Angelman Syndrome: **UBE3A Gene Deletion/Duplication**

**Test Code:** DUBE3  
**Turnaround time:** 2 weeks  
**CPT Codes:** 81228 x1

## Condition Description

Angelman syndrome (AS) is characterized by severe developmental delay or mental retardation, severe speech impairment, gait ataxia and/or tremulousness of the limbs, and a unique behavior with an inappropriate happy demeanor that includes frequent laughing, smiling, and excitability. Consensus criteria for the clinical diagnosis of AS have been developed in conjunction with the Scientific Advisory Committee of the US Angelman Syndrome Foundation. Newborns typically have a normal phenotype. Developmental delays are first noted at around six months of age. However, the unique clinical features of AS do not become manifest until after one year of age, and it can take several years before the correct clinical diagnosis is obvious.

Findings typically present in affected individuals:

- Normal prenatal and birth history, normal head circumference at birth, no major birth defects
- Normal metabolic, hematologic, and chemical laboratory profiles
- Structurally normal brain by MRI or CT, although mild cortical atrophy or dysmyelination may be observed
- Delayed attainment of developmental milestones without loss of skills
- Evidence of developmental delay by six to twelve months of age, eventually classified as severe
- Speech impairment, with minimal to no use of words; receptive language skills and nonverbal communication skills higher than expressive language skills
- Movement or balance disorder, usually ataxia of gait and/or tremulous movement of the limbs
- Behavioral uniqueness, including any combination of frequent laughter/smiling; apparent happy demeanor; excitability, often with hand-flapping movements; hypermotoric behavior; short attention span
- Delayed or disproportionately slow growth in head circumference, usually resulting in absolute or relative microcephaly by two years of age
- Seizures, usually starting before three years of age
- Abnormal EEG, with a characteristic pattern of large-amplitude slow-spike waves

The diagnosis of AS rests on a combination of clinical features and molecular genetic testing and/or cytogenetic analysis. Consensus clinical diagnostic criteria for AS have been developed. Analysis of parent-specific DNA methylation imprints in the 15q11.2-q13 chromosome region detects approximately 78% of individuals with AS, including those with a deletion, uniparental disomy (UPD), or an imprinting defect (ID); fewer than 1% of individuals have a cytogenetically visible chromosome rearrangement (i.e., translocation or inversion). **UBE3A** (15q11-q13) sequence analysis detects mutations in an additional approximately 11% of individuals. Accordingly, molecular genetic testing (methylation analysis and **UBE3A** sequence analysis) identifies alterations in approximately 90% of individuals. The remaining 10% of individuals with classic phenotypic features of AS have a presently unidentified genetic mechanism and thus are not amenable to diagnostic testing.

For diagnosis of a proband

- DNA methylation analysis identifies approximately 80% of individuals with AS and should be the first test ordered.
- If DNA methylation analysis is normal, **UBE3A** sequence analysis is the next appropriate diagnostic test.

AS is caused by the loss of the maternally imprinted contribution in the 15q11.2-q13 Angelman syndrome/Prader-Willi syndrome (AS/PWS) region that can occur by one of at least five different known genetic mechanisms. The risk to sibs of a proband depends on the genetic mechanism of the loss of the maternally contributed AS/PWS region: typically less than 1% for probands with a deletion or UPD; as high as 50% for probands with an ID or a mutation of **UBE3A**. Members of the mother’s extended family are also at increased risk when an ID or a **UBE3A** mutation is present. Cytogenetically visible chromosome rearrangements may be inherited or de novo. Prenatal testing for pregnancies at increased risk is possible when the underlying genetic mechanism is a deletion, UPD, an ID, a **UBE3A** mutation, or a chromosome rearrangement.

The prevalence of AS is one in 12,000-20,000.

For patients with suspected Angelman syndrome, methylation analysis of the 15q11.2-q13 chromosome region is recommended as the first step in analysis. For patients in whom a methylation defect is not identified, full gene sequence analysis is appropriate. If sequence analysis is negative, deletion/duplication analysis is appropriate.

**Click here** for the GeneTests summary on this condition.

## Genes

**UBE3A**

## Indications

This test is indicated for:

- Confirmation of a clinical diagnosis of Angelman syndrome after methylation analysis of the 15q11.2-q13 chromosome region is negative and
Sequence analysis of the UBE3A gene is negative

**Methodology**

DNA isolated from peripheral blood is hybridized to a CGH array to detect deletions and duplications. The targeted CGH array has overlapping probes which cover the entire genomic region.

Please note that a "backbone" of probes across the entire genome are included on the array for analytical and quality control purposes. Rarely, off-target copy number variants causative of disease may be identified that may or may not be related to the patient’s phenotype. Only known pathogenic off-target copy number variants will be reported. Off-target copy number variants of unknown clinical significance will not be reported.

**Detection**

Detection is limited to duplications and deletions. The CGH array will not detect point or intronic mutations. Results of molecular analysis must be interpreted in the context of the patient’s clinical and/or biochemical phenotype.

**Specimen Requirements**

Submit only 1 of the following specimen types

* Preferred specimen type: Whole Blood

**Type: Whole Blood**

Specimen Requirements:

In EDTA (purple top) or ACD (yellow top) tube:
- Infants (2 years): 3-5 ml
- Older Children & Adults: 5-10 ml

Specimen Collection and Shipping: Refrigerate until time of shipment. Ship sample within 5 days of collection at room temperature with overnight delivery.

**Type: Saliva**

Specimen Requirements:

Oragene™ Saliva Collection kit (available through EGL) used according to manufacturer instructions.

Specimen Collection and Shipping: Store sample at room temperature. Ship sample within 5 days of collection at room temperature with overnight delivery.

**Special Instructions**

Submit copies of diagnostic biochemical test results with the sample, if appropriate. Contact the laboratory if further information is needed.

Methylation analysis of the 15q11.2-q13 chromosome region is required before UBE3A sequence analysis. If methylation analysis is performed outside of Emory Genetics Laboratory, please submit a copy of the methylation report with the test requisition.

Sequence analysis is required before deletion/duplication analysis by targeted CGH array. If sequencing is performed outside of Emory Genetics Laboratory, please submit a copy of the sequencing report with the test requisition.

**Related Tests**

- Methylation analysis of the 15q11.2-q13 chromosome region (test code PW listed under Prader-Willi/Angelman) detects approximately 78% of individuals with AS and is recommended before UBE3A analysis.
- Sequence analysis of the UBE3A gene is available and is required before deletion/duplication analysis.
- Prenatal testing is available to couples who are confirmed carriers of mutations. Please contact the laboratory genetic counselor to discuss appropriate testing prior to collecting a prenatal specimen.