

## Overview

### Useful For

Monitoring treatment with synthetic hormones (synthetic triiodothyronine [T3] will cause a low total thyroxine [T4])

Monitoring treatment of hyperthyroidism with thiouracil and other anti-thyroid drugs

Index of thyroid function when the thyroxine-binding globulin (TBG) is normal and non-thyroidal illness is not present

### Testing Algorithm

See [Thyroid Function Ordering Algorithm](#) in Special Instructions.

### Special Instructions

- [Thyroid Function Ordering Algorithm](#)

### Method Name

Electrochemiluminescence Immunoassay

### NY State Available

Yes

## Specimen

### Specimen Type

Serum

### Ordering Guidance

This test cannot be used in patients receiving treatment with lipid-lowering agents containing dextrothyroxine (D-T4) unless therapy is discontinued for 4 to 6 weeks to allow the physiological state to become reestablished prior to testing.

### Specimen Required

**Patient Preparation:** For 12 hours before specimen collection do not take multivitamins or dietary supplements containing biotin (vitamin B7), which is commonly found in hair, skin, and nail supplements and multivitamins.

#### Collection Container/Tube:

**Preferred:** Serum gel

**Acceptable:** Red top

**Submission Container/Tube:** Plastic vial

**Specimen Volume:** 1 mL

### Specimen Minimum Volume

0.75 mL

**Reject Due To**

|                 |        |
|-----------------|--------|
| Gross hemolysis | Reject |
| Gross lipemia   | OK     |
| Gross icterus   | OK     |

**Specimen Stability Information**

| Specimen Type | Temperature              | Time    | Special Container |
|---------------|--------------------------|---------|-------------------|
| Serum         | Refrigerated (preferred) | 7 days  |                   |
|               | Frozen                   | 30 days |                   |

**Clinical & Interpretive****Clinical Information**

Thyroxine (T4) is synthesized in the thyroid gland. T4 is metabolized to triiodothyronine (T3) peripherally by deiodination. T4 is considered a reservoir or prohormone for T3, the biologically most active thyroid hormone. About 0.05% of circulating T4 is in the free, or unbound, portion. The remainder is bound to thyroxine-binding globulin (TBG), prealbumin, and albumin.

The hypothalamus secretes thyrotropin-releasing hormone (TRH), which stimulates the pituitary to release thyrotropin (previously thyroid-stimulating hormone: TSH). TSH stimulates the thyroid to secrete T4. T4 is partially converted peripherally to T3. High amounts of T4 and T3 (mostly from peripheral conversion of T4) cause hyperthyroidism.

T4 and T3 cause positive feedback to the pituitary and hypothalamus with resultant suppression or stimulation of the thyroid gland as follows: decrease of TSH if T3 or T4 is high (hyperthyroidism) and increase of TSH if T3 or T4 is low (hypothyroidism).

Measurement of total T4 gives a reliable reflection of clinical thyroid status in the absence of protein-binding abnormalities and non-thyroidal illness. However, changes in binding proteins can occur that affect the level of total T4, but leave the level of unbound hormone unchanged.

See [Thyroid Function Ordering Algorithm](#) in Special Instructions.

**Reference Values**

Pediatric

0-5 days: 5.0-18.5 mcg/dL

6 days-2 months: 5.4-17.0 mcg/dL

3-11 months: 5.7-16.0 mcg/dL

1-5 years: 6.0-14.7 mcg/dL

6-10 years: 6.0-13.8 mcg/dL

11-19 years: 5.9-13.2 mcg/dL

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Adult (> or =20 years): 4.5-11.7 mcg/dL

For SI unit Reference Values, see [www.mayocliniclabs.com/order-tests/si-unit-conversion.html](http://www.mayocliniclabs.com/order-tests/si-unit-conversion.html)

**Interpretation**

Values of more than 11.7 mcg/dL in adults or more than the age-related cutoffs in children are seen in hyperthyroidism and in patients with acute thyroiditis.

Values below 4.5 mcg/dL in adults or below the age-related cutoffs in children are seen in hypothyroidism, myxedema, cretinism, chronic thyroiditis, and occasionally, subacute thyroiditis.

