

# Elecsys Anti-TSHR

REF			SYSTEM
08496633190	08496633500	300	cobas e 402 cobas e 801

## English

### System information

Short name	ACN (application code number)
ATSHR	10174

### Intended use

Immunoassay for the in vitro quantitative determination of autoantibodies to TSH receptor in human serum using a human thyroid stimulating monoclonal antibody. The anti-TSH receptor determination is used as an aid in the differential diagnosis of Graves' disease.

The electrochemiluminescence immunoassay "ECLIA" is intended for use on **cobas e** immunoassay analyzers.

### Summary

Hyperthyroidism in Graves' disease (autoimmune hyperthyroidism) is typically caused by autoantibodies to the thyroid stimulating hormone receptor (TSHR), and measurement of these TSHR antibodies (TRAb) can be useful in disease diagnosis and management.<sup>1,2,3,4,5</sup>

TSH autoantibodies can be classified as stimulating, blocking or neutral depending on their mechanism of action. Despite having actions similar to TSH, TSHR stimulating antibodies are not subject to the negative feedback mechanisms associated with TSH, leading to prolonged activation of the TSHR. This results in the elevated thyroid hormone levels and clinical thyrotoxic state associated with Graves' disease.<sup>6,7</sup>

Indications for TRAb determination include:

- the detection or exclusion of autoimmune hyperthyroidism and its differentiation from disseminated autotomy of the thyroid gland. The presence of TRAb indicates that the patient's thyrotoxicosis is of autoimmune etiology rather than due to toxic nodular goiter.<sup>8,9</sup> Because the aim of treatment for Graves' disease may differ from the treatment of other forms of thyrotoxicosis, an initial TRAb determination is clearly of value.
- monitoring the therapy of Graves' disease patients and prediction of relapse, thereby constituting an important decision-making aid in treatment management. TRAb levels tend to fall during antithyroid drug therapy for Graves' disease. Low levels or the absence of TRAb after a course of drug treatment may indicate disease remission, and therefore the withdrawal of therapy can be considered.<sup>10,11,12</sup>
- TRAb measurement during the last trimester of pregnancy. Because TRAb are IgG-class antibodies, they cross the placenta and can cause neonatal thyroid disease. The measurement of TRAb during pregnancy in patients with a history of thyroid disease is therefore important in assessing the risk of thyroid disease in the neonate.<sup>13,14</sup>

Over the last few decades there has been a substantial improvement in TRAb detection methodologies in clinical practice and the available assays have undergone several important modifications. Available second generation assays using coated plate or tube technique with antibody-immobilized human or porcine TSHR determine the ability of serum TRAb to inhibit the binding of labeled TSH to the receptor.<sup>15,16</sup> The sensitivity and predictive value of these assays in Graves' disease patient management are independent of whether human recombinant or native porcine TSHR is used.<sup>13,17,18,19,20</sup>

The availability of a human thyroid stimulating monoclonal antibody (M22)<sup>20,21</sup> has allowed the development of a third generation TRAb assay system in which patient serum autoantibodies inhibit the binding of the labeled thyroid stimulating antibody (rather than labeled TSH) to the TSHR.<sup>22</sup> These new assays show excellent reproducibility, sensitivity and specificity for detecting Graves' disease and discriminating from other thyroid diseases, as well as a similar or improved performance compared with established second generation assays.<sup>23,24,25,26,27</sup>

The availability of fully automated TRAb assays has allowed to reduce manual procedures and integration of this assay into the workflow on routine laboratory analyzers.<sup>25,27</sup>

Solubilized porcine TSH receptor (pTSHR) immunocomplexed with a biotinylated mouse monoclonal antibody to the porcine TSH receptor

C-terminus and human monoclonal autoantibody M22 as a ruthenium<sup>a)</sup> labeled assay ligand are used in the Elecsys Anti-TSHR assay.

a) Tris(2,2'-bipyridyl)ruthenium(II)-complex (Ru(bpy)<sub>3</sub><sup>2+</sup>)

### Test principle

Competition principle. Total duration of assay: 27 minutes.

