

# Routine Blood Tests

*It's a matter  
of health...*

Your  
Laboratory  
Tests



**Sanford**  
Laboratories

## Your Laboratory Tests

Sanford Laboratories has prepared this patient information brochure as a guide to understanding your laboratory blood tests. **Your physician can best interpret your laboratory test results and determine their significance to your health.**

*The information presented in this brochure is not to be used for diagnosis. It is designed to provide sufficient information for you to understand the usefulness of these tests and be able to discuss the significance of your test results with your physician.*

Laboratory blood tests are an important component - along with your history and a physical examination - that assist your physician in determining wellness or diagnosing disease.

Many laboratory tests require an overnight fast to ensure accurate test results. *An overnight fast means nothing to eat or drink, except water, for 12–16 hours after an evening meal.*

Blood test results are compared to a “reference range” statistically established from normal (healthy) individuals. If a test result is outside this range, either above or below, your physician will determine its significance. Even healthy individuals may have a test result slightly outside of the “reference range,” normal for that individual.

### Other Factors Affecting Test Results

- ◆ Medications—prescription and non-prescription drugs (aspirin, cold medications, vitamins, etc.)
- ◆ Alcohol intake
- ◆ Eating within 8–12 hours before having blood drawn

Common blood tests in this brochure are divided into two groups: blood chemistry tests and blood hematology tests. The “blood chemistry tests” measure over 20 chemical substances in the blood. Tests that assess the cellular portion of the blood are called “blood hematology tests.” Your physician will choose which tests are appropriate for your condition.

## Blood Chemistry Tests

### Albumin

Albumin is the major protein of the blood comprising over 60% of the total protein. It is made in the liver. Albumin helps maintain the osmotic pressure (keeping water) in blood vessels and transports substances. Decreased albumin levels can be associated with malnutrition, liver disease, and kidney disease. Dehydration from fluid loss can cause increased albumin levels.

### Alkaline Phosphatase

Although this enzyme is found in all body tissue, the primary sites in adults are bone and liver with a small amount in the intestine. Alkaline phosphatase levels are very useful in evaluating liver and bone disease, usually producing elevated results. Certain drugs may also cause an elevation. Levels of alkaline phosphatase in children (due to increased bone growth), pregnant women, and older patients are normally higher.

### Bilirubin- Total & Direct

As red blood cells normally age and breakdown, bilirubin (a by-product) is released into the blood causing the yellow pigment in serum. The liver normally clears bilirubin from the blood which is excreted in the bile. A small amount of bilirubin is normal, so low levels are generally not significant. High bilirubin values may indicate a liver function problem, bile duct blockage, or excessive destruction of red blood cells.

### (BUN) Blood Urea Nitrogen

BUN is a waste product produced by the liver during protein breakdown and excreted by the kidneys. An elevated BUN level may be caused by various kidney diseases, urinary tract obstruction, congestive heart failure, dehydration, or a high-protein diet. Low BUN results are less frequent and could be due to low protein intake, pregnancy, or severe liver damage.

## Calcium

Calcium is the most important mineral in the body with approximately 98% found in the bones. The calcium in the blood is necessary for many important bodily functions, including muscle contraction, blood clotting, bone formation, conduction of nerve impulses, and parathyroid gland activity. Blood calcium levels are strictly regulated by various substances called hormones. Abnormal levels may be associated with bone diseases, or excess intake of antacids, calcium-rich foods (milk), and Vitamin D. Low calcium levels in the blood may be due to malnutrition.

## Carbon Dioxide (CO<sub>2</sub>)

Carbon dioxide—often measured in its total form—serves as an indicator of water and acid-base balance in body fluids. Abnormal carbon dioxide levels may indicate impaired respiratory function. Interpretation requires clinical information and evaluation of the other electrolytes (sodium, potassium, and chloride).

## Chloride

Chloride, an electrolyte, is involved in maintaining the normal amount of water and the acid-base balance in body fluids. Your physician will interpret the significance of low or elevated levels in relation to the other electrolytes.

## Cholesterol

Cholesterol, a soft, fat-like substance, is necessary for proper body cell function. “Lipoproteins” serve as packages in transporting cholesterol in the blood. The major forms are high-density lipoprotein (HDL) and low-density lipoprotein (LDL). Cholesterol can build up in artery walls (narrowing or blocking arteries) and cause atherosclerosis, the condition responsible for 97% of heart attacks. For most individuals, the “optimal” cholesterol is less than 200. Routine screening for cholesterol and triglyceride is recommended.

## Cholesterol - HDL

High-density lipoprotein (HDL), a fat and protein combination, is often considered “good cholesterol” as it carries cholesterol away from blood vessels to the liver. In the liver, it is processed and passed from the body. Research indicates that high levels of HDL are linked with lower risk of heart and artery disease.

