Medical Testing Protocols

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

An example of a preventable disorder that can be detected by a yearly blood test is calcium overload. This condition is caused when too much calcium is removed from the bone and deposited into the vascular system. Unless discovered by a blood test, people don't find out about calcium imbalance until after they have a crippling bone fracture; a painful kidney stone (renal calculi); or heart valve failure (due to excess valvular calcification). These diseases often manifest years after the calcium imbalance first begins, yet an inexpensive Blood Chemistry Test could detect this problem early and enable the person to take relatively simple steps to correct the calcium imbalance before it causes irreversible damage.

Excess amounts of serum iron generate free radicals that increase the risk of cancer, atherosclerosis, and probably neurological disorders such as Alzheimer's disease and Parkinson's disease. If a blood test shows high iron levels, there are many ways to bring it down. You should not wait for an iron-induced disease to manifest just because you don't want to "bother" with getting an annual Blood Chemistry Test.

The average person over age 60 takes several prescription drugs every day to treat or prevent chronic medical conditions. These drugs have toxic side effects that result in between 125,000-189,000 Americans dying each year. In fact, according to the American Medical Association, adverse reactions to prescription drugs are between the fourth and sixth leading causes of death in the United States. The American Medical Association emphasizes that these deaths are occurring even though the drugs are being prescribed by doctors who are supposed to monitor patients to prevent such drug-induced deaths. The problem is that cost-conscious HMOs and hurried physicians are not mandating blood tests that would detect drug-induced liver and kidney impairment 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.

It's not just prescription drugs that can cause liver or kidney damage. There are many factors (alcohol, over-the-counter drugs, excess niacin, hepatitis C) that can make a person susceptible to liver or kidney damage. For most people, these conditions 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, yet a simple Blood Chemistry Test can detect an underlying problem in time to take corrective actions.

The reason most people consider blood testing is to ascertain their cardiovascular disease risk factors. 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 the blood fat levels over the course of 1 year, meaning that the previous tests may not accurately reflect their current serum-lipid status.

The Life Extension Foundation has advocated regular medical testing since 1983 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 only concern is when a particular result is 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 upon 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. There has been a long-standing controversy about how to best 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 Lancet challenges 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 et al. 2002).

The standard blood test used to determine thyroid gland hormone output is the thyroid stimulating hormone test (TSH). When there is a deficiency in thyroid hormone, the pituitary gland releases more 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 authors, however, is whether the current reference range for TSH reflects optimal thyroid hormone status.

The TSH reference range used by many laboratories is between 0.2-5.5 (mU/L). A greater TSH level is indicative of a thyroid hormone deficiency. That is because the pituitary gland is over-signaling TSH due to low levels of thyroid hormone in the blood. Any reading over 5.5 alerts a doctor to a thyroid gland problem and 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 0.2 to be as normal as a 5.5 reading. The difference between 0.2 and 5.5, however, is 27-fold, a parameter far too great to indicate optimal or even normal thyroid function.

A review of published findings about TSH levels reveals that readings over 2.0 may be indicative of adverse health problems relating to insufficient thyroid hormone output. One study showed that individuals with TSH values over 2.0 have an increased risk of developing overt hypothyroid disease over the next 20 years (Vanderpump et al. 1995). Other studies show that TSH values over 1.9 indicate abnormal pathologies of the thyroid, specifically autoimmune attacks on the thyroid gland itself that can result in significant impairment (Hak et al. 2000).

A more startling study showed that TSH values over 4.0 increase the prevalence of heart disease, after correcting other known risk factors (Hak 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 effect in lowering cholesterol in patients whose TSH range was between 0.2-1.9 (Michalopoulou et al.1998). It also showed that in people with elevated cholesterol, TSH values over 1.9 could indicate that a thyroid deficiency is the culprit, causing excess production of cholesterol, whereas TSH levels below 2.0 would indicate a 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 first attempt to correct a thyroid deficiency (based on a TSH value over 1.9) instead of resorting to cholesterol-lowering drugs.

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

The authors of The Lancet study stated that "the emerging epidemiological data begin to suggest that TSH concentrations above 2.0 (mU/L) may be associated with adverse effects."

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

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

Despite presenting these intriguing findings, The Lancet authors stated that more studies were needed to define optimal TSH level as between 0.2-2.0 instead of between 0.2-5.5. As a health-conscious person, however, this type of precise information provides an opportunity to correct a medical condition that has been unresponsive to mainstream therapies or possibly prevent disorders from developing in the first place.

