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AU242003

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Intended Use

The Aurora Total Thyroxine Assay is a chemiluminescent microparticle immunoassay (CMIA) for the quantitative determination of Total Thyroxine (TT4) in human serum and plasma. The assay kit is intended for in vitro diagnostic use.

Summary

Total Thyroxine (TT₄) is an iodine-containing hormone with a molecular weight of approximately 777 daltons secreted by the thyroid gland, which is an indispensable component of the integrity of hypothalamus anterior pituitary thyroid regulatory system. T₄ and its associate thyroid hormone T₃ are responsible for regulating diverse biochemical processes throughout the body which are essential for normal metabolic and neural activity. T₄ is 99.9% bound to serum thyroxine binding proteins (TBP). The hormone is transported bound primarily to thyroxine binding globulin (TBG) and secondarily by thyroxine binding prealbumin (TBPA) and albumin. Less than 0.05% of the total circulating T₄ is unbound and therefore biologically active. Clinically, T₄ measurements have long been recognized as an aid in the assessment and diagnosis of thyroid status. Elevated T₄ values are characteristically seen in patients with overt hyperthyroidism, while T₄ levels are generally depressed in patients with overt hypothyroidism. The changes of serum TBG concentration significantly affects the determination result of T₄. So, the results of measurement of T₄ should also consider the effect of changes in TBG content.

Test Principles

The Aurora Total Thyroxine assay is a quantitative competitive immunoassay to determine the presence of TT4 in human serum and plasma using CMIA technology with flexible assay protocols.

1. Sample, assay auxiliary and paramagnetic anti-T4 coated microparticles are mixed, T4 present in the sample is displaced from the T4 binding protein and binds to anti-T4 coated microparticles, forming an antigen antibody complex.

2. After incubation, a conjugate containing acridinium-labeled T4 is added to the reaction mixture and binds to unoccupied binding sites of the anti-T4 coated microparticles.
3. After further incubation and washing, Pre-Trigger and Trigger Solutions are added to the reaction mixture.
4. The resulting chemiluminescent reaction is measured as relative light units (RLUs). There is a relationship between the amount of TT4 in the sample and the RLUs detected by the optical system. Results are calculated automatically based on the previously established calibration curve.

Reagents

R1	3.0 mL
R2	3.0 mL
R3	3.0 mL
CAL	Contains 3 levels, 1.0 mL each level
CON	Contains 2 levels, 1.0 mL each level
R1:	Microparticles. Anti-T4 coated microparticles. Preservative: 0.05% ProClin 300
R2:	Conjugate. Acridinium-labeled T4. Preservative: 0.05% ProClin 300
R3:	Assay auxiliary. 8-Anilino-1-naphthalenesulfonic acid (ANS) .
CAL:	Calibrator. Solutions of different concentrations of T4. Preservative: 0.05% ProClin 300
CON:	Control. Tris buffer solution for quality control of Total Thyroxine (TT4)

Required Materials

- Pre-Trigger Solution: Hydrogen peroxide solution.
- Trigger Solution: Sodium hydroxide solution.
- Wash Buffer: Phosphate buffered saline solution with 0.05% ProClin 300.

Safety Precautions

- Exercise the normal precautions required for handling all laboratory reagents.
- Disposal of all waste material should be in accordance with local guidelines.
- Wear gloves when handling specimens or reagents.
- Clean and disinfect all spills of specimens or

reagents using a suitable disinfectant.

- Trigger solution contains sodium hydroxide (NaOH) and should be avoided contact with eyes.

Warning (Contains Proclin 300)

Hazardous Component: 0.05% Proclin 300

- Reaction mass of:
5-chloro-2-methyl-4-isothiazolin [EC no. 247-500-7]
and 2-methyl-4-isothiazolin-3-one [EC no.
200-239-6] (3:1)

Hazard Statement

- H317: May cause an allergic skin reaction.
- H319: Causes serious eye irritation.
- H410: Very toxic to aquatic life with long-lasting effects.

