

SUPPLEMENTARY TABLE 1: Mass cytometry antibody cocktail.

<u>Mass</u>	<u>Metal</u>	<u>Epitope</u>	<u>Clone</u>	<u>Concentration</u>		<u>Vendor</u>
141	Pr	EpCAM	EBA-1	0.5	µg/ml	BD
142	Nd	Casp3 (cleaved)	D3E9	0.5	%	Fluidigm
143	Nd	β-cat (active)	D2U8Y	0.25	µg/ml	Cell Signaling
145	Nd	EGFR	D38B1	0.2	µg/ml	Cell Signaling
146	Nd	IgG	DA1E	0.1	µg/ml	Cell Signaling
147	Sm	HER3	D22C5	0.25	µg/ml	Cell Signaling
148	Nd	HER2	29D8	0.25	µg/ml	Cell Signaling
149	Sm	p4EBP1 (T37/46)	236B4	0.25	%	Fluidigm
150	Nd	pStat5 (Y694)	47	1	%	Fluidigm
151	Eu	c-Met	D1C2	0.2	µg/ml	Cell Signaling
152	Sm	pAkt (S473)	D9E	1	%	Fluidigm
153	Eu	pStat1 (Y701)	58D6	0.25	µg/ml	Cell Signaling
154	Sm	pAkt (T308)	D25E6	0.25	µg/ml	Cell Signaling
156	Gd	p-p38	D3F9	0.5	%	Fluidigm
158	Gd	pStat3 (Y705)	Y705	1	%	Fluidigm
159	Tb	c-Myc	D3N8F	0.25	µg/ml	Cell Signaling
160	Dy	m-CD45	30-F11	0.05	µg/ml	Biologend
162	Dy	pJnk (T183/Y185)	G9	0.3	µg/ml	Cell Signaling
164	Dy	p-p90RSK (S380)	D5D8	0.25	µg/ml	Cell Signaling
166	Er	CD44	IM7	0.05	µg/ml	Biologend
168	Er	Ki-67	B56	0.5	%	Fluidigm
169	Tm	GFP	5F12.4	0.5	%	Fluidigm
170	Er	IGF1R-B	D23H3	0.3	µg/ml	Cell Signaling
171	Yb	pErk (T202/Y204)	D13.14.4E	0.5	µg/ml	Cell Signaling
172	Yb	pS6 (S235/236)	N7-548	0.25	%	Fluidigm
175	Lu	CK 5, 8, 18	RCK102, C-04	0.025	µg/ml	Abcam

