

Supplemental Table 10: List of HCl pathways enriched among PAC-coexpressed genes. Term, which pathway; Overlap, number of genes that overlap and total genes; P-value, enrichment p-value; Adjusted P-value, Q-value; Odds Ratio, enrichment; Combined Score, approximation of overall association ($-\log_{10}(P) * \log(\text{Odds})$), Genes, genes in the pathway which are co-expressed with COBLL1.

Term	Overlap	P-value	Adjusted P-value	Old P-value	Old Adjusted P-value	Odds Ratio	Combined Score	Genes
Integrin-linked kinase signaling Homo sapiens 21738158-6194-11e5-8ac5-06603eb7f303	5/45	3.37E-05	0.003600712643	0	0	15.46484375	159.279421	PPP1R14A;ARHGEF7;LIMS2;TNS1;ARHGEF6
Signaling events mediated by focal adhesion kinase Homo sapiens 8fb80085-6195-11e5-8ac5-	5/58	1.16E-04	0.006193572074	0	0	11.66391509	105.7208509	PIK3CA;ROCK2;PTPN21;ARHGEF7;CRK
E-cadherin signaling in the nascent adherens junction Homo sapiens aef0d8c2-6191-11e5-8ac5-06603eb7f303	4/39	2.93E-04	0.01046151033	0	0	14.05501331	114.3272589	TJP1;DLG1;PIK3CA;CRK
VEGFR3 signaling in lymphatic endothelium Homo sapiens 9048d98c-6196-11e5-8ac5-06603eb7f303	3/25	0.001109703492	0.02905211847	0	0	16.67760943	113.4688246	PIK3CA;ITGA1;CRK
IGF1 pathway Homo sapiens 5e904cd6-6193-11e5-8ac5-06603eb7f303	3/28	0.001552216019	0.02905211847	0	0	14.67407407	94.91296294	PIK3CA;IRS2;CRK
Nectin adhesion pathway Homo sapiens 685baa82-6194-11e5-8ac5-06603eb7f303	3/29	0.001720898249	0.02905211847	0	0	14.10897436	89.80233628	PIK3CA;PTPRM;CRK
Regulation of CDC42 activity Homo sapiens 0ffe6681-6195-11e5-8ac5-06603eb7f303	3/30	0.001900605881	0.02905211847	0	0	13.58573388	85.12253726	ITSN1;ARHGEF7;ARHGFE6
CDC42 signaling events Homo sapiens 50b98ae0-6190-11e5-8ac5-06603eb7f303	4/70	0.002682635008	0.03588024324	0	0	7.441746659	44.06225271	DLG1;PIK3CA;ARHGEF7;ARHGFE6
Signaling events regulated by Ret tyrosine kinase Homo sapiens e4431190-6195-11e5-8ac5-06603eb7f303	3/38	0.003763345993	0.03883069402	0	0	10.47619048	58.48277627	PIK3CA;IRS2;CRK
EPHB forward signaling Homo sapiens 01c81f4a-6192-11e5-8ac5-06603eb7f303	3/39	0.004052516484	0.03883069402	0	0	10.18467078	56.10141609	PIK3CA;ITSN1;CRK
Plasma membrane estrogen receptor signaling Homo sapiens dcc37895-6194-11e5-8ac5-06603eb7f303	3/40	0.004354844189	0.03883069402	0	0	9.908908909	53.86945081	PIK3CA;ROCK2;GNAI1
Internalization of ErbB1 Homo sapiens 3aa9aafa-6194-11e5-8ac5-06603eb7f303	3/40	0.004354844189	0.03883069402	0	0	9.908908909	53.86945081	PIK3CA;ITSN1;ARHGFE7
PAR1-mediated thrombin signaling events Homo sapiens be5084c0-6194-11e5-8ac5-06603eb7f303	3/43	0.00534245545	0.04397251793	0	0	9.164351852	47.94852957	PIK3CA;ROCK2;GNAI1
Angiotensin receptor Tie2-mediated signaling Homo sapiens ad60647c-6188-11e5-8ac5-06603eb7f303	3/48	0.007266330027	0.05553552235	0	0	8.144032922	40.10532209	ANGPT1;PIK3CA;CRK