Precautionary Statement

- P261: Avoid breathing dust/fume/gas/mist/vapors/spray.
- P264: Wash hands thoroughly after handling.
- P272: Contaminated work clothing should not be allowed out of the workplace.
- P280: Wear protective gloves/protective clothing/eye protection/face protection.
- P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- P337+P313: If eye irritation persists: Get medical advice/attention.
- P333+P313: If skin irritation or rash occurs: Get medical advice/attention.
- P302+P352: IF ON SKIN: Wash with plenty of soap and water.
- P321: Seek immediate care from a doctor.
- P363: Wash contaminated clothing before reuse.
- P273: Avoid release to the environment.
- P391: Collect spillage.
- P501: Dispose of contents/container in a safe way.

Reagent Handling

- Do not use reagent kits beyond the expiration date.
- Do not pool reagents within a kit or between kits.
- Before loading the reagent kit on the system for

the first time, the microparticle bottle requires mixing to resuspend microparticles that may have settled during shipment.

- Septums MUST be used to prevent reagent evaporation and contamination and to ensure reagent integrity. Reliability of assay results cannot be guaranteed if septums are not used according to the instructions in this package insert.
- To avoid contamination, wear clean gloves when placing a septum on an uncapped reagent bottle.
- Once a septum has been placed on an open reagent bottle, do not invert the bottle as this will result in reagent leakage and may compromise assay results.

Reagent Storage

REAGENT	Storage Temperature	Maximum Storage Time
Unopened	2°C~8°C Do not freeze.	12 months
On board/Opened	2°C~8°C Do not freeze.	28 days

- Reagents may be stored on or off the chemiluminescence immunoassay analyzer. If reagents are removed from the analyzer, store them at 2-8°C (with septums and replacement caps) in an upright position. For reagents stored off the system, it is recommended that they be stored in their original trays and boxes to ensure they remain upright. If the microparticle bottle does not remain upright (with a septum installed) while in refrigerated storage off the system, the reagent kit must be discarded.

Calibrator & Control Storage

CAL	CON	Storage Temperature	Maximum Storage Time
Unopened		2°C~8°C	12 months
Opened		2°C~8°C	30 days

Applicable Analyzer

Automatic Chemiluminescence Immunoassay Analyzer (model: Aurora S-01).

Specimen Types

Verified specimen types to be used with this assay:

Specimen Types	Collection Tubes
Serum	Serum separator tubes (SST)
Plasma	Dipotassium EDTA Tripotassium EDTA Sodium heparin Lithium heparin powder Plasma separator tubes (PST) -lithium heparin gel

- Other specimen collection tube types have not been tested with this assay.
- Liquid anticoagulants may have a dilution effect resulting in lower concentrations for individual patient specimens.
- The instrument does not provide the capability to verify specimen type. It is the responsibility of the operator to verify that the correct specimen types are used in the assay.

Specimen Conditions

Do not use specimens with the following conditions:

- Heat-inactivated
- Pooled
- Grossly hemolyzed (> 500 mg/dl hemoglobin)
- Obvious microbial contamination
- Fungal growth
- For accurate results, serum and plasma specimens should be free of fibrin, red blood cells, and other particulate matter. Serum specimens from patients receiving anticoagulant or thrombolytic therapy may contain fibrin due to incomplete clot formation.
- To prevent cross contamination, use of disposable pipettes or pipette tips is recommended.

Preparation for Analysis

- Follow the tube manufacturer’s processing instructions for collection tubes. Gravity separation is not sufficient for specimen preparation.
- Mix thawed specimens thoroughly by low speed vortexing or by inverting 10 times. Visually inspect the specimens. If layering or stratification is observed, continue mixing until specimens are visibly homogeneous.
- Avoid more than 1 freeze/thaw cycles.

