

## Blood Testing Protocols

Too often, people fall victim to a disease that could have been prevented if their blood had been tested once a year.

For instance, we know that prescription drugs can cause liver and kidney problems, but other factors (alcohol, over-the-counter drugs, excess niacin, hepatitis C) can make a person susceptible to liver or kidney damage. These conditions often smolder for years until a life-threatening medical crisis occurs. Because of a phenomenon known as “individual variability,” some people are especially vulnerable to liver and kidney damage. The good news is that a simple blood chemistry test can detect an underlying problem in time to take corrective actions.

The average person older than age 60 takes several prescription drugs every day to treat or prevent chronic medical conditions. According to the American Medical Association, adverse reactions to prescription drugs are either the fourth, fifth, or sixth leading cause of death in the United States (Lazarou J et al 1998). The American Medical Association emphasizes that these deaths occur even though the doctors who are prescribing the drugs are supposed to be monitoring their patients to prevent such drug-induced deaths. The problem is that cost-conscious health maintenance organizations and hurried physicians are not mandating blood tests that would detect drug-induced tissue damage in time to prevent disability and death. If you are taking certain prescription medications, regular blood testing is mandatory according to the drug labeling, yet doctors routinely fail to prescribe the recommended blood tests, and their patients too often pay the “ultimate” price.

The reason most people consider blood testing is to ascertain their risk factors for cardiovascular disease. Published studies consistently show that various cholesterol fractions (HDL, LDL) and triglycerides can contribute to heart attack and stroke. What most people fail to realize is that significant changes can occur in their blood fat levels over the course of a single year, meaning that an earlier test may not accurately reflect their current serum-lipid status.

Since 1983 the Life Extension Foundation has advocated regular medical testing for the purpose of optimizing your personal life extension program.

### THE IMPORTANCE OF ACHIEVING YOUTHFUL BLOOD TEST READINGS

When physicians review a patient's blood test results, their primary concern is any result that falls outside the normal laboratory reference range. The problem is that standard reference ranges usually represent “average” populations rather than the optimal level required to maintain good health. It now appears that most standard reference ranges are too broad to adequately detect health problems or prescribe appropriate therapy on an individual basis. This is especially true when these reference ranges are relied on to treat a patient with a serious medical disorder.

An example of flawed reference ranges can be seen in blood tests used to assess thyroid status. A long-standing controversy rages over the best way to diagnose thyroid deficiency. Most conventional doctors rely on thyroid blood tests whereas alternative physicians look for signs and symptoms of thyroid deficiency. An article in the August 3, 2002, issue of the British medical journal *Lancet* challenged conventional medical wisdom regarding the use of standard reference ranges in diagnosing and treating thyroid deficiency. According to the researchers, the problem with thyroid blood tests may be faulty reference ranges that fail to reflect what the optimal level of thyroid hormone should be in a particular individual (Dayan CM et al 2002).

The standard blood test used to determine thyroid gland hormone output is the thyroid-stimulating hormone (TSH) test. When a deficiency in thyroid hormone occurs, the pituitary gland releases TSH to signal the thyroid gland to produce more hormones.

When the TSH level is in the “normal range,” doctors usually assume that the thyroid gland is secreting enough thyroid hormone. The question raised by the *Lancet* article's authors, however, was whether the current reference range for TSH reflects optimal thyroid hormone status.

The TSH reference range used by many laboratories is 0.35–5.50 mIU/mL (milli international units per milliliter). A higher TSH level indicates a thyroid hormone deficiency (because the pituitary gland is oversignaling TSH to compensate for low levels of thyroid hormone in the blood). Any reading of more than 5.50 mIU/mL alerts a doctor to a thyroid gland problem and the possibility that thyroid hormone therapy may be warranted.

The trouble is that the TSH reference range is so broad that most doctors will interpret a TSH reading as low as 0.35 to be as normal as a 5.50 reading. The difference between 0.35 and 5.50, however, is 15.7-fold, a range of values far too great to indicate

optimal or even normal thyroid function.

A review of published findings about TSH levels reveals that readings greater than 2.0 may indicate health problems relating to insufficient thyroid hormone output. One study showed that individuals with TSH values greater than 2.0 have an increased risk of developing clinically significant thyroid deficiency during the next 20 years (Vanderpump MP et al 1995). Other studies show that TSH values greater than 1.9 indicate risk of autoimmune disease of the thyroid gland (Hak AE et al 2000).

A more startling study showed that TSH values greater than 4.0 increases the likelihood of heart disease in postmenopausal women (Hak AE et al 2000). Another study showed that administration of thyroid hormone lowered cholesterol in patients with TSH ranges of 2.0–4.0 but had no cholesterol-lowering effect in patients whose TSH value was in the 0.2–1.9 range (Michalopoulou G et al 1998). It also showed that in people with elevated cholesterol, TSH values of 2.0 or greater could indicate that a thyroid deficiency is the culprit, causing excess production of cholesterol, whereas TSH levels at or below 1.99 would indicate normal thyroid hormone status.

Doctors routinely prescribe cholesterol-lowering drugs to patients without properly evaluating their thyroid status. Based on the evidence presented to date, it might make sense for doctors to investigate a thyroid deficiency (based on a TSH value greater than 1.9) before resorting to cholesterol-lowering drugs.

In a study to evaluate psychological well-being, impairment was found in patients with thyroid abnormalities who were nonetheless within “normal” TSH reference ranges (Pollock MA et al 2001).

The authors of the Lancet study stated, “The emerging epidemiological data begin to suggest that TSH concentrations above 2.0 (mU/L – milliunit per liter) may be associated with adverse effects.”

The authors prepared a chart based on previously published studies that provides guidance when interpreting the results from TSH blood tests. Here are three highlights from their chart that may be useful in understanding what your TSH values really mean:

- TSH values greater than 2.0: increased 20-year risk of thyroid deficiency and increased risk of thyroid-induced autoimmune attack (Vanderpump MP et al 1995)
- TSH values greater than 4.0: greater risk of heart disease (Hak AE et al 2000)
- TSH values between 2.0 and 4.0: cholesterol levels decline in response to thyroxine (T4) therapy (Michalopoulou G et al 1998)

Despite these intriguing findings, the Lancet authors stated that more studies were needed to define an optimal TSH range, suggested as 0.2–2.0 instead of 0.2–5.5 (mU/L). **Note: These optimal reference ranges are now expressed in mIU/mL, so the ideal range according to this epidemiological data is 0.35–2.1 mIU/mL.**

If you have depression, heart disease, high cholesterol, chronic fatigue, poor mental performance, or any of the many other symptoms associated with thyroid deficiency, you may want to ask your doctor to “defy the reference ranges” and try a different thyroid replacement therapy.

