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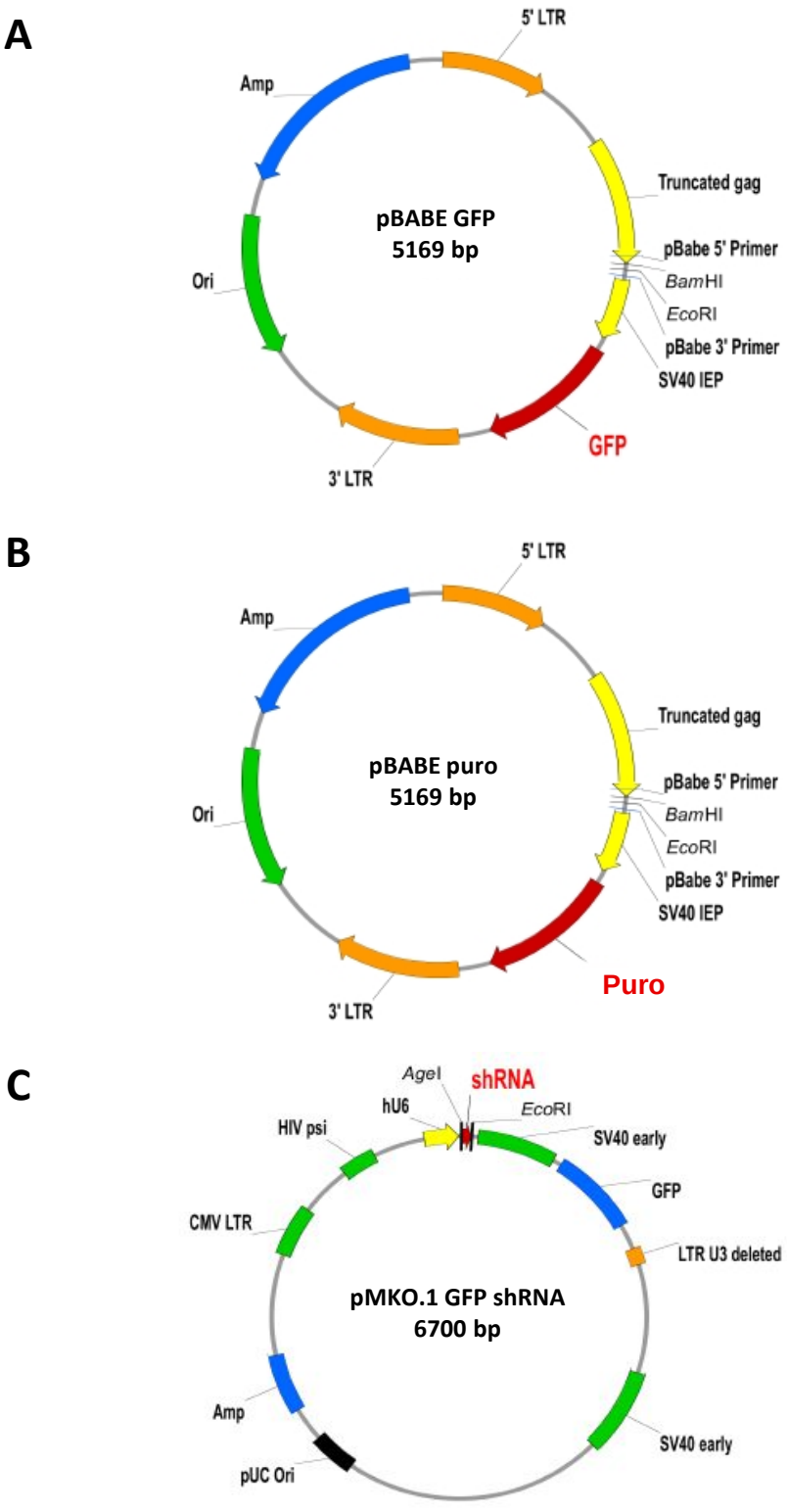


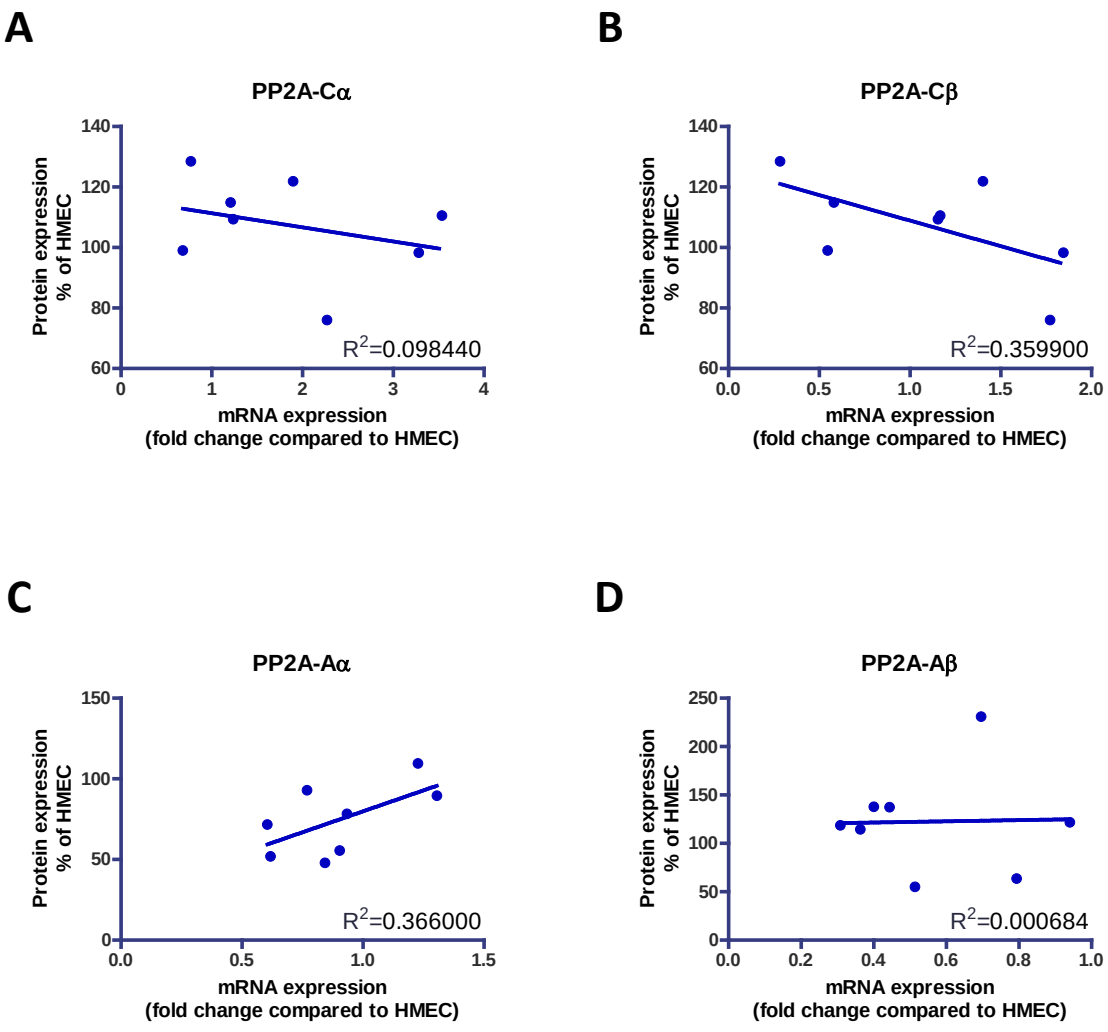
Appendix 1. Vector Maps for DNA constructs used in this thesis.

A) pBABE GFP constructs contained SV40 sequences.

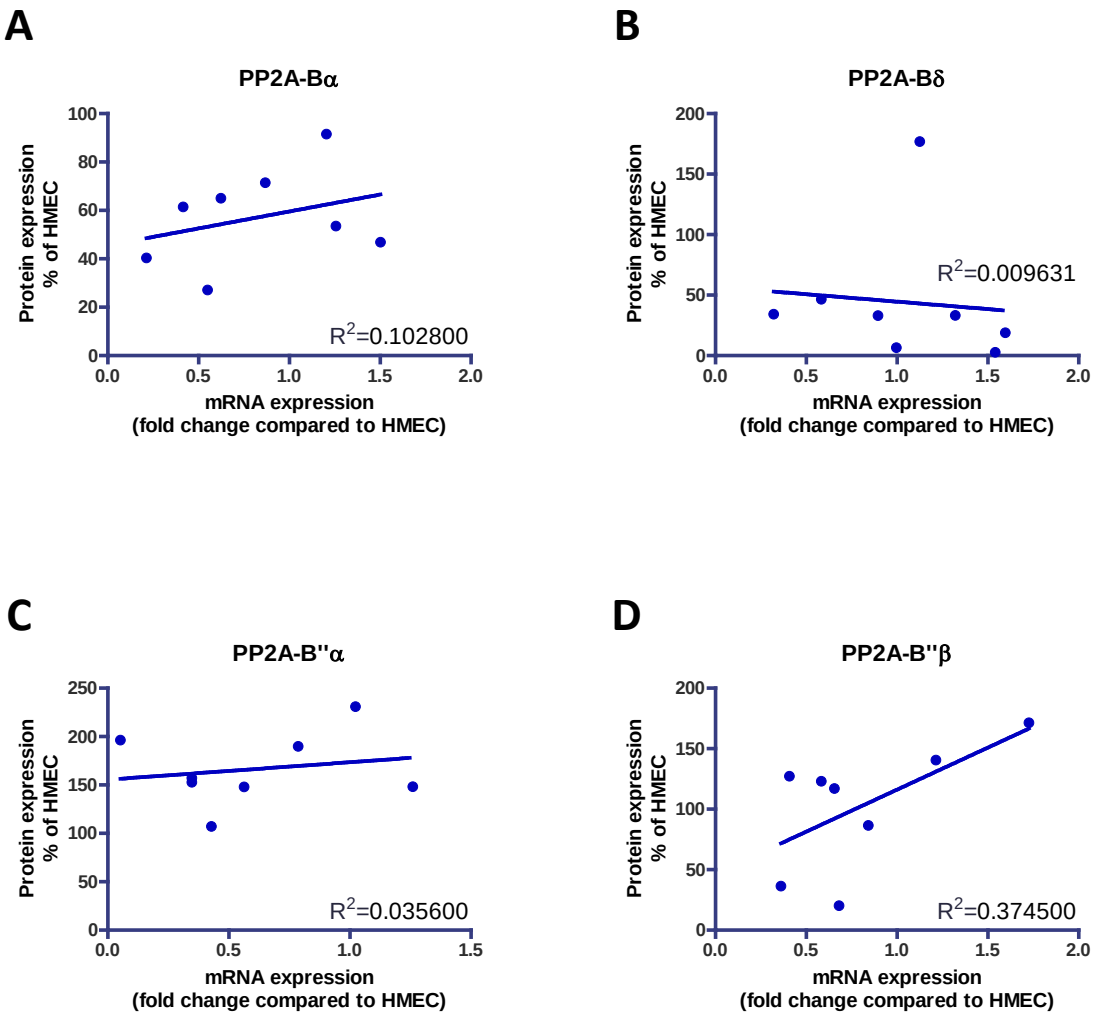
B) pBABE puro constructs contained H-Ras-V12 and PP2A-Aα mutants.

C) pMKO GFP constructs contained shRNA sequences against PP2A-Aα and regulatory B subunits.

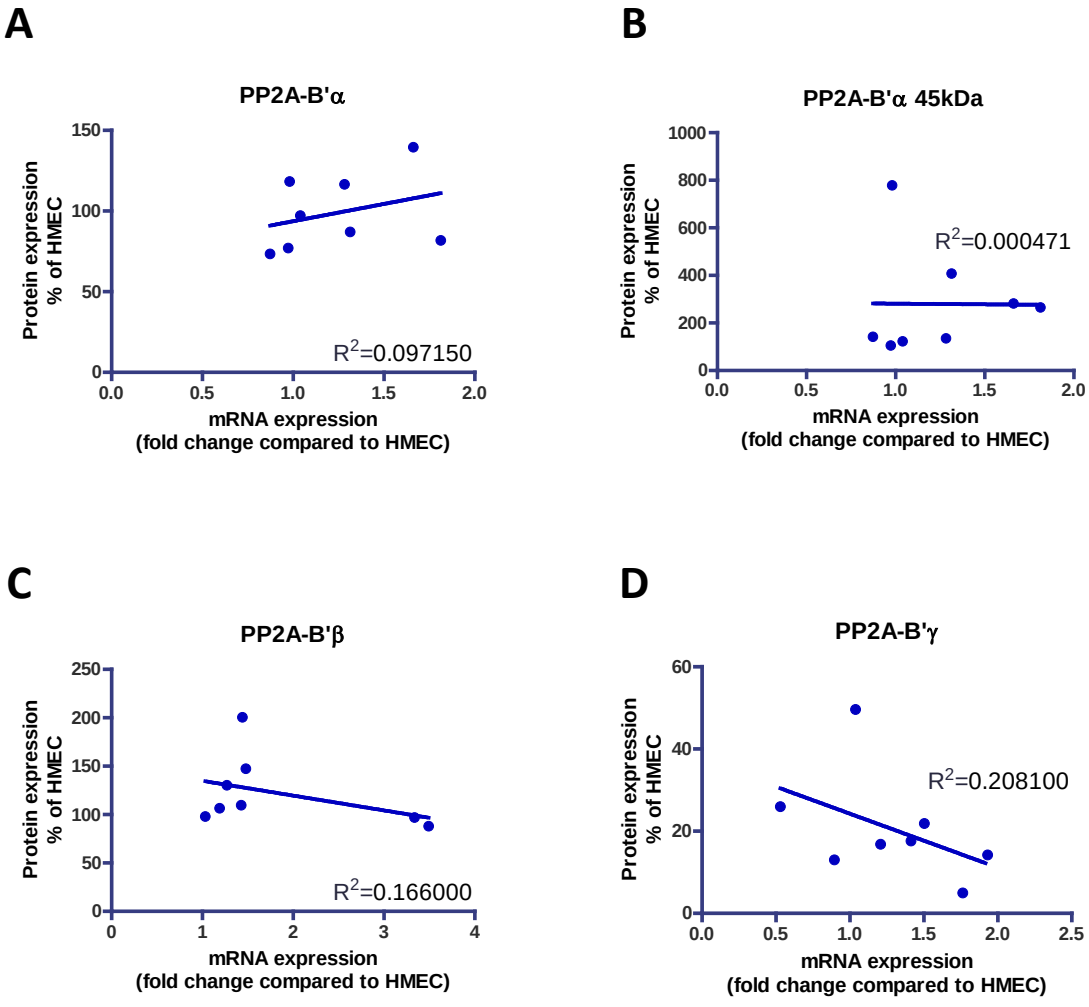
All constructs and these vector maps were originally obtained from Addgene inc (www.addgene.org)