- 1st incubation: 30 µL of serum sample are incubated with pretreatment buffer solution (ATSHR PT1) and pretreatment reagent buffer (ATSHR PT2) consisting of a pre-formed immunocomplex of solubilized pTSHR and biotinylated anti-porcine TSH receptor mouse monoclonal antibody. TRAb in patient's sera are allowed to interact with the TSHR complex.
- 2nd incubation: After addition of buffer solution, TRAb are allowed to further interact with the TSHR complex.
- 3rd incubation: After addition of streptavidin-coated microparticles and a human thyroid stimulating monoclonal autoantibody (M22) labeled with a ruthenium complex, bound TRAb are detected by their ability to inhibit the binding of labeled M22. The entire complex becomes bound to the solid phase via 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 with ProCell II M. Application of a voltage to the electrode then induces chemiluminescent emission which is measured by a photomultiplier.
- Results are determined via a calibration curve which is instrument-specifically generated by 2-point calibration and a master curve provided via the **cobas** link.

### Reagents - working solutions

The **cobas e** pack (M, R1, R2) is labeled as ATSHR.

#### cobas e pack

- M Streptavidin-coated microparticles, 1 bottle, 12.4 mL:  
Streptavidin-coated microparticles 0.72 mg/mL; preservative.
- R1 Buffer solution, 1 bottle, 12.0 mL:  
Phosphate buffer 20 mmol/L, pH 7.4; stabilizers; preservative.
- R2 Anti-TSHR~Ru(bpy)<sub>3</sub><sup>2+</sup>, 1 bottle, 13.9 mL:  
Monoclonal anti-TSHR antibody M22 (human) labeled with ruthenium complex approximately 0.3 mg/L; phosphate buffer 20 mmol/L, pH 7.4; stabilizers; preservative.

#### Pretreatment reagents

- ATSHR PT1 Pretreatment buffer solution (black cap), 1 bottle, 6.3 mL:  
Phosphate buffer 20 mmol/L, pH 7.4; stabilizers; preservative.
- ATSHR PT2 Empty bottle (white cap) for pretreatment reagent (PTR) reconstituted with pretreatment buffer (PTB).
- ATSHR PTR Pretreatment reagent, pTSHR-anti-pTSHR-Ab-biotin complex (white cap), 2 bottles for 4.0 mL each of PTB:  
Phosphate buffer 40 mmol/L, pH 7.2; stabilizers.
- ATSHR PTB Pretreatment buffer (white cap), 2 bottles of 5.0 mL each:  
Reconstitution medium for PTR; phosphate buffer 10 mmol/L, pH 7.2; stabilizer.

### Precautions and warnings

For in vitro diagnostic use for health care professionals. Exercise the normal precautions required for handling all laboratory reagents.

Infectious or microbial waste:

Warning: handle waste as potentially biohazardous material. Dispose of waste according to accepted laboratory instructions and procedures.

# Elecsys Anti-TSHR

## Environmental hazards:

Apply all relevant local disposal regulations to determine the safe disposal.  
Safety data sheet available for professional user on request.

This kit contains components classified as follows in accordance with the Regulation (EC) No. 1272/2008:



## Warning

H317 May cause an allergic skin reaction.

H319 Causes serious eye irritation.

## Prevention:

P261 Avoid breathing mist or vapours.

P280 Wear protective gloves/ eye protection/ face protection.

## Response:

P333 + P313 If skin irritation or rash occurs: Get medical advice/attention.

P337 + P313 If eye irritation persists: Get medical advice/attention.

P362 + P364 Take off contaminated clothing and wash it before reuse.

## Disposal:

P501 Dispose of contents/container to an approved waste disposal plant.

Product safety labeling follows EU GHS guidance.

Contact phone: all countries: +49-621-7590

All human material should be considered potentially infectious. All products derived from human blood are prepared exclusively from the blood of donors tested individually and shown to be free from HBsAg and antibodies to HCV and HIV. The testing methods use assays that have been approved by the FDA or that are in compliance with the legal rules applicable to placing in vitro diagnostic medical devices for human use on the market in the European Union.

However, as no testing method can rule out the potential risk of infection with absolute certainty, the material should be handled with the same level of care as a patient specimen. In the event of exposure, the directives of the responsible health authorities should be followed.<sup>28,29</sup>

Avoid foam formation in all reagents and sample types (specimens, calibrators and controls).

## Reagent handling

The reagents (M, R1, R2) in the kit are ready-for-use and are supplied in **cobas e** packs.

