Supporting information

Supporting information is available from the corresponding author (OP) and includes siRNA experiment controls, and overall expression of ATP13A3 and Cav-1 in human cancers, the ATP13A3 over- and Cav-1 under-expression mRNA pattern in common cancers, extensive data tables obtained from our analysis of human cancer databases showing the inverse correlations between ATP13A3 and Cav-1 and the complete ATP13A3-Cav1 mRNA expression correlation data used for **Figure 9**.

Table S1. ATP13A3 and CAV1 mRNA expression in human cancer datasets

Gene	Expression		Column 1 shows the average MAS5.0-normalized data for mRNA expression, with their SEM, calculated over 130 independent cancer datasets representing most different cancer types in R2 (17,363 samples in total). Column 2 shows the percentage of samples with a present call indicative of significant mRNA expression. For comparison: *GAPDH* and *ACTB* household mRNA expression in these datasets ranges between 5,000 and 10,000.
	Mean	Present call	
ATP13A3	478.1 (± 20.3)	99.6%	
CAV1	888.4 (± 83.7)	76.8%	

Table S1 shows the widespread, medium-level expression of both ATP13A3 and CAV1. Both genes are usually expressed in cancer cells. Affymetrix mRNA arrays have a built-in weighing algorithm for perfectly homologous vs. non-perfect mismatched probes for each gene to distinguish between significant ("present call") and absent/background ("absent call") expression. The above information allows the definition of significant expression for each sample. The inverse correlations we found are, therefore, not based on just a few signals, and are likely robust. For these mRNA arrays and this normalization procedure, expression values are almost linear and allow the following rule-of-thumb: 50-100: low expression. Visible with a very good antibody on Western blot; 250-2500: good expression. Levels for most genes, Visible with any reasonable antibody; > 2500: high expression. Usually reserved for household genes. While the mean expression of ATP13A3 mRNA expression is lower than CAV1 mRNA expression, the ATP13A3 expression is almost invariant, while that of CAV1 is more variable and is absent in almost 25% of samples. As shown below in Table S2, it is the inverse correlation that is most striking, not the actual expression levels.

Table S2. ATP13A3 over- and CAV1 under-expression mRNA pattern in common cancers[a]

Type	Subtype	SETS	High ATP13A3	Low CAV1
Adrenal Gland	Adenoma, cortex	1	1	1
Bladder	Carcinoma, urothelial infiltrating	3	2	2
Breast	Carcinoma, ductal	4	2	4
Breast	Carcinoma, ductal and lobular mixed	2	1	2
Breast	Carcinoma, ductal invasive	6	3	6
Breast	Carcinoma, invasive	3	2	3
Breast	Carcinoma, lobular invasive	1	1	1
Breast	Carcinoma, male	1	1	1
Cervix	Carcinoma, squamous cell (SCC)	3	3	3
Colon	Adenocarcinoma, cecum	2	2	2
Colon	Adenocarcinoma, mucinous	2	2	1
Colon	Adenocarcinoma, NOS	2	2	2
Colon	Adenocarcinoma, rectal	3	3	2
Colon	Adenocarcinoma, rectal mucinous	2	2	1
Colon	Adenocarcinoma, rectosigmoid	2	2	1
Colon	Carcinoma, colorectal	2	2	1
Colon	Carcinoma, NOS	1	1	1
Germ cell	Seminoma	2	2	1
Liver	Dysplasia, liver cell	1	1	1
Lung	Carcinoma, squamous cell (SCC)	6	6	5
Lung	Mesothelioma, pleural malignant	1	1	1
Lymphoma	Mantle cell	1	1	1
Ovary	Adenocarcinoma, clear cell	2	1	2
Ovary	Adenocarcinoma, endometrioid	2	2	2
Ovary	Adenocarcinoma, mucinous	2	2	2
Ovary	Adenocarcinoma, serous	4	2	4

Ovary	Carcinoma, NOS	1	1	1
Ovary	Carcinoma, serous surface papillary	1	1	1
Ovary	Cystadenocarcinoma, serous	1	1	1
Prostate	Adenocarcinoma	1	1	2
Prostate	Carcinoma, NOS	14	10	11
Prostate	Neoplasia, intraepithelial	1	1	1
Skin	Melanoma, cutaneous	1	1	1
Stomach	Cancer, NOS	2	2	1
Vulva	Neoplasia, intraepithelial	1	1	1

[a]Tumor types and subtypes are indicated in the first two columns. Column 3 shows the total amount of sets and column 4-5 show the number of datasets that have significant *ATP13A3* tumor mRNA over-expression and *CAV1* under-expression, respectively, per tumor subtype. Text is on a green background if ≥ 50% of the datasets for that tumor subtype showed the inverse *ATP13A/CAV1* expression pattern. Data from Oncomine, complete data in Supplemental Table.

Table S3. Complete ATP13A3 and CAV1 mRNA expression used for Table S2 and **Figure 9A-D**

