

## Hormones:

• **Thyroid:** There are 2 types of thyroid hormones easily measurable in the blood: thyroxine (T4) and triiodothyronine (T3). For technical reasons, it is easier and less expensive to measure the T4 level, so T3 is usually not measured on screening tests. **In particular, the "Total T3," "Free T3" and "T3 Uptake tests" are very confusing to interpret and are not the same test.**

- **Thyroxine (T4):** This shows the total amount of T4. High levels may be due to hyperthyroidism; however, technical artifact occurs when estrogen levels are higher from pregnancy, birth control pills or estrogen replacement therapy. A Free T4 test (see below) can avoid this interference.
- **T3 Resin Uptake or Thyroid Uptake:** This is a test that confuses doctors, nurses and patients. First, this is not a thyroid test, but a test on the proteins that carry thyroid around in your blood stream. Not only that, a high test number may indicate a low level of the protein. The method of reporting varies from lab to lab. The proper use of the test is to compute the free thyroxine index.
- **Free Thyroxine Index (FTI or T7):** A mathematical computation allows the lab to estimate the free thyroxine index from the T4 and T3 Uptake tests. The results tell us how much thyroid hormone is free in the blood stream to work on the body. Unlike the T4 alone, it is not affected by estrogen levels.
- **Free T4:** This test directly measures the free T4 in the blood rather than estimating it like the FTI. While it is a more reliable test, it is also a little more expensive. Some labs now do the Free T4 routinely rather than the Total T4.
- **Total T3:** This is usually not ordered as a screening test, but rather when thyroid disease is being evaluated. T3 is the more potent and shorter lived version of thyroid hormone. Some people with high thyroid levels secrete more T3 than T4. In these (overactive) hyperthyroid cases, the T4 can be normal, the T3 high, and the TSH low. The Total T3 reports the total amount of T3 in the bloodstream, including T3 bound to carrier proteins plus freely circulating T3.
- **Free T3:** This test measures only the portion of thyroid hormone T3 that is "free," that is, not bound to carrier proteins.

• **Thyroid Stimulating Hormone (TSH):** This protein hormone is secreted by the pituitary gland and regulates the thyroid gland. A high level suggests your thyroid is underactive, and a low level suggests your thyroid is overactive.

• **Insulin:** Insulin is secreted by the pancreas in response to eating or elevated blood sugar. It is deficient in persons with type 1 diabetes, and present at insufficient levels in persons with type 2 diabetes. The natural evolution of type 2 diabetes causes insulin levels to fall from high levels to low levels over a course of years. Thus, insulin levels in persons with type 1 and type 2 diabetes overlap significantly, and insulin levels are not very useful in determining type 1 vs. type 2.

Insulin levels vary widely from person to person, depending upon an individual's insulin sensitivity or insulin resistance. Insulin levels also vary widely according to your most recent meal.

Because insulin resistance is a risk factor for coronary disease, assessing an individual's insulin resistance may have some value using the HOMA-IR calculation. Insulin levels are also elevated in patients with true hypoglycemia; however the interpretation of these levels is difficult. Insulin level, when measured by itself at a random time, is rarely useful.

• **C-peptide:** This is a fragment cleaved off of the precursor of endogenously (inside the body) produced insulin. However, it is not present with exogenously (outside the body) produced insulin. C-peptide levels correlate with the insulin levels, except when people take insulin injections. When a patient is hypoglycemic, this test may be useful to determine whether high insulin levels are due to excessive pancreatic release of insulin, or from an injection of insulin. Consequently, this test has value in certain CSI-type testing or when a patient may be suffering from associated psychiatric illness leading to self-induced hypoglycemia from exogenous insulin.

• **Estradiol:** This is the most commonly measured type of estrogen. In women, it varies by age, as well as normal menstrual cycles. Hormone levels also change when taking birth control pills or estrogen replacement.

• **Testosterone:** This is the male hormone most frequently measured in men and women, although normal ranges are significantly different for gender and age.