provider's CPRS order for the transfusion in a pneumatic tube. The blood product will be placed in a plastic biohazard bag. The BTRF and a Blood Products Transport Tracking Form will be enclosed in the side pouch. Only one blood product will be shipped per pneumatic tube. Blood Bank staff will call the ward when the product is being sent. Receiving ward personnel will record time of receipt of the product and sign the Blood Products Transport Tracking Form. Form will be immediately returned in the pneumatic tube to the Blood Bank tube station. Return of the Blood and Blood Products Transport Tracking Form indicates a successful transport of the blood product.

If picking up blood products directly from the Blood Bank, Ward staff must verbally verify the patient and product information on the blood products with a Blood Bank technologist at the time of issue. Products for only one patient at a time will be released to the wards.

### **SURGERY ISSUE**

Red cells and plasma will be issued in blue or red coolers for temporary storage in the patient's surgical suite. Blue coolers have a maximum storage time of 24 hours. Red coolers have a maximum storage time of 8 hours. Internal storage temperature must be recorded every 4 hours if not returned to the Blood Bank. Surgery may use a form with the patient's full name and social security number stamped, written, or labeled on all copies. If the requesting person does not have a slip and the transfusion need is urgent, the CPRS Provider's Order may be printed from a terminal in the Blood Bank.

### **INFUSION GUIDELINES**

Refer to Nursing Memorandum No. 56 for Nursing Transfusion Instructions.

1. Once the blood leaves the Blood Bank, the transfusion should be started within 30 minutes. If for some reason the transfusion cannot be started, return the component to the Blood Bank promptly for proper storage. Under no circumstances should nursing units store components in refrigerators on the ward. This is an AABB and FDA regulation to assure proper storage of blood components.

2. Under normal conditions a red cell transfusion should be completed within two hours, but must not exceed four hours. This would be an infusion rate of approximately 2 ml per minute for the first 15 minutes. Platelets, FFP, and cryoprecipitate can be infused as fast as the patient can tolerate. All blood products should be transfused within four hours from the time of issue by the Blood Bank.
3. IV Solutions and Medications  
Only normal saline can be infused with blood. Ringer's lactate and D5W must not be infused with any blood products. These solutions can cause hemolysis and clotting. If medications must be given in the same tubing as blood, the line must be flushed with saline prior to and at the completion of the medication. Do not add medication to a blood transfusion.
4. Blood Filters  
All blood components must be infused through a filter. Use a standard blood filter (150-280 micron screen) for all blood products. Leukocyte-reduction filters are not indicated if products have been leukoreduced by the blood manufacturer.
5. Number of Components Transfused at One Time  
Under routine conditions, one blood product should be transfused at a time. In emergency situations, more than one unit can be transfused at the same time, if additional IV sites are available.
6. ABO/Rh of Patient vs. ABO/Rh of Component  
The ABO/Rh of any red cell product must be type specific or type compatible. The blood type of units issued may not be the same type as the patient due to blood shortages. If the ABO/Rh of the unit is not the same as the patient's, verify with the Blood Bank staff to make sure a clerical error has not occurred.
7. The empty bag and the completed Blood Transfusion Record Form should be placed in the plastic biohazard bag provided by the Blood Bank. Place the BTRF in the pouch so that it will not come in contact with the empty blood bag. Return to the Blood Bank as soon as completing the transfusion in order to allow for prompt recording of patient transfusion data in the computer. This may be returned to the Blood Bank via the translogic system.

## **POST TRANSFUSION COUNTS**

Laboratory orders must be in the computer for collection post transfusion. If requested as a regular draw, the specimen may be inadvertently drawn while the blood is still infusing. The specimen should be collected 30 minutes to an hour after the completion of the transfusion. Patient blood specimens may have to be re-collected if transfusion time does not coincide with the scheduled draw times.

Laboratory values obtained during transfusion may not represent the hemostatic end point of the blood component infused.

## **TRANSFUSION REACTIONS**

### **Symptoms**

The symptoms of a transfusion reaction may include any of the following: urticaria, wheezing, respiratory distress, hypotension, chills, back pain, hematuria, fever (more than 1C or 2F increase), and unexplained bleeding. Except for uncomplicated urticarial reactions, the transfusion must be discontinued.

### Nursing Responsibilities

1. Stop the transfusion. Keep the line open with saline.
2. Check the information on the caution tag and the patient's armband for any clerical error.
3. Call the patient's physician. It is the physician's responsibility to determine if a transfusion reaction work-up is to be performed. If a transfusion reaction work-up is needed, continue with the next step.
4. Call the Blood Bank at 76452 or 56485
5. Order a Transfusion Reaction Consult in CPRS and send the following to the Blood Bank:
  - a. Remaining blood and infusion set.
  - b. One 7 mL pink top tube from patient (must meet Blood Bank specimen labeling requirements).
  - c. First post-transfusion urine
6. Provider or nurse must initiate the Blood Transfusion Reaction Consult in CPRS. Consults → Path & Lab Medicine Service → Blood Transfusion Reaction Consult/Lab Orders → Complete template.

### **Special Procedures:**

**Therapeutic Phlebotomy** is performed Monday through Friday, excluding holidays between 0800 – 1400 hours. The procedure is scheduled with the Blood Bank in Appointment Scheduling. Provider must order the procedure not to exceed 12 months from date of order. Place in CPRS → Order Sets → Hem/Onc orders → Therapeutic Phlebotomy indicating the number of procedures requested, frequency of phlebotomy, if more than one procedure, reason for the procedure, and any limiting criteria such as ferritin level or minimum hemoglobin. Unless otherwise stated in the order, the volume removed is one unit (500 mL). Preprocedure patient assessment will include hemoglobin or hematocrit, blood pressure, pulse rate, review by staff pathologist and patient informed consent.

**Therapeutic Apheresis** is not performed on site, but is orderable as a referral to UAMS. Order procedure as a consult: Consult → Path & Lab Medicine Service → Therapeutic Plasma Exchange (Apheresis) request. Chief of Staff approval is required for procedure performance at UAMS Apheresis Department.



## GENERAL TEST INSTRUCTIONS

### **BLOOD BANK** **PHONE 76452**

#### **ABO/RH**

Forward and reverse blood grouping and Rh typing

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: Pink top tube preferred  
Minimum requirement: 3 ml.

#### **ANTIBODY SCREEN (INDIRECT COOMBS)**

Detection of relevant clinically significant atypical antibodies other than ABO

RESULT AVAILABILITY: 24 hours a day, seven days a week .

ACCEPTABLE SAMPLES: Pink top tube  
Minimum requirement: 3 ml.

#### **DIRECT ANTIGLOBULIN TEST (DIRECT COOMBS)**

Detection of immune mediated or drug-induced hemolysis

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: Pink top tube  
Minimum requirement: 3 ml.

#### **TRANSFUSION REACTION WORKUP (MUST BE ORDERED AS CPRS CONSULT)**

All suspected transfusion reactions must be immediately reported to the Blood Bank and should be immediately worked-up by the patient's physician and laboratory staff. Transfusion reactions can be immediate (e.g., allergic, febrile, circulatory overload, gram-negative sepsis, hemolytic, etc.) or delayed (e.g., hemolytic, HIV, hepatitis, Graft vs Host disease, iron overload, etc.)

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: Draw post-transfusion blood specimen in 7 ml pink-top tube (fully filled) plus first voided urine specimen.

#### **TYPE & SCREEN (TAS)**

Determination of ABO group and Rh type plus Antibody Screen

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: Pink top tube  
Minimum requirement: 3 ml.

**BLOOD COMPONENTS (TRANSFUSION REQUEST)** – Order may require Type and Screen in Diagnostic Test menu. Choices in Blood Component menu include:

### **RED BLOOD CELLS**

This is the product of choice in the greatest majority of clinical situations regarding increased oxygen carrying capacity. RBCs contain no functional platelets and insignificant quantities of coagulation factors. One unit of RBC should raise the Hgb of a 70 kg patient by approximately 1 gm/dl (3% increase in Hct). The transfusion review criteria at CAVHS for RBC are an Hgb of 8.0 g/dl or Hct of 24% for a physiologically stable medical or surgical patient. Exceptions may be made if the patient has a compromised cardiovascular or cerebrovascular status, uncontrolled bleeding, or anticipated blood requirements.

Patients who have received frequent transfusions and women who have had multiple pregnancies may be alloimmunized to leukocyte and sometimes platelet antigens. This sensitization can be manifest as febrile transfusion reactions and/or as refractoriness to platelet transfusion. Patients who have severe or recurrent febrile nonhemolytic transfusion reactions may benefit from leukocyte-reduced blood components to prevent these reactions. Leukocyte-reduced blood is also considered to be CMV-safe in certain patient populations. When ordering this product, please be sure that your blood transfusion order calls for “leukocyte-reduced” red cells or platelets. The majority of the cellular blood products received by this facility are leukocyte reduced.

### **FRESH FROZEN PLASMA PREPARATIONS**

Fresh Frozen Plasma (FFP) – Expires 24 hours post-thaw

Thawed Plasma (TP) – This product is converted from Thawed FFP with an expiration of 5 days in refrigerated storage.

FFP or TP is indicated for patients requiring multiple coagulation factor replacement in case of bleeding due to multiple, significant factor deficiencies (e.g., massive transfusion, DIC, or Vitamin K deficiency). A significant coagulopathy is defined by the CAVHS screening criteria for appropriate FFP use is as follows: PT>15.1 seconds or PTT >38.1 seconds or INR >1.5.

FFP is also used in patients with congenital factor deficiencies for which no purified concentrate exists. Each unit of FFP provides the equivalent amount of all coagulation factors and plasma proteins found in the plasma of a single unit of freshly drawn blood (400-800 fibrinogen and 200 U (1U/ml) of other coagulation factors. One unit of FFP would be expected to raise the level of a given coagulation factor by 7-10% , and the usual dose is 0.5-1 unit per 10 Kg adult (or 4-8 units). FFP should be given shortly before an anticipated interventional or surgical procedure if used to correct coagulopathy since Factor VII has a half-life of only 4-6 hours. FFP should NOT be used for blood volume expansion or protein supplement. FFP is an acellular product and does not cause graft vs host disease, Rh immunization, or transmit CMV or HTLV-I/II. FFP takes ½ hour to thaw. It should be ABO compatible with the recipient and is transfused via standard (180 micron) blood filters. FFP, once thawed, should be stored at 1-6°C (in Blood Bank refrigerator) and infused as soon as possible, ideally within 2-4 hours. If unused, it should be returned to the Blood Bank within 30 minutes.

Thawed plasma is equivalent to FFP for all indications with the exception that it should not be used to treat Factor V or VIII deficiency.

## **PLATELETS**

The CAVHS Blood Bank does not routinely stock platelets. Random donor platelets are no longer manufactured by our blood suppliers. Platelets are supplied as Apheresis Platelets (Platelet Pheresis). They must be obtained on-demand from our blood suppliers due to their limited shelf life. Platelets outdate in a maximum of 5 days. Platelets are stored at 20-24°C with continuous gentle agitation. A single pheresis platelet contains more than  $3 \times 10^{11}$  platelets (equal to 6-8 units of platelet concentrate) in a volume of 300-400 ml. One unit of apheresis platelets will usually increase the platelet count of a 70-kg adult by 30,000-60,000/ul. Most units of apheresis platelets have sufficiently few WBC to be considered "leukocyte-reduced" ( $<5 \times 10^6$  WBC), and units meeting this criterion will be labeled as such.

Platelets are used for serious bleeding in thrombocytopenia (usually  $<50,000/\text{ul}$ ) due to leukemia or other bone marrow infiltrative diseases, chemotherapy, aplastic anemia, massive blood transfusions, congenital or acquired platelet dysfunction with normal platelet levels. Platelets may be used for prophylaxis against bleeding in patients who have chemotherapy-induced bone marrow failure. At CAVHS, the screening criteria for platelet transfusions are as follows:

1. The platelet count is  $<50,000/\text{ul}$ .
2. The patient is significantly bleeding or undergoing a **minor or minimally invasive** surgical procedure and the platelet count is  $<50,000/\text{ul}$ .
3. The patient is significantly bleeding or undergoing a **major invasive** surgical procedure and the platelet count is  $<100,000/\text{ul}$ .

## **CRYOPRECIPITATE (CRYO)**

CRYO Single Donor Unit (5-15 ml/bag) or 5 Donor Pooled Unit with 100 Normal Saline Expires 6 hours post thaw.

Each single donor unit contains 80-100 U Factor VIII, approximately 250 mg fibrinogen as well as von Willebrand Factor, and Factor XIII. The chief clinical indication for CRYO is the treatment of bleeding due to fibrinogen deficiency, where fibrinogen is disproportionately lower than other coagulation factors. It is the component of choice to correct the common form of coagulopathy associated with massive transfusion and hemodilution in which all coagulation factors are severely diminished. Cryo may also be used to treat bleeding in patients who have platelet dysfunction due to uremia and who fail to respond to DDAVP. CAVHS CRYO screening criteria is as follows:

1. The patient is significantly bleeding or undergoing a surgical/invasive procedure and has a fibrinogen  $<100 \text{ mg/dl}$  or PT  $> 15.1$  seconds.
2. There is documentation of DIC in the medical record (clinical presentation and laboratory data).
3. The patient has renal failure requiring dialysis and is significantly bleeding, OR undergoing a surgical/invasive procedure; and is unresponsive to DDAVP therapy.

The dose of CRYO varies with the specific indication. One bag of CRYO may be expected to increase the fibrinogen in an adult by 20 mg/dl. One pool of cryo is the equivalent of 5 bags of cryo. Since the critical level of fibrinogen for transfusion is approximately 100 mg/dl, a reasonable starting dose of CRYO to treat fibrinogen deficiency would be 10-15 bags of CRYO, (1 bag/5 Kg), or 1-2 pools. Approximately 10 bags/2 pools are usually used to treat uremic bleeding. When ordering this product, be

sure to specify the number of bags of CRYO in the pool (if other than 5) and the number of pools.

**WHOLE BLOOD**

(WB 500 ml; Hct=36-44%, Shelf Life=35 days

A request for whole blood is rarely justified. It must be approved by the Blood Bank pathologist and special ordered. Expected availability of the product is 3-5 days.

**CHEMISTRY/TOXICOLOGY**  
**PHONE 76455 OR 56491**

**ACETAMINOPHEN**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	ug/ml	10	30		>300

Toxic: > 120

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN YELLOW SST tube.

Minimum requirement: 3 ml.

**ALBUMIN**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	g/dL	3.4	5.0		

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN YELLOW SST tube.

Minimum requirement: 3 ml.

**ALKALINE PHOSPHATASE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	IU/L	31	126		

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN YELLOW tube.

Minimum requirement: 3 ml.

**ALPHA-FETOPROTEIN**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	ng/mL	0	9.0		

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in RED/YELLOW tube.

Minimum requirement: 3 ml.

**(ALT) SGPT**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	U/L	11	63		

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN/YELLOW PST tube.

Minimum requirement: 3 ml.

**AMIKACIN PEAK & TROUGH**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
	ug/mL				
Serum	Peak	20	25		
	Trough	5	10		10

RESULT AVAILABILITY: 24 hours a day, seven days a week

ACCEPTABLE SAMPLE: Blood. Draw in Red/Yellow tube.  
Minimum requirement: 3 ml

**AMYLASE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	U/L	28	100		

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD

Draw blood in GREEN YELLOW tube. Minimum requirement: 3 ml.

**PHYSICIAN INFORMATION:** A reference range for body fluids has not been established.

**(AST) SGOT**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	U/L	15	37		

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN/YELLOW PST tube.  
Minimum requirement: 3 ml.

**BASIC METABOLIC PANEL** -This is a profile test. See ranges of tests in the panel

RESULT AVAILABILITY: 24 hours a day, 7 days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN/YELLOW SST tube.  
Minimum requirement: 3 ml.

Tests in Panel:

SODIUM  
POTASSIUM  
CHLORIDE  
C02  
CREATININE (EGFR) PANEL  
GLUCOSE  
BUN  
CALCIUM

**B-TYPE NATRIURETIC PEPTIDE (BNP)**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	pg/mL	0	100		

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: PLASMA. Draw in LAVENDER/YELLOW PST tube.

**BETA HCG, TOTAL (QUANT)**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	mIU/ml	<5			

RESULT AVAILABILITY: 24 hours a day, 7 days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN/YELLOW TUBE.

Minimum requirement: 3 ml.

**BILIRUBIN, TOTAL**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	mg/dL	0.0	1.1		

Direct Bilirubin will be automatically done on Total Bilirubin levels that are greater than 1.5 mg/dl.

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN/YELLOW SST TUBE.

Minimum requirement: 3 ml.

**C-REACTIVE PROTEIN, HIGH SENSITIVITY**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	mg/L	0	6.0		

RESULT AVAILABILITY: 24 hours a day, 7 days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN YELLOW tube.

Minimum requirement: 3 ml.

**CALCIUM**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	mg/dL	8.3	10.3	6.5	13

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: PLASMA. Draw in GREEN YELLOW tube.

Minimum requirement: 3 ml.

**CALCIUM (24 HR URINE)**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
URINE	mg/24 H	50	150		

FOR 24 HR. COLLECTION, NORMAL: 50 - 150 mg/24 HRS.

RESULT AVAILABILITY: 24 hours a day, seven days per week.

ACCEPTABLE SAMPLES: URINE (24HR.)

Collect 24 hour urine specimen in proper container and deliver to lab.

### **CARBAMAZEPINE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	mcg/ml	8	12		15

Optimal peak therapeutic range with tegretol as only anticonvulsant, individual variability in time to peak serum conc. (6 - 18 hrs post oral dose).

RESULT AVAILABILITY: 24 hours a day, seven days per week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN YELLOW top tube.

Minimum requirement: 3 ml.

### **CEA**

SPECIMEN: SERUM

REFERENCE RANGE: SMOKER 0-7 ng/ml

NON-SMOKERS 0-3.0 ng/ml

RESULT AVAILABILITY: 24 hours a day, seven 7 days a week.

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW tube.

Minimum requirement: 3 ml.

### **CHLORIDE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
URINE	mmol/L/	55	125		
PLASMA	mmol/l	100	109		

\*NOTE FOR 24 HR. COLLECTION, NORMAL: 110 - 250 mmol/L/24 HRS.

RESULT AVAILABILITY: 24 hours a day, seven days a week .

ACCEPTABLE SAMPLES: PLASMA. Draw in GREEN YELLOW tube.

Minimum Requirement: 3 ml.

