MAYO CLINIC LABORATORIES

Test Definition: I2SWB

Iduronate-2-Sulfatase, Leukocytes

Overview

Useful For

Supporting the biochemical diagnosis of mucopolysaccharidosis II (MPS II; Hunter syndrome) in whole blood specimens

This test is **not useful for** carrier detection for MPS II.

Genetics Test Information

This test provides diagnostic testing for individuals with positive newborn screen results or clinical signs and symptoms suspicious of mucopolysaccharidosis type II (MPS II, Hunter syndrome). If an enzyme deficiency is detected by this test, additional biochemical or molecular testing is required to confirm a diagnosis.

Testing Algorithm

For more information see Newborn Screening Follow up for Mucopolysaccharidosis Type II: Decreased Iduronate 2-Sulfatase Activity and Elevated Blood Glycosaminoglycans

Special Instructions

- Informed Consent for Genetic Testing
- Biochemical Genetics Patient Information
- Informed Consent for Genetic Testing (Spanish)
- Newborn Screening Follow up for Mucopolysaccharidosis Type II: Decreased Iduronate 2-Sulfatase Activity and Elevated Blood Glycosaminoglycans

Method Name

Liquid Chromatography Tandem Mass Spectrometry (LC-MS/MS)

NY State Available

Yes

Specimen

Specimen Type

Whole Blood ACD

Shipping Instructions

For optimal isolation of leukocytes, it is recommended the specimen arrive refrigerated within 6 days of collection to be stabilized. Pre-analytical processing is performed Monday through Friday and Sunday. This test may be canceled if specimens are outside of stability when processing occurs. Collect and package specimens for arrival on days when processing is performed.

Necessary Information

1. Patient's age is required.

2. Reason for testing is required.

Specimen Required

Container/Tube:
Preferred: Yellow top (ACD solution B)
Acceptable: Yellow top (ACD solution A) or lavender top (EDTA)
Specimen Volume: 6 mL
Collection Instructions: Send whole blood specimen in original tube. **Do not aliquot**.

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. Biochemical Genetics Patient Information (T602)
3. If not ordering electronically, complete, print, and send a Biochemical Genetics Test Request (T798) with the specimen.

Specimen Minimum Volume

5 mL

Reject Due To

Gross hemolysis	Reject

Specimen Stability Information

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

Clinical & Interpretive

Clinical Information

Mucopolysaccharidosis II (MPS II; Hunter syndrome) is an X-linked lysosomal disorder caused by the deficiency of iduronate sulfatase enzyme due to disease-causing variants in the *IDS* gene. Clinical features and severity of symptoms are widely variable ranging from severe infantile onset disease to an attenuated form, which generally has a later onset with a milder clinical presentation. Symptoms may include coarse facies, short stature, enlarged liver and spleen, hoarse voice, stiff joints, cardiac disease, and profound neurologic involvement leading to developmental delays and regression. As an X-linked disorder, MPS II occurs primarily in male patients with an estimated incidence of 1 in 120,000 male births, although symptomatic female carriers have been reported. Treatment availability, including hematopoietic stem cell transplantation and enzyme replacement therapy, makes early diagnosis desirable, as early initiation of treatment has been shown to improve clinical outcomes. Newborn screening for MPS II has been implemented in some states.

A diagnostic workup in an individual with MPS II includes urine or blood glycosaminoglycans levels showing increased amounts of both dermatan and heparan sulfate (see MPSQU / Mucopolysaccharides Quantitative, Random, Urine and MPSBS / Mucopolysaccharidosis, Blood Spot). Reduced or absent activity of iduronate sulfatase can confirm a diagnosis of MPS II but may also be deficient in unaffected individuals with pseudodeficiency as well as individuals with multiple sulfatase deficiency. Enzymatic testing is not reliable to detect carriers. Molecular genetic testing of the *IDS* gene allows for detection of the disease-causing variant in affected patients and subsequent carrier detection in female relatives (see IDS / Mucopolysaccharidosis Type II, *IDS* Gene Sequencing with Deletion/Duplication, Varies

Reference Values

>2.20 nmol/hr/mg protein

An interpretive report will be provided.

Interpretation

Abnormal results are not sufficient to establish a diagnosis of a particular disease. To verify a preliminary diagnosis based on this assay, additional biochemical or molecular genetic analyses are required.

When abnormal results are detected, a detailed interpretation is given, including an overview of the results and of their significance, a correlation to available clinical information, elements of differential diagnosis, recommendations for additional biochemical testing, and in vitro, confirmatory studies (enzyme assay, molecular analysis), and a phone number to reach one of the laboratory directors in case the referring physician has additional questions.

Cautions

Individuals with pseudodeficiency alleles can show reduced enzyme activity.

Carrier status (heterozygosity) for these conditions cannot be reliably detected.

Enzyme levels may be normal in individuals receiving enzyme replacement therapy or who have undergone hematopoietic stem cell transplant.

Iduronate-2-sulfatase can also be deficient in individuals with multiple sulfatase deficiency.

Clinical Reference

1. Neufeld EF, Muenzer J. The mucopolysaccharidoses. In: Valle DL, Antonarakis S, Ballabio A, Beaudet AL, Mitchell GA. eds. The Online Metabolic and Molecular Bases of Inherited Disease. McGraw-Hill; Accessed October 13, 2025. https://ommbid.mhmedical.com/content.aspx?bookid=2709&sectionid=225544161
2. Hopwood JJ, Ballabio A. Multiple sulfatase deficiency and the nature of the sulfatase family. In: Valle DL, Antonarakis S, Ballabio A, Beaudet AL, Mitchell GA. eds. The Online Metabolic and Molecular Bases of Inherited Disease. McGraw-Hill; Accessed October 13, 2025. https://ommbid.mhmedical.com/content.aspx?bookid=2709&sectionid=225546905

Performance

Method Description

Leukocytes are incubated with four cocktail mixes in 96-well plates:
1. Substrate and internal standard (IS) for iduronate 2-sulfatase, heparan N-sulfatase, alpha-N-acetylglucosaminidase, N-acetylgalactosamine-sulfate, beta-galactosidase, arylsulfatase B, beta-glucuronidase, and tripeptidyl peptidase 1
2. Substrate and IS for acetyl-CoA:alpha-glucosaminide N-acetyltransferase
3. substrate and IS for N-acetylglucosamine-6-sulfatase
4. Substrate and IS for palmitoyl-protein thioesterase 1

Following overnight incubation, the plates are combined and purified by liquid-liquid extraction. The extracts are evaporated, reconstituted with mobile phase, and analyzed by tandem mass spectrometry.(Unpublished Mayo method)

PDF Report

No

Day(s) Performed

Preanalytical processing: Monday through Friday, Sunday
Testing performed: Tuesday

Report Available

8 to 15 days

Specimen Retention Time

White blood cell homogenate: 1 month

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

82657

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
I2SWB	Iduronate-2-sulfatase, WBC	24089-5

Test Definition: I2SWB

Iduronate-2-Sulfatase, Leukocytes

Result ID	Test Result Name	Result LOINC® Value
BG765	Reason for Referral	42349-1
618291	Iduronate-2-sulfatase	24089-5
618454	Interpretation	59462-2
618453	Reviewed By	18771-6