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An HIV Information Site & HIV Educational Resource Site (HIS & HERS)

Understanding Laboratory and Blood Tests in HIV Treatment

Test names Test abbreviations	Normal Range or Best Values	What This Test Means
HIV & The Immune System		
CD4-lymphocyte count T-cells	600 or above (usually 1000 or above)	The **CD4-lymphocyte count** (also known as T-cell count) is the key test of what is called cell-mediated immunity or one of the most important forms of defense in the human body. The lower the number here, the more likely you are to have unusual infections and many other problems such as diarrhea, fever, weight loss, or even cancers. Currently (June 2004) there is not much treatment that can directly increase your CD4 count; however, antiviral treatment against HIV can indirectly improve this number by lowering the amount of virus in the body. Less than 250 CD4 cells usually makes it likely that you will have some symptoms like weight loss, fever, nightsweats, skin problems, or diarrhea. Less than 200 CD4 cells qualifies you as having "AIDS" by the **Center for Disease Control's** definition, but the diagnosis of AIDS is not the death sentence that it was before we had effective therapy like we do now. Even if your CD4 count is very low, you can still raise it to normal levels with appropriate antiviral therapy therapy and adherence to your treatment plan.

HIV viral load **HIV RNA PCR**	"Undetectable" means either less than 400 copies per cc (regular viral load test) or less than 20-50 copies per cc (ultrasensitive test)	The **HIV viral load** test is the key test to determine how much HIV virus is in your bloodstream and probably your body. The more virus that is detected by this test, the more likely your immune system is to suffer and the more likely you are to have damage to your nervous system (brain, nerves in your feet, etc.) and stomach/bowels especially if your CD4 count is low too. Your CD4 count will usually fall faster or rise slower the higher the viral load. Also a large amount of virus in the body makes it easier to transmit the virus to other persons through sex. The drugs to treat HIV will directly lower this test. The more effective the treatment, the lower the viral load will go. Taking every dose of medication will directly affect this test.
Genotype	Not applicable	A **genotype** is a newer test which will tell you what resistance your strain of HIV has to HIV treatment medications. It is just a blood test but it may take from 2-4 weeks for the results to come back. It is very important that you are taking your medications for at least 2-4 weeks before you have this test done. A genotype test looks at the RNA molecules or genes of the virus to determine if the virus has mutated and exactly what mutations the virus' RNA has developed to resist the effects of HIV medications. Once the mutations have been found, your healthcare provider can look up what the mutations mean in a well established table or database.
Phenotype	Not applicable	The **phenotype** is another type of resistance test for HIV, and it is very similar to the genotype above, but it may take a little longer to run the test. It costs a bit more also. Like the genotype, it is very important that you are taking medications for at least 2-4 weeks before you have this test done. The phenotype is a complicated test where the virus is grown with the HIV medications. Note is made of which medications inhibit the virus' growth and which medications do not work in the this way.

Blood Cell Counts

White blood cell count **WBC**	4,500 - 11,000	**White blood cells** (WBC) are an important cell in the immune system. If they are too high, that is usually a signal that your body may be fighting an infection or some other problem. Sometimes white cells are too high when the body's production of white cells goes out of control like in leukemia which is a cancer of white blood cells. Certain medications can also raise white blood cells (see below) If your white cells are too low, you can be abnormally sensitive to bacterial or fungal infections like strept or staph (bacteria) or yeast (fungus). Many things can lower white blood cell counts such as HIV itself or drugs (zidovudine, ganciclovir, valganciclovir, sulfamethoxazole/trimethoprim, dapsone, vancomycin, amphotericin B, other sulfa drugs, pyrimethamine, chemotherapy, or interferon) or even cirrhosis of the liver and other medical problems (lupus). White cells can be stimulated by administration of stimulating hormones like granulocyte-colony stimulating factor (G-CSF, Neupogen), granulocyte macrophage-colony stimulating factor (GM-CSF) or Neulasta. If you have fever and your white blood cells are low, you should inform your healthcare provider promptly or go to an Emergency Department.
Hemoglobin **Hgb**	13.5 - 16.5	**Hemoglobin** is a way to measure the amount of red blood cells in your bloodstream. Red blood cells carry oxygen to all of your tissues. If your red blood cells are too low for you which is called anemia, then you may feel tired or get short of breath quickly with any activity or more quickly than is normal for you. You may also appear pale (especially around your lips, gums, fingernails,) and your heartbeat may be fast or faster than normal (more than 100 beats per minute.) Anemia can be caused by many things including bleeding, low amounts of iron in the body, low amounts of vitamins, medications (zidovudine, amphotericin B, ribavirin,) general illness, HIV itself, infections, ulcers in the stomach, cancer, and other causes as well. Anemia can be treated with many things depending on the cause: iron supplements, erythropoietin injections, vitamin B12

