Test Definition: FMTT

Familial Variant, Targeted Testing, Varies

Overview

Useful For

Diagnostic or predictive testing for specific conditions when a DNA variant of interest has been previously identified in a family member and follow-up testing for this specific variant in other family members is desired

Carrier screening for individuals at risk for having a variant that was previously identified in a family member

Segregation analysis for a familial DNA variant

Confirmation of germline status for variants detected via somatic testing

Reflex Tests

Test Id	Reporting Name	Available Separately	Always Performed
MATCC	Maternal Cell Contamination, B	Yes	No
CULFB	Fibroblast Culture for Genetic Test	Yes	No
CULAF	Amniotic Fluid Culture/Genetic Test	Yes	No
_G001	Gene GRHPR	No, (Bill Only)	No
_G002	Gene PPOX	No, (Bill Only)	No
_G003	Gene CFTR	No, (Bill Only)	No
_G005	Gene MLH1	No, (Bill Only)	No
_G006	Gene MSH2	No, (Bill Only)	No
_G007	Gene MSH6	No, (Bill Only)	No
_G008	Gene MECP2	No, (Bill Only)	No
_G009	Gene MLH3	No, (Bill Only)	No
_G010	Gene CHEK2	No, (Bill Only)	No
_G011	Gene IDUA	No, (Bill Only)	No
_G012	Gene AXIN2	No, (Bill Only)	No
_G013	Gene BMPR1A	No, (Bill Only)	No
_G014	Gene PTEN	No, (Bill Only)	No
_G015	Gene SMAD4	No, (Bill Only)	No
_G016	Gene STK11	No, (Bill Only)	No
_G017	Gene TP53	No, (Bill Only)	No
_G018	Gene IDS	No, (Bill Only)	No
_G019	Gene FLCN	No, (Bill Only)	No
_G020	Gene SPINK1	No, (Bill Only)	No
_G021	Gene PRSS1	No, (Bill Only)	No
_G022	Gene CTRC	No, (Bill Only)	No

_G025	Gene ABCD1	No, (Bill Only)	No
_G026	Gene CDH1	No, (Bill Only)	No
_G027	Gene NAGLU	No, (Bill Only)	No
_G028	Gene SGSH	No, (Bill Only)	No
_G029	Gene ARSB	No, (Bill Only)	No
_G030	Gene GNPTAB	No, (Bill Only)	No
_G031	Gene SEPT9	No, (Bill Only)	No
_G032	Gene ACADVL	No, (Bill Only)	No
_G033	Gene ACADM	No, (Bill Only)	No
_G034	Gene ACADS	No, (Bill Only)	No
_G035	Gene FECH	No, (Bill Only)	No
_G036	Gene MAPT	No, (Bill Only)	No
_G037	Gene PKHD1	No, (Bill Only)	No
_G038	Gene GRN	No, (Bill Only)	No
_G039	Gene FTCD	No, (Bill Only)	No
_G040	Gene CDKN1C	No, (Bill Only)	No
_G041	Gene CPOX	No, (Bill Only)	No
_G042	Gene ATP7B	No, (Bill Only)	No
_G043	Gene GAA	No, (Bill Only)	No
_G044	Gene HMBS	No, (Bill Only)	No
_G045	Gene GALT	No, (Bill Only)	No
_G046	Gene GLA	No, (Bill Only)	No
_G047	Gene BTD	No, (Bill Only)	No
_G048	Gene HEXA	No, (Bill Only)	No
_G049	Gene AGXT	No, (Bill Only)	No
_G050	Gene APC	No, (Bill Only)	No
_G051	Gene MLYCD	No, (Bill Only)	No
_G052	Gene MMACHC	No, (Bill Only)	No
_G053	Gene GBA	No, (Bill Only)	No
_G054	Gene SMPD1	No, (Bill Only)	No
_G055	Gene CPT2	No, (Bill Only)	No
_G056	Gene TTR	No, (Bill Only)	No
_G057	Gene UBE3A	No, (Bill Only)	No
_G058	Gene GALC	No, (Bill Only)	No
_G059	Gene GSN	No, (Bill Only)	No
_G060	Gene LYZ	No, (Bill Only)	No
_G061	Gene FGA	No, (Bill Only)	No
_G062	Gene APOA1	No, (Bill Only)	No
_G063	Gene APOA2	No, (Bill Only)	No
_G064	Gene MMADHC	No, (Bill Only)	No
_G065	Gene SLC25A20	No, (Bill Only)	No
_G066	Gene ARSA	No, (Bill Only)	No
_G067	Gene NPC1/2_SEQ and	No, (Bill Only)	No