SUPPLEMENTARY TABLE 2: Antibody signal spillover table

ANTIBODY	CHANNEL																																				
	Pr141	Nd142	Nd143	Nd144	Nd145	Nd146	Sm147	Nd148	Sm149	Nd150	Eu151	Sm152	Eu153	Sm154	Gd155	Gd156	Gd158	Tb159	Dy160	Dy161	Dy162	Dy163	Dy164	Ho165	Er166	Er167	Er168	Tm169	Er170	Yb171	Yb172	Yb174	Lu175	Yb176			
EpCAM	1	0.001	0	0	0.005	0.001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Cl-Casp3	0	1	0.004	0	0	0	0	0	0	0	0	0	0	0	0	0	0.014	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
β-Cat	0	0.008	1	0.021	0.001	8E-04	0	0	0	0	0	0	0	0	0	0	0	0.012	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
EGFR	0	0.003	0.002	0.011	1	0.036	0	0	0	0	0	0	0	0	0	0	0	0	0	0.015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
HER3	0	0	0	2E-04	0	0	1	0.023	0.004	0	0	0.002	0	0.002	0	0	0	0	0	0	0	0	0.003	0	0	0	0	0	0	0	0	0	0	0	0	0	
HER2	0	0.004	0.001	0.003	3E-04	0.004	0	1	0	0.003	0	0	0	0	0	0	0	0	0	0	0	0	0	0.014	0	0	0	0	0	0	0	0	0	0	0	0	
p4EBP1	0	0	0	0	0	0	6E-04	0.007	1	0.015	2E-04	0.004	0	0.003	0	0	0	0	0	0	0	0	0	0	0.003	0	0	0	0	0	0	0	0	0	0	0	
pStat5	0	0.003	0.001	0.004	0	0.002	0	0.001	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.011	0	0	0	0	0	0	0	0	0	0	0	
c-Met	0	0	0	0	0	0	0	0	0	0	1	5E-04	0.008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
pAkt473	0	0	0	0	0	0	0	0	0	0	0	1	0	0.005	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
pStat1	0	0	0	0	0	0	0	0	0	0	0.006	0	1	1E-03	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
pAkt308	0	0	0	0	0	0	1E-04	0	1E-04	0	0	0.006	0	1	6E-04	0.001	0	0	0	0	0	0	0	0	0	0	0	0	0	0.001	0	0	0	0	0	0	0
pStat3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4E-06	0.001	1	0.002	0.006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.002	0	0	
c-Myc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.007	3E-04	0	0	0	0	4E-06	0	0	0	0	0	0	0	0	0	0	0	0
m-CD45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.005	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.002	
pJnk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2E-04	0.015	1	0.045	0.007	0	0	0	0	0	0	0	0	0	0	0	0	0	
p-p90RSK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3E-04	0.001	0.01	1	0.001	0	0	0	0	1E-04	5E-05	0	0	0	0	0	0		
GFP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2E-04	1	0.003	5E-05	0.002	3E-04	1E-04	0	0	0	
IGF1R	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.004	0.003	0.006	4E-05	1	0.003	3E-04	0	4E-04	0	0	
pErk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.001	1	0.037	0.002	0.01	0	6E-04	0	3E-04	
pS6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.008	1	0.01	0	6E-04	0	
CK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6E-04	0	1	

SUPPLEMENTARY TABLE 3: Cell number statistics for mass cytometry datasets

Model	Sample Set	Mean Cell Number	Median Cell Number	Min Cell Number	Max Cell Number	Std Dev Cell Number
PC3	Primary	8998	2581	148	49619	16015.3
PC3	CTC	89	44	15	314	100.4
PC3	Lung	1236	321	47	3985	1544.4
PC3	Liver	2974	1324	52	16806	5653.4
PC3	Bone	7652	5134	141	17680	9036.5
CE1-4	Primary	33427	32310	20304	50948	10464.7
CE1-4	CTC	8	10	4	11	3.8
CE1-4	Lung	141	165	12	247	119.3
CE1-4	Liver	153	128	17	338	150.5
CE1-4	Bone	5681	4998	20	12709	5855.5