## THE RISK OF FOLLOWING STANDARD REFERENCE RANGES

Standard laboratory reference ranges represent average populations and not optimal levels. In the 1960s, for instance, the upper reference range for cholesterol was 300 mg/dL (milligrams per deciliter). This number was based on a statistical calculation indicating that it was “normal” to have total cholesterol levels as high as 300 mg/dL. Of course, it was also considered “normal” for men to have fatal heart attacks at a relatively young age. As greater knowledge accumulated about the risk of heart attack and high cholesterol, the upper limit reference range has gradually dropped to 200 mg/dL (American Family Physician 2001; ADVANCEDATA 1977).

Blood test reference ranges are not the only measures that fail to provide physicians and patients with optimal numbers. For example, high blood pressure (hypertension) is defined medically as a blood pressure reading of 140/90 (read as “140 over 90”) or greater. Yet a diastolic blood pressure reading (the second number in a blood pressure reading—90 in this example) higher than 80 mmHg (millimeters of mercury) is associated with an increased risk of stroke. A high percentage of people older than age 60 have diastolic readings higher than 80 mmHg, and this is the age group most vulnerable to stroke (Hansson L et al 1998). If your physician checks your blood pressure and says it is “normal,” Life Extension advises you to ask what the optimal range is. Optimal blood pressure is defined as 115/75. In fact, the risk of cardiovascular disease doubles with each increase of 20/10 mmHg, starting at 115/75 mmHg. It is important to know that midlife hypertension predisposes people to stroke later in life, so keeping blood pressure readings within optimal ranges is important at any age.

## STANDARD HORMONE REFERENCE RANGES MAY BE ANTIQUATED

Conventional medicine tends to neglect the hormone imbalances that develop in both men and women as they grow older. The result is that aging people suffer a variety of miseries that are correctable and preventable if simple hormone adjustments are made.

Aging men, for instance, often suffer from excess production of insulin and estrogen, with simultaneous deficiencies of free testosterone and dehydroepiandrosterone (DHEA). The standard reference ranges for all four of these hormones are so wide that most men would fall into the so-called normal category. Standard reference ranges indicate that dangerously high insulin and estrogen levels are “normal” in older men (but so are heart attack, stroke, cancer, benign prostate enlargement, weight gain, type II diabetes, kidney impairment, and a host of other diseases that are associated with excess insulin and estrogen). The same standard reference ranges for free testosterone and DHEA show that very low levels are perfectly “normal” for aging men. It is no coincidence that aging men with low levels of testosterone and DHEA have high rates of depression, memory loss, atherosclerosis, senility, impotency, cholesterol, abdominal obesity, fatigue, and many other diseases related to low blood levels of testosterone and DHEA (Shippen E 2001; Tan RS et al 2001; Janowsky JS et al 2000; Barrett-Connor E et al 1999; Rabkin JG et al 1999; Schweiger U et al 1999; Seidman SN et al 1999; Shackman J 1999; Wright JV 1999; Gooren LJ 1998; Gelfand MM et al 1997; Phillips GB et al 1994; Tenover JS 1992).

Standard reference ranges have failed aging people because these reference ranges are adjusted to reflect age. Since it is normal for an aging person to have imbalances of critical hormones, standard laboratory reference ranges do not flag dangerously high levels of estrogen and insulin or deficient levels of testosterone, thyroid, and DHEA. The following table compares standard and optimal hormone and TSH blood reference ranges for 60-year-old men.

<b>Hormone</b>	<b>Standard Reference Range</b>	<b>Life Extension’s Optimal Range</b>
DHEA	42–290 µg/dL	500-640 µg/dL
Insulin (fasting)	6–27 µIU/mL	Under 5 µIU/mL
Free testosterone	6.6–18.1 pg/mL	15–22 pg/mL
Estradiol	<54 pg/mL	10–30 pg/mL
Thyroid stimulating hormone	0.35–5.50 mIU/mL	0.35 to 2.1 mIU/mL

### **DEFYING THE REFERENCE RANGES**

Traditional medical thinking accepts that imbalances of life-sustaining hormones are normal in aging people. Traditional practitioners almost never test hormone levels because they think that nothing should be done to restore hormone profiles to youthful ranges. For more specific information on optimizing your hormone levels, turn to the following protocols: Male Hormone Modulation, Female Hormone Modulation, Thyroid Deficiency, and DHEA Replacement Therapy.

### **THE MOST IMPORTANT BLOOD TESTS**

The Life Extension Foundation suggests that a basic battery of tests be performed annually. The recommended male panel consists of a complete blood count (CBC)/chemistry test, homocysteine, free testosterone, estradiol, prostate-specific antigen (PSA), and DHEA. The recommended female panel consists of the CBC/chemistry test, estradiol, progesterone, free testosterone, DHEA, and homocysteine.

In addition to these special male and female panels, the following tests are especially important for men and women over age 40: fasting insulin, fibrinogen, thyroid stimulating hormone (TSH), and free triiodothyroxine (T3). If a serious abnormality is detected—such as elevated blood glucose (sugar), hormone imbalance, or high cholesterol—testing should be repeated more often than annually to determine the benefits of any therapy you are using to correct the potentially life-shortening abnormality.

We also recommend that you consult your physician regarding any other test that may be appropriate for your individual condition. The following list describes individual tests and ranges that can be used to assess your health and longevity. If your physician is unwilling to prescribe these tests, or if commercial laboratory prices are beyond your budget, we provide information at the end of this protocol about the availability of low-cost mail order blood testing.

### **ALPHABETICAL LISTING OF BLOOD TESTS**

#### ***ABO Grouping and Rh (D) Typing***

This test is used to determine blood grouping and Rh typing. The possible blood types are O positive, O negative, A positive, A negative, B positive, B negative, AB positive, and AB negative.

### ***Alpha 1 Antitrypsin (Serum)***

This test is used to detect hereditary decreases in the production of alpha1-antitrypsin (AAT). Decreased or nearly absent levels of AAT can be a factor in chronic obstructive lung disease and liver disease. Elevated levels of AAT can be an indication of inflammatory states (e.g., rheumatoid arthritis, bacterial infection, vasculitis, or neoplasia).

Reference Range:90–200 mg/dL

### ***Amino Acid Profile (Quantitative)***

This panel evaluates 41 amino acids and is used to monitor body functions and nutritional status. Increased amino acid concentrations in plasma may reflect inherited metabolic abnormalities, as in the tyrosemias or phenylketonuria.

### ***Apolipoprotein A-1***

This test is used to evaluate survival rate or risk factors for patients with myocardial infarction and peripheral vascular diseases. APO A-1 deficiency states include Tangier disease, HDL deficiency, and hypoalpha-lipoprotein anemia. Apolipoprotein levels may be a better indicator of atherogenic risks than high-density lipoprotein (HDL), low-density lipoprotein (LDL), and very-low-density lipoprotein (VLDL) measures.