URINE. Collect a minimum of 5 ml of a random urine.

### **CHOLESTEROL**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	mg/dL	135	200		

DESIRABLE <200 MG/DL; BORDERLINE HIGH 200 - 239 MG/DL; HIGH 240 - 280 MG/DL

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN YELLOW tube.

Minimum requirement: 3 ml.



**CK**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	U/L	38	397		

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN YELLOW tube.  
Minimum requirement: 3 ml.

CK-MB testing will be performed on all total CK's >250, per lab policy.

**CK-MB**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	ng/ml	0.6	6.3		

CK-MB >8 ng/mL and CK Index >2.0 suggest MI

CK Index =  $100 \times (\text{CK-MB (ng/ml)} / \text{Total CK activity (IU/L)})$

RESULT AVAILABILITY: **This test is orderable only following interventional cardiology procedures.**

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN YELLOW tube.  
Minimum requirement: 3 ml.

**CO2**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	mmol/l	22	29		

RESULT AVAILABILITY: 24 hours a day, seven days a week .

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN YELLOW tube.  
Minimum requirement: 3 ml.

**CORTISOL**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	ug/dl				

Morning 4.3 – 22.4 ug/dl

Evening 3.1 – 16.7 ug/dl

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: PLASMA. Draw in GREEN/YELLOW tube.  
Minimum requirement: 3 ml.

**CREATININE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	mg/dL	0.6	1.3		
Dialysate	No established reference range				

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN YELLOW tube.  
Minimum requirement: 3 ml.

**CREATININE (24HR URINE)**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
URINE	mg/24 H	1000	2000		

FOR 24 HR. COLLECTION, NORMAL IN MALES:1000-2000 mg/24 HR

RESULT AVAILABILITY: 24 hours a day, seven days per week.

ACCEPTABLE SAMPLES: URINE (24HR.)

Collect 24 hour urine specimen in proper container and deliver to lab.  
Minimum requirement: 10 ml.

**CSF GLUCOSE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
				<35 mg/dL	

CSF Glucose values should be approximately 60% of the serum values and must always be compared with concurrently measured serum values for adequate clinical interpretation.

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: CSF – 1 ml minimum

**CSF PROTEIN**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
	mg/dl	15	45		>75

RESULT AVAILABILITY: 24 hours a day, seven days a week .

ACCEPTABLE SAMPLES: CSF

**CYCLOSPORIN**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
Whole Blood Therapeutic Range:		300-450 ng/ml for up to 3 months post-transplant			
		125-350 ng/ml for >3 months post-transplant			

RESULT AVAILABILITY: Day shift, Monday-Friday.

ACCEPTABLE SAMPLES: BLOOD . Draw in LAVENDER top tube.  
Minimum requirement: 3 ml.

**DIGOXIN**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	ng/mL	0.5	2.0		2.5

Reference range - 0.5 – 2.0

Dose and draw times should be included with each order. Digoxin drug levels should be drawn at least 5 hours or more after oral drug administration or just before administration of the next IV dose. Minimum requirement-3 ml.

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN YELLOW top tube.  
Minimum requirement: 3 ml.

**DILANTIN**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	ug/mL	10	20		30

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN YELLOW top tube.  
Minimum requirement: 3 ml.

**ERYTHROPOIETIN**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	mIU/ml	1.48	31.88		

RESULT AVAILABILITY: 24 hours a day, seven days a week

ACCEPTABLE SAMPLES: BLOOD. Draw in RED/YELLOW tube.  
Minimum requirement: 3 ml.

**ETHANOL**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	mg/dL	<5			500

NORMAL RANGE: NONE DETECTED.

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN YELLOW tube.  
Minimum requirement: 3 ml.

**Do not use an alcohol swab to prep venipuncture site.**

**FERRITIN**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	ng/mL				
	Males	23.9	336.2		
	Females	10	200		

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN YELLOW tube.  
Minimum requirement: 3 ml.

**FOLATE**

SPECIMENS	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	ng/ml	5.90	>24.8		

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN/YELLOW tube.  
Minimum requirement : 3 ml.

**FSH**

SPECIMEN	UNITS	REF LOW	REF HIGH
PLASMA	mIU/ml		
ADULT MALE		1.27	19.26
ADULT FEMALE			
	FOLLICULAR		3.85 – 8.78
	LUTEAL		1.79 – 5.12
	POST-MENOPAUSAL		16.74 – 113.59
	MID		4.54 – 22.51

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN YELLOW tube.  
Minimum requirement: 3 ml.

**GAMMA-GTP**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	IU/L	5	60		

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN YELLOW tube.  
Minimum requirement: 3 ml.

**GENTAMICIN, PEAK & TROUGH**

SPECIMEN		UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	Peak	ug/mL	5	10		>12
	Trough			0	2	>5

RESULT AVAILABILITY: 24 hours a day, seven days per week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN/YELLOW top tube.  
Minimum requirement: 3 ml.

**GLUCOSE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	mg/dl	70	109	50	400

The above plasma reference range is for fasting 12 hrs.

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: PLASMA

Draw blood in GREEN YELLOW tube.  
Minimum requirement: 3 ml.

**GLUCOSE TOLERANCE (2HR)**

Pre: <120 mg/dL      2 Hour Post: 0-139 mg/dL

RESULT AVAILABILITY: This test is available on the day shift, Monday through Friday.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN/YELLOW  
Minimum requirement: 3 ml.

**HDL**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	mg/dl	30	70		

RESULT AVAILABILITY: 24 hours a day, 7 days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN YELLOW tube.  
Minimum requirement: 3 ml.

**HEMOGLOBIN A1C**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	%	4.0	6.0		

RESULT AVAILABILITY: Monday through Friday, day shift.

ACCEPTABLE SAMPLES: BLOOD. Draw in LAVENDER top tube.  
Minimum requirement: 3 ml.

**IONIZED CALCIUM**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	mmol/L	1.13	1.32	<0.8	>1.6

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN/YELLOW top tube.  
Tube should be full: 3 ml.

**IRON**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	ug/dl	28	182		

RESULT AVAILABILITY: 24 hours a day, 7 days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN/YELLOW top tube.  
Minimum requirement: 3 ml.

**IRON & TIBC**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
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IRON      This is a profile test. See ranges of tests in the panel.

TIBC  
IRON SATURATION  
UIBC

RESULT AVAILABILITY: 24 hours a day, 7 days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN/YELLOW top tube.  
Minimum requirement: 3 ml.

**LACTIC ACID**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	mmol/l	.5	2.2		

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GRAY top tube.  
Minimum requirement: 3 ml. **Transport to lab on ice.**

**LDH**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	u/l	100	190		

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: PLASMA

Draw in GREEN/YELLOW tube.  
Minimum requirement: 3 ml plasma

**LH**

SPECIMEN : SERUM

Female	FOLLICULAR	1 - 18	mIU/ml
	LUTEAL	0.4 - 20	mIU/ml
	POST MENOPAUSAL	15 - 62	mIU/ml
	MID CYCLE	24 - 105	mIU/ml
	ORAL CONTRACEPTIVE	< 4.6	mIU/ml

Male normal range: 1.24 – 8.62 mIU/ml

RESULT AVAILABILITY: 24 hours a day, 7 days a week .

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN/YELLOW tube.  
Minimum requirement: 3 ml.

**LIPASE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	U/L	10	50		

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN/YELLOW tube.  
Minimum requirement: 3 ml.

**LITHIUM**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	mEq/mL	0.5	1.5		2.0

RESULT AVAILABILITY: 24 hours a day, 7 days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in RED/YELLOW top tube.  
Minimum requirement: 3 ml.

**MAGNESIUM**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	mg/dL	1.5	2.4	1.0	4.0
URINE (24 HOUR)	mg/24hr	72.9	121.5		

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN/YELLOW PST tube.  
URINE

Minimum requirement: 3 ml.

**MICROALBUMIN**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
URINE (24 H)	MG/24H	0	30		
URINE (RANDOM)					

\*Random urines reported as a ratio of urine microalbumin (ug) divided by urine creatinine (mg)  
NORMAL VALUE <5

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: URINE (24 HR)  
URINE

**OSMOLALITY, PLASMA**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	mOsm/L	281	308		

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN/YELLOW PST tube.  
Minimum requirement: 3 ml.

**OSMOLALITY, URINE**

UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
mOsm/L	500	850		

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: URINE, 10 ml of random urine and deliver to lab.

#### **PO4**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
URINE (24 HOUR)	mg/24 hr	400	1300		
PLASMA	mg/dL	2.5 – 4.9		<1.0	

\*NOTE FOR 24 HR. COLLECTION, NORMAL: 400 - 1300 mg/24 HRS.

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN/YELLOW tube.  
URINE (24 HOUR)

Minimum requirement: 3 ml.

#### **POTASSIUM**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
URINE , Random	MMOL/L	12.0	75.0		
PLASMA	meq/L	3.5	5.0	2.8	6.0

\*NOTE FOR 24 HR. COLLECTION, NORMAL: 25 - 120 mmol/L/24 HRS.

RESULT AVAILABILITY: 24 hours a day, seven days a week .

ACCEPTABLE SAMPLES: PLASMA  
URINE (24HR.)  
URINE, RANDOM

Draw in GREEN/YELLOW PST tube. Minimum requirement: 3 ml, blood; 5 ml urine.

Hemolysis will falsely elevate K+ result. New specimen will be requested if hemolysis is pronounced.

#### **PROLACTIN**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	NG/ML				
MALES		2.64 – 13.3			
FEMALES, PREMENOPAUSAL		3.34 – 26.72			
FEMALES, POSTMENOPAUSAL		2.74 – 19.64			

RESULT AVAILABILITY: 24 hours a day, 7 days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN/YELLOW PST tube.

Minimum requirement: 3 ml.

#### **PROSTATIC SPECIFIC ANTIGEN, DIAGNOSTIC**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	ng/ml	0	4.0		



**Order if following patient with prostate cancer**

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in RED/YELLOW tube.  
Minimum requirement : 3 ml.

**PROSTATIC SPECIFIC ANTIGEN, TOTAL**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	ng/ml	0	4 ng/ml		

Free PSA will be performed if total PSA 4-10 ng/ml.

REFERENCE: Normal >25% Free PSA, Abnormal: < 25% Free PSA

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in RED/YELLOW SST tube.  
Minimum requirement: 3 ml.

**PROTEIN, TOTAL**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM/PLASMA	g/dL	6.1	7.9		>12
URINE (24 HR)	mg/24 hr	0	200		

RESULT AVAILABILITY: 24 hours a day, seven days a week .

ACCEPTABLE SAMPLES: URINE (24 HOUR)  
BLOOD  
SERUM

Draw in GREEN/YELLOW PST tube.  
Minimum requirement: 3 ml.

**PTH, INTACT**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	pg/ml	12	88		

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in LAVENDER/YELLOW tube.  
Minimum requirement: 3 ml

**PTH, INTRAOPERATIVE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	pg/ml				

RESULT AVAILABILITY: This test is available Monday thru Friday 7 AM – 3:30 P.M. **Testing must be scheduled in advance (please call 76455).**

ACCEPTABLE SAMPLES: BLOOD. Draw in LAVENDER/YELLOW tube.  
Minimum requirement: 3 ml.

**SALICYLATE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	mg/dL	15	30		50

Normal: Not present. Peak serum 2-6 hrs after oral dosage.

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN/YELLOW PST tube.  
Minimum requirement: 3 ml.

**SODIUM**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
URINE	MMOL/L	20	110		
SERUM	mmol/l	135	145	124	160
PLASMA	meq/L	135	145	124	160

\*NOTE FOR 24 HR. COLLECTION, NORMAL 40 -220 mmol/L/24 HRS.

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD  
SERUM  
PLASMA  
URINE (24HR.)  
URINE

Draw blood in GREEN/YELLOW PST tube. Collect urine in a sterile container.  
Minimum requirement: 3 ml.

**T4, FREE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	NG/DL	0.47	1.41		

RESULT AVAILABILITY: 24 hours a day, 7 days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN YELLOW tube.  
Minimum requirement: 3 ml.

**TESTOSTERONE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	ng/dL				

Male: 168 - 746

RESULT AVAILABILITY: 24 hours a day, 7 days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN/YELLOW top tube.

### **TRANSFERRIN**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	mg/dl	168	336		

Increased in severe iron deficiency anemia. Decreased in protein losing states such as nephrotic syndrome

RESULT AVAILABILITY: 24 hours a day, 7 days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN/YELLOW SST tube.

Minimum requirement : 3 ml.

### **TRIGLYCERIDE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	mg/dL	30	200		

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN/YELLOW PST tube.

Minimum requirement: 3 ml. Patient should be fasting (12 hours).

### **TROPONIN I**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	ng/mL	0.01	0.49		

Normal <0.03

Intermediate (repeat test in 4-6 hrs) 0.4 – 0.49 ng/ml

Definitive abnormal range 0.5 ng/ml or higher

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN/YELLOW PST tube.

Minimum requirement: 3 ml.

### **TSH**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	uIU/mL	0.34	5.6		

Free T4 will be performed if TSH is <0.4 or >5.5

RESULT AVAILABILITY: 24 hours a day, 7 days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN/YELLOW SST tube.

Minimum requirement: 3 ml.

### **UREA NITROGEN**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
URINE	MG/DL				
URINE (24 HR)	MG/24 HR	6000	17,000		
PLASMA	mg/dL	5	20		
DIALYSATE	No established reference range				
RESULT AVAILABILITY:	24 hours a day, seven days a week.				

ACCEPTABLE SAMPLES: PLASMA  
URINE

Draw in GREEN/YELLOW PST tube.  
Minimum requirement: 3 ml.

#### **URIC ACID**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	mg/dL	2.6	8.7		
URINE	MG/DL				
FOR 24 HR. COLLECTION, NORMAL: 250-750 mg/24 HRS.					

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD  
URINE

Draw in GREEN/YELLOW PST tube.  
Minimum requirement: 3 ml.

#### **VALPROIC ACID**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	ug/ml	50	100		>160

RESULT AVAILABILITY: 24 hours a day, seven days per week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN/YELLOW PST tube.  
Minimum requirement: 3 ml.

#### **VANCOMYCIN - PEAK & TROUGH**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	UG/ML				>30 (Trough)

PEAK 30-40 UG/ML; TROUGH 10-15 UG/ML

RESULT AVAILABILITY: 24 hours a day, seven days per week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN/YELLOW top tube.  
Minimum requirement: 3 ml.

#### **VITAMIN B12**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	pg/ml	180	914		

RESULT AVAILABILITY: 24 hours a day, 7 days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in GREEN/YELLOW tube.  
Minimum requirement :3 ml.

**DRUG ABUSE SURVEY** - This is a profile test. See ranges of tests in the panel.

Tests in panel: Amphetamines, Barbiturates, Benzodiazepines, Cannabinoids, Cocaine, Opiates

AVAILABILITY: 24 hours a day, 7 days a week.

ACCEPTABLE SAMPLES: URINE, Random  
Minimum requirement: 10 ml.

Urine Drug Screens performed at CAVHS are for medical purposes only and are unconfirmed.

Results are reported as negative or positive.

NORMAL: Negative

### **AMPHETAMINES**

Cut off for amphetamine assay is 1000 ng/ml.

### **BARBITURATES**

Cutoff for barbiturate assay is 200 ng/ml.

A negative test result indicates that barbiturates are either not present or are at levels below the cutoff of the test.

A positive result indicates only the presence of barbiturates. The absorbance reading does not necessarily correlate with the degree of intoxication.

### **BENZODIAZEPINES**

Cutoff for benzodiazepine assays is 200 ng/ml.

A negative test result indicates that benzodiazepines are either not present or are at levels below the cutoff of the assay.

A positive result indicates only the presence of benzodiazepines. The absorbance reading does not necessarily correlate with the degree of intoxication.

### **CANNABINOIDS**

The cutoff of marijuana is 50 ng/ml.

A negative test result indicates that marijuana is either not present, or is at levels below the cutoff of the test.

A positive result indicates only the presence of marijuana and does not necessarily correlate with degree of intoxication.

## **COCAINE**

Cutoff for cocaine metabolite assay is 300 ng/ml.

A negative test result indicates that cocaine metabolites are either not present or are at levels below the cutoff of the assay.

A positive result indicates only the presence of cocaine metabolites. The absorbance reading correlates with the degree of intoxication.

## **OPIATES**

Immunoassays do not distinguish between codeine, morphine, and their glucuronide conjugates. Confirmation of a positive screen is highly recommended.

False-positive results with non-opiate substances have not been reported. Metabolites are seen in urine for 24-48 hours after administration.

The cutoff for opiate assay is 300 ng/ml.

A negative test result indicates that opiates are either not present or are at levels below the cutoff of the assay.

A positive result indicates only the presence of opiates. The readings do not necessarily correlate with the degree of intoxication.

## **OXYCODONE**

Availability: Tuesday and Friday; 8:00 – 4:30

Acceptable Samples: Urine, Random. Minimum requirement: 10 ml(25 ml if confirmation requested).

Oxycodone screens performed at CAVHS-NLR are for medical purposes only and are unconfirmed.

Cutoff for oxycodone assay is 300 ng/ml. Results are reported as negative or positive.

NORMAL: Negative

A negative test result indicates that oxycodone is either not present or is at a level below the cutoff of the assay.

A positive result indicates only the presence of oxycodone or oxymorphone and does not necessarily correlate with the extent of physiological and psychological effects.

**COAGULATION**  
**PHONE 76460**

**D-DIMER**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	UG/ML	<0.5 ug/ml			

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLE: Blood in 3.2% NaCitrate Blue top tube filled completely.

The presence of rheumatoid factor (RF) may lead to false positive results with the D-Dimer test. Other processes which may cause a positive D-Dimer, include liver disease, disseminated cancer, and post-operative situations.

The anticoagulant to blood ratio is critical. A D-Dimer will only be performed once in 24 hours.

The D-Dimer is of little value in the intraoperative or post-operative period.

**FIBRINOGEN**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	mg/dl	206	468		

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLE: Blood in 3.2% NaCitrate Blue Top Tube filled completely.

**HEPARIN/LOW MOLECULAR WEIGHT HEPARIN (LMWH)**

The heparin therapeutic range is 0.3 – 0.7 IU/ml.

Low Molecular Weight Heparin: Therapeutic range is dependent on the LMWH used. (Pay careful attention to the package insert).

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLE: 1 ml citrated plasma (BLUE top tube) specimen. Blue top tube must be filled completely.

