

RNA-Based Detection of Gene Fusions in Formalin-Fixed and Paraffin-Embedded Solid Cancer Samples

Martina Kirchner, Olaf Neumann, Anna-Lena Volckmar, Fabian Stögbauer, Michael Allgäuer, Daniel Kazdal, Jan Budczies, Eugen Rempel, Regine Brandt, Suranand Babu Talla, Moritz von Winterfeld, Jonas Leichsenring, Tilmann Bochtler, Alwin Krämer, Christoph Springfeld, Peter Schirmacher, Roland Penzel, Volker Endris and Albrecht Stenzinger

Table S1. PCR Primers for gene fusions identified with either the OCAv3- or Archer-panel.

Fusion	Primer	Seq	Primer	Seq	Amplicon [bp]
AXL::CAPN15 (A19C2)	AXL F	CATGGATGAGGGTGGAGGTT	CAPN15 R	CTGGGCACACGTGAATCAC	178
BRD3::NUTM1 (B11N2)	BRD3 F	AAGAAACAGGCAGCCAAGTC	NUTM1 R	CTGGTGGGTCAGAAGTTGGT	217
ESR1-CCDC170 (E2C7)	ESR1 F	GGAGACTCGCTACTGTGCA	CCDC170 R	CCCAGACTCCTTCCCAACT	167
ESR1-QKI (E2Q5)	ESR1 F	GGAGACTCGCTACTGTGCA	QKI R	GGCTGGTGATTAAATGTGGC	197
ETV6::NTRK3 (E5N15)	ETV6 F	AAGCCCATCAACCTCTCTCA	NTRK3 R	GGGCTGAGGTTGTAGCACTC	206
FGFR2::INA (F17I2)	FGFR2 F	CTCCCAGAGACCAACGTTCA	INA R	GTCCTGGTATTCGGAAGGT	148
FNDC3B-PIK3CA (F3P2)	FNDC3B F	GCAGCTCAGCAGGTTATTCT	PIK3CA R1	GTCGTGGAGGCATTGTTCTG	177
GATM::RAF1 (G2R8)	GATM F	CTTACAACGAATGGGACCCC	RAF1 R	GTTGGGCTCAGATTGTTGGG	160
GPBP1L1::MAST2 (G6M4)	GPBP1L1 F1	CGTAGTGGAGGTGGCACA	MAST2 R1	AGGTGATGTGCTAGAGGTCA	178
HNRNPA2B1::ETV1 (H9E6)	HNRNPA 2B1 F	GGAGGATATGGTGGTGGAGG	ETV1 R	TTGATTTTCAGTGGCAGGCC	164
MYB::NFIB (M12N9)	MYB12 F	TGATGAATCTGGAATTGTTGCT G	NFIB9 R	CGTAATTTTGACATTGGCCG	150
MYB::NFIB (M13N9)	MYB13 F	TCTTCTGCTCACACCACTGG	NFIB9 R	CGTAATTTTGACATTGGCCG	160
SND1::BRAF (S9B9)	SND1 F	CGATTACCTGTCCAGCATC	BRAF R	CGCTGAGGTCCTGGAGATT	184
TBL1XR1::PIK3CA (T1P2)	TBL1XR1 F	TTTCCTGTGCCTCCATTCC	PIK3CA R	GTCGTGGAGGCATTGTTCTG	195
TMPRSS2::ERG (T2E4)	TMPRSS2 F	CGCGGCAGGTCATATTGAA	ERG R	CCTTCCCATCGATGTTCTGG	190
WHSC1L1::FGFR1 (W1F2)	WHSC1L1 F	TGATCGCACTGACACGGC	FGFR1 R	ACAAGGCTCCACATCTCCAT	108

Table S2. Clinical and diagnostic implications of the detected gene fusions.

Fusion	Entity Where Fusion Is Detected	Reclassification Based on Molecular Analysis (AMP/OCA)	Entities Where Fusion Is Supportive of Diagnosis	Drug	Ref.	3'- Gene	5'-Gene
TMPRSS2::ERG	Prostate cancer		Prostate cancer	None		TMPRSS2 Exon 1 (NM_005656)	ERG Exon 2 (NM_182918)
TMPRSS2::ERG	Prostate cancer		Prostate cancer	None		TMPRSS2 Exon 1 (NM_005656)	ERG Exon 2 (NM_004449)
TMPRSS2::ERG	Prostate cancer		Prostate cancer	None		TMPRSS2 Exon 2 (NM_005656)	ERG Exon 4 (NM_004449)
TMPRSS2::ERG	Prostate cancer		Prostate cancer	None		TMPRSS2 Exon 2 (NM_005656)	ERG Exon 4 (NM_004449)
TMPRSS2::ERG	Prostate cancer		Prostate cancer	None		TMPRSS2 Exon 2 (NM_005656)	ERG Exon 4 (NM_004449)
TMPRSS2::ERG	Prostate cancer		Prostate cancer	None		TMPRSS2 Exon 1 (NM_005656)	ERG Exon 5 (NM_004449)
TMPRSS2::ERG	Prostate cancer		Prostate cancer	None		TMPRSS2 Exon 1 (NM_005656)	ERG Exon 4 (NM_004449)
TMPRSS2::ERG	CUP DD Prostate cancer	Prostate cancer	Prostate cancer	None		TMPRSS2 Exon 1 (NM_005656)	ERG Exon 4 (NM_004449)
TMPRSS2::ERG	Prostate cancer		Prostate cancer	None		TMPRSS2 Exon 1 (NM_005656)	ERG Exon 4 (NM_004449)
MYB::NFIB	Adenoid cystic carcinoma		Adenoid cystic carcinoma	None		MYB Exon 12 (NM_005375)	NFIB Exon 9 (NM_005596)
MYB::NFIB	CUP	Adenoid cystic carcinoma	Adenoid cystic carcinoma	None		MYB Exon 12 (NM_005375)	NFIB Exon 9 (NM_005596)
MYB::NFIB	Adenoid cystic carcinoma		Adenoid cystic carcinoma	None		MYB Exon 14 (NM_005375)	NFIB Exon 9 (NM_005596)
MYB::NFIB	Adenoid cystic carcinoma		Adenoid cystic carcinoma	None		MYB Exon 11 (NM_005375)	NFIB Exon 9 (NM_005596)
MYB::NFIB	Adenoid cystic carcinoma		Adenoid cystic carcinoma	None		MYB Exon 13 (NM_005375)	NFIB Exon 9 (NM_005596)