Type	Subtype	ATP13A3		CAV1		Set (size)	N	N
		P	Fold	P	Fold		Tumor	Normal
Adrenal Gland	Adenoma, cortex	4.70E-02	1.111	3.00E-03	-1.214	Giordano 2 (65)	22	10
Adrenal Gland	Carcinoma, cortex			1.90E-02	2.894	Giordano (19)	9	3
Adrenal Gland	Carcinoma, cortex	5.00E-03	1.199	2.40E-02	1.129	Giordano 2 (65)	29	10
Bladder	Cancer, superficial			1.80E-02	-2.815	Blaveri 2 (93)	27	3
Bladder	Cancer, superficial			7.48E-05	-2.391	Dyrskjot 3 (60)	28	9
Bladder	Cancer, superficial			7.37E-12	-3.128	Lee (256)	126	68
Bladder	Cancer, superficial	9.00E-03	-1.731	1.74E-18	-10.666	Sanchez-Carbayo 2 (157)	28	48
Bladder	Carcinoma, urothelial infiltrating	3.10E-02	1.462			Dyrskjot 3 (60)	13	9
Bladder	Carcinoma, urothelial infiltrating			2.96E-05	-2.022	Lee (256)	62	68
Bladder	Carcinoma, urothelial infiltrating	6.00E-03	1.248	1.30E-21	-3.880	Sanchez-Carbayo 2 (157)	81	48
Brain	Astrocytoma	1.00E-02	2.090	4.70E-02	5.614	Rickman (51)	45	6
Brain	Astrocytoma	9.00E-03	1.524			Shai (42)	5	7
Brain	Astrocytoma, anaplastic	3.30E-02	1.672	4.10E-02	1.466	Sun (180)	19	23
Brain	Astrocytoma, pilocytic			2.50E-02	3.861	Gutmann (15)	8	3
Brain	Glioblastoma			4.25E-04	2.934	Bredel 2 (54)	27	4
Brain	Glioblastoma	8.00E-03	-1.728	3.66E-09	8.409	Lee (101)	22	3
Brain	Glioblastoma			3.05E-04	2.878	Liang (38)	30	2
Brain	Glioblastoma	2.84E-04	1.863	2.12E-08	3.810	Murat (84)	80	4
Brain	Glioblastoma	1.40E-05	2.117	4.67E-06	3.153	Shai (42)	27	7
Brain	Glioblastoma	1.64E-05	2.898	5.47E-19	3.714	Sun (180)	81	23
Brain	Glioblastoma	2.32E-05	2.055	1.79E-21	5.771	TCGA (557)	542	10
Brain	Glioblastoma, malignant glioma			3.40E-02	47.793	Pomeroy (85)	10	4
Brain	Oligoastrocytoma, anaplastic			1.20E-02	-1.562	Bredel 2 (54)	6	4
Brain	Oligoastrocytoma, anaplastic	2.80E-02	2.368			French (33)	4	6
Brain	Oligodendroglioma			2.50E-02	-1.437	Bredel 2 (54)	5	4
Brain	Oligodendroglioma	3.97E-04	1.871			Shai (42)	3	7
Brain	Oligodendroglioma, anaplastic	2.00E-03	1.788	6.00E-03	1.676	French (33)	23	6
Breast	Adenocarcinoma, intraductal cribriform			1.00E-03	-5.777	TCGA (593)	3	61
Breast	Carcinoma	no data	no data	8.39E-13	-4.565	Curtis (2,136)	14	144
Breast	Carcinoma, ductal	1.60E-02	1.158	5.00E-03	-9.284	Perou (65)	36	3
Breast	Carcinoma, ductal	2.19E-05	4.208	2.42E-09	-8.398	Richardson 2 (47)	40	7
Breast	Carcinoma, ductal			2.01E-06	-5.473	Sorlie (85)	65	4
Breast	Carcinoma, ductal			9.14E-27	-5.462	Sorlie 2 (167)	94	4
Breast	Carcinoma, ductal and lobular invasive	no data	no data	1.68E-48	-5.400	Curtis (2,136)	90	144
Breast	Carcinoma, ductal and lobular invasive			9.05E-05	-8.837	TCGA (593)	3	61
Breast	Carcinoma, ductal and lobular mixed	1.30E-02	1.521	8.31E-12	-4.730	TCGA (593)	7	61
Breast	Carcinoma, ductal in situ	no data	no data	5.57E-06	-3.550	Curtis (2,136)	10	144

Breast	Carcinoma, ductal in situ epithelia	2.77E-04	1.615	1.28E-05	-4.516	Ma 4 (66)	9	14
Breast	Carcinoma, ductal in situ stroma	4.00E-02	1.387			Ma 4 (66)	11	14
Breast	Carcinoma, ductal invasive	no data	no data	8.68E-91	-7.821	Curtis (2,136)	1556	144
Breast	Carcinoma, ductal invasive			3.60E-02	-1.574	Karnoub (22)	7	15
Breast	Carcinoma, ductal invasive	6.00E-03	1.793	8.00E-03	-3.683	Ma 4 (66)	9	14
Breast	Carcinoma, ductal invasive			1.20E-02	-2.054	Radvanyi (63)	31	9
Breast	Carcinoma, ductal invasive	3.34E-17	1.885	1.00E-40	-11.297	TCGA (593)	389	61
Breast	Carcinoma, ductal invasive	3.90E-02	1.722	2.10E-02	-5.086	Turashvili (30)	5	10
Breast	Carcinoma, ductal invasive			3.30E-02	-3.885	Zhao (64)	37	3
Breast	Carcinoma, invasive	no data	no data	1.17E-12	-4.065	Curtis (2,136)	21	144
Breast	Carcinoma, invasive			6.00E-03	-4.771	Gluck (158)	154	4
Breast	Carcinoma, invasive	1.12E-06	1.500	1.92E-35	-7.607	TCGA (593)	76	61
Breast	Carcinoma, invasive stroma	3.07E-07	2.405	2.62E-31	-31.695	Finak (59)	53	6
Breast	Carcinoma, lobular			1.80E-02	-3.568	Perou (65)	4	3
Breast	Carcinoma, lobular			7.00E-03	-12.424	Sorlie (85)	4	4
Breast	Carcinoma, lobular			3.00E-03	-6.906	Sorlie 2 (167)	7	4
Breast	Carcinoma, lobular invasive	no data	no data	2.23E-60	-4.900	Curtis (2,136)	148	144
Breast	Carcinoma, lobular invasive	5.90E-04	1.335	8.58E-20	-6.366	TCGA (593)	36	61
Breast	Carcinoma, male	3.75E-09	2.072	1.14E-04	-8.963	TCGA (593)	3	61
Breast	Carcinoma, medullary	no data	no data	6.01E-28	-4.592	Curtis (2,136)	32	144
Breast	Carcinoma, mixed invasive			3.30E-02	-1.721	Radvanyi (63)	3	9
Breast	Carcinoma, mucinous	no data	no data	3.94E-37	-4.257	Curtis (2,136)	46	144
Breast	Carcinoma, mucinous			7.32E-06	-5.711	TCGA (593)	4	61
Breast	Carcinoma, tubular	no data	no data	6.91E-45	-3.784	Curtis (2,136)	67	144
Breast	Fibroadenoma			5.10E-04	-14.128	Sorlie (85)	3	4
Breast	Fibroadenoma			4.72E-04	-12.864	Sorlie 2 (167)	3	4
Breast	Neoplasm, benign	no data	no data	2.89E-04	-2.730	Curtis (2,136)	3	144
Breast	Tumor, phyllodes	no data	no data	6.00E-03	-4.268	Curtis (2,136)	5	144
Cervix	Cancer	3.17E-10	3.643			Pyeon (84)	20	8
Cervix	Carcinoma, squamous cell (SCC)	1.41E-04	2.250	3.50E-07	-1.684	Biewenga (45)	40	5
Cervix	Carcinoma, squamous cell (SCC)	1.82E-10	3.145	1.00E-02	-1.526	Scotto 2 (66)	32	21
Cervix	Carcinoma, squamous cell (SCC)	4.82E-07	2.713	1.00E-02	-1.767	Zhai (41)	21	10
Cervix	Neoplasia, intraepithelial squamous high grade			4.50E-02	-1.420	Zhai (41)	7	10
Colon	Adenocarcinoma	5.01E-04	1.572	3.10E-02	-1.310	Kaiser (105)	41	5
Colon	Adenocarcinoma	no data	no data	1.17E-09	-14.481	Notterman (36)	18	18
Colon	Adenocarcinoma	3.01E-10	2.096	2.75E-07	-3.070	TCGA (237)	101	19
Colon	Adenocarcinoma, cecum	3.00E-03	1.354	4.00E-03	-1.574	Kaiser (105)	17	5
Colon	Adenocarcinoma, cecum	3.07E-10	2.146	1.56E-07	-3.005	TCGA (237)	22	19
Colon	Adenocarcinoma, mucinous	1.00E-02	1.270			Kaiser (105)	13	5
Colon	Adenocarcinoma, mucinous	2.87E-05	1.707	1.00E-03	-1.929	TCGA (237)	22	19
Colon	Adenocarcinoma, rectal	2.10E-02	1.292			Kaiser (105)	8	5
Colon	Adenocarcinoma, rectal	4.60E-02	1.100	5.00E-03	-1.472	Skrzypczak (105)	45	24
Colon	Adenocarcinoma, rectal	4.47E-11	2.208	2.36E-08	-3.322	TCGA (237)	60	19
Colon	Adenocarcinoma, rectal mucinous	7.21E-05	2.121			Kaiser (105)	4	5
Colon	Adenocarcinoma, rectal mucinous	1.44E-04	1.960	2.77E-04	-3.406	TCGA (237)	6	19
Colon	Adenocarcinoma, rectosigmoid	1.89E-04	1.613			Kaiser (105)	10	5
Colon	Adenocarcinoma, rectosigmoid	3.40E-02	2.192	1.57E-05	-2.346	TCGA (237)	3	19
Colon	Adenoma	6.07E-06	1.520			Sabates-Bellver (64)	25	5
Colon	Adenoma	2.00E-02	1.180			Skrzypczak (105)	5	10
Colon	Adenoma			6.00E-03	-1.407	Skrzypczak 2 (40)	5	10
Colon	Adenoma, rectal	7.33E-04	1.925			Sabates-Bellver (64)	7	7
Colon	Carcinoma	1.96E-04	1.374	3.60E-02	-1.252	Skrzypczak (105)	5	10
Colon	Carcinoma, colorectal	2.84E-07	1.828	2.00E-03	-1.412	Hong (82)	70	12
Colon	Carcinoma, colorectal	1.00E-03	1.242			Skrzypczak (105)	36	24
Colon	Carcinoma, epithelia	3.91E-07	1.692			Skrzypczak (105)	5	10
Colon	Carcinoma, epithelia			5.00E-03	-1.834	Skrzypczak 2 (40)	5	10