- To ensure consistency in results, specimens must be transferred to a centrifuge tube and centrifuged for a minimum of 30,000 g-minutes before testing if they contain fibrin, red blood cells, or other particulate matter, they were previously frozen.
- Examples of acceptable time and force ranges that meet this criterion are listed in the table below. Centrifugation time using alternate Relative Centrifugal Force values (RCF) can be calculated using the following formula:

Centrifugation Time (Minutes)	RCF (xg)	g × minutes
10	3,000	30,000
15	2,000	30,000
20	1,500	30,000

- Transfer clarified specimen to a sample cup or secondary tube for testing. For centrifuged specimens with a lipid layer, transfer only the clarified specimen and not the lipemic material.
- Inspect all specimens for bubbles. Remove bubbles with an applicator stick before analysis. Use a new applicator stick for each specimen to prevent cross contamination.

Specimen Storage

Specimen Type	Storage Temperature	Maximum Storage Time
Serum/Plasma	Room temperature	≤ 8 hours
	2°C~8°C	≤ 3 days
	-20°C	≤ 90 days

- Remove serum or plasma from the clot, red blood cells, or separator gel if stored longer than the maximum room temperature storage time.
- Remove serum or plasma from the clot, red blood cells, or separator gel if stored longer than the maximum 2-8°C storage time and store frozen.
- Frozen specimens must be mixed thoroughly after thawing.
- Use caution in handling patient specimens to prevent cross-contamination.
- Do not exceed the storage limitations listed above.

Assay Procedure

- Refer to the system operating instruction or the online help system for detailed information on preparing the system.
- Before loading the reagent kit on the system for the first time, the microparticle bottle requires mixing to resuspend microparticles that may have settled during shipment. After the first time the microparticles have been loaded, no further mixing is required.
- Invert the microparticle bottle 30 times. Visually inspect the bottle to ensure microparticles are resuspended. If microparticles are still adhered to the bottle, continue to invert the bottle until the microparticles have been completely resuspended. If the microparticles do not resuspend, DO NOT USE. Once the microparticles have been resuspended, place a septum on the bottle.
- Load the reagent kit on the chemiluminescence immunoassay analyzer.
- Verify that all necessary reagents are present.
- Verify adequate sample volume is present prior to running the test.
- Sample volume for first test: 250 μL
- Sample volume for each additional test from same sample cup: 10 μL
- The test-specific parameters stored in barcode on the reagent pack are read in. In cases the barcode cannot be read, enter the sequence numbers
- Order calibration, if necessary.
- Prepare Total Thyroxine Calibrators and Controls.
- Mix calibrator(s) and controls by gentle inversion before use.
- Hold bottles vertically and dispense recommended volumes into each respective sample cup.
- Place the calibrators in the calibrator rack in the sample zone.
- Calibration.
- Load samples. For information on loading samples, refer to the Analyzer's Operations Manual.
- Press RUN.
- The chemiluminescence immunoassay analyzer performs all the functions automatically and calculates the results.

For optimal performance, it is important to perform routine maintenance as described in the Analyzer's Operations Manual. Perform maintenance more frequently when required by laboratory procedures.

Sample Dilution Procedures

Samples cannot be diluted for TT4 determinations. Samples which read $> 24.86 \mu\text{g/dL}$ should be reported as such.

Calibration

- Traceability: This assay has been standardized against the ID-GC/MS.
- Every TT4 assay kit has a two-dimension code label containing the predefined master curve of the particular reagent lot.
- Test Calibrators in duplicate. The calibrators should be priority loaded. A replicate of each control level must be tested to evaluate the assay calibration. Ensure that assay control values are within the ranges specified in the respective control package insert.
- Once calibration is accepted and stored, all subsequent samples may be tested without further calibration unless:
 - After 28 days when using the same lot reagent.
 - A reagent kit with a new lot number is used.
 - Controls are out of range.
 - Required by pertinent regulations.
- Assay may also need to be recalibrated after specified service procedures have been performed or maintenance to critical part or subsystems that might influence the performance of the assay. For detailed information on how to perform an assay calibration, refer to the Analyzer's Operations Manual.
- Calibration Range: $0.42 \mu\text{g/dL} \sim 24.86 \mu\text{g/dL}$.

