# Thyroid Screen (Serum)

GENOVA DIAGNOSTICS EUROPE

46-50 Coombe Road
New Malden
Surrey KT3 4QF

63 Zillicoa Street
Asheville, NC 28801 USA

Patient:
DOB:
Sex: F
MRN:

**Order Number:**

Completed:
Received:
Collected:

| Sample Type - Serum | Result | | Reference Range | Units |
|---|---|---|---|---|
| **Central Thyroid Regulation & Activity** | | | | |
| Total Thyroxine (T4) | 75 | | 58-161 | nmol/L |
| Thyroid Stimulating Hormone (TSH) | 3.97 | | 0.40-4.00 | microIU/mL |
| Free Thyroxine (FT4) | 12.9 | | 11.5-22.7 | pmol/L |
| **Peripheral Thyroid Function** | | | | |
| Free T3 | 4.4 | | 2.8-6.5 | pmol/L |
| FT4 : FT3 Ratio | 2.9 | | | |
| **Thyroid Auto Immunity** | | | | |
| Thyroglobulin (TG) | 43 | H | <= 40 | IU/mL |
| Peroxidase (TPO) | 143 | H | <= 34 | IU/mL |

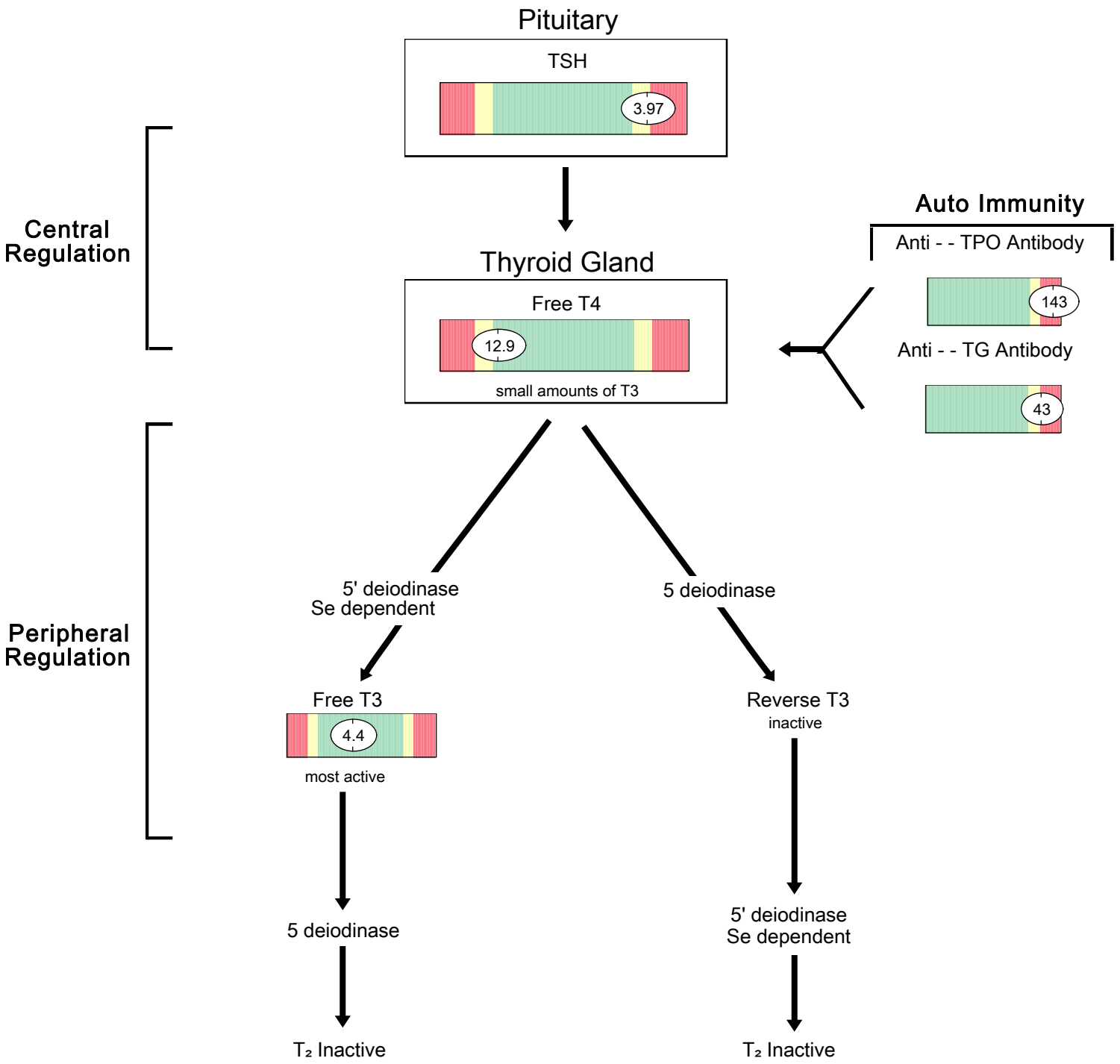
## Key Guide

*Testing performed by Genova Diagnostics, Inc. 63 Zillicoa St., Asheville, NC 28801-0174*

Inside Reference Range

Outside Reference Range

## *Metabolism at a Glance*



## Commentary

Please note the reference range for Peroxidase (TPO) has been updated due to a methodology update.

Commentary is provided to the practitioner for educational purposes, and should not be interpreted as diagnostic or treatment recommendations. Diagnosis and treatment decisions are the responsibility of the practitioner.

Thyroid hormones play an integral role in regulating the body's temperature and production of energy. In addition, thyroid hormones regulate protein synthesis and enzyme production at the cellular level. Thyroid hormone deficiencies may be suspected clinically whenever an insidious slowing of the