### Pretreatment reagents

The pretreatment reagent (bottle ATSHR PT2) is not ready for use and has to be prepared. See "Preparation of working solutions" for further details.

### Preparation of working solutions

*Reconstitution of pretreatment reagent (ATSHR PTR, white cap) with pretreatment buffer (ATSHR PTB, white cap):*

Carefully dissolve the contents of the lyophilized pretreatment reagent (ATSHR PTR; 2 bottles) by adding exactly 4.0 mL of pretreatment buffer (ATSHR PTB) to each bottle.

Allow to reconstitute closed for 60 minutes by permanent gentle agitation with a rotator until complete solution is obtained.

Pour the working solution of ATSHR PTR/PTB from both bottles (8.0 mL in total) carefully into the empty bottle (ATSHR PT2; white cap). Avoid foam formation!

## Storage and stability

Store at 2-8 °C.

Do not freeze.

Store the **cobas e** pack **upright** in order to ensure complete availability of the microparticles during automatic mixing prior to use.

Stability of the <b>cobas e</b> pack:	
unopened at 2-8 °C	up to the stated expiration date
on the analyzers	16 weeks

Stability of the pretreatment reagents:	
unopened at 2-8 °C	up to the stated expiration date
after reconstitution (ATSHR PT2) at 2-8 °C or on the analyzers	16 weeks

## Specimen collection and preparation

Only the specimens listed below were tested and found acceptable.

Serum collected using standard sampling tubes or tubes containing separating gel.

Stable for 7 hours at 20-25 °C, 6 days at 2-8 °C, 12 months at -20 °C (± 5 °C). Freeze only once.

The sample types listed were tested with a selection of sample collection tubes that were commercially available at the time of testing, i.e. not all available tubes of all manufacturers were tested. Sample collection systems from various manufacturers may contain differing materials which could affect the test results in some cases. When processing samples in primary tubes (sample collection systems), follow the instructions of the tube manufacturer.

Centrifuge samples containing precipitates before performing the assay.

Do not use heat-inactivated samples.

Do not use samples and controls stabilized with azide.

Ensure the samples and calibrators are at 20-25 °C prior to measurement.

Due to possible evaporation effects, samples and calibrators on the analyzers should be analyzed/measured within 2 hours.

## Materials provided

See "Reagents – working solutions" section for reagents.

## Materials required (but not provided)

- [REF] 05042666191, PreciControl ThyroAB, for 4 x 2.0 mL
- [REF] 08496641190, CalSet Anti-TSHR, for 4 x 2.0 mL
- General laboratory equipment

## **cobas e** analyzer

Additional materials for **cobas e** 402 and **cobas e** 801 analyzers:

- [REF] 06908799190, ProCell II M, 2 x 2 L system solution
- [REF] 04880293190, CleanCell M, 2 x 2 L measuring cell cleaning solution
- [REF] 07485409001, Reservoir Cup, 8 cups to supply ProCell II M and CleanCell M
- [REF] 05694302001, Assay Tip/Assay Cup tray, 6 magazines x 6 magazine stacks x 105 assay tips and 105 assay cups, 3 wasteliners
- [REF] 07485425001, Liquid Flow Cleaning Cup, 2 adaptor cups to supply ISE Cleaning Solution/Elecsys SysClean for Liquid Flow Cleaning Detection Unit
- [REF] 07485433001, PreWash Liquid Flow Cleaning Cup, 1 adaptor cup to supply ISE Cleaning Solution/Elecsys SysClean for Liquid Flow Cleaning PreWash Unit
- [REF] 11298500316, ISE Cleaning Solution/Elecsys SysClean, 5 x 100 mL system cleaning solution

## Assay

For optimum performance of the assay follow the directions given in this document for the analyzer concerned. Refer to the appropriate operator's manual for analyzer-specific assay instructions.

Resuspension of the microparticles takes place automatically prior to use.

# Elecsys Anti-TSHR

Place the cooled (stored at 2-8 °C) **cobas e** pack on the reagent manager. Avoid foam formation. The system automatically regulates the temperature of the reagents and the opening/closing of the **cobas e** pack.

## Calibration

**Traceability:** This method has been standardized against the NIBSC (National Institute for Biological Standards and Control) 1st IS 90/672 Standard.

The predefined master curve is adapted to the analyzer using the relevant CalSet.

