

## Overview

### Useful For

Confirmation of diagnosis in patients suspected of having either Prader-Willi syndrome (PWS) or Angelman syndrome (AS) based on clinical assessment or previous laboratory analysis

Prenatal diagnosis in families at risk for PWS or AS

### Reflex Tests

Test Id	Reporting Name	Available Separately	Always Performed
CULAF	Amniotic Fluid Culture/Genetic Test	Yes	No
MATCC	Maternal Cell Contamination, B	Yes	No
CULFB	Fibroblast Culture for 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

### Genetics Test Information

Preferred first-tier test for diagnosis of Angelman syndrome (AS) and Prader-Willi syndrome (PWS). Multiplex ligation probe amplification (MLPA) is used to identify abnormal methylation of the PWS/AS region of chromosome 15.

### Testing Algorithm

**For prenatal specimens only:** If amniotic fluid (nonconfluent cultured cells) is received, amniotic fluid culture/genetic test will be added at an additional charge. For any prenatal specimen that is received, maternal cell contamination studies will be added.

See [Prader-Willi and Angelman Syndromes: Laboratory Approach to Diagnosis](#)

### Special Instructions

- [Molecular Genetics: Congenital Inherited Diseases Patient Information](#)
- [Informed Consent for Genetic Testing](#)
- [Prader-Willi and Angelman Syndromes: Laboratory Approach to Diagnosis](#)
- [Informed Consent for Genetic Testing \(Spanish\)](#)

### Method Name

Multiple Ligation-Dependent Probe Amplification (MLPA)

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**NY State Available**

Yes

**Specimen****Specimen Type**

Varies

**Additional Testing Requirements**

Mayo Clinic Laboratories highly recommends that this test be ordered along with a routine chromosomal microarray analysis, CMA CB / Chromosomal Microarray, Congenital, Blood, if the diagnosis of Prader-Willi syndrome (PWS) or Angelman syndrome (AS) is not certain and chromosome analysis has not already been done.

All prenatal specimens must be accompanied by a maternal blood specimen. Order MATCC / Maternal Cell Contamination, Molecular Analysis, Varies on the maternal specimen.

**Shipping Instructions**

Specimen preferred to arrive within 96 hours of collection.

**Specimen Required**

**Patient Preparation:** A previous bone marrow transplant from an allogenic donor will interfere with testing. Call 800-533-1710 for instructions for testing patients who have received a bone marrow transplant.

**Submit only 1 of the following specimens:**

**Specimen Type:** Whole blood

**Container/Tube:**

**Preferred:** Lavender top (EDTA) or yellow top (ACD)

**Acceptable:** Any anticoagulant

**Specimen Volume:** 3 mL

**Collection Instructions:**

1. Invert several times to mix blood.
2. Send whole blood specimen in original tube. **Do not aliquot.**

**Specimen Stability Information:** Ambient (preferred)/Refrigerated

**Prenatal Specimens**

**Due to the complexity of prenatal testing, consultation with the laboratory is required for all prenatal testing.**

**Specimen Type:** Amniotic fluid

**Container/Tube:** Amniotic fluid container

**Specimen Volume:** 20 mL

**Specimen Stability Information:** Refrigerated (preferred)/Ambient

**Acceptable:****Specimen Type:** Confluent cultured cells**Container/Tube:** T-25 flask**Specimen Volume:** 2 Flasks**Collection Instructions:** Submit confluent cultured cells from another laboratory.**Specimen Stability Information:** Ambient (preferred)/Refrigerated**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: Congenital Inherited Diseases Patient Information \(T521\)](#)

3. If not ordering electronically, complete, print, and send a [Neurology Specialty Testing Client Test Request \(T732\)](#) with the specimen.

**Specimen Minimum Volume**

Blood: 1 mL

Amniotic Fluid: 10 mL

**Reject Due To**

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

**Specimen Stability Information**

Specimen Type	Temperature	Time	Special Container
Varies	Varies		

**Clinical & Interpretive****Clinical Information**

Prader-Willi syndrome (PWS) is a congenital disorder characterized by a biphasic clinical course. Neonates with PWS are hypotonic, have a weak cry, and are initially poor feeders that improve over time. In later infancy and childhood, individuals with PWS have global developmental delay, short stature, hypogonadism, small hands and feet, and marked hyperphagia leading to obesity. PWS is thought to be due to loss of function of paternally expressed genes, although specific genes have not yet been definitively implicated in the phenotype of PWS.

Etiology of Prader-Willi syndrome:

-Chromosome 15 deletion (15q11-13): approximately 70% to 75%

-Maternal uniparental disomy (UPD): 20% to 30%

-Imprinting defect: 1% to 5%

-Chromosome rearrangement: rare

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The phenotype caused by paternal deletions of 15q11-13 and by maternal UPD are generally identical with the exception of relative hypopigmentation being more common in patients with deletion PWS.

Angelman syndrome (AS) is a nonprogressive congenital disorder characterized by more significant developmental delay and intellectual disability, ataxia, seizures, jerky arm movements, macrostomia, tongue thrusting, unprovoked laughter, brachycephaly, and virtual absence of speech. AS is due to loss of function of the maternally expressed gene UBE3A.

Etiology of Angelman syndrome:

- Chromosome 15 deletion (15q11-13): approximately 70% to 75%
- Paternal UPD: approximately 5%
- UBE3A variant: approximately 10%
- Imprinting defect: 2% to 5%
- Chromosome rearrangement: rare
- Unknown: approximately 10%

The phenotype of AS patients with maternal deletions is generally more severe than that associated with paternal UPD or imprinting defects, including a higher rate or severity of microcephaly, seizures, and motor difficulties. Patients with AS caused by paternal UPD or imprinting defects generally show better growth and higher developmental and language abilities.

