



04773250001V12.0

UREAL

cobas[®]

Urea/BUN

Order information

REF	CONTENT	Analyzer(s) on which kit(s) can be used
04657616190	Urea/BUN (4 x 100 tests)	cobas c 111

Materials required (but not provided):

10759350190	Calibrator f.a.s. (12 x 3 mL)	Code 401
12149435122	Precinorm U plus (10 x 3 mL)	Code 300
12149443122	Precipath U plus (10 x 3 mL)	Code 301
05117003190	PreciControl ClinChem Multi 1 (20 x 5 mL)	Code 391
05947626190	PreciControl ClinChem Multi 1 (4 x 5 mL)	Code 391
05117216190	PreciControl ClinChem Multi 2 (20 x 5 mL)	Code 392
05947774190	PreciControl ClinChem Multi 2 (4 x 5 mL)	Code 392
04774230190	NaCl Diluent 9 % (4 x 12 mL)	Code 951
11930630001	Chimneys	

English**System information**

UREL: ACN 418

URELU: ACN 417

Intended use

In vitro test for the quantitative determination of urea/urea nitrogen in human serum, plasma and urine on the **cobas c 111** system.

Summary

Measurements of urea/urea nitrogen in human serum, plasma and urine, performed with this assay are used as screening tests and as an aid in diagnosis and monitoring of renal function.

Urea is the major end product of protein nitrogen metabolism. It is synthesized by the urea cycle in the liver from ammonia which is produced by amino acid deamination. Urea is excreted mostly by the kidneys but minimal amounts are also excreted in sweat and degraded in the intestines by bacterial action.¹

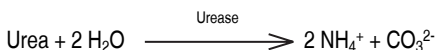
Serum urea mass concentration is either specified for the complete urea molecule or for nitrogen equivalents [blood urea nitrogen (BUN)].² Determination of blood urea nitrogen is primarily used as a screening test for renal function. When used in conjunction with serum creatinine determinations it can aid in the differential diagnosis of the three types of azotemia: prerenal, renal, and postrenal. The urea to creatinine ratio has been proposed as a crude discriminator between prerenal and intrinsic azotemia.¹

Elevations in blood urea nitrogen concentration are seen in inadequate renal perfusion, shock, diminished blood volume (prerenal causes), chronic nephritis, nephrosclerosis, tubular necrosis, glomerular-nephritis (renal causes), and urinary tract obstruction (postrenal causes). Transient elevations may also be seen during periods of high protein intake. Liver diseases may lead to unpredictable blood urea nitrogen concentrations, including abnormally low levels. Low blood urea nitrogen concentrations are not common, but can be found in cases such as malnutrition, lack of protein in the diet, or overhydration.^{1,3}

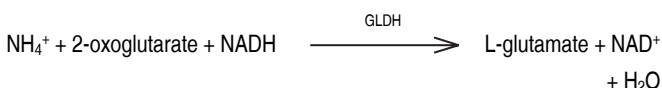
Test principle

Kinetic test with urease and glutamate dehydrogenase^{4,5,6,7}

Urea is hydrolyzed by urease to form ammonium and carbonate.



In the second reaction 2-oxoglutarate reacts with ammonium in the presence of glutamate dehydrogenase (GLDH) and the coenzyme NADH to produce L-glutamate. In this reaction two moles of NADH are oxidized to NAD for each mole of urea hydrolyzed.



The rate of decrease in the NADH concentration is directly proportional to the urea concentration in the specimen and is measured photometrically.

Reagents - working solutions

R1 TRIS buffer: 220 mmol/L, pH 8.6; 2-oxoglutarate: 73 mmol/L; NADH: 2.5 mmol/L; ADP: 6.5 mmol/L; urease (jack bean): $\geq 300 \mu\text{kat/L}$; GLDH (bovine liver): $\geq 80 \mu\text{kat/L}$; preservative

Precautions and warnings

For in vitro diagnostic use for laboratory 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.

Environmental hazards:

Apply all relevant local disposal regulations to determine the safe disposal.