MYB::NFIB	Adenoid cystic carcinoma		Adenoid cystic carcinoma	None		MYB Exon 13 (NM_005375)	NFIB Exon 9 (NM_005596)
MYB::NFIB	Adenoid cystic carcinoma		Adenoid cystic carcinoma	None		MYB Exon 14 (NM_005375)	NFIB Exon 10 (NM_001282787)
DNAJB1::PRKACA	Fibrolamellar carcinoma		Fibrolamellar carcinoma	None		DNAJB1 Exon 1 (NM_006145)	PRKACA Exon 2 (NM_207518)
KIF5B::RET	CUP		Lung cancer	Cabozantinib (Pan-kinase inhibitor), Nintedanib, Sunitinib, Vandetanib (Pan-TK inhibitor)	[34–37]	KIF5B Exon 15 (NM_004521)	RET Exon 12 (NM_020630)
EML4::ALK (V2)	CUP	CUP (Biliary tract / NSCLC)	Lung cancer	e.g. Alectinib, Crizotinib (ALK inhibitor), Entrictinib (Pan-TK inhibitor)	[38–42]	EML4 Exon 20 (NM_019063)	ALK Exon 20 (NM_004304)
EML4::ALK (V3)	Lung		Lung cancer	e.g. Alectinib, Crizotinib (ALK inhibitor), Entrictinib (Pan-TK inhibitor)	[38–42]	EML4 Exon 6 (NM_019063)	ALK Exon 20 (NM_004304)
VTCN1::NRG1	Cholangiocarcinoma		None	Afatinib (ERBB2&EGFR inhibitor 2nd gen), Lapatinib (ERBB2 inhibitor)		VCTN1 Exon 2 (NM_024626)	NRG1 Exon 2 (NM_004495)
TRIM24::BRAF	CUP		None	BRAF inhibitor, MEK inhibitors (Selumetinib,Trametinib), Sorafenib	[43–45]	TRIM24 Exon 9 (NM_003852)	BRAF Exon 11 (NM_004333)
SND1::BRAF	Pancreatic carcinoma		None	BRAF inhibitor, MEK inhibitors (Selumetinib,Trametinib), Sorafenib		SND1 Exon 9 (NM_014390)	BRAF Exon 9 (NM_004333)
SND1::BRAF	Pancreatic carcinoma		None	BRAF inhibitor, MEK inhibitors (Selumetinib,Trametinib), Sorafenib		SND1 Exon 9 (NM_014390)	BRAF Exon 9 (NM_004333)
GATM::RAF1	Neuroendocrine tumor (pancreas)		None	Pan-RAF inhibitors,Sorafenib (Pan-Tk Inhibitor), U0126 (MEK Inhibitor)		GATM Exon 2 (NM_001482)	RAF1 Exon 8 (NM_002880)
ETV6::NTRK3	MASC		None	Larotrectinib, Entrectinib, IGF1R inhibitors, PI3K pathway inhibitors, Midostaurin (Pan-TK inhibitor)		ETV6 Exon 5 (NM_001987)	NTRK3 Exon 15 (NM_002530)

FGFR2::INA	Pancreatic carcinoma		None	FGFR inhibitors		FGFR2 Exon 17 (NM_000141)	INA Exon 2 (NM_032727)
WHSC1L1::FGFR1	Pancreatic carcinoma		None	None		WHSC1L1 Exon 1 (NM_0177778)	FGFR1 Exon 2 (NM_015850)
TBL1XR1::PIK3CA	Pancreatic carcinoma		None	None		TBL1XR1 Exon 1 (ENST00000457928)	PIK3CA Exon 2 (NM_006218)
TBL1XR1::PIK3CA	Chordoma		None	None		TBL1XR1 Exon 1 (ENST00000457928)	PIK3CA Exon 2 (NM_006218)
RNF130::SEPT14	CUP		None	None		RNF130 Exon 3 (NM_018434)	SEPT14 Exon 10 (NM_207366)
PTPRK::RSPO3	Pancreatic carcinoma		None	None		PTPRK Exon 1 (NM_002844)	RSPO3 Exon 2 (NM_032784)
MTMR::MAML2	Cholangiocarcinoma		None	None		MTMR Exon 2	MAML2 Exon 1
HNRNPA2B1::ETV1	Prostate cancer		Prostate cancer	None		HNRNPA2B1 Exon 9 (NM_002137)	ETV1 Exon 6 (NM_004956)
GPBP1L1::MAST2	Pancreatic cancer		None	None		GPBP1L1 Exon 6	MAST Exon 4
FNDC3B::PIK3CA	Gallbladder carcinoma		None	None		FNDC3B Exon 3 (NM_022763)	PIK3CA Exon 2 (NM_006218)
ESR1::QKI	CUP		None	None		ESR1 Exon 2 (NM_001122742)	QKI Exon 5 (NM_006775)
AXL::CAPN15	Gastric cancer		none	None		AXL Exon 19	CAPN15 Exon 2
BRD4::NUTM1	CUP	NUT Midline Tumor	NUT Midline Tumor	Birabresib	[46,47]	BRD4 Exon 14 (NM_058243)	NUTM1 Exon 2 (NM_001284293)
BRD3::NUTM1	Lung cancer (NUT Midline Tumor)	NUT Midline Tumor	NUT Midline Tumor	Birabresib	[46,47]	BRD3 Exon 11 (NM_007371)	NUTM1 Exon 2 (NM_175741)

Table S3. OCAv3 Fusion panel overview.