SUPPLEMENTARY TABLE 4: Patient survival data for breast cancer dataset 2

	Patient	OS days	OS event	TTP days	TTP event
BR21_1_SC1_052113	BR21	220	1	43	1
BR21_1_SC2_052113	BR21	220	1	43	1
BR21_1_SC3_052113	BR21	220	1	43	1
BR29_1_012913	BR29	999	0	408	0
BR29_2_012913	BR29	999	0	408	0
BR29_3_BYL_012913	BR29	998	0	407	0
BrTr08_1_CL1_012913	BrTr08	28	0	28	0
BrTr08_1_CL2_012913	BrTr08	28	0	28	0
BrTr11_1_CL1_022513	BrTr11	125	1	71	1
BrTr11_1_CL2_022513	BrTr11	125	1	71	1
BrTr11_1_CL3_022513	BrTr11	125	1	71	1
BrTr11_1_SC2_022513	BrTr11	125	1	71	1
BrTr12_SC_022813	BrTr12	NA	NA	NA	NA
Brx03_CL1_012913	Brx03	NA	NA	NA	NA
Brx10_1_SC1_041113	Brx10	621	1	29	1
Brx10_1_SC2_041113	Brx10	621	1	29	1
Brx10_1_SC3_041113	Brx10	621	1	29	1
Brx100_1_SC3_080113	Brx100	98	0	98	0
Brx100_1_SC4_080113	Brx100	98	0	98	0
Brx100_1_SC5_080113	Brx100	98	0	98	0
Brx100_2_BYL_SC2_080213	Brx100	97	0	97	0
Brx107_1_SC2_092013	Brx107	754	0	645	1
Brx107_1_SC1_092013	Brx107	754	0	645	1
Brx109_1_SC1_121613	Brx109	92	1	64	0
Brx109_1_CL1_121613	Brx109	92	1	64	0
Brx11_CL_020413	Brx11	NA	NA	NA	NA
Brx11_SC_020413	Brx11	NA	NA	NA	NA
Brx116_1_SC1_120213	Brx116	637	0	275	1
Brx116_1_SC3_120213	Brx116	637	0	275	1
Brx116_2_SC1_120213	Brx116	637	0	275	1
Brx116_1_SC1_092414	Brx116	342	0	98	0
Brx116_2_TX_SC1_092414	Brx116	342	0	98	0
Brx117_1_SC1_120613	Brx117	501	0	223	1
Brx117_1_SC2_120613	Brx117	501	0	223	1
Brx117_2_SC1_091814	Brx117	216	0	232	1
Brx12_SC_012913	Brx12	NA	NA	NA	NA
Brx120_1_SC2_120513	Brx120	NA	NA	208	1
Brx120_1_SC3_120513	Brx120	NA	NA	208	1
Brx120_2_BYL_SC1_120613	Brx120	NA	NA	207	1
Brx121_1_SC1_120913	Brx121	651	0	447	1
Brx121_1_SC2_120913	Brx121	651	0	447	1
Brx121_1_SC3_120913	Brx121	651	0	447	1
Brx122_1_SC1_121213	Brx122	636	0	165	1

Brx122_1_SC2_121213	Brx122	636	0	165	1
Brx122_1_SC3_121213	Brx122	636	0	165	1
Brx126_1_SC3_021214	Brx126	615	0	62	1
Brx130_1_SC1_011714	Brx130	83	0	83	0
Brx130_1_SC2_011714	Brx130	83	0	83	0
Brx134_1_SC1_021914	Brx134	593	0	53	1
Brx134_1_SC2_021914	Brx134	593	0	53	1
Brx146_2_relapse_SC1_082114	Brx146	NA	NA	NA	NA
Brx146_2_relapse_SC2_082114	Brx146	NA	NA	NA	NA
Brx146_2_relapse_SC3_082114	Brx146	NA	NA	NA	NA
Brx163_1_SC2_090814	Brx163	NA	NA	175	1
Brx163_1_SC3_090814	Brx163	NA	NA	175	1
Brx163_1_SC4_090814	Brx163	NA	NA	175	1
Brx164_1_SC1_091814	Brx164	395	1	372	1
Brx164_1_SC2_091814	Brx164	395	1	372	1
Brx164_1_SC3_091814	Brx164	395	1	372	1
Brx164_1_SC4_091814	Brx164	395	1	372	1
Brx17_SC1_020713	Brx17	NA	NA	NA	NA
Brx17_CL2_020713	Brx17	NA	NA	NA	NA
Brx35_1_SC1_091213	Brx35	567	1	56	1
Brx35_1_SC2_110713	Brx35	510	1	119	1
Brx50_2_031113	Brx50	31	1	8	1
Brx52_CL1_020413	Brx52	NA	NA	NA	NA
Brx52_CL2_020413	Brx52	NA	NA	NA	NA
Brx52_CL3_020413	Brx52	NA	NA	NA	NA
Brx52_CL4_020413	Brx52	NA	NA	NA	NA
Brx52_CL5_020413	Brx52	NA	NA	NA	NA
Brx52_SC1_020413	Brx52	NA	NA	NA	NA
Brx52_SC2_020413	Brx52	NA	NA	NA	NA
Brx53_CL2_010313	Brx53	246	1	82	1
Brx53_SC1_010313	Brx53	246	1	82	1
Brx53_CL1_011513	Brx53	219	1	55	1
Brx53_CL2_011513	Brx53	219	1	55	1
Brx53_SC_011513	Brx53	219	1	55	1
Brx61_1_CL1_032012	Brx61	NA	NA	NA	NA
Brx61_1_CL2_032012	Brx61	NA	NA	NA	NA
Brx61_1_CL3_032012	Brx61	NA	NA	NA	NA
Brx61_1_CL4_032012	Brx61	NA	NA	NA	NA
Brx61_1_CL5_032012	Brx61	NA	NA	NA	NA
Brx61_1_CL6_032012	Brx61	NA	NA	NA	NA
Brx61_1_SC1_032012	Brx61	NA	NA	NA	NA
Brx61_1_SC2_032012	Brx61	NA	NA	NA	NA
Brx61_1_SC4_032012	Brx61	NA	NA	NA	NA
Brx66_1_012913	Brx66	1007	0	1007	0
Brx66_2_CL1_012913	Brx66	1007	0	1007	0
Brx66_2_CL2_012913	Brx66	1007	0	1007	0

