

Sample collection planning for hematology and/or clinical chemistry testing:

Step 1: What sample type do you need?

- a. **Hematology only:** Submit anticoagulated (unclothed) whole blood in **EDTA**. Blood should be submitted within 1-2 hours of collection, or refrigerated for a maximum of 4 hours prior to submission. Mix immediately after draw to reduce potential clotting.
- b. **Chemistry only:** Submit serum or Lithium Heparin plasma for most routine chemistries. View "Sample Type" on Page 2 of desired analytes. Whole blood can be submitted in the required tube for serum harvesting at the diagnostic lab if submission is within 2 hours of blood collection. Prolonged serum/plasma contact with RBC's will alter some analytes. If samples are being separated in your lab, please consult us for appropriate sample handling & storage strategies.
- c. **Hematology and chemistry:** submit a) anticoagulated whole blood in EDTA for hematology, and b) serum or plasma for chemistry (as above, serum or plasma can be refrigerated up to 24 hours prior to submission, or frozen in many cases – check with us first).

Step 2: What sample volume do you need?

- a. **Hematology:**
 1. A full CBC or any automated hematology test requires 250 μ L of EDTA-anticoagulated whole blood. CBC's can be performed with a minimum of 150 μ L of EDTA-anticoagulated blood in a microtainer, however, the blood to EDTA ratio will be off and may affect RBC morphology and MCV.
 2. A blood smear for differential or cellular morphology only requires 10 μ L of EDTA-anticoagulated whole blood.
- b. **Chemistry:**
 1. To calculate the volume of serum or plasma needed, start with 50 μ L (the "dead space" volume).
 2. To 50 μ L, add the volume(s) needed for each test or panel (see Table page two).
 3. This is the total volume of serum or plasma needed. To calculate the volume of whole blood needed to obtain this amount of serum or plasma, multiply the number by 2.5.
*Example: If a liver panel will be ordered, add 50 μ L (dead space volume) to 82 μ L (volume needed for liver panel) = 132 μ L of serum or plasma is needed.
For whole blood draw volume, multiply this by 2.5: 132 μ L x 2.5 = 330 μ L of whole blood is needed.*

Notes about obtaining a good blood sample:

- 1) A good, clean, quick flowing blood draw is best for both CBC and chemistries. Slow draws can lead to clotting before the blood can be placed into the EDTA microtainer and also can contribute to hemolysis.
- 2) It is ok to draw a SMALL amount of heparin (1:1000 or more dilute) to "flush" the needle. We recommend filling the needle hub about halfway, no more. Our studies have shown that this small amount of heparin does not likely affect the platelet count, as long as the sample is placed into an EDTA tube for hematology. Ideally an EDTA "flush" can be used for hematology samples ONLY (EDTA is not acceptable for several chemistry analytes).
- 3) Be sure to fill anticoagulant tubes to proper volumes. The EDTA and lithium heparin microtainers should be filled between the lower and upper fill lines. Under-filling tubes may cause artifacts. Over-filling tubes can lead to sample clotting and rejection of the sample.
- 4) **Blood drawing training videos can be found at:** [Place link to website training videos](#)
- 5) If you need help with animal procedures, contact our veterinary staff at 650-724-5524 or visit <http://vsc.stanford.edu/services/vetmed.html#vettech>