Quality Control Procedures

- Order Control, if necessary.
- The recommended control requirement for the TT4 assay is that a single replicate of each control level be tested:
 - Once every 24 hours each day of use
 - After performing calibration
 - After instrument service procedures or

maintenance that may affect assay performance have been performed.

- If the quality control procedures in your laboratory require more frequent use of controls to verify test results, follow your laboratory-specific procedures.
- Each laboratory should establish control ranges to monitor the acceptable performance of the assay. If a control is out of its specified range, the associated sample results are invalid and the samples must be retested. Recalibration may be indicated.
- These results should be applied to your laboratory's quality control practices. In addition, the laboratory must ensure that the matrix of the control material is suitable for use in the assay per the assay package insert.
- Unless specified, target values and ranges provided with the commercial control product insert are guidelines only and should not be used for quality control purposes.
- Refer to Clinical and Laboratory Standards Institute (CLSI) Document C24-A3, or other published guidelines for general quality control recommendations.

Results

Calculation

- The analyzer automatically calculates the concentration of each sample. The results are given in nmol/L.

Alternate Result Units

- The default result unit for the TT4 assay is nmol/L. When the alternate result unit, µg/dL, is selected, the conversion factor used by the system is 12.872.
- Conversion Formula:
- $(\text{Concentration in } \mu\text{g/dL}) \times (12.872) = \text{Concentration in nmol/L.}$

Limits

- Results should be used in conjunction with other data; e.g., symptoms, results of other tests, and clinical impressions.
- If the TT4 results are inconsistent with clinical

evidence, additional testing is recommended.

- Specimens from patients who have received preparations of mouse monoclonal antibodies for diagnosis or therapy may contain human anti-mouse antibodies (HAMA). Such specimens may show either falsely elevated or depressed values when tested with assay kits that employ mouse monoclonal antibodies. Additional information may be required for diagnosis.
- Heterophilic antibodies in human serum can react with reagent immunoglobulins, interfering with in vitro immunoassays. Patients routinely exposed to animals or to animal serum products can be prone to this interference, and anomalous values may be observed. Additional information may be required for diagnosis.
- Rheumatoid factor (RF) in human serum can react with reagent immunoglobulins, interfering with in vitro immunoassays. Additional information may be required for diagnosis.
- The Aurora Total Thyroxine assay is susceptible to interference effects from triglycerides at > 500 mg/dL.

Expected Values

- It is recommended that each laboratory establish its own reference range, which may be unique to the population it serves depending upon geographical, season, patient, dietary, or environmental factors. A study was performed based on guidance from Clinical and Laboratory Standards Institute (CLSI) C28-A3c.
- Human serum specimens from apparently healthy individuals were collected the 150 specimens, 75 were female and 75 were male, age between 21 and 90 years.

The population	n	Reference range*
Apparently healthy individuals	150	5.36 µg/dL ~15.28 µg/dL

*According to the 92.5th-97.5th percentile.

*Representative data; results in individual laboratories and in different geographical areas may vary from these data.

Specific Performance Characteristics

- Data in the section SPECIFIC PERFORMANCE CHARACTERISTICS were generated using the Aurora S-01 Automatic Chemiluminescence Immunoassay Analyzer System.
- Assay results obtained in individual laboratories may vary from data presented.

Limit of Blank (LoB)

- The Limit of Blank was determined in accordance with the CLSI (Clinical and Laboratory Standards Institute) EP17-A requirements.
- The Limit of Blank is the 95th percentile value from $n \geq 20$ measurements of analyte-free samples over several independent series. The Limit of Blank corresponds to the concentration below which analyte-free samples are found with a probability of 95 %.
- The observed LoB value was $\leq 0.42 \mu\text{g/dL}$.

Precision

Intra Assay Variation

- Within run variation was determined by replicate determination ($n=10$) of three different control sera in one assay. The within assay variability is $\leq 8.0\%$.