Reference Ranges:

Men: 110–180 mg/dL

Women: 110–205 mg/dL

### ***B-Type Natriuretic Peptide***

This test is used to support the finding of congestive heart failure.

Reference Range:0–100 pg/mL

### ***Cancer Antigen (CA-15-3)***

The CA 15-3 antigens are tumor-associated serum markers, most specifically for breast tissue, available for monitoring various types of malignancies, evaluating response to therapy, and possibly indicating recurrence.

Reference Range:0.0–32.4 U/mL

### ***Cancer Antigen (CA-27.29)***

This test is used to monitor metastatic carcinoma of the breast. CA-27.29 is a useful measurement in the monitoring of both the course of disease and the response to therapy because there is a direct correlation between the changing levels of CA-27.29 and clinical status.

Reference Range:0–38.6 U/mL

### ***Cancer Antigen (CA-125)***

CA-125 is a tumor marker for monitoring disease progression in ovarian cancer. It is most useful in monitoring progression or recurrence in cases of known ovarian carcinoma.

Reference Range:0–32 U/mL

### ***Candida Antibodies Qualitative***

This test is used to diagnose systemic candidiasis. This test is qualitative, and if candida antibodies are found, you have had or now have a candida infection.

### **Carbohydrate Antigen (CA-19-9)**

This test is used to monitor gastrointestinal, pancreatic, liver, and colorectal malignancies. This test may also be positive in patients with nonneoplastic disease, inflammatory disease of the bowel, cirrhosis, and autoimmune conditions.

Reference Range:0–37 U/mL

### **Carcinoembryonic Antigen (CEA)**

This tumor marker is used to determine the extent of disease and its prognosis in cancer patients (especially those with gastrointestinal or breast cancers). It can also be used to monitor the disease and its treatment.

Reference Range:

Nonsmoker: <2.5 ng/mL

Smoker: <5.0 ng/mL

### ***Carotene, Beta***

This test is used to confirm carotenoderma and detect fat malabsorption and depressed carotene levels that may be found in cases of steatorrhea.

Reference Range:10–85 µg/dL

### ***Chemistry Panel/CBC***

This panel is a comprehensive blood evaluation including the following 35 tests:

#### ***Glucose Fasting***

This test directly measures glucose levels and is commonly used in the evaluation of diabetes.

Reference Range: 65–99 mg/dL

LE's Optimal Range:70–85 mg/dL

#### ***Uric Acid***

This test is used in the evaluation of gout or recurrent urinary calculus.

Reference Range: 2.4–8.2 mg/dL

LE's Optimal Range:3–7 mg/dL

#### ***BUN (Blood Urea Nitrogen)***

This test is used to measure liver function and to indirectly assess renal function and glomerular filtration rate.

Reference Range:5–26 mg/dL

#### ***Creatinine***

This is a renal function test used to estimate glomerular filtration rate and to follow progression of renal disease.

Reference Range: 0.5–1.5 mg/dL

LE's Optimal Range:<1.5 mg/dL and ideally <1.1 mg/dL

#### ***BUN/Creatinine Ratio***

This test is used to diagnose impaired renal function. With creatinine, BUN is used to monitor patients on dialysis.

Reference Range:8:1–27:1

#### ***Sodium***

This routine test is used to evaluate and monitor fluid and electrolyte balance and therapy.

Reference Range:135–148 mmol/L

#### ***Potassium***

This routine test is used to evaluate and monitor electrolyte balance and is especially important for cardiac patients.

Reference Range:3.5–5.5 mmol/L

#### ***Chloride***

This test by itself does not provide adequate information. However, as part of a multiphasic testing for electrolytes, it can give an indication of acid-base balance and hydration status.

Reference Range:96–109 mmol/L

### ***Carbon Dioxide***

This test is used to assist in the evaluation of pH and electrolyte status.

Reference Range:20–32 mmol/L

### ***Calcium***

This test is used to evaluate parathyroid function and calcium metabolism.

Reference Range:8.5–10.6 mg/dL

### ***Phosphorus***

This test is used to measure serum phosphorus levels. An imbalance could indicate the possibility of any number of conditions.

Reference Range for people between 12 and 60 years old:2.5–4.5 mg/dL

### ***Protein/Albumin/Globulin***

This test is used to assist in the diagnosis of many diseases that affect blood proteins as a whole or one single fraction of protein.

Reference Range:

Total Protein: 6.0–8.5 g/dL

Albumin: 3.5–5.5 g/dL

Globulin: 1.5–4.5 g/dL

### ***Albumin/Globulin Ratio***

This test is used to evaluate renal disease and other chronic diseases.

Reference Range:1.1:1–2.5:1

### ***Bilirubin***

This test is used to evaluate liver function.

Reference Range:

Total Bilirubin: 0.1–1.2 mg/dL

### ***Alkaline Phosphatase***

This test is used to detect and monitor liver or bone disease.

Reference Range:25–150 IU/L

### ***LDH (Lactic Dehydrogenase)***

This test measures the intracellular enzyme LDH, which when present in the blood, supports the diagnosis of injury or disease.

Reference Range:100–250 IU/L

### ***AST (SGOT)***

This test is used to evaluate the possibility of coronary occlusive heart disease or liver disease.

Reference Range:0–40 IU/L

**ALT (SGPT)**

This test is used to identify liver disease and to distinguish between liver and red blood cell hemolysis as the source of jaundice.

Reference Ranges:

Men: 0–55 IU/L

Women: 0–40 IU/L

**Iron**

This test is used to evaluate many diseases, including iron deficiency anemia and hemochromatosis.

Reference Range: 35–155 µg/dL

LE's Optimal Range:40–100 µg/dL

**Cholesterol**

This test is used to determine the risk of developing coronary heart disease and hyperlipidemias.

Reference Range: 100–199 mg/dL

LE's Optimal Range:180–200 mg/dL

**Triglycerides**

This test is used to identify the risk of developing coronary heart disease or when disorders in fat metabolism are suspected.

Reference Range: 0–149 mg/dL

LE's Optimal Range:Under 100 mg/dL

**HDL Cholesterol**

This test measures alpha lipoprotein and is used to predict heart disease.

Reference Range: 40–59 mg/dL

LE's Optimal Range:>60mg/dL

**LDL Cholesterol**

This test measures beta lipoproteins and is also used to predict heart disease.

Reference Range:0–99 mg/dL

**Ratio of Total Cholesterol to HDL Cholesterol**

This test is used to determine the risk of coronary heart disease.

Reference Range:

Men: 5:1 or less

Women: 4.4:1 or less

LE's Optimal Range:3:1 or less

**CBC (Complete Blood Count) with Platelets and Differential**

This is a series of tests of the peripheral blood that provides a variety of information about the blood components.