## Cholesterol - LDL & VLDL

Low-density lipoprotein (LDL), also a fat and protein combination, contains more fat than HDL, and is often called “bad cholesterol.” LDL tends to build up as fatty deposits in the artery walls, hindering the flow of oxygen to the heart muscle. Very low-density lipoprotein (VLDL) contains large quantities of triglyceride and provides its transport.

## Coronary Risk Factors

These specific indicators based on total cholesterol, triglyceride, and HDL offer additional information in determining an individual’s risk for coronary heart disease. Your physician will use this information to help determine if you need to change diet and/or take medication.

## Creatinine

Creatinine, a waste product of creatine in muscles, is constantly released into the blood and excreted by the kidney. Creatinine allows a more precise evaluation of kidney function than BUN alone. Elevated levels, especially with an elevated BUN, usually indicate kidney disease.

## GGTP (GGT)

GGTP is an enzyme primarily found in the liver. This is a good indicator of damage to liver cells, possibly due to excessive drinking, certain drugs, liver disease, or bile duct disease.

## Globulin

Globulin and albumin are the major protein groups in the blood. The globulin proteins help fight infections, and play an important role in blood clotting and other bodily functions. If the globulin level is abnormal, additional testing may be necessary to determine its significance.

## Glucose

Glucose is the primary source of energy for all bodily functions. The blood glucose level is strictly regulated by several hormones, including insulin and glucagon. Elevated glucose results can be associated with eating shortly before the blood sample was drawn, and/or suggest diabetes (*hyperglycemia*). Low glucose levels are termed *hypoglycemia*, and may be a cause of weakness or dizziness.

## LDH (Lactate Dehydrogenase)

LDH is an enzyme found in red blood cells and in many different human tissues, including heart, kidney, liver, and muscle. Trauma to any of these organs or muscles can result in tissue damage, releasing LDH into the blood. Elevated LDH levels can be associated with various conditions including myocardial infarction (heart damage), certain types of anemia, liver disease, and cancer. Slight elevations, when other enzymes are normal, are usually not clinically significant.

## Phosphorus

Phosphorus is a mineral widely distributed throughout the body, the majority complexed with calcium in bones. In addition to bone formation, phosphorus contributes to carbohydrate metabolism and acid-base balance. This level can be affected by diet and tends to fluctuate rhythmically throughout the day. Since there are many causes for low or high values, the significance of an abnormal phosphorus must be considered in relationship to calcium levels.

## Potassium

Potassium is one of the major electrolytes found primarily inside of cells. It plays a significant role in maintaining water balance inside the cells, and in functions of nervous tissue and heart and muscle contraction. Both low and high values are clinically significant. Low values can occur after prolonged fluid loss (vomiting and diarrhea), in renal disease, and intake of diuretics. Elevated blood potassium levels may indicate kidney disease.

## SGOT (AST)

This enzyme is found primarily in the heart, liver, and muscle. Any damage, trauma, or disease involving any of these tissues can cause an elevation in the SGOT level.

## SGPT (ALT)

SGPT, an enzyme found mainly in the liver, is a very good indicator of liver damage or disease. If abnormal, additional testing may be necessary.

## Sodium

Sodium, a major electrolyte, is present in body fluids, and plays a key role in salt and water balance. Low levels can be found in a variety of conditions causing more loss of sodium than water. Some conditions are diarrhea, kidney disease, and medication with diuretics. High sodium levels can occur when salt intake is too much or by excessive water loss. Your physician evaluates the sodium level in relationship to the other electrolytes.

## Total Protein

Serum proteins aid the body in immune defense, inflammation defense, blood clotting, and transport of other substances in the blood. Values below or above the reference range require further testing to determine which specific proteins are involved.

## Triglycerides

Triglycerides are fatty molecules formed in the liver and make up 95% of fat stored in tissue. Their major function is to provide energy. Triglycerides are often elevated after a meal; therefore, at least a 12-hour fast is required to obtain meaningful triglyceride results. When serum triglyceride and cholesterol levels are both elevated, the risk for coronary heart disease increases.

## T Uptake (T3U)

T Uptake helps your physician determine if the proteins carrying thyroxine (T4) in blood are in a normal relationship to the amount of T4. This is an indirect measure of thyroid binding protein.