Esophagus	Adenocarcinoma	4.00E-03	1.759	5.00E-03	5.799	Hao (48)	5	14
Esophagus	Adenocarcinoma			7.62E-04	1.323	Kim (118)	75	28
Esophagus	Adenocarcinoma	4.00E-03	1.689			Kimchi (24)	8	8
Esophagus	Barrett's			3.26E-05	2.233	Hao (48)	14	14
Esophagus	Barrett's	1.10E-02	-2.139			Kimchi (24)	8	8
Esophagus	Carcinoma, squamous cell (SCC)	4.14E-08	1.923			Hu (34)	17	17
Esophagus	Carcinoma, squamous cell (SCC)	2.84E-15	1.635	7.00E-03	1.389	Su 2 (106)	53	53
Germ cell	Carcinoma, embryonal	7.43E-07	2.304	7.10E-09	2.670	Korkola (107)	15	6
Germ cell	Carcinoma, embryonal			3.70E-02	1.962	Skotheim (30)	5	3
Germ cell	Mixed	2.82E-10	1.858	1.48E-05	1.777	Korkola (107)	41	6
Germ cell	Seminoma	1.00E-03	1.428			Korkola (107)	12	6
Germ cell	Seminoma	3.80E-02	1.237	8.70E-06	-2.742	Sperger Others (74)	23	14
Germ cell	Teratoma	2.90E-05	1.758	3.08E-10	4.376	Korkola (107)	14	6
Germ cell	Tumor, yolk sac	1.10E-06	3.492			Korkola (107)	9	6
Germ cell	Tumor, yolk sac	4.60E-02	1.341			Skotheim (30)	4	3
Head & Neck	Adenoma, parathyroid gland	8.00E-03	1.278	2.40E-02	1.438	Morrison (61)	35	5
Head & Neck	Adenoma, thyroid gland follicular			9.77E-04	-1.406	Giordano (99)	10	4
Head & Neck	Adenoma, thyroid gland oncocytic	8.68E-04	-1.228	1.63E-05	-1.443	Giordano (99)	7	4
Head & Neck	Carcinoma, floor of the mouth	4.79E-04	2.389	2.20E-02	3.723	Pyeon (84)	5	9
Head & Neck	Carcinoma, nasopharyngeal			1.90E-07	2.724	Sengupta (41)	31	10
Head & Neck	Carcinoma, oral cavity	4.00E-03	3.263	5.00E-03	3.366	Pyeon (84)	4	9
Head & Neck	Carcinoma, oropharyngeal	2.20E-04	2.412	5.00E-03	2.464	Pyeon (84)	6	9
Head & Neck	Carcinoma, salivary gland adenoid cystic	6.55E-04	1.853	2.10E-02	1.609	FriersonHF (22)	16	6
Head & Neck	Carcinoma, squamous cell (SCC)	4.00E-03	2.676	1.00E-03	2.650	Cromer (38)	34	4
Head & Neck	Carcinoma, squamous cell (SCC)	3.25E-10	3.355	1.40E-02	1.556	Ginos (54)	41	13
Head & Neck	Carcinoma, squamous cell (SCC) hypopha-ryngeal			3.20E-02	4.918	Schlingemann (12)	4	3
Head & Neck	Carcinoma, squamous cell (SCC) oral cavity	1.24E-11	2.571	1.41E-10	1.889	Peng (79)	57	22
Head & Neck	Carcinoma, squamous cell (SCC) tongue	2.45E-10	3.290	4.05E-05	2.203	Estilo (58)	31	26
Head & Neck	Carcinoma, squamous cell (SCC) tongue	2.34E-10	1.988	1.09E-04	2.170	Talbot Lung (93)	31	26
Head & Neck	Carcinoma, squamous cell (SCC) tongue	6.92E-04	1.766	1.30E-02	1.991	Ye (38)	26	12
Head & Neck	Carcinoma, thyroid gland anaplastic	6.00E-03	-1.160			Giordano (99)	4	4
Head & Neck	Carcinoma, thyroid gland follicular			2.74E-05	-1.392	Giordano (99)	13	4
Head & Neck	Carcinoma, thyroid gland follicular oncocytic	9.19E-04	-1.255	2.43E-05	-1.573	Giordano (99)	8	4
Head & Neck	Carcinoma, thyroid gland papillary			6.00E-03	-1.270	Giordano (99)	26	4
Head & Neck	Carcinoma, thyroid gland papillary	2.30E-02	-1.633	3.00E-02	-1.830	He (18)	9	9
Head & Neck	Carcinoma, thyroid gland papillary	2.70E-02	-1.504			Vasko (18)	14	4
Head & Neck	Carcinoma, thyroid gland papillary follicular variant			3.49E-06	-1.434	Giordano (99)	15	6
Head & Neck	Carcinoma, thyroid gland papillary tall cell variant			6.00E-03	-1.308	Giordano (99)	10	4
Head & Neck	Carcinoma, tongue	4.55E-07	2.295	3.91E-06	3.727	Pyeon (84)	15	4
Head & Neck	Hyperplasia, parathyroid	2.30E-02	1.322			Morrison (61)	8	5
Head & Neck	Neoplasia, non-familial multiple gland	9.00E-03	1.361			Morrison (61)	10	5
Kidney	Carcinoma, chromophobe cell			6.00E-03	4.516	Higgins (44)	3	2
Kidney	Carcinoma, chromophobe cell	4.00E-03	-1.634			Jones (92)	6	23
Kidney	Carcinoma, chromophobe cell	9.64E-04	-3.749	3.00E-03	4.721	Yusenko (67)	4	3
Kidney	Carcinoma, clear cell (ccRCC)	7.47E-05	1.983	2.09E-10	8.172	Gumz (20)	10	10
Kidney	Carcinoma, clear cell (ccRCC)			1.26E-04	5.272	Higgins (44)	26	2
Kidney	Carcinoma, clear cell (ccRCC)	4.17E-06	1.696	7.02E-21	9.349	Jones (92)	23	23
Kidney	Carcinoma, clear cell (ccRCC)			5.57E-07	9.378	Lenburg (18)	9	9
Kidney	Carcinoma, clear cell (ccRCC)	2.00E-03	2.715	8.04E-12	5.028	Yusenko (67)	26	3
Kidney	Carcinoma, clear cell (ccRCC) hereditary	1.09E-08	1.750	4.93E-11	7.077	Beroukhim (70)	32	10
Kidney	Carcinoma, clear cell (ccRCC) non-hereditary	2.00E-06	1.524	1.93E-13	8.387	Beroukhim (70)	27	10
Kidney	Carcinoma, papillary cell			3.40E-02	-2.309	Higgins (44)	4	2
Kidney	Carcinoma, papillary cell	1.22E-05	1.849	1.00E-02	1.860	Jones (92)	11	23
Kidney	Carcinoma, papillary cell	2.40E-02	2.642	7.00E-03	1.856	Yusenko (67)	19	3

