Colorectal23
Hereditary Cancer Gene Panel

including: sequencing and high resolution deletion/duplication analysis

PANEL DESCRIPTION:
Using sequencing and high resolution deletion/duplication analysis, the Hereditary Colorectal23 Cancer Panel analyzes 23 genes for genetic variants that predispose a person to colorectal cancer and, in some cases, other cancers or noncancerous conditions. Identifying causative genetic variants in any of the genes included in this panel provides valuable information for a patient’s diagnosis, treatment and risk reduction options, surveillance (early screening for other associated cancers), and familial screening.

TEST DETAILS:
• This panel includes both sequencing and high resolution deletion/duplication analysis of the genes specified when performed on a blood specimen.
  o Sequencing is performed using a customized next generation sequencing library. Analysis includes the coding exons of all genes in the panel plus ten bases into the introns and untranslated regions (5' and 3'). Sanger sequencing is performed to confirm variants classified as pathogenic or suspected pathogenic.
    ▪ Of note, deletions of EPCAM are the only known pathogenic variants in this gene; therefore, sequencing analysis of EPCAM is not performed.
  o Deletion/duplication analysis is performed using a high resolution, custom microarray platform designed to target the genes of interest at the exon level.
    ▪ In addition, deletion/duplication analyses of CHEK2 and PMS2 are performed using Multiplex Ligation-dependent Probe Amplification (MLPA) because of the presence of highly homologous pseudogenes. A rare rearrangement of exons 1-7 in the MSH2 gene, the Boland inversion, is also detected using MLPA. However, MLPA cannot be performed on a buccal specimen.
• Detection rates are limited to the genes specified; this test does not provide whole genome analysis.
• Gene panels are a more cost-effective approach than single gene testing to confirm or establish a diagnosis. However, if single gene or targeted testing is desired for the patient or family members of an individual with a known mutation, that must be ordered separately.

INDICATIONS FOR TESTING*:
• Family history of colon, endometrial, ovarian, or stomach cancer in multiple individuals
• Colorectal cancer diagnosed < age 50
• Multiple primary cancers in the same person
• 10 or more colon polyps
• Tumor testing positive for high microsatellite instability (MSI) and/or abnormal immunohistochemistry (IHC) indicating mismatch repair deficiency
• Personal and/or family history raising concern for the syndromes included in this panel
  o Ataxia telangiectasia GeneReviews® https://www.ncbi.nlm.nih.gov/books/NBK26468/
  o Constitutional mismatch repair deficiency
  o Familial adenomatous polyposis (FAP) GeneReviews® http://www.ncbi.nlm.nih.gov/books/NBK1345/
  o Li-Fraumeni syndrome GeneReviews® http://www.ncbi.nlm.nih.gov/books/NBK1311/
• PTEN hamartoma tumor (Cowden) syndrome GeneReviews® http://www.ncbi.nlm.nih.gov/books/NBK1488/
• Known familial variant in any of the genes included in this panel (targeted analysis)
*It is possible that someone could qualify for testing and not fit the above criteria.

SPECIMEN COLLECTION & TRANSPORT:
Complimentary test kits are available upon request, but are not required.

SAMPLE TYPE and REQUIREMENTS:
- blood: 3-5 ml whole blood in an EDTA tube (purple top)
- buccal mucosa swab: 5 swabs^  
- extracted DNA (from blood or buccal): 5 µg in a DNA microcentrifuge tube

^ Deletion/duplication and rearrangement analyses cannot be performed for indicated genes on a buccal specimen.

SHIPPING:
- Maintain and ship samples at room temperature.
- Coordinate transport for sample to be received in our laboratory within 24-48 hours of collection.
  - LOCAL: Call 402-559-5070 (option 1)
  - OUT OF AREA: Prior to shipment, please fax the completed test request form to 402-559-7248, including the FedEx® airbill tracking number.
    ▪ Saturday delivery MUST be checked when sending FedEx® on Friday.
    ▪ Please include Internal Billing Reference # 3155070600 on the FedEx® airbill.
- Ship To: Human Genetics Laboratory – Zip 5440
  UNMC Shipping & Receiving Dock  
  601 S. Saddle Creek Road
  Omaha, NE 68106

FORMS FOR TESTING: The following forms can be downloaded via our website.
  - Required: Hereditary Cancer Test Request Form
  - Optional: Informed Consent for Hereditary Cancer Genetic Testing

POTENTIAL TEST RESULTS:
- Positive for a Pathogenic Variant – This designation is reported when a pathogenic change is identified in a gene and the change is known to increase the risk for certain cancers.
- Negative – This designation is reported when no harmful or uncertain changes are found in any of the genes tested.
- A Variant of Uncertain Clinical Significance (UCS) – This designation is reported when an inconclusive change in a gene is found; the change may increase the risk for cancer or be harmless. Variants of uncertain clinical significance may also be classified as “Likely Pathogenic” or “Likely Benign” based on the ACMG recommendations for variant classification.1

TURNAROUND TIME: For all sample types, results are typically available in 14 days.

BILLING: Our laboratory offers patient/self-pay, insurance (including Medicare/Medicaid), and client/institution billing options. Verifying coverage requirements or obtaining preauthorization PRIOR TO OR AT THE TIME OF SPECIMEN COLLECTION is often necessary. We provide preauthorization services upon request by calling 402-559-5070 (option 3); the following form is helpful for obtaining the information required by insurance providers and can be downloaded via our website.
  - Insurance Preauthorization Request
In some circumstances, a test may be warranted even though insurance coverage is denied or not guaranteed. For these situations, we request the following form be signed by the patient and submitted with the sample. This helps inform patients of their potential financial responsibility, should the costs of genetic testing not be paid by their insurance provider.

- Advanced Beneficiary Notice of Noncoverage (ABN) – required when billing Medicare

**CPT CODES:** 81435, 81436

**PRICING:** For current costs contact the laboratory billing staff at 402-559-5070 (option 3).

**GENE LIST:**

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<th>Gene</th>
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<tbody>
<tr>
<td>APC</td>
<td>BLM</td>
<td>CHEK2</td>
<td>GREM1</td>
<td>MSH3</td>
<td>NTHL1</td>
<td>POLE</td>
<td>STK11</td>
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<td>BMPR1A</td>
<td>EPCAM</td>
<td>MLH1</td>
<td>MSH6</td>
<td>PMS2</td>
<td>PTEN</td>
<td>TP53</td>
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<td>CDH1</td>
<td>GALNT12</td>
<td>MSH2</td>
<td>MUTYH</td>
<td>POLD1</td>
<td>SMAD4</td>
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**RESOURCES:** The following resource can be downloaded via our website, or you may request brochures for your clinic by contacting our marketing specialist at 402-559-6935 | humangenetics@unmc.edu.

- PATIENT BROCHURE: Colorectal23

**REFERENCES:**

1 Richards et al. 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 advance online publication 5 March 2015; 1-20.

updated 9-16-2018