BECKMAN COULTER

AU/DxC AU US

Instructions For Use

GLUC
GLUCOSE

REF OSR6121 4 x 25 mL R1, 4 x 12.5 mL R2
OSR6221 4 x 53 mL R1, 4 x 27 mL R2
OSR6621 4 x 173 mL R1, 4 x 91 mL R2

For *in vitro* diagnostic use only.

For Rx use only

PRINCIPLE

INTENDED USE

The Glucose test system is for the quantitative measurement of glucose in human serum, plasma, urine and cerebrospinal fluid on Beckman Coulter AU/DxC AU analyzers.

Glucose measurements are used in the diagnosis and treatment of carbohydrate metabolism disorders including diabetes mellitus, neonatal hypoglycemia, and idiopathic hypoglycemia, and of pancreatic islet cell carcinoma.

SUMMARY AND EXPLANATION

Serum glucose levels may be abnormally high (hyperglycemia) or abnormally low (hypoglycemia).[1]

Glucosuria (the presence of urinary glucose) is common in healthy, pregnant women. The cardinal feature of the glucosuria of pregnancy is a conspicuous variability both from day to day and during the course of the day.[2] Glucose is not present in normal patient urine.

Determinations of cerebrospinal fluid (CSF) glucose helps distinguish bacterial from viral meningitis; the glucose value is often low (less than 40% to 45% of simultaneously analyzed, equilibrated serum glucose) in bacterial meningitis and tuberculous meningitis and is generally normal in viral disease. Carcinomatous meningitis (widespread infiltration of the meninges by tumor cells) also drives CSF glucose values below the normal range.[2]

METHODOLOGY

Stein[1] first introduced the hexokinase G-6-PDH method for assay of glucose in serum or plasma. Several investigators[3,4,5,6] have demonstrated the accuracy and usefulness of the method.

In this Beckman Coulter procedure, glucose is phosphorylated by hexokinase (HK) in the presence of adenosine triphosphate (ATP) and magnesium ions to produce glucose-6-phosphate (G-6-P) and adenosine diphosphate (ADP). Glucose-6-phosphate dehydrogenase (G6P-DH) specifically oxidizes G-6-P to 6-phosphogluconate with the concurrent reduction of nicotinamide adenine dinucleotide (NAD+) to nicotinamide adenine dinucleotide, reduced (NADH). For Beckman Coulter AU/DxC AU analyzers, the change in absorbance at 340/660 nm is proportional to the amount of glucose present in the sample.

$$\text{Glucose} + \text{ATP} \xrightarrow{\text{HK, } Mg^{2+}} \text{G-6-P} + \text{ADP}$$

$$\text{G-6-P} + NAD^{+} \xrightarrow{\text{G6P-DH}} \text{6-Phosphogluconate} + \text{NADH} + H^{+}$$

SPECIMEN

SPECIMEN STORAGE AND STABILITY

Glucose in serum, free from hemolysis and bacterial contamination, and without added preservatives, is stable for 8 hours when stored at 15 - 25°C, or for up to 72 hours when stored at 2 - 8°C.[7] Fluoride preserved plasma samples are stable for up to 72 hours at 15 - 25°C[7]. Urine specimens should be maintained at 2 - 8°C and analyzed as soon as possible.[7] Cerebrospinal fluid can be stored between 2 - 8°C for at least 5 days if protected from evaporation. Specimens that will not be tested within 5 days should be stored frozen ≤ -20°C immediately after collection.[2]

Specimen storage and stability information provides guidance to the laboratory. Based on specific needs, each laboratory may establish alternative storage and stability information according to good laboratory practice or from alternative reference documentation.

Additional handling conditions as designated by this laboratory:

SPECIMEN COLLECTION AND PREPARATION

Fasting serum or plasma (EDTA, heparin or sodium fluoride) samples, free from hemolysis, are the recommended specimens. Separate from red cells rapidly to minimize loss of glucose through glycolysis. Fresh, random collections are recommended for urine specimens.