Kidney	Oncocytoma	2.02E-08	-3.597	4.75E-05	1.838	Jones (92)	12	3
Kidney	Oncocytoma	2.00E-03	-2.800	2.76E-04	3.406	Yusenko (67)	4	3
Kidney	Wilms			5.54E-04	-2.195	Cutcliffe (35)	18	3
Leukemia	Hairy cell (HCL)			2.99E-04	5.626	Basso (336)	16	5
Leukemia	Leukemia/Lymphoma, T-cell acute adult			3.05E-06	9.872	Choi (47)	22	6
Leukemia	Leukemia/Lymphoma, T-cell chronic adult	6.21E-04	-1.652			Choi (47)	19	6
Leukemia	Lymphoblastic, B-Cell acute (B-ALL)	3.54E-12	-1.441			Haferlach (2,096)	147	74
Leukemia	Lymphoblastic, B-Cell acute (B-ALL)	2.86E-04	-1.360			Maia (28)	18	5
Leukemia	Lymphoblastic, B-Cell acute (B-ALL) pediatric	4.30E-02	1.659			Coustan-Smith (288)	238	4
Leukemia	Lymphoblastic, B-cell acute (B-ALL) pediatric	2.10E-11	-1.380	2.96E-05	1.130	Haferlach (2,096)	359	74
Leukemia	Lymphoblastic, pro-B acute (pro-B-ALL)	3.15E-10	-1.458	2.45E-08	-1.173	Haferlach (2,096)	70	74
Leukemia	Lymphoblastic, T-cell acute (T-ALL)			3.50E-02	-1.071	Haferlach (2,096)	174	74
Leukemia	Lymphoblastic, T-cell acute (T-ALL) pediatric	9.00E-03	2.411			Coustan-Smith (288)	46	4
Leukemia	Lymphocytic, chronic (CLL)	1.56E-05	-1.913			Basso (336)	34	5
Leukemia	Lymphocytic, chronic (CLL)	7.66E-15	-1.474	1.74E-06	1.122	Haferlach (2,096)	448	74
Leukemia	Myeloid, acute (AML)	4.10E-02	1.335	1.20E-02	1.930	Andersson (127)	23	6
Leukemia	Myeloid, acute (AML)	1.80E-02	-1.097	1.17E-14	1.352	Haferlach (2,096)	542	74
Leukemia	Syndrome, myelodysplastic (MDS)	3.00E-04	1.169	1.00E-03	1.094	Haferlach (2,096)	206	74
Liver	Carcinoma, hepatocellular (HCC)			3.00E-02	1.228	Chen (197)	104	76
Liver	Carcinoma, hepatocellular (HCC)	7.56E-06	-1.469	4.18E-06	1.829	Mas (115)	38	19
Liver	Carcinoma, hepatocellular (HCC)	2.80E-02	-1.167	1.00E-03	1.956	Roessler (43)	22	21
Liver	Carcinoma, hepatocellular (HCC)	1.60E-02	-1.081	9.06E-15	1.537	Roessler 2 (445)	225	220
Liver	Carcinoma, hepatocellular (HCC)	4.00E-03	-1.946			Wurmbach (75)	35	10
Liver	Cirrhosis	2.98E-07	-1.546	3.66E-12	3.050	Mas (115)	58	19
Liver	Cirrhosis	5.00E-03	-1.954	4.00E-03	1.941	Wurmbach (75)	13	10
Liver	Dysplasia, liver cell	1.60E-02	1.142	2.20E-02	-1.349	Wurmbach (75)	17	10
Lung	Adenocarcinoma			3.48E-17	-8.702	Beer (96)	86	10
Lung	Adenocarcinoma			7.63E-10	-18.950	Bhattacharjee (203)	132	17
Lung	Adenocarcinoma			9.31E-15	-7.455	Garber (73)	40	5
Lung	Adenocarcinoma	9.25E-07	1.680	2.38E-16	-5.163	Hou (156)	45	65
Lung	Adenocarcinoma			2.59E-46	-11.725	Selamat (116)	58	58
Lung	Adenocarcinoma			7.94E-08	-6.292	Stearman (39)	20	19
Lung	Adenocarcinoma			1.70E-12	-7.611	Su (66)	27	30
Lung	Adenocarcinoma	2.39E-04	1.200	2.17E-33	-6.393	Landi (107)	58	49
Lung	Adenocarcinoma	6.52E-05	1.354	2.69E-33	-4.377	Okayama (246)	226	20
Lung	Carcinoid	3.00E-03	-2.663	2.10E-13	-66.005	Bhattacharjee (203)	20	17
Lung	Carcinoma, large cell	9.60E-05	2.144	3.87E-11	-12.444	Hou (156)	19	65
Lung	Carcinoma, large cell	1.10E-02	2.486			Yamagata (31)	5	3
Lung	Carcinoma, small cell			3.19E-05	-41.875	Bhattacharjee (203)	6	17
Lung	Carcinoma, small cell			1.30E-02	-10.984	Garber (73)	4	5
Lung	Carcinoma, squamous cell (SCC)	5.00E-03	2.531	8.96E-06	-6.689	Bhattacharjee (203)	21	17
Lung	Carcinoma, squamous cell (SCC)	3.10E-02	1.377	2.26E-10	-8.268	Garber (73)	13	5
Lung	Carcinoma, squamous cell (SCC)	1.46E-08	2.130	1.09E-14	-1.711	Hou (156)	27	65
Lung	Carcinoma, squamous cell (SCC)	1.97E-09	1.941	8.00E-03	-1.711	Talbot (93)	34	26
Lung	Carcinoma, squamous cell (SCC)	3.80E-02	1.311	9.87E-06	-7.840	Wachi (10)	5	5
Lung	Carcinoma, squamous cell (SCC)	6.00E-03	2.230			Yamagata (31)	10	3
Lung	Mesothelioma, pleural malignant	9.00E-03	1.679	1.00E-03	-2.575	Gordon (54)	40	5
Lymphoma	Angioimmunoblastic, T-cell	1.86E-08	2.600	2.69E-05	6.141	Piccaluga (60)	6	5
Lymphoma	Burkitt's			7.08E-08	10.240	Basso (336)	17	5
Lymphoma	Burkitt's	4.07E-04	-1.392	2.70E-02	1.273	Brune (67)	5	5
Lymphoma	Centroblastic	4.80E-02	1.365	2.18E-14	14.838	Basso (336)	28	5
Lymphoma	Effusion, primary			2.00E-03	8.972	Basso (336)	9	5
Lymphoma	Follicular	3.90E-02	-1.727	7.69E-04	2.384	Basso (336)	6	5
Lymphoma	Follicular			8.00E-03	1.369	Brune (67)	5	5
Lymphoma	Follicular	7.00E-03	-1.297	5.37E-23	11.075	Compagno (136)	38	5
Lymphoma	Hodgkin's			2.45E-04	1.999	Brune (67)	12	5