	NPC1/2_MLPA		
_G068	Gene PMS2	No, (Bill Only)	No
_G070	Gene RAI1	No, (Bill Only)	No
_G071	Gene MUTYH	No, (Bill Only)	No
_G072	Gene HGSNAT	No, (Bill Only)	No
_G073	Gene GNS and GRHPR_MLPA	No, (Bill Only)	No
_G074	Gene PSAP	No, (Bill Only)	No
_G077	Gene RET	No, (Bill Only)	No
_G078	Gene SUMF1	No, (Bill Only)	No
_G079	Gene CASR_Seq	No, (Bill Only)	No
_G080	Gene VHL_SEQ	No, (Bill Only)	No
_G084	Gene SDHB, SDHC, SDHD_Seq	No, (Bill Only)	No
_G085	Gene BRCA1	No, (Bill Only)	No
_G086	Gene BRCA2	No, (Bill Only)	No
_G087	Gene DMD_MLPA	No, (Bill Only)	No
_G089	Gene MPZ_MLPA	No, (Bill Only)	No
_G102	Gene SERPINA1	No, (Bill Only)	No
_G112	Gene SDHAF2	No, (Bill Only)	No
_G113	Gene TMEM127	No, (Bill Only)	No
_G114	Gene MAX	No, (Bill Only)	No
_G115	Gene SMN1	No, (Bill Only)	No
_G125	Gene PMP22	No, (Bill Only)	No
_G126	Gene G6PD	No, (Bill Only)	No
_G127	Gene GJB2	No, (Bill Only)	No
_G128	Gene HBA1/HBA2	No, (Bill Only)	No
_G129	Gene HBB	No, (Bill Only)	No
_G130	Known Familial Variant,Other	No, (Bill Only)	No
G168	Gene CSTB	No, (Bill Only)	No
G169	Gene CACNA1A	No, (Bill Only)	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
G230	Gene AR	No, (Bill Only)	No
G231	Gene FXN	No, (Bill Only)	No
G232	Gene PALB2	No, (Bill Only)	No

Genetics Test Information

Familial variant targeted testing is available for most genes that are currently part of another genetic test offered by Mayo Clinic Laboratories. Additional genes may also be available and require consultation with the laboratory prior to

ordering.

Genes or gene regions generally not offered under this test ID currently include, but are not limited to, the following:
-Genes with limitations related to patents
-Genes with limitations related to homology
-Mitochondrial DNA genes for heteroplasmy
-Globin genes for prenatal testing
-*CFHR1, CFHR2, CFHR3, CFHR4, CFHR5*
-*CYP21A2*
-*NOTCH2* exons 1-4
-*PKD1* single- or multi-exon deletions/duplications involving exons 1-33
-*PKLR*
-*TNXB* single- or multi-exon deletions/duplications involving exons 32-44
-*TTC25* (*ODAD4*) exons 9-12
-*TTN* (NM_001256850.1) exons 154-156
-*UGT1A1*
Additional genes/variants may be unavailable per laboratory discretion.

Targeted testing is available regardless as to whether the family/individual had previous testing through Mayo Clinic Laboratories or another laboratory. See Additional Testing Requirements if the familial variant was previously identified at an outside laboratory. Documentation of the specific familial variants is **required** and must be provided with the specimen in order to perform this test.

Consultation with the laboratory is required prior to ordering this test on prenatal specimens.

The preferred specimen for this test is whole blood. Other specimens may be acceptable depending on the gene and methodology required. Contact the laboratory if you have questions regarding a specific specimen type. In general, deletion/duplication analysis requires a higher volume and concentration of DNA, therefore, whole blood is the preferred specimen type.

In some cases, testing for a known variant may require submission of additional proband sample or may not be available for technical or legal reasons. Testing may be declined at the discretion of the laboratory.

Testing Algorithm

Pricing for this test is based on the genes selected. The assigned CPT codes correspond to the reflexed bill only G code.