Signaling events mediated by PTP1B Homo sapiens be498a9b-6195-11e5-8ac5-06603eb7f303	3/52	0.009064913001	0.06344692205	0	0	7.477702192	35.17020598	PIK3CA;LEP;CRK
CXCR4-mediated signaling events Homo sapiens 46a5529b-6191-11e5-8ac5-06603eb7f303	4/100	0.009487390212	0.06344692205	0	0	5.108436853	23.79403482	PIK3CA;ITGA1;CRK;GNAI1
SHP2 signaling Homo sapiens 85755aa4-6195-11e5-8ac5-06603eb7f303	3/57	0.01164854846	0.0733173344	0	0	6.783607682	30.20451317	PIK3CA;ANGPT1;GNAI1
PDGFR-alpha signaling pathway Homo sapiens c66cc833-6194-11e5-8ac5-06603eb7f303	2/22	0.01402373867	0.0833633354	0	0	12.15644172	51.87158259	PIK3CA;CRK
Integrin family cell surface interactions Homo sapiens 1ca2bf67-6194-11e5-8ac5-06603eb7f303	2/26	0.01931095986	0.108751195	0	0	10.12832311	39.97732665	ITGAM;ITGA1
Nongenotropic Androgen signaling Homo sapiens 843e2f77-6194-11e5-8ac5-06603eb7f303	2/30	0.02529901189	0.1251412801	0	0	8.679666959	31.91504809	PIK3CA;GNAI1

Signaling events mediated by Hepatocyte Growth Factor Receptor (c-Met) Homo sapiens ac39d2b9-6195-11e5-8ac5-06603eb7f303	3/77	0.02585736009	0.1251412801	0	0	4.945195195	18.07547965	PIK3CA;RANBP9;CRK
Osteopontin-mediated events Homo sapiens 94bf7f2a-6194-11e5-8ac5-06603eb7f303	2/31	0.0268995275	0.1251412801	0	0	8.379944997	30.29891928	PIK3CA;ROCK2
Nephrin/Neph1 signaling in the kidney podocyte Homo sapiens 6cfb9873-6194-11e5-8ac5-06603eb7f303	2/31	0.0268995275	0.1251412801	0	0	8.379944997	30.29891928	TJP1;PIK3CA
N-cadherin signaling events Homo sapiens 5fc9c1e1-6194-11e5-8ac5-06603eb7f303	2/34	0.0319371572	0.1366910328	0	0	7.593174847	26.15078137	PIK3CA;LRP5
EGF receptor (ErbB1) signaling pathway Homo sapiens NULL	2/34	0.0319371572	0.1366910328	0	0	7.593174847	26.15078137	PIK3CA;GNAI1
Regulation of RAC1 activity Homo sapiens 351aacd6-6195-11e5-8ac5-06603eb7f303	2/38	0.03917718682	0.1612291919	0	0	6.748125426	21.86163654	ARHGEF7;ARHGEF6
Urokinase-type plasminogen activator (uPA) and uPAR-mediated signaling Homo sapiens 503076a2-6196-11e5-8ac5-06603eb7f303	2/42	0.04697331103	0.17331532	0	0	6.07208589	18.56950545	ITGAM;CRK
Signaling events mediated by TCPTP Homo sapiens cd5ca44d-6195-11e5-8ac5-06603eb7f303	2/42	0.04697331103	0.17331532	0	0	6.07208589	18.56950545	PIK3CA;ITGA1
BMP receptor signaling Homo sapiens 2a3c66e7-618e-11e5-8ac5-06603eb7f303	2/42	0.04697331103	0.17331532	0	0	6.07208589	18.56950545	PPM1A;ZFYVE16
CXCR3-mediated signaling events Homo sapiens 3a38a0ca-6191-11e5-8ac5-06603eb7f303	2/43	0.0490040877	0.1747812461	0	0	5.923686967	17.86496059	PIK3CA;GNAI1
ErbB2/ErbB3 signaling events Homo sapiens 51e35311-6192-11e5-8ac5-06603eb7f303	2/44	0.05106623494	0.1762608754	0	0	5.78235466	17.20037584	PIK3CA;RNF41
S1P5 pathway Homo sapiens 845321c3-6195-11e5-8ac5-06603eb7f303	1/8	0.06413600988	0.2144547831	0	0	17.271777	47.44124133	GNAI1