**PT & INR**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	SECS.	12.0	14.7		

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in BLUE top tube; fill completely.

Suggested Therapeutic Guidelines for Oral Anticoagulation

(Warfarin)\*: Moderate-intensity      2.0-3.0

Higher-intensity 2.5-3.5

\*Note that optimal target range must balance an individual patient's indication for use and other risk factors (e.g., high bleeding risk, thrombotic event despite adequate anticoagulation).

**PTT**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	SECS.	23.0	36.9		>140

Suggested therapeutic guidelines for heparin therapy:

For patients on heparin anticoagulation, it is recommended the patient be maintained at heparin levels of 0.3 to 0.7 U/mL. This translates to a therapeutic PTT of 65 to 100 seconds in patients without liver or renal disease or lupus anticoagulants.

Patients with lupus anticoagulants with a prolonged baseline PTT who need to be anticoagulated with heparin should be followed with anti-Xa levels maintained at 0.3 to 0.7 U/mL.

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in BLUE top tube; fill completely.

Must specify anticoagulant. Hemolyzed specimens and tubes not filled properly will not be accepted for analysis.

**HEPARIN ANTIBODY**

REFERENCE RANGE: Negative

TURNAROUND TIME: 1 Week

RESULT AVAILABILITY: Every Wednesday

ACCEPTABLE SAMPLES: 1 ml citrated (BLUE top tube) plasma specimen



**HEMATOLOGY**  
**PHONE: 76460**

**BONE MARROW ASPIRATES**

Bone marrow aspirates are performed Monday-Thursday, 9:00 AM, 10:00 AM, and 11:00 AM and must be scheduled in advance with the Hematology Lab at ext. 76460

In order to provide optimal patient care, the patient's physician present at the bone marrow biopsy procedure must fill out the SF-515 Tissue Form with the following information:

- a. Pertinent medical history of the patient
- b. Specific question(s) to be answered.
- c. Signature of the physician.
- d. Printed name of the physician.
- e. Pager number of the physician.

All bone marrow aspirate smears will be reviewed by a pathologist on the day the biopsy procedure is performed. Additional studies such as flow cytometry, cytogenetics, and molecular testing may be added by the pathologist, based on aspirate and medical record review.

**CBC**

WBC	4.0 – 10.0 X 10 <sup>3</sup> /μL	
RBC	4.0 – 6.0 X 10 <sup>6</sup> /μL	
HGB	Males 13.5 - 18 g/dL	Females 12-16 g/dL
HCT	Males 40-54%	Females 37-47%
MCV	Males 80-94 fL	Females 81-99 fL
MCH	30±3 picograms	
MCHC	32-36 gm/l	
RDW	13±1.5	
PLT	150-450 x 10 <sup>3</sup> μl	
MPV	8.9±1.5 fl	
NEUTROPHIL #	2.4 – 7.6 (x10 <sup>3</sup> /uL)	
LYMPH #	1.0 – 4.3 (x10 <sup>3</sup> /uL)	
MONO #	0 – 0.6	
EOSINOPHIL #	0 – 0.5	
BASOPHILS #	0 – 0.1	

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in LAVENDER top tube.  
Minimum requirement: 3 ml.

**CELL COUNT (FLUID) -** This is a profile test. See ranges of tests in the panel.

RESULT AVAILABILITY: 24 hours a day, seven days a week.

Fresh specimens are preferred. If specimen transport is to be delayed for hours, then refrigeration is recommended. Refrigeration temporarily preserves cells suspending their metabolic processes.

A Cell Count will be performed on all body fluids EXCEPT BAL (Bronchoalveolar lavage).

Specimens are retained for 48 hours at 2-8°C.

		<u>Expected Ranges:</u>	
ACCEPTABLE SAMPLES:	CSF	WBC Counts:	
	SYNOVIAL	Pleural Fluids	0-1000/μL
	PERITONEAL	Peritoneal Fluids	0- 300/μL
	PLEURAL	Synovial Fluids	0- 200/μL
	PERICARDIAL	Pericardial Fluids	0-1000/μL
		CSF	0-5 mononuclear Cells/μL

Minimum requirement: 2 ml. Anticoagulate sample immediately after collection.

### **CRYSTALS**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SYNOVIAL FLUID					

NORMAL: NEGATIVE

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: SYNOVIAL

Minimum requirement: 1 ml.

**DIFF COUNT (BLOOD)** -This is a profile test. See ranges of tests in the panel. Ranges reported in absolute values.

RESULT AVAILABILITY: 24-hours a day, 7 days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in LAVENDER top tube.

Minimum requirement: 3 ml.

Counts are best performed within four hours (for RBC and platelet morphology) and eight hours for WBC. Keep at room temperature. DO NOT refrigerate.

### **Criteria for a Manual Differential**

1. WBC count is  $<2.0 \times 10^3/\mu\text{L}$  or  $>30.0 \times 10^3/\mu\text{L}$
2. Differential is ordered and the automated diff can not be reported due to abnormal or immature cells, cellular interference (NRBCs) upon review of slide.

A physician may call the Hematology Lab (76460) and request a differential with a valid order number. Where it is clinically relevant, the physician should provide pertinent information on patient's history. CBC must be ordered with Diff Count (Blood). A manual diff will not be performed more than once per day.

Peripheral smears are retained in the Hematology Lab (2D-183) for 7 days and are available for physician review.

**DIFF COUNT (FLUID)** -This is a profile test. See ranges of tests in the panel.

RESULT AVAILABILITY: 24-hours a day, 7 days a week.

ACCEPTABLE SAMPLES: PLEURAL  
CSF  
SYNOVIAL  
PERITONEAL  
PERICARDIAL

**Expected Ranges for Leukocytes Differentials**

Pleural and Pericardial fluids:	<25% PMN's
Peritoneal Fluids:	<25% PMN's
Synovial Fluids:	<20% Neutrophils
	<15% Lymphocytes
	65% Monocytes and Macrophages.

CSF Differential:

Neutrophils	= 0-6%
Lymphocytes	= 40-80%
Monocytes	= 15-45%
Lining cells/Neuroectodermal cells	= Very rare

**PHYSICIAN INFORMATION:** 2 mls pleural, pericardial, peritoneal, or synovial fluids.  
Anticoagulate sample immediately after collection.

A differential count will be performed on all body fluids. The count will be performed on stained smears made from concentrated leukocytes.

Smears are retained in the Hematology lab (2D-171) and are available for physician review.

All fluid smears which are suspicious for malignant cells will be referred to a pathologist for review.

If gout is suspected, please order crystal analysis.

Fluids for specialized cell analysis should go to Cytology.

**FECAL WBC's**

ACCEPTABLE SAMPLES: STOOL

**PHYSICIAN INFORMATION:** Stool that is dried or collected more than three hours before receipt is unsatisfactory.

No fecal white blood cells should be encountered in specimens from normal individuals.

**HCT**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	PERCENT	40 MALE	54 MALE	21	60
	PERCENT	37 FEMALE	47 FEMALE		

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in LAVENDER top tube.  
Minimum requirement: 3 ml.

**HGB**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	g/dL	Male 13.5	18	7	20
		Female 12	16	7	20

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in LAVENDER top tube.  
Minimum requirement: 3 ml.

**PLATELET COUNT**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	K/cmm	150	400	25	1000

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in LAVENDER top tube.  
Minimum requirement: 3 ml.

**RETICULOCYTES**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	%	.5	2.5		
	#	0.02	0.15		

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in LAVENDER top tube.  
Minimum requirement: 3 ml.

**SPERM COUNT (POST-VASECTOMY)**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SEMINAL FLUID		0	0		

RESULT AVAILABILITY: Monday thru Friday.

ACCEPTABLE SAMPLES: SEMINAL FLUID  
If sperm are present, number per hpf + % motile are reported.

LAB INSTRUCTIONS: After a 4-7 day period of abstinence, collection of the specimen should be by masturbation to avoid losing part of the ejaculate and to avoid bacterial contamination. Patients may collect the specimen at home and bring it to the CAVHS laboratory within 4 hours of collection. These specimens may be brought to the CAVHS laboratory (Room 2D154) Monday-Friday, 7:00 AM until 4:00 PM. This does not include holidays. A completed Post Vasectomy Sample Requisition must accompany each specimen. The requesting provider will give the patient a sterile collection cup and appropriate forms for specimen collection.

#### **TOTAL EOSINOPHIL**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
URINE	/UL				

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: URINE

#### **WESTERGREN SED RATE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD – MALE	mm/Hr	0	15		
- FEMALE	mm/Hr	0	20		

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: BLOOD. Draw in BLACK TOP or LAVENDER top tube.

Minimum requirements: 3 ml.

#### **PERIPHERAL SMEAR FOR PATH REVIEW**

SPECIMEN  
BLOOD

ACCEPTABLE SAMPLES: Draw in Lavender Top Tube/ CBC MUST be ordered with Path Review

A peripheral smear (a smear examined by a pathologist) is primarily ordered to evaluate blood cell populations when a complete blood count with differential (CBCD), performed with an automated blood cell counter, indicates abnormal white blood cells, red blood cells, or platelets. It may also be performed when a doctor suspects a deficiency, disease, or disorder affecting blood cell production or increased cell destruction.

#### **CBC CRITERIA FOR PERIPHERAL SMEAR FOR PATH REVIEW**

WBC <2,000 or > 30,000  
Platelet Count - <25,000 or > 800,000

## **HEPATITIS & HIV SEROLOGY**

Hepatitis & HIV testing is performed on Tuesday and Thursday.

**ACCEPTABLE SAMPLES:** Blood drawn in a RED/YELLOW (SST) tube. Minimum requirement: 2 ml for one hepatitis test. If more than one hepatitis test is ordered, draw a full SST tube. Minimum requirement for HIV: 5 ml.

### **INTERPRETATION OF HBV SEROLOGY**

Susceptible	HBsAg	Negative
	anti-HBc	Negative
	anti-HBs	Negative
Immune due to natural infection	HBsAg	Negative
	anti-HBc	Positive
	anti-HBs	Positive
Immune due to HBV vaccination	HBsAg	Negative
	anti-HBc	Negative
	anti-HBs	Positive
Acutely infected	HBsAg	Positive
	anti-HBc	Positive
	IgM anti-HBc	Positive
	anti-HBs	Negative
Chronically infected	HBsAg	Positive
	anti-HBc	Positive
	IgM anti-HBc	Negative
	anti-HBs	Negative
Interpretation unclear: 4 possibilities		
1. Resolved infection (most common)	HBsAg	Negative
2. False-positive anti-HBc, thus susceptible	anti-HBc	Positive
3. "Low level" chronic infection	anti-HBs	Negative
4. Resolving acute infection		

## **HEPATITIS C ANTIBODY**

Negative

**PHYSICIAN INFORMATION:** Positive antibody will be confirmed by HCV viral load testing.

### **HIV 1-2**

**SPECIMEN SERUM**

Specimens which are reactive will be referred for confirmation by Western Blot.

## MICROBIOLOGY

### LABORATORY COVERAGE

Bacteriology	Daily (Monday-Friday)	7 a.m. – 4:30 p.m.
	Weekends/Holidays	7 a.m. – 3:30 p.m.
Mycobacteriology	Monday – Friday	7 a.m. – 4:30 p.m.
Mycology	Monday – Friday	8 a.m. – 4:30 p.m.
Parasitology		Referred to Reference Lab
Virology		Referred to Reference Lab

### GENERAL GUIDELINES

1. All Microbiology specimens **MUST** be submitted in a biohazard bag with the order placed in the outside pocket. Microbiological examinations of clinical materials are rendered completely valueless by improper specimen collection and handling, resulting in needlessly delayed and often erroneous diagnoses. Carefully select a site for collection, which will insure the specimen is indicative of an infectious process, and fully prep the site according to procedures outlined in the collection/transfer guidelines. Avoid contamination with any microorganisms normally present; collect all specimens **aseptically**.

2. Daily examinations of microbiology cultures are reported in the computer by noon. Critical values are called to the provider. Please consult the computer for results and phone only when you cannot find a result in the computer.

3. Positive emergency room reports on patients not admitted are called to the ER provider.

4. Tests must be ordered in the computer. A computer generated order should accompany each specimen. If the computer is down, a fully completed (legible) computer downtime form must accompany each specimen.

**a. Label each specimen with: Patient's full name, full social security number, ward (LR/NLR), source of specimen (suspected diagnosis, antibiotic therapy (if any), date and time of collection.**

b. If a specimen is directly cultured at bedside, label with patient's full name, full SS number, ward, and culture site.

c. Deliver specimens to Room 2D-154. Place in the Microbiology basket through the window after clocking the date and time on the accompanying order form.

### REJECTION OF SPECIMENS

A. All specimens must meet the requirements of Specimen Collection and Transport before being accepted by the laboratory. The following are cause for rejection:

1. Specimens submitted in improper tubes or containers. The nursing station will be asked to recollect a specimen in the proper container.
2. Specimens not indicative of infection (i.e. a sputum specimen consisting of saliva).
3. Specimens without an order number in the computer, unless it is accompanied by a computer downtime form. The form must be properly and legibly filled out and the name on the specimen must match that on the form.

4. Unlabeled or mislabeled specimens. The laboratory will request a fresh, properly labeled specimen. Exceptions are CSF, BAL, and tissue, in which cases the provider must verify the specimen in the laboratory, signing a log to that effect.
5. Leaking containers. The laboratory will request that a fresh specimen be collected for processing.
6. Specimens in syringes with needles attached. Needles must be removed and the syringe capped before being sent to the laboratory.
7. Swabs for AFB or fungal culture.

## **COLLECTION AND DELIVERY OF SPECIMENS**

### **GENERAL GUIDELINES**

Collect sufficient material for each type of examination desired and send to the laboratory (Room 2D-154) or via the pneumatic tube system as soon as possible after collection, optimally within one hour, properly labeled with correct computer generated order for each examination. Duplicate specimens on the same day WILL NOT BE PROCESSED. Between 7 A.M. and 4 P.M. STAT specimens should be hand delivered to Microbiology Staff in room 2E-112. After 4 P.M., all fluids or STAT specimens must be handed to one of the evening lab personnel.

### **ANAEROBIC CULTURE**

If fluid or pus is to be cultured for anaerobes, the syringe may be sent – first remove the needle and cap the end. Fluids may also be inoculated into anaerobic blood culture bottle (minimum of 5cc) or sent in Port-a-cul anaerobic transport media.

### **BLOOD CULTURES**

**DATE & TIME OF COLLECTION MUST BE NOTED ON BLOOD CULTURE BOTTLES. FOR EACH EPISODE OF SUSPECTED BACTEREMIA, collect TWO BLOOD CULTURE SETS** from two separate venipuncture sites. Employee collecting blood cultures must initial blood culture bottles before sending to the Lab.

Blood cultures drawn from catheter lines and I-ports should always be accompanied by a blood culture from a peripheral site. Also note anatomical site.

A minimum of three sets per 24-hour period are recommended in cases of suspected low bacteremic rates, and additional ones the following day at the discretion of the attending physician.

Special media is available for AFB Blood cultures (Ext. 76767 or 76447) and for Fungal Blood cultures (Ext. 56457) upon request. Call 76452 or 76460 4:30 P.M. until 7:00 A.M.

### **LABORATORY PROCEDURES**

1. Blood cultures are monitored for five days. If a longer period of observation is required for a specific isolate, it should be requested by the physician by calling the Micro Lab at ext. 56457 or 76447. At 24 hours, a preliminary report will be entered.
2. Positive blood cultures will immediately be called to the provider, final identification and susceptibility results will be issued via the computer.



All blood cultures should be drawn by properly trained personnel.

### **Procedure for drawing blood cultures**

**DATE & TIME OF COLLECTION MUST BE NOTED ON BLOOD CULTURE BOTTLES. FOR EACH EPISODE OF SUSPECTED BACTEREMIA,** collect **TWO BLOOD CULTURE SETS** from two separate venipuncture sites.

- Blood cultures drawn from catheter lines and I-ports should always be accompanied by a blood culture from a peripheral site. Also note anatomical site.

### **Procedure for drawing blood cultures**

- With properly gloved hands, select an appropriate venipuncture site. Remove caps from the blood culture bottles (aerobic-blue and anaerobic-purple) and **disinfect the tops with an alcohol pad.**

#### **1. Aseptic skin preparation:**

- Thoroughly scrub the selected site with a Chloraprep One-Step Frepp Applicator, which contains 2% chlorhexidine gluconate and 70% isopropyl alcohol. Use repeated back and forth strokes for approximately 30 seconds. Completely wet area with antiseptic. Allow to dry completely.

**Do not touch the disinfected area, if additional palpation is required, then disinfection must re occur.**

#### **2. Blood drawing procedure:**

- Disinfect the top of each bottle with an alcohol pad.
- Draw a 20-ml blood sample with a sterile needle and syringe.
- **Do not change the needle.**
- Inoculate each bottle of the set with 10 ml of blood and mix. (5 ml minimum, 10 ml maximum).
- Remove excess iodine left on the puncture site with a clean alcohol pad, dry and apply a Band-Aid.
- Repeat the entire above procedure within 15-30 minutes from an entirely different site selected for venipuncture.

3. Label all four bottles with the following information, taking care not to cover any part of the bar code on the side of each one, nor the bottom of the bottles.

- Full name of patient, full SS# and ward location, **date, time, and anatomical site** of the drawing. **Initials** of person collecting the specimen.
- Deliver all blood cultures to the laboratory immediately (2D-154) after drawing the second set, accompanied by a computer generated order for each blood culture set.

**If a patient has been started on antibiotics before a Blood Culture is collected, draw a FAN Aerobic (Green) and Anaerobic-Purple bottle.**

### **BONE MARROW**

Inoculate a green topped heparin tube at bedside. The technologist assisting the procedure will bring it to the lab.

## **BRONCHO-ALVEOLAR LAVAGE (BAL)/BRONCHIAL WASHINGS (BW)**

Bronchial wash and bronchoalveolar lavage specimens are generally obtained before brushing or biopsy specimens to avoid excess blood in the recovered fluid, because blood may alter the concentration of cellular and noncellular components.

Gently suction the 0.85% NaCl into a sterile container before administering the next aliquot. Keep aliquots separate during collection. Combine aliquots from the same site for microbiology cultures and smears, but aliquots from separate sites (i.e., right upper lobe and right lower lobe) should be combined only after consultation with the physician of record.