**White Blood Cell Count**

Reference Range:4.0–10.5 x10E3/uL

### ***Red Blood Cell Count***

Reference Ranges:

Men: 4.1–5.6 x10E6/uL

Women: 3.8–5.10 x10E6/uL

### ***Hemoglobin***

Reference Ranges:

Men: 12.5–17.0 g/dL

Women: 11.5–15.0 g/dL

LE's Optimal Range: Upper end of reference range

### ***Hematocrit***

Reference Ranges:

Men: 34–50%

Women: 34–44%

LE's Optimal Range: Upper end of reference range

### ***Red Blood Cell Indices***

#### ***Mean Corpuscular Volume***

Reference Range: 80–98 fL

#### ***Mean Corpuscular Hemoglobin***

Reference Range: 27–34 pg

#### ***Mean Corpuscular Hemoglobin Concentration***

Reference Range: 32–36 g/dL

#### ***Red Blood Cell Distribution of Width***

Reference Range: 11.7–15.0%

### ***Differential Count***

Reference Ranges:

Polyneutrophils: 1.8–7.8 x10E3/uL

Lymphocytes: 0.7–4.5 x10E3/uL

Monocytes: 0.1–1.0 x10E3/uL

Eosinophils: 0.0–0.4 x10E3/uL

Basophils: 0.0–0.2 x10E3/uL

### ***Platelet Count***

Reference Range:140–415 x10E3/uL

### ***C-Peptide***

This test is used to evaluate diabetics and monitor insulinoma.

Reference Ranges:1.1–5.0 ng/mL

### ***Cortisol A.M.–P.M.***

This test is to measure adrenal function. It is used to diagnose adreno-cortical insufficiency or hypersecretion and Cushing's syndrome and is also useful in detecting malfunction of the hypothalamic axis.

Reference Ranges:

a.m.: 4.3–22.4 µg/dL

p.m.: 3.1–16.7 µg/dL

### ***C-Reactive Protein (CRP) (Cardiac) (High Sensitivity)***

This test is used to assess risk of cardiovascular and peripheral vascular disease.

Relative Risk CategoryAverageHigh Sensitivity CRP Level

Low <1.0 mg/L

Average 1.0 mg/L–3.0 mg/L

High >3.0 mg/L

LE's Optimal Ranges:

Men: <0.55 mg/L

Women: <1.5 mg/L

## ***Cytokine Panel***

This panel is used to find the source of chronic inflammation, after a high CRP reading or the persistence of any chronic inflammatory condition. This panel measures interleukin-1 beta (IL-1b), interleukin-6 (IL-6), interleukin-8 (IL-8), and tumor necrosis factor-alpha (TNF-alpha). Each is described separately.

## ***D-Dimer***

This test is a very specific confirmatory test for disseminated intravascular coagulation (DIC). It is also used for the detection of deep vein thrombosis, acute myocardial infarction, and unstable angina. The Fragment D-Dimer assesses both thrombin and plasmin activity.

Reference Range:0.0–0.4 µg/mL

## ***Dehydroepiandrosterone (DHEA) Sulfate***

This test is used to determine female infertility, amenorrhea, or hirsutism and to aid in the evaluation of excess androgen/adrenocortical disease, including congenital adrenal hyperplasia and adrenal tumors.

Reference Ranges:

### **Men:**

19–29 years	280–640 µg/dL
30–39 years:	120–520 µg/dL
40–49 years:	95–530 µg/dL
50–59 years:	70–310 µg/dL
60–69 years	42–290 µg/dL
>69 years	28–175 µg/dL

LE's Optimal Range:500-640 µg/dL

### **Women:**

19–29 years:	65–380 µg/dL
30–39 years:	45–270 µg/dL
40–49 years	32–240 µg/dL
50–59 years	26–200 µg/dL
60–69 years	13–130 µg/dL
>69 years	17–90 µg/dL

LE's Optimal Range:250-380 µg/dL

## ***Deoxyypyridinoline (Dpd) Cross Link Test***

This test can be used to assess bone resorption rates in healthy individuals and in those with enhanced risk of developing metabolic bone disease. Dpd can be used to monitor antiresorptive therapies (which may include bisphosphonates) and osteoporosis.

Reference Range:2.3–7.4 nmol Dpd/mmol creatinine

## ***Dihydrotestosterone***

This test measures serum concentrations of dihydrotestosterone, which is closely related to testosterone levels but are lower and may indicate hypergonadism or hirsutism.

Reference Ranges:

Men: 30–85 ng/dL

Women: 4–22 ng/dL

LE's Optimal Range:

Men: 30–50 ng/dL

### ***Epstein-Barr Virus (EBV) Acute Infection***

This test is used to diagnose a suspected EBV infection (infectious mononucleosis).

#### **EBV Interpretation VCA-IgG VCA-IgM EA-IgG EBV-NA**

Susceptible	–	–	–	–
Acute infection	+	+	±	–
Convalescent phase	+	±	±	+
Chronic or reactivated	+	–	+	±
Old infection	±	–	–	+

Antibody present: +

Antibody absent: –

### ***ESR Westergren Sedimentation Rate (ESR, Sed Rate Test)***

The ESR is a nonspecific test used to detect illness associated with acute and chronic infection, inflammation (collagen-vascular diseases), advanced neoplasm, and tissue necrosis or infarction.

Reference Ranges:

**Men:** 0–50 years: 0–15 mm/hour

50 years and older: 0–20 mm/hour

**Women:** 0–50 years: 0–20 mm/hour

50 years and older: 0–30 mm/hour

### ***Estradiol***

This test is used to assess hypothalamic and pituitary functions, menopausal status, and sexual maturity. In males it is helpful in the assessment of gynecomastia or feminization syndromes.

**Reference Ranges:**

**Reference Ranges:**

**Adult Men:** <54 pg/mL **Adult Women:**

LE's Optimal Range: 10–30 pg/mL Follicular phase (-12): 19–83 pg/mL

Follicular phase (-4): 64–183 pg/mL

Midcycle peak: (-1) 150–528 pg/mL

Luteal phase: (+2) 58–157 pg/mL

Luteal phase: (+6) 60–211 pg/mL

Luteal phase: (+12) 55–150 pg/mL

Postmenopausal (untreated): 0–31 pg/mL

### ***Estriol***

This test provides an objective assessment of placental function and fetal normality in high-risk pregnancies. Estriol is the major estrogen in the pregnant female.

Reference Range:

Men or Nonpregnant Women:<2.0 mg/dL

### ***Estrogens Total***

Estrogen measurements are used to evaluate sexual maturity, menstrual and fertility problems in females. This test is also used in the evaluation of males with gynecomastia or feminization syndromes. In pregnant women, it is used to indicate fetal-placental health. In patients with estrogen-producing tumors, it can be used as a tumor marker.