Additional instructions for patient sample preparation as designated by this laboratory:

Additional type conditions as designated by this laboratory:

REAGENTS

CONTENTS

Glucose Reagent

Reagent storage location in this laboratory:

WARNING AND PRECAUTIONS

1. Exercise the normal precautions required for handling all laboratory reagents.
2. Dispose of all waste material in accordance with local guidelines.
3. This product contains material of animal origin. The product should be considered as potentially capable of transmitting infectious diseases.

REACTIVE INGREDIENTS

Final concentration of reactive ingredients in the test:

PIPES- buffer (pH 7.6)	24.0 mmol/L
NAD^+	≥ 1.32 mmol/L
Hexokinase	≥ 0.59 KU/L
ATP	≥ 2.0 mmol/L
Mg^{2+}	2.37 mmol/L
G6P-DH	≥ 1.58 KU/L
Also contains preservatives	

⚠ CAUTION

Sodium azide preservative may form explosive compounds in metal drain lines. See NIOSH Bulletin: Explosive Azide Hazard (8/16/76).
To avoid the possible build-up of azide compounds, flush wastepipes with water after the disposal of undiluted reagent. Sodium azide disposal must be in accordance with appropriate local regulations.

GHS HAZARD CLASSIFICATION

Not classified as hazardous

SDS	Safety Data Sheet is available at beckmancoulter.com/techdocs

MATERIALS NEEDED BUT NOT SUPPLIED WITH REAGENT KIT

Chemistry Calibrator (Cat # DR0070)

Urine Calibrator (Cat # DR0090)

Storage location of the Calibrator in this laboratory:

EQUIPMENT AND MATERIALS

For use on the AU480, AU680, AU5800, DxC 500 AU, DxC 500i and DxC 700 AU Beckman Coulter Analyzers.

OSR6621 for use on the AU5800 systems only.

Storage location of test tubes or sample cups in this laboratory:

REAGENT PREPARATION

The Glucose reagents are ready for use. No preparation is required.

STORAGE AND STABILITY

1. The unopened reagents are stable until the expiration date printed on the label when stored at 2 – 8°C.
2. Opened reagents are stable for 30 days when stored in the refrigerated compartment of the analyzer.

INDICATIONS OF DETERIORATION

Visible signs of microbial growth, turbidity or precipitate, or any change in reagent color may indicate degradation and warrant discontinuance of use.

Additional storage requirements as designated by this laboratory:

STABILITY OF FINAL REACTION MIXTURE

The Beckman Coulter AU/DxC AU analyzer automatically computes every determination at the same time interval.

CALIBRATION

CALIBRATION INFORMATION

The frequency of calibration is every 30 days. Calibration of this glucose procedure for serum and plasma specimens is accomplished by use of the Chemistry Calibrator (Cat # DR0070) material, which is traceable to the National Institutes of Standards and Technology (NIST) Standard Reference Material (SRM) 965a. For urine specimens use Urine Calibrator (Cat # DR0090). For CSF specimens use Serum Calibrator (Cat # DR0070).

Recalibration of this test is required when any of these conditions exist:

1. A reagent lot number has changed or there is an observed shift in control values.
2. Major preventative maintenance was performed on the analyzer.
3. A critical part was replaced.

QUALITY CONTROL

During operation of the Beckman Coulter AU/DxC AU analyzer, at least two levels of an appropriate quality control material should be tested a minimum of once a day. In addition, controls should be performed after calibration with each new lot of reagent, and after specific maintenance or troubleshooting steps described in the appropriate Beckman Coulter AU/DxC AU analyzer Instructions For Use (IFU) and Reference Manual. Quality control testing should be performed in accordance with regulatory requirements and each laboratory's standard procedure.

Appropriate qualified urine controls should be established and utilized during urine analysis.

Location of controls used at this laboratory.

CONTROL NAME	SAMPLE TYPE	STORAGE

TESTING PROCEDURE(S)

A complete list of test parameters and operational procedures are provided in the relevant AU/DxC AU analyzer IFU and Reference Manual.