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 different thyroid replacement therapeutic approaches.

The Risk of Following Standard Reference Ranges

Standard laboratory reference ranges represent "average" populations and are not reflective of the optimal levels. In the 1960s for instance, the upper reference range for cholesterol extended up to 300 (mg/dL). This number was based on a statistical calculation indicating that it was "normal" to have total cholesterol levels as high as 300 (mg/dL). At that time, it was also "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 gradually dropped to the point where it is now 200 (mg/dL) (ADVANCEDATA 1977; AFP 2001).

The same situation occurred with homocysteine reference ranges. Until recently, it was considered normal to have a homocysteine blood reading as high as 15 (mm/L) (Mahanonda et al. 2001). Most reference ranges now provide a chart showing that homocysteine

levels above 7 indicate an increased risk of heart attack and stroke (Robinson et al. 1995).

It is not just blood test reference ranges that fail to provide physicians and patients with optimal numbers. For example, when your blood pressure is checked, a diastolic number up to 90 mmHg is considered normal. Yet a diastolic blood pressure reading over 85 mmHg is associated with an increased risk of stroke. A high percentage of people over age 60 have diastolic readings over 85 mmHg and this is the age group most vulnerable to stroke (Hansson et al. 1998). If your physician checks your blood pressure and says it is "normal," The Foundation advises you to instead inquire what the optimal range should be. In the case of diastolic blood pressure, taking steps to keep it at 85 mmHg or below could greatly reduce long-term vascular damage. It is important to note that mid-life hypertension predisposes people to stroke later in life, so keeping blood pressure readings in 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 part of growing older. The result is that aging people suffer a variety of discomforts and lethal diseases 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). If a physician were to test blood levels of all four of these hormones, the standard "reference ranges" 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 elderly 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 standard reference ranges for free testosterone and DHEA show that very low levels are perfectly "normal" for aging men. It is no coincidence that these same aging men (with low levels of testosterone/DHEA) have high rates of depression, memory loss, atherosclerosis, senility, impotency, high cholesterol, abdominal obesity, fatigue, and a host of other diseases related to low blood levels of testosterone and DHEA (Tenover 1992; Phillips et al. 1994; Gelfand et al. 1997; Gooren 1998; Barrett-Connor et al. 1999; Rabkin et al. 1999; Schweiger et al. 1999; Seidman et al. 1999; Shackman et al. 1999; Wright et al. 1999; Janowsky et al. 2000; Shippen et al. 2001; Tan et al. 2001).

When it comes to assessing hormone status, the use of standard reference ranges has failed aging people because reference ranges are adjusted to reflect a person's age. Since it is normal for an aging person to have imbalances of critical hormones, standard laboratory reference ranges are not flagging dangerously high levels of estrogen and insulin or deficient levels of testosterone, thyroid, and DHEA. The following table shows standard hormone blood reference ranges for men (age 60) and compares them to what the "optimal" ranges should be.

Hormone	Standard Reference Range	Optimal Range
DHEA	42-290 mcg/dL	280-500 mcg/dL
Insulin (fasting)	6-27 mcU/mL	Under 5 mcU/mL
Free testosterone	6.6-18.1 pg/mL	15-22 pg/mL
Estradiol	3-70 pg/mL	10-30 pg/mL
TSH*	0.2-5.5 mU/L	Under 2.1 mU/L

*Thyroid stimulating hormone

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. More and more, however, aging people are seeking the health and vitality of a younger person. If you are 80 years old and are told that your hormone profile is normal for your age, tell your doctor that you would prefer the hormone profile of a 25-year-old because you perceive a 25-year-old as having more vitality and a reduced risk of contracting lethal diseases.

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 complete 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 40: Fasting Insulin, Ferritin, Cortisol, Fibrinogen, Thyroid Stimulating Hormone (TSH), and Free triiodothyroxine (T3). If a serious abnormality is detected--such as elevated homocysteine, hormone

imbalance, high PSA--testing should be repeated more often to determine the benefits of whatever therapy you are using to correct the potentially life-shortening abnormality.

We also recommend that you consult with your physician regarding any other test that may be appropriate for your individual condition.The following expanded 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

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. The 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).

Normal Ranges:

Male: 110-180 mg/dL

Female: 110-205 mg/dL

Optimal Ranges:

Male: 130-180 mg/dL

Female: 130-205 mg/dL

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 as possible indicators of recurrence.