**Calibration frequency:** Calibration must be performed once per reagent lot using fresh reagent (i.e. not more than 24 hours since the reagent kit was registered on the analyzer).

Calibration interval may be extended based on acceptable verification of calibration by the laboratory.

Renewed calibration is recommended as follows:

- daily
- as required: e.g. quality control findings outside the defined limits

## Quality control

For quality control, use PreciControl ThyroAB.

In addition, other suitable control material can be used.

Controls for the various concentration ranges should be run individually at least once every 24 hours when the test is in use, once per **cobas e** pack, and following each calibration.

The control intervals and limits should be adapted to each laboratory's individual requirements. Values obtained should fall within the defined limits. Each laboratory should establish corrective measures to be taken if values fall outside the defined limits.

If necessary, repeat the measurement of the samples concerned.

Follow the applicable government regulations and local guidelines for quality control.

## Calculation

The analyzer automatically calculates the analyte concentration of each sample in IU/L.

## Limitations - interference

The effect of the following endogenous substances and pharmaceutical compounds on assay performance was tested. Interferences were tested up to the listed concentrations and no impact on results was observed.

### Endogenous substances

Compound	Concentration tested
Bilirubin	≤ 427 µmol/L or ≤ 25 mg/dL
Hemoglobin	≤ 0.248 mmol/L or ≤ 400 mg/dL
Intralipid	≤ 1500 mg/dL
Biotin	≤ 2456 nmol/L or ≤ 600 ng/mL
Rheumatoid factors	≤ 600 IU/mL

**Criterion:** For concentrations of 1.1-5 IU/L the deviation is ≤ ± 0.75 IU/L. For concentrations ≥ 5-40 IU/L the deviation is ≤ 15 %.

The assay result is not affected in samples with biotin concentrations up to 600 ng/mL (2456 nmol/L). Some studies have shown that serum concentrations of biotin can reach up to 355 ng/mL within the first hour after biotin ingestion for subjects consuming supplements of 20 mg biotin per day.<sup>30</sup> Concentrations up to 1160 ng/mL have been described after a single dose of 300 mg biotin used in controlled settings.<sup>31</sup> If the biotin threshold for the assay is exceeded the result will have a positive bias (e.g. 114 % at 675 ng/mL).

### Pharmaceutical substances

In vitro tests were performed on 17 commonly used pharmaceuticals. No interference with the assay was found except for sodium heparin. Do not use samples from patients under sodium heparin treatment. Sodium heparin showed no interference up to a concentration of 50 IU/L.

In addition, the following special thyroid drugs were tested. No interference with the assay was found.

### Special thyroid drugs

Drug	Concentration tested mg/L
Amiodarone	≤ 200
Carbimazole	≤ 30
Flucortolone	≤ 20
Hydrocortisone	≤ 200
Iodide	≤ 0.040
Levothyroxine	≤ 0.250
Liothyronine	≤ 0.015
Thiamazole	≤ 16
Octreotide	≤ 0.300
Perchlorate	≤ 400
Prednisolone	≤ 20
Propranolol	≤ 240
Propylthiouracil	≤ 60

Drug interferences are measured based on recommendations given in CLSI guidelines EP07 and EP37 and other published literature. Effects of concentrations exceeding these recommendations have not been characterized.

In rare cases, interference due to extremely high titers of antibodies to test-specific antibodies, streptavidin or ruthenium can occur. These effects are minimized by suitable test design.

For diagnostic purposes, the results should always be assessed in conjunction with the patient's medical history, clinical examination and other findings.

## Limits and ranges

### Measuring range

0.8-40 IU/L (defined by the Limit of Detection and the maximum of the master curve). Values below the Limit of Detection are reported as < 0.8 IU/L. Values above the measuring range are reported as > 40 IU/L.

### Lower limits of measurement

*Limit of Blank, Limit of Detection and Limit of Quantitation*

Limit of Blank = 0.5 IU/L

Limit of Detection = 0.8 IU/L

Limit of Quantitation = 1.1 IU/L

The Limit of Blank, Limit of Detection and Limit of Quantitation were determined in accordance with the CLSI (Clinical and Laboratory Standards Institute) EP17-A2 requirements.