RESULTS INTERPRETATION

The default unit of measure is mg/dL, for conversion to SI units (mmol/L) multiply by 0.0555.

REPORTING RESULTS

EXPECTED RESULTS

Serum[8]	Adult	74 - 109 mg/dL
	Newborn	36 - 99 mg/dL

Urine:	There should be no detectable glucose in urine	
Cerebrospinal fluid:[7]	Child	60 – 80 mg/dL
	Adult	40 – 70 mg/dL

Reference Intervals shown above were taken from the literature. Expected values may vary with age, sex, sample type, diet and geographical location. Each laboratory should verify the transferability of the expected values to its own population, and if necessary determine its own reference interval according to good laboratory practice. For diagnostic purposes, results should always be assessed in conjunction with the patient's medical history, clinical examinations and other findings.

Expected reference ranges in this laboratory:

INTERVALS	SAMPLE TYPE	UNITS

Additional reporting information as designated by this laboratory:

PROCEDURAL NOTES

ANTICOAGULANT TEST RESULTS

The following anticoagulants were assessed by Deming regression analysis with a minimum of 40 paired serum and plasma samples. Values of serum (X) ranging from 15 mg/dL to 728 mg/dL were compared with the values for plasma (Y) yielding the following results on the DxC 500 AU analyzer.

DxC 500 AU

Y Method	Glucose Fluoride Oxalate	Glucose K2 EDTA	Glucose K3 EDTA	Glucose Lithium Heparin
X Method	SERUM	SERUM	SERUM	SERUM
Slope	0.996	1.000	1.008	1.003
Intercept	2.112	1.198	-1.069	1.207
Y =	0.996x + 2.112	1.000x + 1.198	1.008x - 1.069	1.003x + 1.207
Correlation Coeff.(r)	0.9998	0.9999	0.9998	0.9999

INTERFERENCES

Results of studies [9] show that the following substances interfere with this glucose procedure.

The criteria for no significant interference is recovery within 10% of the initial value

Bilirubin:	No significant interference up to 40 mg/dL Bilirubin
Hemolysis:	No significant interference up to 500 mg/dL Hemolysate
Lipemia:	No significant interference up to 700 mg/dL Intralipid*

*Intralipid, manufactured by KabiVitrium Inc., is a 20% IV fat emulsion used to emulate extremely turbid samples.

**Intralipid interference is not applicable to OSR6x21 Urine and CSF Applications.

Eltrombopag and its metabolites may interfere with this assay causing erroneously high patient results.

The information presented is based on results from Beckman Coulter studies and is current at the date of publication. Beckman Coulter Inc., makes no representation about the completeness or accuracy of results generated by future studies. Further information on interfering substances is available.[10]

In very rare cases gammopathy, especially monoclonal IgM (Waldenström's Macroglobulinemia), may cause unreliable results.

Laboratory specific procedure notes:

PERFORMANCE CHARACTERISTICS

PERFORMANCE CHARACTERISTICS

Data contained within this section is representative of performance on Beckman Coulter systems. Data obtained in your laboratory may differ from these values.

DYNAMIC RANGE / ANALYTICAL MEASURING RANGE

The Glucose procedure is linear from 10 - 800 mg/dL for serum and cerebrospinal fluid determinations. Samples exceeding the upper limit of linearity should be manually diluted; using 1-part sample with 1-part physiological saline, repeated and the result multiplied by two. A concentration result is obtained from manually diluted samples in the >800 – 1,600 mg/dL range. Dilution of samples above 1600mg/dL is not supported.

The Glucose procedure is linear from 10 - 700 mg/dL for urine determinations. Samples exceeding the upper limit of linearity should be manually diluted; using 1-part sample with 1-part physiological saline, repeated and the result multiplied by two. A concentration result is obtained from manually diluted samples in the >700 – 1,400 mg/dL range. Dilution of samples above 1400mg/dL is not supported.

SENSITIVITY

Typical change in absorbance for 1 mg/dL of Glucose is 2.5 mAbsorbance on the AU480, AU680, AU5800, DxC 500 AU, DxC 500i and DxC 700 AU analyzers.