metabolism is observed as might be the case with protracted fatigue, low energy, depression, mental asthenia, coldness or cold extremities, fluid retention, or diffuse hair loss. Conversely, thyroid hormone excess may be suspected when the opposite clinical picture is observed: excess energy, palpitations, anxiety, nervousness ("like I'm going to jump out of my skin"), short sleep, or feeling like "everything is moving too fast". Physically, such thyroid excess may present as heat intolerance, diarrhea, idiopathic weight loss without loss of appetite, fine tremor of the extremities, and in prolonged cases, exophthalmia.

**Common Laboratory Patterns in Thyroidal Illness**

| | TSH | FT4 | FT3 | rT3 | α-TPO | α-Tg |
|---|---|---|---|---|---|---|
| Early Hashimoto's | nl | nl | nl | nl | ± | ↑ |
| Late Hashimoto's | ↑ | ↓ | ↓ | ± | ↑ | ± |
| Early Graves' | ↓ | nl | ↑ | ± | ↑ | ↑ |
| Late Graves' | ↓ | ↑ | ↑ | ↑ | ↑ | ± |
| Wilson's Syndrome, Low T3, or ESS | nl | nl | ↓ | ↑ | – | – |
| Early DeQuervain's | ↓ | ↑ | ↑ | ± | – | – |
| Late DeQuervain's | ↑ | ↓ | ↓ | ± | ± | ± |
| Plummer's Disease | ↓ | ↑ | ↑↑ | ± | – | – |

**nl = normal**
**± = indeterminate**

Thyroid-stimulating hormone (TSH) is measured to be within the reference range, suggesting balanced production of T4 and T3. In some individuals, high normal TSH, even in the presence of normal free T4, may be indicative of subclinical hypothyroidism. Although subclinical hypothyroidism is often asymptomatic, potential risks associated with the condition include progression to overt hypothyroidism, cardiovascular effects, hyperlipidemia, and neuropsychiatric effects.