		supplements, folic acid supplements, transfusions (as a last resort or if you feel very bad), changing medications, treating HIV or other infections, treatments for ulcers or cancer treatment. If you have too many red blood cells, you may feel fatigued and rarely you could have strokes or other problems from the blood being too thick. Cigarette smoking is probably the most common cause of too many red blood cells. Anabolic steroids, testosterone, and erythropoietin can cause too many red blood cells. Rarely forms of bone marrow cancer can also cause this condition.
Hematocrit **Hct**	40 - 45	**Hematocrit** is just another way of measuring red blood cells. See the discussion under "Hemoglobin" above for more information.
Mean corpuscular volume **MCV**	70 - 100	**MCV** or mean corpuscular volume refers to the size of your red blood cells. If your MCV is too low, your red blood cells are too small. You may have iron deficiency or some genetic diseases of red blood cells. If your MCV is too high, your red blood cells are too large. You may have vitamin B12 deficiency, folic acid deficiency, or you may be taking certain medications such as zidovudine, stavudine, or abacavir. Too much alcohol use (wine coolers, wine, beer, mixed drinks or liquor) can also cause your red blood cells to be too large. Treatment of abnormal red blood cell size relates to the specific cause. If the problem is just due to a medication, in many cases the medication may be continued, and your condition monitored.

Platelet count	150,000 - 450,000	**Platelets** are the clotting cells in the bloodstream. Clotting is very important or you can bleed seriously without any injury (for example, nose bleeds) or from very minor injuries like brushing your teeth, bumping yourself on something, or shaving. Platelets can be lowered by HIV itself, other infections, medications (dapsone, sulfamethoxazole/trimethoprim, other sulfa drugs, pyrimethamine, amphotericin B, interferon, cancer chemotherapy, valganciclovir, ganciclovir and many others), cirrhosis of the liver, and certain forms of cancer. Usually low platelets are not much of a problem unless you are bleeding, taking medications to thin your blood (heparin, Lovenox, or warfarin/Coumadin) or they get below 20,000 or so. If they are low, you should avoid taking aspirin, anti-inflammatory drugs (ibuprofen, naprosyn, Vioxx, Celebrex, etc.) and you should studiously avoid injuring yourself with cuts or bruises. Use an electric razor if possible. If you are see bleeding (especially nose bleeds, red blood from your rectum, or black colored bowel movements) and you have low platelet cells, you should notify your Healthcare Provider immediately or go to an Emergency Department. Platelets can be too high also. Usually platelets that are too high are due to some sort of inflammation/infection or blood loss. High platelets usually do not require treatment. Treatments for low platelets depends on the cause. In many cases if the platelets are in the range of 40,000 or above, no treatment may be necessary as long as the platelet count is not getting worse. If low platelets are due to HIV, treating HIV with medications will slowly raise your platelets. If low platelets are due a drug, the drug can be changed in some cases. Platelets can also be transfused if you are bleeding. Sometimes it might be necessary to have surgery for removal of your spleen which is an organ in your belly just above your stomach on the left side.

Metabolic or biochemistry profile

Sodium Na	135 - 145	**Sodium** (sometimes abbreviated as "Na") is the concentration of a vital form of salt in your bloodstream. The sodium on this lab test does NOT refer to how much sodium you have in your entire body. You may have a low sodium value in your blood, but your body sodium is usually just fine. Sodium can be too low due to general illness, hormone problems, taking certain medications (diuretics like HCTZ or furosemide/Lasix), nausea and vomiting, diarrhea or getting too much fluid that has no salt in it. Very low sodium or sodium that drops very quickly can cause weakness and seizures (convulsions). The approach to low sodium is to determine whether you are dehydrated or have too much fluid in your body and then treat whatever that is either by taking fluids with sodium or by removing fluid from your body. Sodium tablets should not be used except in rare circumstances and only as advised by your healthcare provider. Sodium can be too high usually due to dehydration. The treatment is usually to take fluids.
Potassium K	3.5 - 5.0	**Potassium** (commonly abbreviated by healthcare providers as just "K") is another important salt in the body. If your potassium is too low, you can feel weak or your heart can go out of rhythm. Usually low potassium is due to use of fluid pills (diuretics like furosemide/Lasix or HCTZ,) amphotericin B, or from vomiting or diarrhea. Sometimes low potassium can be due to low amounts of acid in the body. Normally it is not necessary to take a potassium supplement or pill, but if your potassium is low, you should eat and drink things that are high in potassium like fruits, vegetables, juices or you may be prescribed potassium supplements like pills, liquids or fizzy tablets. Potassium supplements can upset your stomach or they can cause nausea and vomiting due to their bad taste or due to irritation of your stomach. If your potassium is too high, you may develop heart rhythm problems. Usually high potassium is due to weak kidneys, certain medications (spironolactone, captopril, benazepril, lisinopril, ramipril or other blood pressure medications called ACE inhibitors or ACE blockers,) excessive supplementation/ intake, or hormone problems. Treatment for high potassium may involve any combination of the following: stopping supplementation, fluid pills (like furosemide/Lasix), increasing