A2M-ALK	ACBD5-RET	ACTG2-ALK	ADAMTS16-TERT	AFAP1-NTRK2
A22A19	A11R12	A2A18	A8T3	A14N12
AFAP1-RET	AGAP3-BRAF	AGAP3-BRAF	AGBL4-NTRK2	AGGF1-RAF1
A3R12	A10B11	A9B9	A6N16	A5R8
AGK-BRAF	AGTRAP-BRAF	AKAP13-NTRK3	AKAP13-RET	AKAP13-RET
A2B8	A5B8	A14N14	A35R12	A36R12
AKAP9-BRAF	AKAP9-BRAF	AKAP9-BRAF	AKAP9-BRAF	AKAP9-BRAF
A21B10	A22B9	A28B9	A7B11	A8B9
ALK-PTPN3	AP3B1-BRAF	AR-AR	AR-AR	AR-AR
A11P3	A22B9	A1ins69A3	A2A3	A3A3
AR-AR	AR-AR	AR-AR	AR-AR	AR-AR
A3A3int4	A3A4	A3A5	A3int4A3	A4A6
AR-AR	AR-AR	AR-AR	AR-AR	AR-AR
A4A8	A6A8	A6A9	A8A9	E4E7
AR-AR	ARHGEF2-NTRK1	ARMC10-BRAF	AR-OPHN1	ATAD2-ERBB4
E7E8	A21N10	A4B11	A3O3	A8E15
ATF7IP-JAK2	ATF7IP-PDGFRB	ATG7-BRAF	ATIC-ALK	ATP1B1-PRKACA
A13J17	A13P11	A18B9	A7A20	A1P2
ATP1B1-PRKACB	ATRNL1-ALK	AXL-MBIP	B4GALT1-RAF1	BAG4-FGFR1
A1P2	A19A20	A20M4	B1R8	B1F8
BAG4-FGFR1	BAIAP2L1-BRAF	BAIAP2L1-MET	BBS9-BRAF	BCAM-AKT2
B2F6	B12B9	B9M15	B19B4	B13A5
BCAN-NTRK1	BCL2L11-BRAF	BCR-FGFR1	BCR-JAK2	BCR-JAK2
B13N11	B3B10	B4F10	B1J15	B1J17
BCR-JAK2	BCR-PDGFRA	BCR-PDGFRA	BCR-PDGFRA	BEND5-ALK
B1J19	B12ins12P12	B1P13	B7ins24P12	B3A20
BICD2-JAK2	BIN2-PDGFRB	BIRC6-ALK	BRAF-AP3B1	BRAF-BRAF
B7J13	B9P12	B10A20	B8A23	B1B11
BRAF-BRAF	BRAF-BRAF	BRAF-BRAF	BRAF-CIITA	BRAF-MACF1
B1B9	B3B11	B3B9	B9C6	B8M15
BRAF-MRPS33	BRAF-SLC26A4	BRAF-SUGCT	BRCA1-BRCA1	BRCA1-BRCA1

B1M2	B3S7	B1S13	B10B14	B10B16
BRCA1-BRCA1	BRCA1-BRCA1	BRCA1-BRCA1	BRCA1-BRCA1	BRCA1-BRCA1
B11B16	B13B15	B15B17	B15B18	B16B18
BRCA1-BRCA1	BRCA1-BRCA1	BRCA1-BRCA1	BRCA1-BRCA1	BRCA1-BRCA1
B19B21	B19B23	B20B23	B4B15	B7B12
BRCA1-BRCA1	BRCA1-BRCA1	BRCA2-BRCA2	BRCA2-BRCA2	BRCA2-BRCA2
B7B14	B7B9	B11B11	B11B22	B11B27
BRCA2-BRCA2	BRCA2-BRCA2	BRCA2-BRCA2	BRCA2-BRCA2	BRD3-NUTM1
B13B17	B1B3	B21B25	B7B10	B10N2
BRD4-NUTM1	BRD4-NUTM1	BRD4-NUTM1	BTBD1-NTRK3	BTF3L4-BRAF
B11N2	B14N2del585	B15N2	B4N14	B3B11
C11orf95-RELA	C11orf95-RELA	C7orf73-BRAF	C8orf34-MET	CAD-ALK
C3R2	C3R3	C2B9	C2M15	C35A20
CAND1-EGFR	CAPRIN1-PDGFRB	CAPZA2-MET	CAPZA2-MET	CARS-ALK
C4E16	C7P11	C1M6	C4M11	C17A20
CCDC127-TERT	CCDC6-BRAF	CCDC6-PDGFRB	CCDC6-RET	CCDC6-RET
C2T3	C1B9	C7P11	C1R11	C1R11
CCDC6-RET	CCDC6-RET	CCDC6-RET	CCDC6-RET	CCDC6-RET
C1R12	C1R12	C1R13	C1R9	C2R11
CCDC6-RET	CCDC6-RET	CCDC6-RET	CCDC6-RET	CCDC6-RET
C2R12	C5ins16R11	C8R11	C8R11	C8R12
CCDC6-ROS1	CCDC88A-ALK	CCDC88C-PDGFRB	CCDC88C-PDGFRB	CCDC88C-PDGFRB
C5R35	C12A20	C10P12	C12P11	C25P11
CCDC91-BRAF	CCNY-BRAF	CD44-FGFR2	CD74-NRG1	CD74-NRG1
C11B9	C1B10	C1F3	C6N6	C8N6
CD74-NTRK1	CD74-ROS1	CD74-ROS1	CD74-ROS1	CD74-ROS1
C7N10	C4R33	C6R32	C6R34	C6R35
CDC27-BRAF	CDK5RAP2-PDGFRB	CDK6-EGFR	CDKN2A-CDKN2A	CEL-NTRK1
C16B9	C13ins40P12	C2E23	C1C3	C7N7
CEP85L-PDGFRB	CEP85L-ROS1	CEP89-BRAF	CHD9-RAD51B	CHTOP-NTRK1
C11P12	C8R36	C16B9	C2R8	C5N10