The Limit of Blank is the 95<sup>th</sup> percentile value from n ≥ 60 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 Limit of Detection is determined based on the Limit of Blank and the standard deviation of low concentration samples. The Limit of Detection corresponds to the lowest analyte concentration which can be detected (value above the Limit of Blank with a probability of 95 %).

The Limit of Quantitation is the lowest analyte concentration that can be reproducibly measured with an intermediate precision CV of ≤ 20 %.

### Dilution

Samples with anti-TSHR concentrations above the measuring range can be diluted manually with anti-TSHR negative serum pool. The recommended dilution is 1:5 to 1:10. The concentration of the diluted sample must be ≥ 4 IU/L. After dilution, multiply the result by the dilution factor.

**Please note:** The autoantibodies are heterogeneous and this gives rise to non-linear dilution phenomena for certain individual samples.

### Expected values

In an external study using the Elecsys Anti-TSHR assay on samples from 436 apparently healthy individuals, 210 patients with thyroid diseases\* without diagnosis of Graves' disease, and 102 patients with untreated Graves' disease an optimal cutoff of 1.75 IU/L was determined. At this

# Elecsys Anti-TSHR

cutoff the sensitivity was calculated at 97 % and the specificity at 99 %. The calculated receiver operating characteristic (ROC) curve had an area under the curve (AUC) of 0.99. The upper limits of anti-TSHR values in the cohorts of healthy individuals and patients with thyroid disease without diagnosis of Graves' disease were 1.22 IU/L and 1.53 IU/L, respectively (97.5<sup>th</sup> percentiles).

\*91 subacute thyroiditis, 45 adenomatous goiter, 27 Hashimoto's disease, 32 painless thyroiditis, 7 autonomously functioning thyroid nodules, 1 toxic multinodular goiter, 7 others

Each laboratory should investigate the transferability of the expected values to its own patient population and if necessary determine its own reference ranges.

## Specific performance data

Representative performance data on the analyzers are given below. Results obtained in individual laboratories may differ.

## Precision

Precision was determined using Elecsys reagents, pooled human sera and controls in a protocol (EP05-A3) of the CLSI (Clinical and Laboratory Standards Institute): 2 runs per day in duplicate each for 21 days (n = 84). The following results were obtained:

cobas e 402 and cobas e 801 analyzers					
Sample	Mean IU/L	Repeatability		Intermediate precision	
		SD IU/L	CV %	SD IU/L	CV %
Human serum 1	1.12	0.115	10.3	0.194	17.3
Human serum 2	1.81	0.140	7.8	0.199	11.0
Human serum 3	21.8	0.296	1.4	0.403	1.9
Human serum 4	37.9	0.483	1.3	0.635	1.7
PC <sup>b)</sup> THYRO1	3.88	0.143	3.7	0.229	5.9
PC THYRO2	16.2	0.331	2.0	0.419	2.6

b) PC = PreciControl

## Method comparison

a) A comparison of the Elecsys Anti-TSHR assay, [REF] 08496633190 (cobas e 801 analyzer; y), with the Elecsys Anti-TSHR assay, [REF] 07026951190 (cobas e 801 analyzer; x), gave the following correlations (IU/L):

Number of samples measured: 142

Passing/Bablok<sup>32</sup> Linear regression

$$y = 1.02x - 0.158$$

$$y = 1.03x - 0.266$$

$$\tau = 0.934$$

$$r = 1.00$$

The sample concentrations were between 0.862 and 38.4 IU/L.

b) A comparison of the Elecsys Anti-TSHR assay, [REF] 08496633190 (cobas e 402 analyzer; y), with the Elecsys Anti-TSHR assay, [REF] 08496633190 (cobas e 801 analyzer; x), gave the following correlations (IU/L):

Number of samples measured: 140

Passing/Bablok<sup>32</sup> Linear regression

$$y = 1.02x - 0.107$$

$$y = 1.02x - 0.137$$

$$\tau = 0.980$$

$$r = 1.00$$

The sample concentrations were between 0.970 and 38.9 IU/L.

## Analytical specificity

No influence with human autoantibodies to thyroglobulin (< 4000 IU/mL) or anti-TPO (< 600 IU/mL) was detectable.