METHODS COMPARISON

Reference[11,12]

Patient serum samples were evaluated in method comparison studies.

Results of Deming regression analysis were as follows:

Y Method	DxC 500 AU
X Method	DxC 700 AU
Slope	0.986
Intercept	0.227
Correlation Coeff. (r)	0.9999
No. of Samples (n)	133
Range (mg/dL)	14 - 773

Patient Urine samples were evaluated in method comparison studies.

Results of Deming regression analysis were as follows:

Y Method	DxC 500 AU
X Method	DxC 700 AU
Slope	1.001
Intercept	-0.216
Correlation Coeff. (r)	1.0000
No. of Samples (n)	113
Range (mg/dL)	11 - 688

Patient CSF samples were evaluated in method comparison studies.

Results of Deming regression analysis were as follows:

DxC 500 AU versus DxC 700 AU

Y Method	DxC 500 AU
X Method	DxC 700 AU
Slope	1.009
Intercept	0.891
Correlation Coeff. (r)	0.9998
No. of Samples (n)	111
Range (mg/dL)	34 - 772

PRECISION

Estimates of precision for serum, CSF and urine, based on CLSI recommendations,[13], are consistent with typical performance. The within run precision for all applications is less than or equal to 3% CV and total precision is less than or equal to 3% CV. Assays of control sera were performed and this data reduced following CLSI guidelines above.

The following data was generated on DxC 500 AU analyzer:

DxC 500 AU Serum

N = 80	Within-run		Total	
Mean, mg/dL	**SD**	**CV%**	**SD**	**CV%**
51.1	0.2	0.4	0.5	0.9
121.4	0.4	0.3	1.1	0.9
288.9	0.7	0.3	2.9	1.0

*Total precision includes a composite of Within-run, Between run and Between day precision

DxC 500 AU Urine

N = 80	Within-run		Total	
Mean, mg/dL	**SD**	**CV%**	**SD**	**CV%**
56.8	0.3	0.5	0.4	0.7
131.4	0.6	0.4	1.7	1.3
341.8	1.5	0.4	3.0	0.9

*Total precision includes a composite of Within-run, Between run and Between day precision

DxC 500 AU CSF

N = 80	Within-run		Total	
Mean mg/dL	**SD**	**CV%**	**SD**	**CV%**
36.9	0.2	0.5	0.4	1.2
122.7	0.4	0.4	1.0	0.8
317.2	1.3	0.4	3.2	1.0

*Total precision includes a composite of Within-run, Between run and Between day precision

ADDITIONAL INFORMATION

DxC 700 AU analyzers require that each reagent application has a standard format of abbreviated Test Name. This Test Name is required to allow automated loading of the calibrator information for each application. Refer to the table below for the Test Name assigned to each application for this assay.

Test Name	Description
GLU1U	Glucose (Serum)
GLU1U	Glucose (Urine)
GLU1U	Glucose (CSF)

Refer to the Beckman Coulter Chemistry Systems Reagent Guide (BAGUIDE) for specific chemistry information for the AU/DxC AU clinical chemistry systems and guidance on symbols used on all AU/DxC AU product labelling.

Setting Sheet Footnotes

User defined

Lot or Lot + Bottle

Urine: † Beckman Coulter System Calibrator Cat No.: DR0090

Serum: † Beckman Coulter System Calibrator Cat No.: DR0070

* Values set for working in mg/dL. To work in SI units (mmol/L) divide by 18.

REVISION HISTORY

Add DxC 500i instrument to IFU

Preceding version revision history

Updated REPORTING RESULTS section

Updated PROCEDURAL NOTES section

Updated References Section

REFERENCES

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10. AACC Effects on Clinical Laboratory Tests: Drugs, Disease, Herbs and Natural Products https://clinfx.wiley.com/aaccweb/aacc/
11. Data is on file for specific AU/DxC AU analyzers.
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13. CLSI EP05-A3: 2014. Titled: Evaluation of Precision of Quantitative Measurement Procedures; Approved Guideline-Third Edition

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