TGF-beta receptor signaling Homo sapiens 1f188fcc-6196-11e5-8ac5-06603eb7f303	2/54	0.07327446892	0.2375869144	0	0	4.668003775	12.20002878	ZFYVE16;SPTBN1
IL2-mediated signaling events Homo sapiens a2a1883c-6193-11e5-8ac5-06603eb7f303	2/55	0.07564068724	0.2380456922	0	0	4.579696724	11.82368216	PIK3CA;IRS2
Fc-epsilon receptor I signaling in mast cells Homo sapiens 86cd7795-6192-11e5-8ac5-06603eb7f303	2/58	0.08288187427	0.2467977965	0	0	4.33369851	10.79237792	FCER1G;PIK3CA
FGF signaling pathway Homo sapiens 98ed0df6-6192-11e5-8ac5-06603eb7f303	2/59	0.08534129411	0.2467977965	0	0	4.25745345	10.47800522	PIK3CA;FGFR2
Coregulation of Androgen receptor activity Homo sapiens 27e0e369-6191-11e5-8ac5-06603eb7f303	2/59	0.08534129411	0.2467977965	0	0	4.25745345	10.47800522	LATS2;NRIP1
IL4-mediated signaling events Homo sapiens cff33f50-6193-11e5-8ac5-06603eb7f303	2/60	0.08782266764	0.2472901431	0	0	4.183837529	10.17691551	PIK3CA;IRS2
Neurotrophic factor-mediated Trk receptor signaling Homo sapiens 774988f5-6194-11e5-8ac5-06603eb7f303	2/61	0.09032547059	0.2478160347	0	0	4.112717064	9.888352838	PIK3CA;CRK
Endothelins Homo sapiens dfb9dc47-6191-11e5-8ac5-06603eb7f303	2/63	0.09539330293	0.2551770853	0	0	3.977471588	9.346051545	CRK;GNAI1
LPA receptor mediated events Homo sapiens 4b994cde-6194-11e5-8ac5-06603eb7f303	2/65	0.1005407368	0.2623868008	0	0	3.850813127	8.846058235	CRK;GNAI1

S1P4 pathway Homo sapiens 821b0c12-6195-11e5-8ac5-06603eb7f303	1/14	0.1095395298	0.2663802202	0	0	9.297373358	20.56086033	GNAI1		
IL5-mediated signaling events Homo sapiens e1d816a1-6193-11e5-8ac5-06603eb7f303	1/14	0.1095395298	0.2663802202	0	0	9.297373358	20.56086033	PIK3CA		
JNK signaling in the CD4+ TCR pathway Homo sapiens 400ebdab-6194-11e5-8ac5-06603eb7f303	1/14	0.1095395298	0.2663802202	0	0	9.297373358	20.56086033	CRK		
PAR4-mediated thrombin signaling events Homo sapiens c3b87da1-6194-11e5-8ac5-06603eb7f303	1/15	0.1168909629	0.2779407341	0	0	8.632839721	18.5305089	ROCK2		
Atypical NF-kappaB pathway Homo sapiens d2dd121d-618b-11e5-8ac5-06603eb7f303	1/17	0.1314133413	0.2991750535	0	0	7.552972561	15.32806027	PIK3CA		
Regulation of cytoplasmic and nuclear SMAD2/3 signaling Homo sapiens 13312fe2-6195-11e5-8ac5-06603eb7f303	1/17	0.1314133413	0.2991750535	0	0	7.552972561	15.32806027	PPM1A		
Regulation of nuclear beta catenin signaling and target gene transcription Homo sapiens 1590a3b3-6195-11e5-8ac5-06603eb7f303	2/79	0.138483738	0.3026249697	0	0	3.148434388	6.224470543	TCF7L2;CTNNBIP1		
EPHA2 forward signaling Homo sapiens fb172ba9-6191-11e5-8ac5-06603eb7f303	1/18	0.1385852665	0.3026249697	0	0	7.108321377	14.04795874	PIK3CA		
E-cadherin signaling in keratinocytes Homo sapiens a5f1af61-6191-11e5-8ac5-06603eb7f303	1/21	0.1597497837	0.3287159011	0	0	6.041158537	11.08037003	PIK3CA		
