MAYO CLINIC LABORATORIES

Test Definition: GALMP

Galactosemia, GALT Gene, Variant Panel, Varies

Overview

Useful For

Second-tier test for confirming a diagnosis of galactosemia as indicated by enzymatic testing or newborn screening

Carrier testing family members of an affected individual of known genotype (has variants included in the panel)

Resolution of Duarte variant and Los Angeles (LA) variant genotypes

Reflex Tests

Test Id	Reporting Name	Available Separately	Always Performed
CULFB	Fibroblast Culture for Genetic Test	Yes	No
CULAF	Amniotic Fluid Culture/Genetic Test	Yes	No
_STR1	Comp Analysis using STR (Bill only)	No, (Bill only)	No
_STR2	Add'l comp analysis w/STR (Bill Only)	No, (Bill only)	No
MATCC	Maternal Cell Contamination, B	Yes	No

Genetics Test Information

This targeted genotyping panel is for 24 variants in the *GALT* gene. For details regarding the specific variants for this test, see the Targeted Variants Table in Clinical Information.

Testing Algorithm

For cord blood specimens that have an accompanying maternal blood specimen, maternal cell contamination studies will be performed at an additional charge.

For more information see Galactosemia Testing Algorithm

Special Instructions

- Molecular Genetics: Congenital Inherited Diseases Patient Information
- Informed Consent for Genetic Testing
- Galactosemia Testing Algorithm
- Informed Consent for Genetic Testing (Spanish)
- Galactosemia-Related Test List

Highlights

A targeted genotyping array is utilized to detect 24 genetic targets associated with galactosemia for the purpose of

diagnostic testing or carrier screening.

Method Name
Targeted Genotyping Array followed by Multiplex Ligation-Dependent Probe Amplification (MLPA), Polymerase Chain Reaction (PCR), Relative Quantitative PCR (qPCR), or Sanger Sequencing, as needed

NY State Available
Yes

Specimen

Specimen Type
Varies

Ordering Guidance
The recommended first-tier test is galactose-1-phosphate uridyltransferase (GALT) enzyme analysis; order GALT / Galactose-1-Phosphate Uridyltransferase, Blood.

This genetic variant panel is recommended for individuals with a GALT enzyme value less than 24.5 nmol/h/mg of hemoglobin.

Specimen Required
Patient Preparation: A previous hematopoietic stem cell transplant from an allogenic donor will interfere with testing. For information about testing patients who have received a hematopoietic stem cell transplant, call 800-533-1710.

Submit only 1 of the following specimens:

Specimen Type: Whole blood
Container/Tube: Lavender top (EDTA) or yellow top (ACD)
Specimen Volume: 3 mL
Collection Instructions:
1. Invert several times to mix blood.
2. Send whole blood specimen in original tube. **Do not aliquot.**
3. Whole blood collected postnatal from an umbilical cord is also acceptable. See Additional Information
Specimen Stability Information: Ambient (preferred) 4 days/Refrigerated 4 days/Frozen 4 days
Additional Information:
1. Specimens are preferred to be received within 4 days of collection. Extraction will be attempted for specimens received after 4 days, and DNA yield will be evaluated to determine if testing may proceed.
2. To ensure minimum volume and concentration of DNA are met, the requested volume must be submitted. Testing may be canceled if DNA requirements are inadequate.
3. For postnatal umbilical cord whole blood specimens, maternal cell contamination studies are recommended to ensure test results reflect that of the patient tested. A maternal blood specimen is required to complete maternal cell

contamination studies. Order MATCC / Maternal Cell Contamination, Molecular Analysis, Varies on both the cord blood and maternal blood specimens under separate order numbers.

Specimen Type: Extracted DNA
Container/Tube:
Preferred: Screw Cap Micro Tube, 2 mL with skirted conical base
Acceptable: Matrix tube, 1 mL
Collection Instructions:
1. The preferred volume is at least 100 mcL at a concentration of 75 ng/mcL.
2. Include concentration and volume on tube.
Specimen Stability Information: Frozen (preferred) 1 year/Ambient/Refrigerated
Additional Information: DNA must be extracted in a CLIA-certified laboratory or equivalent and must be extracted from a specimen type listed as acceptable for this test (including applicable anticoagulants). Our laboratory has experience with Chemagic, Puregene, Autopure, MagnaPure, and EZ1 extraction platforms and cannot guarantee that all extraction methods are compatible with this test. If testing fails, one repeat will be attempted, and if unsuccessful, the test will be reported as failed and a charge will be applied. If applicable, specific gene regions that were unable to be interrogated due to DNA quality will be noted in the report.

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:
-Informed Consent for Genetic Testing (T576)
-Informed Consent for Genetic Testing-Spanish (T826)
2. Molecular Genetics: Biochemical Disorders Patient Information (T527)

Specimen Minimum Volume

See Specimen Required

Reject Due To

All specimens will be evaluated at Mayo Clinic Laboratories for test suitability.

