

# A study of potential treatment-responsive biomarkers and clinical outcomes in Hunter syndrome

<b>Submission date</b> 23/12/2025	<b>Recruitment status</b> No longer recruiting	<input type="checkbox"/> Prospectively registered
<b>Registration date</b> 15/01/2026	<b>Overall study status</b> Completed	<input type="checkbox"/> Protocol
<b>Last Edited</b> 18/02/2026	<b>Condition category</b> Nutritional, Metabolic, Endocrine	<input type="checkbox"/> Statistical analysis plan
		<input type="checkbox"/> Results
		<input type="checkbox"/> Individual participant data
		<input checked="" type="checkbox"/> Record updated in last year

## Plain English summary of protocol

### Background and study aims

The primary objectives of the study were to characterize the progression of adaptive behavior, characterize the progression of neurocognition, and to assess levels of potential disease-related or treatment-responsive biomarkers in blood, urine, and/or CSF samples from participants with mucopolysaccharidosis Type II (Hunter Syndrome or MPS II).

### Who can participate?

Participants with a confirmed diagnosis of MPS II. This included genetic testing (looking for changes in the iduronate 2-sulfatase [IDS] gene) and lab tests showing iduronate-2-sulfatase (IDS) enzyme activity in the blood, white blood cells, or skin cells.

### What does the study involve?

No new or experimental treatments were given in this study. This was a six-part, forward-looking (prospective), observational study done at multiple centers in different regions. The goal was to study biomarkers and look at how the disease affects people with MPS II, including both types: the kind that affects the brain (nMPS II) and the kind that does not (nnMPS II).

### What are the possible benefits and risks?

Participants in the study did not receive any additional medical therapy for MPS II, and, as such, did not receive direct therapeutic benefit. However, there was a possible benefit from participation in the study via the included assessments of health status and information that may be used to request educational, medical, or other services.

### Where is the study run from?

The study was sponsored by Denali Therapeutics Inc. and run from multiple medical institutes in the United States of America, The Netherlands, and the UK.

### When is the study starting and how long is it expected to run for?

October 2019 to March 2024.

Who is funding the study?  
Denali Therapeutics Inc.

Who is the main contact?  
Clinical Trials Disclosures Group at Denali Therapeutics, [clinical-trials-disclosures@dnli.com](mailto:clinical-trials-disclosures@dnli.com)

## Contact information

**Type(s)**  
Public

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None Clinical Trials Disclosures Group

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# Additional identifiers

## ClinicalTrials.gov (NCT)

NCT04007536

## Integrated Research Application System (IRAS)

263187

## Central Portfolio Management System (CPMS)

42373

## Protocol serial number

DNLI-E-0001

# Study information

## Scientific Title

A prospective, longitudinal study of potential treatment-responsive biomarkers and clinical outcomes in Hunter syndrome

## Study objectives

This study observed how mucopolysaccharidosis type II (MPS II) changes over time and looked for biomarkers that might respond to treatment. It included both the neuronopathic form (nMPS II), which affects the brain, and the non-neuronopathic form (nnMPS II), which does not. The goal was to better understand these biomarkers and how they relate to signs and symptoms of MPS II as the disease gets worse over time.

## Ethics approval required

Ethics approval required

## Ethics approval(s)

approved 30/09/2019, NHS HRA North East - Tyne & Wear South Research Ethics Committee (NHSBT Newcastle Blood Donor Centre, Holland Drive, Newcastle upon Tyne, NE2 4NQ, United Kingdom; +44 0207 1048084; nrescommittee.northeast-tyneandwearsouth@nhs.net), ref: 19/NE/0169

## Study design

Six-part, prospective, multicenter, multiregional, observational study.

## Primary study design

Observational

## Study type(s)

Other

## Health condition(s) or problem(s) studied

Mucopolysaccharidosis II

## Interventions

This was a six-part, prospective, multicenter, multiregional, observational study designed to evaluate biomarkers and assess the clinical outcomes of disease in patients with MPS II, including nMPS II and nnMPS II. Eligible participants were required to have a documented diagnosis of MPS II, which included genetic analysis (ie, mutation analysis of the iduronate 2-sulfatase [IDS] gene) and biochemical assessment (eg, IDS enzyme activity in plasma, white blood cells, or fibroblasts). No experimental therapies were administered in this study.