S1P1 pathway Homo sapiens 7327884f-6195-11e5-8ac5-06603eb7f303	1/21	0.1597497837	0.3287159011	0	0	6.041158537	11.08037003	GNAI1		
Sphingosine 1-phosphate (S1P) pathway Homo sapiens eff796f3-6195-11e5-8ac5-06603eb7f303	1/21	0.1597497837	0.3287159011	0	0	6.041158537	11.08037003	GNAI1		
Signaling events mediated by the Hedgehog family Homo sapiens d3a49cee-6195-11e5-8ac5-06603eb7f303	1/22	0.1666891242	0.3365233263	0	0	5.753193961	10.30756459	PIK3CA		
Signaling events mediated by PRL Homo sapiens bb67523a-6195-11e5-8ac5-06603eb7f303	1/23	0.1735714996	0.3439287122	0	0	5.491407982	9.616365099	ITGA1		
Plexin-D1 Signaling Homo sapiens e3068f36-6194-11e5-8ac5-06603eb7f303	1/24	0.1803973747	0.3446878409	0	0	5.252386002	8.995200678	ITGA1		
S1P2 pathway Homo sapiens 7796a240-6195-11e5-8ac5-06603eb7f303	1/24	0.1803973747	0.3446878409	0	0	5.252386002	8.995200678	GNAI1		
IL3-mediated signaling events Homo sapiens c868db9f-6193-11e5-8ac5-06603eb7f303	1/26	0.1938814641	0.3464780769	0	0	4.831707317	7.926456035	PIK3CA		
VEGFR1 specific signals Homo sapiens 8b13143b-6196-11e5-8ac5-06603eb7f303	1/27	0.2005405894	0.3464780769	0	0	4.645637899	7.464325789	PIK3CA		
Insulin-mediated glucose transport Homo sapiens 145e3376-6194-11e5-8ac5-06603eb7f303	1/27	0.2005405894	0.3464780769	0	0	4.645637899	7.464325789	LNPEP		
TRAIL signaling pathway Homo sapiens 3a79fddf-6196-11e5-8ac5-06603eb7f303	1/28	0.207145036	0.3464780769	0	0	4.4733514	7.04255848	PIK3CA		
Retinoic acid receptors-mediated signaling Homo sapiens 5797691b-6195-11e5-8ac5-06603eb7f303	1/28	0.207145036	0.3464780769	0	0	4.4733514	7.04255848	NRIP1		
Wnt signaling network Homo sapiens 987a2b9f-6196-11e5-8ac5-06603eb7f303	1/28	0.207145036	0.3464780769	0	0	4.4733514	7.04255848	LRP5		
Beta2 integrin cell surface interactions Homo sapiens 95b6b434-618d-11e5-8ac5-06603eb7f303	1/29	0.2136952504	0.3464780769	0	0	4.31337108	6.656412982	ITGAM		

Reelin signaling pathway Homo sapiens 054f432f-6195-11e5-8ac5-06603eb7f303	1/29	0.2136952504	0.3464780769	0	0	4.31337108	6.656412982	PIK3CA		
S1P3 pathway Homo sapiens 7cb02d01-6195-11e5-8ac5-06603eb7f303	1/29	0.2136952504	0.3464780769	0	0	4.31337108	6.656412982	GNAI1		
IL2 signaling events mediated by STAT5 Homo sapiens 9938526b-6193-11e5-8ac5-06603eb7f303	1/30	0.220191675	0.3464780769	0	0	4.164423886	6.30184302	PIK3CA		
Netrin-mediated signaling events Homo sapiens 716a3d34-6194-11e5-8ac5-06603eb7f303	1/30	0.220191675	0.3464780769	0	0	4.164423886	6.30184302	PIK3CA		
Ephrin B reverse signaling Homo sapiens 149a63dc-6192-11e5-8ac5-06603eb7f303	1/30	0.220191675	0.3464780769	0	0	4.164423886	6.30184302	PIK3CA		
Aurora A signaling Homo sapiens f131cf8e-618b-11e5-8ac5-06603eb7f303	1/31	0.226634749	0.3514480891	0	0	4.025406504	5.975376181	ARHGEF7		