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Varies	Varies		

Clinical & Interpretive

Clinical Information

Galactosemia is an autosomal recessive disorder that results from a deficiency of any 1 of the 4 enzymes catalyzing the conversion of galactose to glucose: galactose-1-phosphate uridyltransferase (GALT), galactokinase (GALK), uridine diphosphate galactose-4-epimerase (GALE), and galactose mutarotase (GALM). GALT deficiency is the most common cause of galactosemia and is often referred to as classic galactosemia. Classic galactosemia is caused by pathogenic variants in the *GALT* gene. The complete or near-complete deficiency of GALT enzyme is life threatening if left untreated.

Complications in the neonatal period include failure to thrive, liver failure, sepsis, and death.(1)

Galactosemia is treated by a galactose-restricted diet, which allows for rapid recovery from the acute symptoms and a generally good prognosis.(2) Despite adequate treatment from an early age, individuals with galactosemia remain at increased risk for developmental delays, speech problems, and abnormalities of motor function. Female individuals with galactosemia are at increased risk for premature ovarian failure. Based upon reports by newborn screening programs, the frequency of classic galactosemia in the United States is approximately 1 in 30,000, although literature reports range from 1 in 10,000 to 1 in 60,000 live births.

Duarte-variant galactosemia (compound heterozygosity for the c.-119_-116del/c.940A>G (p.N314D) variants in addition to a classic variant) is generally associated with higher levels of enzyme activity (5%-20%) than classic galactosemia (<5%); however, this may be indistinguishable by newborn screening assays.(3) Previously, it was unknown whether children with Duarte-variant galactosemia were at an increased risk for adverse developmental outcomes due to milk exposure and were often treated with a low galactose diet during infancy. More recently, the outcomes data suggest a lack of evidence for developmental complications due to milk exposure, therefore treatment recommendations remain controversial.(2,4) The Duarte variant, c.-119_-116del/c.940A>G (p.N314D), is found in 5% of the general United States population. The Los Angeles variant, which consists of p.N314D and a second variant, p.L218L, is associated with higher levels of GALT enzyme activity than the Duarte-variant allele.

Newborn screening for galactosemia is performed in all 50 US states, though the method by which potentially affected individuals are detected varies from state to state and may include the measurement of total galactose (galactose and galactose-1-phosphate) 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 indicative of carrier or affected status, molecular testing for common *GALT* variants may be performed. If one or both disease-causing variants are not detected by targeted variant analysis and biochemical testing has confirmed the diagnosis of galactosemia, sequencing of the *GALT* gene (GALZ / Galactosemia, *GALT* Gene, Full Gene Analysis, Varies) is available to identify additional variants.

For more information see Galactosemia Testing Algorithm.

Table. Targeted Variants

Associated phenotype	Gene (transcript)	Variants
Galactosemia	*GALT* (NM_000155)	c.-119_-116del*, c.136_140del, c.221T>C*, c.253-2A>G*, c.292G>A*, c.404C>T*, c.413C>T*, c.425T>A*, c.443G>A*, c.505C>A, c.512T>C*, c.563A>G*, c.584T>C*, c.607G>A*, c.626A>G*, c.855G>T*, c.940A>G*, c.958G>A*, c.997C>G*, c.997C>T*, c.1018G>T, c.1030C>A*, c.1138T>C* Deletion analysis of exon 1-11

*Previously detected in a known positive sample

Reference Values

An interpretive report will be provided.

Interpretation

The interpretive report includes an overview of the findings as well as the associated clinical significance.

Results should be interpreted in the context of biochemical results.

If results of the galactose-1-phosphate uridyltransferase enzyme analysis and this test are discordant, then consider GALZ / Galactosemia, *GALT* Gene, Full Gene Analysis, Varies.

Cautions

This assay will not detect all of the known disease-associated variants that cause galactosemia. Therefore, the absence of a detectable variant does not rule out the possibility that an individual is a carrier of or affected with this disease.

Many disorders may present with symptoms similar to those associated with galactosemia. Therefore, biochemical testing is recommended to establish the diagnosis of galactosemia prior to DNA analysis.

A negative result does not eliminate the risk of carrier status for any of the included conditions, due to the possibility that the patient carries a variant that is not interrogated with this assay or the rare chance of a false-negative result for a tested variant. For tested variants, the negative predictive value of this screen is greater than 98%. The patient's residual risk to be a carrier after a negative screen is dependent on ethnic background and family history.

A positive control was not available for all variants targeted on this panel. For more information regarding availability of a positive control for each variant see the Table (Targeted Variants) in Clinical Information. The negative predictive value of these targets is unknown.