Normal Range:

CA 15-3: 0.0-31.3 U/mL

Cancer Antigen (CA) 125
This test 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.

Normal Range:

CA 125: 0-35 U/mL

Candida Antibodies Qualitative
This test is used to diagnose systemic candidiasis. Candidiasis normally occurs in the mouth, vagina, or gastrointestinal tract. 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 non-neoplastic disease, inflammatory disease of the bowel, cirrhosis, and autoimmune conditions.

Normal Range:

CA 19-9: 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 gastrointestinal or breast cancers). It can also be used to monitor the disease and its treatment.

Normal Ranges:
Nonsmoker: 0-3.0 ng/mL
Smoker: 0-5.0 ng/mL

CD4/CD8 Ratio Profile
This test is used to determine the ratio of CD4-helper cells to CD8-suppressor cells. A progressive depletion of CD4 T lymphocytes is associated with the increased likelihood of clinical complications from AIDS. These test results can indicate if an AIDS patient is at risk for developing opportunistic infections.

Normal Range: > 1.0

Chem 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.

Normal Range: 65-109 mg/dL
Optimal Range: 70-100 mg/dL

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

Normal Ranges:
Male: 2.4-8.2 mg/dL
Female: 2.0-6.6 mg/dL
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.

Normal 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.

Normal Ranges:
Male: 0.5-1.5 mg/dL
Female: 0.5-1.1 mg/dL

BUN/Creatinine Ratio. This test is used to diagnose impaired renal function. With creatinine, BUN is used to monitor patients on dialysis. (Calculation)

Normal Range: 12:1 to 20:1

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

Normal Range: 135-148 mEq/L

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

Normal Range: 3.5-5.5 mEq/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.

Normal Range: 96-109 mmol/L

Carbon Dioxide. This test is used to assist in the evaluation of the pH and electrolytes status.

Normal Range: 20-32 mmol/L

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

Normal 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.

Normal Range:	2.5-4.5 mg/dL 12-60 years
Male:	2.3-3.7 mg/dL > 60 years
Female:	2.8-4.1 mg/dL > 60 years

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.

Normal Ranges:

Total Protein:	6.0-8.5 grams/dL
Albumin:	3.5-5.5 grams/dL
Globulin:	1.5-4.5 grams/dL

Albumin/Globulin Ratio. This test is used to evaluate renal disease and other chronic diseases.

Normal Range: 1.1-2.5

Bilirubin. This test is used to evaluate liver function.

Normal Ranges:

Total Bilirubin:	0.1-1.2 mg/dL
Indirect Bilirubin:	0.2-0.8 mg/dL
Direct Bilirubin:	0.1-0.3 mg/dL

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

Optimal 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.

Normal Range: 100-250 IU/L

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

Normal Range: 0-40 IU/L

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

Normal Range: 0-40 IU/L

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

Normal Ranges:

Male:	40-155 mg/dL
Female:	35-155 mg/dL
Optimal Range:	40-100 mg/dL

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

Normal Range: 100-199 mg/dL

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.

Normal Range: 0-199 mg/dL

Optimal Range: 40-100 mg/dL

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

Normal Range: 35-150 mg/dL

Optimal Range: 55-150 mg/dL

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

Normal Range: 0-129 mg/dL

Optimal Range: < 100 mg/dL

Total Cholesterol/HDL Ratio. This test is used to determine the risk for coronary heart disease.

Normal Range: 5:1 or less

Optimal Range: 3:1 or less

CBC (Complete Blood Count) with Platelets and Differential
This is a series of tests of the peripheral blood which provides a variety of information about the blood components.

Red Blood Cell Count

Normal Ranges:

Male: 4.1-5.6 million/mm3

Female: 3.8-5.10 million/mm3

Hemoglobin

Normal Ranges:

Male: 12.5-17.0 g/dL

Female: 11.5-15.0 g/dL

Optimal Range: Upper end of normal range

Hematocrit

Normal Ranges:

Male: 36-50%

Female: 34 - 44%

Optimal Range: Upper end of normal range

Red Blood Cell Indices
Mean Corpuscular Volume.