Cross-reactant	Concentration tested mIU/mL
Human LH	< 10000

Cross-reactant	Concentration tested mIU/mL
Human FSH	< 10000
hCG	< 50000

## References

- McIntosh RS, Asghar MS, Weetman AP. The antibody response in human autoimmune thyroid disease. *Clin Sci* 1997;92:529-541.
- Schott M, Seibler J, Scherbaum WA. Diagnostic testing for autoimmune thyroid diseases. *J Lab Med* 2006;34(4):254-257.
- Feldt-Rasmussen U. Analytical and clinical performance goals for testing autoantibodies to thyroperoxidase, thyroglobulin, and thyrotropin receptor. *Clin Chem* 1996;42(1):160-163.
- Farid NR, Szkudlinski MW. Minireview: structural and functional evolution of the thyrotropin receptor. *Endocrinology* 2004;145(9):4048-4057.
- Rapoport B, Chazenbalk GD, Jaume JC, et al. The thyrotropin (TSH) receptor: interaction with TSH and autoantibodies. *Endocrine Reviews* 1998;19(6):673-716.
- Michalek K, Morshed SA, Latif R, et al. TSH receptor autoantibodies. *Autoimmun Rev* 2009;9(2):113-116.
- Chiamolera MI, Wondisford FE. Minireview: Thyrotropin-releasing hormone and the thyroid hormone feedback mechanism. *Endocrinology* 2009;150:1091-1096.
- Paunkovic J, Paunkovic N. Does autoantibody-negative Graves' disease exist? A second evaluation of the clinical diagnosis. *Horm Metab Res* 2006;38:53-56.
- Sturniolo G, Gagliano E, Tonante A, et al. Toxic multinodular goitre. Personal case histories and literature review. *G Chir* 2013;34(9-10):257-259.
- Quadbeck B, Hoermann R, Roggenbuck U, et al. Sensitive thyrotropin and thyrotropin-receptor antibody determinations one month after discontinuation of antithyroid drug treatment as predictors of relapse in Graves' disease. *Thyroid* 2005;15:1047-1054.
- Okamoto Y, Tanigawa SI, Ishikawa K, et al. TSH receptor antibody measurements and prediction of remission in Graves' disease patients treated with minimum maintenance doses of antithyroid drugs. *Endocr J* 2006;53(4):467-472.
- Zöphel K, Wunderlich G, Kopprasch C, et al. Predictive value of thyrotropin receptor antibodies using the second generation TRAb human assay after radioiodine treatment in Graves' disease. *Nuklearmedizin* 2003;42:63-70.
- Barbesino G, Tomer Y. Clinical Utility of TSH Receptor Antibodies. *J Clin Endocrinol Metab* 2013;98:2247-2255.
- Kamijo K. TSH-receptor antibodies determined by the first, second and third generation assays and thyroid-stimulating antibody in pregnant patients with Graves' disease. *Endocr J* 2007;54(4):619-624.
- Bolton J, Sanders J, Oda Y, et al. Measurement of thyroid-stimulating hormone receptor autoantibodies by ELISA. *Clin Chem* 1999;45:2285-2287.
- Costagliola S, Morgenthaler NG, Hoermann R, et al. Second generation assay for thyrotropin receptor antibodies has superior diagnostic sensitivity for Graves' disease. *J Clin Endocrinol Metab* 1999;84:90-97.
- Kamijo K. TSH receptor antibody measurement in patients with various thyrotoxicosis and Hashimoto's thyroiditis: a comparison of two two-step assays, coated plate ELISA using porcine TSH-receptor and coated tube radioassay using human recombinant TSH-receptor. *Endocr J* 2003;50(1):113-116.
- Zöphel K, Wunderlich G. Predictive value of TSH receptor antibody measurement in Graves' disease is independent on the TSH receptor (human or porcine) but depends on the generation of the assay used. *Endocr J* 2006;53(6):869-870.
- Zöphel K, von Landenberg P, Roggenbuck D, et al. Are porcine and human TSH receptor antibody measurements comparable? *Clin Lab* 2008;54(1-2):1-8.