CHTOP-NTRK1	CIC-NUTM1	CLCN6-BRAF	CLCN6-RAF1	CLIP1-ALK
C5N11	C16N4	C2B11	C2R8	C13A20
CLIP1-ROS1	CLIP2-BRAF	CLIP4-ALK	CLTC-ALK	CLTC-ALK
C19R36	C6B11	C12A23	C31A20	C31A20
CLTC-ALK	CNTLN-RAF1	CNTRL-FGFR1	COX5A-NTRK3	CPSF6-FGFR1
C31ins63A20	C5R8	C40F10	C1N15	C8int8F10
CPSF6-PDGFRB	CREB3L2-PPARG	CTNNB1-FGFR2	CUL1-BRAF	CUX1-BRAF
C5P11	C2P2	C1F10	C7B9	C10B9
CUX1-FGFR1	CUX1-RET	DAB2IP-NTRK2	DCTN1-ALK	DCTN1-ALK
C11F10	C10R12	D1N17	D26A20	D29A20
DCTN1-MET	DIP2C-PDGFRB	DIP2C-PDGFRB	DNAJB1-PRKACA	DNAJB1-PRKACA
D26M15	D1P10	D1P11	D1P2	D2P2
DTD1-PDGFRB	DYNC1I2-BRAF	EBF1-JAK2	EBF1-PDGFRB	EBF1-PDGFRB
D4P12	D7B10	E14J17	E11P11	E14P11
EBF1-PDGFRB	EGFR-ACADM	EGFR-DYM	EGFR-EGFR	EGFR-EGFR
E15P11	E1A3	E1D3	E13E15	E1E8
EGFR-EGFR	EGFR-EGFR	EGFR-EGFR	EGFR-ERP44	EGFR-GNS
E24E28	E25E18	E3E5	E1E5	E17G14
EGFR-PDP1	EGFR-PSPH	EGFR-SEPT14	EGFR-VOPP1	EIF3E-RAD51B
E1P2	E24P6	E24S10	E24V2	E1R5
EIF3E-RSPO2	EIF3E-RSPO2	EIF3E-RSPO2	EML4-ALK	EML4-ALK
E1ins351R2	E1R2	E1R3	E13A20	E13A20
EML4-ALK	EML4-ALK	EML4-ALK	EML4-ALK	EML4-ALK
E13ins90A20	E14A20	E14del36A20	E14ins124A20	E14ins2del52A20
EML4-ALK	EML4-ALK	EML4-ALK	EML4-ALK	EML4-ALK
E15A20	E17A20	E17ins30A20_V8a	E17ins65A20	E17ins68A20
EML4-ALK	EML4-ALK	EML4-ALK	EML4-ALK	EML4-ALK
E17int17Aint19E20	E18A20	E19A20	E20A20	E21A20
EML4-ALK	EML4-ALK	EML4-ALK	EML4-ALK	EML4-ALK
E2A20	E3p53insA20	E6A17	E6A18	E6A19
EML4-ALK	EML4-ALK	EML4-ALK	EML4-ALK	EML4-BRAF
E6aA20	E6bA20	E6ins18A20	E7A20	E6B10

EML4-NTRK3	EPHB2-NTRK1	EPS15-BRAF	EPS15-MET	EPS15-NTRK1
E2N14	E3N9	E22B10	E21M15	E21N9
EPS15-NTRK1	ERBB2-ERBB2	ERBB2-GRB7	ERBB2-GRB7	ERC1-BRAF
E21N9	E19E21	E29G10	E30G11	E12B10
ERC1-BRAF	ERC1-PDGFRB	ERC1-PDGFRB	ERC1-RET	ERC1-RET
E17B8	E15P10	E15P11	E11R12	E12R12
ERC1-RET	ERC1-RET	ERC1-ROS1	ERLIN2-FGFR1	ERVK3_1-FGFR1
E17R12	E7R12	E11R36	E8F2	E3F10
ESR1-AKAP12	ESR1-AKAP12	ESR1-ARMT1	ESR1-CCDC170	ESR1-CCDC170
E5A4	E6A4	E3A4	E2C10	E2C6
ESR1-CCDC170	ESR1-CCDC170	ESR1-DAB2	ESR1-MTHFD1L	ESR1-PDE10A
E2C7	E2C8	E6D3	E6M21	E7P6
ESR1-POLH	ESR1-YAP1	ESRP1-RAF1	ETV6-FGFR3	ETV6-FLT3
E6P2	E6Y4	E13R6	E5F9	E4F16
ETV6-FLT3	ETV6-FLT3	ETV6-FLT3	ETV6-FLT3	ETV6-JAK2
E4ins16F14del11	E5F14	E5F16	E5ins6F14	E4J16
ETV6-JAK2	ETV6-JAK2	ETV6-JAK2	ETV6-JAK2	ETV6-NTRK3
E4J17	E5J12	E5J17	E5J19	E4N14
ETV6-NTRK3	ETV6-NTRK3	ETV6-NTRK3	ETV6-PDGFRA	ETV6-PDGFRB
E4N15	E5N14	E5N15	E6P12	E4P11
ETV6-PDGFRB	ETV6-PDGFRB	ETV6-PDGFRB	EZR-ERBB4	EZR-ROS1
E4P9	E7ins34P12	E7P10	E12E18	E10R34
EZR-ROS1	FAM114A2-BRAF	FAM131B-BRAF	FAM131B-BRAF	FAM131B-BRAF
E10R35	F9B11	F1B10	F2B9	F3B9
FAT1-NTRK3	FCHSD1-BRAF	FGFR1-ADAM32	FGFR1-NTM	FGFR1OP2-FGFR1
F2N7	F13B9	F17A14	F1N2	F4F10
FGFR1OP-FGFR1	FGFR1OP-FGFR1	FGFR1OP-FGFR1	FGFR1-PLAG1	FGFR1-PLAG1
F5F10	F6F10	F7F10	F1P2	F1P3
FGFR1-PLAG1	FGFR1-PLAG1	FGFR1-TACC1	FGFR1-TACC1	FGFR1-ZNF703
F2P2	F2P3	F17T7	F18T7	F14Z2
FGFR2-AFF3	FGFR2-AHCYL1	FGFR2-BICC1	FGFR2-BICC1	FGFR2-BICC1