		fluid intake, or Kayexelate which is a resin that one takes by mouth or by enema to pull the potassium out of your system.
Creatinine **Cr**	0.5 - 1.5	**Creatinine** is a rough measure of how well your kidneys work. If the creatinine is too high, your kidneys are weak or you are dehydrated or both. Weak kidneys can be due to dehydration, a weak heart, blockage of the kidneys by stones or a big prostate gland, certain medications (like aspirin, ibuprofen, naprosyn, Vioxx, Celebrex, furosemide, sulfa drugs, certain blood pressure medications and others,) HIV itself, other kidney diseases, high blood pressure, certain infections, or autoimmune diseases (lupus, polyarteritis nodosa). If the creatinine is too low, sometimes that might mean that you do not have a lot of muscles. If your creatinine is too high, you should avoid aspirin, other anti-inflammatory medications (like ibuprofen, naprosyn, Vioxx, Celebrex, etc.,) and you should drink plenty of fluids. The exception to drinking a lot of fluids is if you are on dialysis. In that situation, consult your healthcare provider about exactly how much fluid to drink.
Blood urea nitrogen **BUN**	5 - 20	The **BUN** test is too high if you are dehydrated, your kidneys are weak, or your heart is not pumping very well. See what to do about high creatinine above.
Albumin **alb**	3.5 - 4.5	**Albumin** is a protein in the blood that varies with three main things: how much you eat, how much your liver makes, and how much your kidneys urinate out. It its too low it can be due to poor nutrition or especially poor protein intake, poor liver function (due to hepatitis or cirrhosis), recent severe illness (infections, fever, trauma, diarrhea, vomiting) or leakage of protein into the urine (nephrosis or nephrotic syndrome) due to kidney problems or HIV itself. Treatment of low albumin depends on the cause. If your albumin is low due to poor nutrition, you can eat more protein-type foods like meat, fish, and beans. You can also take nutrition supplements which are available canned (Ensure, Boost, Jevity, etc.) or in powder form (Instant Breakfast, Ensure, generic, or even whey/soy protein powder).

		If your albumin is low due to poor production by the liver, you can take stress off of your liver by not drinking alcohol, by not taking acetaminophen (like Tylenol), or by changing your other medications under the supervision of your healthcare provider. If your albumin is low due to kidney problems and losing it in the urine, you can take certain medications like lisinopril, benazepril or other ACE inhibitors or ACE blockers.
Lactate dehydrogenase LDH	less than 250	**LDH** is an enzyme in the blood that can be elevated for several reasons: 1. muscle damage from lifting weights, running long distances, other vigorous exercise, heart damage ("heart attack") 2. red blood cell breakup due to medications (like dapsone, ribavirin, sulfa drugs), trauma to red blood cells, or to conditions where the body attacks its own red blood cells (sickle cell, thalassemia, lupus) 3. liver problems like hepatitis Increased LDH itself is not a problem, but the cause can bad. Therefore, the treatment for elevated LDH is to treat the cause.
Liver profile		
Albumin	3.5 - 4.5	See above under "Albumin: Metabolic or Biochemistry Profile"
LDH	less than 250	See above.
Bilirubin	less than 1.5	**Bilirubin** is a pigment that is made by the liver to help in the digestion of fatty foods. When the levels of bilirubin are too high in the bloodstream, your eyes and/or skin might look yellow. High bilirubin can be the result of any of the following: 1. Blockage of the small or large bile ducts in the liver by anything including gall stones, liver inflammation (hepatitis due viruses, drugs or alcohol) 2. Breakdown of red blood cells too rapidly 3. Certain medications like indinavir (Crixivan) or atazanavir (Reyataz) Treatment of high bilirubin relates to treating the cause. If high bilirubin is due to indinavir or atazanavir, generally no treatment is necessary.

AST or SGOT	less than 40	**AST** is a liver enzyme and a muscle enzyme. Enzymes are just special proteins with certain important chemical functions within living organisms including man. The AST can be elevated due to liver inflammation like viral hepatitis, drug-related hepatitis [sulfamethoxazole, HIV antiviral medications, fluconazole (Diflucan) and many others] or due to drinking any form of alcohol. The AST can also be elevated due to muscle injury from trauma, heart damage (heart attack), or vigorous exercise. AST itself is not harmful, but usually the cause should be diagnosed and treated
Alkaline phosphatase	less than 160	The **alkaline phosphatase** is an enzyme which can come from liver, intestines, or bone. Increased alkaline phosphatase can be caused by liver problems include medications, hepatitis, liver tumors, and blocked bile ducts due to stones or other causes. Disseminated MAC infection is a common cause in persons with very low T-cells. Bone problems that increase alkaline phosphatase include infections and trauma. They are relatively rare. It is usually important to diagnose the cause of elevated alkaline phosphatase by doing blood tests and possibly a liver scan with x-rays or sound waves.
ALT or SGPT	less than 40	**ALT** is a liver enzyme that is elevated by liver inflammation. See AST and the liver above. Unlike AST, ALT only comes from the liver.
GGT	less than 50	**GGT** is another liver enzyme that is increased by anything that can increase AST and/or ALT. Many times the GGT is obtained to see if an elevated alkaline phosphatase comes from liver or bone. If the GGT is elevated, the likelihood is that elevated alkaline phosphatase is coming from the liver.