Reference Ranges:

**Men:** 40–115 pg/mL

LE's Optimal Range:40–77 pg/mL

**Women:**

Day 1–10: 61–394 pg/mL

Day 11–20: 122–437 pg/mL

Day 21–30: 156–350 pg/mL

### ***Estrone***

This test is used to evaluate postmenopausal bleeding due to peripheral conversion of androgenic steroids. Increased estrone levels may be associated with increased levels of circulating androgens and their subsequent peripheral conversion.

Reference Ranges:

**Men:** 12–72 pg/mL

**Women:**

Follicular phase: 37–138 pg/mL

Midcycle peak: 60–229 pg/mL

Luteal phase: 50–114 pg/mL

### ***Factor VIII Activity***

This test is used to evaluate levels of coagulant factor VIII. A deficiency in factor VIII is known as hemophilia A. Elevated levels are associated with a significantly increased risk of ischemic heart disease and with the development of the geriatric syndrome of frailty.

### ***Fasting Glucose and Insulin***

These two tests are used to determine elevated levels of glucose and insulin. Excess glucose and insulin are implicated in many age-related diseases, such as type 2 diabetes, hypertension, heart disease, and stroke, and are a hallmark of mammalian aging. *Please note:* These tests require a fasting blood level, meaning that a 12-hour fast is required before the collection of a blood sample. Each of these tests is described separately.

- *Glucose:* This test is used to detect diabetes mellitus and evaluate carbohydrate metabolism disorders including alcoholism. It is also used to evaluate acidosis, ketoacidosis, dehydration, coma, hypoglycemia, insulinoma, and neuroglycopenia.
- *Insulin:* This test is primarily used to measure insulin evaluation in individuals with fasting hypoglycemia. Insulin levels tend to be inappropriately elevated in individuals with insulin-secreting tumors. Fasting hypoglycemia in association with markedly elevated serum insulin levels is considered the determining factor for insulinoma. Insulin levels can be useful in predicting susceptibility to the development of type II diabetes, although C-peptide has largely supplanted insulin measurement for this role.

### ***Female Panel***

The Female panel consists of a Chemistry Panel, CBC, Free Testosterone, DHEA-S, Estradiol, Progesterone, Homocysteine, and Cardiac CRP. Each of these tests is described separately.

## **Ferritin**

This test is used to evaluate iron reserves in the body and to determine iron deficiency anemia or iron overload.

Reference Ranges:

Men: 22–322 ng/mL

Women: 10–291 ng/mL

LE's Optimal Range: 50–150 ng/mL

## **Fibrinogen, Antigen**

This test is used primarily for detecting suspected bleeding disorders or excessive amounts that could contribute to abnormal clotting.

Reference Range Adult: 180–350 mg/dL

LE's Optimal Range: 180–250 mg/dL

Critical Value: Values <100 mg/dL can be associated with spontaneous bleeding.

High Value: Values >400 mg/dL can cause spontaneous clotting.

## **Follicle-Stimulating Hormone (FSH) and Luteinizing Hormone (LH)**

This test is used in the determination of menopause and is integral in the evaluation of suspected gonadal failure.

<b>FSH</b>	<b>Reference Ranges:</b>	<b>LH</b>	<b>Reference Ranges:</b>
<b>Adult Men:</b>		<b>Adult Men:</b>	
		20–70 years:	1.5–9.3 mIU/mL
> 15 years:	1.4–18.1 mIU/mL	> 70 years:	3.1–34.6 mIU/mL
LE's Optimal Range:	1.4–14 mIU/mL	LE's Optimal Range:	0.5–9.3 mIU/mL
<b>Women:</b>		<b>Women:</b>	
Follicular phase:	2.5–10.2 mIU/mL	Follicular phase:	1.9–12.5 mIU/mL
Ovulatory peak:	3.4–33.4 mIU/mL	Ovulatory peak:	8.7–76.3 mIU/mL
Luteal phase:	1.5–9.1 mIU/mL	Luteal phase:	0.5–16.9 mIU/mL
Postmenopausal phase:	23.0–116.3 mIU/mL	Postmenopausal phase:	5.0–52.3 mIU/mL
		Contraceptives	0.7–5.6 mIU/mL

## **Fructosamine**

This test is used to evaluate diabetic control. Fructosamine, rather than glucose level, is an index of longer-term control.

## **Gamma Glutamyl Transpeptidase**

This test is a sensitive indicator of hepatobiliary disease (obstructive jaundice, intrahepatic cholestasis, or pancreatitis). It is also used as an indicator of chronic and heavy alcohol abuse.

Reference Range: 0–65 IU/L

## **Glucose (Serum)**

This test is used to detect diabetes mellitus. It is used to evaluate carbohydrate metabolism disorders including alcoholism. It is also used to evaluate acidosis, ketoacidosis, dehydration, coma, hypoglycemia, insulinoma, and neuroglycopenia. Please note: These tests require a fasting blood level, meaning that a 12-hour fast is required before the collection of a blood sample.

Reference Range: 65–99 mg/dL

LE's Optimal Range:70–85 mg/dL

***Human Chorionic Gonadotropin (HCG) Beta Subunit, Pregnancy***

This test is used to detect the beta subunit of HCG, providing a sensitive, specific test for the detection of early pregnancy, ectopic pregnancy, or threatened abortion.

***HCG Beta Subunit, Quantitative (Cancer)***

This test is used to detect a tumor marker for certain cancers.

Reference Ranges:

Negative: <10 mIU/mL

Borderline: 10–20 mIU/mL

Positive: >20 mIU/mL

***Heavy Metals Profile I, Blood***

This test is used to monitor exposure to arsenic, lead, and mercury.

LE's Optimal Range:As low as possible

### ***Helicobacter (Campylobacter) Pylori, Immunoglobulin M***

This test is used as an aid in the diagnosis of H. pylori infection and gastric and duodenal disease.

Reference Ranges:

Negative: <0.8 U/mL  
Equivocal: 0.8–1.19 U/mL  
Positive: >1.19 U/mL

### ***Hemoglobin A1C***

This test is most frequently used to assess glucose control in insulin-dependent diabetic patients whose glucose levels are very labile.

Reference Range, Adult:4.5–5.7%

LE's Optimal Range: Below 4.6%

### ***Hepatitis Panel (A, B, C), Acute***

This test is used as a comprehensive panel for detecting markers for hepatitis A, B, and C virus infections and is used for all stages of infection.

Reference Range:Negative or Positive

(Interpretation included)

### ***Hepatitis B Surface Antibody, Qualitative***

This test is useful for evaluation of possible immunity in individuals who are at increased risk of exposure to hepatitis B.