## T4 (Thyroxine)

Thyroxine (T4) is the primary hormone secreted by the thyroid gland. It regulates the body's rate of metabolism and is necessary for normal growth and development. Low values usually indicate too little T4 is being produced by the thyroid gland, called *hypothyroidism*. Treatment is often thyroid medication. High values are usually due to excessive T4 production, called *hyperthyroidism*. Your physician may request additional tests to determine the exact cause of the high value and best course of treatment. Slightly elevated blood T4 levels can be seen in pregnancy, use of birth control pills, and individuals taking thyroid medication. Both low and high values require medical evaluation by your physician.

## TSH

Thyroid stimulating hormone (TSH) is secreted by the pituitary gland and acts on the thyroid gland to stimulate production and release of thyroxine (T4). When the thyroid gland is underactive, TSH levels will be high; low TSH levels signal an overactive thyroid. Various medications can affect the result of this test.

## Uric Acid

Uric acid, formed mainly by the liver, is a waste product of cell metabolism in our bodies. Along with BUN and creatinine, uric acid is excreted by the kidneys. A diet rich in certain foods such as "organ meat" may raise the uric acid blood level. Elevated values, more common than low, are associated with many diseases, such as gout, arthritis, kidney problems, and the use of some diuretics. Low uric acid levels are of little significance.

## **Blood Hematology Tests**

A brief explanation follows of the ten common hematology (cellular) tests. Any abnormal test should be discussed with your physician.

### Hematocrit (HCT)

The HCT is the comparison of the cellular portion of the blood to the serum (fluid) portion. This comparison is reported as a percentage. A low number of red blood cells causes a low HCT. Men tend to have higher hematocrits than women. The hematocrit is often used along with a hemoglobin to evaluate anemias.

### Hemoglobin (HGB)

Approximately one-third of each red cell is comprised of hemoglobin, which contains iron. Hemoglobin carries oxygen from the lung to body tissues. Men tend to have higher hemoglobin levels than women. Low values may indicate anemia, blood loss, and other conditions associated with iron loss.

### MCV, MCH, and MCHC

These calculations help your physician determine if significant abnormalities are present requiring additional testing. The *MCV* measures the actual size of the average red blood cell. The *MCH* represents the weight of hemoglobin in an average red blood cell. The *MCHC* uses the *MCV* and the *MCH* to compare the size of the red blood cell to the amount of hemoglobin present. These calculations are helpful in classifying anemias.

## Platelets

Platelets play a vital role in the blood clotting process. The platelets stop bleeding by sticking together and forming “plugs.” A variety of disease conditions can cause low numbers of platelets; these individuals tend to bleed more easily and excessively. Extremely low or high platelet counts may indicate blood disorders which require additional testing.

## RDW

The red cell distribution width or RDW is an analysis of the variation in size of all red blood cells tested. This evaluation is helpful in classifying anemias.

## Red Blood Cell Count (RBC)

Red blood cells are the major component of blood. They are made in the bone marrow and released into the circulating blood. This count is a good indicator of the body’s ability to transport oxygenated blood to body tissues. A decreased number of red blood cells is associated with anemias, and other diseases affecting production of new red blood cells.

## White Blood Cell Count (WBC)

Blood contains a variety of white blood cells, the body’s defense system against infections. Elevated counts usually indicate infection or inflammation. A mild decrease in white blood cells is frequently seen in viral infections. Extremely elevated or decreased counts may indicate an active disease process, requiring medical evaluation by your physician.

## WBC Differential

Five major types of white blood cells are normally found in the blood: neutrophils, lymphocytes, monocytes, eosinophils, and basophils. The “differential count” gives the percentage of each cell type. Increases or decreases in the cell percentages are consistent with certain medical conditions. These percentages assist your physician in determining a specific diagnosis or disease state.

## *System Function Tests*

### BONE & CELLULAR

Calcium  
Phosphorus

### HEART

SGOT  
LDH

### KIDNEY

BUN  
Creatinine  
Electrolytes

Carbon Dioxide (CO<sub>2</sub>)  
Chloride  
Potassium  
Sodium

### **Protein**

Albumin  
Globulin  
Total Protein

### **Uric Acid**

### LIPIDS & CORONARY RISK

Cholesterol, Total  
HDL  
LDL & VLDL  
Cardiac Risk Ratios  
Triglycerides

### LIVER

Alkaline Phosphatase  
Bilirubin  
GGTP  
SGOT  
SGPT

### PANCREAS

Glucose

### THYROID

T Uptake  
T4 (Thyroxine)  
TSH

*Provided by*



**Sioux Falls**  
**(605) 328-5464 • 1-800-522-2561**

**Rapid City**  
**(605) 716-0361 • 1-800-557-4893**

[www.sanfordlaboratories.org](http://www.sanfordlaboratories.org)  
[sanfordlaboratories@sanfordhealth.org](mailto:sanfordlaboratories@sanfordhealth.org)

© Sanford Laboratories 2008