The National Academy of Clinical Biochemistry (NACB) has published new thyroid testing guidelines, produced in collaboration with every major thyroid organization. NACB points out that 95% of normal euthyroid individuals have serum TSH values between 0.4 and 2.5 MicroIU/mL, suggesting that the current upper limit of the reference range is skewed by the inclusion of subjects with subclinical hypothyroidism and may be accordingly adjusted in the future. For hypothyroid patients being treated with levothyroxine (T4), NACB suggests a therapeutic target range for TSH of 0.5-2.0 MicroIU/mL.

For the rare night-time collection, it also should be noted that serum TSH levels exhibit a diurnal variation with the peak occurring during the night and the trough (about 50% of the peak value) occurring between 10 a.m. and 4 p.m.

## Commentary

Free T4 (FT4) is within the reference range. FT4 measures the biologically active fraction of total T4, the majority of which is bound by protein carriers in the serum, hence inactive.

The National Academy of Clinical Biochemistry (NACB) suggests a serum FT4 concentration in the upper third of the reference range as the therapeutic target for patients being treated with levothyroxine (T4) for hypothyroidism due to pituitary and/or hypothalamic dysfunction.

Free T3 (FT3) is measured to be within the reference range. FT3 measures the biologically active fraction of total T3, the majority of which is bound by protein carriers in the serum and is therefore inactive. T3 is 3-5 times as physiologically active as T4, and 80% of the circulating T3 is from the peripheral conversion of T4 predominately in liver and kidney.

Abnormal levels of anti-thyroglobulin antibodies were found in this patient. Thyroglobulin (Tg) is a large glycoprotein synthesized in response to TSH stimulation. T4 and, to a limited extent, T3 are produced when tyrosine residues in Tg are iodinated and coupled together under the action of thyroid peroxidase (TPO). Subsequent proteolysis of Tg in cellular lysosomes allows for the release of T4 and T3 from the thyroid gland into the systemic circulation.

Antibodies to thyroglobulin can form any time there is significant leakage of thyroid cellular contents, stimulating an autoimmune response. Any variant of thyroiditis can initiate such cellular leakage. Typically, anti-Tg antibodies form more quickly in thyroiditis than anti-TPO antibodies, but anti-Tg antibody levels also tend to normalize over time, especially in chronic thyroiditis.

Anti-Tg antibody levels may be elevated in Grave's disease or in Hashimoto's thyroiditis. In either case, antibody levels alone are insufficient markers to predict hyper- or hypothyroidism. FT4, FT3 and TSH levels are necessary to make this diagnosis.

In Hashimoto's thyroiditis, the most common cause of hypothyroidism in the U.K., lymphocytes become sensitized to thyroidal antigens and autoantibodies are formed that react with these antigens. In early stages, anti-Tg antibodies are markedly elevated whereas anti-TPO antibodies are only slightly elevated. In later stages, anti-Tg antibodies may decrease, but anti-TPO antibodies will remain elevated, often for many years. As Hashimoto's thyroiditis progresses, lymphocyte infiltration can destroy normal thyroid architecture, and the destruction of the gland can result in falling FT4 and FT3 levels and rising TSH levels. In early stages, secondary to the effect of TSH stimulation and lymphocyte infiltration, the thyroid gland is usually painlessly enlarged and palpable.

Abnormal levels of anti-thyroid peroxidase (TPO) antibodies were found in this patient. Thyroid peroxidase is a heme-containing enzyme that is necessary for the oxidation of iodide ions and for using hydrogen peroxide for the incorporation of these iodide ions into the tyrosine residues of thyroglobulin. Antibodies to TPO can form whenever there is leakage of thyroid cellular contents, stimulating an autoimmune response. Any variant of thyroiditis can initiate such cellular leakage.

In any thyroiditis with autoimmune antibodies, antibody levels alone are insufficient markers to predict hyper- or hypo-thyroidism. FT4, FT3 and TSH levels are necessary to make this diagnosis.

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