Rare variants (ie, polymorphisms) exist that could lead to false-negative or false-positive results. If results obtained do not match the clinical findings, additional testing should be considered.

All detected variants are evaluated according to American College of Medical Genetics and Genomics recommendations.(5) This assay was designed to specifically target known pathogenic or likely pathogenic variants. In rare cases, DNA variants of undetermined significance may be identified. The laboratory encourages health care providers to contact the laboratory at any time to learn how the status of a particular variant may have changed over time.

Multiple in-silico evaluation tools may have been used to assist in the interpretation of these results. Of note, the sensitivity and specificity of these tools for the determination of pathogenicity is currently unvalidated.

Test results should be interpreted in the context of clinical findings, family history, and other laboratory data. Misinterpretation of results may occur if the information provided is inaccurate or incomplete.

Bone marrow transplants from allogenic donors will interfere with testing. Call Mayo Clinic Laboratories for instructions for testing patients who have received a bone marrow transplant.

An online research opportunity called GenomeConnect (genomeconnect.org), a project of ClinGen, is available for the recipient of this genetic test. This patient registry collects deidentified genetic and health information to advance the

knowledge of genetic variants. Mayo Clinic is a collaborator of ClinGen. This may not be applicable for all tests.

Clinical Reference

1. Berry GT. Classic galactosemia and clinical variant galactosemia. In: Adam MP, Bick S, Mirzaa GM, et al, eds. GeneReviews [Internet]. University of Washington, Seattle; 2000. Updated March 11, 2021. Accessed November 6, 2025. Available at www.ncbi.nlm.nih.gov/books/NBK1518/
2. Welling L, Bernstein LE, Berry GT, et al. International clinical guideline for the management of classical galactosemia: diagnosis, treatment, and follow-up. J Inherit Metab Dis. 2017;40(2):171-176. doi:10.1007/s10545-016-9990-5
3. Fridovich-Keil JL, Gambello MJ, Singh RH, Sharer JD. Duarte variant galactosemia. In: Adam MP, Bick S, Mirzaa GM, et al, eds. GeneReviews [Internet]. University of Washington, Seattle; 2014. Updated June 25, 2020. Accessed November 6, 2025. Available at www.ncbi.nlm.nih.gov/books/NBK258640/
4. Carlock G, Fischer ST, Lynch ME, et al. Developmental outcomes in Duarte galactosemia. Pediatrics. 2019;143(1):e20182516. doi:10.1542/peds.2018-2516
5. Richards S, Aziz N, Bale S, et al. Standards and guidelines for the interpretation of sequence variants: a joint consensus recommendation of the American College of Medical Genetics and Genomics and the Association for Molecular Pathology. Genet Med. 2015;17(5):405-424. doi:10.1038/gim.2015.30
6. Elsas LJ 2nd, Lai K. The molecular biology of galactosemia. Genet Med. 1998;1(1):40-48. doi:10.1097/00125817-199811000-00009
7. Kaye CI; Committee on Genetics, Accurso F, et al. Newborn screening fact sheets. Pediatrics. 2006;118(3):e934-e963. doi:10.1542/peds.2006-1783
8. Novelli G, Reichardt JK. Molecular basis of disorders of human galactose metabolism: past, present, and future. Mol Genet Metab. 2000;71(1-2):62-65. doi:10.1006/mgme.2000.3073
9. Succoio M, Sacchettini R, Rossi A, Parenti G, Ruoppolo M. Galactosemia: Biochemistry, molecular genetics, newborn screening, and treatment. Biomolecules. 2022;12(7):968

Performance

Method Description

The targeted genotyping assay utilizing the ThermoFisher GeneTitan platform is used to detect 24 targets in the *GALT* gene. Confirmatory testing of homozygous results is performed as reflex tests when appropriate. For details regarding the targeted disease-causing variants identified by this test, see the Targeted Variants table in Clinical Information.

Multiplex ligation-dependent probe amplification, polymerase chain reaction (PCR), relative quantitative PCR, and Sanger sequencing are used to confirm variants detected by array when appropriate.(Unpublished Mayo method)

PDF Report

No

Day(s) Performed

Varies

Report Available

7 to 21 days

Specimen Retention Time
Whole Blood: 28 days (if available); Extracted DNA: 3 months

Performing Laboratory Location
Mayo Clinic Laboratories - Rochester Main Campus

Fees & 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 account representative. 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. It has not been cleared or approved by the US Food and Drug Administration.

CPT Code Information
81401

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
GALMP	Galactosemia Mutation Panel	42318-6

Result ID	Test Result Name	Result LOINC® Value
606344	Result Summary	50397-9
606345	Result	82939-0
606346	Interpretation	69047-9
606347	Additional Information	48767-8
606348	Method	85069-3
606349	Specimen	31208-2
606350	Source	31208-2
606351	Released By	18771-6