

Technical Specifications

FoundationOne®Heme, a Laboratory Developed Test (LDT), is a comprehensive genomic profiling assay for hematologic malignancies and sarcomas and for solid tumors where fusion detection is desired.¹



Methods²

- Uses hybrid capture-based next-generation sequencing.
- Identifies the four main classes of genomic alterations (base substitutions, insertions and deletions, copy number alterations, and rearrangements).
- Sequences DNA of the entire coding region of 406 genes and selected introns of 31 genes involved in rearrangements.
- Sequences RNA of 265 genes commonly rearranged in cancer to better identify known and novel gene fusions.
- Sequences to a median depth of ~500X unique coverage for DNA and RNA to an average of ~6.9 million unique pairs.
- All specimens are reviewed by a hematopathologist or pathologist to ensure specimen viability and tumor content.

PERFORMANCE SPECIFICATIONS		
Sensitivity	Base Substitutions at ≥5% Minor Allele Frequency	>99%
	Insertions/Deletions (1-40 base pairs) at ≥10% Minor Allele Frequency	98%
	Focal Copy Number Alterations (homozygous deletions or amplifications ≥8 copies)	>95%
	Known Gene Fusions	>95%
Specificity (PPV)	Positive Predictive Value (PPV) for Base Substitutions, Insertions/Deletions and Focal Copy Number Alterations	>99%
	Positive Predictive Value (PPV) for Known Gene Fusions	>95%
Reproducibility	Concordance between replicates inter-batch	97%
	Concordance between replicates intra-batch	97%
Immunotherapy Biomarkers	TMB [†] and MSI [‡]	
Specimen Type	Peripheral whole blood, bone marrow aspirate, FFPE block or slides, or extracted nucleic acid (see Specimen Instructions for more details)	
Turnaround Time	14 days [§]	

[†] Chalmers ZR, et al. "Analysis of 100,000 human cancer genomes reveals the landscape of tumor mutational burden". Genome Med. 2017;9(1):34.

[‡] Hall MJ, et al. Multigene Panels to Evaluate Hereditary Cancer Risk: Reckless or Relevant? J Clin Oncol. 2016 Dec;34(34):4186-4187."

[§] Based on typical turnaround time from receipt of sample



Reporting

- Test results are provided in an interpretive report, curated by biomedical informatics scientists, and approved by on-site board-certified and licensed pathologists and hematopathologists.
- Genomic findings are listed with clinically relevant targeted therapies, immunotherapies, and clinical trial options.
- Reported alterations may indicate response or lack of response to validated targets for therapy (FDA-approved or in clinical trials), or may be unambiguous drivers of oncogenesis based on reported scientific literature.
- Reports include tumor mutational burden (TMB) status and microsatellite instability (MSI) status, biomarkers that may help predict response to checkpoint inhibitors.
- Test results are available via our online portal at www.foundationmedicine.com* or by fax.

*Visit foundationmedicine.com to create an online account.