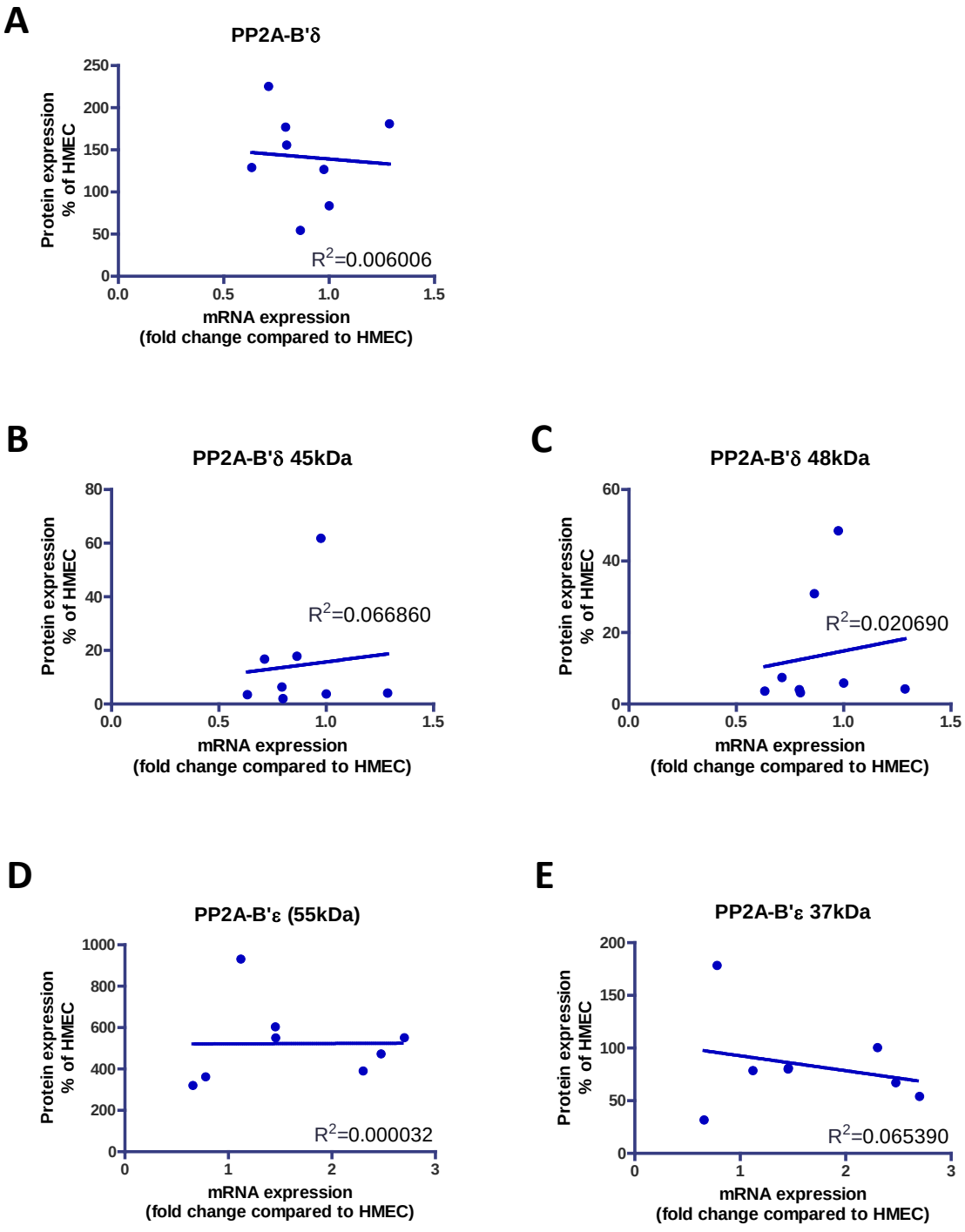
Appendix 2a Correlation of protein expression and mRNA expression for PP2A subunits.
Average protein expression was plotted against average mRNA expression for all cell lines, and analysed by linear regression.



Appendix 2b Correlation of protein expression and mRNA expression for PP2A subunits.
Average protein expression was plotted against average mRNA expression for all cell lines, and analysed by linear regression.

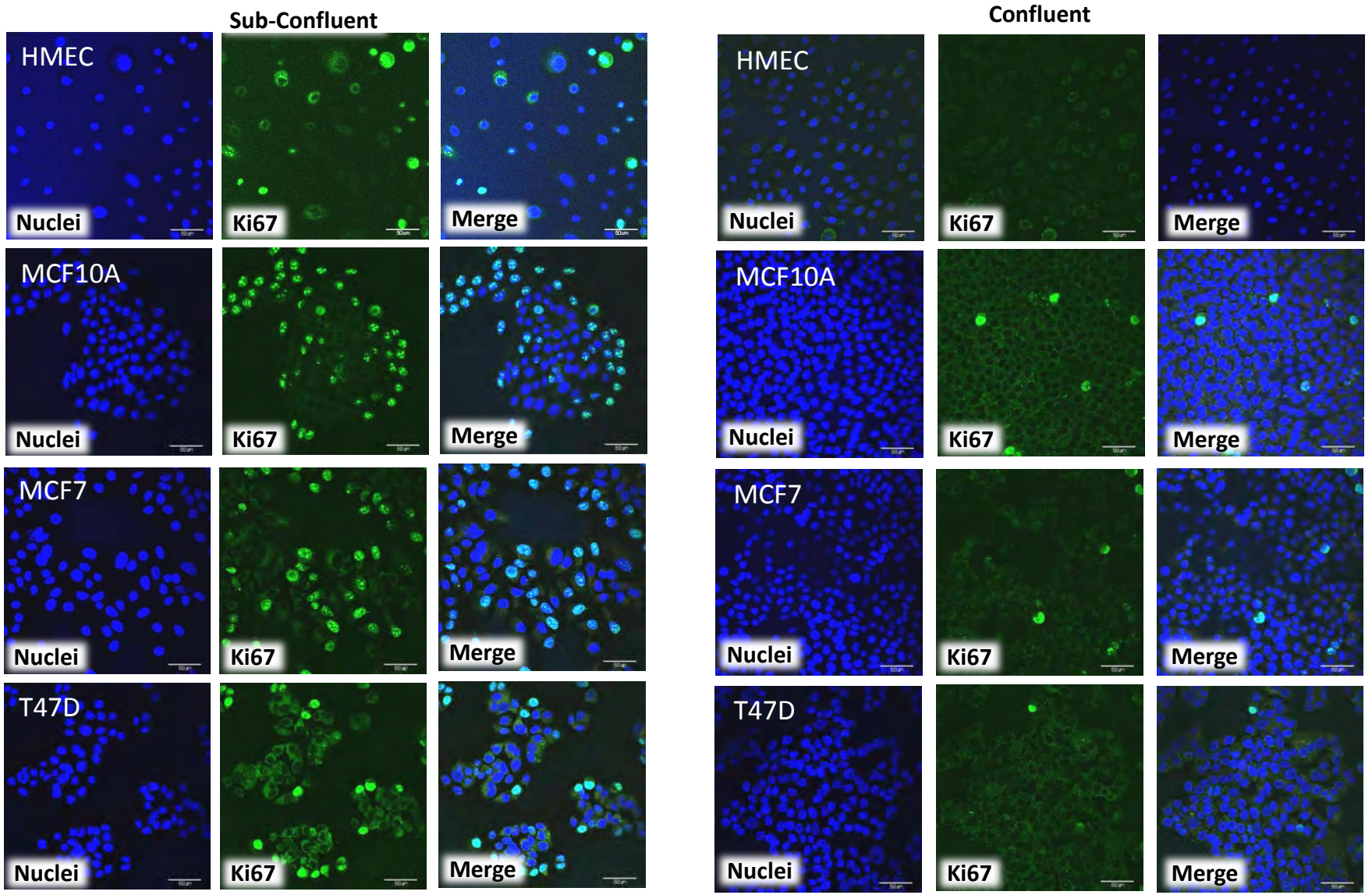


Appendix 2c Correlation of protein expression and mRNA expression for PP2A subunits.
Average protein expression was plotted against average mRNA expression for all cell lines, and analysed by linear regression.



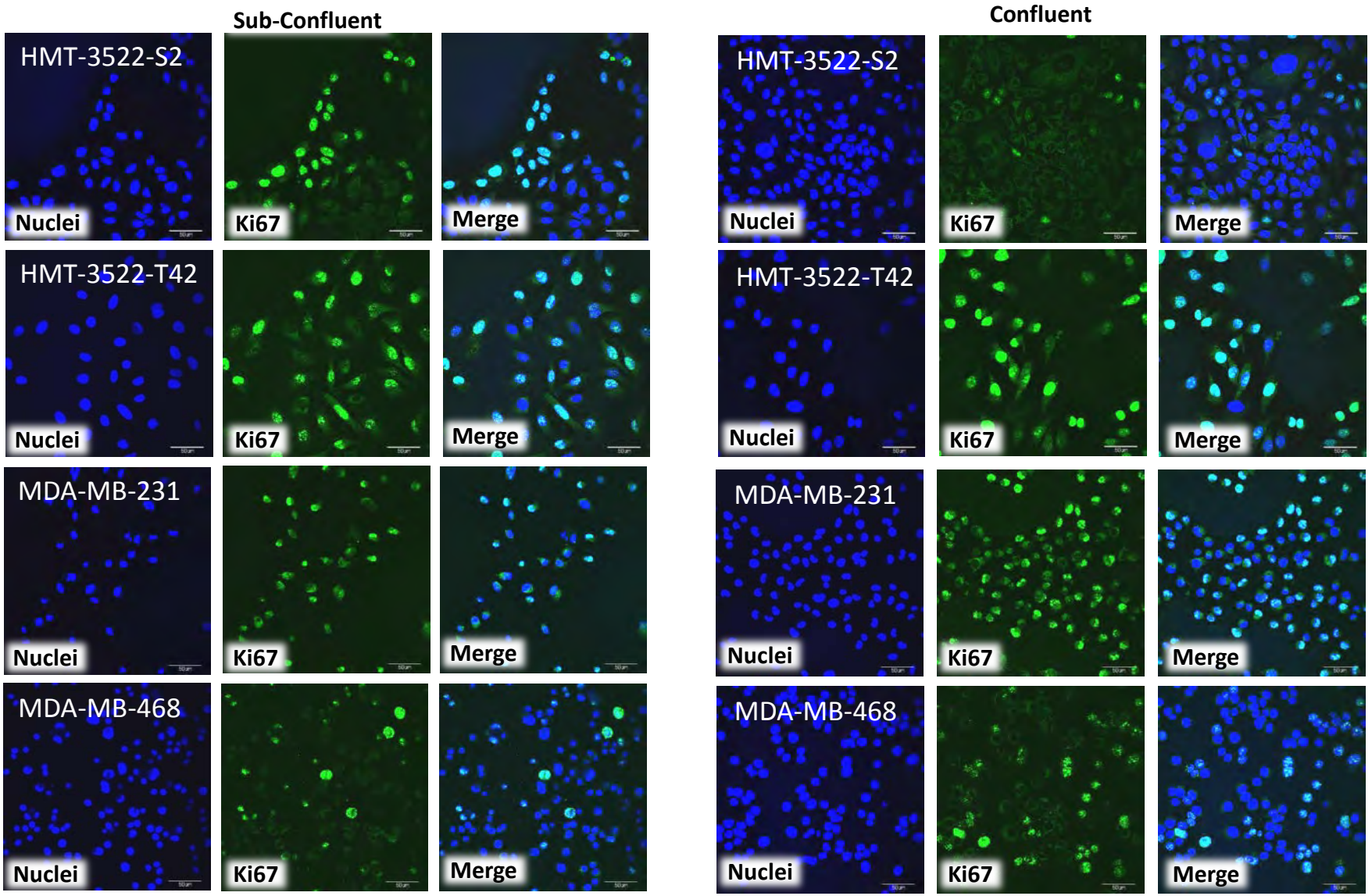
Appendix 2d Correlation of protein expression and mRNA expression for PP2A subunits.

Average protein expression was plotted against average mRNA expression for all cell lines, and analysed by linear regression.



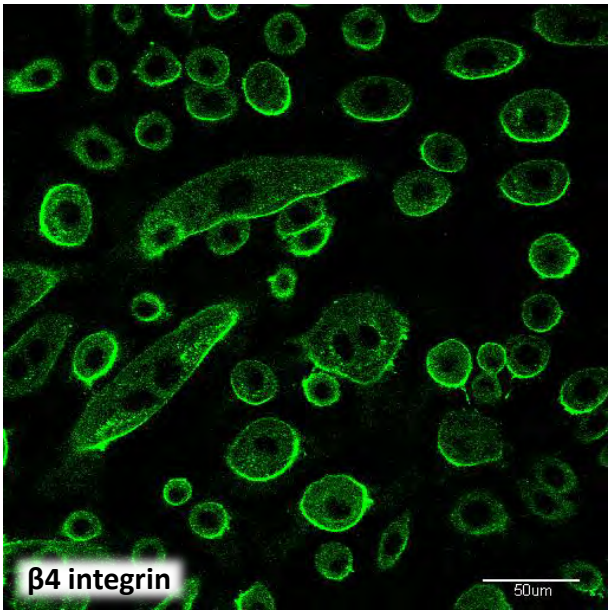
Appendix 3a Ki67 staining shows proliferation in sub-confluent breast and breast cancer cells, but not in confluent cells.

