

## Overview

### Useful For

Diagnosis of UDP-galactose 4' epimerase deficiency

### Genetics Test Information

Enzymatic testing for the diagnosis of uridine diphosphate (UDP)-galactose 4' epimerase (GALE) deficiency.

### Testing Algorithm

See [Galactosemia Testing Algorithm](#) in Special Instructions for additional information.

### Special Instructions

- [Informed Consent for Genetic Testing](#)
- [Galactosemia Testing Algorithm](#)
- [Biochemical Genetics Patient Information](#)
- [Informed Consent for Genetic Testing \(Spanish\)](#)
- [Galactosemia-Related Test List](#)

### Method Name

Enzyme Reaction followed by Liquid Chromatography-Tandem Mass Spectrometry (LC-MS/MS)

### NY State Available

Yes

## Specimen

### Specimen Type

Whole Blood EDTA

### Advisory Information

This test is appropriate for diagnosis of uridine diphosphate-galactose 4' epimerase (GALE) deficiency but will **not** detect galactokinase (GALK) deficiency or galactose-1-phosphate uridyltransferase (GALT) deficiency.

-To evaluate for GALK deficiency, order GALK / Galactokinase, Blood.

-To evaluate for GALT deficiency, order GALT / Galactose-1-Phosphate Uridyltransferase, Blood.

This assay is **not** appropriate for monitoring dietary compliance. If dietary monitoring is needed, order GAL1P / Galactose-1-Phosphate (Gal-1-P), Erythrocytes.

### Necessary Information

**Patient's age is required.**

[Biochemical Genetics Patient Information](#)(T602) is recommended, but not required, to be filled out and sent with the specimen to aid in the interpretation of test results.

### Specimen Required

Multiple whole blood tests for galactosemia can be performed on 1 specimen. Prioritize order of testing when

submitting specimens. See [Galactosemia-Related Test List](#) in Special Instructions for a list of tests that can be ordered together.

**Container/Tube:**

**Preferred:** Lavender top (EDTA)

**Acceptable:** Green top (sodium or lithium heparin) or yellow top (ACD)

**Specimen Volume:** 5 mL

**Forms**

1. **New York Clients-Informed consent is required.** Document on the request form or electronic order that a copy is on file. The following documents are available in Special Instructions:

-[Informed Consent for Genetic Testing](#) (T576)

-[Informed Consent for Genetic Testing-Spanish](#) (T826)

2. [Biochemical Genetics Patient Information](#)(T602) is recommended, see Special Instructions.

3. If not ordering electronically, complete, print, and send an [Inborn Errors of Metabolism Test Request](#) (T798) with the specimen.

**Specimen Minimum Volume**

2 mL

**Reject Due To**

Gross hemolysis	Reject
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**Specimen Stability Information**

Specimen Type	Temperature	Time	Special Container
Whole Blood EDTA	Refrigerated (preferred)	14 days	
	Ambient	6 days	

**Clinical and Interpretive**
**Clinical Information**

Galactosemia is an autosomal recessive disorder that results from a deficiency of any 1 of the 3 enzymes catalyzing the conversion of galactose to glucose: galactose-1-phosphate uridylyltransferase (GALT), galactokinase (GALK), and uridine diphosphate galactose-4-epimerase (GALE). Epimerase deficiency galactosemia can be categorized into 3 types: generalized, peripheral, and intermediate. Generalized epimerase deficiency galactosemia results in profoundly decreased enzyme activity in all tissues, whereas peripheral epimerase deficiency galactosemia results in decreased enzyme activity in red and white blood cells, but normal enzyme activity in all other tissues. This is compared to intermediate epimerase deficiency galactosemia which results in decreased enzyme activity in red and

white blood cells and less than 50% of normal enzyme levels in other tissues.