# Elecsys Anti-TSHR

- 20 Sanders J, Evans M, Premawardhana LDKE, et al. Human monoclonal thyroid stimulating autoantibody. *Lancet* 2003;362:126-128.
- 21 Sanders J, Jeffreys J, Depraetere H, et al. Characteristics of a human monoclonal autoantibody to the thyrotropin receptor: sequence, structure and function. *Thyroid* 2004;14:560-570.
- 22 Rees Smith B, Bolton J, Young S, et al. A new assay for thyrotropin receptor autoantibodies. *Thyroid* 2004;14:830-835.
- 23 Hermsen D, Broecker-Preuss M, Casati M, et al. Technical evaluation of the first fully automated assay for the detection of TSH receptor autoantibodies. *Clinica Chimica Acta* 2009;401:84-89.
- 24 Hermsen D, Eckstein A, Schinner S, et al. Reproducibility of Elecsys® Anti-TSHR Test Results in a Lot-to-Lot Comparison. *Horm Metab Res* 2010;42:295-297.
- 25 Schott M, Hermsen D, Broecker-Preuss M, et al. Clinical value of the first automated TSH receptor autoantibody assay for the diagnosis of Graves' disease (GD): an international multicenter trial *Clin Endocrinol* 2009;71:566-573.
- 26 Syme NR, Toft AD, Stoddart M, et al. Clinical performance of the Roche cobas e411 automated assay system for thyrotropin-receptor antibodies for the diagnosis of Graves' disease. *Ann Clin Biochem* 2011;48:471-473.
- 27 Tozzoli R, Bagnasco M, Giavarina D, et al. TSH receptor autoantibody immunoassay in patients with Graves' disease: Improvement of diagnostic accuracy over different generations of methods. Systematic review and meta-analysis. *Autoimmun Rev* 2012;12:107-113.
- 28 Occupational Safety and Health Standards: Bloodborne pathogens. (29 CFR Part 1910.1030). Fed. Register.
- 29 Directive 2000/54/EC of the European Parliament and Council of 18 September 2000 on the protection of workers from risks related to exposure to biological agents at work.
- 30 Grimsey P, Frey N, Bendig G, et al. Population pharmacokinetics of exogenous biotin and the relationship between biotin serum levels and in vitro immunoassay interference. *Int J Pharmacokinet* 2017;2:247-256, Future Science Ltd London, UK. cited 2018 Jan 1. Available from: <http://www.future-science.com/doi/10.4155/ipk-2017-0013>
- 31 Piketty ML, Prie D, Sedel F, et al. High-dose biotin therapy leading to false biochemical endocrine profiles: validation of a simple method to overcome biotin interference. *Clin Chem Lab Med* 2017 May 1;55(6):817-825. doi: 10.1515/cclm-2016-1183.
- 32 Bablok W, Passing H, Bender R, et al. A general regression procedure for method transformation. Application of linear regression procedures for method comparison studies in clinical chemistry, Part III. *J Clin Chem Clin Biochem* 1988 Nov;26(11):783-790.

This product or portions thereof is manufactured under license from RSR Ltd., Cardiff, UK, under patents including EP1021721, EP1456234, EP1565493, EP2383296, US6844162, US8298769, US8298771, US8309693, US9751940, US8110664, US8753637, US8900823, and foreign equivalents of these patent rights. Additional patents pending.

For further information, please refer to the appropriate operator's manual for the analyzer concerned, the respective application sheets, the product information and the Method Sheets of all necessary components (if available in your country).

A point (period/stop) is always used in this Method Sheet as the decimal separator to mark the border between the integral and the fractional parts of a decimal numeral. Separators for thousands are not used.

Any serious incident that has occurred in relation to the device shall be reported to the manufacturer and the competent authority of the Member State in which the user and/or the patient is established.

## Symbols

Roche Diagnostics uses the following symbols and signs in addition to those listed in the ISO 15223-1 standard (for USA: see [dialog.roche.com](http://dialog.roche.com) for definition of symbols used):

CONTENT	Contents of kit
SYSTEM	Analyzers/Instruments on which reagents can be used
REAGENT	Reagent

CALIBRATOR

Calibrator



Volume after reconstitution or mixing

GTIN

Global Trade Item Number

COBAS, COBAS E, ELECSYS and PRECICONTROL are trademarks of Roche. INTRALIPID is a trademark of Fresenius Kabi AB.

All other product names and trademarks are the property of their respective owners.

Additions, deletions or changes are indicated by a change bar in the margin.

© 2023, Roche Diagnostics



Roche Diagnostics GmbH, Sandhofer Strasse 116, D-68305 Mannheim  
[www.roche.com](http://www.roche.com)

+800 5505 6606