F17A8	F17A2	F17B18	F17B2	F17B3
FGFR2-CASP7	FGFR2-CCAR2	FGFR2-CCDC6	FGFR2-CCDC6	FGFR2-CIT
F17C2	F17C4	F17C1	F17C2	F17C23
FGFR2-COL14A1	FGFR2-CREB5	FGFR2-FAM76A	FGFR2-KCTD1	FGFR2-MGEA5
F17C34	F17C8	F17F2	F17K2	F17M12
FGFR2-NOL4	FGFR2-OFD1	FGFR2-PPHLN1	FGFR2-SHTN1	FGFR2-TACC3
F17N7	F17O3	F17P3	F17S7	F17T11
FGFR2-TXLNA	FGFR2-USP10	FGFR3-AES	FGFR3-BAIAP2L1	FGFR3-ELAVL3
F17T6	F17del11U5	F17A2	F17B2	F17E2
FGFR3-FBXO28	FGFR3-JAKMIP1	FGFR3-TACC3	FGFR3-TACC3	FGFR3-TACC3
F17F4	F17J4	F14T11	F15T11	F16T10
FGFR3-TACC3	FGFR3-TACC3	FGFR3-TACC3	FGFR3-TACC3	FGFR3-TACC3
F16T11	F17ins1T10	F17intron17T4	F17T10	F17T11
FGFR3-TACC3	FGFR3-TACC3	FGFR3-TACC3	FGFR3-TACC3	FGFR3-TACC3
F17T13	F17T14	F17T4	F17T5	F17T6
FGFR3-TACC3	FGFR3-TACC3	FGFR3-TACC3	FGFR3-TACC3	FGFR3-TACC3
F17T7	F17T8	F17T9	F18T1	F18T10
FGFR3-TACC3	FGFR3-TACC3	FGFR3-TACC3	FGFR3-TACC3	FGFR3-TACC3
F18T11	F18T11del5	F18T4and5	F18T7	TruncatedF17T4
FIP1L1-PDGFR	FIP1L1-PDGFR	FIP1L1-PDGFR	FIP1L1-PDGFR	FIP1L1-PDGFR
F10int10P12del106	F10int10P12del22	F10int10P12del67	F10P12del47	F11P12del24
FIP1L1-PDGFR	FIP1L1-PDGFR	FIP1L1-PDGFR	FIP1L1-PDGFR	FIP1L1-PDGFR
F11P12del26	F11P12del45	F11P12del77	F11P12del77	F12P12del107
FIP1L1-PDGFR	FIP1L1-PDGFR	FIP1L1-PDGFR	FIP1L1-PDGFR	FIP1L1-PDGFR
F12P12del84	F13ins11P12del99	F13insP12del91	F13P12del71	F13P12del75
FIP1L1-PDGFR	FIP1L1-PDGFR	FKBP15-RET	FN1-ALK	FN1-ALK
F16ins16P12del71	F9P12del38	F25R12	F20A19	F23A19
FN1-FGFR1	FN1-FGFR1	FN1-FGFR1	FN1-FGFR1	FN1-FGFR1
F22F3	F22F4	F23F3	F23F4	F28F5
FNDC3B-PIK3CA	FOXP1-PDGFR	FXR1-BRAF	FYCO1-RAF1	GATM-BRAF
F3P2	F16P12	F13B10	F11R6	G2B11
GFPT1-ALK	GHR-BRAF	GIT2-PDGFRB	GLIS3-TERT	GNAI1-BRAF

G18A20	G1B10	G12P11	G3T3	G1B10
GOLGA4-PDGFRB	GOLGA4-RAF1	GOLGA5-RET	GOLGB1-PDGFRB	GOPC-ROS1
G10P11	G16R8	G7R12	G10P12	G4R36
GOPC-ROS1	GRHL2-RSPO2	GTF2I-BRAF	GTF2IRD1-ALK	GTF3C2-ALK
G8R35	G8R2	G4B10	G7A20	G1A18
HACL1-RAF1	HERPUD1-BRAF	HIP1-ALK	HIP1-ALK	HIP1-ALK
H16R8	H4B7	H21A20	H28A20	H30A20
HIP1-PDGFRB	HLA_A-ROS1	HMBS	HMGA2-RAD51B	HMGA2-RAD51B
H30P11	H7R34	ENCTRL	H3R11	H3R8
HOOK3-RET	IRF2BP2-NTRK1	ITGB7	KANK1-PDGFRB	KANK2-ALK
H11R12	I1N10	ENCTRL	K2P9	K4A16
KCNQ5-ALK	KCTD7-BRAF	KCTD7-BRAF	KDEL2-ROS1	KDEL2-ROS1
K1A10	K3B8	K4B8	K5R35	K5Rintron34
KDM7A-BRAF	KDR-PDGFRB	KIAA1468-RET	KIAA1549-BRAF	KIAA1549-BRAF
K11B11	K13ins35P10	K10R12	K12B11	K12B9
KIAA1549-BRAF	KIAA1549-BRAF	KIAA1549-BRAF	KIAA1549-BRAF	KIAA1549-BRAF
K13B9	K14B11	K14B9	K15B10	K15B11
KIAA1549-BRAF	KIAA1549-BRAF	KIAA1549-BRAF	KIAA1549-BRAF	KIAA1549-BRAF
K15B9	K16B10	K17B10	K18B9	K9B9
KIAA1598-ROS1	KIF5B-ALK	KIF5B-ALK	KIF5B-ALK	KIF5B-ALK
K11R36	K15A20	K15A20	K17A20	K24A19
KIF5B-ALK	KIF5B-PDGFRB	KIF5B-RET	KIF5B-RET	KIF5B-RET
K24A20	K23P12	K15R11	K15R12	K16R12
KIF5B-RET	KIF5B-RET	KIF5B-RET	KIF5B-RET	KIF5B-RET
K18R12	K22R12	K23R12	K24R11	K24R8
KLC1-ALK	KLHL7-BRAF	KTN1-ALK	KTN1-RET	LMNA-NTRK1
K9A20	K5B9	K43A19	K29R12	L10N11
LMNA-NTRK1	LMNA-NTRK1	LMNA-NTRK1	LMNA-NTRK1	LMNA-NTRK1
L10N12	L11N11	L2N11	L3N11	L5N10
LMNA-NTRK1	LMNA-RAF1	LRIG3-ROS1	LRP1	LRRFIP1-FGFR1
L6N12	L10R8	L16R35	ENCTRL	L8F10
LRRFIP1-MET	LSM12-BRAF	LSM14A-BRAF	LYN-NTRK3	MACF1-BRAF