Lymphoma	Hodgkin's, classical	2.10E-02	1.142	1.30E-02	1.326	Eckerle (64)	4	5
Lymphoma	Hodgkin's, nodular lymphocyte predominant	3.20E-02	1.136	1.00E-03	4.433	Brune (67)	5	5
Lymphoma	Large cell, anaplastic	3.91E-09	2.746	5.28E-05	6.090	Piccaluga (60)	6	5
Lymphoma	Large cell, anaplastic ALK-positive	2.00E-03	1.121	5.30E-05	1.965	Eckerle (64)	5	5
Lymphoma	Large cell, primary cutaneous anaplastic	2.50E-02	-1.707			Eckerle (64)	7	5
Lymphoma	Large, B-cell T-cell/histiocyte-rich			3.31E-04	2.105	Brune (67)	4	5
Lymphoma	Lymphoma, diffuse large B-cell (DLBCL)	2.42E-04	1.960	4.61E-09	9.840	Basso (336)	32	5
Lymphoma	Lymphoma, diffuse large B-cell (DLBCL)	4.10E-02	1.230	6.83E-05	1.650	Brune (67)	11	5
Lymphoma	Lymphoma, diffuse large B-cell (DLBCL)	2.60E-02	1.198	5.16E-27	16.343	Compagno (136)	44	5
Lymphoma	Lymphoma, diffuse large B-cell (DLBCL)-like activated	7.63E-04	1.530	1.19E-15	13.262	Compagno (136)	17	5
Lymphoma	Lymphoma, diffuse large B-cell (DLBCL)-like germinal	2.60E-02	-1.630	1.20E-11	10.997	Compagno (136)	9	5
Lymphoma	Mantle cell	2.50E-02	1.636	5.00E-03	-3.053	Basso (336)	8	5
Lymphoma	Marginal zone, B-cell			5.00E-03	1.869	Storz (27)	5	3
Lymphoma	T-cell, unspecified peripheral	9.45E-09	2.107	5.07E-05	4.782	Piccaluga (60)	28	5
Myeloma	Gammopathy, monoclonal of undetermined significance			3.10E-02	-1.418	Agnelli 3 (158)	11	5
Myeloma	Gammopathy, monoclonal of undetermined significance	1.60E-04	1.419			Zhan 3 (78)	44	22
Myeloma	Leukemia, plasma cell	4.00E-03	1.570			Agnelli 3 (158)	9	5
Myeloma	Leukemia, plasma cell	3.10E-02	1.526			Zhan (131)	5	37
Myeloma	Multiple	8.04E-09	1.873	6.00E-03	1.689	Zhan (131)	74	37
Myeloma	Multiple	1.40E-02	1.185			Agnelli 3 (158)	133	5
Myeloma	Smoldering	2.58E-05	2.145	4.60E-02	1.786	Zhan 3 (78)	12	22
Ovary	Adenocarcinoma, clear cell	2.00E-03	1.140	2.20E-08	-1.884	Hendrix (103)	8	4
Ovary	Adenocarcinoma, clear cell			9.34E-04	-4.935	Lu (50)	12	4
Ovary	Adenocarcinoma, endometrioid	3.43E-04	1.165	2.05E-12	-1.725	Hendrix (103)	37	4
Ovary	Adenocarcinoma, endometrioid	1.90E-02	1.237	1.00E-03	-4.725	Lu (50)	9	5
Ovary	Adenocarcinoma, mucinous	4.00E-03	1.103	2.09E-07	-1.558	Hendrix (103)	13	4
Ovary	Adenocarcinoma, mucinous	1.60E-02	1.585	1.80E-02	-2.764	Lu (50)	9	5
Ovary	Adenocarcinoma, serous			3.94E-04	-6.790	Adib (16)	12	4
Ovary	Adenocarcinoma, serous	5.70E-05	1.230	2.15E-11	-1.704	Hendrix (103)	41	5
Ovary	Adenocarcinoma, serous	1.00E-03	1.388	1.00E-03	-4.970	Lu (50)	20	5
Ovary	Adenocarcinoma, serous			1.52E-29	-23.044	Yoshihara (53)	43	10
Ovary	Carcinoma	2.68E-05	1.362	3.91E-10	-7.582	Bonome (195)	185	10
Ovary	Carcinoma, serous surface papillary	5.97E-04	3.416	8.20E-06	-46.045	Welsh (32)	28	4
Ovary	Cystadenocarcinoma, serous	5.92E-07	1.693	2.72E-06	-3.555	TCGA (594)	586	8
Pancreas	Adenocarcinoma	4.00E-03	2.160			Logsdon (27)	27	5
Pancreas	Adenocarcinoma, ductal	1.40E-09	2.079	5.00E-03	1.668	Badea (78)	39	39
Pancreas	Adenocarcinoma, ductal			3.80E-02	-1.295	Buchholz (38)	11	5
Pancreas	Adenocarcinoma, ductal			1.50E-02	1.540	Ishikawa (49)	24	25
Pancreas	Carcinoma	1.70E-02	1.468			Pei (52)	36	16
Prostate	Adenocarcinoma	3.30E-02	1.164	7.07E-05	-2.456	Vanaja (40)	27	8
Prostate	Adenocarcinoma			7.05E-04	-1.581	Wallace (89)	69	20
Prostate	Carcinoma			1.36E-06	-2.909	Arredouani (21)	13	8
Prostate	Carcinoma	4.77E-04	1.246	4.79E-11	-2.548	Grasso (122)	59	28
Prostate	Carcinoma	5.00E-03	1.222			Holzbeierlein (54)	39	4
Prostate	Carcinoma			1.92E-27	-3.278	Lapointe (112)	62	41
Prostate	Carcinoma	1.20E-02	1.430			LaTulippe (35)	32	3
Prostate	Carcinoma	2.00E-03	1.164	1.75E-07	-2.273	Liu (57)	44	13
Prostate	Carcinoma	4.90E-02	1.411	4.00E-03	-1.838	Luo 2 (30)	15	15
Prostate	Carcinoma	2.10E-02	2.004			Magee (15)	8	4
Prostate	Carcinoma	5.00E-03	2.165	8.00E-03	-1.606	Singh (102)	52	50
Prostate	Carcinoma	1.00E-03	1.235	4.79E-12	-2.059	Taylor 3 (185)	131	29
Prostate	Carcinoma	1.40E-02	1.573	1.10E-02	-1.713	Tomlins (101)	59	28
Prostate	Carcinoma			1.00E-03	-2.199	Varambally (19)	7	6