Normal Range: 80-98 mm3

Mean Corpuscular Hemoglobin

Normal Range: 27-34 pg

Mean Corpuscular Hemoglobin Concentration

Normal Range: 32-36 g/dL

Red Blood Cell Distribution of Width

Normal Range: 11.7%-15.0%

White Blood Cell Count

Normal Range: 4000-10,500/mm3

Critical Values: < 2500 or > 30,000/mm3

Differential Count

Normal Range Reference Interval:	
Polyneutrophils:	4000-7400/mm3 1.8-7.8 × 10-3/mcL
Lymphocytes:	1400-4600/mm3 0.7-4.5 × 10-3/mcL
Monocytes:	400-300/mm3 0.1-1.0 × 10-3/mcL
Eosinophils:	0-700/mm3 0.0-0.4 × 10-3/mcL
Basophils:	0-300/mm3 0.0-0.2 × 10-3/mcL

Platelet Count

Normal Range: 140-415 × 10-3/mcL

Critical Values: < 50,000 or > 1 million/mm3

C-peptide
This test is used to evaluate diabetics and monitor insulinoma.

Normal Ranges:

Fasting:	0.9-4.0 ng/mL
1 hour after glucose load:	5-12 ng/mL

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

Normal Ranges:

a.m.: 4.3-22.4 mcg/dL

p.m.: 3.1-16.7 mcg/dL

C-Reactive Protein (Cardiac)(High Sensitivity)
This test is used to assess risk of cardiovascular and peripheral vascular disease.

Normal Ranges:

Relative Risks-Male

CRP (mg/L)	Future MI	Future Stroke
> 2.11	2.9	1.9
1.15-2.10	2.6	1.9
0.56-1.14	1.7	1.7
< 0.55	1.0	1.0

Relative Risks-Female

CRP (mg/L)	Future MI or Stroke
%gt; 7.30	5.5
3.80-7.30.1.1.1	3.5
1.50-3.70.1.1.1.1	2.7
< 1.50	1.0
Optimal Range:	As low as possible.

Cytokine Testing
These tests are used to find the source of chronic inflammation, after a high CRP reading or the persistence of any chronic inflammatory condition. These tests can be ordered as a panel or individually.

Pro-Inflammatory Cytokines

Normal Ranges (All Adults):

Interleukin-1B (IL-1B)	0-150 pg/mL
Interleukin-6 (IL-6)	2-29 pg/mL
Interleukin-8 (IL-8)	10-80 pg/mL

Tumor Necrosis Factor-alpha (TNF-a)

Normal Range (All Adults): 0-25 pg/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.

Normal Ranges:

Male

18-30 years:	125-619 mcg/dL
31-50 years:	59-452 mcg/dL
51-60 years:	20-413 mcg/dL
61-83 years:	10-285 mcg/dL
Optimal Range:	400-500 mcg/dL

Female

19-30 years:	29-781 mcg/dL
31-50 years:	12-379 mcg/dL
Postmenopausal:	30-260 mcg/dL
Optimal Range:	350-430 mcg/dL

Dihydrotestosterone (DHT)
This test measures serum concentrations of dihydrotestosterone and is closely related to those of testosterone, but are lower, and may indicate hypergonadism or hirsutism.

Normal Ranges:

Male: 30-85 mg/dL

Female: 4-22 mg/dL

Optimal Ranges:

Male: 30-50 mg/dL

Epstein-Barr Virus (EBV) Acute Infection
This test is used to diagnose a suspected EBV infection (infectious mononucleosis, IM).

Normal Range:

Titers < 1:10 are nondiagnostic.

Titers of 1:10 to 1:60 indicate infection at an undetermined time.

Titers of > 1:320 suggest active infection.

Fourfold increase in titer in paired sera drawn 10-14 days apart is usually indicative of an acute infection.

ESR Westergen 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.

Normal Range; Westergren Method:

Male:	up to 15 mm/hr
Female:	up to 20 mm/hr

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.

Normal Ranges:		Serum
Adult Male:	3-70 pg/mL	Optimal Range: 10-30 pg/mL
Adult Female:		
Follicular phase:	9-175 pg/mL	
Midcycle peak:	150-750 pg/mL	
Luteal phase:	44-196 pg/mL	
Postmenopausal:	< 20 g/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.

Normal Range for Male or Nonpregnant Female: < 2.0 mg/dL

Estrogens Total
Estrogen measurements are used to evaluate sexual maturity, menstrual problems, 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.

Normal Ranges:	
Male:	12-72 mg/dL
Optimal Range:	12-34 mg/dL
Female:	
Follicular phase:	37-138 mg/dL
Midcycle peak:	60-229 mg/dL
Luteal phase:	50-114 mg/dL

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.