Transbronchial biopsies – obtain the biopsy sample through the biopsy channel of the bronchoscope and transport it in a sterile container with a small amount of nonbacteriostatic sterile 0.85% NaCl. **Do not put specimens for culture in formalin.**

Lab Section: Microbiology

Phone: 76447 or 56457

AFB: 76767

Testing performed in house

BAL/BW should be brought to the lab as soon as possible. The specimen should be accompanied by a computer generated order that requests exactly the tests needed on the specimen. For BW, only AFB or fungal cultures are indicated.

If Cytology or Virology is needed, a separate request form must accompany the specimen. Cytology will screen for Pneumocystis, if requested. Culture and susceptibility are available 7 days a week. The other tests are available Monday-Friday. Virology is a send out test. The doctor's pager number should be written on the order if smears are to be called.

## **CEREBROSPINAL FLUID**

### **General Consideration**

#### Collection of specimen

- a. Selected site for puncture procedure
  - (1) Lumbar – simplest and most common
  - (2) Cisternal – used only when: There is a block in the spinal canal; a deformity of vertebrae; or an infection of back tissue.
  - (3) Ventricular – primarily in infants; or for placement of an Ommaya reservoir for treatment of fungal meningitis.
- b. Collection – strictly **Aseptic technique**. Label all tubes and bottles appropriately and send immediately to the laboratory, Room 2D-154, accompanied by computer generated orders for each examination requested.
  1. Discard first few drops from needle to clear the bore of blood and tissue material. Carefully dispense the fluid into sterile screw-capped tubes numbered 1-4.
  2. Tube #1 – Chemistry and serologic tests.
  3. Tube #2 – Microbiology.
  4. Tube #3 - Cell count and differential analysis; viral studies (if indicated).
  5. Tube #4 – for Cytology.

c. Testing of cerebrospinal fluid

- (1) Bacterial culture and gram stain are available 24 hours, seven days a week.
- (2) Fungal culture is available daily on the day shift.
- (3) AFB culture is available Monday-Friday, 8 a.m. – 4:00 p.m., AFB smear is available 8 a.m. – 4:00 p.m., Monday-Friday.
- (4) Cryptococcal antigen testing is available daily from 8 a.m. – 4:00 p.m. Any request after 4:00 p.m. will be done the next day. Weekend and holiday coverage is 7 a.m. – 3:00 p.m.

**Normal CSF Findings and Those Typical of Various Types of Meningitis**

DIAGNOSIS	CELLS (per uL)	GLUCOSE (mg/dl)	PROTEIN (mg/dl)
Normal <sup>1</sup>	0-5 Lymphocytes	45-85	15-45
Bacterial Meningitis	200-20,000 PMNs	Low (<45)	High (>50)
Mycobacterial or fungal Meningitis <sup>2</sup>	100-1000 Mostly Lymphocytes	Low (<45)	High (>50)
Viral Meningitis <sup>2,3</sup>	100-1000 Mostly Lymphocytes	Normal	Moderately high (>50)
Syphilis, Leptospirosis <sup>2</sup>	25-2000 Mostly Lymphocytes	Normal or Low	High (>50)

1. CSF glucose level must be considered in relation to blood glucose level, normally CSF glucose level is 20-30 mg/dl lower than blood glucose level, or 50-70% of blood glucose normal value.
2. PMNs may predominate early.
3. Virus isolation from CSF early.

**SPUTUM**

**Expectorated Sputum**

1. If possible, have the patient rinse mouth and gargle with water prior to sputum collection.
2. Instruct the patient not to expectorate saliva or postnasal discharge into the container.
3. Collect specimen resulting from deep cough in sterile screw-cap cup or other suitable sterile collection assembly.

**Induced Sputum** – This procedure is performed by respiratory care on a consultative basis.

1. Using an ultrasonic nebulizer, the patient inhales approximately 20 to 30 ml of hypertonic (3%) NaCl over approximately a 15-minute interval. When indicated by physician orders, 0.85% or 0.45% NaCl may be used in the procedure.

2. Collect the induced sputum in a sterile screw-cap cup or other suitable sterile collection assembly.
3. Induced specimens should be collected in the early morning on 3 separate and consecutive days.

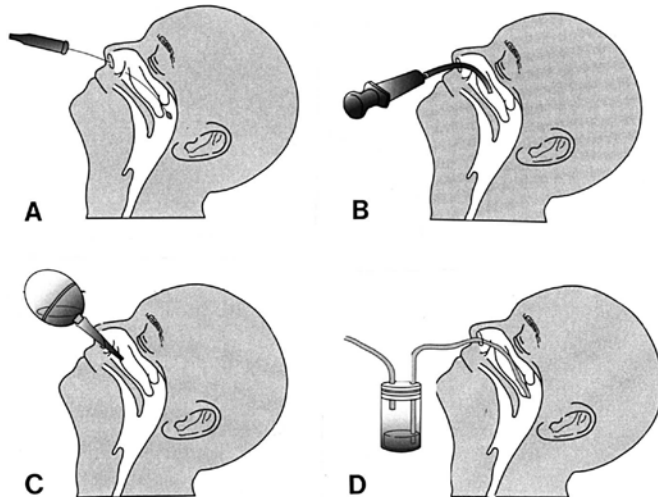
### **NASAL SWAB**

– Submitted primarily for the detection of staphylococcal carriers (primarily MRSA).  
Order

**“MRSA Screen.”** Do **not** order **“Culture & Susceptibility.”**

1. Insert a sterile swab into the nose until resistance is met at the level of the turbinates (approximately 1 inch into the nose).
2. Rotate the swab against the nasal mucosa.
3. Repeat the process on the other side of the nose.
4. Submit swabs.

### **Nasopharyngeal Swab & Nasal Wash Collection**



### **Nasopharyngeal swabs (refer to Fig. A**

- i Use a *Dacron fiber tip* swab on a fine flexible wire (available in Microbiology laboratory). Bend the wire so that it mimics the curve of the nasal airway and gently pass the swab through the nostril to the posterior nasopharynx. Do not force the swab; resistance will be felt when the posterior nasopharynx is reached.
- ii Rotate the swab and leave it in place for up to 30 s or until the patient coughs. Withdraw as quickly as possible.
- iii *Repeat procedure through the second nostril, using the same swab.*
- iv Place swab in saline transport (available in Microbiology laboratory).
- v Submit swab for testing.

- vi Call Microbiology (56457) to alert the technologist that a swab for influenza is being sent to processing.

**Nasal wash: syringe method (refer to Fig. B)**

- i Use a 3- to 5-ml syringe with a 2-in 18-gauge tubing attachment. Fill the syringe with saline.
- ii Instruct the patient not to swallow during the procedure.

**Figure A-D** Collection of nasal pharyngeal swab(s) (A), nasal wash specimen(s) by syringe method (B), nasal wash specimen(s) by bulb method (C), and nasal aspirate specimen(s), assisted by vacuum (D).

- iii With the patient's head hyperextended (approximately 70° angle), quickly instill approximately 5 ml of sterile 0.85% NaCl into one nostril.
- iv Immediately aspirate the saline solution back into the syringe, *or*
- v Tilt the head forward and allow the fluid to run out of the nares into a sterile container, *or*
- vi Aspirate the fluid by inserting a rubber bulb syringe into each nostril.
- vii Place the specimen in a sterile container.
- viii Follow steps v and vi above.

**Nasal wash: bulb method (refer to Fig. C)**

- i Suction 3 to 5 ml of sterile 0.85% NaCl into a 1- to 2-oz tapered rubber bulb.
- ii Instruct the patient not to swallow during the procedure.
- iii With the patient's head hyperextended (approximately 70° angle), insert the bulb into one nostril until the nostril is occluded.
- iv Quickly instill the sterile saline into the nostril with one squeeze of the bulb.
- v Immediately release the bulb to collect the nasal wash specimen.
- vi Empty the bulb contents into a sterile container and transport.

**THROAT (Pharyngeal specimens)**

- Submitted primarily for the detection of group A streptococci (can also be used to detect *N. gonorrhoeae*, *Haemophilus influenzae* in epiglottitis, and rarely *A. haemolyticum*).

1. Do not obtain throat samples if epiglottitis is inflamed, as sampling may cause serious respiratory obstruction.
2. Depress tongue gently with tongue depressor.
3. Extend sterile culturette swab between the tonsillar pillars and behind the uvula. (Avoid touching the cheeks, tongue, uvula, or lips).
4. Sweep the swab back and forth across the posterior pharynx, tonsillar areas, and any inflamed or ulcerated areas to obtain sample.

**URINE (Submit a minimum of 3 ml)**

1. Clean-catch urine specimens (female)
  - a. The person obtaining should wash hands with soap and water, rinse and dry. If the patient is collecting the specimen, she should be given detailed instructions, including diagrams or a pictorial display.

- b. Cleanse the urethral opening and vaginal vestibule area with soapy water or clean gauze pads soaked with liquid soap.
  - c. Rinse the area well with water or wet gauze wipes.
  - d. Hold labia apart during voiding.
  - e. Allow a few milliliters of urine to pass. (Do not stop the flow of urine).
  - f. Collect the midstream portion of urine in a sterile container.
  - g. Transfer urine to BD urine tube.
2. Clean-catch urine specimens (male).
  - a. The person obtaining the urine should wash hands with soap and water, rinse and dry. If the patient is collecting the specimen, he should be given detailed instructions, including diagrams or a pictorial display.
  - b. Clean the penis, retract the foreskin (if not circumcised), and wash with soapy water.
  - c. Rinse the area well with sterile water.
  - d. Keep foreskin retracted (to minimize contamination with skin flora), allow a few milliliters of urine to pass. (Do not stop the flow of urine).
  - e. Collect the midstream portion of urine in a sterile container.
  - f. Immediately transfer urine to BD urine tube from sterile container used to collect urine.
3. Straight catheter urine (in/out catheter urine specimens). In/out catheter specimens are useful if clean-catch urine cannot be obtained or when results from clean-catch urine specimens are equivocal and a diagnosis is critical.
  - a. Prior to catheterization, the patient should force fluids until the bladder is full.
  - b. Clean the patient's urethral opening (and in females, the vaginal vestibule) with soap, and carefully rinse the area with sterile water.
  - c. Using sterile technique, pass a catheter into the bladder.
  - d. Collect the initial 15 to 30 ml of urine, and discard it from the mouth of the catheter.
  - e. Collect a sample from the mid- or later flow of urine in a sterile container.
  - f. Transfer urine to BD urine tube.
4. Indwelling catheter urine. Indwelling catheters are placed in patients who are unable to pass urine.
  - a. Clean the catheter collection port with a 70% alcohol wipe.
  - b. Using sterile technique, puncture the collection port with a needle attached to a syringe. **(Note: Do not collect urine from collection bag).**
  - c. Aspirate the urine, and place it in a BD urine tube.
5. Urine for Legionella Urinary Antigen is collected in a sterile screw cap container. Minimum volume is 1 ml. Performed daily 7:00 AM – 3:30 PM
6. Urine for Streptococcus pneumoniae antigen collected in sterile screw cap container. Minimum volume is 1 ml. Performed daily 7:00 AM – 3:30 PM

### **SPECIMENS FOR DIAGNOSIS OF CUTANEOUS MYCOSES**

1. Skin – Clean the area with 70% alcohol and allow to thoroughly dry. Scrape skin scales from the active borders of the lesion with the edge of a glass slide or knife blade; collect in a sterile container – avoid any use of cotton swabs or gauze.

2. Nails – Clean area beneath the nail tip with alcohol and gently scrape with a knife blade; collect in a sterile container. The infected part of the nail will have a honey-combed and friable appearance.
3. Hair – Clip superficially infected hairs and place in a sterile cup for transport. (Screen dermatophytic hair infections with a Wood's light (UV) and pull fluorescent hairs with forceps – including root).
4. Ocular – Specimens should be collected by the physician as corneal scrapings and inoculated directly onto Sabouraud Dextrose Agar Emmons modification without antimicrobials.

## SPECIMEN COLLECTION GUIDELINES BY SITE

**For optimal recovery of organisms, all specimens collected via swabs (BBL Culture Swab Plus) should have one swab submitted for each culture ordered (e.g., 1 for routine C&S, 1 for anaerobic, 1 for gram stain). Swabs are not acceptable for AFB or fungal culture and will be rejected.**

<b>Specimen Type</b>	<b>Guidelines</b>	<b>Device and/or minimum vol</b>
Abscess	Remove surface exudate by wiping with sterile saline or 70% alcohol	
Open	Aspirate if possible, or pass swab deep into lesion and firmly sample lesion's advancing edge	Swab transport system
Closed	Aspirate abscess wall material with needle and syringe. Aseptically transfer <b>all</b> material into anaerobic transport device or vial.	Amies Anaerobic transport system, 1 ml or Port-a-cul anaerobic transport media
Catheter, i.v.	<ol style="list-style-type: none"> <li>1. Cleanse skin around catheter site with alcohol.</li> <li>2. Remove catheter aseptically and clip 5-cm distal tip of catheter directly into sterile cup</li> <li>3. Transport directly to Microbiology laboratory to prevent drying</li> </ol>	Sterile cup
Cellulitis	<ol style="list-style-type: none"> <li>1. Cleanse site by wiping with sterile saline or 70% alcohol.</li> <li>2. Aspirate area of maximum inflammation with fine needle and syringe.</li> <li>3. Draw small amount of sterile saline into syringe.</li> <li>4. Remove needle (with protective device) and cap.</li> </ol>	Capped syringe or sterile tube
Ear	Tympanocentesis is reserved for complicated, recurrent, or chronic persistent otitis media.	Sterile tube, swab, transport medium or anaerobic system
Inner	<ol style="list-style-type: none"> <li>1. For intact eardrum, clean ear canal with soap solution, dry canal, and collect fluid via syringe aspiration technique.</li> <li>2. For ruptured eardrum, collect fluid on flexible shaft swab via auditory speculum.</li> </ol>	
Outer	<ol style="list-style-type: none"> <li>1. Use moistened swab to remove any debris or crust from ear canal.</li> <li>2. Obtain sample by firmly rotating swab in outer canal</li> </ol>	Swab transport



Specimen Type	Guidelines	Device and/or minimum vol
Eye Conjunctival	1. Sample both eyes with separate swabs (premoistened with sterile saline) by rolling swab over each conjunctiva.	Direct culture inoculation
Corneal Scrapings	2. Inoculate medium at time of collection 3. Smear swabs onto 2 slides for staining  1. Obtain conjunctival swab specimens as described above. 2. Instill 2 drops of local anesthetic 3. Using sterile spatula, scrape ulcers or lesions, and inoculate scraping directly onto medium. 4. Apply remaining material to 2 clean glass slides for staining.	Direct culture inoculation
Feces Routine Culture	Pass directly into clean, dry container. Transport to laboratory, Room 2D154 within 30 min of collection, or transfer to enteric transport system. (Available in Microbiology Room 2E-112)	Sterile, leakproof, wide-mouth container or Cary Blair transport media
<i>Clostridium difficile</i>	Pass liquid or soft stool directly into clean, dry container. Soft stool is defined as stool that assumes shape of its container. Formed stools are not appropriate and will be rejected.	Sterile, leakproof, wide-mouth container, 5 ml
O & P	Pass directly into clean, dry container. Should be placed in preservative within 30-60 minutes of collection for optimal presentation of parasites  Stools from patients who have been on antibiotics (in the last 2 weeks) and/or had a barium enema in the last 7-10 days are not appropriate and will be rejected.	10 ml required
Rectal Swab	Stools for routine culture and/or O&P from patients who have been hospitalized for more than 3 days are not appropriate and will be rejected.  1. Carefully insert swab 1 in (2.5 cm) beyond anal sphincter. 2. Gently rotate swab to sample anal crypts.	Swab transport
Fluids: pericardial, peritoneal, pleural,	1. Disinfect overlying skin with iodine. 2. Obtain specimen via percutaneous needle aspiration or surgery. Transfer specimen to green/yellow (heparin) tube. 3. Transport immediately to laboratory.	Green/Yellow (heparin ) tube, 1 ml or sterile leakproof wide-mouth container, 5 ml

	4. Always submit as much fluid as possible; <b>never</b> submit swab dipped in fluid.	
Genital: Female Cervical	1. Visualized cervix with speculum without lubricant. 2. Remove mucus and/or secretions from cervix with swab and discard swab. 3. Firmly yet gently, sample endocervical canal with sterile swab.	Swab transport or direct inoculation
Vaginal	1. Wipe away excess amount of secretion or discharge. 2. Obtain secretions from mucosal membrane of vaginal vault with sterile swab.	Swab transport or direct inoculation

**MICROBIOLOGY**  
PHONE 76767, 56457, 76447

**AFB CULTURE & SMEAR**

RESULT AVAILABILITY: Cultures held six weeks

ACCEPTABLE SAMPLES:	URINE	BAL
	CSF, other fluids	TISSUE
	SPUTUM	STOOL
	BRONCHIAL WASHING	ABSCESS MATERIAL, EXUDATES

All mycobacterial isolates will be identified. Susceptibility testing will be performed on all initial isolates of M. tuberculosis. Susceptibility testing of a nontuberculous mycobacterium must be specifically requested (call the Mycobacteriology lab at 76767).

**AFB SMEAR**

RESULT AVAILABILITY: Smears are prepared Monday through Friday. Results reported same day; positive smears called to provider.

ACCEPTABLE SAMPLES: SPUTUM

**ANAEROBIC CULTURE**

ACCEPTABLE SAMPLES: Anaerobic cultures may be submitted in capped syringe, from which needle has been removed, in BBL Culture Swab Plus Anaerobic Transport (AMIES), or in Port-a-cal anaerobic transport media. Anaerobic transport is available from SPD. When collecting routine C&S with anaerobic culture, if a swab is used for collection – submit one swab for each test (one for C&S, one for Gram stain, and one for anaerobic culture). Fluids for anaerobic culture may be submitted in anaerobic blood culture bottle as long as a minimum of 5cc is inoculated. The anaerobic blood culture should accompany an aerobic blood culture bottle to achieve optimal results. The aerobic blood culture also requires a minimum of 5 cc's of fluid.

**BLOOD CULTURE**

RESULT AVAILABILITY: Positive Blood Cultures: Smear results are called to the provider as soon as they are determined and are entered in the computer.

Negative Blood Cultures are reported as negative to date after 24 hours of incubation. Negative blood cultures are continuously monitored for 5 days. At the end of 5 day incubation, blood cultures are reported as negative for growth at 5 days.

**CLOSTRIDIUM DIFFICILE PANEL**

ACCEPTABLE SPECIMENS: Liquid or soft stool. Testing is performed on Monday thru Friday. Copies of Positive reports are sent to the ward printer. Positives on outpatients are called to the provider. Only one specimen per 7 days will be tested.