L19M15	L3B9	L9B9	L8N14	M60B9
MAD1L1-BRAF	MAD1L1-BRAF	MCFD2-ALK	MDM4-MDM4	MDM4-MDM4
M16B9	M17B10	M1A20	M2M11	M3M10
MDM4-MDM4	MDM4-MDM4	MDM4-MDM4	MDM4-MDM4	MEMO1-ALK
M5M10	M5M7	M7M10	M8M10	M2A7
MET-MET	MET-MET	MET-MET	MIR143HG- NOTCH1	MKRN1-BRAF
M13M15	M17M20	M18M20	M1N27	M4B11
MKRN1-BRAF	MPRIP-NTRK1	MPRIP-NTRK1	MPRIP-NTRK1	MPRIP-PDGFRB
M4B9	M14N12	M18N12	M21N12	M20P12
MPRIP-RAF1	MRPL13	MRPL24-NTRK1	MRPL24-NTRK1	MSN-ALK
M22R8	ENCTRL	M1N9	M1N9	M11A20
MSN-ALK	MSN-ROS1	MTMR12-TERT	MYB-ESR1	MYBL1-NFIB
M11int12A20	M9R34	M7T3	M15E8	M14N11
MYBL1-NFIB	MYBL1-NFIB	MYBL1-NFIB	MYBL1-NFIB	MYBL1-YTHDF3
M15N11	M8N11	M8N12	M9N11	M8Y4int3
MYBL1-YTHDF3	MYB-NFIB	MYB-NFIB	MYB-NFIB	MYB-NFIB
M9Y4int3	M13N11	M13N12	M15N10	M15N11
MYB-NFIB	MYB-NFIB	MYB-NFIB	MYB-NFIB	MYB-NFIB
M15N12	M15N8	M15N9	M8N11	M8N12
MYB-NFIB	MYB-PCDHGA1	MYB-QKI	MYB-QKI	MYB-QKI
M8N9	M9P2	M11Q5	M15Q5	M9Q5
MYB-QKI	MYB-TYK2	MYC	MYH13-RET	MYH9-ALK
M9Q6	M6T18	ENCTRL	M35R12	M34A20del23
MYH9-ALK	MYO18A-FGFR1	MYO18A- PDGFRB	MYO5A-ROS1	MYRIP-BRAF
M9A6ins10	M33F10	M41P10	M23R35	M16B9
MZT1-BRAF	NACC2-NTRK2	NAV1-NTRK2	NCOA1-ALK	NCOA4-RET
M2B11	N4N13	N15N11	N21A1	N6R12
NCOA4-RET	NCOR2-ROS1	NDE1-PDGFRB	NF1-ABCB5	NF1-ACACA
N7R12	N7R36	N6P11	N48A5	N1A42
NF1-ASIC2	NF1-ATAD5	NF1-PSMD11	NFASC-NTRK1	NFKB2-ROS1
N27A2	N5A11	N5P2	N20N10	N13R36

NIN-PDGFRB	NOTCH1-GABBR2	NOTCH1-NUP214	NOTCH1-SDCCAG3	NOTCH1-SNHG7
N30P12	N30G14	N2N25	N21S5	N2S4
NPC2-RAD51B	NPM1-ALK	NSD1-NOTCH4	NTRK1-DYNC2H1	NTRK1-NTRK1
N1R9	N4A20	N14N18	N17D85	N6N8
NTRK3-HOMER1	NUB1-BRAF	NUDCD3-BRAF	NUP214-BRAF	OFD1-JAK2
N17H2	N3B9	N4B9	N21B10	O21J13
OXR1-MET	PAPD7-RAF1	PAPSS1-BRAF	PARK2-FGFR2	PAX5-JAK2
O9M13	P11R10	P5B9	P9F11	P5J19
PAX8-PPARG	PAX8-PPARG	PAX8-PPARG	PAX8-PPARG	PCM1-JAK2
P10P2	P7P2	P8P2	P9P2	P23J12
PCM1-JAK2	PCM1-JAK2	PCM1-JAK2	PCM1-JAK2	PCM1-JAK2
P24J17	P26J9	P28J11	P29J13	P35J11
PCM1-JAK2	PCM1-JAK2	PCM1-JAK2	PCM1-JAK2	PCM1-NRG1
P36J11	P36J11ins12	P36J9	P36J9ins3	P2N8
PCM1-RET	PCNX-RAD51B	PDE4DIP-PDGFRB	PDE7A-NRG1	PDHX-FGFR2
P29R12	P1R8	P16P11	P3N6	P1F7
PDZRN3-RAF1	PLIN3-BRAF	PPFIBP1-ALK	PPFIBP1-ALK	PPFIBP1-JAK2
P5R8	P1B9	P12A20	P8A20ins49	P12J19
PPFIBP1-MET	PPFIBP1-ROS1	PPL-NTRK1	PPL-NTRK1	PPL-NTRK1
P9M15	P9R35	P12N13	P22N10	P22N11
PPM1G-ALK	PPP4R3B-ALK	PRKAR1A-ALK	PRKAR1A-RET	PRKG2-PDGFRB
P1A18	P9A2	P2A20	P7R12	P3P12
PRKG2-PDGFRB	PTEN-BTAF1	PTEN-SHROOM4	PTEN-SHROOM4	PTPRK-RSPO3
P6P12	P2B2	P2S3	P3S4	P1R2
PTPRK-RSPO3	PTPRZ1-MET	PTPRZ1-MET	PTPRZ1-MET	PWWP2A-ROS1
P7R2	P1M2	P3M2	P8M2	P1R36
QKI-NTRK2	QKI-RAF1	RABEP1-PDGFRB	RABGAP1L-NTRK1	RAD18-BRAF
Q6N16	Q3R8	R14P11	R14N16	R7B10
RAF1-C9orf153	RANBP2-ALK	RANBP2-FGFR1	RB1-RB1	RB1-RB1
R14C2	R18A20	R20F10int9	R20R24	R21R23
RB1-RB1	RBMS3-BRAF	RBPM5-NTRK3	RNF11-BRAF	RNF130-BRAF