Normal Ranges:	
Male:	12-72 pg/mL
Female:	
Follicular phase:	37-138 mg/dL
Midcycle peak:	60-229 mg/dL
Luteal phase:	50-114 mg/dL

Female Panel
Chem Panel, CBC, Free Testosterone, DHEA-S, Estradiol, Progesterone, Homocysteine, Cardiac CRP

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

Normal Ranges:	
Male:	22-322 ng/mL
Female:	10-291 ng/mL
Optimal Range:	50-150 ng/mL

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

Normal Range Adult:	200-400 mg/dL
Optimal Range:	200-300mg/dL
Critical Value:	Values of < 100 mg/dL can be associated with spontaneous bleeding.
High Value:	> 400 mg/dL can cause spontaneous clotting.

FSH and LH (Follicle-Stimulating Hormone and Luteinizing Hormone)
This test is used in the determination of menopause and is integral in the evaluation of suspected gonadal failure.

Normal Ranges:	FSH
Adult Male: > 15 yrs:	1.4-18.1 mIU/mL
Optimal Range:	1.4-14 mIU/mL
Female:	
Follicular phase:	2.5-10.2 mIU/mL
Ovulatory peak:	3.4-33.4 mIU/mL
Luteal phase:	1.5-9.1 mIU/mL
Postmenopausal phase:	23.0-116.3 mIU/mL
Normal Ranges:	LH
Adult Male:	
20-70 years:	0.5-9.3 mIU/mL
> 70 years:	3.1-34.6 mIU/mL
Optimal Range:	0.5-9.3 mIU/mL
Female:	
20-70 years:	0.0-76.3 mIU/mL
> 70 years:	5.0-52.3 mIU/mL
Follicular phase:	1.9-12.5 mIU/mL
Ovulatory peak:	8.7-76.3 mIU/mL
Luteal phase:	0.5-16.9 mIU/mL
Postmenopausal phase:	5.0-52.3 mIU/mL

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

Normal Range Male and Female: 0-65 IU/L

HCG Beta Subunit, Quantitative (Cancer)
This test is used as a tumor marker for certain cancers.

Heavy Metals Profile I, Blood
This test is used to monitor exposure to arsenic, lead, and mercury.

Optimal Range: As low as possible

Helicobactor (Campylobacter) Pylori, IGG
This test is used as an aid in the diagnosis of H. pylori infection and to determine the cause of chronic type B gastritis, and ulcers of the stomach or duodenum.

H. pylori is the causative agent of Type B active chronic gastritis; there may be evidence to link H. pylori to duodenal ulcer disease as well. The presence of IgG and IgA antibodies has been observed in 81-100% of patients with gastritis but in only 25% of patients without histological evidence of H. pylori. Testing for IgM is not helpful.

Hemoglobin A1C
This test is most frequently used to assess glucose control in insulin-dependent diabetic patients whose glucose levels are very labile.

Normal Range Adult: 4.5-5.7%

Hepatitis Panel (A, B, C), Acute
This test is used as a comprehensive panel for detecting markers for HAV, HBV, or HCV infections and is used for all stages of infection.

Normal Range: Negative or Positive

Hepatitis B Surface Antibody, Qualitative
This test is useful for evaluation of possible immunity in individuals who are at increased risk for 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.

Normal Range: Negative or Positive

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

Normal:	5-15 micromol/L
Desirable:	< 7.2 micromol/L
Hyperhomocysteinemia	
Borderline:	12-15 micromol/L
Moderate:	> 15-30 micromol/L
Intermediate:	> 30-100 micromol/L
Severe:	> 100 micromol/L

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

Insulin Fasting
This test is used for insulin measurement in the evaluation of 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.

Normal Range Adult:	0-22 mcIU/mL
Optimal Range:	As low as possible, ideally under 5 mcIU/mL

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

Normal Ranges:

Male:	40-180mg/dL
Female:	50-170 mg/dL
Optimal Range:	40-100 mg/dL
TIBC:	250-420 mg/dL

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

Normal Range: 0-59 U/L

Lipoprotein(a)
This test is used to measure excess small dense lipoprotein which is a strong indicator for 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.

Normal Range:	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

Male Panel
Chem Panel, CBC, Free Testosterone, DHEA-S, PSA, Estradiol, Homocysteine, Cardiac CRP

MHMP
Male Panel + Total Testosterone, Progesterone, FSH & LH, and TSH.

Parathyroid Hormone (PTH), Intact
This test is used in diagnosing parathyroid disease, diagnosing and monitoring other diseases of calcium homeostasis, and for monitoring patients undergoing renal dialysis.