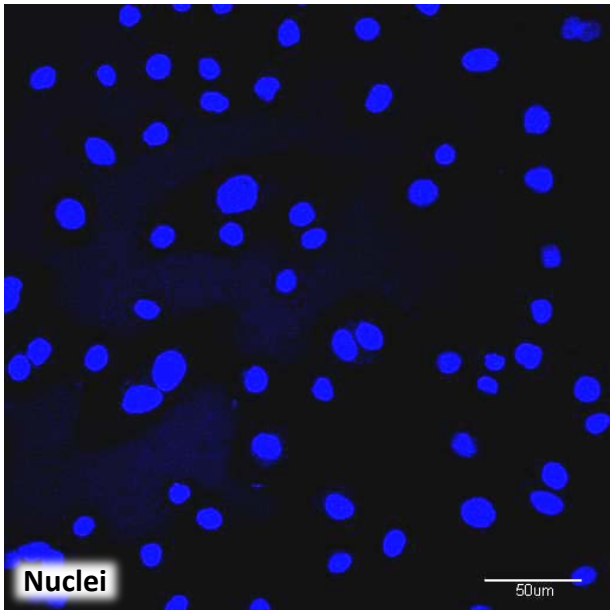
Cells were grown on glass coverslips; fixed, permeabilised and dividing cells detected with anti-Ki67 antibody, followed by secondary fluorescently labelled antibody. Nuclei were labelled with DAPI (blue). Scale bar = 50µm. Sub-confluent cells are on the left, and confluent cultures on the right for each cell line.

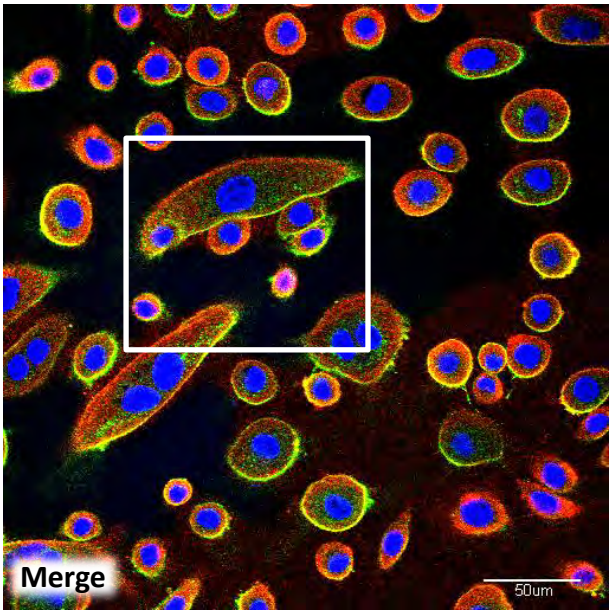


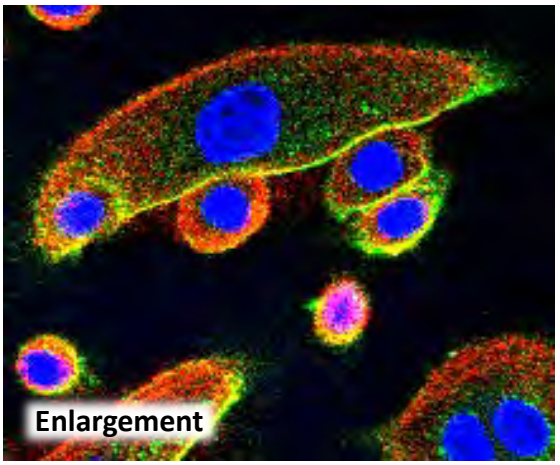
Appendix 3b Ki67 staining shows proliferation in sub-confluent breast and breast cancer cells, but not in confluent cells.

Cells were grown on glass coverslips; fixed, permeabilised and dividing cells detected with anti-Ki67 antibody, followed by secondary fluorescently labelled antibody. Nuclei were imaged with DAPI (blue). Scale bar = 50µm. Sub-confluent cells are on the left, and confluent cultures on the right for each cell line.





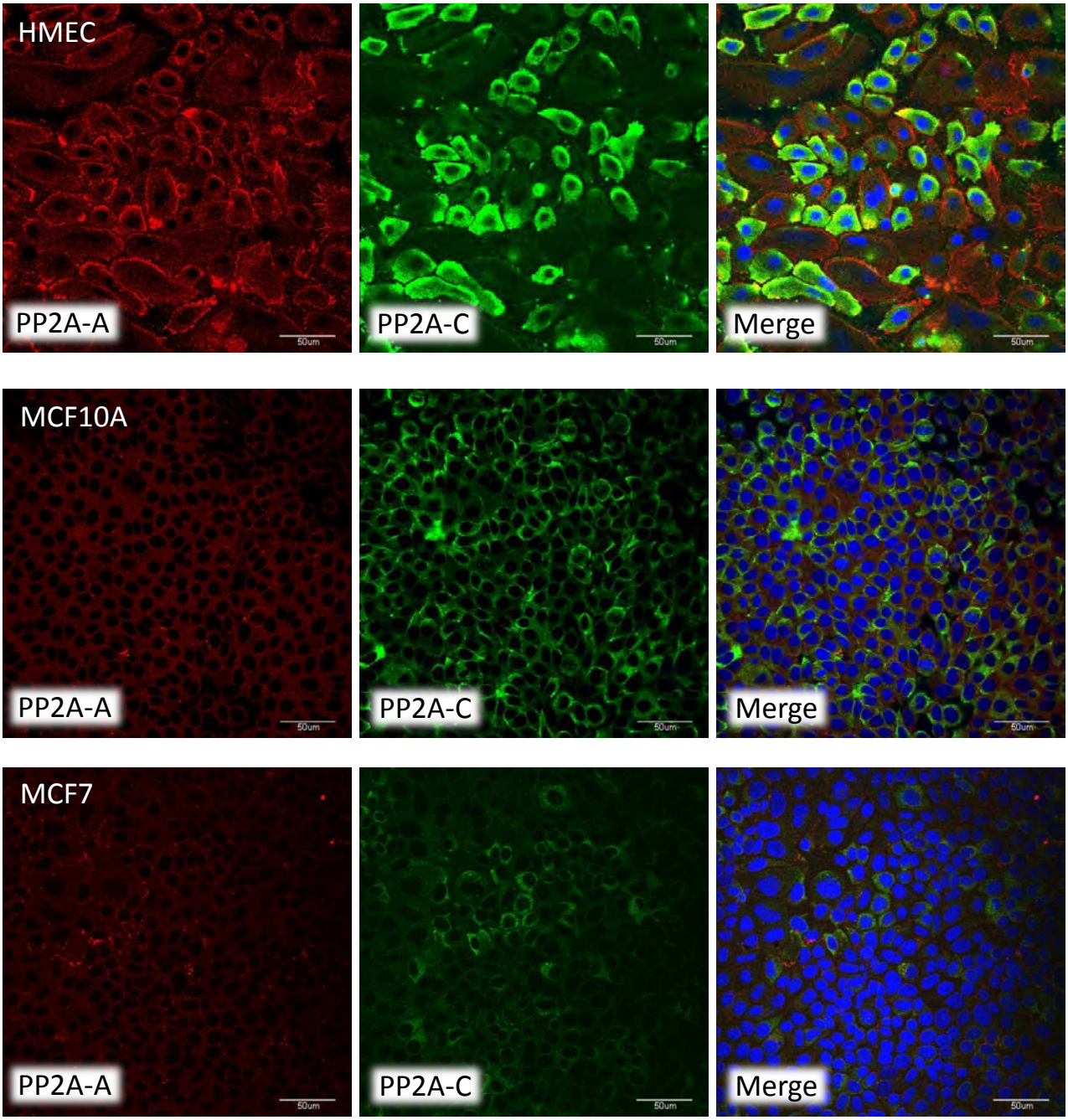




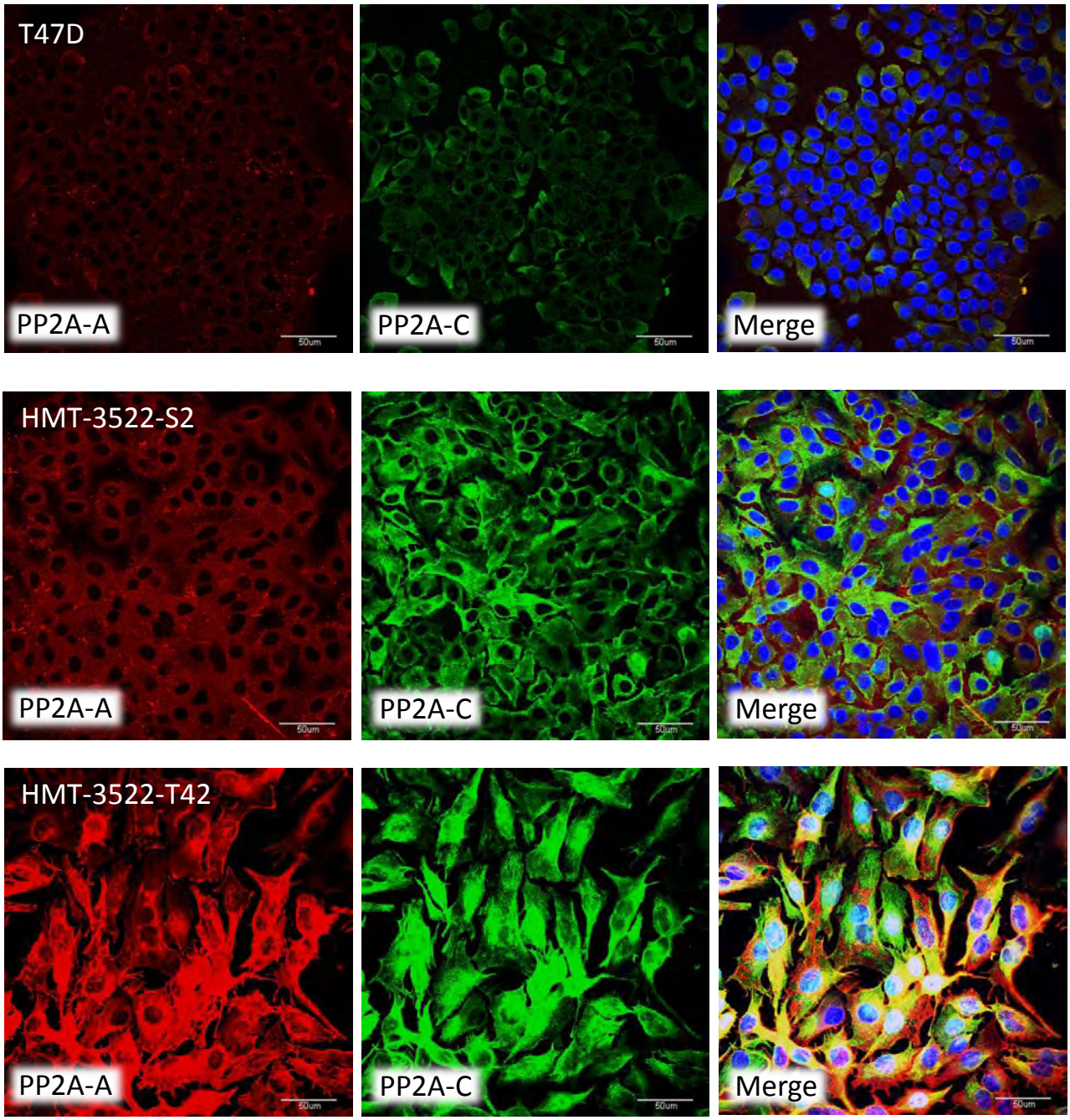
Appendix 4 PP2A-A co-localises with β4 integrin in primary human mammary epithelial cells.

HMEC cells were grown on glass coverslips; fixed, permeabilised and proteins detected with specific antibodies as indicated, followed by secondary fluorescently labelled antibodies. Nuclei were labelled with DAPI (blue). Scale bar = 50μm.

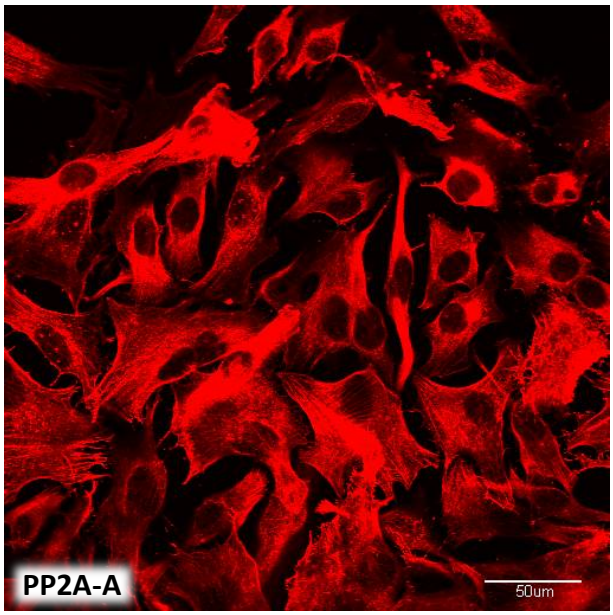
PP2A-A (red) and β4 integrin (green) co-localise (yellow on merge image) at the periphery of HMEC cells.

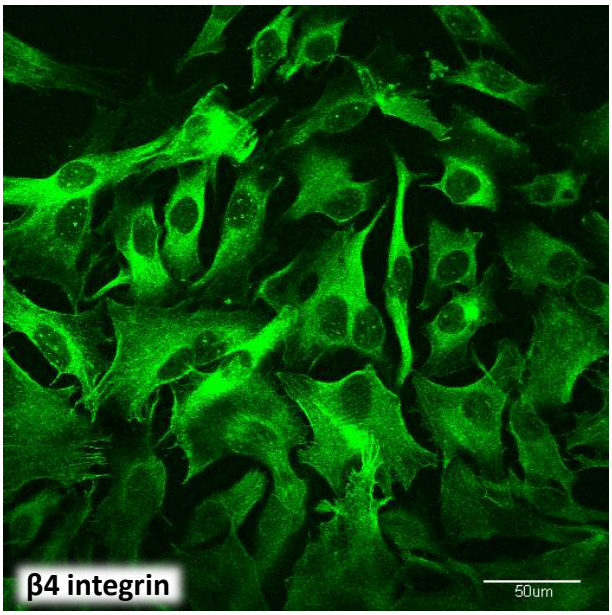


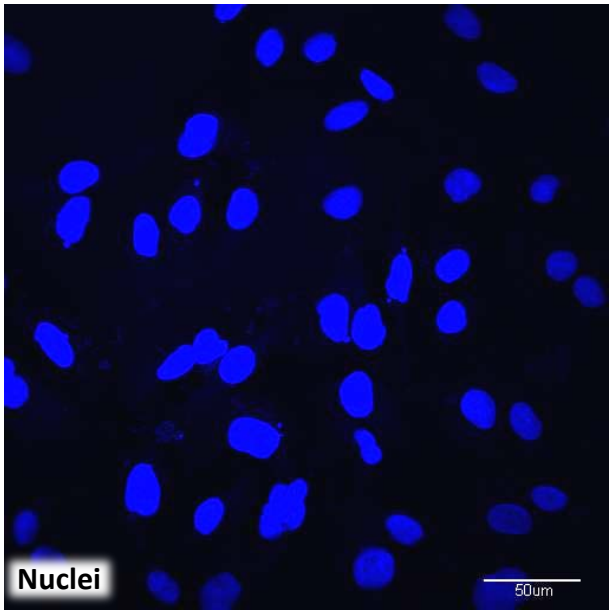
Appendix 5a PP2A is not expressed in the nuclei in confluent breast and breast cancer cell lines.
Cells were grown on glass coverslips until they reached confluence; then were fixed, permeabilised and proteins detected with specific anti-PP2A antibodies as indicated, followed by secondary fluorescent antibodies. Nuclei were labelled with DAPI (blue). Scale bar = 50µm.