Safety data sheet available for professional user on request.

Reagent handling

Ready for use

Under conditions of extreme humidity, condensation may lead to a dilution of the reagent that affects the measurements. Hence under environmental conditions in which temperature and humidity are equal to, or in excess of 25 °C/80 %, 28 °C/70 %, 30 °C/60 % or 32 °C/55 % a chimney (Cat. No. 11930630001) should be used to reduce the condensation rate. Place a white chimney in R1. The chimneys can be reused for reagent bottles within the same kit. However, to avoid contamination of the reagent with detergent or dilution of the reagent with water it is not permitted to wash the chimneys before reuse.

Storage and stability

Shelf life at 2-8 °C: See expiration date on reagent

On-board in use and refrigerated on the analyzer: 4 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, K₃-EDTA plasma. Do not use ammonium heparin.

Urine

Bacterial growth in the specimen and high atmospheric ammonia concentration as well as contamination by ammonium ions may cause erroneously elevated results.

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.



See the limitations and interferences section for details about possible sample interferences.

Stability in <i>serum/plasma</i> : ⁸	7 days at 20-25 °C
	7 days at 2-8 °C
	1 year at (-15)-(-20) °C

Freeze only once.

Stability in <i>urine</i> : ⁸	2 days at 20-25 °C
	7 days at 2-8 °C
	1 year at (-15)-(-20) °C

Freeze only once.

Materials provided

See "Reagents – working solutions" section for reagents.

Materials required (but not provided)

See "Order information" section

General laboratory equipment

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, plasma and urine

cobas c 111 test definition

Measuring mode	Absorbance
Abs. calculation mode	Kinetic
Reaction direction	Decrease
Wavelength A/B	340/409 nm
Calc. first/last	10/13
Unit	mmol/L

Serum, plasma

Reaction mode R-S

Urine

Reaction mode R-S

Predilution factor 50

Pipetting parameters

		Diluent (H ₂ O)
R	50 µL	95 µL
Sample	2 µL	98 µL
Total volume	245 µL	

Calibration

Calibrator	Calibrator f.a.s. Deionized water is used automatically by the instrument as the zero calibrator.
Calibration mode	Linear regression
Calibration interval	Each lot and as required following quality control procedures

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

Traceability: This method has been standardized against ID/MS.

Quality control

Serum, plasma

For quality control, use control materials as listed in the "Order information" section. In addition, other suitable control material can be used.

Urine

Quantitative urine controls are recommended for routine quality control.

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.

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

Calculation

The **cobas c 111** analyzer automatically calculates the analyte concentration of each sample.

Conversion factors:

mmol/L urea × 6.006 = mg/dL urea

mmol/L urea × 2.801 = mg/dL urea nitrogen

mmol/L urea = mmol/L urea nitrogen

mg/dL urea × 0.167 = mmol/L urea

mg/dL urea × 0.467 = mg/dL urea nitrogen

mg/dL urea × 0.167 = mmol/L urea nitrogen

Limitations - interference

In very rare cases, gammopathy, in particular type IgM (Waldenström's macroglobulinemia), may cause unreliable results.⁹

Serum, plasma

Criterion: Recovery within ± 0.83 mmol/L of initial values of samples ≤ 8.3 mmol/L and within ± 10 % for samples > 8.3 mmol/L.

Icterus:¹⁰ 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:¹⁰ No significant interference up to an H index of 1000 (approximate hemoglobin concentration: 621 µmol/L or 1000 mg/dL).

Lipemia (Intralipid):¹⁰ No significant interference up to an L index of 2000. There is poor correlation between the L index (corresponds to turbidity) and triglycerides concentration.

Ammonium ions may cause erroneously elevated results.

Drugs: No interference was found at therapeutic concentrations using common drug panels.^{11,12}

Urine

Criterion: Recovery within ± 15 mmol/L of initial values of samples ≤ 150 mmol/L and within ± 10 % for samples > 150 mmol/L.