Prostate	Carcinoma	7.88E-04	1.363	1.68E-06	-3.000	Welsh (34)	25	9
Prostate	Carcinoma			6.69E-06	-2.105	Yu (112)	65	23
Prostate	Hyperplasia, benign stroma	3.00E-03	-1.706			Tomlins (101)	6	5
Prostate	Neoplasia, intraepithelial	4.00E-03	1.928	5.90E-04	-1.925	Tomlins (101)	13	23
Skin	Carcinoma, basal cell	3.20E-02	3.928			Riker (87)	15	4
Skin	Carcinoma, squamous cell (SCC)	3.30E-02	2.705			Nindl (15)	5	6
Skin	Carcinoma, squamous cell (SCC)	1.90E-02	4.985			Riker (87)	11	4
Skin	Melanoma, cutaneous			1.20E-02	-1.900	Riker (87)	14	4
Skin	Melanoma, cutaneous	6.00E-03	3.290	2.30E-02	-1.455	Talantov (70)	45	7
Skin	Nevus, benign melanocytic	5.00E-03	3.353	1.80E-02	1.661	Talantov (70)	18	7
Soft tissue	Fibrosarcoma	8.71E-04	2.957			Detwiller (54)	7	1
Soft tissue	Histiocytoma, malignant fibrous	4.82E-06	2.953	6.00E-03	2.756	Detwiller (54)	9	1
Soft tissue	Leiomyosarcoma			9.56E-05	-2.018	Barretina (158)	26	9
Soft tissue	Leiomyosarcoma	4.84E-04	3.313	3.00E-03	2.749	Detwiller (54)	6	1
Soft tissue	Leiomyosarcoma			1.50E-02	-2.231	Quade Uterus (24)	4	4
Soft tissue	Liposarcoma, dedifferentiated			1.76E-11	-3.208	Barretina (158)	46	9
Soft tissue	Liposarcoma, dedifferentiated	1.70E-02	1.845			Detwiller (54)	4	1
Soft tissue	Liposarcoma, myxoid/round cell	4.65E-05	-2.016	1.11E-07	-2.657	Barretina (158)	20	9
Soft tissue	Liposarcoma, pleomorphic			3.45E-05	-2.184	Barretina (158)	23	9
Soft tissue	Liposarcoma, pleomorphic	2.11E-04	2.217	2.40E-02	3.029	Detwiller (54)	3	1
Soft tissue	Liposarcoma, round cell	3.90E-02	1.447			Detwiller (54)	4	1
Soft tissue	Myxofibrosarcoma			2.61E-07	-2.683	Barretina (158)	31	9
Soft tissue	Sarcoma, synovial	1.00E-03	2.768			Detwiller (54)	4	1
Stomach	Adenocarcinoma, diffuse	3.70E-02	1.132	1.48E-04	1.794	Chen (132)	13	28
Stomach	Adenocarcinoma, diffuse	4.60E-02	1.114			DErrico (69)	6	31
Stomach	Adenocarcinoma, intestinal type	3.00E-02	1.106	1.35E-06	1.416	Chen (132)	63	27
Stomach	Adenocarcinoma, intestinal type	3.57E-06	1.725	1.60E-02	1.432	DErrico (69)	26	31
Stomach	Adenocarcinoma, mixed			1.30E-02	1.351	Chen (132)	8	27
Stomach	Adenocarcinoma, mixed	7.02E-08	2.187			DErrico (69)	4	31
Stomach	Cancer	7.31E-04	1.257	5.51E-04	-1.461	Cui (160)	80	80
Stomach	Cancer	2.30E-02	1.500			Wang (27)	12	12
Stomach	Tumor, gastrointestinal stromal (GIST)			7.00E-03	-2.775	Cho (90)	20	19
Uterus	Leiomyoma, uterine corpus			1.70E-02	-1.146	Crabtree (77)	50	27
Uterus	Leiomyosarcoma, uterine corpus			1.00E-03	-8.555	Quade (24)	9	4
Vulva	Neoplasia, intraepithelial	2.41E-05	1.639	7.61E-06	-1.940	Santegoets (19)	9	10