Increased total thyroxine (T4) is seen in pregnancy and patients who are on estrogen medication. These patients have increased total T4 levels due to increased thyroxine-binding globulin (TBG) levels.

Decreased total T4 is seen in patients on treatment with anabolic steroids or nephrosis (decreased TBG levels).

A thyrotropin-releasing hormone (TRH) stimulation test may be required for certain cases of hyperthyroidism.

Clinical findings are necessary to determine if thyrotropin, TBG, or free T4 testing is needed.

**Cautions**

In pregnancy, incomplete release of thyroxine (T4) from its binding proteins might result in falsely low total T4 levels. Therefore, total T4 should not be used as the only marker for thyroid function evaluation.

Thyrotropin (TSH) may be better than T4 as the initial test of thyroid status. TSH is elevated in primary hypothyroidism. TSH is low in primary hyperthyroidism.

Free T4 may more accurately measure the physiologic amount of T4.

Some patients who have been exposed to animal antigens, either in the environment or as part of treatment or imaging procedure, may have circulating anti-animal antibodies present. These antibodies may interfere with the assay reagents to produce unreliable results.

Autoantibodies to thyroid hormones can interfere with testing.

Binding protein anomalies may cause values that deviate from the expected results. Pathological concentrations of binding proteins can lead to results outside the reference range, although the patient may be in a euthyroid state.

In rare cases, interference due to extremely high titers of antibodies to analyte-specific antibodies, ruthenium or streptavidin can occur.

**Clinical Reference**

1. Ross DS, Burch HB, Cooper DS, et al: 2016 American Thyroid Association guidelines for diagnosis and management of hyperthyroidism and other causes of thyrotoxicosis. *Thyroid*. 2016 Oct 26(10):1343-1421

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2. Persani L, Cangiano B, Bonomi M: The diagnosis and management of central hypothyroidism in 2018. *Endocr Connect.* 2019 Feb;8(2):R44–R54 doi:10.1530/EC-18-0515

## Performance

### Method Description

The Roche Elecsys T4 (thyroxine) assay is a competitive assay using electrochemiluminescence detection. Bound T4 is released from binding proteins by 8-anilino-1-naphthalene sulfonic acid (ANS). Patient specimen is incubated with sheep polyclonal anti-T4 antibody labeled with ruthenium. Streptavidin-coated microparticles and biotinylated T4 are added for a second incubation during which the still free binding sites of the labeled antibody become occupied. The resulting immunocomplex becomes bound to the solid phase by interaction of biotin and streptavidin. The reaction mixture is aspirated into the measuring cell where the microparticles are magnetically captured onto the surface of the electrode. Unbound substances are then removed and application of a voltage to the electrode induces the electrochemiluminescent emission. This signal is measured against a calibration curve to determine patient results. (Package insert: Elecsys T4. Roche Diagnostics; V 2.0 English 03/2020)

### PDF Report

No

### Day(s) Performed

Monday through Friday

### Report Available

1 to 3 days

### Specimen Retention Time

14 days

### Performing Laboratory Location

Rochester

## Fees & Codes

### Fees

- Authorized users can sign in to [Test Prices](#) for detailed fee information.
- Clients without access to Test Prices can contact [Customer Service](#) 24 hours a day, seven days a week.
- Prospective clients should contact their Regional Manager. For assistance, contact [Customer Service](#).

### Test Classification

This test has been cleared, approved, or is exempt by the US Food and Drug Administration and is used per manufacturer's instructions. Performance characteristics were verified by Mayo Clinic in a manner consistent with CLIA requirements.

**CPT Code Information**

84436

**LOINC® Information**

| Test ID | Test Order Name               | Order LOINC® Value |
|---------|-------------------------------|--------------------|
| T4      | T4 (Thyroxine), Total Only, S | 83119-8            |

| Result ID | Test Result Name              | Result LOINC® Value |
|-----------|-------------------------------|---------------------|
| T4        | T4 (Thyroxine), Total Only, S | 83119-8             |