Alpha4 beta1 integrin signaling events Homo sapiens aa07df5d-6187-11e5-8ac5-06603eb7f303	1/32	0.2330249078	0.3557193948	0	0	3.895357986	5.674017125	CRK		
IL1-mediated signaling events Homo sapiens 68fce8e7-6193-11e5-8ac5-06603eb7f303	1/33	0.2393625834	0.3557193948	0	0	3.7734375	5.395169587	PIK3CA		
EPO signaling pathway Homo sapiens 20fe3c0e-6192-11e5-8ac5-06603eb7f303	1/33	0.2393625834	0.3557193948	0	0	3.7734375	5.395169587	IRS2		
EPHA forward signaling Homo sapiens f25420e8-6191-11e5-8ac5-06603eb7f303	1/34	0.2456482042	0.3600596966	0	0	3.658906135	5.136573052	CRK		
IL2 signaling events mediated by PI3K Homo sapiens 8bbf39aa-6193-11e5-8ac5-06603eb7f303	1/35	0.2518821951	0.363328324	0	0	3.551111908	4.896251013	PIK3CA		
GMCSF-mediated signaling events Homo sapiens 095aa3ef-6193-11e5-8ac5-06603eb7f303	1/36	0.2580649778	0.363328324	0	0	3.449477352	4.672468415	PIK3CA		
Trk receptor signaling mediated by PI3K and PLC-gamma Homo sapiens 4037def0-6196-11e5-8ac5-06603eb7f303	1/36	0.2580649778	0.363328324	0	0	3.449477352	4.672468415	PIK3CA		
IL23-mediated signaling events Homo sapiens b71d0ffd-6193-11e5-8ac5-06603eb7f303	1/37	0.2641969702	0.3660735293	0	0	3.35348916	4.463696472	PIK3CA		
ErbB4 signaling events Homo sapiens 6104ebb2-6192-11e5-8ac5-06603eb7f303	1/38	0.270278587	0.3660735293	0	0	3.262689519	4.26858338	PIK3CA		
FAS (CD95) signaling pathway Homo sapiens 79cc9c14-6192-11e5-8ac5-06603eb7f303	1/38	0.270278587	0.3660735293	0	0	3.262689519	4.26858338	PIK3CA		
amb2 Integrin signaling Homo sapiens 5d4f90b6-6188-11e5-8ac5-06603eb7f303	1/40	0.2822923363	0.3718511648	0	0	3.095059412	3.914668568	ITGAM		
IFN-gamma pathway Homo sapiens 51b1ed75-6193-11e5-8ac5-06603eb7f303	1/40	0.2822923363	0.3718511648	0	0	3.095059412	3.914668568	PIK3CA		
PDGFR-beta signaling pathway Homo sapiens c901a3e4-6194-11e5-8ac5-06603eb7f303	2/128	0.2849700516	0.3718511648	0	0	1.919271594	2.409398258	PIK3CA;CRK		
Insulin Pathway Homo sapiens 073b9f25-6194-11e5-8ac5-06603eb7f303	1/43	0.2999453194	0.3813127381	0	0	2.8735482	3.46019769	PIK3CA		
FOXA1 transcription factor network Homo sapiens aa3927b7-6192-11e5-8ac5-06603eb7f303	1/44	0.3057332054	0.3813127381	0	0	2.806579694	3.325916035	NRIP1		
a6b1 and a6b4 Integrin signaling Homo sapiens 73d1a893-6186-11e5-8ac5-06603eb7f303	1/45	0.3114735261	0.3813127381	0	0	2.742655211	3.199145303	PIK3CA		
RhoA signaling pathway Homo sapiens 5c6b5f5c-6195-11e5-8ac5-06603eb7f303	1/45	0.3114735261	0.3813127381	0	0	2.742655211	3.199145303	ROCK2		
TNF receptor signaling pathway Homo sapiens 316be05e-6196-11e5-8ac5-06603eb7f303	1/46	0.31716667	0.3813127381	0	0	2.681571816	3.079323653	MAP4K3		
IL6-mediated signaling events Homo sapiens e684d5d2-6193-11e5-8ac5-06603eb7f303	1/46	0.31716667	0.3813127381	0	0	2.681571816	3.079323653	PIK3CA		
PLK1 signaling events Homo sapiens e5e87977-6194-11e5-8ac5-06603eb7f303	1/46	0.31716667	0.3813127381	0	0	2.681571816	3.079323653	ROCK2		
