# Application Sheet

Laboratory Name

## Test Name: Albumin Gen.2

### System information

For **cobas c** 311/501 analyzers:
**ALB2:** ACN 413

### Intended use

In vitro test for the quantitative determination of albumin in human serum and plasma on Roche/Hitachi **cobas c** systems.

### Summary[1,2]

Albumin is a carbohydrate-free protein, which constitutes 55-65 % of total plasma protein. It maintains plasma oncotic pressure, and is also involved in the transport and storage of a wide variety of ligands and is a source of endogenous amino acids. Albumin binds and solubilizes various compounds, e.g. bilirubin, calcium and long-chain fatty acids. Furthermore, albumin is capable of binding toxic heavy metal ions as well as numerous pharmaceuticals, which is the reason why lower albumin concentrations in blood have a significant effect on pharmacokinetics.
Hyperalbuminemia is of little diagnostic significance except in the case of dehydration. Hypoalbuminemia occurs during many illnesses and is caused by several factors: compromised synthesis due either to liver disease or as a consequence of reduced protein uptake; elevated catabolism due to tissue damage (severe burns) or inflammation; malabsorption of amino acids (Crohn's disease); proteinuria as a consequence of nephrotic syndrome; protein loss via the stool (neoplastic disease). In severe cases of hypoalbuminemia, the maximum albumin concentration of plasma is 2.5 g/dL (380 µmol/L). Due to the low osmotic pressure of the plasma, water permeates through blood capillaries into tissue (edema). The determination of albumin allows monitoring of a controlled patient dietary supplementation and serves also as an excellent test of liver function.

### Test principle[3]

Colorimetric assay
At a pH value of 4.1, albumin displays a sufficiently cationic character to be able to bind with bromcresol green (BCG), an anionic dye, to form a blue-green complex.

$$\text{Albumin} + \text{BCG} \xrightarrow{\text{pH 4.1}} \text{albumin-BCG complex}$$

The color intensity of the blue-green color is directly proportional to the albumin concentration in the sample and is measured photometrically.

### Reagents - working solutions

**R1** Citrate buffer: 95 mmol/L, pH 4.1; preservatives, stabilizers

**R2** Citrate buffer: 95 mmol/L, pH 4.1; bromcresol green: 0.66 mmol/L; preservatives, stabilizers

R1 is in position B and R2 is in position C.

### Precautions and warnings

For in vitro diagnostic use.
Exercise the normal precautions required for handling all laboratory reagents.
Disposal of all waste material should be in accordance with local guidelines.
Safety data sheet available for professional user on request.
For USA: For prescription use only.

## Reagent handling

Ready for use

## Storage and stability

*ALB2*

| | |
|---|---|
| Shelf life at 15-25 °C: | See expiration date on **cobas c** pack label. |
| On-board in use and refrigerated on the analyzer: | 12 weeks |

*Diluent NaCl 9 %*

| | |
|---|---|
| Shelf life at 2-8 °C: | See expiration date on **cobas c** pack label. |
| On-board in use and refrigerated on the analyzer: | 12 weeks |

## Specimen collection and preparation

For specimen collection and preparation only use suitable tubes or collection containers.
Only the specimens listed below were tested and found acceptable.
Serum.
Plasma: Li-heparin and $K_2$-EDTA plasma
Do not use fluoride plasma.
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.

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| Stability:[4] | 2.5 months at 20-25 °C |
| | 5 months at 4-8 °C |
| | 4 months at -20 °C |

## Materials provided

See “Reagents – working solutions” section for reagents.

## Materials required (but not provided)

- See “Order information” section
- General laboratory equipment

In addition, other suitable control material can be used.

## 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.
The performance of applications not validated by Roche is not warranted and must be defined by the user.