Panel or test	Analyte(s):	Volume (µL)	Sample type
Complete Chemistry Panel	Alb, TP, AlkPhos, ALT, AST, GGT, Cholesterol, GLU, BUN, Creat, Ca, Phos, Bilirubin, Lytes, CO2	177	Serum, Plasma (LiH only)
Cardiac BioMarker Panel	BNP, CRP, Troponin I	40	Serum, Plasma (LiH, NaH)
Electrolyte Panel	Na, K, Cl, CO2	45	Serum, Plasma (LiH only)
Lipid Panel	Chol, Trig, HDL, LDL	13	Serum, Plasma (LiH, NaH)
Liver Panel	AST, ALT, Alk Phos, GGT, Bilirubin	82	Serum, Plasma (LiH, NaH)
Metabolic Panel	Glu, BUN, Creat, Lytes, CO2	71	Serum, Plasma (LiH only), Urine
PreClinical Toxicity Panel	Chemistry Panel plus CK, Triglyceride, GLDH, Urine S/G	245	Serum, Plasma (LiH only), Urine
Renal Panel	BUN, Creatinine, Phos, Alb, Lytes	74	Serum, Plasma (LiH only), Urine
Individual Tests:	AST	20	Serum, Plasma (LiH, EDTA)
	Albumin	3	Serum, Plasma (LiH, EDTA)
	Alkaline Phosphatase	7	Serum, Plasma (LiH, NaH)
	Ammonia	44	Plasma (LiH, EDTA)
	Amylase	10	Serum, Plasma (LiH, NaH)
	ALT	20	Serum, Plasma (LiH, EDTA)
	Bilirubin – Total	10	Serum, Plasma (LiH, EDTA)
	Bilirubin - Direct	10	Serum, Plasma (LiH, EDTA)
	BUN	3	Serum, Plasma (LiH, EDTA), Urine
	Calcium	5	Serum, Plasma (LiH, NaH)
	Chlorine (includes Na & K)	40	Serum, Plasma (LiH only), Urine
	Cholesterol	3	Serum, Plasma (LiH, EDTA)
	CO ₂ Enzymatic	5	Serum, Plasma (LiH only)
	BNP	8	Serum, Plasma (LiH, NaH)
	Na/K (includes Chlorine)	40	Serum, Plasma (LiH only), Urine
	CK - Total	14	Serum, Plasma (LiH, EDTA)
	Creatinine	20	Serum, Plasma (LiH, NaH, EDTA), Urine
	CRP (C-Reactive Protein)	12	Serum, Plasma (LiH)
	Electrolytes (potassium, sodium, and chloride)	40	Serum, Plasma (LiH only), Urine
	Fructosamine *	18	Serum, Plasma (EDTA)
	GGT	15	Serum, Plasma (LiH, EDTA)
	Globulin	13	Serum, Plasma (LiH, EDTA)
	GLDH *	20	Serum
	Glucose	3	Serum, Plasma (LiH, NaH, EDTA), Urine
	HDL	3	Serum, Plasma (LiH, NaH, EDTA)
	Hemoglobin A1C *	200	EDTA Whole Blood
	Iron, Total	25	Serum, Plasma (LiH, NaH)
	Lactic Acid *	4	Plasma (NaF only)
	LDH (Lactate Dehydrogenase)	8	Serum, Plasma (LiH, NaH)
	Lipase	3	Serum, Plasma (LiH, NaH)
	LDL	3	Serum, Plasma (LiH, NaH, EDTA)
	Magnesium	4	Serum, Plasma (LiH, NaH), Urine
	Microalbumin *	17	Urine
	Phosphorus	3	Serum, Plasma (LiH, EDTA), Urine
	Protein, Total	10	Serum, Plasma (LiH, NaH, EDTA)
	Tacrolimus *	200	EDTA Whole Blood
	TIBC (Total Iron Binding Capacity)	25	Serum, Plasma (LiH, NaH)
	Triglycerides	4	Serum, Plasma (LiH, NaH)
	Troponin I	20	Serum, Plasma (LiH, NaH)
	Uric Acid	10	Serum, Plasma (LiH, NaH, EDTA)

Sample Volume Requirement Example Sheet

For Serum or Plasma

Add **50 µL** to the total testing volume to account for the “dead space” volume.

Example: ALT + AST

- ALT: 20 µL
- AST: 20 µL
- Total: 40 µL
- The “dead space” volume: +50 µL
- **Total serum/plasma needed: 90 µL**

For Whole Blood

If **whole blood** will be submitted, first calculate the total serum/plasma volume needed, then multiply by **2.5**.

Example: Liver Panel

- Liver panel testing volume: 82 µL
- Dead volume: +50 µL
- Serum/plasma volume needed: 132 µL
- Whole blood conversion: $132 \mu\text{L} \times 2.5$
- **Total whole blood needed: 330 µL**

Quick Formula:

Serum/Plasma: Testing volume + 50 µL = Total needed

Whole Blood: Total serum/plasma volume $\times$ 2.5 = Total whole blood needed

* For these marked tests, please call or email the laboratory prior to sample collection and submission at (650) 725-8305 or diagnosticlab@stanford.edu