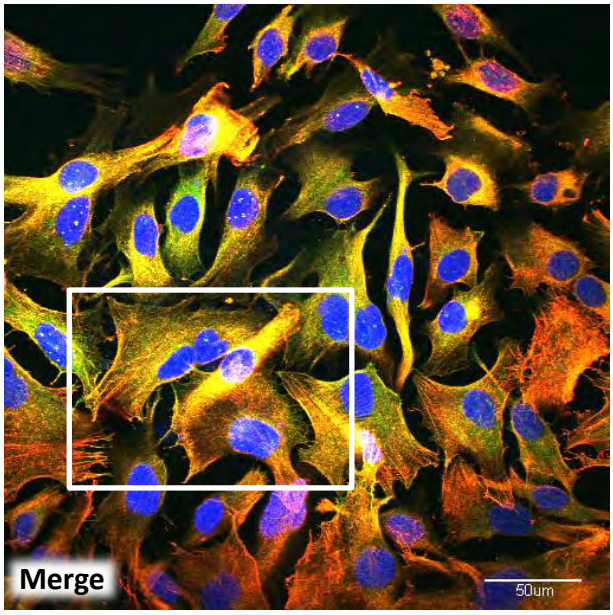


Appendix 5b PP2A is not expressed in the nuclei in confluent breast and breast cancer cell lines.
Cells were grown on glass coverslips until they reached confluence; then were fixed, permeabilised and proteins detected with specific anti-PP2A antibodies as indicated, followed by secondary fluorescent antibodies. Nuclei were labelled with DAPI (blue). Scale bar = 50µm. Note for HMT-3522-T42 cells, the exposure time had to be reduced in order to see any cellular structures. All other images are taken at the same exposure.





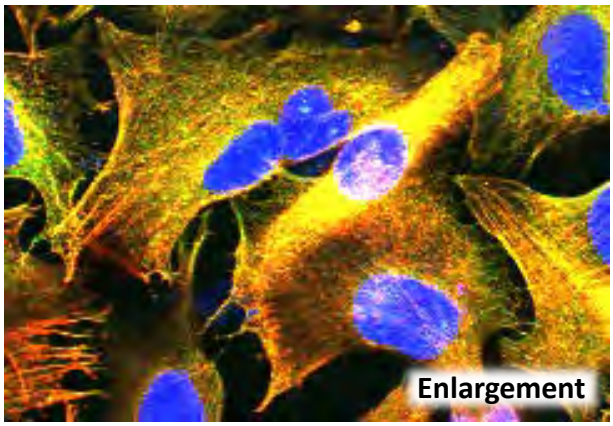




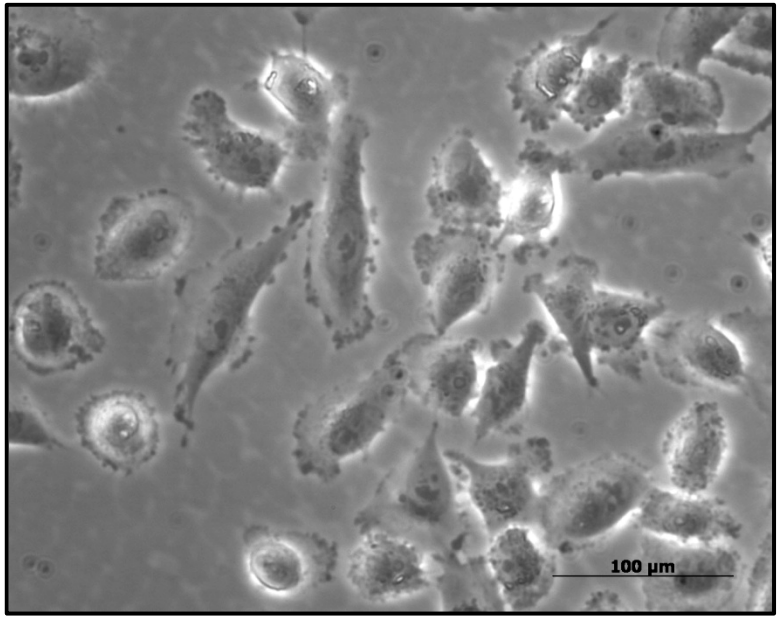
Appendix 6 PP2A-A co-localises with β4 integrin at the periphery of HMT-3522-T42 cells.

Cells were grown on glass coverslips; fixed, permeabilised and proteins detected with specific antibodies as indicated, followed by secondary fluorescently labelled antibodies. Nuclei were labelled with DAPI (blue). Scale bar = 50μm.

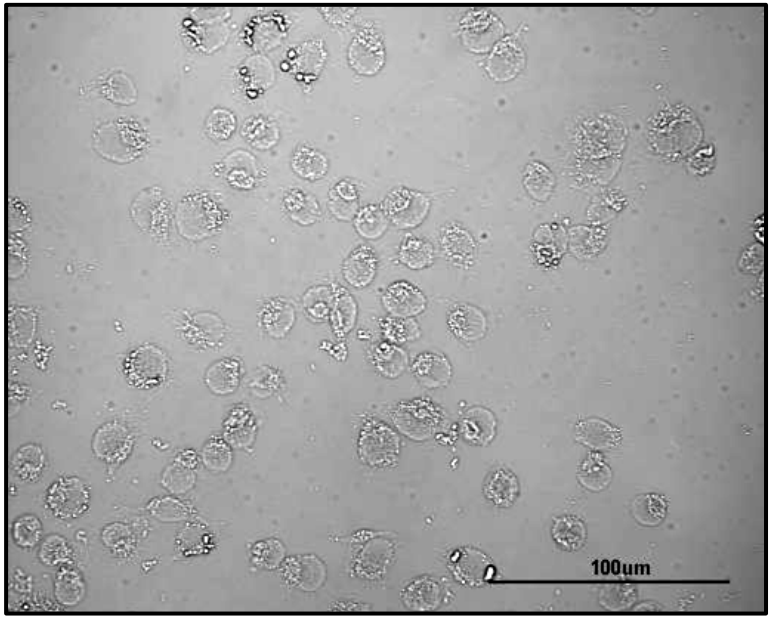
PP2A-A (red) and β4 integrin (green) co-localise (yellow on merge image) at the periphery of HMT-3522-T42 cells.



Tissue Culture Flask

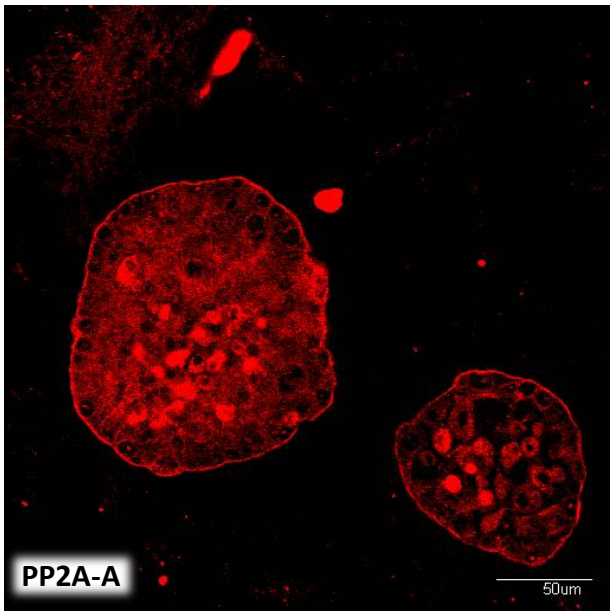


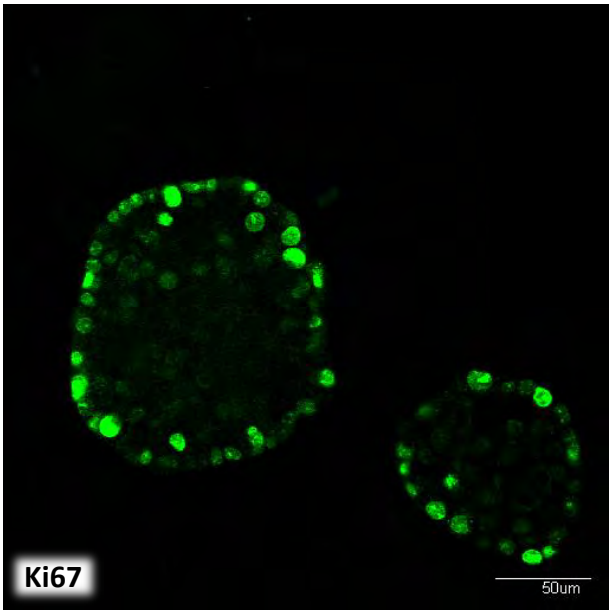
Glass Coverslips

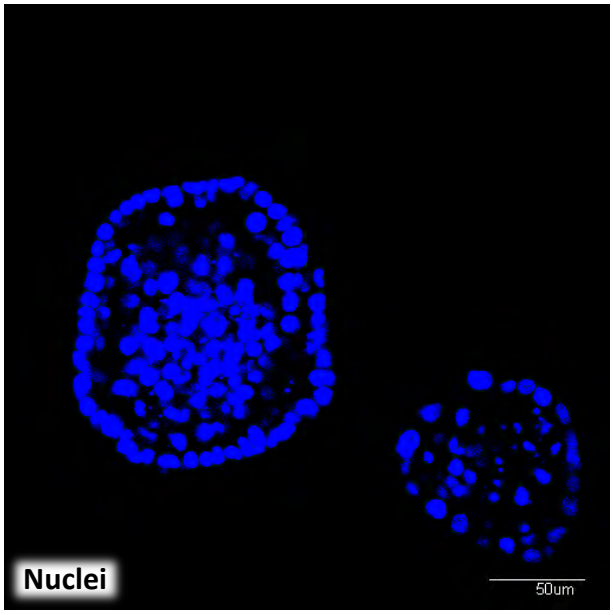


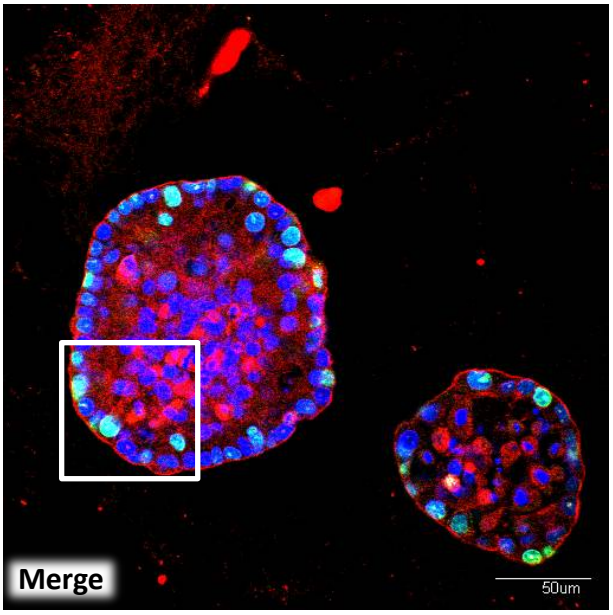
Appendix 7 MDA-MB-231 cells did not spread on glass coverslips as on tissue culture plastic.

As MDA-MB-231 cells did not spread on glass coverslips and have the same morphology as when cultured on tissue culture plastic, PP2A expression by immunofluorescence (Figure 3.20) must be interpreted with caution.





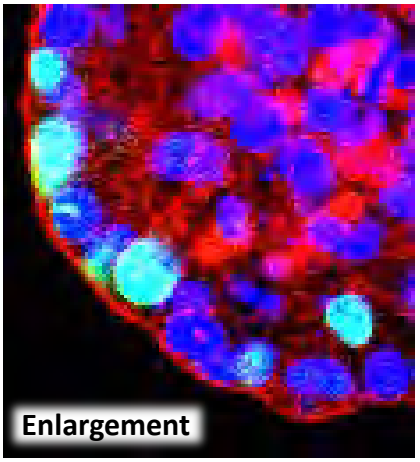


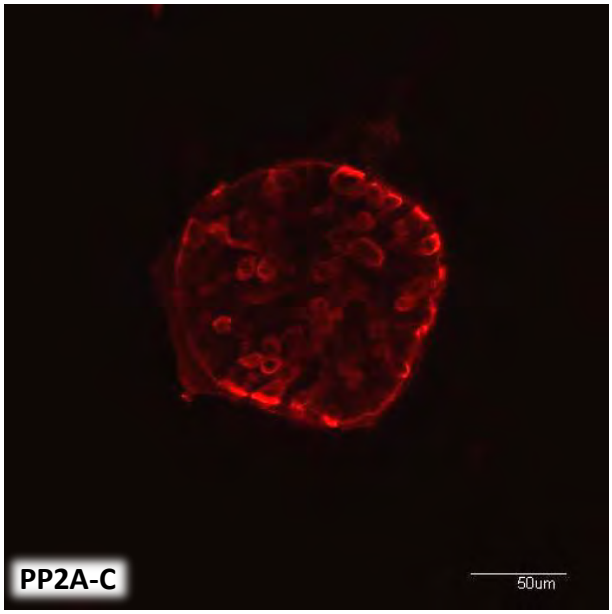


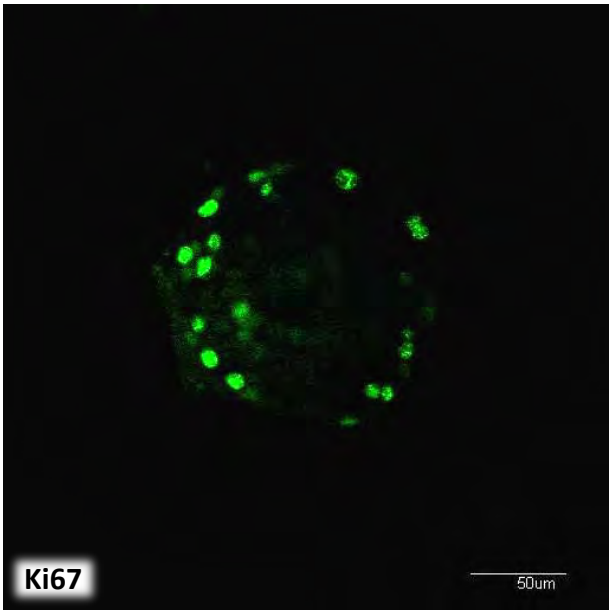
Appendix 8a PP2A-A does not co-localise with proliferating cells in the outer cell layer of MCF10A acini – Day 8.