FoundationOne Heme Gene List

I Genes With Complete Exonic (Coding) Coverage³

<i>ABL1</i>	<i>ACTB</i>	<i>AKT1</i>	<i>AKT2</i>	<i>AKT3</i>	<i>ALK</i>	<i>AMER1 (FAM123B or WTX)</i>	<i>APC</i>	
<i>APH1A</i>	<i>AR</i>	<i>ARAF</i>	<i>ARFRP1</i>	<i>ARHGAP26 (GRAF)</i>	<i>ARID1A</i>	<i>ARID2</i>	<i>ASMTL</i>	<i>ASXL1</i>
<i>ATM</i>	<i>ATR</i>	<i>ATRX</i>	<i>AURKA</i>	<i>AURKB</i>	<i>AXIN1</i>	<i>AXL</i>	<i>B2M</i>	<i>BAP1</i>
<i>BARD1</i>	<i>BCL10</i>	<i>BCL11B</i>	<i>BCL2</i>	<i>BCL2L2</i>	<i>BCL6</i>	<i>BCL7A</i>	<i>BCOR</i>	<i>BCORL1</i>
<i>BIRC3</i>	<i>BLM</i>	<i>BRAF</i>	<i>BRCA1</i>	<i>BRCA2</i>	<i>BRD4</i>	<i>BRIP1 (BACH1)</i>	<i>BRSK1</i>	<i>BTG2</i>
<i>BTK</i>	<i>BTLA</i>	<i>C11orf30 (EMSY)</i>	<i>CAD</i>	<i>CALR</i>	<i>CARD11</i>	<i>CBFB</i>	<i>CBL</i>	<i>CCND1</i>
<i>CCND2</i>	<i>CCND3</i>	<i>CCNE1</i>	<i>CCT6B</i>	<i>CD22</i>	<i>CD274 (PD-L1)</i>	<i>CD36</i>	<i>CD58</i>	<i>CD70</i>
<i>CD79A</i>	<i>CD79B</i>	<i>CDC73</i>	<i>CDH1</i>	<i>CDK12</i>	<i>CDK4</i>	<i>CDK6</i>	<i>CDK8</i>	<i>CDKN1B</i>
<i>CDKN2A</i>	<i>CDKN2B</i>	<i>CDKN2C</i>	<i>CEBPA</i>	<i>CHD2</i>	<i>CHEK1</i>	<i>CHEK2</i>	<i>CIC</i>	<i>CIITA</i>
<i>CKS1B</i>	<i>CPS1</i>	<i>CREBBP</i>	<i>CRKL</i>	<i>CRLF2</i>	<i>CSF1R</i>	<i>CSF3R</i>	<i>CTCF</i>	<i>CTNNA1</i>
<i>CTNNB1</i>	<i>CUX1</i>	<i>CXCR4</i>	<i>DAXX</i>	<i>DDR2</i>	<i>DDX3X</i>	<i>DNM2</i>	<i>DNMT3A</i>	<i>DOT1L</i>
<i>DTX1</i>	<i>DUSP2</i>	<i>DUSP9</i>	<i>EBF1</i>	<i>ECT2L</i>	<i>EED</i>	<i>EGFR</i>	<i>ELP2</i>	<i>EP300</i>
<i>EPHA3</i>	<i>EPHA5</i>	<i>EPHA7</i>	<i>EPHB1</i>	<i>ERBB2</i>	<i>ERBB3</i>	<i>ERBB4</i>	<i>ERG</i>	<i>ESR1</i>
<i>ETS1</i>	<i>ETV6</i>	<i>EXOSC6</i>	<i>EZH2</i>	<i>FAF1</i>	<i>FAM46C</i>	<i>FANCA</i>	<i>FANCC</i>	<i>FANCD2</i>
<i>FANCE</i>	<i>FANCF</i>	<i>FANCG</i>	<i>FANCL</i>	<i>FAS (TNFRSF6)</i>	<i>FBXO11</i>	<i>FBXO31</i>	<i>FBXW7</i>	<i>FGF10</i>
<i>FGF14</i>	<i>FGF19</i>	<i>FGF23</i>	<i>FGF3</i>	<i>FGF4</i>	<i>FGF6</i>	<i>FGFR1</i>	<i>FGFR2</i>	<i>FGFR3</i>
<i>FGFR4</i>	<i>FHIT</i>	<i>FLCN</i>	<i>FLT1</i>	<i>FLT3</i>	<i>FLT4</i>	<i>FLYWCH1</i>	<i>FOXL2</i>	<i>FOXO1</i>
<i>FOXO3</i>	<i>FOXP1</i>	<i>FRS2</i>	<i>GADD45B</i>	<i>GATA1</i>	<i>GATA2</i>	<i>GATA3</i>	<i>GID4 (c17orf39)</i>	<i>GNA11</i>
<i>GNA12</i>	<i>GNA13</i>	<i>GNAQ</i>	<i>GNAS</i>	<i>GPR124</i>	<i>GRIN2A</i>	<i>GSK3B</i>	<i>GTSE1</i>	<i>HDAC1</i>
<i>HDAC4</i>	<i>HDAC7</i>	<i>HGF</i>	<i>HIST1H1C</i>	<i>HIST1H1D</i>	<i>HIST1H1E</i>	<i>HIST1H2AC</i>	<i>HIST1H2AG</i>	<i>HIST1H2AL</i>
<i>HIST1H2AM</i>	<i>HIST1H2BC</i>	<i>HIST1H2BJ</i>	<i>HIST1H2BK</i>	<i>HIST1H2BO</i>	<i>HIST1H3B</i>	<i>HNF1A</i>	<i>HRAS</i>	<i>HSP90AA1</i>
<i>ICK</i>	<i>ID3</i>	<i>IDH1</i>	<i>IDH2</i>	<i>IGF1R</i>	<i>IKBKE</i>	<i>IKZF1</i>	<i>IKZF2</i>	<i>IKZF3</i>
<i>IL7R</i>	<i>INHBA</i>	<i>INPP4B</i>	<i>INPP5D (SHIP)</i>	<i>IRF1</i>	<i>IRF4</i>	<i>IRF8</i>	<i>IRS2</i>	<i>JAK1</i>
<i>JAK2</i>	<i>JAK3</i>	<i>JARID2</i>	<i>JUN</i>	<i>KAT6A (MYST3)</i>	<i>KDM2B</i>	<i>KDM4C</i>	<i>KDM5A</i>	<i>KDM5C</i>
<i>KDM6A</i>	<i>KDR</i>	<i>KEAP1</i>	<i>KIT</i>	<i>KLHL6</i>	<i>KMT2A (MLL)</i>	<i>KMT2C (MLL3)</i>	<i>KMT2D (MLL2)</i>	<i>KRAS</i>
<i>LEF1</i>	<i>LRP1B</i>	<i>LRRK2</i>	<i>MAF</i>	<i>MAFB</i>	<i>MAGED1</i>	<i>MALT1</i>	<i>MAP2K1 (MEK1)</i>	<i>MAP2K2 (MEK2)</i>
<i>MAP2K4</i>	<i>MAP3K1</i>	<i>MAP3K14</i>	<i>MAP3K6</i>	<i>MAP3K7</i>	<i>MAPK1</i>	<i>MCL1</i>	<i>MDM2</i>	<i>MDM4</i>
<i>MED12</i>	<i>MEF2B</i>	<i>MEF2C</i>	<i>MEN1</i>	<i>MET</i>	<i>MIB1</i>	<i>MITF</i>	<i>MKI67</i>	<i>MLH1</i>
<i>MPL</i>	<i>MRE11A</i>	<i>MSH2</i>	<i>MSH3</i>	<i>MSH6</i>	<i>MTOR</i>	<i>MUTYH</i>	<i>MYC</i>	<i>MYCL (MYCL1)</i>
<i>MYCN</i>	<i>MYD88</i>	<i>MYO18A</i>	<i>NCOR2</i>	<i>NCSTN</i>	<i>NF1</i>	<i>NF2</i>	<i>NFE2L2</i>	<i>NFKBIA</i>
<i>NKX2-1</i>	<i>NOD1</i>	<i>NOTCH1</i>	<i>NOTCH2</i>	<i>NPM1</i>	<i>NRAS</i>	<i>NSD1</i>	<i>NT5C2</i>	<i>NTRK1</i>
<i>NTRK2</i>	<i>NTRK3</i>	<i>NUP93</i>	<i>NUP98</i>	<i>P2RY8</i>	<i>PAG1</i>	<i>PAK3</i>	<i>PALB2</i>	<i>PASK</i>
<i>PAX5</i>	<i>PBRM1</i>	<i>PC</i>	<i>PCBP1</i>	<i>PCLO</i>	<i>PDCD1 (PD-1)</i>	<i>PDCD11</i>	<i>PDCD1LG2 (PD-L2)</i>	<i>PDGFRA</i>
<i>PDGFRB</i>	<i>PDK1</i>	<i>PHF6</i>	<i>PIK3CA</i>	<i>PIK3CG</i>	<i>PIK3R1</i>	<i>PIK3R2</i>	<i>PIM1</i>	<i>PLCG2</i>
<i>POT1</i>	<i>PPP2R1A</i>	<i>PRDM1</i>	<i>PRKAR1A</i>	<i>PRKDC</i>	<i>PRSS8</i>	<i>PTCH1</i>	<i>PTEN</i>	<i>PTPN11</i>
<i>PTPN2</i>	<i>PTPN6 (SHP-1)</i>	<i>PTPRO</i>	<i>RAD21</i>	<i>RAD50</i>	<i>RAD51</i>	<i>RAF1</i>	<i>RARA</i>	<i>RASGEF1A</i>
<i>RB1</i>	<i>RELN</i>	<i>RET</i>	<i>RHOA</i>	<i>RICTOR</i>	<i>RNF43</i>	<i>ROS1</i>	<i>RPTOR</i>	<i>RUNX1</i>
<i>SIPR2</i>	<i>SDHA</i>	<i>SDHB</i>	<i>SDHC</i>	<i>SDHD</i>	<i>SERP2</i>	<i>SETBP1</i>	<i>SETD2</i>	<i>SF3B1</i>
<i>SGK1</i>	<i>SMAD2</i>	<i>SMAD4</i>	<i>SMARCA1</i>	<i>SMARCA4</i>	<i>SMARCB1</i>	<i>SMC1A</i>	<i>SMC3</i>	<i>SMO</i>
<i>SOCS1</i>	<i>SOCS2</i>	<i>SOCS3</i>	<i>SOX10</i>	<i>SOX2</i>	<i>SPEN</i>	<i>SPOP</i>	<i>SRC</i>	<i>SRSF2</i>
<i>STAG2</i>	<i>STAT3</i>	<i>STAT4</i>	<i>STAT5A</i>	<i>STAT5B</i>	<i>STAT6</i>	<i>STK11</i>	<i>SUFU</i>	<i>SUZ12</i>
<i>TAF1</i>	<i>TBL1XR1</i>	<i>TCF3 (E2A)</i>	<i>TCL1A (TCL1)</i>	<i>TET2</i>	<i>TGFBR2</i>	<i>TLL2</i>	<i>TMEM30A</i>	<i>TMSB4XP8</i>
<i>(TMSL3)</i>	<i>TNFAIP3</i>	<i>TNFRSF11A</i>	<i>TNFRSF14</i>	<i>TNFRSF17</i>	<i>TOPI</i>	<i>TP53</i>	<i>TP63</i>	<i>TRAF2</i>
<i>TRAF3</i>	<i>TRAF5</i>	<i>TSC1</i>	<i>TSC2</i>	<i>TSHR</i>	<i>TUSC3</i>	<i>TYK2</i>	<i>U2AF1</i>	<i>U2AF2</i>
<i>VHL</i>	<i>WDR90</i>	<i>WHSC1 (MMSET or NSD2)</i>	<i>WISP3</i>	<i>WT1</i>	<i>XBPI</i>	<i>XPO1</i>	<i>YY1AP1</i>	
<i>ZMYM3</i>	<i>ZNF217</i>	<i>ZNF24 (ZSCAN3)</i>	<i>ZNF703</i>	<i>ZRSR2</i>				

I Genes With Select Intronic (Non-Coding) Coverage⁴

<i>ALK</i>	<i>BCL2</i>	<i>BCL6</i>	<i>BCR</i>	<i>BRAF</i>	<i>CCND1</i>	<i>CRLF2</i>	<i>EGFR</i>	<i>EPOR</i>
<i>ETV1</i>	<i>ETV4</i>	<i>ETV5</i>	<i>ETV6</i>	<i>EWSR1</i>	<i>FGFR2</i>	<i>IGH</i>	<i>IGK</i>	<i>IGL</i>
<i>JAK1</i>	<i>JAK2</i>	<i>KMT2A (MLL)</i>	<i>MYC</i>	<i>NTRK1</i>	<i>PDGFRA</i>	<i>PDGFRB</i>	<i>RAF1</i>	<i>RARA</i>
<i>RET</i>	<i>ROS1</i>	<i>TMPRSS2</i>	<i>TRG</i>					

| Genes with RNA sequencing coverage

<i>ABI1</i>	<i>ABL1</i>	<i>ABL2</i>	<i>ACSL6</i>	<i>AFF1</i>	<i>AFF4</i>	<i>ALK</i>	<i>ARHGAP26 (GRAF)</i>	
<i>ARHGEF12</i>	<i>ARID1A</i>	<i>ARNT</i>	<i>ASXL1</i>	<i>ATF1</i>	<i>ATG5</i>	<i>AT1C</i>	<i>BCL10</i>	<i>BCL11A</i>
<i>BCL11B</i>	<i>BCL2</i>	<i>BCL3</i>	<i>BCL6</i>	<i>BCL7A</i>	<i>BCL9</i>	<i>BCOR</i>	<i>BCR</i>	<i>BIRC3</i>
<i>BRAF</i>	<i>BTG1</i>	<i>CAMTA1</i>	<i>CARS</i>	<i>CBFA2T3</i>	<i>CBFB</i>	<i>CBL</i>	<i>CCND1</i>	<i>CCND2</i>
<i>CCND3</i>	<i>CD274 (PD-L1)</i>	<i>CDK6</i>	<i>CDX2</i>	<i>CHIC2</i>	<i>CHN1</i>	<i>CIC</i>	<i>CIITA</i>	<i>CLP1</i>
<i>CLTC</i>	<i>CLTCL1</i>	<i>CNTRL (CEP110)</i>	<i>COL1A1</i>	<i>CREB3L1</i>	<i>CREB3L2</i>	<i>CREBBP</i>	<i>CRLF2</i>	<i>CSF1</i>
<i>CTNNB1</i>	<i>DDIT3</i>	<i>DDX10</i>	<i>DDX6</i>	<i>DEK</i>	<i>DUSP22</i>	<i>EGFR</i>	<i>EIF4A2</i>	<i>ELF4</i>
<i>ELL</i>	<i>ELN</i>	<i>EML4</i>	<i>EP300</i>	<i>EPOR</i>	<i>EPS15</i>	<i>ERBB2</i>	<i>ERG</i>	<i>ETS1</i>
<i>ETV1</i>	<i>ETV4</i>	<i>ETV5</i>	<i>ETV6</i>	<i>EWSR1</i>	<i>FCGR2B</i>	<i>FCRL4</i>	<i>FEV</i>	<i>FGFR1</i>
<i>FGFR1OP</i>	<i>FGFR2</i>	<i>FGFR3</i>	<i>FLI1</i>	<i>FNBP1</i>	<i>FOXO1</i>	<i>FOXO3</i>	<i>FOXO4</i>	<i>FOXP1</i>
<i>FSTL3</i>	<i>FUS</i>	<i>GAS7</i>	<i>GLI1</i>	<i>GMPS</i>	<i>GPHN</i>	<i>HERPUD1</i>	<i>HEY1</i>	<i>HIP1</i>
<i>HIST1H4I</i>	<i>HLF</i>	<i>HMGA1</i>	<i>HMGA2</i>	<i>HOXA11</i>	<i>HOXA13</i>	<i>HOXA3</i>	<i>HOXA9</i>	<i>HOXC11</i>
<i>HOXC13</i>	<i>HOXD11</i>	<i>HOXD13</i>	<i>HSP90AA1</i>	<i>HSP90AB1</i>	<i>IGH</i>	<i>IGK</i>	<i>IGL</i>	<i>IKZF1</i>
<i>IL21R</i>	<i>IL3</i>	<i>IRF4</i>	<i>ITK</i>	<i>JAK1</i>	<i>JAK2</i>	<i>JAK3</i>	<i>JAZF1</i>	<i>KAT6A (MYST3)</i>
<i>KDSR</i>	<i>KIF5B</i>	<i>KMT2A (MLL)</i>	<i>LASP1</i>	<i>LCP1</i>	<i>LMO1</i>	<i>LMO2</i>	<i>LPP</i>	<i>LYL1</i>
<i>MAF</i>	<i>MAFB</i>	<i>MALT1</i>	<i>MDS2</i>	<i>MECOM</i>	<i>MKL1</i>	<i>MLF1</i>	<i>MLLT1 (ENL)</i>	<i>MLLT10 (AF10)</i>
<i>MLLT3</i>	<i>MLLT4 (AF6)</i>	<i>MLLT6</i>	<i>MNI</i>	<i>MXN1</i>	<i>MSI2</i>	<i>MSN</i>	<i>MUC1</i>	<i>MYB</i>
<i>MYC</i>	<i>MYH11</i>	<i>MYH9</i>	<i>NACA</i>	<i>NBEAP1 (BCL8)</i>	<i>NCOA2</i>	<i>NDRG1</i>	<i>NF1</i>	<i>NF2</i>
<i>NFKB2</i>	<i>NIN</i>	<i>NOTCH1</i>	<i>NPM1</i>	<i>NR4A3</i>	<i>NSD1</i>	<i>NTRK1</i>	<i>NTRK2</i>	<i>NTRK3</i>
<i>NUMA1</i>	<i>NUP214</i>	<i>NUP98</i>	<i>NUTM2A</i>	<i>OMD</i>	<i>P2RY8</i>	<i>PAFAH1B2</i>	<i>PAX3</i>	<i>PAX5</i>
<i>PAX7</i>	<i>PBX1</i>	<i>PCM1</i>	<i>PCSK7</i>	<i>PDCD1LG2 (PD-L2)</i>	<i>PDE4DIP</i>	<i>PDGFB</i>	<i>PDGFRA</i>	<i>PDGFRB</i>
<i>PER1</i>	<i>PHF1</i>	<i>PICALM</i>	<i>PIM1</i>	<i>PLAG1</i>	<i>PML</i>	<i>POU2AF1</i>	<i>PPP1CB</i>	<i>PRDM1</i>
<i>PRDM16</i>	<i>PRRX1</i>	<i>PSIP1</i>	<i>PTCH1</i>	<i>PTK7</i>	<i>RABEP1</i>	<i>RAF1</i>	<i>RALGDS</i>	<i>RAP1GDS1</i>
<i>RARA</i>	<i>RBM15</i>	<i>RET</i>	<i>RHOH</i>	<i>RNF213</i>	<i>ROS1</i>	<i>RPL22</i>	<i>RPN1</i>	<i>RUNX1</i>
<i>RUNX1T1 (ETO)</i>	<i>RUNX2</i>	<i>SEC31A</i>	<i>SEPT5</i>	<i>SEPT6</i>	<i>SEPT9</i>	<i>SET</i>	<i>SH3GL1</i>	<i>SLC1A2</i>
<i>SNX29 (RUNC2A)</i>	<i>SRSF3</i>	<i>SS18</i>	<i>SSX1</i>	<i>SSX2</i>	<i>SSX4</i>	<i>STAT6</i>	<i>STL</i>	<i>SYK</i>
<i>TAF15</i>	<i>TAL1</i>	<i>TAL2</i>	<i>TBL1XR1</i>	<i>TCF3 (E2A)</i>	<i>TCL1A (TCL1)</i>	<i>TEC</i>	<i>TET1</i>	<i>TFE3</i>
<i>TFG</i>	<i>TFPT</i>	<i>TFRC</i>	<i>TLX1</i>	<i>TLX3</i>	<i>TMPRSS2</i>	<i>TNFRSF11A</i>	<i>TOP1</i>	<i>TP63</i>
<i>TPM3</i>	<i>TPM4</i>	<i>TRIM24</i>	<i>TRIP11</i>	<i>TTL</i>	<i>TYK2</i>	<i>USP6</i>	<i>WHSC1 (MMSET or NSD2)</i>	
<i>WHSC1L1</i>	<i>YPEL5</i>	<i>ZBTB16</i>	<i>ZMYM2</i>	<i>ZNF384</i>	<i>ZNF521</i>			

To learn more about our scientific and analytical validation see our publication in Blood²: “Integrated genomic DNA/RNA profiling of hematologic malignancies in the clinical setting.”

FoundationOne Heme is a laboratory developed test that was developed and its performance characteristics determined by Foundation Medicine. FoundationOne Heme has not been cleared or approved by the U.S. Food and Drug Administration. For more information on FoundationOne Heme, visit <http://www.foundationmedicine.com/genomic-testing/foundation-one-heme>

References

1. FoundationOne Heme is a laboratory developed test that was developed and its performance characteristics determined by Foundation Medicine, FoundationOne Heme has not been cleared or approved by the U.S. Food and Drug Administration. For more information on FoundationOne Heme see its Technical Specifications at <http://www.foundationmedicine.com>.
2. He, J. et al. (2016) Integrated genomic DNA/RNA profiling of hematologic malignancies in the clinical setting. *Blood*. 127(24):3004-14.
3. Current as of November 2019. Please visit www.foundationmedicine.com for the most up-to-date gene list.
4. Select Introns only. Detailed list available upon request.