Normal Range:Negative or Positive

### ***Hepatitis C Virus Antibody***

This test is used to assess exposure to hepatitis C virus infection.

Reference Range:Negative or Positive

### ***Homocysteine***

This test is intended for use in screening patients who may be at risk for heart disease and stroke. Homocysteine has been shown to be an independent risk factor for the premature development of coronary artery disease and thrombosis.

Reference Range:

**Men:** 4.3–11.4 µmol/L  
Desirable: <7.2 µmol/L  
**Women:** 3.3–10.4 µmol/L  
Desirable: <7.2 µmol/L

### ***Hyperhomocysteinemia***

Borderline: 12–15 µmol/L  
Moderate: > 15–30 µmol/L  
Intermediate: > 30–100 µmol/L  
Severe: > 100 µmol/L

Studies have shown that even moderate levels of homocysteine pose an increased risk for arteriosclerosis compared with the 20 percent of the population at least risk for arteriosclerosis (<7.2 pmol/L).

### ***Insulin Fasting***

This test is used for insulin measurement in patients with fasting hypoglycemia or hyperglycemia. High fasting insulin is a sign of insulin resistance and the start of Type-II diabetes or syndrome X.

Reference Range: 6–27 µU/mL

LE's Optimal Range: As low as possible, ideally <5 µU/mL

### ***Interleukin-1 beta (IL-1b)***

This test is used to identify elevated levels of interleukin-1 beta, which have been implicated in sepsis, cachexia, rheumatoid arthritis, chronic myelogenous leukemia, asthma, psoriasis, inflammatory bowel disease, anorexia, AIDS, physical stress, anxiety and panic disorders, and graft-versus-host disease associated with bone marrow transplants. Higher-than-normal levels of IL-1b have been associated with a significant increased risk of myocardial infarction independent of cardio-CRP levels.

Reference Range:

IL-1B <2.9 pg/mL

### ***Interleukin-6 (IL-6)***

This test is used to identify elevated levels of interleukin-6. Elevated IL-6 serum or plasma levels may occur in sepsis, autoimmune diseases, lymphomas, AIDS, alcoholic liver disease, tumor development, Alzheimer's disease, and in concert with infections or transplant rejection. Elevated levels of IL-6 may be associated with an increased risk of heart attack or stroke.

Reference Range:

IL-6: 0–14 pg/mL

### ***Interleukin-8 (IL-8)***

This test is used to identify elevated levels of IL-8. Elevated concentrations are observed in psoriasis, rheumatoid arthritis, chronic polyarthritis, tumor development, and hepatitis C.

Reference Range:

IL-8 7.8 pg/mL

### ***Iron and Total Iron Binding (TIB)***

This test is used in the diagnosis of anemia. TIB levels are often used to monitor the course of patients receiving hyperalimentation.

Reference Range: 40–180 µg/dL

LE's Optimal Range: 40–100 mg/dL

TIBC: 250–420 mg/dL

### ***Insulin-Like Growth Factor I***

This test is used to determine acromegaly, in which somatomedin-C and insulin-like growth factor is increased. It is also used to evaluate hypopituitarism. Low values may indicate hypopituitarism, malnutrition, diabetes mellitus, Laron dwarfism, hypothyroidism, maternal deprivation syndrome, pubertal delay, cirrhosis, hepatoma, anorexia nervosa, nonfunctioning pituitary tumors, constitutional delay of growth, and some cases of short stature. High values occur with adolescence, true precocious puberty, pregnancy, obesity, pituitary gigantism, acromegaly, and diabetic retinopathy.

Reference Ranges:

20 years 127–424 ng/mL 51–55 years 87–238 ng/mL

21–25 years 116–358 ng/mL 56–60 years 81–225 ng/mL

26–30 years	117–329 ng/mL	61–65 years	75–212 ng/mL
31–35 years	115–307 ng/mL	66–70 years	69–200 ng/mL
36–40 years	109–284 ng/mL	71–75 years	64–188 ng/mL
41–45 years	101–267 ng/mL	76–80 years	59–177 ng/mL
46–50 years	94–252 ng/mL	81–85 years	55–166 ng/mL

### ***Lipase***

This test is used to diagnose pancreatitis or inflammatory bowel disease. An injured or diseased pancreas will produce abnormal amounts of this enzyme.

Reference Range: 0–59 U/L

### ***Lipoprotein (a)***

This test is used to measure excess small dense lipoprotein. Elevated lipoprotein (a) is a strong indicator of premature coronary disease and atherosclerotic vascular disease and is associated with increased risk of cardiac death in patients with acute coronary syndromes and coronary bypass procedures.

Reference Ranges: 0–30 mg/dL

Desirable: <20mg/dL

Borderline High Risk: 20–30 mg/dL

High Risk: 31–50 mg/dL

Very High Risk: >50 mg/dL

### ***Magnesium (Serum)***

This test is used to evaluate magnesium levels. Decreased levels of magnesium have been associated with cardiac arrhythmias, hypocalcemia, hypokalemia, long-term hyperalimentation, intravenous therapy, diabetes mellitus (especially during treatment of ketoacidosis), alcoholism and other types of malnutrition, malabsorption, hyperparathyroidism, dialysis, pregnancy, and hyperaldosteronism. Magnesium deficiency produces neuromuscular disorders causing weakness, tremors, tetany, and convulsions. Renal loss of magnesium occurs with cis-platinum therapy. Increased magnesium levels relate mostly to individuals in renal failure or with Addison's disease. Marked increases may be found in individuals who take magnesium salts (e.g., antacids, which contain magnesium) or magnesium-containing cathartics and in pregnant woman with severe preeclampsia or eclampsia who are receiving magnesium sulfate as an anticonvulsant. High magnesium levels are manifested in decreased reflexes, somnolence, and heart block.

Reference Range: 1.6–2.6 mg/dL

### ***Magnesium (Rbc)***

This test is used to evaluate magnesium deficiency.

Reference Range: 4.2–6.8 mg/dL

### ***Male Panel***

This panel consists of a chemistry panel, CBC, free testosterone, DHEA-S, PSA, estradiol, homocysteine, and cardiac CRP. Each of these tests is described separately.

### ***MHMP***

This panel consists of a male panel + total testosterone, progesterone, FSH and LH, and TSH. Each of these tests is described separately.

### ***Osteocalcin***

This test is used to evaluate bone disease characterized by increased bone turnover. Osteocalcin has been found to be elevated in Paget disease of the bone, cancer accompanied by bone metastases, primary hyperparathyroidism, and renal osteodystrophy. Osteocalcin levels may also be used to monitor therapeutic results.