## Application for serum and plasma

**cobas c** 501 **test definition**

| | | | |
|---|---|---|---|
| Assay type | 2-Point End | | |
| Reaction time / Assay points | 10 / 10-14 | | |
| Wavelength (sub/main) | 505/570 nm | | |
| Reaction direction | Increase | | |
| Units | g/L (µmol/L, g/dL) | | |
| Reagent pipetting | | Diluent ($H_2O$) | |
| R1 | 100 µL | – | |
| R2 | 20 µL | 30 µL | |
| *Sample volumes* | *Sample* | *Sample dilution* | |
| | | *Sample* | *Diluent (NaCl)* |
| Normal | 2 µL | – | – |
| Decreased | 2 µL | 35 µL | 70 µL |
| Increased | 2 µL | – | – |

## Calibration

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|---|---|
| Calibrators | S1: $H_2O$<br>S2: C.f.a.s. |
| Calibration mode | Linear |
| Calibration frequency | 2-point calibration<br>• after 4 weeks on board<br>• after reagent lot change<br>• as required following quality control procedures |

Traceability: This method has been standardized against the reference preparation of the IRMM (Institute for Reference Materials and Measurements) BCR470/CRM470 (RPPHS - Reference Preparation for Proteins in Human Serum).[5]

## Quality control

At least once daily run solutions at two levels of a quality control material with known concentrations.

Refer to Brown Clinic Quality Control Requirements, Rules and Reviews Policy

Refer to Brown Clinic Quality Control Specialty and Subspecialty Policy

## Calculation

Roche/Hitachi **cobas c** systems automatically calculate the analyte concentration of each sample.

| | |
|---|---|
| Conversion factors: | g/L x 15.2 = µmol/L |
| | µmol/L x 0.0658 = g/L |
| | g/L x 0.1 = g/dL |

## Limitations - interference

Criterion: Recovery within ± 10 % of initial values at an albumin concentration of 35 g/L (532 µmol/L).

Icterus:[6] No significant interference up to an I index of 60 for conjugated and unconjugated bilirubin (approximate conjugated and unconjugated bilirubin concentration: 1026 µmol/L or 60 mg/dL).
Hemolysis:[6] No significant interference up to an H index of 1000 (approximate hemoglobin concentration: 621 µmol/L or 1000 mg/dL).
Lipemia (Intralipid):[6] No significant interference up to an L index of 550. There is poor correlation between the L index (corresponds to turbidity) and triglycerides concentration.
Drugs: No interference was found at therapeutic concentrations using common drug panels.[7,8]
In very rare cases, gammopathy, in particular type IgM (Waldenström's macroglobulinemia), may cause unreliable results.[9]
For diagnostic purposes, the results should always be assessed in conjunction with the patient's medical history, clinical examination and other findings.
Colorimetric methods used for the determination of Albumin may lead to falsely elevated test results in patients suffering from renal failure or insufficiency due to interference with other proteins. Immunoturbidimetric methods are less affected.

**ACTION REQUIRED**
**Special Wash Programming:** The use of special wash steps is mandatory when certain test combinations are run together on Roche/Hitachi **cobas c** systems. The latest version of the carry-over evasion list can be found with the NaOHD/SMS/Multiclean/SCCS or the NaOHD/SMS/SmpCln1+2/SCCS Method Sheets. For further instructions refer to the operator's manual. **cobas c** 502 analyzer: All special wash programming necessary for avoiding carry-over is available via the **cobas** link, manual input is not required.
**Where required, special wash/carry-over evasion programming must be implemented prior to reporting results with this test.**

## Limits and ranges

### Measuring range
2-60 g/L (30.4-912 µmol/L, 0.2-6 g/dL)
Determine samples having higher concentrations via the rerun function. Dilution of samples via the rerun function is a 1:3 dilution. Results from samples diluted using the rerun function are automatically multiplied by a factor of 3.

### Lower limits of measurement
*Lower detection limit of the test*
2 g/L (30.4 µmol/L, 0.2 g/dL)
The lower detection limit represents the lowest measurable analyte level that can be distinguished from zero. It is calculated as the value lying 3 standard deviations above that of the lowest standard (standard 1 + 3 SD, repeatability, n = 21).

## Expected values

| | | | |
|---|---|---|---|
| Reference Range Study[10] | | | |
| Adults | 3.97-4.94 g/dL | 39.7-49.4 g/L | 603-751 µmol/L |
| Consensus Values[11] | | | |
| Adults | 3.5-5.2 g/dL | 35-52 g/L | 532-790 µmol/L |
| Reference Intervals according to Tietz[12] | | | |
| Newborn | | | |
| 0-4 days | 2.8-4.4 g/dL | 28-44 g/L | 426-669 µmol/L |
| Children | | | |
| 4 days-14 years | 3.8-5.4 g/dL | 38-54 g/L | 578-821 µmol/L |
| 14-18 years | 3.2-4.5 g/dL | 32-45 g/L | 486-684 µmol/L |

Each laboratory should investigate the transferability of the expected values to its own patient population and if necessary determine its own reference ranges.
Roche has not evaluated reference ranges in a pediatric population.