Samples received by the laboratory undergo review for appropriateness of testing and clinical utility. For prenatal samples, variant curation will be performed prior to initiating testing. For all other samples, if the proband was not tested at Mayo Clinic Laboratories, a full variant curation will not typically be completed before testing is performed. Variants may occasionally be classified differently by independent laboratories.

For prenatal specimens only:
-If amniotic fluid (nonconfluent cultured cells) is received, amniotic fluid culture/genetic test will be added at an additional charge.
-If chorionic villus specimen (nonconfluent cultured cells) is received, fibroblast culture for genetic test will be added at

an additional charge.

For any prenatal specimen that is received, maternal cell contamination studies will be added.

If skin biopsy is received, fibroblast culture and cryopreservation will be performed at an additional charge. If viable cells are not obtained, the client will be notified.

For more information see Full Gene Analysis/Multi-Gene Panels versus Familial Mutation Targeted Testing.

Special Instructions

- Informed Consent for Genetic Testing
- Familial Variant Testing: Required Patient Information
- Full Gene Analysis/Multi-Gene Panels versus Familial Mutation Targeted Testing
- Blood Spot Collection Card-Spanish Instructions
- Blood Spot Collection Card-Chinese Instructions
- Informed Consent for Genetic Testing (Spanish)
- Blood Spot Collection Instructions

Method Name

Polymerase Chain Reaction (PCR) followed by DNA Sequencing Analysis, Gene Dosage Analysis by Multiplex Ligation-Dependent Probe Amplification (MLPA), and/or Quantitative Polymerase Chain Reaction (qPCR)

NY State Available

Yes

Specimen

Specimen Type

Varies

Ordering Guidance

This test can only be performed if a variant was previously detected in a family member of this individual. For additional information regarding requests for germline confirmation of somatic results or clinical confirmation of research results, call 800-533-1710.

For answers to frequently asked questions and more information, see Familial studies on MayoClinicLabs.com.

Additional Testing Requirements

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

If the familial variant was previously identified at an outside laboratory, sending a proband sample (ie, blood or DNA from a family member with a positive genetic test result) to be used as a positive control is strongly recommended to ensure that the specific familial variant can be detected by our laboratory. Proband samples should be sent as a separate

FMTT order, under the proband's identifiers (ie, do not send the patient and proband samples under the same order number). If a positive control is not provided, the possibility of a false-negative result should be considered.

Shipping Instructions

Specimen preferred to arrive within 96 hours of collection.

Necessary Information

The identification of a specific variant in an affected family member is required before this test can be performed for additional family members. If a familial variant has not been previously identified, call 800-533-1710 to discuss testing options.

Familial Variant Testing: Required Patient Information **(T721) with documentation of the specific familial variant is required**. Testing will be held until information is received. If information is not received within 14 days of sample receipt, testing may be canceled.

Specimen Required

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

Submit only 1 of the following specimen types:

Preferred:
Specimen Type: Whole blood
Container/Tube: Lavender top (EDTA)
Specimen Volume: 3 mL
Collection Instructions: Send whole blood specimen in original tube. **Do not aliquot**.
Specimen Stability Information: Ambient (preferred) 4 days/Refrigerated 14 days

Specimen Type: Blood spot
Supplies: Card-Blood Spot Collection (Filter Paper) (T493)
Container/Tube:
Preferred: Collection card (Whatman Protein Saver 903 Paper)
Acceptable: Whatman FTA Classic paper, PerkinElmer 226 filter paper, or Blood Spot Collection Card
Specimen Volume: 2 to 5 Blood spots on collection card
Collection Instructions:
1. An alternative blood collection option for a patient older than 1 year is a fingerstick. For detailed instructions, see How to Collect Dried Blood Spot Samples.
2. Let blood dry on the filter paper at ambient temperature in a horizontal position for a minimum of 3 hours.
3. Do not expose specimen to heat or direct sunlight.
4. Do not stack wet specimens.
5. Keep specimen dry.
Specimen Stability Information: Ambient (preferred)/Refrigerated
Additional Information:
1. Due to lower concentration of DNA yielded from blood spot, it is possible that additional specimen may be required to complete testing.
2. For collection instructions, see Blood Spot Collection Instructions

3. For collection instructions in Spanish, see Blood Spot Collection Card-Spanish Instructions (T777)
4. For collection instructions in Chinese, see Blood Spot Collection Card-Chinese Instructions (T800)