## CRYPTOCOCCAL ANTIGEN

**ACCEPTABLE SAMPLES:**

CSF	Test available: 8:00 to 4:00 P.M. – Monday-Friday 7-3:00 Sat/Sun & holidays
SERUM	Test available Monday – Friday 8:00 to 4:00 P.M.

If positive, a titer will be performed and the provider notified.

## CULTURE & SUSCEPTIBILITY

**RESULT AVAILABILITY:** Preliminary report in 24 hours.

ACCEPTABLE SAMPLES: CSF, other FLUIDS BAL/WASHES TISSUE  
SPUTUM FECES  
URINES: Submit in BD collection tube.  
Minimum requirement – 3ml.  
WOUNDS, ABSCESS MATERIAL

LAB INSTRUCTIONS: Deliver to 2D-154

**GC CULTURE**

ACCEPTABLE SAMPLES: Endocervical, urethral, rectal, and throat swabs. If possible inoculate directly to Chocolate and Thayer Martin agar. Place into CO2 bag and transport immediately to Microbiology Lab. Otherwise, phone ext. 76447 or 56457 for instructions.

## GRAM STAIN

ACCEPTABLE SAMPLES: SPUTUM  
WOUNDS, FLUIDS  
TISSUE

If STAT gram stain is ordered, the doctor's pager number must be on the order form. A legibly completed computer downtime form with the OR extension should accompany the OR Stats. The person who delivers the specimen to the lab should tell lab personnel that the specimen is STAT. If a slide is prepared by the physician for gram stain, DO NOT place a coverslip on the slide.

LAB INSTRUCTIONS: 7:00 – 4:30 P.M. Deliver to 2E-112. 4:30 P.M. – 7:00 A.M. deliver to 2D-154

## INFLUENZA A/B PANEL

Page Infection Control Nurse (1845 or 1485) or call Microbiology (76447) for questions 7:00 – 4:30. After 4:30 P.M., call the General Laboratory (76452).

ACCEPTABLE SAMPLES: Nasopharyngeal washes and swabs, BAL fluid. NP swabs and saline are available in Room 2E-112. Deliver to Microbiology as soon as possible. Test available 7 days a week 24 hours a day during influenza season. Specimens with negative result and those positive for influenza A will be tested for influenza A/H1N1 by PCR.

## **LEGIONELLA URINARY ANTIGEN**

ACCEPTABLE SAMPLES: 1 ml urine in sterile screw cup container

Testing performed daily 8:00 AM – 4:00 PM

## **MYCOBACTERIUM TUBERCULOSIS DETECTION BY PCR**

Results are reported as “Positive” or “Negative” for detection of *Mycobacterium tuberculosis* complex IS6110 DNA.

Some reagents used in this assay are not FDA approved.

Interpretation: Results should be used in conjunction with other clinical data to establish the diagnosis of the disease. A positive result for *Mycobacterium tuberculosis* complex IS6110 DNA is indicative of the presence of *M. tuberculosis* complex. It has been noted by some researchers that some patients previously infected with *M. tuberculosis* may continue to have detectable levels of *M. tuberculosis* DNA even after resolution of the infection. A negative result is suggestive of the absence of *M. tuberculosis* complex IS6110 DNA in the sample tested, but does not necessarily exclude the diagnosis of the disease. Results are dependent, in part, upon the quantity and the quality of the specimen submitted.

RESULT AVAILABILITY: Test performed Tuesdays & Fridays.

ACCEPTABLE SAMPLES: (See below)

### **CEREBROSPINAL FLUID (CSF)**

1. Volumes of 1-5 mls are requested with a minimum of 0.5 ml required.
2. Samples should be collected and stored using sterile materials and techniques. Sterile polypropylene screw cap tubes are preferred for sample storage.
3. Samples should be maintained at 4° C following collection.

### **SPUTUM AND BAL FLUID**

1. Volumes of 5-10 mls are requested.
2. Samples should be collected and stored using sterile materials and techniques. Sterile polypropylene screw cap tubes are preferred for sample storage.
3. Samples should be maintained at 4° C following collection.

### **FRESH TISSUE**

1. Amounts of 50-500 mg are requested with a minimum of 50 mg of tissue required.
2. Samples should be collected and stored using sterile materials and techniques. Sterile polypropylene screw cap tubes are preferred for sample storage.
3. Tissue is to be kept moist in a minimal volume of sterile saline or sterile PBS (do not use formalin or formaldehyde); 0.5 – 1.0 saline or PBS is sufficient in most circumstances.
4. Samples should be maintained at 4°C following collection if stored for less than 1 week or at -70°C following collection if stored for more than one week.

### **PARAFFIN EMBEDDED TISSUE BLOCK**

1. Paraffin embedded tissue blocks with identifiable tissue mass are accepted.
2. Samples should be collected and stored using sterile materials and techniques prior to embedding the tissue.
3. Individual blocks should not come in contact with other blocks. Wrap blocks individually.

### **PLEURAL FLUID:**

1. Volumes of 5-10 mls are requested.

2. Samples should be collected and stored using sterile materials and techniques. Sterile polypropylene screw cap tubes are preferred for sample storage.
3. Samples should be maintained at 4° C following collection.

### **MRSA SURVL NARES AGAR**

ACCEPTABLE SAMPLES: Nasal Swab

### **MYCOLOGY (FUNGUS) CULTURE**

ACCEPTABLE SAMPLES: Tissue, hair, skin scrapings, BAL, bronchial wash, sputum, body fluids, abscess material, nails.

### **MYCOLOGY SMEAR (CALCOFLUOR)**

RESULT AVAILABILITY: Monday-Friday, Day shift.

### **PARASITOLOGY**

ACCEPTABLE SAMPLES: Liquid or soft stool on recently admitted patients (specimens from patients hospitalized for >3 days are rejected). Collect at least 10 cc feces in clean container with tight fitting lid to prevent spillage.

Specimens must be placed in preservative within 30 – 60 minutes.

Preservative kits (Unifix) and requisition forms (Clinical Microbiology form) are available in room 2E-159 LR (Client Services) and Bldg 66, Room 218 NLR. Collection container should be filled to the line with stool. The Clinical Microbiology Form must accompany the specimen.

Submit 3 specimens collected on separate days. Specimens sent to ADH for examination. Delay collection 7-10 days post barium enema; 2 weeks post antibiotic therapy.

### **SPUTUM SCREEN**

**PHYSICIAN INFORMATION:** If the Gram stain shows oropharyngeal contamination, collection of another appropriate sputum specimen will be requested when ordering provider is notified.

### **STOOL CULTURE WITH CAMPY ANTIGEN**

ACCEPTABLE SAMPLES: Liquid or soft stool on recently admitted patients (stool on inpatients in house > 3 days will be rejected).

**PHYSICIAN INFORMATION:** Feces are routinely cultured for Salmonella, Shigella, and Campylobacter. Culture for Aeromonas, Plesiomonas, Vibrio, Yersinia or E. coli O157 or detection of shiga-like toxin must be specifically requested.

### **STREPTOCOCCUS PNEUMONIAE ANTIGEN TEST**

ACCEPTABLE SAMPLES: URINE (Need not be clean catch) 1 ml & CSF 1 ml

**PHYSICIAN INFORMATION:** The test screens for the pneumococcal antigen in the urine or CSF of patients suspected of having pneumococcal pneumonia or meningitis. The results are available the same day (Mon-Fri 7 AM to 4 PM and weekends and holiday 7 AM to 3 PM) and should be used in conjunction with other tests, such as sputum culture, blood culture, etc. Include the doctor's pager number on the request so positive results can be called.

**WET PREP**

PHYSICIAN INFORMATION: Submit material on culturette swab and place in sterile cup of saline. Must be submitted to the lab within 20 minutes of collection. **DO NOT** place material on slide. Available 7 AM – 4 PM Monday-Friday and 7 AM – 3 PM weekends & holidays.

**MOLECULAR DIAGNOSTICS**  
**PHONE 76443 OR 56440**

**B-CELL GENE REARRANGEMENT ASSAY**

IGH: Negative for evidence of clonal immunoglobulin heavy chain gene rearrangement.

IGK: Negative for evidence of clonal immunoglobulin kappa light chain gene rearrangement.

IGL: Negative for evidence of clonal immunoglobulin lambda light chain gene rearrangement.

RESULT AVAILABILITY: Turnaround time is 5 – 10 working days.

ACCEPTABLE SAMPLES: 1. Peripheral blood, bone marrow biopsy, or bone marrow aspirate anti-coagulated with EDTA. Ship at ambient temperature within 72 hours . 2. Minimum 5 mm cube of tissue shipped frozen; or at room temperature or on ice in RPMI 1640. 3. Formalin-fixed paraffin-embedded tissue or slides. 4. 2 µg of genomic DNA.

Genomic DNA is extracted from whole blood, bone marrow, fresh or paraffin-embedded tissue. DNA is amplified by polymerase chain reaction using commercial multiplex immunoglobulin heavy chain (IGH), kappa light chain (IGK), or lambda light chain (IGL) primer sets (BIOMED-2k InVivoScribe Technologies). Fragment analysis by capillary electrophoresis is used to analyze fluorescently-labeled amplification products.

**PHYSICIAN INFORMATION:** The European BIOMED-2 collaborative study found that this multiplex PCR assay results in a detection rate for clonal gene rearrangements in B cell malignancies of greater than 90%. Although positive results are highly suggestive of malignancy, these assays should only be used in support of diagnosis in combination with histological and immunophenotypic data. The limit of detection of the IgH and IgK assays has been determined to be approximately 5 malignant cells in 100 normal cells. The limit of detection of IgL assay has been determined to be approximately 10 malignant cells in 100 normal cells. THEREFORE, A NEGATIVE RESULT DOES NOT RULE OUT MALIGNANCY.

**FLOW CYTOMETRY – ACUTE LEUKEMIA PROFILE -** This is a profile test. See ranges of tests in the panel.

RESULT AVAILABILITY: Specimens accepted Monday through Noon on Friday. Turnaround time is 2-3 working days.

ACCEPTABLE SAMPLES:   BLOOD                      FINE NEEDLE ASPIRATE  
                                  BONE MARROW        OTHER BODY FLUID  
                                  TISSUE

Draw one EDTA tube (Lavender). Order a CBC and DIFF to be drawn at same time as flow cytometry specimen. Keep at room temperature.

Put 1-3 ml of bone marrow aspirate in EDTA tube. Keep at room temperature.

For tissue biopsy, fine needle aspirate or other body fluid, call the Flow Cytometry lab for collection and transport information.



**PHYSICIAN INFORMATION:** Acute Leukemia Profile: This profile consists of numerous cell surface antibodies that will aid in the diagnosis of the acute leukemias. The profile may be customized according to the ordering physician's tentative diagnosis and the pathologist's review of the sample to be analyzed. The final report will include a pathologist's interpretation of the results. For more information, contact the Flow Cytometry lab.

**FLOW CYTOMETRY – CD4 PROFILE**

Percent CD4 – 26-62%  
Percent CD8 – 11-47%  
Percent CD3 – 56-88%  
Absolute CD4 – 500-1500/ $\mu$ l  
Absolute Lymph – 1000-4000/ $\mu$ l

**RESULT AVAILABILITY:** Specimens accepted Monday through Noon on Friday. Turnaround time is 2-3 working days.

**ACCEPTABLE SAMPLES:** BLOOD

Draw one EDTA tube (Lavender). Keep at room temperature.

To insure specimen integrity, please submit samples for flow cytometry by 12:00 Noon on Fridays and by 12:00 Noon on the day prior to a federal holiday.

**PHYSICIAN INFORMATION:** CD4 profile: This profile is an abbreviated lymphocyte profile. It evaluates the T-cells only. The report includes CD3/CD4/CD8 as well as absolute lymphocyte and absolute helper cell counts. This profile is used to follow the progression of the immunosuppressed patient after the initial evaluation.

**FLOW CYTOMETRY – CLL PROFILE** This is a profile test. See ranges of tests in the panel.

**RESULT AVAILABILITY:** Specimens accepted Monday through Noon on Friday. Turnaround time is 2-3 working days.

**ACCEPTABLE SAMPLES:** BLOOD  
BONE MARROW  
TISSUE  
FINE NEEDLE ASPIRATE  
OTHER BODY FLUID

Draw one EDTA tube (Lavender). Order a CBC and DIFF to be drawn at same time as flow cytometry specimen. Keep at room temperature.

Put 1-3 ml of bone marrow aspirate in EDTA tube. Keep at room temperature.  
For tissue biopsy, fine needle aspirate and other body fluid, call the Flow Cytometry lab for collection and transport information.

**PHYSICIAN INFORMATION:** CLL Profile consists of cell surface antibodies that aid in the diagnosis of CLL/small lymphocytic lymphoma. The profile is customized according to the ordering physician's tentative diagnosis and the pathologist's review of the sample to be analyzed. The final report includes a pathologist's interpretation of the results.

**FLOW CYTOMETRY – LYMPHOCYTE PROFILE** This is a profile test. See ranges of tests in the panel.

RESULT AVAILABILITY: Specimens accepted Monday through Noon on Friday. Turnaround time is 2-3 working days.

ACCEPTABLE SAMPLES: BLOOD

Draw one EDTA tube (Lavender). Keep at room temperature..

**PHYSICIAN INFORMATION:** Lymphocyte Profile evaluates the lymphocyte subsets, T cells (helper and suppressor), B cells and NK cells. The report includes CD3/CD4/CD8/CD19/(CD16&56).

**FLOW CYTOMETRY – LYMPHOMA PROFILE** - This is a profile test. See ranges of tests in the panel.

RESULT AVAILABILITY: Specimens accepted Monday through Noon on Friday. Turnaround time is 2-3 working days.

ACCEPTABLE SAMPLES: BLOOD FINE NEEDLE ASPIRATE  
BONE MARROW OTHER BODY FLUID  
TISSUE

Draw one EDTA tube (Lavender). Order a CBC and DIFF to be drawn at same time as flow cytometry specimen. Keep at room temperature.

Put 1-3 ml of bone marrow aspirate in EDTA tube. Keep at room temperature.

For tissue biopsy, fine needle aspirate, or other body fluids, call the Flow Cytometry lab for collection and transport information.

**PHYSICIAN INFORMATION:** Lymphoma Profile: This profile consists of numerous cell surface antibodies that will aid in the diagnosis of various types of lymphoma. The profile will be customized according to the referring physician's tentative diagnosis and the pathologist's review of the sample to be analyzed. The final report will include a pathologist's interpretation of the results. For more information, contact the Flow Cytometry lab.

**FACTOR V LEIDEN (1691) GENE MUTATION**

No mutation (WILD-TYPE)

TURNAROUND TIME: Turnaround time is up to 5 working days.

ACCEPTABLE SAMPLES: 1 Lavender EDTA tube of peripheral blood. May be stored at room temperature unspun for up to 3 days or refrigerated unspun for up to 5 days.

The Verigene *F5* Nucleic Acid Test is an *in vitro* diagnostic for the detection and genotyping of a single point mutation (C.1601G>A(p.Arg534Gln); also known as Factor V Leiden) of the human Factor V gene (*F5*; Coagulation Factor V gene) in patients with suspected thrombophilia, from isolated genomic DNA obtained from whole blood samples.

**PHYSICIAN INFORMATION:** The *F5* gene, located on human chromosome 1q23, encodes a protein that plays a role in the formation of blood clots (i.e., coagulation). The relative risk for deep vein thrombosis or its recurrence is directly associated with an individual's *F5* genotype. Individuals with one copy of the Factor V Leiden mutation (i.e., heterozygous) are at a 4-8 fold relative risk for venous thrombosis as compared to individuals with no mutation. Individuals with 2 copies of the Factor V Leiden mutation (i.e., homozygous mutant) are at an 80-fold risk for venous thrombosis as compared to individuals with no mutation.

#### **HFE BY PCR**

##### **Tests in Panel: HFE Cys282Tyr Mutation**

Molecular testing for the HFE Cys282Tyr mutation, (p.C2824(c.845G>A)), can help to establish a diagnosis of Hereditary Hemochromatosis in individuals with iron overload. Early diagnosis is important because treatment can prevent damage to organs and tissue.

**RESULT AVAILABILITY:** Turnaround time is 5-10 working days.

**ACCEPTABLE SAMPLES:** BLOOD

One Lavender EDTA tube of peripheral blood. May be stored at room temperature unspun for up to 3 days or refrigerated unspun for up to 5 days.

**PHYSICIAN INFORMATION:** The HFE Molecular Test for Cys282Tyr Mutation can be used to confirm a diagnosis of Hereditary Hemochromatosis in patients with signs, symptoms, and iron studies consistent with the disease. It can also be used to determine carrier status in family members of patients with a known HFE mutation.

##### **HFE His63Asp Mutation**

Molecular testing for the HFE His63Asp mutation,(p.His63Asp(c.187C>G)), is performed on patients demonstrating a heterozygous mutation for the HFE Cys282Tyr mutation. These patients are at risk for Hereditary Hemochromatosis due to iron overload. Early diagnosis is important because treatment can prevent damage to organs and tissues.

**RESULT AVAILABILITY:** Turnaround time is 10 working days.

**ACCEPTABLE SAMPLES:** BLOOD

One Lavender EDTA tube of peripheral blood. May be stored at room temperature unspun for up to 3 days or refrigerated unspun for up to 5 days.

**PHYSICIAN INFORMATION:** The HFE Molecular Test for the His63Asp Mutation can be used in the diagnosis of Hereditary Hemochromatosis in patients with a heterozygous mutation for the Cys282Tyr mutation.

#### **INFLUENZA A/2009 H1N1 BY P(CR)**

The Cepheid Xpert Flu Assay is an automated *in vitro* diagnostic test for qualitative detection by real-time PCR of influenza A, influenza B, and influenza A subtype 2009 H1N1 directly from nasopharyngeal swab specimens of patients with signs and symptoms of respiratory infection.

**RESULT AVAILABILITY:** Turnaround time is 1.5 hours

**Nasopharyngeal Swabs:** Carefully insert a flocked nasopharyngeal swab (supplied by Microbiology) into the nostril that presents the most secretion under visual inspection. Keep the swab near the septum floor of the nose while gently pushing the swab into the posterior nasopharynx. Rotate the swab several times then remove it from the nasopharynx. Place the swab into a 3 mL Universal Transport Medium (UTM) tube.