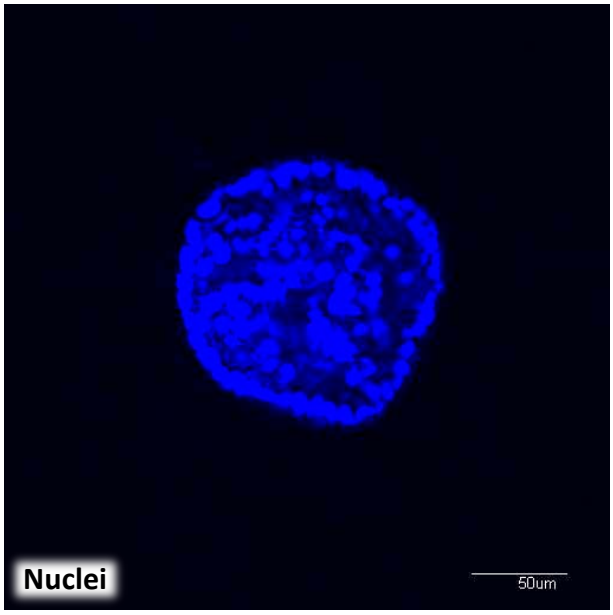
MCF10A cells were cultured from single cells on extracellular matrix proteins for up to 20 days as a model of mammary gland development. Acini were fixed, permeabilised and proteins detected with specific antibodies as indicated, followed by secondary fluorescently labelled antibodies. Nuclei were labelled with DAPI (blue). Scale bar = 50µm.

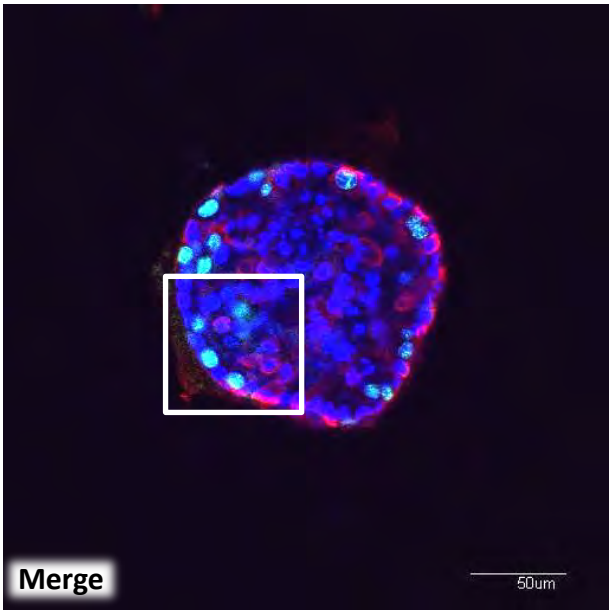
PP2A-A (red) does not co-localise with a marker of cellular proliferation, Ki67 (green) in day 8 acini.







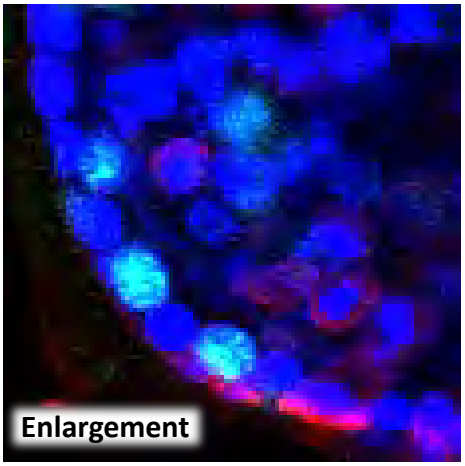


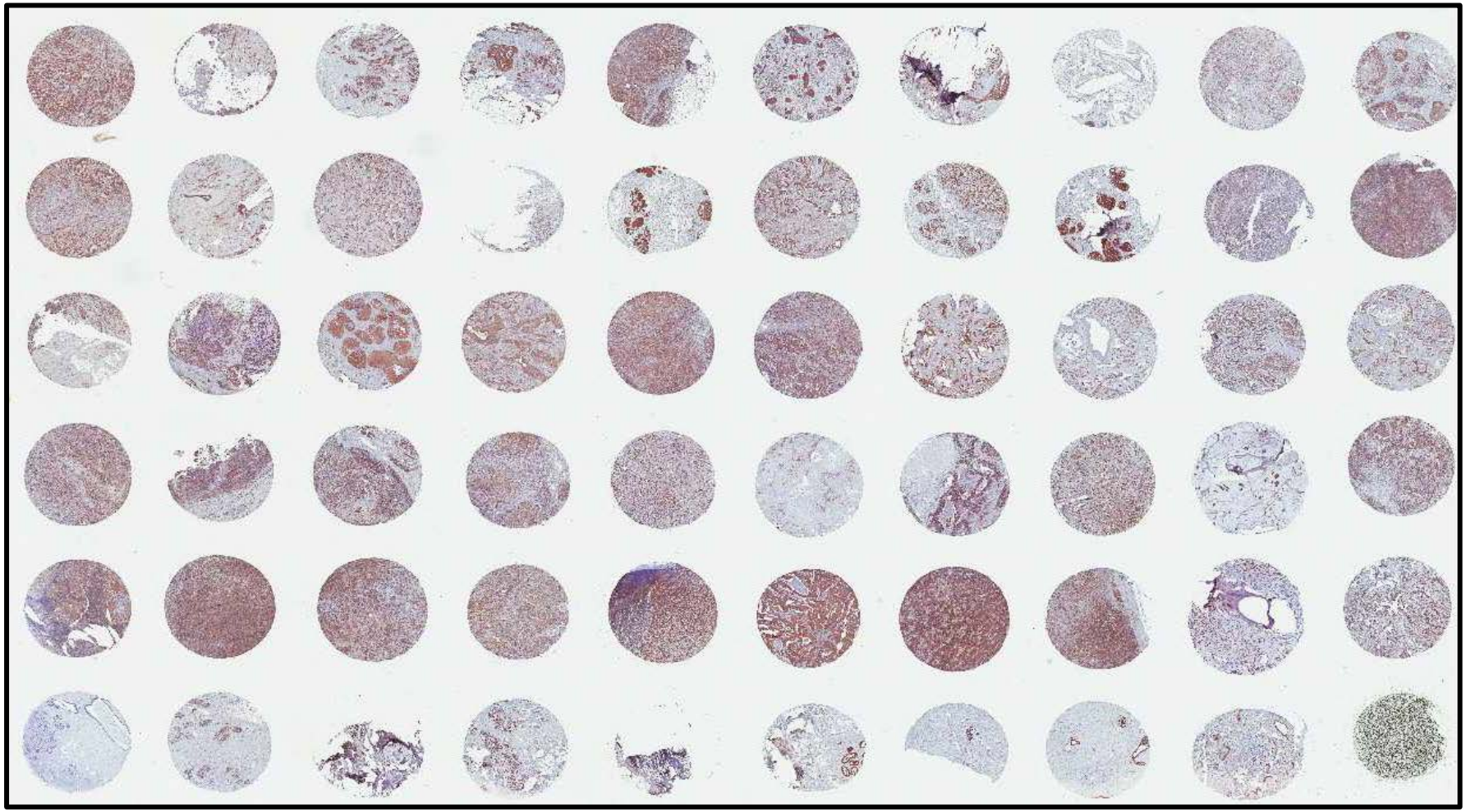


Appendix 8b PP2A-C does not co-localise with proliferating cells in the outer cell layer of MCF10A acini – Day 14.

MCF10A cells were cultured from single cells on extracellular matrix proteins for up to 20 days as a model of mammary gland development. Acini were fixed, permeabilised and proteins detected with specific antibodies as indicated, followed by secondary fluorescently labelled antibodies. Nuclei were labelled with DAPI (blue). Scale bar = 50µm.

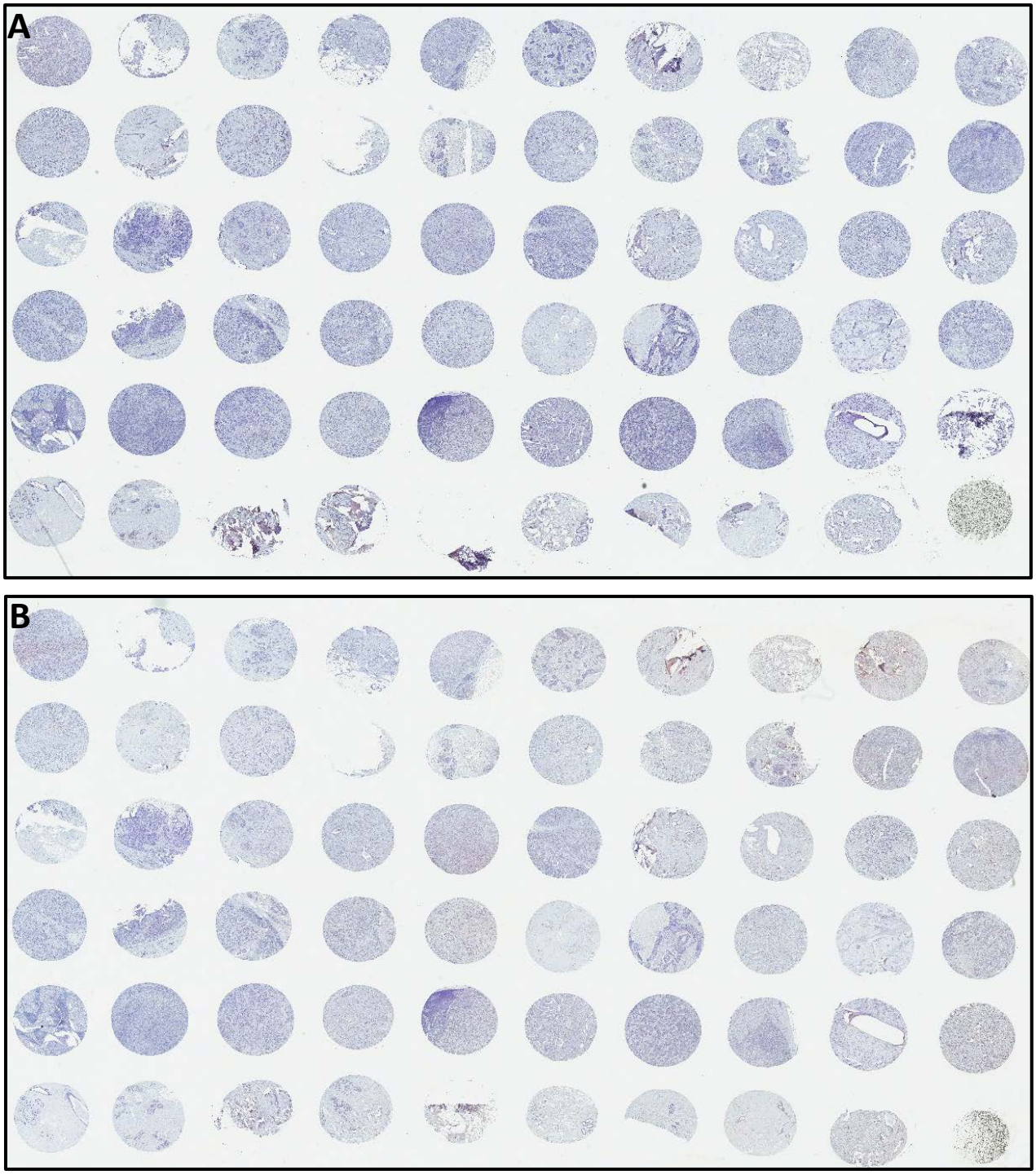
PP2A-C (red) does not co-localise with a marker of cellular proliferation, Ki67 (green) in day 14 acini.





Appendix 9 PP2A-C protein expression in a breast cancer tissue array.