Drugs: No interference was found at therapeutic concentrations using common drug panels.¹²

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

ACTION REQUIRED

Special Wash Programming: The use of special wash steps is mandatory when certain test combinations are run together on the **cobas c 111** analyzer. For information about test combinations requiring special wash steps, please refer to the latest version of the carry-over evasion list found with the CLEAN Method Sheet and the operator's manual for further instructions.

Where required, special wash/carry-over evasion programming must be implemented prior to reporting results with this test.

Limits and ranges

Measuring range

Serum, plasma

0.5-40 mmol/L (3.0-240 mg/dL urea, 1.40-112 mg/dL urea nitrogen)

Determine samples having higher concentrations via the rerun function. Dilution of samples via the rerun function is a 1:10 dilution. Results from samples diluted using the rerun function are automatically multiplied by a factor of 10.



Urine

1.0-2000 mmol/L (6-12000 mg/dL urea, 2.8-5600 mg/dL urea nitrogen)

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

Serum, plasma

Lower detection limit of the test:

0.5 mmol/L (3.0 mg/dL urea, 1.40 mg/dL urea nitrogen)

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).

Urine

Lower detection limit of the test:

1.0 mmol/L (6 mg/dL urea, 2.8 mg/dL urea nitrogen)

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

Urea

Serum, plasma¹³

Adults 2.76-8.07 mmol/L (16.6-48.5 mg/dL)

Urine¹⁴

24-hour urine 428-714 mmol/24 h (25.7-42.9 g/24 h),
corresponding to
286-595 mmol/L (1.71-3.57 g/dL)^{a)}

a) Based on average urine output of 1.2-1.5 L/24 h

Urea nitrogen (BUN)

Serum/plasma¹⁴

Adult (18-60 years) 2.14-7.14 mmol/L (6-20 mg/dL)

Adult (60-90 years) 2.86-8.21 mmol/L (8-23 mg/dL)

Infant (< 1 year) 1.43-6.78 mmol/L (4-19 mg/dL)

Infant/child 1.79-6.43 mmol/L (5-18 mg/dL)

Urine¹⁴

24-hour urine: 428-714 mmol/24 h (12-20 g/24 h),
corresponding to
286-595 mmol/L (801-1666 mg/dL)^{a)}

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 **cobas c 111** analyzer are given below. Results obtained in individual laboratories may differ.

Precision

Precision was determined using human samples and controls in an internal protocol with repeatability (n = 21) and intermediate precision (3 aliquots per run, 1 run per day, 10 days). The following results were obtained on the **cobas c 111** analyzer:

Serum, plasma

Repeatability	Mean mmol/L (mg/dL urea)	SD mmol/L (mg/dL urea)	CV %
Precinorm U	6.53 (39.2)	0.07 (0.4)	1.1
Precipath U	23.3 (140)	0.1 (1)	0.6
Human serum 1	3.75 (22.5)	0.05 (0.3)	1.2
Human serum 2	35.3 (212)	0.3 (2)	0.7

Intermediate precision	Mean mmol/L (mg/dL urea)	SD mmol/L (mg/dL urea)	CV %
Precinorm U	6.33 (38.0)	0.06 (0.4)	0.9
Precipath U	22.3 (134)	0.2 (1)	1.1
Human serum 3	4.84 (29.1)	0.05 (0.3)	1.0
Human serum 4	32.3 (194)	0.3 (2)	0.8

Urine

Repeatability	Mean mmol/L (mg/dL urea)	SD mmol/L (mg/dL urea)	CV %
Control level 1	164 (984)	2 (13)	1.3
Control level 2	262 (1574)	3 (16)	1.0
Control level 3	286 (1720)	3 (19)	1.1
Urine sample 1	121 (729)	2 (15)	2.0
Urine sample 2	30.6 (183)	0.9 (5)	3.0
Urine sample 3	535 (3211)	5 (30)	0.9
Urine sample 4	1636 (9826)	14 (85)	0.9

Method comparison

Urea values for human samples obtained on the **cobas c 111** analyzer (y) were compared with those determined on a COBAS INTEGRA 400 analyzer (x), using the corresponding reagent.