**PHYSICIAN INFORMATION:** The Gene Xpert Instrument Systems automate and integrate sample purification, nucleic acid amplification, and detection of the target sequence in simple or complex samples using real-time RT-PCR and PCR assays. The systems consist of an instrument, personal computer, and preloaded software for running tests and viewing the results. The systems require the use of single-use disposable GeneXpert cartridges that hold the RT-PCR and PCR reagents and host the RT-PCR and PCR processes. Because the cartridges are self-contained, cross contamination between samples is minimized. For a full description of the systems, refer to the appropriate GeneXpert Instrument System operator manual. The Xpert Flu Assay includes reagents for the detection and differentiation of influenza A, influenza B, and influenza A subtype 2009 H1N1 directly from nasopharyngeal (NP) swab specimens of patients with signs and symptoms of respiratory infection.

#### **JAK2 ACTIVATING MUTATION ASSAY**

##### **REFERENCE RANGES**

Positive	Mean V617F MUTATION/WILD TYPE Ratio is $\geq$ the value for the 5% standard ( $\geq$ )	
Negative	Mean V617F MUTATION/WILD TYPE Ratio is $<$ the value for the 5% standard ( $<$ )	

TURNAROUND TIME: 5-10 WORKING DAYS

ACCEPTABLE SAMPLES: This assay tests genomic DNA from granulocytes. 5cc of peripheral blood or bone marrow aspirate anticoagulated with EDTA. Ship at ambient temperature

**PHYSICIAN INFORMATION:** This assay is helpful in identifying the presence of the clonal JAK2 V617F mutation highly suggestive of myeloproliferative disorders such as: polycythemia vera (PV), essential thrombocythemia (ET), and myeloid metaplasia with myelofibrosis (MMM). Patients with JAK2 mutations may benefit from novel therapeutic strategies that target and inhibit JAK2 tyrosine kinase activity.

A Real-time PCR Allelic Discrimination assay is used. DNA is extracted from granulocytes isolated by density centrifugation and amplified by Real-Time PCR using a commercial JAK2 MutaScreen kit (Ipsogen).

#### **KRAS MUTATION ASSAY**

REFERENCE RANGE – No mutation detected

RESULT AVAILABILITY: Turnaround time is up to 2 weeks

### **SPECIMEN COLLECTION INSTRUCTIONS**

ACCEPTABLE SAMPLES: The preferred specimen is formalin-fixed, paraffin-embedded tumor tissue from which 10  $\mu$ m sections will be taken for DNA extraction by the MagneSil Genomic, Fixed Tissue System (Promega). Tissue size of 1-2  $\text{cm}^2$  and 5-10  $\mu$ m thickness.

The percentage of neoplastic cells on the macro dissected area of the FFPE slide must be at least 25%.

DNA is isolated from a formalin-fixed, paraffin-embedded (FFPE) specimen. DNA analysis of the mutations in the KRAS gene is performed using the Shifted Termination Assay (STA) primer extension reaction (Applied Biosystems®) and capillary electrophoresis fragment analysis. The assay is designed to detect and differentiate 12 mutations in codons 12 and 13 of the KRAS gene.

**PHYSICIAN INFORMATION:** v-Ki-ras2 Kirsten rat sarcoma viral oncogene homolog (KRAS) is a small GTP-binding protein that acts as a self-inactivating signal transducer by cycling from GDP- to GTP-bound states in response to stimulation of a cell surface receptor, including epidermal growth factor receptor (EGFR). Mutations in the KRAS gene are frequently found in human cancers including approximately 30-50% of colorectal carcinomas. Studies have shown that patients with a KRAS mutation do not respond to anti-EGFR therapy.<sup>1,2</sup> KRAS mutation testing is recommended prior to prescribing the anti-EGFR monoclonal antibody drugs.<sup>3,4</sup> Results should be interpreted in conjunction with clinical and other laboratory findings for the most accurate information.

## References

1. Amade RG, Wolf M, Peeters M, et al. Wild-type KRAS is required for panitumumab efficacy in patients with metastatic colorectal cancer. *J Clin Oncol* 2008; 26:1626-34.
2. Karapetis CS, Khambata-Ford S, Jonker DJ, et al. KRAS mutations and benefits from cetuximab in advanced colorectal cancer. *N Engl J Med*. 2008; 359:1757-65.
3. Engstrom PF, Benson AB, and Ryan DP. NCCN Clinical Practice Guidelines in Oncology: colon cancer. National Comprehensive Cancer Network website. [http://www.nccn.org/professionals/physician\\_gls/PDF/colon.pdf](http://www.nccn.org/professionals/physician_gls/PDF/colon.pdf). Version 3.2010. Accessed July 9, 2010.
4. Allegra CJ, Jessup JM, Somerfield MR, et al. American Society of Clinical Oncology provisional clinical opinion: Testing for KRAS gene mutations in patients with metastatic colorectal carcinoma to predict response to anti-epidermal growth factor receptor monoclonal antibody therapy. *J Clin Oncol*. 2009;27:2091-2096.

## **MRSA SURVL NARES DNA**

REFERENCE RANGE - MRSA Not Detected

The GeneXpert®Dx System automates and integrates sample purification, nucleic acid amplification, and detection of the target sequence in simple or complex samples using real-time PCR and RT-PCR assays. The primers and probes in the Xpert MRSA assay detect a proprietary sequence for the presence of a cassette inserted into the *S. aureus* chromosome.

RESULT AVAILABILITY: Turnaround time is 24 hours.

ACCEPTABLE SAMPLES: Red capped COPAN Swabs. Available upon request from 2E-110 or 2E-112.

1. Open the Cepheid Collection Device by peeling back the outer packaging.
2. Ask the patient to tilt his/her head back. Insert dry swabs approximately 1-2 cm into each nostril.

3. Rotate the swab against the inside of the nostril for 3 seconds. Apply slight pressure with a finger on the outside of the nose to help assure good contact between the swab and the inside of the nose.
4. Using the same swabs, repeat for the second nostril, trying not to touch anything but the inside of the nose.
5. Remove the plastic transport tube. Twist off the tube cap and discard it. Place the swabs into the plastic transport tube. The swabs should go all the way into the tube until they rest on top of the sponge at the bottom of the tube. Make sure the red cap is on tightly. **Note:** The swabs should stay attached to the red cap at all times.
6. Label the plastic transport tube with patient ID and send to the laboratory.

**PHYSICIAN INFORMATION:** The Cepheid Xpert MRSA assay performed in the GeneXpert® Dx System (Xpert MRSA) is a qualitative *in vitro* diagnostic test designed for rapid detection of methicillin-resistant *Staphylococcus aureus* (MRSA) from nasal swabs in patient at risk for nasal colonization. The Xpert MRSA Assay is intended to aid in the prevention and control of MRSA infections in healthcare settings. The Xpert MRSA Assay is **not** intended to diagnose MRSA nor to guide or monitor treatment for MRSA infections. MRSA target DNA is **Detected** (presumptive positive for MRSA colonization). MRSA target DNA is **Not Detected** (presumed not colonized with MRSA). MRSA target DNA is **Invalid** (presence or absence of MRSA cannot be determined).

#### **MICROSATELLITE INSTABILITY (MSI)**

REFERENCE RANGE - Microsatellite Stable

RESULT AVAILABILITY: Turnaround time is up to 1 week

ACCEPTABLE SAMPLES: Formalin-fixed, paraffin-embedded tissue: 1 (one) block that includes tumor and 1 (one) that has **only** normal tissue.

PCR amplification of DNA followed by fragment analysis by capillary electrophoresis. (Promega MSI Analysis System).

**PHYSICIAN INFORMATION:** Identify colorectal cancers with microsatellite instability. High frequency microsatellite instability (MSI-H) is associated with hereditary nonpolyposis colorectal cancer (HNPCC) and is also found in 15-20% of sporadic colorectal cancers. Additionally some studies have shown that cancers exhibiting MSI-H may be less responsive to chemotherapy with 5-FU. Clinical indications for testing include: 1) colorectal cancer diagnosed in a patient <50 years of age, 2) colorectal cancer in a patient with synchronous and/or metachronous HNPCC-associated tumors, 3) high-grade colorectal cancer with mucin and/or lymphocyte infiltrates. Testing also might be considered when the proposed chemotherapeutic regimen includes 5-FU.

#### **PROTHROMBIN (20210) GENE MUTATION**

REFERENCE RANGE - NO MUTATION (WILD-TYPE)

TURNAROUND TIME: Up to 5 working days.

### **SPECIMEN COLLECTION INSTRUCTIONS**

ACCEPTABLE SAMPLES: 1 Lavender EDTA tube of peripheral blood. May be stored at room temperature unspun for up to 3 days or refrigerated unspun for up to 5 days.

The Verigene *F2* Nucleic Acid Test is an *in vitro* diagnostic for the detection and genotyping of a single point mutation (c.1601G>A(p.Arg534Gln)) of the human Factor II gene (*F2*; prothrombin gene) in patients with suspected thrombophilia from isolated genomic DNA obtained from whole blood samples.

**PHYSICIAN INFORMATION:** The *F2* gene, located on the short arm of human chromosome 11 (11p11q12), encodes a protein that plays a role in the formation of blood clots (i.e., coagulation) in response to injury. The most common recurring mutation in the *F2* gene occurs in the 3' untranslated region of the gene, where there is a G to A base change at position 20210. Individuals with one copy of the *F2* 20210G>A mutation (i.e., heterozygous) are at a 2-4 fold relative risk for venous thrombosis compared to individuals with no mutation. Individuals with 2 copies of the *F2* 20210G>A mutation (i.e., homozygous mutant) are at a >4 fold risk for venous thrombosis. Individuals carrying both the Factor V Leiden and *F2* 20210G>A mutations (i.e., a compound heterozygote) have a 20-fold more likely chance of having a venous thrombosis than individuals without either mutation.

### **T-CELL GENE REARRANGEMENT ASSAY**

TCRB: Negative for the detection of clonal T-cell receptor beta chain gene rearrangement.

TCRG: Negative for the detection of clonal T-cell receptor gamma chain gene rearrangement.

TCRD: Negative for the detection of clonal T-cell receptor delta chain gene rearrangement.

RESULT AVAILABILITY: Turnaround time is 5-10 working days.

#### **ACCEPTABLE SAMPLES:**

1. Peripheral blood, bone marrow biopsy, or bone marrow aspirate anti-coagulated with EDTA. Ship at ambient temperature within 72 hours.
2. Minimum 5mm cube of tissue shipped frozen, or at room temperature or on ice in RPMI 1640.
3. Formalin-fixed paraffin embedded tissue or slides
4. 2 µg of genomic DNA.

Genomic DNA is extracted from whole blood, bone marrow, fresh or paraffin-embedded tissue. DNA is amplified by polymerase chain reaction using commercial multiplex T-Cell Receptor Beta (TCRB), T-Cell Receptor Gamma (TCRG) or T-Cell Receptor Delta (TCRD) primer sets (BIOMED-2, InVivoScribe Technologies). Fragment analysis by capillary electrophoresis is used to analyze fluorescently-labeled amplification products.

**PHYSICIAN INFORMATION:** The European BIOMED-2 collaborative study found that this multiplex PCR assay results in a detection rate for clonal TCR gene rearrangements in T cell malignancies of greater than 90%. Although positive results are highly suggestive of malignancy, these assays should only be used in support of diagnosis in combination with histological and immunophenotypic data. The limit of detection of this assay has been determined to be approximately 5 malignant cells in 100 normal cells. THEREFORE, A NEGATIVE RESULT DOES NOT RULE OUT MALIGNANCY.

### **VIRAL LOAD HEPATITIS C**

The Roche Taqman HCV can detect from 15-25,000,000 IU of HCV RNA.

Viral Load Hepatitis C is a polymerase chain reaction test to quantitate Hepatitis C RNA levels in blood. Results are reported in International Units/mL. One IU/mL is equivalent to one copy/mL for the current test methodology used in this laboratory

RESULT AVAILABILITY: Turnaround time is 1-2 working days.

ACCEPTABLE SAMPLES: PLASMA OR SERUM

Draw blood specimen in WHITE/YELLOW tube. WHITE/YELLOW tube should be centrifuged within 2 hours of collection. The specimen may then be stored at -20°C to -80°C. Minimum requirement -3mL.

**PHYSICIAN INFORMATION:** The quantitative HCV test is intended for use as an aid in the management of HCV-infected individuals undergoing anti-viral therapy. The assay measures HCV RNA levels at baseline and during treatment and can be utilized to predict sustained and non-sustained virological response to HCV therapy. This test has been cleared/approved by the U.S. Food and Drug Administration.

### **VIRAL LOAD HIV**

COBAS Ampliprep/COBAS Taqman HIV-1 Test can quantitate virion associated HIV-1 RNA in plasma at concentrations as low as 50 RNA copies/ml plasma. Reference range 20-5,000,000 copies/mL

RESULT AVAILABILITY: Turnaround time is 5 working days

ACCEPTABLE SAMPLES: PLASMA

Draw blood specimen in WHITE/YELLOW tube. WHITE/YELLOW tube should be centrifuged within 2 hours after collection. Transfer plasma to a sterile polypropylene tube. The specimen may then be stored at -20°C to -80°C. Minimum requirement -3 mL.

**PHYSICIAN INFORMATION:** The quantitative HIV test is not intended to be used as a screening test for HIV or as a diagnostic test to confirm the presence of HIV infection. The test is intended for use in conjunction with clinical presentation and other laboratory markers as an indicator of disease prognosis. The test has also been used as an aid in assessing response to antiretroviral treatment as measured by changes in plasma HIV RNA levels. This test has been cleared/approved by the U.S. Food and Drug Administration.



**SEROLOGY**  
**Phone 56475 or 56472**

**AMIKACIN**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	ug/mL				
	Peak	20	25		
	Trough	5	10		10

RESULT AVAILABILITY: 24 hours a day, seven days a week

ACCEPTABLE SAMPLE: Blood. Draw in Red/Yellow Tube. Minimum requirement: 3 mL

**ANA PANEL**

SPECIMEN	UNITS
SERUM	TITER

Negative at 1:80 or less

RESULT AVAILABILITY: Weekly, TAT is 5 working days or less

ACCEPTABLE SAMPLES: Red/Yellow SST Tube. Minimum requirement 3 mL.

**ANTI-DNA ANTIBODY**

SPECIMEN	UNITS
SERUM	TITER

Negative at 1:10 or less. Increased levels of IgG anti-ds-DNA antibodies are consistent with the diagnosis of SLE.

RESULT AVAILABILITY: Weekly. Turnaround time is 5 working days or less.

ACCEPTABLE SAMPLES: BLOOD. Draw in RED/YELLOW SST tube.  
Minimum requirement: 3 mL.

**CERULOPLASMIN**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	mg/dl	20	60		

Decreased in: Wilson's Disease, malnutrition, nephrosis, gastroenteropathies  
Increased in: Malignancy, hypoplastic anemia, pregnancy

RESULT AVAILABILITY: Monday through Friday, day shift.

ACCEPTABLE SAMPLES: BLOOD. Draw in RED/YELLOW SST tube.  
Minimum requirement: 3 mL.

**COMPLEMENT C3**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	mg/dl	90	180		

RESULT AVAILABILITY: Monday through Friday, day shift

ACCEPTABLE SAMPLES: BLOOD, Draw in RED/YELLOW SST tube.

Minimum requirement: 3 ml.

**COMPLEMENT C4**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	mg/dl	10	40		

RESULT AVAILABILITY: Monday through Friday, day shift

ACCEPTABLE SAMPLES: BLOOD. Draw in RED/YELLOW SST tube.

Minimum requirement: 3 ml.

**CRYOGLOBULIN, 72 HOUR PANEL**

Tests in Panel:

24 Hour Cryoglobulins

48 Hour Cryoglobulins

72 Hour Cryoglobulins

SPECIMEN	UNITS
SERUM	Neg/Pos

RESULT AVAILABILITY: Weekly

ACCEPTABLE SAMPLES: Red/Yellow SST tube kept at 37°C until specimen clots. Patient should be fasting for 12 hours prior to draw.

**CYTOPLASMIC AB**

SPECIMEN: SERUM                      UNITS: TITER

Negative at 1:20 or less. Cytoplasmic ANCA (c-ANCA) and/or Perinuclear ANCA (p-ANCA). Immunofluorescent staining of human neutrophil substrates.

RESULT AVAILABILITY: Turnaround time is 5 working days or less.

ACCEPTABLE SAMPLES: BLOOD. Draw in RED/YELLOW SST tube.

Minimum requirement: 3 ml.

**FREE LIGHT CHAINS**

SPECIMEN	UNITS
Free Kappa    3.3 to 19.4	mg/L
Free Lambda   5.7 to 26.3	mg/L

RESULT AVAILABILITY: Monday through Friday, day shift.

ACCEPTABLE SAMPLES: BLOOD. Draw in RED/YELLOW tube.

Minimum requirement: 3 ml.

**HAPTOGLOBIN**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	mg/dl	30	200		

Decreased in: Hemolytic conditions, Liver disease

Increased in: Acute and chronic collagen disease, kidney disease, and Hodgkin's Disease.

RESULT AVAILABILITY: Monday through Friday, day shift.

ACCEPTABLE SAMPLES: BLOOD. Draw in RED/YELLOW SST tube.

Minimum requirement: 3 ml.

**IMMUNOGLOBULINS TOTAL**

NORMALS:	IgG	700-1600 mg/dl
	IgA	70-400 mg/dl
	IgM	40-230 mg/dl
	IgG CSF	0-3.4 mg/dl

RESULT AVAILABILITY: Monday through Friday, day shift.

ACCEPTABLE SAMPLES: BLOOD. Draw in RED/YELLOW tube.

Minimum requirement: 3 ml. CSF (IgG) minimum requirement 0.5 ml.

**MEASLES, IgG**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM		Negative			

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW top tube.

Minimum requirement: 3 ml.

**MUMPS, IgG**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM		Negative			

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW tube.

Minimum requirement: 3 ml.

**MONO TEST**

SERUM

Normal: Negative. A negative test result does not exclude mononucleosis.

A positive result indicates a clinical significant concentration of infectious mononucleosis heterophile antibodies in the sample.

RESULT AVAILABILITY: Monday through Friday, day shift.

ACCEPTABLE SAMPLES: BLOOD. Draw in RED/YELLOW SST tube.

Minimum requirement: 3 ml.

**QUANTITATIVE CRYOGLOBULIN**

SPECIMEN	UNITS
SERUM	0/0 cryoglobulin, 0% is negative

RESULT AVAILABILITY: Weekly

ACCEPTABLE SAMPLES: Draw in Red/Yellow SST tubes kept at 37°C until specimen clots. Patient should be fasting for 12 hours prior to draw.