Normal Range Adults older than 20 years: 12-72 pg/mL

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

Normal Ranges:

Male:	10-200 ng/dL
Female:	10-230 ng/dL
Optimal Range:	100-170 ng/dL

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

Normal Ranges:

Male (ng/mL):	< 0.3-1.2
Female:	
Follicular:	0.2-1.4
Luteal:	3.3-25.6
Midluteal:	4.4-28.0
Postmenopausal:	0.0-0.7

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 hypothyroid when TSH is high. Some studies indicate that elevated prolactin may promote breast and prostate cancer growth.

Normal Ranges:

Male:	2.1-17.7 ng/mL
Optimal Range:	2.1-5 ng/mL
Female:	2.8-29.2 ng/mL
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.

Normal Findings: 0-4.0 ng/mL

Optimal Range: 0-2.5 ng/mL

PSA Free/Total Ratio Reflex
This test is used to measure the percentage of free PSA relative to the amount of total PSA. This helps determine the probability of prostate cancer. The lower the percentage of free PSA, the higher the possibility of prostate cancer. The percentage in the two age groups is the percent with cancer for that percent of free PSA.

Normal Findings: 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%

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

Normal Range: 90-350 pg/mL

Rheumatoid Arthritis (RA) Factor:
This test is used in the differential diagnosis and prognosis of arthritic disorders.

Normal 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 life extension, optimal levels are in the upper half of normal range.

Reference Interval Environmental Exposure:	79-326 mcg/L
Normal Range:	46-143 mcg/L

Sex Hormone Binding Globulin (SHBG)
This test is used to monitor SHBG 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 in women using oral contraceptives.

Normal Ranges:

Adult Male:	13-71 nmol/L
Female:	1-114 nmol/L
Optimal Range:	Lower part of normal range is desirable for healthy people.

Sex Hormone Profile (EPT)
This is a test for total estrogens, progesterone, and free testosterone.

Somatomedin-C (IGF-I)
This test is a screening test to identify patients with growth hormone deficiency, pituitary insufficiency, and acromegaly.

Normal Findings:

Age (years)	Male (ng/mL)	Female (ng/mL)
16-24	182-780	182-780
25-39	114-492	114-492
40-54	90-360	90-360
> 55	71-290	71-290

T3 Uptake
This is a thyroid function test for the diagnosis of hypothyroidism or hyperthyroidism.

Normal Range:

Adult Male and Female: 24-39%

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

LabCorp. Reference Values

	Male:		Female:
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		
Optimal Range:	15-22 pg/mL for aging men without prostate cancer.		

Quest Diagnostics Reference Values

Adult Male (20-60+ years):	1.0-2.7%	50-210 pg/mL
Adult Females:	0.5-1.8%	1.0-8.5 pg/mL (premenopausal)
	0.8-1.9%	0.6-6.7 pg/mL (postmenopausal)
Optimal Range:	150-210 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 where 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, hypo-pituitarism, Klinefelter's syndrome, and impotence in males and hirsutism, anovulation, amennorrhea, and virilism in females.

LabCorp. Reference Values

	Normal Ranges:
Male:	241-827 ng/dL,
(Optimal Range:	500-827 ng/dL)
Female:	14-76 ng/dL

Quest Diagnostics Reference Values

Adult Males:	
Normal Range:	260-1000 ng/dL
Optimal Range:	500-1000 ng/dL (no prostate cancer)
Adult Females:	
Premenopausal:	15-70 ng/dL
Postmenopausal:	5-51 ng/dL

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

Normal Range: < 5 mcIU/mL

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

Normal Range: 0.35-5.50 mcIU/mL

Optimal Range: Under 2.1 mcIU/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.

Normal Range Adults: 4.5-12.0 mcg/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.

Normal 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.

Normal Range: 60-181 ng/mL

Tri-Iodothyronine (T3) Free
This test is used to evaluate thyroid function and access abnormal binding protein disorders.

Normal Range Adults: 260-480 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.

Normal Range: < 10 mg/L

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

Vitamin B12 & Folate
This test measures the amount of vitamin B12 and folic acid in the blood. It is used to evaluate malnourished patients, evaluate macrocytic/megaloblastic anemia, and diagnose congenital absence of transcobalamin II or cobalophilin.

Normal Ranges:

B12: 211-911 pg/mL

Folic Acid: 3-20 ng/mL

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.

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