Shown are all Oncomine tumor (sub)types with significant results. Subtypes that have significant *ATP13A3* tumor mRNA over-expression and *CAV1* under-expression, respectively are on a green background. Tumor type and subtype are listed in the first two columns. Columns 3-4 and 5-6 show *P* value and Fold increased/decreased mRNA expression in tumor over (matched) normal tissue, respectively. *P* and Fold values are as determined by a 2log-median centered t-test using Oncomine default settings. Column 7 shows name, type, and size. Columns 8-9 show amount of tumor samples, and normal tissue samples used in the t-test, respectively. Results in red type are used as the examples in **Figure 9A-D**.

Table S4. Complete ATP13A3-CAV1 mRNA expression correlation data used for **Figure 9E**, **9F**

Cancer Type	ATP-CAV		Dataset				
	R	P	Name	Size	Array	Study	PubMed
Breast	-0.202	2.00E-02	Chin	124	Affymetrix HG U133A	E-TABM-158	17157792
Breast	-0.179	4.40E-03	Miller	251	Affymetrix HG U133A	GSE3494	16141321
Breast	-0.193	8.00E-06	TCGA Breast	528	Agilent G4502	TCGA	23000897
Breast	-0.218	3.40E-03	Wessels	178	Illumina HumanWG-6 v3.0	GSE34138	23203637
Colon	-0.241	1.50E-06	Domany	390	Affymetrix HG U133A	GSE41258	19359472
Colon	-0.694	3.40E-04	Hong	22	Affymetrix HG U133P2	GSE4107	17317818
Colon	-0.251	7.80E-03	Matsuyama	111	Affymetrix HG U133P2	GSE18105	20162577
Colon	-0.451	9.40E-07	Medema	108	Affymetrix HG U133P2	GSE33114	22056143
Colon	-0.287	9.20E-04	Olschwang	130	Affymetrix HG U133P2	GSE37892	n.y.
Colon	-0.182	1.80E-03	Sieber	290	Affymetrix HG U133P2	GSE14333	19996206
Colon	-0.130	1.00E-02	SieberSmith	355	Affymetrix HG U133P2	*	22115830
Colon	-0.205	1.00E-02	Skrzypczak	145	Affymetrix HG U133P2	GSE20916	20957034
Colon	-0.341	2.20E-05	Sugihara	148	Affymetrix HG U133P2	GSE21510	21270110
Colon	-0.328	9.90E-06	TCGA Colon	174	Agilent G4502	TCGA	22810696
Colon	-0.296	2.00E-02	Uddin	59	Affymetrix HG U133P2	GSE23878	21281787
Liver	-0.225	4.10E-03	Cillo	161	Agilent-014850 HG 4x44K	GSE54236	25666192
Lung	-0.437	1.50E-05	Farez-Vidal	91	Affymetrix HG U133P2	GSE18842	20878980
Lung	-0.275	5.20E-04	Hou	156	Affymetrix HG U133P2	GSE19188	20421987
Lung	-0.495	1.60E-07	Muley	100	Affymetrix HG U133P2	GSE33532	n.y.
Lung	-0.176	3.60E-04	Plamadeala	410	Affymetrix HG U133P2	GSE63074	n.y.
Ovary	-0.100	2.00E-02	TCGA Ovary	541	Agilent G4502	TCGA	21720365
Ovary	-0.225	5.00E-02	Wong	77	Affymetrix HG U133P2	GSE40595	23824740
Prostate	-0.240	2.00E-02	Ambs	89	Affymetrix HG U133A	GSE6956	18245496

[a]Column 1 shows tumor type, columns 2-3 the *R* and *P* values of the 2log Pearson correlation tests for *ATP13A3* versus *CAV1* expression in R2. A negative R value indicates a negative correlation coefficient and a *P* value < 0.05 is considered statistically significant. Columns 4-8 contain dataset properties: R2 dataset name, amount of samples, array type, study number, and PubMed ID, respectively. GSE, TCGA, or E-TABM indicate NCBI GEO, TCGA, or EBI datasets, respectively n.y. means not yet published. *indicates GSE14333/17537/17538. Results in red type are used as the examples in **Figure 9E**, **9F**.

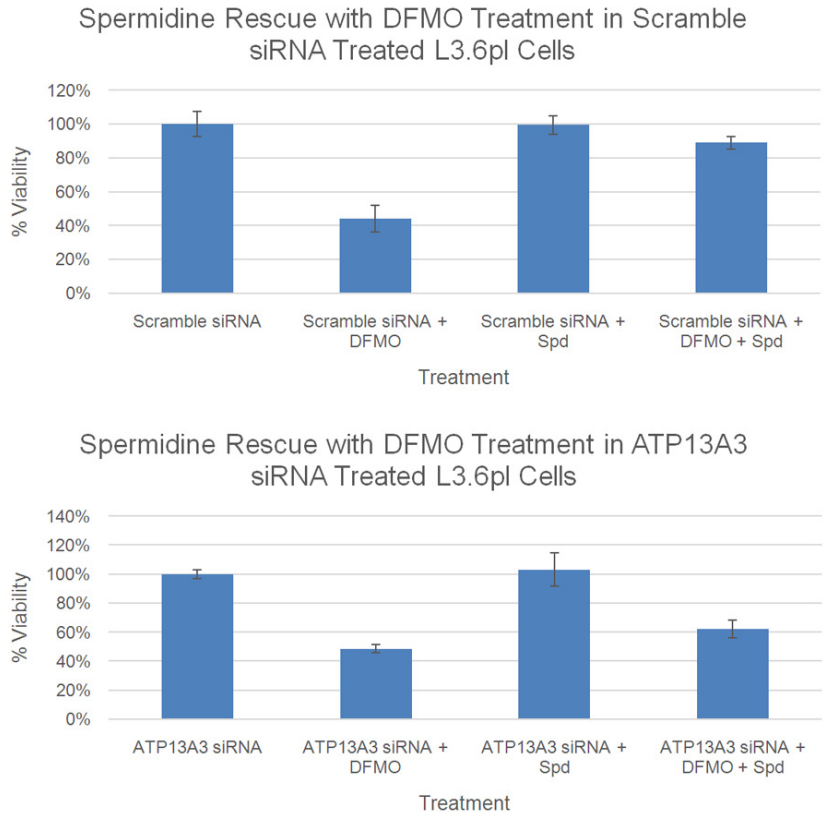

Figure S1. siRNA experiments in L3.6pl pancreatic cancer cells with scrambled vs ATP13A3 siRNA showing relative viability changes in the presence of the 48 h IC_{50} DFMO dose, spermidine (Spd, 1 μM) or the combination of DFMO+Spd. Comparison of the rightmost columns (in the top and bottom panels) are consistent with ATP13A3 protein playing a role in the spermidine rescue of DFMO-treated cells.