Clinically, infants with generalized epimerase deficiency galactosemia develop symptoms such as liver and renal dysfunction and mild cataracts when on a normal milk diet, while infants with peripheral or intermediate epimerase deficiency galactosemia do not develop any symptoms. Generalized epimerase deficiency galactosemia is treated by a galactose- and lactose-restricted diet, which can improve or prevent the symptoms of renal and liver dysfunction and mild cataracts. Despite adequate treatment from an early age, individuals with generalized epimerase deficiency galactosemia remain at increased risk for developmental delay and intellectual disability. Unlike patients with classic galactosemia resulting from a GALT deficiency, females with generalized epimerase deficiency galactosemia experience normal puberty and are not at increased risk for premature ovarian failure. Based upon reports by newborn screening programs, the frequency of epimerase deficiency galactosemia in the United States ranges from approximately 1 in 6700 in African American infants to 1 in 70,000 infants of European ancestry.

Galactose-1-phosphate (Gal-1-P) accumulates in the erythrocytes of patients with galactosemia due to either GALT or GALE deficiency. The quantitative measurement of Gal-1-P (GAL1P / Galactose-1-Phosphate [Gal-1-P], Erythrocytes) is useful for monitoring compliance with dietary therapy. Gal-1-P is thought to be the causative factor for development of liver disease in these patients and, because of this, patients should maintain low levels and be monitored on a regular basis.

Newborn screening varies from state to state and identifies potentially affected individuals by measuring total galactose (galactose and Gal-1-P) and/or determining the activity of the GALT enzyme.. The diagnosis of galactosemia is established by follow-up quantitative measurement of GALT enzyme activity. If enzyme levels are normal, but an infant has an elevated Gal-1-P, then epimerase deficiency galactosemia is to be considered. Molecular testing via sequencing of the *GALE* gene may be performed.

See [Galactosemia Testing Algorithm](#) in Special Instructions.

## Reference Values

> or =3.5 nmol/h/mg of hemoglobin

## Interpretation

An interpretive report will be provided.

## Cautions

The results of testing performed in erythrocytes, including analysis of enzymes, biochemical phenotyping, or galactose-1-phosphate are invalid following a transfusion.

## Clinical Reference

1. Fridovich-Keil J, Bean L, He M, et al: Epimerase Deficiency Galactosemia. In GeneReviews Edited by MP Adam, HH Ardinger, RA Pagon, et al. University of Washington, Seattle. Updated 2016 Jun 16. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK51671/>

2. Walter JH, Fridovich-Keil JL: Walter J.H., Fridovich-Keil J.L. Walter, John H., and Judith L. Fridovich-Keil. Galactosemia. In The Online Metabolic and Molecular Bases of Inherited Disease. Edited by D Valle, AL Beaudet, B Vogelstein, et al. New York, McGraw-Hill, Accessed June 18, 2019. Available at <http://ommbid.mhmedical.com/content.aspx?bookid=971&sectionid=62672411>

## Performance

## Method Description

A buffered enzyme incubation with substrate and cofactors is performed on lysed red blood cells. A postincubation

extraction is performed and subjected to liquid chromatography-tandem mass spectrometry (LC-MS/MS). The ratio of the extracted product to its internal standard is used to calculate the total enzymatic product. This is then normalized using the calculated hemoglobin concentration to determine the patient's enzyme level in nmol/h/mg of hemoglobin.(Unpublished Mayo method)

**PDF Report**

No

**Day(s) and Time(s) Test Performed**

Friday, 7 a.m. (specimen must be received the day prior)

**Analytic Time**

8 days (not reported on Saturday or Sunday)

**Maximum Laboratory Time**

15 days

**Specimen Retention Time**

2 months

**Performing Laboratory Location**

Rochester

**Fees and Codes****Fees**

- Authorized users can sign in to [Test Prices](#) for detailed fee information.
- Clients without access to Test Prices can contact [Customer Service](#) 24 hours a day, seven days a week.
- Prospective clients should contact their Regional Manager. For assistance, contact [Customer Service](#).

**Test Classification**

This test was developed and its performance characteristics determined by Mayo Clinic in a manner consistent with CLIA requirements. This test has not been cleared or approved by the U.S. Food and Drug Administration.

**CPT Code Information**

82542

**LOINC® Information**

Test ID	Test Order Name	Order LOINC Value
GALE	UDP-galactose 4' epimerase, RBC	79469-3

Result ID	Test Result Name	Result LOINC Value
64372	UDP-galactose 4' epimerase, RBC	79469-3
37979	Interpretation (GALE)	59462-2
37978	Reviewed By	18771-6