Specimen Type: Cultured fibroblasts
Container/Tube: T-75 or T-25 flask
Specimen Volume: 1 Full T-75 or 2 full T-25 flasks
Additional Information: Indicate the tests to be performed on the fibroblast culture cells. A separate culture charge will be assessed under CULFB / Fibroblast Culture for Biochemical or Molecular Testing. An additional 3 to 4 weeks is required to culture fibroblasts before genetic testing can occur.
Specimen Stability Information: Ambient (preferred)/Refrigerated <24 hours

Specimen Type: Skin biopsy
Supplies: Fibroblast Biopsy Transport Media (T115)
Container/Tube: Sterile container with any standard cell culture media (eg, minimal essential media, RPMI 1640). The solution should be supplemented with 1% penicillin and streptomycin.
Specimen Volume: 4-mm punch
Specimen Stability Information: Refrigerated (preferred)/Ambient
Additional Information: A separate culture charge will be assessed under CULFB / Fibroblast Culture for Biochemical or Molecular Testing. An additional 3 to 4 weeks is required to culture fibroblasts before genetic testing can occur.

Specimen Type: Cord blood
Container/Tube: Lavender top (EDTA)
Specimen Volume: 3 mL
Collection Instructions:
1. Send specimen in original tube
2. Label specimen as cord blood
Specimen Stability Information: Ambient (preferred) 4 days/Refrigerated 14 days

Specimen Type: Extracted DNA
Container/Tube: 2 mL screw top tube
Specimen Volume: 100 mcL (microliters)
Collection Instructions:
1. The preferred volume is 100 mcL at a concentration of 250 ng/mcL.
2. Include concentration and volume on tube.
Specimen Stability Information: Frozen (preferred)/Ambient/Refrigerated

Prenatal Specimens
Due to its complexity, consultation with the laboratory is required for all prenatal testing; call 800-533-1710 to speak to a genetic counselor.

Specimen Type: Amniotic fluid
Container/Tube: Amniotic fluid container
Specimen Volume: 20 mL
Specimen Stability Information: Refrigerated (preferred)/Ambient
Additional information:

1. A separate culture charge will be assessed under CULAF / Culture for Genetic Testing, Amniotic Fluid.
2. All prenatal specimens must be accompanied by a maternal blood specimen; order MATCC / Maternal Cell Contamination, Molecular Analysis, Varies on the maternal specimen.

Specimen Type: Cultured amniocytes
Container/Tube: T-25 flask
Specimen Volume: 2 Full flasks
Collection Instructions: Submit confluent cultured cells from another laboratory.
Specimen Stability Information: Ambient (preferred)/Refrigerated
Additional Information: All prenatal specimens must be accompanied by a maternal blood specimen; order MATCC / Maternal Cell Contamination, Molecular Analysis, Varies on the maternal specimen.

Specimen Type: Chorionic villi
Container/Tube: 15-mL tube containing 15-mL of transport media
Specimen Volume: 20 mg
Specimen Stability Information: Refrigerated
Additional Information:
1. A separate culture charge will be assessed under CULFB / Fibroblast Culture for Biochemical or Molecular Testing.
2. All prenatal specimens must be accompanied by a maternal blood specimen; order MATCC / Maternal Cell Contamination, Molecular Analysis, Varies on the maternal specimen.

Specimen Type: Cultured chorionic villi
Container/Tube: T-25 flasks
Specimen Volume: 2 Full flasks
Collection Instructions: Submit confluent cultured cells from another laboratory.
Specimen Stability Information: Ambient (preferred)/Refrigerated
Additional Information: All prenatal specimens must be accompanied by a maternal blood specimen; order MATCC / Maternal Cell Contamination, Molecular Analysis, Varies on the maternal specimen.

Forms

1. **Familial Mutation Testing: Required Patient Information (T721) is required**
2. **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)
3. If not ordering electronically, complete, print, and send 1 of the following forms with the specimen:
-Hematopathology/Cytogenetics Test Request(T726)
-Cardiovascular Test Request (T724)
-Coagulation Test Request (T753)

Specimen Minimum Volume

Blood: 1 mL; Amniotic fluid: 10 mL; Chorionic villi: 10 mg
All other specimen types: See Specimen Required

Reject Due To

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

Specimen Stability Information

Specimen Type	Temperature	Time	Special Container
Varies	Varies		

Clinical & Interpretive

Clinical Information

This test is available for the analysis of up to 4 genetic variants (single nucleotide variant, small insertion/deletion, or exon level deletion/duplication). Targeted testing is used for diagnostic or predictive testing in family members of an affected individual with a previously detected variant, carrier screening, segregation analysis, confirmation of research results, or testing for germline status of a variant detected by somatic or tumor testing. This test is available for any of the genes on Mayo Clinic Laboratories' (MCL) test menu. In addition, genes not on the MCL test menu may be able to be tested. Call the laboratory at 800-533-1710 with specific inquiries.