Serum, plasma

Sample size (n) = 71

Passing/Bablok¹⁵ Linear regression

$y = 1.014x - 0.006$ mmol/L $y = 1.011x + 0.053$ mmol/L

$\tau = 0.987$

$r = 0.999$

The sample concentrations were between 1.35 and 38.6 mmol/L (8.1 and 232 mg/dL urea).

Urine

Sample size (n) = 86

Passing/Bablok¹⁵ Linear regression

$y = 0.966x + 0.316$ mmol/L $y = 0.954x + 4.56$ mmol/L

$\tau = 0.976$

$r = 0.999$

The sample concentrations were between 30.6 and 1909.3 mmol/L (183.8 and 1104 mg/dL urea) on the reference system (x).

References

- Lamb EJ, Jones GRD. Kidney Function Tests. In: Rifai N, Chiu RWK, Young I, Burnham CAD, Wittwer CT, editors. Tietz Textbook of Clinical Chemistry and Molecular Diagnostics. 7th ed. 2023; p. 352e1-352e59.
- Vanholder R, Gryp T, Glorieux G. Urea and chronic kidney disease: the comeback of the century? (in uraemia research). Nephrol Dial Transplant. 2018 Jan 1;33(1):4-12. doi: 10.1093/ndt/gfx039.
- Rosenberg WMC, Badrick T, Lo SF, et al. Liver disease. In: Rifai N, Chiu RWK, Young I, Burnham CAD, Wittwer CT, editors. Tietz Textbook of Laboratory Medicine, Saunders Elsevier, Philadelphia, 7th edition, 2023, chapter 51, p. 701-763.e21.
- Richterich R, Colombo JP. Klinische Chemie. 4th ed. Basel: Karger S 1978:319-324.
- Talke H, Schubert GA. Enzymatische Harnstoffbestimmung in Blut und Serum im optischen Test nach Warburg. Klin Wochenschr 1965;43:174.
- Tiffany TO, Jansen JM, Burtis CA, et al. Enzymatic kinetic rate and end-point analyses of substrate, by use of a GeMSAEC Fast Analyzer. Clin Chem 1972;18:829-840.



UREAL

Urea/BUN





- 7 Sampson EJ, Baired MA, Burtis CA, et al. A coupled-enzyme equilibrium method for measuring urea in serum: Optimization and evaluation of the AACC study group on urea candidate reference method. Clin Chem 1980;26:816-826.
- 8 Guder WG, Narayanan S, Wisser H, et al. List of Analytes; Preanalytical Variables. Brochure in: Samples: From the Patient to the Laboratory. Darmstadt: GIT-Verlag 1996.
- 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 Glick MR, Ryder KW, Jackson SA. Graphical Comparisons of Interferences in Clinical Chemistry Instrumentation. Clin Chem 1986;32:470-475.
- 11 Breuer J. Report on the Symposium "Drug effects in Clinical Chemistry Methods". Eur J Clin Chem Clin Biochem 1996;34:385-386.
- 12 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.
- 13 Lühr B, El-Samalouti V, Junge W, et al. Reference Range Study for Various Parameters on Roche Clinical Chemistry Analyzers. Clin Lab 2009;55:465-471.
- 14 Wu AHB, ed. Tietz Clinical Guide to Laboratory Tests, 4th edition. St. Louis (MO): Saunders Elsevier 2006;1096.
- 15 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.

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:

	Contents of kit
	Reagent
	Volume for reconstitution
	Global Trade Item Number

Rx only For USA: Caution: Federal law restricts this device to sale by or on the order of a physician.

COBAS, NAVIFY, PRECINORM, PRECIPATH and PRECICONTROL are trademarks of Roche.

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.

© 2024, Roche Diagnostics



 Roche Diagnostics GmbH
Sandhofer Strasse 116
68305 Mannheim, Germany
www.roche.com
 +800 5505 6606