R21R25	R11B11	R5N14	R1B11	R3B9
RNF213-ALK	RNF213-NTRK1	RP2-BRAF	RUFY2-RET	SART3-PDGFRB
R20A20	R15N12	R3B10	R9R12	S15P11
SCAF11-PDGFR	SDC4-NRG1	SDC4-ROS1	SDC4-ROS1	SDC4-ROS1
S1P2	S4N6	S2R32	S2R34	S4R32
SDC4-ROS1	SEC16A-NOTCH1	SEC16A-NOTCH1	SEC31A-ALK	SEC31A-ALK
S4R34	S1N27	S1N28	S21A20	S22A20
SEC31A-JAK2	SEC61G-EGFR	SLC12A7-BRAF	SLC12A7-TERT	SLC34A2-ROS1
S22J17	S2E9	S17B11	S1T3	S13R32
SLC34A2-ROS1	SLC34A2-ROS1	SLC34A2-ROS1	SLC34A2-ROS1	SLC3A2-NRG1
S13R34	S13R36	S4R32	S4R34	S5N6
SLC45A3-BRAF	SLC45A3-ERG	SLC45A3-FGFR2	SLC45A3-FGFR2	SLMAP-NTRK2
S1B8	S1E4	S1F1	S1F2	S14N16
SND1-BRAF	SND1-BRAF	SND1-BRAF	SND1-BRAF	SND1-BRAF
S10B11	S10B9	S11B11	S14B11	S14B9
SND1-BRAF	SND1-BRAF	SND1-BRAF	SND1-BRAF	SNX19-FGFR2
S16B9	S18B10	S9B2	S9B9	S7F7
SNX19-FGFR2	SOX6-BRAF	SOX6-BRAF	SPAG9-JAK2	SPECC1L-RET
S8F7	S5B9	S6B9	S25J19	S10R11
SPECC1L-RET	SPECC1-PDGFRB	SPTBN1-FLT3	SQSTM1-ALK	SQSTM1-FGFR1
S10R12	S3P11	S3F14	S5A20	S6F10
SQSTM1-NTRK1	SQSTM1-NTRK1	SQSTM1-NTRK2	SRGAP3-RAF1	SRGAP3-RAF1
S2N10	S5N10	S5N17	S11R8	S12R10
SSBP2-JAK2	SSBP2-JAK2	SSBP2-JAK2	SSBP2-JAK2	SSBP2-NTRK1
S10J18	S4J11	S5J11	S8J18	S12N12
STK32B-ALK	STRN3-BRAF	STRN3-JAK2	STRN-ALK	STRN-PDGFR
S11A20	S3B10	S9J17	S3A20	S6P12
STRN-PDGFR	TANK-BRAF	TAX1BP1-BRAF	TBL1XR1-PIK3CA	TBL1XR1-RET
S6P12	T4B9	T8B11	T1P2	T9R11
TBL1XR1-RET	TBP	TENM4-NRG1	TERF2-JAK2	TERT-ALK
T9R12	ENCTRL	T12N2	T8J19	T11A5
TFG-ALK	TFG-ALK	TFG-ALK	TFG-ALK	TFG-MET

T4A20	T5A20	T6A20	T7A19	T5M15
TFG-NTRK1	TFG-NTRK1	TFG-ROS1	TMEM106B-ROS1	TMEM178B-BRAF
T6N10	T6N14	T4R35	T3R35	T2B9
TMPRSS2-BRAF	TMPRSS2-ERG	TMPRSS2-ERG	TMPRSS2-ERG	TMPRSS2-ERG
T3B11	T1E2	T1E3	T1E4	T1E5
TMPRSS2-ERG	TMPRSS2-ERG	TMPRSS2-ERG	TMPRSS2-ERG	TMPRSS2-ERG
T1E6	T1EIIIc_4	T2E2	T2E4	T2E5
TMPRSS2-ERG	TMPRSS2-ERG	TMPRSS2-ERG	TMPRSS2-ERG	TMPRSS2-ERG
T2EIIIc_4	T3E4	T4E4	T4E5	T5E4
TMPRSS2-ERG	TMPRSS2-ETV1	TMPRSS2-ETV1	TMPRSS2-ETV1	TMPRSS2-ETV1
T5E5	T1bE4	T1E4	T1E5	T2E5
TMPRSS2-ETV4	TMPRSS2-ETV5	TMPRSS2-ETV5	TMPRSS2-ETV5	TNIP1-PDGFRB
T1bE3	T1bE2	T1E2	T3E2	T14P11
TNKS2-PDGFRB	TP53BP1-PDGFRB	TP53-NTRK1	TP53-NTRK1	TP53-NTRK1
T25P12	T23P11	T10N9	T11N9	T8N9
TP53-NTRK1	TPM1-ALK	TPM3-ALK	TPM3-JAK2	TPM3-NTRK1
T9N9	T8A20	T7A20	T7J17	T7N10
TPM3-NTRK1	TPM3-NTRK1	TPM3-NTRK1	TPM3-NTRK1	TPM3-PDGFRB
T7N12	T7N13	T7N7	T8N10	T7P11
TPM3-ROS1	TPM3-ROS1	TPM4-ALK	TPR-ALK	TPR-ALK
T3R36	T7R35	T7A20	T15A20	T4A20
TPR-FGFR1	TPR-JAK2	TPR-MET	TPR-NTRK1	TPR-NTRK1
T22F10	T39J17	T4M15	T16int9N10	T21N10
TPR-NTRK1	TPR-NTRK1	TPR-NTRK1	TRAF1-ALK	TRAK1-RAF1
T21N9	T6N12	T6N12	T6A20	T9R8
TRIM24-BRAF	TRIM24-BRAF	TRIM24-BRAF	TRIM24-BRAF	TRIM24-BRAF
T10B9	T11B2	T3B10	T3B11	T5B8
TRIM24-BRAF	TRIM24-FGFR1	TRIM24-NTRK2	TRIM24-NTRK2	TRIM24-RET
T9B9	T11F10	T12N15	T12N16	T9R12
TRIM27-RET	TRIM33-RAF1	TRIM33-RET	TRIM33-RET	TRIM33-RET
T3R12	T9R10	T11R12	T15R12	T16R12
TRIM4-BRAF	TRIM4-MET	TRIO-TERT	TRIP11-PDGFRB	TRMT61B-ALK

T6B10	T6M15	T33T2	T16P11	T1A9
TSEN2-PPARG	TSEN2-PPARG	TTLL7-TERT	UBE2L3-KRAS	UBN2-BRAF
T5P4	T6P6	T1T3	U3K2	U3B11
VAMP2-NRG1	VCL-ALK	VCL-NTRK2	WASF2-FGR	WDR48-PDGFRB
V4N4	V16A20	V16N12	W1F2	W9P12
WHSC1L1-FGFR1	WHSC1L1-FGFR1	WHSC1L1-NUTM1	WIPF2-ERBB2	YWHAE-ROS1
W14F5	W1F2	W7N2	W1E4	Y4R36
ZC3HAV1-BRAF	ZC3HAV1-BRAF	ZCCHC8-ROS1	ZEB2-PDGFRB	ZKSCAN1-MET
Z3B10	Z7B11	Z2R36	Z9P9	Z3M15
ZKSCAN5-BRAF	ZMYM2-FGFR1	ZMYND8-RELA	ZNF226-AKT2	ZSCAN30-BRAF
Z2B9	Z17F10	Z21R2	Z2A5	Z3B10

Genes are given in **bold**, exon break points are listed below.

