Clinical Exome Sequencing, Family Trios (with Mitochondrial Genome)

**Test Code:** EXMTT  
**Turnaround time:** 6 weeks  
**CPT Codes:** 81415 x1, 81416 x1, 81460 x1

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**Condition Description**

**What is the Medical EmExome?**

The human exome is the complete coding (exonic) region of the genome. It is estimated to encompass approximately 1-2% of the genome, yet contains approximately 85% of disease-causing pathogenic variants. The Medical EmExome is expertly curated to target genes known or suspected to cause disease. The design provides >96% coverage of 19,000 genes, with a mean read depth of 100X. For the ~5,400 disease-associated genes analyzed, we typically get coverage >98%.

This testing includes sequencing of the mitochondrial genome.

Medical EmExome Trios includes the option to choose an EGL sequencing panel as an EmExome Boost. This option puts additional focus on variants in panel genes and offers fill-in coverage of the exons on the chosen panel at no additional cost.

**Will a particular gene be covered on the EmExome?**

The Exome Coverage Tool can be used to view typical depth of sequence coverage obtained by exome sequencing performed by EGL. To access this tool, please click [here](#). If a gene of specific interest does not have consistent (100%) coverage, please ask us about Sanger fill-in.

**Will EGL release raw exome data?**

Yes, upon request.

**Will EGL re-analyze data?**

Yes, upon request.

**What options are available for Medical EmExome testing?**

- EXOMT - Medical EmExome: Clinical Exome Sequencing, Trios
- EXOME - Medical EmExome: Clinical Exome Sequencing, Proband Only
- EXOMA - Medical EmExome: Clinical Exome Sequencing, Additional Family Member (EXOMT should be order first or at the same time)
- EXMTT – Clinical Exome Sequencing, Family Trios (with Mitochondrial Genome)
- EXMTO – Clinical Exome Sequencing, Proband Only (with Mitochondria Genome)
- EXMX3 – Expedited Medical EmExome: Clinical Exome Sequencing, Trios
- EXMXX – Expedited Medical EmExome: Clinical Exome Sequencing, Proband Only
- EXODD - Medical EmExome Array: Deletion/Duplication Analysis
- EXINT - Interpretation Only (Exome or Genome)
- EXOMR - Medical EmExome: Clinical Exome Reanalysis
- EX3UP – Medical EmExome: Trios Upgrade (Reanalysis of a proband-only exome as a trio; call for details)

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**Indications**

This test is indicated for individuals with a complex or ambiguous phenotype or for individuals with clinical features of a genetic disorder for whom previous testing has been non-diagnostic.

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**Methodology**

Medical EmExome is performed on genomic DNA using in solution hybridization to enrich for the exome. These targeted regions are then sequenced using next-generation sequencing technology at an average coverage of 100X in the target regions. This sequencing typically provides >96% coverage of the ~19,100 genes in the exome at >20X. Intronic variants within 10 nucleotides from the exon/intron boundaries are analyzed, unless prohibited by the complexity of the sequence. The DNA sequence is mapped to and analyzed in comparison with the published human genome build UCSC hg19 reference sequence. The targeted coding exons and splice junctions of genes associated with disease are assessed for the depth of coverage and data quality threshold values. EGL has developed an EmExome bioinformatics analysis pipeline to compare sequence changes in the individual being tested to the reference sequence. High-quality variants which pass EGL's quality filters are not confirmed by Sanger sequencing. Reportable variants that do not pass the quality filters are confirmed using bidirectional Sanger sequence analysis.

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Mitochondrial DNA sequencing: PCR was used to amplify the mitochondrial genome. Direct sequencing of the amplified region was performed using next generation short base pair read sequencing. Sequences are compared to revised Cambridge reference sequence (rCRS) NC_012920.1. Sequence analysis is limited to m.577_m.16023 region of the mitochondrial genome and excludes the highly variable control regions (m.1-m.576 and m.16024-m.16569).

Heteroplasmy: Heteroplasmy is defined as the co-presence of a reference allele and an alternate allele (variant) at a given position in the mitochondrial genome. For any given variant, the level of heteroplasmy is calculated as a percentage of the total NGS reads (at that particular position) that have the variant. In general, heteroplasmic variants detected at <10% of alleles, are not reported. Known pathogenic or likely pathogenic variants detected at <10% heteroplasmy may be reported with recommendations for additional studies, as appropriate.

**Detection**

Based on published studies, WES is expected to provide a diagnosis in 20-30% of the cases for rare and ultra-rare disorders.

**Specimen Requirements**

**Type: Whole Blood (EDTA)**

**Specimen Requirements:**
- EDTA (Purple Top)
- Infants and Young Children (2 years of age to 10 years old): 3-5 ml
- Older Children & Adults: 5-10 ml
- Autopsy: 2-3 ml unclotted cord or cardiac blood

**Specimen Collection and Shipping:**
Ship sample at room temperature for receipt at EGL within 72 hours of collection. Do not freeze.

**Type: Liquid Buccal Swab**

**Specimen Requirements:**
- ORAcollect-DX (OCD-100)|Assisted saliva collection kit
- DNA Genotek ORAcollect-DX kit used according to manufacturer instructions.
- Please contact EGL for a saliva collection kit for patients that cannot provide a blood sample.

**Specimen Collection and Shipping:**
Please do not refrigerate or freeze saliva sample. Please store and ship at room temperature.

**Type: DNA, Isolated**

**Specimen Requirements:**
- Microtainer
- 8µg
- Isolation using the Perkin Elmer™Chemagen™ Chemagen™ Automated Extraction method or Qiagen™ Puregene kit for DNA extraction is recommended.

**Specimen Collection and Shipping:**
Refrigerate until time of shipment in 100 ng/µL in TE buffer. Ship sample at room temperature with overnight delivery.

**Type: Saliva**

**Specimen Requirements:**
- Oragene™ Saliva Collection Kit
- Orangene™ Saliva Collection Kit used according to manufacturer instructions. Please contact EGL for a Saliva Collection Kit for patients that cannot provide a blood sample.

**Specimen Collection and Shipping:**
Please do not refrigerate or freeze saliva sample. Please store and ship at room temperature.

**Special Instructions**

Please submit medical records or clinic summary notes, and a signed consent form when ordering exome testing. Failure to receive clinic notes or a signed consent form may result in a delay in testing.