**RUBELLA IgG**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM		Negative			

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW top tube.  
Minimum requirement: 3 ml.

**SPEP**

RESULT AVAILABILITY: Monday through Friday, day shift.  
ACCEPTABLE SAMPLES: SERUM. Draw in YELLOW SST tube.  
Minimum requirement: 3 ml.

TEST NAME	RESULT	UNITS	REF. RANGE
ALBUMIN		g/dl	3.2 – 5.1
ALPHA-1 GLOBULIN		g/dl	.1 - .4
Eval: Decreased in:	Alpha-1 Antitrypsin		
Eval: Increased in:	Acute phase protein		
ALPHA-2 GLOBULIN		g/dl	.4 - 1.0
Eval: Decreased in:	Hemolytic conditions		
Eval: Increased in:	Chronic infection, malignancies, acute phase response		
BETA GLOBULIN		g/dl	.5 - 1.1
Eval: Decreased in:	Defective synthesis, excessive intestinal loss		
Eval: Increased in:	Certain monoclonal gammopathies, iron deficiency anemia, Hyperlipemias		
GAMMA GLOBULIN		g/dl	0.5 - 1.7
Eval: A Gamma Globulin of 0.8 gm% indicates a moderate hypogammaglobulinemia			
Eval: A Gamma Globulin of 0.6 gm% indicates a severe hypogammaglobulinemia.			

If an M spike is suspected, immunofixation electrophoresis, total immunoglobulins, and free light chains will be performed.

**PREALBUMIN (Transthyretin)**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	mg/dl	20	40		

Useful for assessing nutritional status, especially in monitoring the response to nutritional support in the acutely ill patient.

RESULT AVAILABILITY: Monday through Friday, day shift.

ACCEPTABLE SAMPLES: SERUM. Draw in YELLOW SST tube.  
Minimum requirement: 3 ml.

**SYPHILIS IGG**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM		Non-reactive, normal			

A reactive or equivocal result will be followed up with RPR and titer.

RESULT AVAILABILITY: Weekly, day shift

ACCEPTABLE SAMPLES: Blood drawn in RED/YELLOW top tube (serum)

Minimum requirement: 3 ml.

**UPEP**

RESULT AVAILABILITY: Monday through Friday, day shift.

ACCEPTABLE SAMPLES: URINE (24 HR)

Collect urine specimen in proper container and deliver to lab. Minimum requirement –10 ml.

Urine with a discrete electrophoretic band is further assessed by immunofixation electrophoresis.

**VARICELLA ZOSTER IgG**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM		Negative			

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW top tube.

Minimum requirement: 3 ml.

RESULT AVAILABILITY: Monday through Friday, day shift.

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW top tube. Minimum volume: 0.5 ml.

**VITAMIN D 25-OH**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	ng/mL	32.0	100.0		

RESULT AVAILABILITY: Monday through Friday, day shift.

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW top tube.

Minimum volume: 0.5 ml.

**URINALYSIS**  
**PHONE 56478**

**PREGNANCY TEST – URINE PANEL**

SPECIMEN - URINE

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: URINE

Minimum requirement for urine – 4 ml.

FOR FOLLOWING CERTAIN NEOPLASMS, ORDER BETA-HCG QUANTITATIVE

**OCCULT BLOOD**

SPECIMEN

FECES

NORMAL: NEGATIVE

ACCEPTABLE SAMPLES: Stool collected using an occult blood vial (available from SPD)

**URINALYSIS**

URINE COLOR	Yellow	URINE PROTEIN	Negative
APPEARANCE	Clear	URINE PH	
UROBILINOGEN	Negative	SPECIFIC GRAVITY	1.11 mg/dL
URINE BLOOD	Negative	NITRITE, URINE	Negative
URINE BILIRUBIN	Negative	LEUKOCYTE ESTERASE, URINE	Negative
URINE KETONES	Negative		

RESULT AVAILABILITY: 24 hours a day, seven days a week.

ACCEPTABLE SAMPLES: URINE

Collect a minimum of 12 ml of a random urine and deliver to lab within 1 hour of collection (see instructions on next page).

## Instructions for Clean Catch Midstream Urine Collections

Caution: There is a sharp needle under the cap label that can harm you. Do not remove the label from the cap. You have been given towelettes and a urine specimen cup to obtain a sample of your urine.

Please follow the instructions below.

1. Unscrew the cap of the urine specimen cup. Place the cap on the counter with the "straw" facing upward. To avoid contamination, do not touch the inside of the cup, cap or straw.
2. Cleanse yourself with towelettes as follows:

Males - Wipe the head (end) of your penis in a single motion with the first towelette. Repeat this with the second towelette. If you are not circumcised, hold the foreskin back before cleansing and continue to hold it back when you are collecting the urine sample.

Females - Separate the labia, which are the folds of skin on either side of the area from which you urinate. Wipe the inner folds of skin from front to back in a single motion with the first towelette. Then wipe down through center of labial folds with the second towelette. Make sure to keep the labia separated while you are collecting the urine sample.

3. Urinate a small amount into toilet.
4. Place the collection cup under the stream of urine and continue to urinate into the cup. Once the collection cup is full, finish urinating into toilet.
5. Replace the cap on the cup, and tighten the cap securely.

Caution: There is a sharp needle under the cap label that can harm you. Do not remove the label from the cap.

6. Give the specimen to the staff.

**REFERENCE TESTS**  
**PHONE 74668**

Information about specimen collection and reference ranges for tests that are not listed in this manual are available through CPRS using the Tools drop-down menu and clicking on Lab Test Information. Information is also available by calling the laboratory at ext. 74668. Pathology consultation is available 24 hours a day for special test requests and result interpretation. The on-call resident can be contacted at pager 688-2820.

**ACETYLCHOLINE RECEPTOR AB**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	nmol/L	0.00	0.24		

ACCEPTABLE SAMPLES: SERUM, Volume 1 ml. Draw specimen in Red top or gel barrier tube.

**ACTH**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	pg/mL	6	48		

ACCEPTABLE SAMPLES: PLASMA, FROZEN (LAVENDER TOP EDTA). Draw in LAVENDER top tube.  
Minimum requirement: 3 ml.

**ALDOLASE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	units/L	1.2	7.6		

ACCEPTABLE SAMPLES: SERUM (RED TOP TUBE OR GEL BARRIER TUBE)

**ALDOSTERONE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	ng/dl	See below			

Reference ranges based on patient's position 2 hours prior to specimen collection. Values relative to regular diet. Reference range 1-16 ng/dl – supine; 4-31 ng/dl - upright

ACCEPTABLE SAMPLES: SERUM (RED TOP TUBE)

**PHYSICIAN INFORMATION:** Note patient's position (i.e. Supine, Erect) 2 hours prior to specimen collection. Patient's salt intake (low, regular, high) 3 days prior to specimen collection should be noted.

**ALDOSTERONE, 24 HOUR URINE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
URINE	ug/24 hr				
Normal ranges: Normal Diet:		0-19 ug/24 hr			
Low Salt Diet:		20-80 ug/24 hr			
High Salt Diet:		0-12 ug/24 hr			

ACCEPTABLE SAMPLES: URINE (24 HOUR)



**ALPHA-1-ANTITRYPSIN**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	mg/dl	83	199		

ACCEPTABLE SAMPLES: SERUM (RED TOP TUBE)

**ALUMINUM**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	ug/L	0	9		>60

Dialysis Patients <40 ug/L

ACCEPTABLE SAMPLES: BLOOD. Draw in DARK BLUE (EDTA) TUBE. Submit original unopened tube, room temperature.

The patient should not take any aluminum containing antacids or medicines (such as Maalox, Basaljel, Sucralfate) for 24 hours prior to blood test.

**AMIODARONE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	ug/mL	1.0	2.5		

ACCEPTABLE SAMPLES: SERUM OR PLASMA. Draw in RED/LAVENDER/GREEN tube. No serum separators.

**AMITRIPTYLINE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	ng/mL	125	250		500

ACCEPTABLE SAMPLES: SERUM OR PLASMA. Draw in RED/LAVENDER/GREEN tube. No serum separators.

**AMOXAPINE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	ng/ml	150	300		500

Therapeutic range is a guide only. THERAPEUTIC LOW 150 ng/ml THERAPEUTIC HIGH 300 ng/ml

ACCEPTABLE SAMPLES: SERUM . Draw in RED/GREEN tube. Serum separators not recommended.

Minimum requirement: 3 ml.

**ANAFRANIL**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	ng/ml	70	200		

ACCEPTABLE SAMPLES: SERUM OR PLASMA. Draw in RED/YELLOW tube.

Minimum requirement: 1 ml.

**ANGIOTENSIN CONVERTING ENZYME**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	Units/L	12	68		

ACCEPTABLE SAMPLES: SERUM. Draw in RED TOP tube.  
Minimum requirement: 2 ml.

**PHYSICIAN INFORMATION:** Stop administration of captopril, enalapril, or lisinopril for 12 hours prior to venipuncture (reduce ACE activity).

**MITOCHONDRIAL ANTIBODIES**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	UNITS				
Negative:	0.0 – 20.0				
Equivocal:	20.1 – 24.9				
Positive:	> 25.0				

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW tube.  
Minimum requirement: 1 ml.

**ANTIPHOSPHATIDYLSERINE ANTIBODIES**

IgG <16 GPS  
IgM <22 MPS

TURNAROUND TIME: 5-7 working days

ACCEPTABLE SAMPLES: 1 ml serum (RED top tube) specimen

**ANTI-STRIATED MUSCLE ANTIBODIES**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	Titer				

Negative: <1:40

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW tube. Minimum volume 1 ml.

**ANTISMOOTH MUSCLE AB. QUANT**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	UNITS	0	19		

0-19 – NEGATIVE  
20-30 – WEAK POSITIVE  
> 30 – MODERATE TO STRONGLY POSITIVE

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW tube.  
Minimum requirement: 1 ml.

**ARSENIC, 24 HOUR URINE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
URINE	ug/24 HR	0	50		

ACCEPTABLE SAMPLES: URINE (24 HR). Collect 24 hour urine specimen in proper container and deliver to lab. Minimum requirement – 5 ml.

Recent ingestion of seafood can cause an increase in urine arsenic levels; however, this elevation is transient. Patient must avoid all seafood for 72 hours prior to beginning collection. The collection container should be refrigerated during the 24-hour collection period.

**ASO (Anti-Streptolysin)**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	IU/ml	0.0	200.0		

Positive = ASO in serum equal to or >200 IU/ml

Negative = ASO in serum <200 IU/ml

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW TUBE

Minimum requirement: 2 ml.

**ASPERGILLUS**

Collection Sample: Red/Yellow. Minimum Volume (in mls): 1

Do NOT open tube after collection. The specimen will be contaminated if the tube is opened because aspergillus floats in the air.

**BETA HYDROXYBUTERATE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	mcg/mL	0.0	43.9		
PLASMA	mmol/L	0.00	0.27		

Collection Sample: Green/Yellow

Collection Sample: Red/Yellow-Pour

**BETA 2 MICROGLOBULIN**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	mg/L	0.6	2.4		

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW tube

Minimum requirement: 0.5 ml.

**C-PEPTIDE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	ng/mL	1.1	4.4		

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW TUBE

Minimum requirement: 1 ml.

**CA 19-9 ANTIGEN**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	Units/mL	0.0	37.0		

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW TUBE  
Minimum requirement: 1 ml.

**CA-125**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	Units/mL	0.0	35		

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW TUBE  
Minimum requirement: 1 ml.

**CALCITONIN**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	pg/ml	0.0	8.4 (MALE)		
		0.0	5.0 (FEMALE)		

ACCEPTABLE SAMPLES: BLOOD. Draw specimen in RED/YELLOW TOP tube.  
Minimum requirement: 1 ml.

**CAROTENE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	ug/dL	3	81		

Protect from light during and after collection

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW TOP tube.  
Minimum requirement: 2 ml.

Patient should fast for 12 hours and receive no vitamin supplement or foods containing Vitamin A or carotene for 48 hours. Patients should also avoid alcohol prior to testing.

Cause for rejection of specimen includes failure to protect from light, non-fasting specimen, insufficient quantity, and hemolysis.

**CATECHOLAMINES, FRACT. (24 HR URINE)**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
Epinephrine	0-20 ug/24 hr				
Norepinephrine	0-135 mg/24 hr				
Dopamine	0-510 ug/24 hr				

Includes urine creatinine.

ACCEPTABLE SAMPLES: URINE , 24 hour collection  
Minimum volume: 30 ml

**CCP**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM		0	19		

Minimum volume (in mls):1

**CHOLINESTERASE, PSEUDO**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	Units/L	1900	3800		

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW top tube.

Minimum requirement: 0.5 ml.

**CITRIC ACID, 24 HR URINE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
URINE	mg/24 hrs	320	1240		

ACCEPTABLE SAMPLES: URINE ( 24 HR)

Minimum Volume: 10 mL

**CMV, AB, IGM**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	INDEX	0.00	1.0		

Negative - 0.00 – 0.8 Index

Equivocal - 0.91 – 1.0

Positive - >1.0

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW TOP TUBE.

Minimum requirement: 1 ml.

**COCCIDIODES AB, QUANTITATIVE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	NEG	<1.1			

ACCEPTABLE SAMPLES: SERUM, CSF. Draw in RED/YELLOW top tube.

Minimum requirement: 1.0 ml

**COMPLEMENT CH50**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	Units/ml	22	60		

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW TOP tube.

Minimum requirement: 1 ml.

**COPPER**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
URINE	ug/24Hr	3	35		
PLASMA	ug/dl	70	155		

ACCEPTABLE SAMPLES: PLASMA OR SERUM. Draw in DARK BLUE TOP tube.

Minimum requirement: 1 ml. – Serum/Plasma  
5 ml. - Urine (24 HR)

**CORTISOL, URINARY FREE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
URINE	ug/24 hr	0	50		

ACCEPTABLE SAMPLES: URINE (24 HR) Minimum volume 10 mL

**CYANIDE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	ug/ml	0.0	0.2		

POTENTIALLY TOXIC: >1.0 ug/mL

ACCEPTABLE SAMPLES: WHOLE BLOOD. Draw in LAVENDER top tube.  
Minimum requirement: 5 ml.

**DESIPRAMINE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	ng/ml	150	250		500

ACCEPTABLE SAMPLES: SERUM OR PLASMA. Draw in RED/YELLOW top tube.  
Minimum requirement: 1 ml.

**DHEA**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	ng/dl				
Males – 20-29 = 208-771	Females 20-29 = 162-995				
Males – 30-39 = 146-850	Females 30-39 = 112-722				
Males - 40-49 = 107-745	Females 40-49 = 110-554				
Males - 50-59 = 131-538	Females 50-59 = 69-414				
Males - 60-69 = 82-338	Females 60-69 = 60-370				
Males - >70 = 69-252	Females >70 = 63-260				

ACCEPTABLE SAMPLES: SERUM OR PLASMA. Draw in RED/YELLOW TOP tube.  
Minimum requirement: 1 ml.

**DHEA – SULFATE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	ug/dl				
Males - 20-29 = 280-640	Females 20-29 = 65-380				
Males – 30-39 = 120-520	Females 30-39 = 45-270				
Males – 40-49 = 95-530	Females 40-49 = 32-240				
Males – 50-59 = 70-310	Females 50-59 = 26-200				
Males – 60-69 = 42-290	Females 60-69 = 13-130				
Males - >69 = 28-175	Females >69 = 17- 90				

ACCEPTABLE SAMPLES: SERUM. Transfer separated serum to RED/YELLOW tube,  
Minimum requirement: 1 ml.

**DILANTIN, FREE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	MCG/ML	1	2		

ACCEPTABLE SAMPLES: SERUM OR PLASMA. Draw in RED/YELLOW top tube.  
Minimum requirement: 3 ml.

**EBV EARLY Ag, Ab, IgG**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	U/mL	Negative			
Negative	<100 U/mL				
Equivocal	100-120 U/mL				
Positive	>120 U/mL				

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW tube  
Minimum requirement: 0.5 ml – 1 ml.

**EHRlichia (HME) IFA**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
IGG AND IGM TITERS					

An IgG titer of 1:64 or greater indicates exposure to *Ehrlichia Chaffeensis*. Specimens demonstrating a four-fold rise in IgG titers between acute and convalescent samples and/or the presence of IgM antibody to *E. chaffeensis* suggest recent or current infection.

ACCEPTABLE SAMPLES: BLOOD. Draw in RED/YELLOW tube.  
Minimum requirement: 3 ml.

**ESTRADIOL**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	pg/ml				
Males (16-55 yrs) –	0-54 pg/ml				
Females (16-55 yrs) –	19-528 pg/ml				
Postmenopausal Females –	0-31 pg/ml				
Ovulating females by day in cycle relative to LH peak follicular phase					
-12 =	19-83 pg/ml				
4 =	64-183 pg/ml				
Mid Cycle - 1 =	150-528 pg/ml				
Luteal Phase + 2 =	58-157 pg/ml				
+ 6 =	60-211 pg/ml				
+12 =	55-150 pg/ml				

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW tube  
Minimum requirement: 1 ml.

**ETHYLENE GLYCOL**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	mg/dL	0	5		100

Normal: <5 mg/dl (none detected) Potentially toxic: >100 mg/dl  
Minimum volume: 7 mL

ACCEPTABLE SAMPLES: SERUM or PLASMA. Draw in RED/YELLOW tube.

**FECAL FAT (SCREEN)**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
FECES		"Normal"			

ACCEPTABLE SAMPLES: STOOL

**FK 506**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
WHOLE BLOOD	ng/mL	10.0	20.0		

COLLECTION SAMPLE: LAVENDER. MINIMUM VOLUME (in mLs): 1

WARD REMARKS: Specimen must be in the lab by 10:00 AM for same day results.

**FLT 3 MUTATION ASSAY (ALIASES: STK1; CD135;FLK-2)**

Results are reported as the numbers of basepairs for two master mixes. They may be interpreted as follows:

Positive	FLT3 ITD >335 basepairs	FLT3 D835 <input type="checkbox"/> 150 basepairs – undigested <input type="checkbox"/> 130 basepairs – digested
Negative	<input type="checkbox"/> 331 pairs	<input type="checkbox"/> 150 basepairs – undigested <input type="checkbox"/> 81 basepairs – digested

TURNAROUND TIME: 5-10 WORKING DAYS

ACCEPTABLE SAMPLES: 1 lavender EDTA anticoagulated peripheral blood or bone marrow aspirate. May be stored at room temperature unspun for 3 days and then refrigerated unspun for up to five days.