Reference Ranges:

Men: 3.2–39.6 ng/dL

Premenopausal Women: 4.9–30.9 ng/dL

Postmenopausal Women: 9.4–47.4 ng/dL

### ***Parathyroid Hormone, Intact***

This test is used in diagnosing parathyroid disease, diagnosing and monitoring other diseases of calcium homeostasis, and monitoring patients undergoing renal dialysis.

<b>Intact Parathyroid Hormone</b>	<b>Calcium</b>	<b>Interpretation</b>
12–65 pg/mL	8.5–10.6 mg/dL	Normal
>65 pg/mL	>10.6 mg/dL	Primary Hyperparathyroidism
>65 pg/mL	<10.6 mg/dL	Secondary Hyperparathyroidism
<65 pg/mL	>10.6 mg/dL	Nonparathyroid Hypercalcemia
<12 pg/mL	<8.5 mg/dL	Hypoparathyroidism
12–65 pg/mL	<8.5 mg/dL	Nonparathyroid Hypocalcemia

### ***Pregnenolone***

This test is used to determine ovarian failure, hirsutism, adrenal carcinoma, and Cushing's syndrome.

Reference Ranges:

Men: 10–200 ng/dL

Women: 10–230 ng/dL

LE's Optimal Range: 100–170 ng/dL

### ***Progesterone***

This test is used to establish the presence of a functional corpus luteum, or luteal cell function, confirm body temperature for occurrence of ovulation, obtain indication of day of ovulation, evaluate the functional state of corpus luteum in infertile patients, assess placental function during pregnancy, and evaluate ovarian function.

Reference Ranges:

Men: <<0.3–1.2 ng/mL

Women: <0.5 ng/mL

Follicular: 0.2–1.4 ng/mL

Luteal: 3.3–25.6 ng/mL

Midluteal: 4.4–28.0 ng/mL

Postmenopausal: 0.0–0.7 ng/mL

### ***Prolactin***

This test is used to assess inappropriate lactation and is also useful in the detection of prolactin-secreting pituitary tumors. Elevated prolactin is associated with anovulation and amenorrhea. Prolactin can also be elevated in hypothyroidism when TSH is high. Some studies indicate that elevated prolactin may promote breast and prostate cancer growth.

Reference Ranges:

**Men:** 2.1–17.7 ng/mL

LE's Optimal Range:2.1–5 ng/mL

**Women:** 2.8–29.2 ng/mL

LE's Optimal Range:2.8–7 ng/mL

Nonpregnant: 2.8–29.2 ng/mL

Pregnant: 9.7–208.5 ng/mL

Postmenopausal: 1.8–20.3 ng/mL

***Prostate-Specific Antigen (PSA)***

PSA is produced by normal, hyperplastic, and cancerous prostatic tissue. Serum PSA has been found to be the most sensitive marker for monitoring patients with prostate cancer and to enhance efficacy in monitoring progression of disease and response to therapy.

Reference Range: 0–4.0 ng/mL

LE's Optimal Range:0–2.5 ng/mL

### **PSA Free-to-Total Ratio**

This test is used in men to measure the percentage of free PSA relative to the amount of total PSA. This ratio helps determine the probability of prostate cancer. The lower the percentage of free PSA, the higher the possibility of prostate cancer. In the following table, the percentages given under each age group are the percentages of men with cancer whose percentage of free PSA falls within the given range.

Reference Ranges:0–4.0 ng/mL

Free PSA	50–64 Years	65–75 Years
0.00–10.00%	56%	55%
10.01–15.00%	24%	35%
15.01–20.00%	17%	23%
20.01–25.00%	10%	20%
>25%	5%	9%

### **Prothrombin Time**

This test is used to evaluate the adequacy of the extrinsic system and common pathway in the clotting mechanism. Prothrombin time testing provides a control for long-term anticoagulant therapy, which usually involves the use of a coumarin derivative (e.g., Coumadin®).

### **Partial Thromboplastin Time**

This test is used to evaluate the intrinsic coagulation system. It is also used to monitor heparin therapy to aid in detecting classical hemophilia A, Christmas disease, and congenital deficiencies of Factors II, V, VIII, IX, X, XI, and XII. Partial thromboplastin time is also used to screen for the presence of dysfibrinogenemia, disseminated intravascular coagulation, liver failure, congenital hypofibrinogenemia, vitamin K deficiency, congenital deficiency of Fitzgerald factor, congenital deficiency of prekallikrein, high molecular weight kininogen, and circulatory anticoagulant.

### **Reticulocyte Count**

This test is used to evaluate erythropoietic activity, which increases in acute and chronic hemorrhage and in hemolytic anemias. It is also used to evaluate erythropoietic response to antianemic therapy.

### **Reverse T3**

This test is useful in evaluating thyroid function and metabolism and is also used to evaluate euthyroid sick patients with low T3 concentrations.

Reference Range:90–350 pg/mL

### **Rheumatoid Arthritis Factor**

This test is used in the differential diagnosis and prognosis of arthritic disorders.

Reference Range: Negative:<10.0 IU/mL

### **Selenium**

This test is used to monitor selenium deficiency and occupational exposure. Because selenium is a very important supplement for the extension of life, optimal levels are in the upper half of the normal range.

Reference Ranges:

Environmental Exposure:79–326 µg/L

Normal Range: 46–143µg/L

## **Sex Hormone Binding Globulin**

This test is used to monitor sex hormone binding globulin levels that are under the positive control of estrogens and thyroid hormones and suppressed by androgens. Decreased levels are found in hirsutism, virilism, obese postmenopausal women, and women with diffuse hair loss. Increased levels are present in hyperthyroidism, testicular feminization, cirrhosis, male hypogonadism, pregnancy, prepubertal children, and women using oral contraceptives.

Reference Ranges:

Adult Men: 13–71 nmol/L

Women: 1–114 nmol/L

LE's Optimal Range: Lower part of normal range is desirable for healthy people.

## **Sex Hormone Profile**

This is a test for total estrogens, progesterone and free testosterone.

## **Somatomedin-C**

This is a screening test to identify patients with growth hormone deficiency, pituitary insufficiency, and acromegaly.

Normal Ranges:

Age (years)

21–25 116–358 ng/mL

26–30 117–329 ng/mL

31–35 115–307 ng/mL

36–40 109–284 ng/mL

41–45 101–267 ng/mL

46–50 94–252 ng/mL

51–55 87–238 ng/mL

56–60 81–225 ng/mL

66–70 75–212 ng/mL

71–75 64–188 ng/mL

76–80 59–177 ng/mL

81–85 55–166 ng/mL

## **T3 Uptake**

This is a thyroid function test for the diagnosis of hypothyroidism or hyperthyroidism.

Reference Range: 24–39%

## **Testosterone Free (Direct)**

This test is used to evaluate hirsutism and masculinization in women and to evaluate testicular function in clinical states in which the testosterone binding proteins may be altered (obesity, cirrhosis, thyroid disorders).