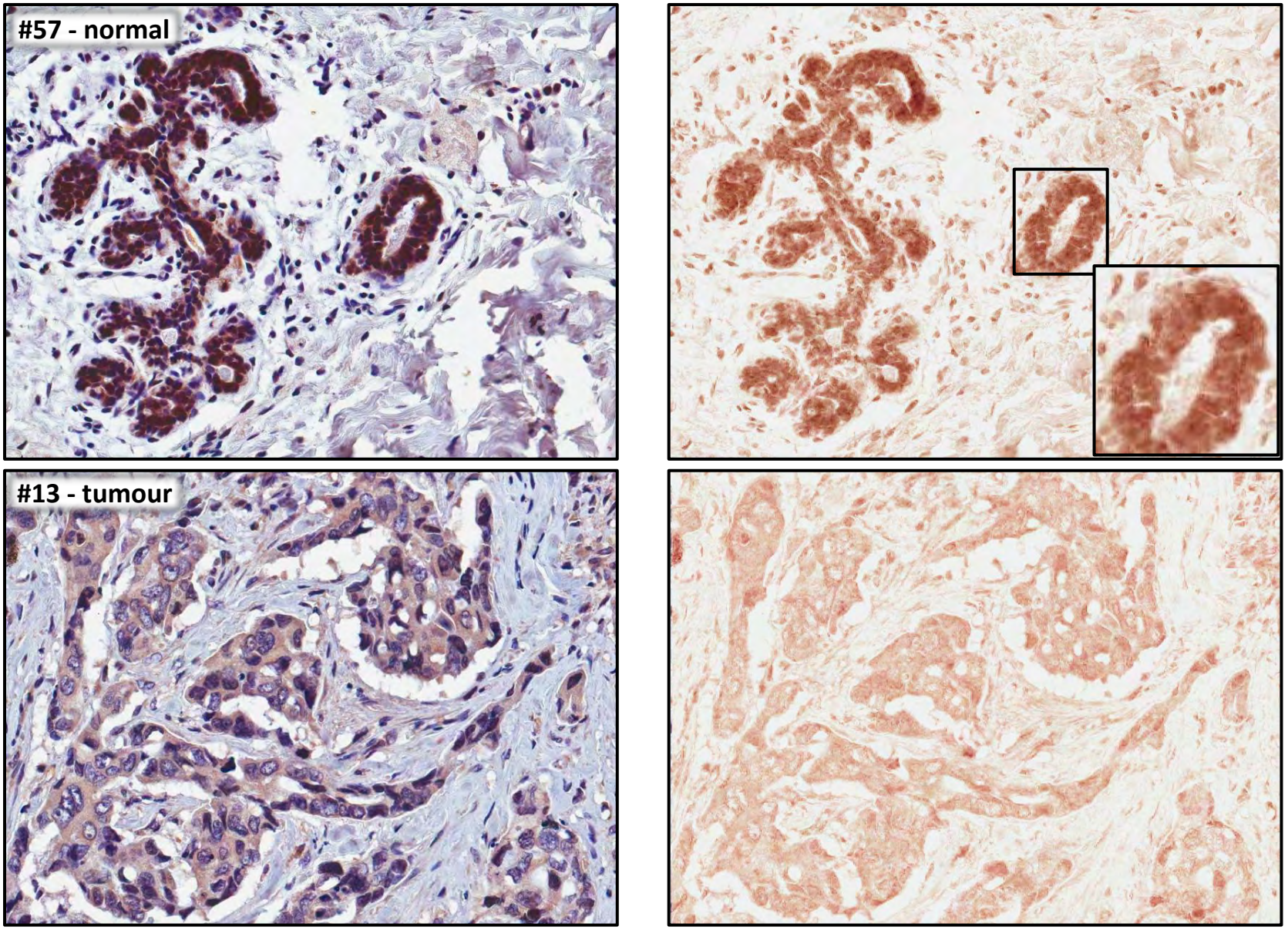
Human tissue arrays were analysed for PP2A subunit expression by immunohistochemistry using an anti-PP2A-C antibody (brown). Nuclei are stained with hematoxylin (blue). Slides were then scanned with an Aperio Scanscope and PP2A subunit expression was quantitated using the Aperio Colour Deconvolution algorithm.



Appendix 10 Negative control slides incubated with isotype matched antibodies for human tissue array analysis by immunohistochemistry.

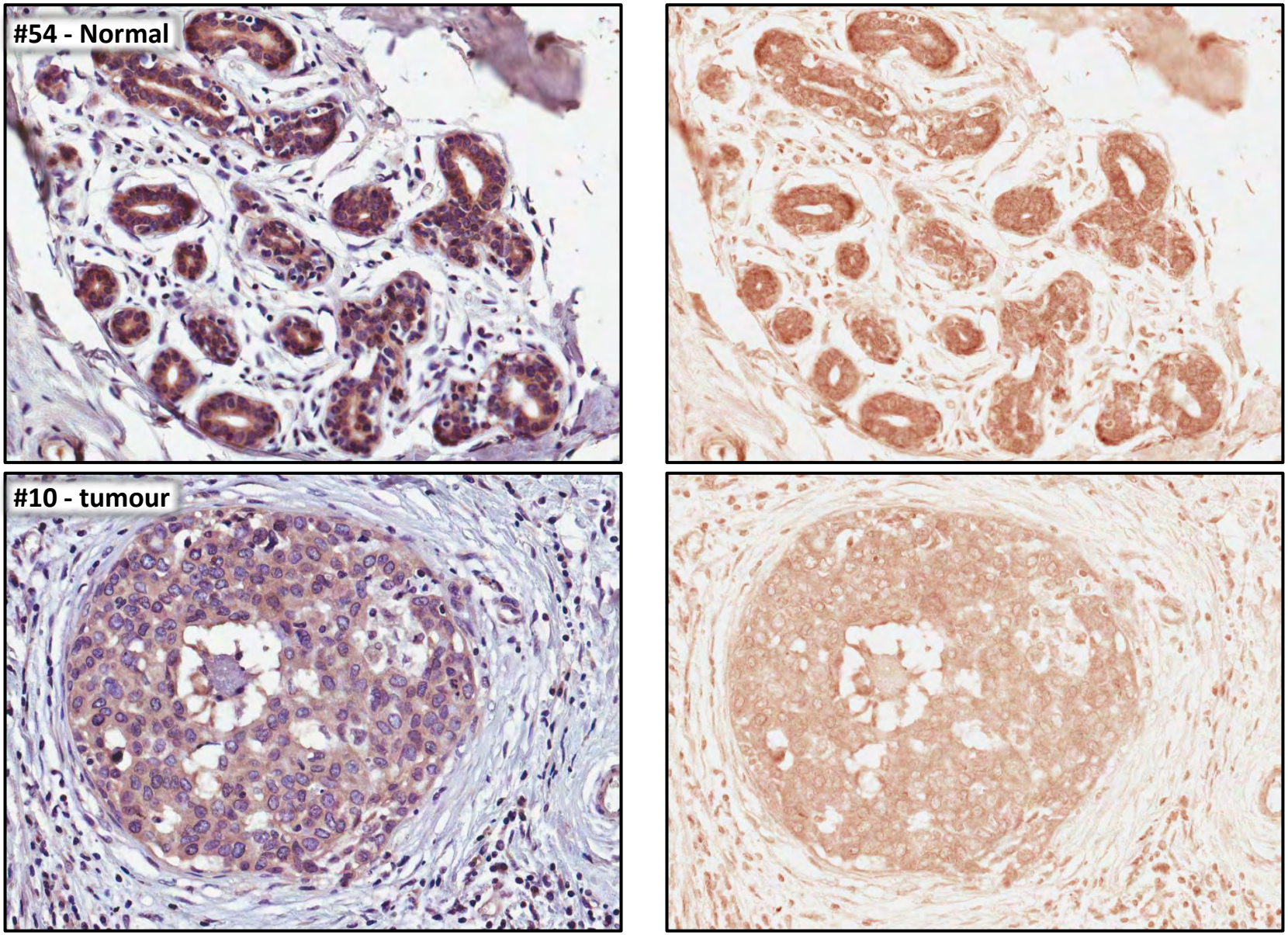
Negative controls for anti-PP2A antibodies were isotype matched immunoglobulins. Nuclei are stained with hematoxylin (blue). Slides were then scanned with an Aperio Scanscope.

A) Negative control slide for anti-PP2A-A antibody.
B) Negative control slide for anti-PP2A-C antibody.



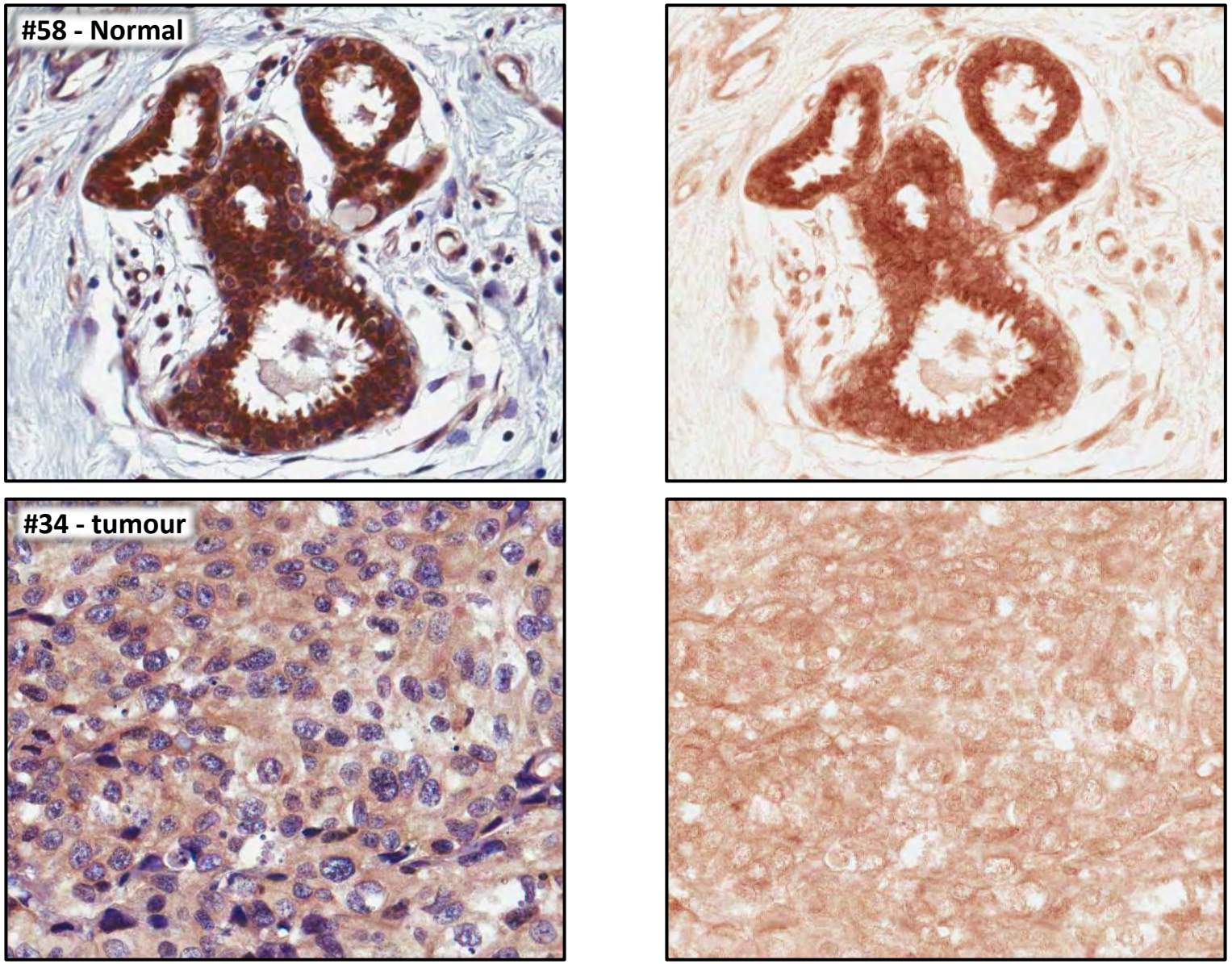
Appendix 11a PP2A-A is not over-expressed in the nuclei of breast tissue.

Human tissue arrays were analysed by immunohistochemistry with an anti-PP2A-A antibody (brown). Nuclei are stained with hematoxylin (blue).



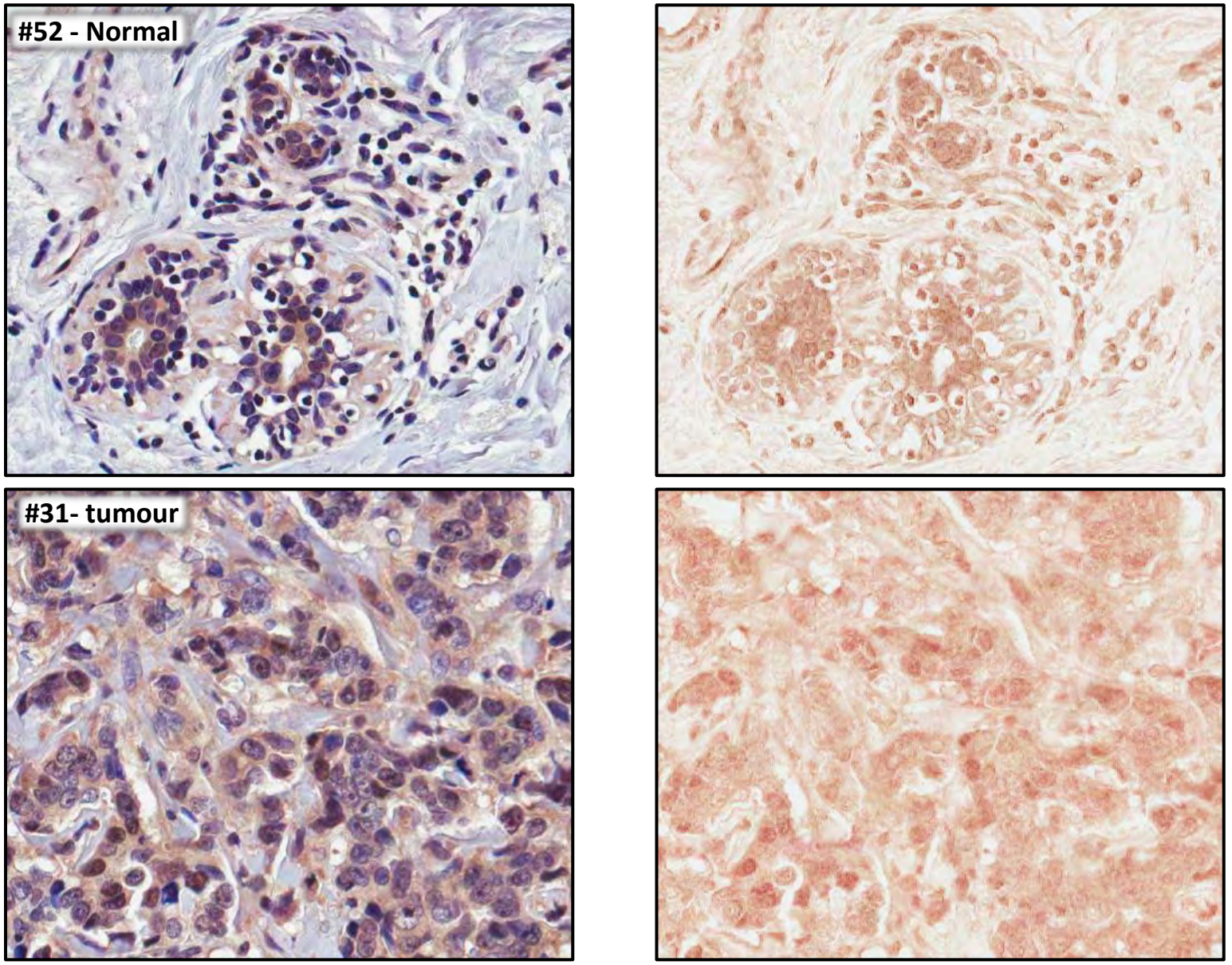
Appendix 11b PP2A-A is not over-expressed in the nuclei of breast tissue.