Both chromosome 15 deletions and UPD most often occur as de novo events during conception, and, thus, recurrence risk to siblings is very low. In rare cases, chromosome 15 deletions and UPD occur as a result of parental translocations or other rare cytogenetic rearrangements, and, in these cases, recurrence risks to siblings are increased.

The recurrence risk associated with imprinting defects is dependent on whether there is an identifiable variant.

UBE3A variants can occur sporadically or be inherited in an autosomal dominant fashion. There is a 50% recurrence risk to siblings in cases of an inherited UBE3A variant.

Due to the complex genetic etiology of PWS and AS and the corresponding variability in recurrence risks, careful cytogenetic and molecular testing and family assessment are necessary to provide accurate genetic counseling.

Initial studies to rule-out PWS or AS should include chromosomal microarray analysis to identify chromosome abnormalities that may have phenotypic overlap with PWS or AS, and methylation-sensitive multiple ligation-dependent probe amplification (MLPA) to identify deletions, duplications, and methylation defects. In cases where methylation-sensitive MLPA suggests either deletion or duplication, fluorescence in situ hybridization (FISH) can be used to confirm type I and type II deletions or characterize the disease mechanism, respectively. In cases where methylation-sensitive MLPA suggests abnormal methylation in the absence of a deletion or duplication, UPD studies can be used to characterize the disease mechanism.

Assessment of patients found to have a deletion in the PWS/AS critical region on routine cytogenetic analysis or chromosomal microarray can include confirmation of the deletion by FISH analysis and MLPA analysis to define parent of origin.

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For more information, see [Prader-Willi and Angelman Syndromes: Laboratory Approach to Diagnosis](#).

**Reference Values**

An interpretive report will be provided.

**Interpretation**

An interpretive report will be provided.

**Cautions**

In addition to disease-related probes, the multiple ligation-dependent probe amplification technique utilizes probes localized to other chromosomal regions as internal controls. In certain circumstances, these control probes may detect other diseases or conditions for which this test was not specifically intended. Results of the control probes are not normally reported. However, in cases where clinically relevant information is identified, the ordering physician will be informed of the result and provided with recommendations for any appropriate follow-up testing.

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.

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

Methylation status cannot be assessed on chorionic villus specimens.

Rare cases of Prader-Willi syndrome or Angelman syndrome (AS) result from a subtle balanced translocation inherited from one of the parents. These may not be detected by this assay.

A negative molecular test result, especially in the case of a clinical suspicion of AS, does not rule out the diagnosis, because point alterations may not be detected by these methods.

**Clinical Reference**

1. Buiting K: Prader-Willi syndrome and Angelman syndrome. *Am J Med Genet C Semin Med Genet*. 2010 Aug 15;154C(3):365-376
2. Williams CA, Beaudet AL, Clayton-Smith J, et al: Angelman syndrome 2005: updated consensus for diagnostic criteria. *Am J Med Genet A*. 2006 Mar 1;140(5):413-418
3. Gunay-Aygun M, Schwartz S, Heeger S, O'Riordan MA, Cassidy SB: The changing purpose of Prader-Willi syndrome clinical diagnostic criteria and proposed revised criteria. *Pediatrics*. 2001 Nov;108(5):E92
4. Nygren AOH, Ameziane N, Duarte HMB, et al: Methylation-specific MLPA (MS-MLPA): simultaneous detection of CpG methylation and copy number changes of up to 40 sequences. *Nucleic Acids Res*. 2005 Aug 16;33(14):e128
5. Procter M, Chou LS, Tang W, Jama M, Mao R: Molecular diagnosis of Prader-Willi and Angelman syndromes by methylation-specific melting analysis and methylation-specific multiplex ligation-dependent probe amplification. *Clin Chem*. 2006 Jul;52(7):1276-1283

**Performance**

**Method Description**

Methylation-sensitive multiple ligation-dependent probe amplification is utilized to test for the presence of large deletions, duplications and methylation defects in the Prader-Willi/Angelman syndrome critical region. (Unpublished Mayo method)

**PDF Report**

No

**Day(s) Performed**

Monday, Wednesday

**Report Available**

10 to 14 days

**Specimen Retention Time**

Whole Blood: 2 weeks (if available) Extracted DNA: 3 months

**Performing Laboratory Location**

Rochester

**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 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 US Food and Drug Administration.

**CPT Code Information**

81331-SNRPN/UBE3A, (small nuclear ribonucleoprotein polypeptide Nand ubiquitin protein ligase E3A) (eg, Prader-Willi syndrome and/or Angelman syndrome), methylation analysis

88235-Tissue culture for amniotic fluid (if appropriate)

88240-Cryopreservation (if appropriate)

81265-Comparative analysis using Short Tandem Repeat (STR) markers; patient and comparative specimen (eg, pre-transplant recipient and donor germline testing, post-transplant non-hematopoietic recipient germline [eg, buccal swab or other germline tissue sample] and donor testing, twin zygosity testing or maternal cell contamination of fetal cells (if appropriate)

**LOINC® Information**

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Test ID	Test Order Name	Order LOINC® Value
PWAS	Prader Willi/Angelman Mol Analysis	35466-2

Result ID	Test Result Name	Result LOINC® Value
52913	Result Summary	50397-9
52914	Result	82939-0
52915	Interpretation	69047-9
52916	Reason for Referral	42349-1
52917	Specimen	31208-2
52918	Source	31208-2
52919	Released By	18771-6