Table S4. Genes included with anchor primers in the Archer FusionPlex Solid Tumor panel.

Assay Targets Solid Tumor Panel			
AKT3	EWSR1	NOTCH1/2	RAF1
ALK	FGFR1/2/3	NRG1	RELA
ARHGAP26	FGR	NTRK1/2/3	RET
AXL	INSR	NUMBL	ROS1
BRAF	MAML2	NUTM1	RSPO2/3
BRD3/4	MAST1/2	PDGFRA/B	TERT
EGFR	MET	PIK3CA	TFE3
ERG	MSMB	PKN1	TFEB
ESR1	MUSK	PPARG	THADA
ETV1/4/5/6	MYB	PRKCA/B	TMPRSS2

References

34. Gautschi, O.; Milia, J.; Filleron, T.; Wolf, J.; Carbone, D.P.; Owen, D.; Camidge, R.; Narayanan, V.; Doebele, R.C.; Besse, B.; et al. Targeting RET in Patients With RET-Rearranged Lung Cancers: Results From the Global, Multicenter RET Registry. *J. Clin. Oncol.* **2017**, *35*, 1403–1410.
35. Takeda, M.; Sakai, K.; Okamoto, K.; Hayashi, H.; Tanaka, K.; Shimizu, T.; Nishio, K.; Nakagawa, K. Genome sequencing for nonsmall-cell lung cancer identifies a basis for nintedanib sensitivity. *Ann. Oncol.* **2016**, *27*, 748–750.
36. Kohno, T.; Ichikawa, H.; Totoki, Y.; Yasuda, K.; Hiramoto, M.; Nammo, T.; Sakamoto, H.; Tsuta, K.; Furuta, K.; Shimada, Y.; et al. KIF5B-RET fusions in lung adenocarcinoma. *Nat. Med.* **2012**, *18*, 375–377.

37. Lipson, D.; Capelletti, M.; Yelensky, R.; Otto, G.; Parker, A.; Jarosz, M.; Curran, J.A.; Balasubramanian, S.; Bloom, T.; Brennan, K.W.; et al. Identification of new ALK and RET gene fusions from colorectal and lung cancer biopsies. *Nat. Med.* **2012**, *18*, 382–384.
38. Lovly, C.M.; McDonald, N.T.; Chen, H.; Ortiz-Cuaran, S.; Heukamp, L.C.; Yan, Y.; Florin, A.; Ozretic, L.; Lim, D.; Wang, L.; et al. Rationale for co-targeting IGF-1R and ALK in ALK fusion-positive lung cancer. *Nat. Med.* **2014**, *20*, 1027–1034.
39. Hrustanovic, G.; Olivas, V.; Pazarentzos, E.; Tulpule, A.; Asthana, S.; Blakely, C.M.; Okimoto, R.A.; Lin, L.; Neel, D.S.; Sabnis, A.; et al. RAS-MAPK dependence underlies a rational polytherapy strategy in EML4-ALK-positive lung cancer. *Nat. Med.* **2015**, *21*, 1038–1047.
40. Crystal, A.S.; Shaw, A.T.; Sequist, L.V.; Friboulet, L.; Niederst, M.J.; Lockerman, E.L.; Frias, R.L.; Gainor, J.F.; Amzallag, A.; Greninger, P.; et al. Patient-derived models of acquired resistance can identify effective drug combinations for cancer. *Science* **2014**, *346*, 1480–1486.
41. Socinski, M.A.; Goldman, J.; El-Hariry, I.; Koczywas, M.; Vukovic, V.; Horn, L.; Paschold, E.; Salgia, R.; West, H.; Sequist, L.V.; et al. A multicenter phase II study of ganetespib monotherapy in patients with genotypically defined advanced non-small cell lung cancer. *Clin. Cancer Res.* **2013**, *19*, 3068–3077.
42. Seto, T.; Kiura, K.; Nishio, M.; Nakagawa, K.; Maemondo, M.; Inoue, A.; Hida, T.; Yamamoto, N.; Yoshioka, H.; Harada, M.; et al. CH5424802 (RO5424802) for patients with ALK-rearranged advanced non-small-cell lung cancer (AF-001JP study): a single-arm, open-label, phase 1–2 study. *Lancet Oncol.* **2013**, *14*, 590–598.
43. Nakaoku, T.; Tsuta, K.; Ichikawa, H.; Shiraishi, K.; Sakamoto, H.; Enari, M.; Furuta, K.; Shimada, Y.; Ogiwara, H.; Watanabe, S.; et al. Druggable oncogene fusions in invasive mucinous lung adenocarcinoma. *Clin. Cancer Res.* **2014**, *20*, 3087–3093.
44. Hutchinson, K.E.; Lipson, D.; Stephens, P.J.; Otto, G.; Lehmann, B.D.; Lyle, P.L.; Vnencak-Jones, C.L.; Ross, J.S.; Pietenpol, J.A.; Sosman, J.A.; et al. BRAF fusions define a distinct molecular subset of melanomas with potential sensitivity to MEK inhibition. *Clin. Cancer Res.* **2013**, *19*, 6696–6702.
45. Palanisamy, N.; Ateeq, B.; Kalyana-Sundaram, S.; Pflueger, D.; Ramnarayanan, K.; Shankar, S.; Han, B.; Cao, Q.; Cao, X.; Suleman, K.; et al. Rearrangements of the RAF kinase pathway in prostate cancer, gastric cancer and melanoma. *Nat. Med.* **2010**, *16*, 793–798.
46. Lewin, J.; Soria, J.C.; Stathis, A.; Delord, J.P.; Peters, S.; Awada, A.; Aftimos, P.G.; Bekradda, M.; Rezai, K.; Zeng, Z.; et al. Phase Ib Trial With Birabresib, a Small-Molecule Inhibitor of Bromodomain and Extraterminal Proteins, in Patients With Selected Advanced Solid Tumors. *J. Clin Oncol.* **2018**, *36*, 3007–3014.
47. Xu, Y.; Vakoc, C.R. Targeting Cancer Cells with BET Bromodomain Inhibitors. *Cold Spring Harb. Perspect. Med.* **2017**, *7*, a026674.



© 2019 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).