Human tissue arrays were analysed by immunohistochemistry with an anti-PP2A-A antibody (brown). Nuclei are stained with hematoxylin (blue).



Appendix 11c PP2A-C is is not over-expressed in the nuclei of breast tissue.

Human tissue arrays were analysed by immunohistochemistry with an anti-PP2A-AC antibody (brown). Nuclei are stained with hematoxylin (blue).



Appendix 11d PP2A-C is expressed in the nucleus of myoepithelial cells and also the tumour tissue from this patient.

Human tissue arrays were analysed by immunohistochemistry with an anti-PP2A-C antibody (brown). Nuclei are stained with hematoxylin (blue).

Appendix 12 Patient data for tissue arrays with PP2A subunit IHC scores.

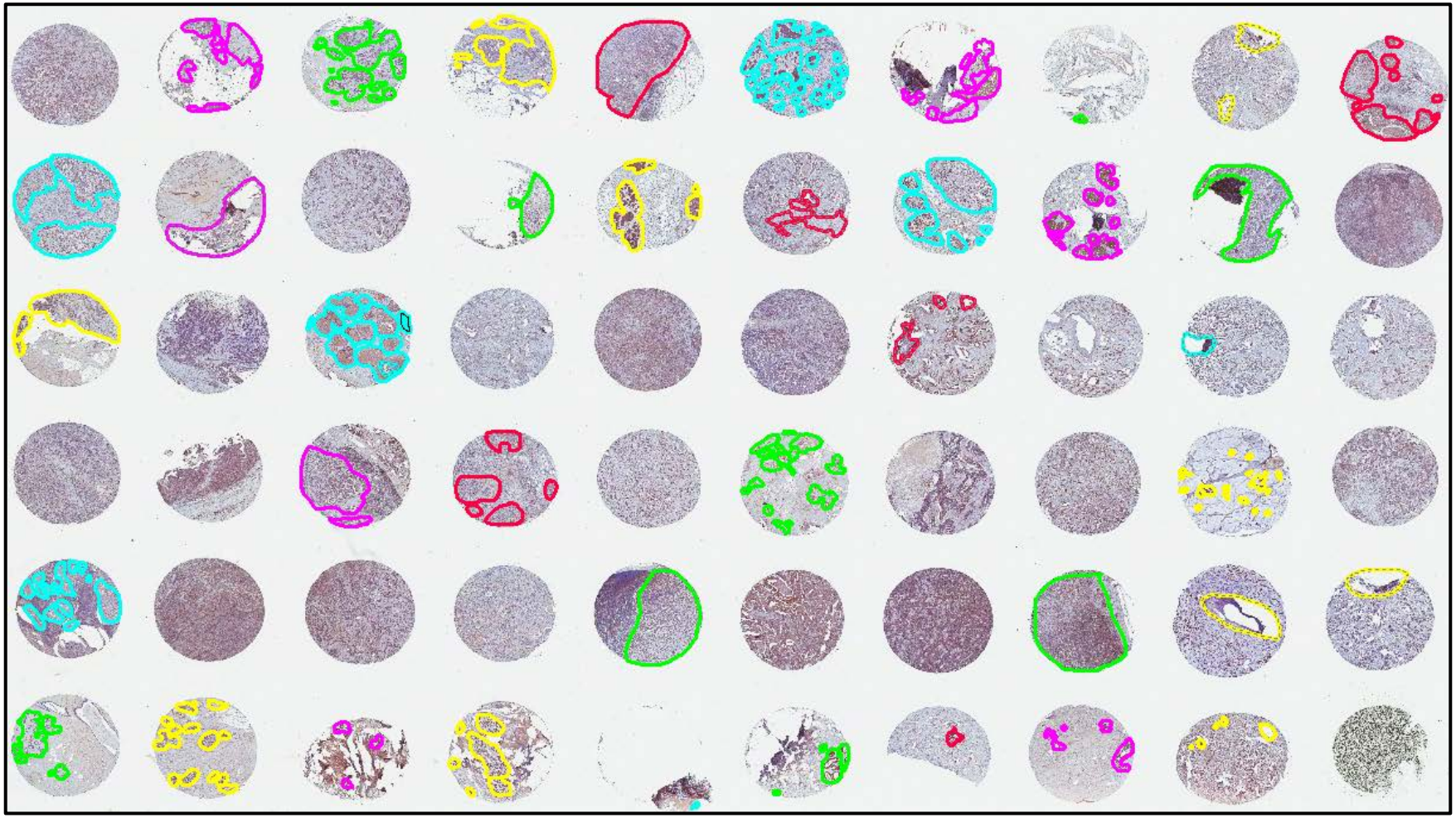
#	Diagnosis	Age	Tumor size	pTNM	Stage	LN	ER	PR	p53	ErbB2	Follow-up (months)	Follow-up result	Cause of death	PP2A-A Score	PP2A-C Score
1	Infiltrating duct carcinoma	59	3.0 cm	T2N0M0	IIA	0/19	0	+	+	0	84	Alive	.	79	128
2	Infiltrating duct carcinoma	48	3.5 cm	T2N0M0	IIA	0/16	0	+	0	0	84	Alive	.	64	92
3	Infiltrating duct carcinoma	42	4.2 cm	T2N2aM0	IIIA	5/19	0	+	0	0	84	Alive	.	55	99
4	Infiltrating duct carcinoma	37	3.0 cm	T2N2aM0	IIIA	8/8	+	0	0	+	34	Deceased	Cancer	50	115
5	Infiltrating duct carcinoma	37	2.5 cm	T2N0M0	IIA	0/20	0	0	0	0	84	Alive	.	59	134
6	Infiltrating duct carcinoma	55	2.5 cm	T2N0M0	IIA	0/19	+	0	+	0	83	Alive	.	112	152
7	Infiltrating duct carcinoma	55	10.0 cm	T3N3aM0	IIIC	20/20	+	0	+	0	57	Deceased	Cancer	118	117
8	Infiltrating duct carcinoma	36	6.0 cm	T3N0M0	IIB	0/14	0	0	0	0	82	Alive	.	103	149
9	Infiltrating duct carcinoma	52	2.5 cm	T2N2aM0	IIIA	5/24	0	0	+	0	82	Alive	.	57	60
10	Ductal carcinoma in situ	40	4.5 cm	T2N0M0	IIA	0/11	0	0	+	0	82	Alive	.	96	110
11	Infiltrating duct carcinoma	51	2.5 cm	T2N0M0	IIA	0/8	0	0	0	+	82	Alive	.	59	117
12	Infiltrating duct carcinoma	55	3.0 cm	T2N0M0	IIA	0/19	+	+	0	0	80	Alive	.	68	66
13	Infiltrating duct carcinoma	60	2.5 cm	T2N0M0	IIA	0/16	0	0	+	0	79	Alive	.	66	90
14	Infiltrating duct carcinoma	45	5.0 cm	T2N1aM0	IIB	3/23	0	0	+	+	38	Deceased	Cancer	74	60
15	Ductal carcinoma in situ	38	5.2 cm	T3N1aM0	IIIA	3/13	+	0	0	0	79	Alive	.	165	176

#	Diagnosis	Age	Tumor size	pTNM	Stage	LN	ER	PR	p53	ErbB2	Follow-up (months)	Follow-up result	Cause of death	PP2A-A Score	PP2A-C Score
16	Infiltrating duct carcinoma	53	2.2 cm	T2N1miM0	IIB	3/14	0	+	0	0	78	Alive	.	60	104
17	Infiltrating duct carcinoma	48	2.5 cm	T2N1miM0	IIB	2/15	0	0	0	0	78	Alive	.	101	132
18	Ductal carcinoma in situ	46	4.5 cm	T2N0M0	IIA	0/15	+	+	0	0	77	Alive	.	179	202
19	Infiltrating duct carcinoma	40	5.5 cm	T3N0M0	IIB	0/10	0	0	+	0	77	Alive	.	62	72
20	Infiltrating duct carcinoma	51	2.5 cm	T2N1aM0	IIB	1/16	0	0	0	0	77	Alive	.	96	128
21	Infiltrating duct carcinoma	56	4.5 cm	T2N0M0	IIA	0/14	+	+	+	0	77	Alive	.	100	113
22	Infiltrating duct carcinoma	45	3.5 cm	T2N0M0	IIA	0/17	0	0	0	0	77	Alive	.	80	103
23	Ductal carcinoma in situ	42	3.0 cm	T2N3aM0	IIIC	12/26	+	0	0	0	76	Alive	.	103	149
24	Infiltrating duct carcinoma	47	3.0 cm	T2N1miM0	IIB	1/11	0	0	+	+	76	Alive	.	47	110
25	Infiltrating duct carcinoma	39	2.5 cm	T2N1aM0	IIB	2/17	0	0	+	+	76	Alive	.	94	127
26	Infiltrating duct carcinoma	51	4.0 cm	T2N1aM0	IIB	1/13	+	+	0	+	76	Alive	.	80	122
27	Infiltrating duct carcinoma	49	2.5 cm	T2N0M0	IIA	0/20	+	0	+	0	78	Alive	.	94	100
28	Infiltrating duct carcinoma	57	5.5 cm	T3N1aM0	IIIA	3/7	+	0	0	0	75	Alive	.	62	51
29	Infiltrating duct carcinoma	52	5.0 cm	T2N1aM0	IIB	1/22	0	0	0	0	75	Alive	.	64	85
30	Infiltrating duct carcinoma	41	10.0 cm	T3N2aM0	IIIA	7/9	0	0	0	+	59	Deceased	Cancer	49	65
31	Infiltrating duct carcinoma	48	3.5 cm	T2N3aM0	IIIC	35/35	0	0	+	0	9	Deceased	Cancer	80	108

#	Diagnosis	Age	Tumor size	pTNM	Stage	LN	ER	PR	p53	ErbB2	Follow-up (months)	Follow-up result	Cause of death	PP2A-A Score	PP2A-C Score
32	Infiltrating duct carcinoma	34	3.0 cm	T2N1aM0	IIB	2/11	0	0	0	0	82	Alive	.	113	108
33	Infiltrating duct carcinoma	37	2.5 cm	T2N3aM0	IIIC	22/23	0	0	+	0	81	Alive	.	89	118
34	Infiltrating duct carcinoma	58	3.5 cm	T2N3aM0	IIIC	19/22	0	0	+	+	9	Deceased	Cancer	69	117
35	Infiltrating duct carcinoma	37	4.5 cm	T2N3aM0	IIIC	17/19	0	0	0	+	78	Alive	.	70	92
36	Infiltrating duct carcinoma	66	5.0 cm	T2N2aM0	IIIA	4/11	0	0	0	0	75	Alive	.	83	49
37	Infiltrating duct carcinoma	51	3.0 cm	T2N1aM0	IIB	3/16	0	0	+	0	73	Alive	.	91	79
38	Infiltrating duct carcinoma	41	3.5 cm	T2N3aM0	IIIC	15/21	0	0	0	+	72	Alive	.	104	112
39	Mucinous Carcinoma	56	6.0 cm	T3N2aM0	IIIA	5/13	0	0	+	+	72	Alive	.	143	115
40	Infiltrating duct carcinoma	47	10.0 cm	T3N3aM0	IIIC	11/13	0	0	+	0	33	Deceased	Cancer	77	102
41	Metastatic carcinoma from #31	48	.				0	0	+	0	.	.	.	80	109
42	Metastatic carcinoma from #32	34	.				0	0	0	0	.	.	.	134	158
43	Metastatic carcinoma from #33	37	.				0	0	+	0	.	.	.	108	121
44	Metastatic carcinoma from #34	58	.				0	0	+	+	.	.	.	66	119
45	Metastatic carcinoma from #35	37	.				0	0	0	+	.	.	.	86	155
46	Metastatic carcinoma from #36	66	.				0	0	0	0	.	.	.	142	166
47	Metastatic carcinoma from #37	51	.				0	0	+	0	.	.	.	136	172

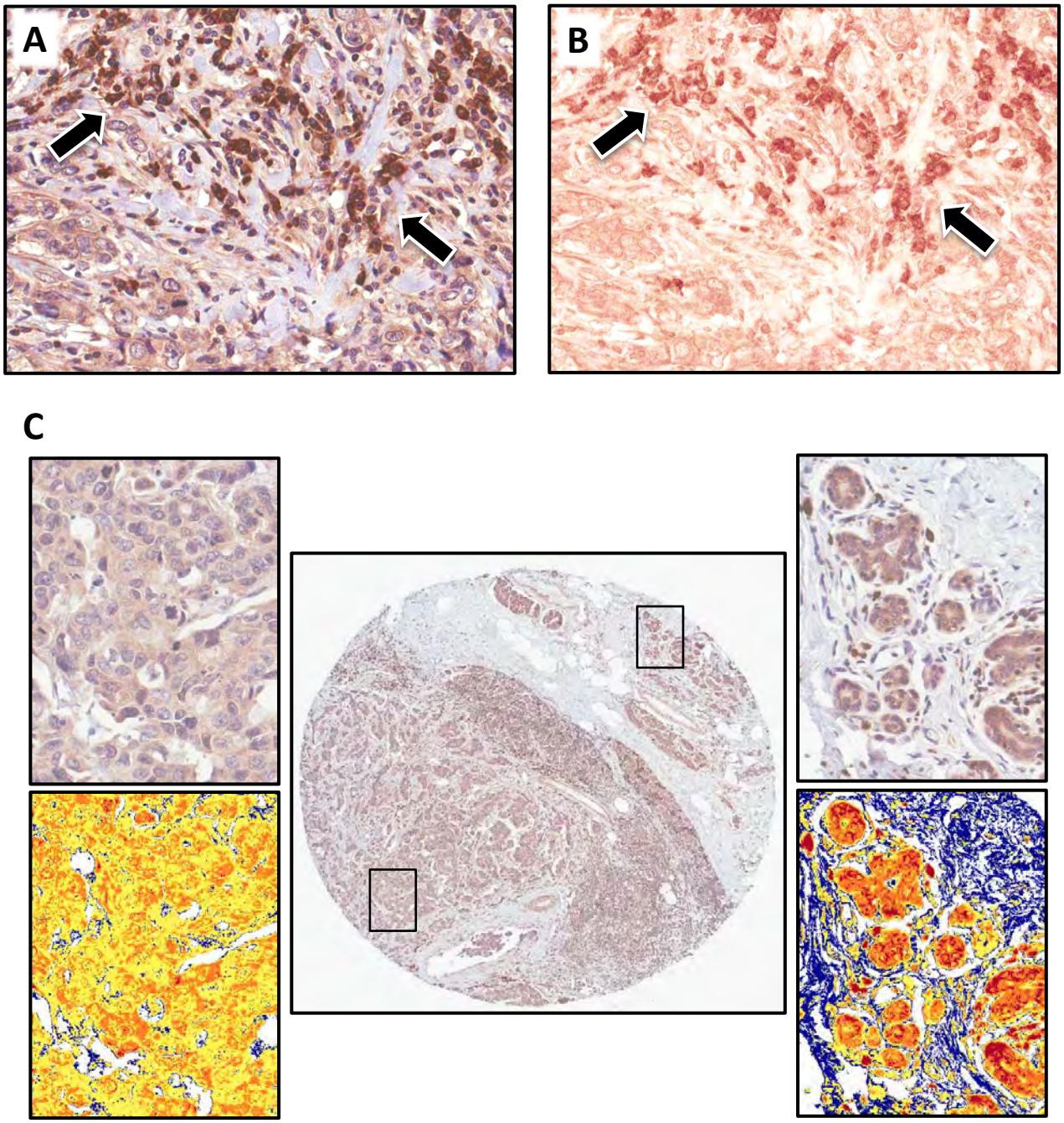
#	Diagnosis	Age	Tumor size	pTNM	Stage	LN	ER	PR	p53	ErbB2	Follow-up (months)	Follow-up result	Cause of death	PP2A-A Score	PP2A-C Score
48	Metastatic carcinoma from #38	41	.				0	0	0	+	.	.	.	128	149
49	Metastatic carcinoma from #39	56	.				0	0	+	+	.	.	.	59	62
50	Metastatic carcinoma from #40	47	.				0	0	+	0	.	.	.	66	94
51	Normal (match to #5)		.				.	.	.	.	.	.	.	38	8
52	Normal (match to #31)		.				.	.	.	.	.	.	.	105	79
53	Normal (match to #8)		.				.	.	.	.	.	.	.	182	121
54	Normal (match to #10)		.				.	.	.	.	.	.	.	121	104
55	Normal (match to #11)		.				.	.	.	.	.	.	.	142	
56	Normal (match to #12)		.				.	.	.	.	.	.	.	157	165
57	Normal (match to #13)		.				.	.	.	.	.	.	.	155	101
58	Normal (match to #34)		.				.	.	.	.	.	.	.	149	153
59	Normal (match to #35)		.				.	.	.	.	.	.	.	142	109
60	Carbon		.				.	.	.	.	.	.	.		