Interpretation

Evaluation and categorization of variants are performed using American College of Medical Genetics and Genomics recommendations.(1) Variants are classified based on known, predicted, or possible pathogenicity and reported with interpretive comments detailing their potential or known significance.

Cautions

Clinical Correlations:
The identification of a disease-associated variant in an affected family member is necessary before predictive testing for other family members can be performed. Call 800-533-1710 to discuss testing options if a familial variant has not been previously identified.

Familial test results may be included on the test report when relevant to the interpretation of variants in a proband.

Test results should be interpreted in the context of clinical findings, family history, and other laboratory testing. Misinterpretation of results may occur if the information provided is inaccurate or incomplete.

Technical Limitations:
Rare allelic variants may be present and could lead to false-negative or false-positive results. If results obtained do not match the clinical findings, additional testing should be considered.

Analysis is performed for the familial variants provided only. This assay does not rule out the presence of other variants within this gene or within other genes that may be associated with the familial condition. **Note:** Analysis of the area surrounding the familial variant may be required in the performance of this assay, which could result in identification of additional variants. Contact the laboratory with any questions regarding assay performance.

In addition to disease-related probes, the multiplex 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.

Reclassification of Variants Policy:
Currently, it is not standard practice for the laboratory to systematically review previously classified variants on a regular basis. The laboratory encourages healthcare providers to contact the laboratory at any time to learn how the status of a particular variant may have changed over time.

Clinical Reference

1. Richards S, Aziz N, Bale S, et al. ACMG Laboratory Quality Assurance Committee: Standards and guidelines for the interpretation of sequence variants: a joint consensus recommendation of the American College of Medical Genetics and Genomics and the Association for Molecular Pathology. Genet Med. 2015;17(5):405-424

Performance

Method Description

DNA sequencing and/or dosage analysis by quantitative polymerase chain reaction, array comparative genomic hybridization, or multiplex ligation-dependent probe amplification are utilized to test for the presence of the specific variants previously identified in a family member or via alternate testing (research, somatic).(Unpublished Mayo method)

PDF Report

No

Day(s) Performed

Monday through Friday

Report Available

15 to 22 days

Specimen Retention Time

Whole Blood: 2 weeks (if available); Extracted DNA: 3 months; Blood Spot: 1 year; Cultured fibroblasts, skin biopsy, cord blood, amniotic fluid, cultured amniocytes, chorionic villi, cultured chorionic villi: 1 month

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 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

The applicable CPT code will be applied on a case-by-case basis.

Gene	CPT Code (as appropriate)
Any gene not listed below	81403
APC	81202
AR	81174
BRCA1	81215
BRCA2	81217
CACNA1A	81186
CFTR	81221
CSTB	81190
FXN	81289
G6PD	81248
GJB2	81253
HBA1	81258
HBA2	81258
HBB	81362
MECP2	81303
MLH1	81293
MSH2	81296
MSH6	81299
PALB2	81308
PMP22	81326
PMS2	81318
PTEN	81322
SMN1	81337
TP53	81353

81265-Maternal cell contamination (if appropriate)
88233-Tissue culture, skin or solid tissue biopsy (if appropriate)
88235-Tissue culture for amniotic fluid (if appropriate)
88240-Cryopreservation (if appropriate)

LOINC® Information

Test ID	Test Order Name	Order LOINC® Value
FMTT	Familial Variant, Targeted Testing	51966-0

Test Definition: FMTT

Familial Variant, Targeted Testing, Varies

Result ID	Test Result Name	Result LOINC® Value
36528	Result Summary	50397-9
36529	Result	82939-0
36530	Interpretation	69047-9
36531	Additional Information	48767-8
36532	Specimen	31208-2
36533	Source	31208-2
36534	Method	85069-3
36535	Released By	18771-6