**PHYSICIAN INFORMATION:** Acute myeloid leukemia (AML) in general has a poor prognosis. Studies have described mutation of the FLT3(fms-like tyrosine kinase 3) receptor to be an important prognostic factor in AML, with FLT3 mutants having a worse outcome and response to standard chemotherapeutic interventions. Accordingly, identification of an FLT3 mutation in AML may indicate a need to reassess and modify standard treatment.

The FLT3 mutation assay is a PCR method using primers conjugated with fluorescent dyes that correspond to different targeted regions of the DNA template. Reaction products from several different master mixes can be pooled, fractionated using capillary electrophoresis, and detected simultaneously. The analysis of the size in basepairs of the resulting fragments identifies the presence or absences of FLT3 mutations. This method uses three master mixes. The ITD and



D835 master mixes target the juxtamembrane and kinase domains respectively. The third master mix is the Specimen Control Size Ladder which targets multiple genes to generate a series of amplicons to ensure that the quality and quantity of input DNA is adequate to yield a valid result.

#### **FREE T3**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	pg/mL	2.5	3.9		

COLLECTION SAMPLE: RED/YELLOW-FROZEN

#### **G-6-PD, Quant.**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	Units/Trillion RBC	146	376		

ACCEPTABLE SAMPLES: BLOOD. Draw in 2 LAVENDER tubes  
Minimum requirement: 4 ml in each tube.

#### **GASTRIN**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	pg/ml	0	115		

ACCEPTABLE SAMPLES: SERUM, FROZEN. Draw in RED/YELLOW tube  
Minimum requirement: 0.5 ml

#### **GLOMERULAR BASEMENT MEMBRANE AB**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	Units	0	<20		

Weak positive 21 – 30  
Mod to strong positive >30

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW TOP tube.  
Minimum requirement: 0.7 ml.

#### **GROWTH HORMONE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	ng/mL	0.0	6.0 (MALE)		
		0.0	10.0 (FEMALE)		

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW top tube.  
Minimum requirement: 0.8 ml.

#### **HCV GENOTYPE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM					

COLLECTION SAMPLE: RED/YELLOW TUBE  
Viral Load should be at least 500 IU/mL. Please send viral load results with paperwork.

**HLA B27**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	Reported either Positive or Negative				

ACCEPTABLE SAMPLES: BLOOD – 2 Lavender tubes required.

**HEAVY METALS SCREEN**

This is a profile test. See ranges of tests in the panel.

TESTS IN PANEL: ARSENIC  
LEAD  
MERCURY

ACCEPTABLE SAMPLES: URINE (24 HR)  
Minimum volume 15 ml.

**HOMOCYSTEINE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	umole/L				
<60 years old		0	15		
>60 years old levels increase 1-2					

RESULT AVAILABILITY: Tuesday and Thursday, day shift

ACCEPTABLE SAMPLES: BLOOD. Draw in LAVENDER/YELLOW top tube. Minimum requirement: 2 ml.

**IMIPRAMINE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	ng/mL				>500
Therapeutic: 150-250 ng/mL (The sum of imipramine and desipramine) Peak serum 1-2 hr. post oral dose.					

ACCEPTABLE SAMPLES: SERUM OR PLASMA. Draw in RED/YELLOW top tube.  
Minimum requirement: 1 ml.

The optimal time for collecting specimens when determining steady-state levels of Imipramine and Desipramine in serum is 10-14 hours after the last dose for patients on a single daily dose schedule and just before the morning dose for patients on a divided-dose schedule.

**IMMUNOGLOBULIN E**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	IU/ml	0	100		

ACCEPTABLE SAMPLES: SERUM. Draw in RED TOP tube.  
Minimum requirement: 0.8 ml.

**INSULIN**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	μIU/mL	2.6	24.9 μIU/mL		

ACCEPTABLE SAMPLES: SERUM – RED/YELLOW TUBE, 1 ml minimum.

**LEAD**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	ug/dl	0	19		
URINE	ug/24hr	0	80		

ACCEPTABLE SAMPLES: WHOLE BLOOD. Draw in DARK BLUE TOP tube.  
Minimum requirement: 1 ml. URINE (24 HR) – 5 mL

**LIDOCAINE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	ug/mL	1.5	6.0		

ACCEPTABLE SAMPLES: SERUM OR PLASMA. Draw in RED/YELLOW top tube.  
Minimum requirement: 1 ml..

**LYME ABS, IgM, QUANT.**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	INDEX	0.00	0.90		
	Negative = <0.91 index				
	Equivocal = 0.91 – 1.09 index				
	Positive = >1.09 index				

ACCEPTABLE SAMPLES: SERUM – RED/YELLOW TUBE  
Minimum requirement: 1 ml.

**LYSOZYME**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	ug/mL	3.0	12.8 (MALE)		
		2.5	12.9 (FEMALE)		

ACCEPTABLE SAMPLES: SERUM, FROZEN. Draw in RED/YELLOW TOP tube,  
Minimum requirement: 1 ml.

**MALARIA SMEAR**

WHOLE BLOOD

NORMAL: NO MALARIAL FORMS PRESENT.

ACCEPTABLE SAMPLES: WHOLE BLOOD. Draw in LAVENDER TOP (EDTA) tube.  
Minimum requirement: 5 ml.

**MERCURY**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
URINE	ug/24 hrs	0	20		

ACCEPTABLE SAMPLES: URINE (24 HR)  
Minimum volume 5 ml.

**METHANOL**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	%	0	0.009		
NEGATIVE (Cutoff = 0.010%)					

ACCEPTABLE SAMPLES: WHOLE BLOOD OR SERUM. Draw in GRAY TOP TUBE.  
Minimum requirement: 7 ml.

SPECIAL INSTRUCTIONS: Do NOT prep venipuncture with alcohol or remove stopper from tube.

**METHOTREXATE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	uMol/L				
Effective (uM)					Toxic Levels (uM)
<10.0 at 24 hours					>10.0 at 24 hours
< 1.0 at 48 hours					> 1.0 at 48 hours
< 0.1 at 72 hours					> 0.1 at 72 hours

ACCEPTABLE SAMPLES: SERUM OR PLASMA. Draw in RED/YELLOW – Pour tube,.  
Minimum requirement: 1 ml.

**MULTISPOT**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM					

COLLECTION SAMPLE: LAVENDER/FROZEN/PLASMA/AMBER. Minimum vol: 1 ml

This test is only used if the HIV 1&2 Antibody test is REACTIVE.

**MYOGLOBIN, SERUM**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	ng/ml	28	72 (males)		
		25	58 (females)		

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW TOP tube.  
Minimum requirement: 0.8 ml

**MYSOLINE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	ug/mL	5	12		15

Phenobarbital levels determined with Primidone request. (Major metabolite) Primidone metabolism affected by other antiepileptics, esp. Phenytoin.

ACCEPTABLE SAMPLES : SERUM OR PLASMA. Draw in RED/YELLOW top tube.  
Minimum requirement: 1 ml.

**N-ACETYL - PROCAINAMIDE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	ug/mL	10.0	30.0		
Therapeutic range 5.0 – 12.0 ug/mL					

ACCEPTABLE SAMPLES: SERUM OR PLASMA. Draw in RED/YELLOW top tube.

Minimum requirement: 1 ml.

**N-TELOPEPTIDE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
URINE	nMBCE/mMCR	3	51 (MALE)		
		5	65 (FEMALE)		

ACCEPTABLE SAMPLES: URINE, minimum volume 20 ml.

**NORTRIPTYLINE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	ng/mL	50	150		500

Peak serum conc. 2-6 hours post oral dose. THERAPEUTIC LOW 50 ng/ml, THERAPEUTIC HIGH 150 ng/ml

ACCEPTABLE SAMPLES: SERUM OR PLASMA. Draw in RED/YELLOW top tube.

Minimum requirement: 1 ml.

The optimal time for collecting specimens when determining steady-state levels of Amitriptyline and Nortriptyline in serum is 10-14 hours after the last dose for patients on a single daily dose schedule and just before the morning dose for patients on a divided-dose schedule.

**OVA & PARASITES**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
FECES			None detected		

ACCEPTABLE SAMPLES: STOOL

Please deliver a stool sample in the proper container and deliver to the lab.

**PHYSICIAN INFORMATION:** Specimens from recently admitted symptomatic in-patient (in hospital less than 3 days), or from symptomatic outpatient. Specimen must NOT BE FORMED. Specimen must reach Microbiology Lab (2E112) within one hour of collection, with date and time of collection noted on request slip. If delivery within one hour is impossible (e.g., outpatient collection at home), 5 cc of the specimen MUST be placed in 1 vial of formalin and 5 cc of the specimen placed in 1 vial of PVA within 1 hour of specimen collection. These vials of preservative are available in 2E-112.

**OLIGOCLONAL BANDING**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
CEREBROSPINAL FLUID (CSF)					
SERUM					

NORMAL: NONE DETECTED

ACCEPTABLE SAMPLES: CSF AND BLOOD. Draw in Red/Yellow top tube. Collected at the same time. Minimum requirement 0.5 ml (CSF) and 0.5 ml (Serum).

**OXALATE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
URINE (24 HR)	mg/24 hrs	7	44		
Adult Males – 7-44 mg/24 hours					
Adult Females – 4-31 mg/24 hours					

ACCEPTABLE SAMPLES: URINE, 24 HOUR

**PHENOBARBITAL**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	ug/mL	15	40		50.0

ACCEPTABLE SAMPLES: SERUM. RED/YELLOW-POUR  
Minimum requirement: 1 ml.

**PORPHOBILINGEN, QN, RANDOM URINE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
URINE (RANDOM)	mg/L	0.0	2.0		

ACCEPTABLE SAMPLES: URINE, RANDOM. Minimum volume: 3 mL.

**PORPHOBILINGEN, QN, 24 HOUR URINE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
URINE (24 HR)	mg/24 HR	0.0	1.5		

ACCEPTABLE SAMPLES: URINE, minimum volume 2 mL.

**PROCAINAMIDE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	ug/mL	4	10		12

ACCEPTABLE SAMPLES: SERUM OR PLASMA. Draw in RED/YELLOW top tube.  
Minimum requirement: 1 ml.

**QUINIDINE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	ug/mL	2.0	5.0		>5.0

ACCEPTABLE SAMPLES: SERUM OR PLASMA. Draw in RED/YELLOW top tube.  
Minimum requiremen: 1 ml.

**RBC FOLATE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	ng/ml	280	791		

ACCEPTABLE SAMPLES: BLOOD. Draw in two LAVENDER tubes.  
Minimum requirement: 10 ml.

**RENIN ACTIVITY, PLASMA**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	ng/ml/hr				
Adult normal salt intake upright: 1.31 – 3.95					
Supine 0.15 – 2.33					

ACCEPTABLE SAMPLES: PLASMA, FROZEN. Draw in LAVENDER TOP tube.  
Minimum requirement: 3 ml.

**RETICULOCYTE, HEMOGLOBIN**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
BLOOD	pg	24	36		

ACCEPTABLE SAMPLES: BLOOD. Draw in LAVENDER TOP tube.  
Minimum requirement : 2.0 ml.

**RHEUMATOID A. FACTOR**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM					

COLLECTION SAMPLE: RED/YELLOW. Minimum volume: 1 mL

**ROCKY MOUNTAIN SPOTTED FEVER, IgG, EIA**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM		Negative			

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW tube.  
Minimum requirement: 0.4 ml.

**SCL-70 ANTIBODY**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	u/mL	0	99		
NEGATIVE = 0 – 99					
EQUIVOCAL = 100 – 120					
POSITIVE = >120					

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW top tube.  
Minimum requirement: 1 ml.

**SEMEN ANALYSIS**

TESTING PERFORMED: ARKANSAS FERTILITY CLINIC, LR

This is a profile test. See ranges of tests in the panel

RESULT AVAILABILITY: This test is by appointment only and **requires Chief of Staff consult.**  
Protocol, instructions, and requisition forms on CAVHS homepage.

ACCEPTABLE SAMPLES: SEMEN

**SEX HORMONE BINDING GLOBULIN**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	nmol/L	Male 20-49 age: 16.5-55.9; Female: 20-49 age: 17.3-122;	> 49 years: 19.3 – 76.4		

Males: 13-71 nmol/L > 18 years of age

Females: 18-114 nmol/L < 18 years of age

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW TOP tube.

Minimum volume: 0.5 ml.

**SIROLIMUS**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
WHOLE BLOOD	ng/mL	5.0	15.0		20.0

COLLECTION SAMPLE: LAVENDER. Minimum volume (in mLs): 1

**SM & RNP ANTIBODIES**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	Birth > 99 years	Neg: <20		0.0 – 0.9	

TESTS IN PANEL: SM ANTIBODY  
RNP ANTIBODY

ACCEPTABLE SAMPLES: BLOOD. Draw in RED/YELLOW top tube.

Minimum requirement: 1 ml.

**SSA/SSB PANEL**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	AI Neg: <20	0.0 – 0.9 AI			

TESTS IN PANEL: SSA  
SSB

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW top tube.

Minimum requirement: 1 ml.

**T-SPOT**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
WHOLE BLOOD					

COLLECTION SAMPLE: Request from laboratory. MINIMUM VOLUME (in mLs):9

Blood can only be collected between midnight and 2 pm Monday-Friday. Specimens collected after 2 pm Monday-Friday will be REJECTED.



**TESTOSTERONE, FREE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	pg/ml				
Males, 20-49 years:	12-40 pg/mL				
Males, >50 years:	11-25 pg/mL				
Females: Ovulating	– 0-4 pg/mL				
Oral Contraceptives	– 0-2 pg/mL				
Post Menopausal	– 0-2 pg/mL				

ACCEPTABLE SAMPLES: BLOOD. Draw in RED/YELLOW top tube.  
Minimum requirement: 3 ml.

**THEOPHYLLINE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	ug/mL	10	20		

Peak serum levels dependent on product formulation. 2 hours post oral, rapid release – 4 hours post oral, sustained release.

RESULT AVAILABILITY: 24 hours a day, 7 days a week

ACCEPTABLE SAMPLE: BLOOD. Draw in GREEN/YELLOW PST top tube. Minimum requirement: 1 ml.

**THIOCYANATE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	mcg/ml				
Normal ranges: Non-smokers	1.0 – 4.0 mcg/ml				
Smokers	3.0 – 12.0 mcg/ml				

Nitroprussin therapeutic range: 6.0 – 29.0 mcg/ml

ACCEPTABLE SAMPLES: BLOOD. Draw in RED/YELLOW top tube.

**THYROID PEROXIDASE ANTIBODIES**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	IU/mL	0	34		

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW top tube.  
Minimum requirement: 1 ml.

**TOBRAMYCIN, PEAK AND TROUGH**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	ug/ml				>12.0 PEAK >2.0 TROUGH

Peak 6 to 10 ug/ml; trough .5 to 2.0 ug/ml.

ACCEPTABLE SAMPLES: SERUM OR PLASMA. Draw in RED/YELLOW top tube.  
Minimum volume: 1 mL

**TOXOPLASMA ANTIBODY IgG**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM					
Neg: <6.5 IU/mL					
Equivocal: 6.5 – 7.9 IU/mL					
Positive: > 7.9 IU/mL					

ACCEPTABLE SAMPLES: SERUM . Draw in RED/YELLOW TUBE.  
Minimum requirement: 1 ml.

**TRICYCLIC ANTIDEPRESSANTS**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM		"Negative"			

ACCEPTABLE SAMPLES: SERUM OR PLASMA. Draw in RED/YELLOW TOP tube.  
Minimum requirement: 2 ml.

**URINE 5HIAA, RANDOM URINE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
URINE	mg/g Creat 24 HR	>17 years: 0.0 – 6.9 mg/g creatinine 0.0 – 14.9 mg/24 hr			

ACCEPTABLE SAMPLES: URINE  
Minimum volume 1 ml. Minimum volume 24 hr 30 mL

**URINE HEMOSIDERIN**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
URINE					

NORMAL: NEGATIVE

ACCEPTABLE SAMPLES: URINE  
Collect a minimum of 4 ml of a random urine.

**VISCOSITY**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	CEN TIPO	1.1	1.5		

Hyperviscosity is seen in multiple myeloma, Waldenstrom's disease, and macroglobulinemia

ACCEPTABLE SAMPLES: BLOOD. Draw in 2 BLUE TOP TUBES (Fill completely).  
Minimum requirement: 1 ml.

**VITAMIN A**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	ug/dL	30	90		

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW tube.  
Minimum requirement: 2 ml.

**VITAMIN B-1**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
WHOLE BLOOD (Protect from light)	ug/L	4.0	20.0		

ACCEPTABLE SAMPLES: PLASMA. Draw in LAVENDER top tube.

Minimum requirement: 2 ml.

**VITAMIN B-2**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
WHOLE BLOOD	ug/L				

COLLECTION SAMPLE: LAVENDER/FROZEN/WHOLE BLOOD/AMBER

MINIMUM VOLUME (in mls): 4

Specimen must be protected from light at all times!!! Send to lab ASAP.

**VITAMIN B6**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	ug/L	5.3	46.7		

Minimum volume: 2 ml

**VITAMIN D, 1.25 DIHYDROXY**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	pg/mL	10.0	75.0		

ACCEPTABLE SAMPLES: SERUM OR PLASMA. Draw in RED/YELLOW top tube.

Minimum requirement: 3 ml.

**VITAMIN E**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	Alpha: 4.6 – 17.8 mg/L Beta plus gamma: <5.0 mg/L				

ACCEPTABLE SAMPLES: SERUM. Draw in RED/YELLOW TOP tube.

Minimum requirement: 2 ml.

**VITAMIN K**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
SERUM	ng/mL	0.10	2.20		
PLASMA	ng/mL	0.10	2.20		

COLLECTION SAMPLE: RED/YELLOW FROZEN/PROTECT FROM LIGHT

**VMA, 24 HR URINE**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
URINE	mg/24 hr	0	7.5		

ACCEPTABLE SAMPLES: URINE (24HR.), minimum volume 30 ml.

**ZINC**

SPECIMEN	UNITS	REF LOW	REF HIGH	CRIT LOW	CRIT HIGH
PLASMA	ug/dL	70	150		

ACCEPTABLE SAMPLES: PLASMA. Draw in DARK BLUE top tube.

Minimum requirement: 2 ml.

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