Hedgehog signaling events mediated by Gli proteins Homo sapiens 153b6970-6193-11e5-8ac5-06603eb7f303	1/47	0.3228130225	0.3837888157	0	0	2.623144221	2.965941956	GNAI1		
Class I PI3K signaling events Homo sapiens 12b82bb7-6191-11e5-8ac5-06603eb7f303	1/48	0.3284129659	0.386155905	0	0	2.567202906	2.858537872	PIK3CA		
Arf6 trafficking events Homo sapiens 7a5b8f09-618a-11e5-8ac5-06603eb7f303	1/49	0.3339668792	0.3884180009	0	0	2.51359248	2.756690693	ITGA1		
Signaling events mediated by Stem cell factor receptor (c-Kit) Homo sapiens c6b6861c-6195-11e5-8ac5-06603eb7f303	1/52	0.3503561846	0.3988096995	0	0	2.365375418	2.480817499	PIK3CA		
Regulation of Androgen receptor activity Homo sapiens 094a8cb0-6195-11e5-8ac5-06603eb7f303	1/52	0.3503561846	0.3988096995	0	0	2.365375418	2.480817499	APPBP2		
RAC1 signaling pathway Homo sapiens faffa4fc-6194-11e5-8ac5-06603eb7f303	1/54	0.3610590517	0.4066665109	0	0	2.275885872	2.318476245	CRK		

Validated targets of C-MYC transcriptional repression Homo sapiens 6bbdafa6-6196-11e5-8ac5-06603eb7f303	1/63	0.4070936593	0.4452935607	0	0	1.944630212	1.747662505	CSDE1		
BCR signaling pathway Homo sapiens acbf44e2-618c-11e5-8ac5-06603eb7f303	1/64	0.4120005842	0.4452935607	0	0	1.91366628	1.696906279	PIK3CA		
Validated nuclear estrogen receptor alpha network Homo sapiens 58949883-6196-11e5-8ac5-06603eb7f303	1/64	0.4120005842	0.4452935607	0	0	1.91366628	1.696906279	NRIP1		
Regulation of retinoblastoma protein Homo sapiens 407a3468-6195-11e5-8ac5-06603eb7f303	1/64	0.4120005842	0.4452935607	0	0	1.91366628	1.696906279	ATF7		
Beta1 integrin cell surface interactions Homo sapiens 2fd0bc63-618d-11e5-8ac5-06603eb7f303	1/66	0.421693666	0.4467447749	0	0	1.854596623	1.60139993	ITGA1		
HIF-1-alpha transcription factor network Homo sapiens 20ef2b81-6193-11e5-8ac5-06603eb7f303	1/66	0.421693666	0.4467447749	0	0	1.854596623	1.60139993	LEP		
p75(NTR)-mediated signaling Homo sapiens b492782f-6194-11e5-8ac5-06603eb7f303	1/68	0.4312279109	0.4479746259	0	0	1.799053513	1.513217252	PIK3CA		
Signaling events mediated by VEGFR1 and VEGFR2 Homo sapiens d6f6ae1f-6195-11e5-8ac5-06603eb7f303	1/68	0.4312279109	0.4479746259	0	0	1.799053513	1.513217252	PIK3CA		
AP-1 transcription factor network Homo sapiens 3ce2f9c5-6189-11e5-8ac5-06603eb7f303	1/69	0.4359362798	0.4485113648	0	0	1.772507174	1.471640377	TCF7L2		
Integrins in angiogenesis Homo sapiens 2ddeac89-6194-11e5-8ac5-06603eb7f303	1/72	0.4498301972	0.4583983914	0	0	1.697354861	1.35599152	PIK3CA		
Glucocorticoid receptor regulatory network Homo sapiens dfba0dfb-6192-11e5-8ac5-06603eb7f303	1/82	0.4937323236	0.4983901757	0	0	1.487052093	1.049504508	VIPR1		
ErbB1 downstream signaling Homo sapiens 30d60550-6192-11e5-8ac5-06603eb7f303	1/105	0.5819357547	0.5819357547	0	0	1.156836304	0.6263056505	PIK3CA		