## **Intervention Type**

Other

## **Primary outcome(s)**

1. Adaptive behavior measured using Vineland-3 8-subdomain Adaptive Behavior Raw Score (ABRS-8) at Baseline, Week 24, and Week 48
2. Adaptive behavior measured using Vineland-3 Adaptive Behavior Composite (ABC) Score at Baseline, Week 24, and Week 48
3. Neurocognition measured using Bayley Scales of Infant and Toddler Development, 3rd Edition (BSID-III) cognitive raw score at Baseline, Week 24, and Week 48
4. Neurocognition measured using Kaufman Assessment Battery for Children, 2nd Edition (KABC-II) score at Baseline, Week 24, and Week 48
5. Neurocognition measured using Wechsler Intelligence Scale for Children, Fifth Edition (WISC-V) score at Baseline and Week 48
6. Cross-sectional CSF HS level measured using the sum of HS D0A0, D0A6, D0S0, and D2S6 at Week 1
7. Cross-sectional CSF DS measured using D0a4 at Week 1
8. Urine HS level measured using the sum of HS D0A0, D0A6, D0S0, D2S6, and normalized to urine creatinine) and percent change in urine HS from first observation to last observation at each visit over 78 weeks
9. Urine DS (D0a4) level (normalized to urine creatinine) and percent change in urine DS measured using urine test at each visit over 78 weeks
10. Sum of urine HS and DS level (normalized to urine creatinine) and percent change in sum of urine HS and DS measured using urine test at each visit over 78 weeks
11. Total urine glycosaminoglycans (GAGs) level measured using a colorimetric assay and normalized to urine creatinine) and percent change in total urine GAGs at each visit over 78 weeks
12. Serum HS level measured using the sum of HS D0A0, D0A6, D0S0, and D2S6 and percent change in serum HS at each visit over 78 weeks
13. Serum DS level and percent change in serum DS measured using D0a4 at each visit over 78 weeks

14. Sum of serum HS and DS level and percent change in sum of serum HS and DS measured using previously measured serum HS and DS levels at each visit over 78 weeks

## **Key secondary outcome(s)**

### **Completion date**

01/03/2024

## **Eligibility**

### **Key inclusion criteria**

#### Key Inclusion Criteria (Part 1):

1. Participants aged 2 through 10 years
2. nMPS II subgroup: participants with a development quotient (DQ) <85 and/or a decline of at least 7.5 points in DQ, assessed at least 6 months apart, or with the same genetic mutation as a blood relative with confirmed nMPS II

#### Key Inclusion Criteria (Part 2):

1. Participants aged 2 through 30 years
2. nMPS II subgroup: patients with an age-adjusted DQ <85 and/or a decline of 10 points or more in DQ in the previous 6 months or more, or with the same genetic mutation as a blood relative with confirmed nMPS II
3. Scheduled to undergo general anesthesia or CSF sampling for non-study-related medical reasons and parent(s)/legally authorized representative consent to donate CSF for research purposes during that procedure, or an adult patient is able to provide consent and agrees to participation in the study for CSF collection/donation

#### Key Inclusion Criteria (Part 3):

1. nMPS II participants aged <8 years

#### Key Inclusion Criteria (Part 4):

1. nnMPS II participants aged 6 to 17 years

#### Key Inclusion Criteria (Part 5):

1. Participants aged  $\leq 3$  years
2. Have undetermined MPS II phenotype
3. Do not have a large deletion(s) or rearrangement(s) in the IDS gene or other definitive mutation indicative of nMPS II
4. Do not have a DQ < 85 at the screening/baseline neurocognitive assessment and/or a documented decline of at least 7.5 points in DQ in the previous 6 to 18 months
5. Do not have the same IDS gene variant as a blood relative with confirmed nMPS II or nnMPS II

#### Key Inclusion Criteria (Part 6):

1. nMPS II participants aged 1 to 17 years
2. Have received an MPS II gene therapy or allogeneic HSCT > 12 months prior to screening
3. Have a post-HSCT or post-gene therapy DQ < 85 at the screening/baseline neurocognitive assessment and/or a documented decline of at least 7.5 points in DQ in the previous 6 to 18 months

### **Participant type(s)**

Patient

**Healthy volunteers allowed**

No

**Age group**

Mixed

**Lower age limit**

0 years

**Upper age limit**

30 years

**Sex**

All

**Total final enrolment**

18

**Key exclusion criteria**

1. Have unstable medical condition that would make participation in the study unsafe or would interfere with necessary medical care
2. Have received any central nervous system (CNS)-targeted MPS II investigational therapy within the previous 6 months

**Date of first enrolment**

23/10/2019

**Date of final enrolment**

01/03/2023

**Locations****Countries of recruitment**

United Kingdom

England

Netherlands

United States of America

**Study participating centre**

**Birmingham Children's Hospital**

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Birmingham

England

B4 6NH

**Study participating centre**  
**Greater Manchester NHS Genomic Medicine Centre**  
Genomic Diagnostics Laboratory  
Manchester Ctr for Genomic Medicine  
St Marys Hospital, Oxford Road  
Manchester  
England  
M13 9WL

**Study participating centre**  
**UCSF Benioff Children's Hospital**  
Oakland  
United States of America  
94609

**Study participating centre**  
**UNC Children's Research Institute**  
Chapel Hill  
United States of America  
27514

**Study participating centre**  
**UPMC | Children's Hospital of Pittsburgh**  
Pittsburgh  
United States of America  
15224

**Study participating centre**  
**Erasmus Medical Center**  
Rotterdam  
Netherlands  
3015 GD

## **Sponsor information**

**Organisation**  
Denali Therapeutics (United States)

ROR

<https://ror.org/00pprn321>

## Funder(s)

### Funder type

Not defined

### Funder Name

Denali Therapeutics

### Alternative Name(s)

DENALI, Denali Therapeutics Inc.

### Funding Body Type

Government organisation

### Funding Body Subtype

For-profit companies (industry)

### Location

United States of America

## Results and Publications

### Individual participant data (IPD) sharing plan

### IPD sharing plan summary

Not expected to be made available

### Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
<a href="#">Plain English results</a>			29/12/2025	No	Yes