Brx66_2_CL3_012913	Brx66	1007	0	1007	0
Brx66_2_SC1_012913	Brx66	1007	0	1007	0
Brx66_2_SC2_012913	Brx66	1007	0	1007	0
Brx70_2_BYLrelapse_SC1_092413	Brx70	NA	NA	128	1
Brx71_SC1_031413	Brx71	454	1	454	1
Brx71_SC2_031413	Brx71	454	1	454	1
Brx72_1_SC1_031813	Brx72	NA	NA	67	1
Brx72_1_SC2_031813	Brx72	NA	NA	67	1
Brx72_1_SC3_031813	Brx72	NA	NA	67	1
Brx72_1_SC4_031813	Brx72	NA	NA	67	1
Brx72_1_SC5_031813	Brx72	NA	NA	67	1
Brx72_1_SC6_031813	Brx72	NA	NA	67	1
Brx72_2_BYL_SC1_031913	Brx72	NA	NA	66	1
Brx72_2_BYL_SC2_031913	Brx72	NA	NA	66	1
Brx72_2_BYL_SC3_031913	Brx72	NA	NA	66	1
Brx73_1_SC1_032013	Brx73	651	0	651	0
Brx73_1_SC2_032013	Brx73	651	0	651	0
Brx74_1_SC2_032813	Brx74	914	0	168	1
Brx78_1_05102013	Brx78	580	1	32	1
Brx82_1_SC1_051613	Brx82	NA	NA	42	1
Brx83_1_SC1_051613	Brx83	568	1	154	1
Brx83_1_SC2_051613	Brx83	568	1	154	1
Brx83_1_SC3_051613	Brx83	568	1	154	1
Brx83_1_SC4_051613	Brx83	568	1	154	1
Brx86_1_CL1_052313	Brx86	99	1	14	1
Brx86_1_SC2_052313	Brx86	99	1	14	1
Brx86_1_SC3_052313	Brx86	99	1	14	1
Brx86_2_BYL_SC1_052413	Brx86	98	1	13	1
Brx86_2_BYL_SC2_052413	Brx86	98	1	13	1
Brx86_2_BYL_SC3_052413	Brx86	98	1	13	1
Brx87_1_SC1_062113	Brx87	485	1	0	0
Brx87_1_SC2_062113	Brx87	485	1	0	0
Brx90_1_SC1_062713	Brx90	596	0	42	0
Brx90_1_SC1_101014	Brx90	126	0	116	1
Brx90_1_SC2_101014	Brx90	126	0	116	1
Brx90_1_SC3_101014	Brx90	126	0	116	1
Brx93_1_SC1_112113	Brx93	NA	NA	NA	NA
Brx95_1_SC1_071713	Brx95	835	0	835	0
Brx95_2_BYL_CL1_071813	Brx95	834	0	834	0
Brx97_1_SC1_072313	Brx97	786	1	297	1
Brx97_1_SC2_072313	Brx97	786	1	297	1
Brx97_1_SC3_072313	Brx97	786	1	297	1
Brx97_1_SC4_072313	Brx97	786	1	297	1
Brx97_1_SC5_072313	Brx97	786	1	297	1
Brx98_1_SC3_072313	Brx98	755	0	464	1
Brx98_1_SC5_072313	Brx98	755	0	464	1