Normal Ranges:

<b>Men:</b>		<b>Women:</b>	
20–29 years	9.3–26.5 pg/mL	20–59 years	0.0–2.2 pg/mL
30–39 years	8.7–25.1 pg/mL	60+ years	0.0–1.8 pg/mL

40–49 years 6.8–21.5 pg/mL

50–59 years 7.2–24.0 pg/mL

60+ years 6.6–18.1 pg/mL

LE's Optimal Range:18–26.5 pg/mL for aging men without prostate cancer.

### ***Testosterone, Free (with Total)***

This test is used to evaluate hirsutism and masculinization in women and to evaluate testicular function in clinical states in which the testosterone binding proteins may be altered (obesity, cirrhosis, thyroid disorders).

### ***Testosterone, Total***

This test is used to evaluate gonadal and adrenal function. It is helpful in diagnosing hypogonadism, hypopituitarism, Klinefelter's syndrome, and impotence in men and hirsutism, anovulation, amenorrhea, and virilism in women.

Reference Range:

**Men:** 241–827 ng/dL

LE's Optimal Range500–827 ng/dL

**Women:** 14–76 ng/dL

### ***Thrombin and Antithrombin III***

These two tests are used to evaluate the intrinsic coagulation system. They can determine heparin effect, warfarin anticoagulant therapy, liver failure, and DIC.

- **Thrombin:** This test is used to evaluate the fibrinogen-to-fibrin reaction. It is used to determine severe hypofibrinogenemia, dysfibrinogenemia, and the presence of heparin-like anticoagulants. Thrombin levels are used to confirm and monitor DIC and fibrinolysis and can be used to monitor therapy with heparin. This test can also be used to monitor fibrinolytic therapy.
- **Antithrombin III:** This test is used to evaluate the hypercoagulable state, fibrinogenolytic state, and response to heparin. Antithrombin deficiency is associated with severe cirrhosis, chronic liver failure, DIC, thrombolytic therapy, pulmonary embolism, nephrotic syndrome, or postsurgical state (especially liver transplant or partial hepatectomy).

### ***Thyroid Antithyroglobulin Antibody***

This test is used to detect and confirm autoimmune thyroiditis and Hashimoto's thyroiditis.

Reference Range:<5 mIU/mL

### ***Thyroid Stimulating Hormone (TSH)***

This is a function test for thyroid disease to differentiate between primary and secondary hypothyroidism. Some doctors believe that any TSH levels greater than 2.0 mIU/mL should be considered suspect for subclinical hypothyroidism if symptoms are present.

Reference Range: 0.35–5.50 mIU/mL

LE's Optimal Range:0.35 to 2.1 mIU/mL

### ***Thyroxine (T4)***

This is one of the first tests done in assessing thyroid function. It is used to diagnose thyroid function and to monitor replacement and suppressive therapy.

Reference Range:4.5–12.0 µg/dL

### ***Tyroxine (T4) Free, Direct***

This test is used to evaluate thyroid function in patients who may have protein abnormalities that could affect total T4 levels. It is also used to diagnose thyroid function and monitor replacement and suppressive therapy.

Reference Range:0.70–1.53 ng/dL

### ***Tri-Iodothyronine (T3)***

This is a test for thyroid function used particularly in the diagnosis of T3 thyrotoxicosis and hyperthyroidism.

Reference Range:85–205 ng/dL

### ***Tri-Iodothyronine (T3) Free***

This test is used to evaluate thyroid function and assess abnormal binding protein disorders.

Reference Range:2.3–4.2 pg/mL

### ***Troponin 1***

This test is used to detect cardiac injury, predict mortality in unstable cases of angina, and serve as a marker for perioperative myocardial infarction.

Reference Range:<1.0 ng/mL

### ***Tumor Necrosis Factor-alpha (TNF-alpha)***

This test is used to identify elevated levels of tumor necrosis factor alpha. TNF-alpha levels may be elevated in sepsis, cachexia, AIDS, hepatitis C, transplant rejection, various infectious, and autoimmune diseases.

Reference Range:<8.1 pg/mL

### ***Urinalysis, Routine***

This test is used to detect abnormalities in urine and diagnose and manage renal disease and metabolic disease, urinary tract infection and neoplasm, systemic diseases, and inflammatory or neoplastic disease.

### ***VAP Test***

The VAP cholesterol test provides a more comprehensive lipoprotein analysis and better assesses the risk of coronary heart disease than a conventional lipid profile. It provides a direct measurement of total cholesterol, LDL-C, HDL-C, VLDL-C, Lp(a), and triglycerides as well as the qualitative assessment of LDL particle size, HDL subfractions (HDL2-C and HDL3-C), and VLDL subfractions (VLDL 1+2-C, VLDL3-C, and IDL-C). Further, the VAP cholesterol test provides information relating to emerging risk factors for metabolic syndrome.

### ***Vitamin B12 and Folate***

This test measures the amount of vitamin B12 and folic acid in the blood. It is used to evaluate for malnutrition and macrocytic or megaloblastic anemia and to diagnose congenital absence of transcobalamin II or cobalophilin.

Reference Ranges:

B12: 211–911 pg/mL

Folic Acid: >5.4 ng/mL

### ***Vitamin D***

This test is used to rule out vitamin D deficiency as a cause of bone disease. It can also be used to identify hypercalcemia.

Reference Range:32–100 ng/mL

## **HOW TO ORDER BLOOD TESTS**

You can order blood tests by mail or by calling (800) 208-3444. All tests must be prepaid. As soon as you place your order, you will be sent a package containing information regarding the location of the nearest blood-drawing stations, a Request for Phlebotomy

form, and a Test Requisition form.

At your convenience, you can then take the Request for Phlebotomy and Test Requisition forms to the designated blood-drawing station in your area. A phlebotomist will draw the appropriate specimens of your blood. You (or your physician) will be mailed your test results. These results will show whether you have any abnormalities. If the results show abnormalities, you should make sure you show these results to your personal physician, who can determine if you have any serious problems and what you can do about them.

You can also request a free consultation with one of the Foundation's doctors to help interpret your test results to make certain that you stay within optimal ranges.

If longevity risk factors such as glucose, homocysteine, C-reactive protein, fibrinogen, or other tests are abnormal, slightly elevated, or below normal, for example, you can take nutritional steps to reverse the trend. You can repeat the test in 45–60 days and then chart your progress in improving your health and your chances of living longer in good health.

## PRODUCT AVAILABILITY

The blood tests discussed in this section are available through Life Extension National Diagnostics, Inc. For ordering information, call 1-800-208-3444 anytime toll-free or visit us online at [www.lef.org](http://www.lef.org).

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