## Specific performance data

For Known Interfering Substances section refer to package insert.
For Known Non-Interfering Substance refer to package insert.
For Additional Technical Information refer to package insert.

## References

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3 Doumas BT, Watson WA, Biggs HG. Albumin standards and the measurement of serum albumin with bromcresol green. Clin Chim Acta 1971;31:87-96.
4 Use of Anticoagulants in Diagnostic Laboratory Investigations. WHO Publication WHO/DIL/LAB/99.1 Rev. 2. Jan. 2002.
5 Baudner S, Bienvenu J, Blirup-Jensen S, et al. The certification of a matrix reference material for immunochemical measurement of 14 human serum proteins CRM470. Report EUR 15243 EN 1993;1-186.
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8 Sonntag O, Scholer A. Drug interference in clinical chemistry: recommendation of drugs and their concentrations to be used in drug interference studies. Ann Clin Biochem 2001;38:376-385.
9 Bakker AJ, Mücke M. Gammopathy interference in clinical chemistry assays: mechanisms, detection and prevention. Clin Chem Lab Med 2007;45(9):1240-1243.
10 Junge W, Bossert-Reuther S, Klein G, et al. Reference Range Study for Serum Albumin using different methods. Clin Chem Lab Med (June 2007 Poster EUROMEDLAB) 2007;45 Suppl:194.
11 Dati F, Schumann G, Thomas L, et al. Consensus of a group of professional societies and diagnostic companies on guidelines for interim reference ranges for 14 proteins in serum based on the standardization against the IFCC/BCR/CAP reference material (CRM 470). Eur J Clin Chem Clin Biochem 1996;34:517-520.
12 Burtis CA, Ashwood ER, Bruns DE, eds. Tietz Textbook of Clinical Chemistry and Molecular Diagnostics, 4th ed Philadelphia, PA: WB Saunders 2006;549.
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## BACK-UP:

Refer to Brown Clinic Back-up Testing Policy

## Source document

Reagent Name: ALB2
Method Sheet Version: V10.0 English

## Order information

| REF | CONTENT | Analyzer(s) on which **cobas c** pack(s) can be used |
|---|---|---|

| | | | |
|---|---|---|---|
| **03183688** 122 | Albumin Gen.2 300 tests | System-ID 07 6592 9 | Roche/Hitachi **cobas c** 311, **cobas c** 501/502 |
| **10759350** 190 | Calibrator f.a.s. (12 x 3 mL) | Code 401 | |
| **10759350** 360 | Calibrator f.a.s. (12 x 3 mL, for USA) | Code 401 | |
| **12149435** 122 | Precinorm U plus (10 x 3 mL) | Code 300 | |
| **12149435** 160 | Precinorm U plus (10 x 3 mL, for USA) | Code 300 | |
| **12149443** 122 | Precipath U plus (10 x 3 mL) | Code 301 | |
| **12149443** 160 | Precipath U plus (10 x 3 mL, for USA) | Code 301 | |
| **10171743** 122 | Precinorm U (20 x 5 mL) | Code 300 | |
| **10171735** 122 | Precinorm U (4 x 5 mL) | Code 300 | |
| **10171778** 122 | Precipath U (20 x 5 mL) | Code 301 | |
| **10171760** 122 | Precipath U (4 x 5 mL) | Code 301 | |
| **04489357** 190 | Diluent NaCl 9 % (50 mL) | System-ID 07 6869 3 | |

## Effective date

Effective date for this procedure: _____

## Author

Source documentation compiled by Roche Diagnostics

Revised by: Heather J Hall, MBA, MT(ASCP), CG(ASCP)$^{cm}$ Date: 4/9/2018

Approved by: Aaron Shives MD (Signature on file Date: 4/11/201

## REVIEW – REVISION SUMMARY DOCUMENTATION

Date: By: Revision Summary: