

Technical Specifications



FoundationOneHeme is a comprehensive genomic profiling assay for hematologic malignancies and sarcomas.



Methods¹

- Uses hybrid-capture next-generation sequencing.
- Identifies the four 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 specimen 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	2 Weeks [§]	

[†] 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 trials.
- Reported alterations may indicate response or lack of response to validated targets for therapy (approved or in clinical trials), or may be unambiguous drivers of oncogenesis based on reported scientific knowledge.
- 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.

Current Gene List²

Entire coding sequence (base substitutions, indels, copy number alterations)

<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>FANGC</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>GNAI1</i>
<i>GNAI2</i>	<i>GNAI3</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>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>PRKARIA</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 (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>YY1API</i>	<i>ZMYM3</i>
<i>ZNF217</i>	<i>ZNF24 (ZSCAN3)</i>	<i>ZNF703</i>	<i>ZRSR2</i>					

Select DNA Rearrangements³

<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>					

Select RNA Gene Fusions

ABI1	ABL1	ABL2	ACSL6	AFF1	AFF4	ALK	ARHGAP26 (GRAF)	
ARHGEF12	ARID1A	ARNT	ASXL1	ATF1	ATG5	ATIC	BCL10	BCL11A
BCL11B	BCL2	BCL3	BCL6	BCL7A	BCL9	BCOR	BCR	BIRC3
BRAF	BTG1	CAMTA1	CARS	CBFA2T3	CBFB	CBL	CCND1	CCND2
CCND3	CD274 (PD-L1)	CDK6	CDX2	CHIC2	CHN1	CIC	CIITA	CLP1
CLTC	CLTCL1	CNTRL (CEP110)	COL1A1	CREB3L1	CREB3L2	CREBBP	CRLF2	CSF1
CTNNB1	DDIT3	DDX10	DDX6	DEK	DUSP22	EGFR	EIF4A2	ELF4
ELL	ELN	EML4	EP300	EPOR	EPS15	ERBB2	ERG	ETS1
ETV1	ETV4	ETV5	ETV6	EWSR1	FCGR2B	FCRL4	FEV	FGFR1
FGFR1OP	FGFR2	FGFR3	FLI1	FNBP1	FOXO1	FOXO3	FOXO4	FOXP1
FSTL3	FUS	GAS7	GLI1	GMPS	GPHN	HERPUD1	HEY1	HIP1
HIST1H4I	HLF	HMGA1	HMGA2	HOXA11	HOXA13	HOXA3	HOXA9	HOXC11
HOXC13	HOXD11	HOXD13	HSP90AA1	HSP90AB1	IGH	IGK	IGL	IKZF1
IL21R	IL3	IRF4	ITK	JAK1	JAK2	JAK3	JAZF1	KAT6A (MYST3)
KDSR	KIF5B	KMT2A (MLL)	LASP1	LCP1	LMO1	LMO2	LPP	LYL1
MAF	MAFB	MALT1	MDS2	MECOM	MKL1	MLF1	MLLT1 (ENL)	MLLT10 (AF10)
MLLT3	MLLT4 (AF6)	MLLT6	MN1	MNX1	MSI2	MSN	MUC1	MYB
MYC	MYH11	MYH9	NACA	NBEAP1 (BCL8)	NCOA2	NDRG1	NF1	NF2
NFKB2	NIN	NOTCH1	NPM1	NR4A3	NSD1	NTRK1	NTRK2	NTRK3
NUMA1	NUP214	NUP98	NUTM2A	OMD	P2RY8	PAFAH1B2	PAX3	PAX5
PAX7	PBX1	PCM1	PCSK7	PDCD1LG2 (PD-L2)	PDE4DIP	PDGFB	PDGFRA	PDGFRB
PER1	PHF1	PICALM	PIM1	PLAG1	PML	POU2AF1	PPP1CB	PRDM1
PRDM16	PRRX1	PSIP1	PTCH1	PTK7	RABEP1	RAF1	RALGDS	RAP1GDS1
RARA	RBM15	RET	RHOH	RNF213	ROS1	RPL22	RPN1	RUNX1
RUNX1T1 (ETO)	RUNX2	SEC31A	SEPT5	SEPT6	SEPT9	SET	SH3GL1	SLC1A2
SNX29 (RUNDC2A)	SRSF3	SS18	SSX1	SSX2	SSX4	STAT6	STL	SYK
TAF15	TAL1	TAL2	TBL1XR1	TCF3 (E2A)	TCL1A (TCL1)	TEC	TET1	TFE3
TFG	TFPT	TFRC	TLX1	TLX3	TMPRSS2	TNFRSF11A	TOPI	TP63
TPM3	TPM4	TRIM24	TRIP11	TTL	TYK2	USP6	WHSC1 (MMSET or NSD2)	
WHSC1L1	YPEL5	ZBTB16	ZMYM2	ZNF384	ZNF521			

To learn more about our scientific and analytical validation see our publication in Blood¹: "Integrated genomic DNA/RNA profiling of hematologic malignancies in the clinical setting."

References

1. He, J. et al. (2016) Integrated genomic DNA/RNA profiling of hematologic malignancies in the clinical setting. Blood. 127(24):3004-14.
2. Current as of November 2017. Please visit www.foundationmedicine.com for the most up-to-date gene list.
3. Select Introns only. Detailed list available upon request.