Inter Assay Variation

- Between run variation was determined by replicate measurements ($n=10$) of three different control sera in 3 different lots. The between assay variability is $\leq 15.0\%$.

Intra-Assay, n=10			Inter-Assay, n=10x3		
Sample	Mean ($\mu\text{g/dL}$)	CV	Sample	Mean ($\mu\text{g/dL}$)	CV
1	2.136	4.25%	1	2.127	4.56%
2	16.768	4.92%	2	16.430	5.12%

Linearity

- The linearity was determined in accordance with the CLSI (Clinical and Laboratory Standards Institute) EP6-A requirements.
- The linearity range was verified by more than 6 concentration levels which encompass or be equal to the minimum and the maximum values of linearity range and duplicate assays ($n=3$) at all levels.

- The Aurora Total Thyroxine assay has been demonstrated to be linear from $0.42 \mu\text{g/dL}$ to $24.86 \mu\text{g/dL}$, regression ≥ 0.99 and max diff $\leq 15\%$ in this interval.

Specificity

Cross-Reactivity

- A study was performed based on guidance from CLSI EP7-A2.
- The cross-reactants listed below (Using TT4-free samples) were evaluated to determine whether TT4 concentrations were affected when using the Aurora Total Thyroxine Assay.

Cross-Reactant	Cross-Reactant Concentration	Results
T3	500 ng/mL	$\leq 1.5 \mu\text{g/dL}$
rT3	50 ng/mL	$\leq 1.5 \mu\text{g/dL}$

Interference





- A study was performed based on guidance from CLSI EP7-A2.
- Potentially interfering substances were evaluated to determine whether TT4 concentrations were affected when using the Aurora Total Thyroxine assay. Samples containing the potential interferences were prepared at two TT4 concentrations. The samples were assayed, and the TT4 concentrations of the spiked samples were compared to the reference samples.

Potential Interferent	Interferent Concentration	% Interferent Bias
Bilirubin	20 mg/dL	$\leq 10\%$
Hb	500 mg/dL	$\leq 10\%$
Intralipid	1000 mg/dL	$\leq 10\%$
Total protein	10 g/dL	$\leq 10\%$
RF	1000IU/mL	$\leq 10\%$
ANA	400AU/mL	$\leq 10\%$
HAMA	600ng/mL	$\leq 10\%$


Reference


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2. Oppenheimer JH. Role of Plasma Proteins in the Binding, Distribution and Metabolism of the Thyroid Hormones. N Engl J Med 1968; 278:1153-1162.
3. Gunjača, Matana A, Boutin T, et al. Genome-wide association meta-analysis for total thyroid hormone levels in Croatian population[J]. Journal of Human Genetics, 2019.
4. Wilke T J, Eastment H T. Discriminative ability of tests for free and total thyroid hormones in diagnosing thyroid disease. [J]. Clinical Chemistry (9):1746.
5. Feng G, Tian X, Wang L, et al. Low TT4 as a predictor of poor outcomes in severe encephalitis: a multivariate analysis of 94 patients[J]. Expert Review of Neurotherapeutics, 2018:14737175.2018.1452613.

-  Conjugate
-  Assay auxiliary.
-  Calibrator
-  Control

Contact Information

 Medunion S.L.
Carrer de Tapioles 33, 2-1, 08004,
Barcelona, SPAIN.















 Carbon Technologies LLC
Innovation Park Muscat (IPM), P.O. Box 92,
Al Khoudh 123, Muscat, OMAN.

24-hour service hotline: +968-97058350
After-sale Service Center: Carbon Technologies LLC



Release Date: Date of Manufacture:

Symbols

-  Manufacturer
-  Date of manufacture
-  Use-by date
-  Contains sufficient for <n> tests
-  Consult instructions for use
-  Biological risks
-  Temperature limit
-  CE Marking
-  EU Representative
-  In Vitro diagnostic medical device
-  Catalogue Number
-  Batch code
-  Reagent
-  Microparticles