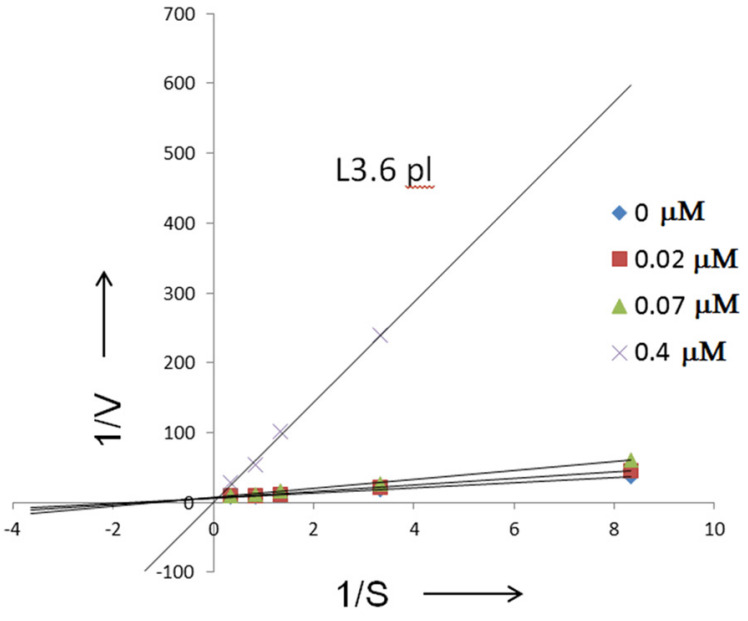

Figure S2. Competition experiments with PTI compound **5b** and ^{3}H-Spd. A classic competitive inhibitor kinetic profile (K_i of 5b = 55 nM) was obtained, where the x-intercept changes and the y-intercept remains constant.

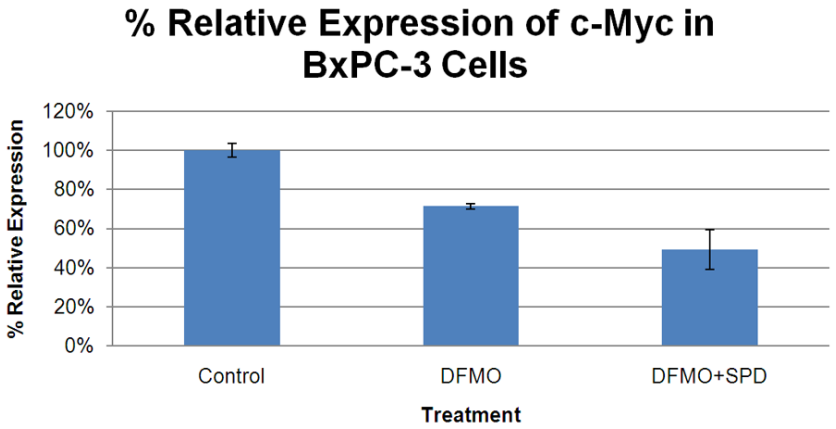

Figure S3. Decreased c-Myc protein expression observed in the presence of DFMO (72 h IC_{50} dose, 14.4 mM) or 72 h IC_{50} DFMO dose+Spd (1 μM) in BxPC-3 cells. Briefly, cells were grown in RPMI 1640 (Gibco), supplemented with 10% fetal bovine serum (Atlanta Biologicals) and penicillin/streptomycin (Gibco). After trypsinization, the cells were allowed 24 hours for reattachment before adding the appropriate drug or vehicle in PBS. DFMO was dosed at the respective IC_{50} values for each cell line, 14.4 mM (BxPC-3), and spermidine was dosed at 1 μM. The cells were incubated for 72 hours with 250 μM aminoguanidine present in the media. After 72 hours, the cells were collected and protein extracted in RIPA buffer for quantification via BCA assay and subsequent loading onto an SDS-PAGE gel. The primary antibody against c-Myc was rabbit monoclonal from Abcam, and against β-actin was mouse monoclonal from Sigma-Aldrich. The secondary antibodies used included goat anti-rabbit and goat anti-mouse (for β-actin) antibodies from Santa Cruz Biotechnology.

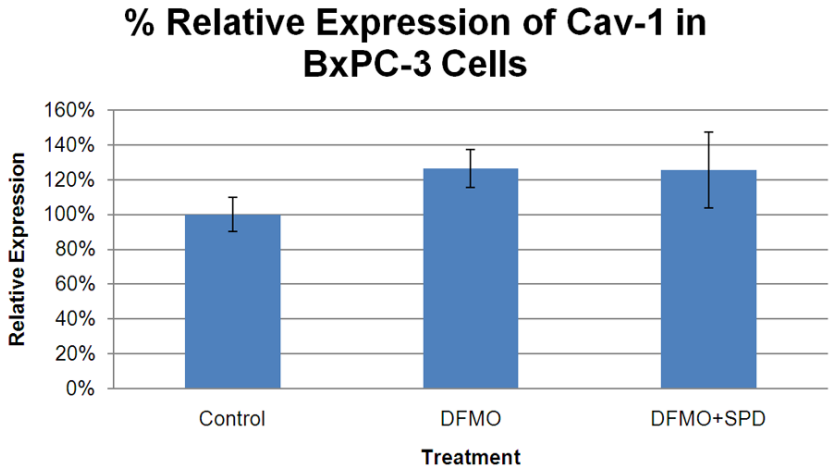

Figure S4. Relative expression of Cav-1 in the presence of the 72 h DFMO IC_{50} dose alone or in combination with Spd (1 μM) in BxPC-3 pancreatic cancer cells. The relatively high initial caveolin-1 levels in BxPC-3 cells did not decrease under these conditions and may explain why BxPC-3 cells were not highly rescuable by exogenous Spd, even though BxPC-3 cells had relatively high ATP13A3 expression.