Spot numbers (#) correspond to those shown in Figure 3.38. TNM and Stage: AJCC Cancer staging manual (6^{th} Ed). LN = lymph nodes positive lymph nodes/lymph nodes examined. ER = Estrogen receptor, PR = Progesterone receptor.



Appendix 13 Regions of analysis for PP2A-A expression in breast tumour arrays .

Human tissue arrays were analysed for PP2A subunit expression by immunohistochemistry using anti-PP2A antibodies. Slides were then scanned with an Aperio Scanscope and PP2A subunit expression was quantitated using the Aperio Colour Deconvolution algorithm. For normal epithelium cores and also tumour samples that were not homogenous, ducts or tumour tissues were traced prior to analysis. Note that for some cores with areas of tissue damage, negative tracing was used to exclude these regions – these are dashed lines on tracings.

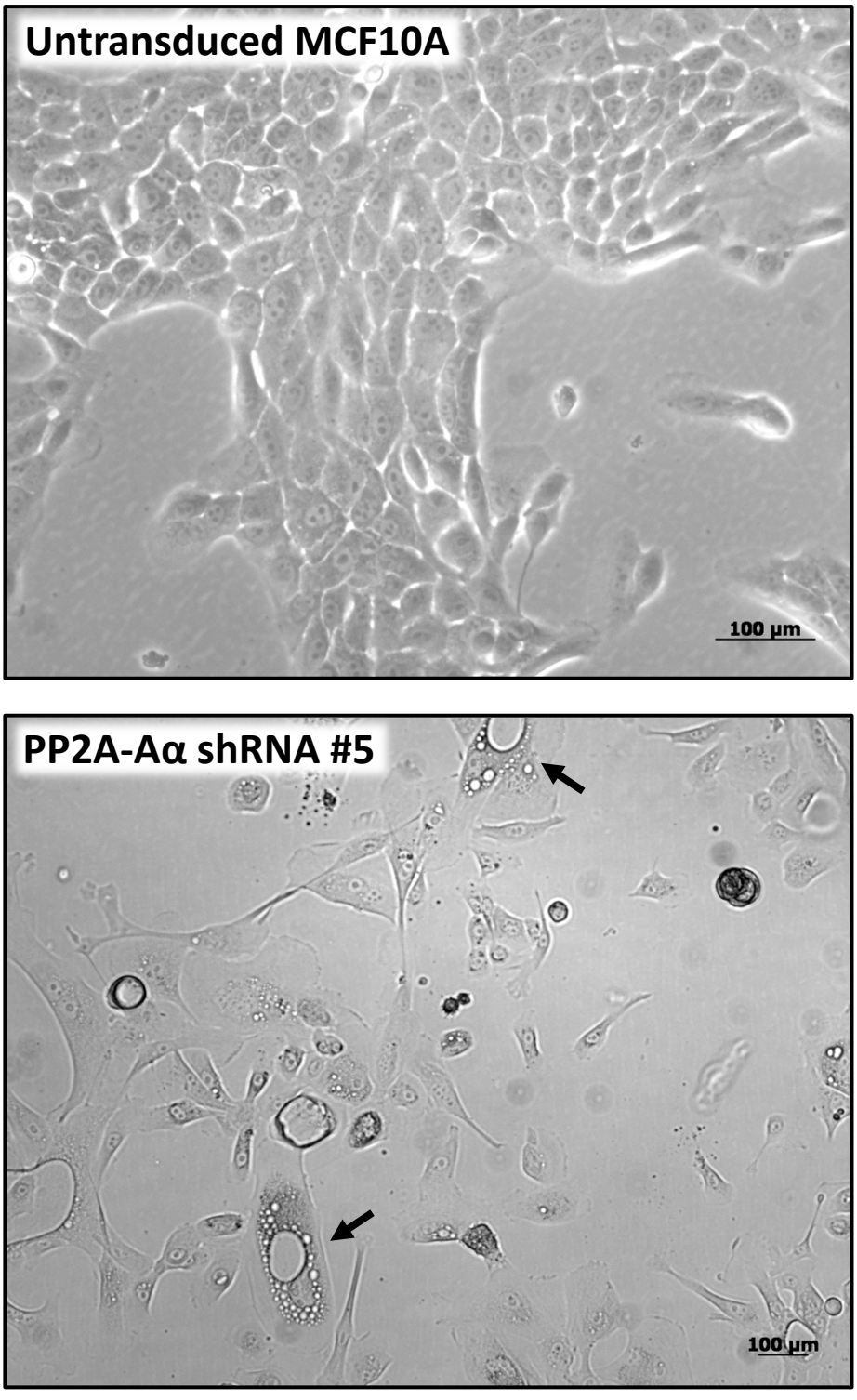


Appendix 14 PP2A-B'γ is highly expressed in plasma cells with considerable levels of background staining.

A) Breast tumour core stained with PP2A-B'γ (brown) and nuclei are stained with hematoxylin (blue). Arrows indicate plasma cells as identified by a pathologist. In comparison the levels of tumour cell staining would be considered background staining.

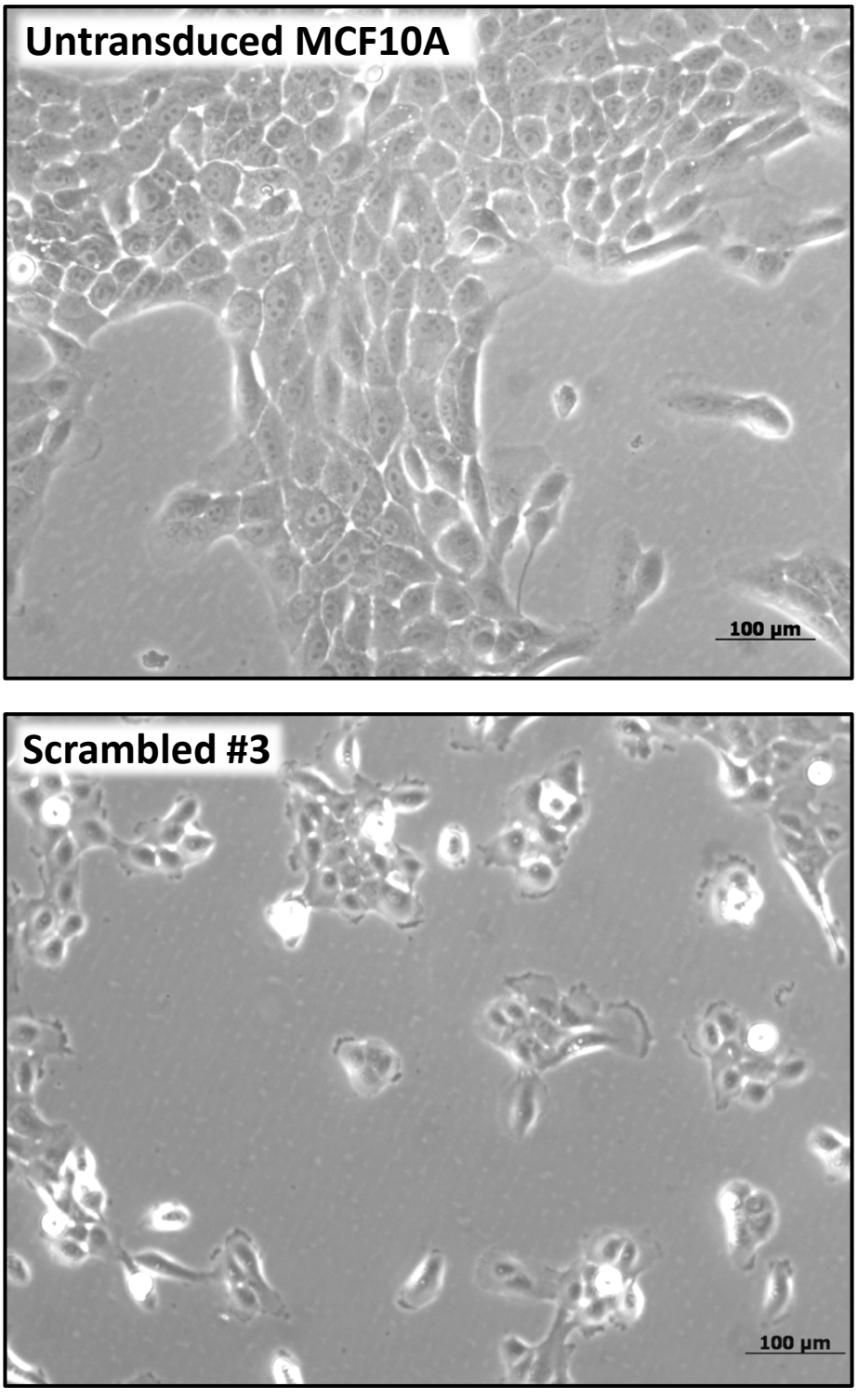
B) PP2A-B'γ (brown) only as for (A).

C) An example of PP2A-B'γ staining in a breast tumour core (#33) with tumour tissue (left) which demonstrates lower intensity staining compared with normal ducts (right). Below each enlargement is a colour representation of the staining intensity, with dark blue = negative, yellow = 1+, orange = 2+ and red = 3+.



Appendix 15 Apoptotic appearance of MCF10A cells with PP2A-Aα expression suppressed below 20%.

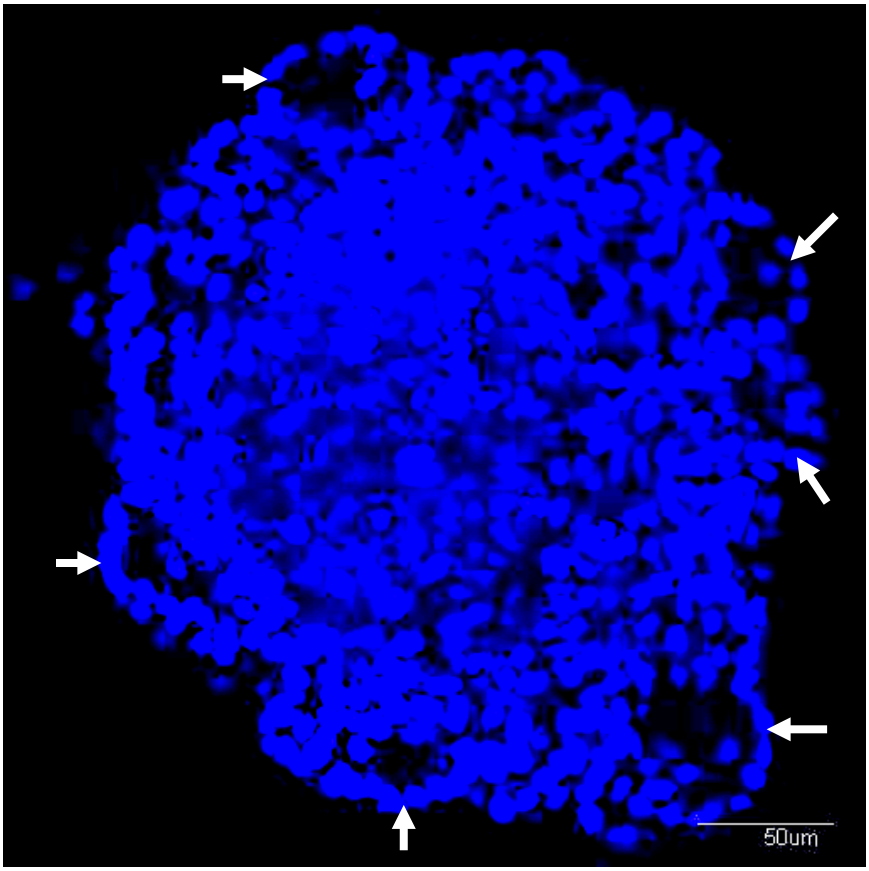
MCF10A cells were transduced with an shRNA sequence that knocks down PP2A-Aα expression. This clone had less than 20% expression compared to untransduced MCF10A cells, proliferated very slowly and eventually died. Arrows indicate cells that seem to have apoptotic vacuoles.



Appendix 16 MCF10A cells infected with scrambled shRNA constructs have an altered cellular morphology compared to untransduced MCF10A cells.

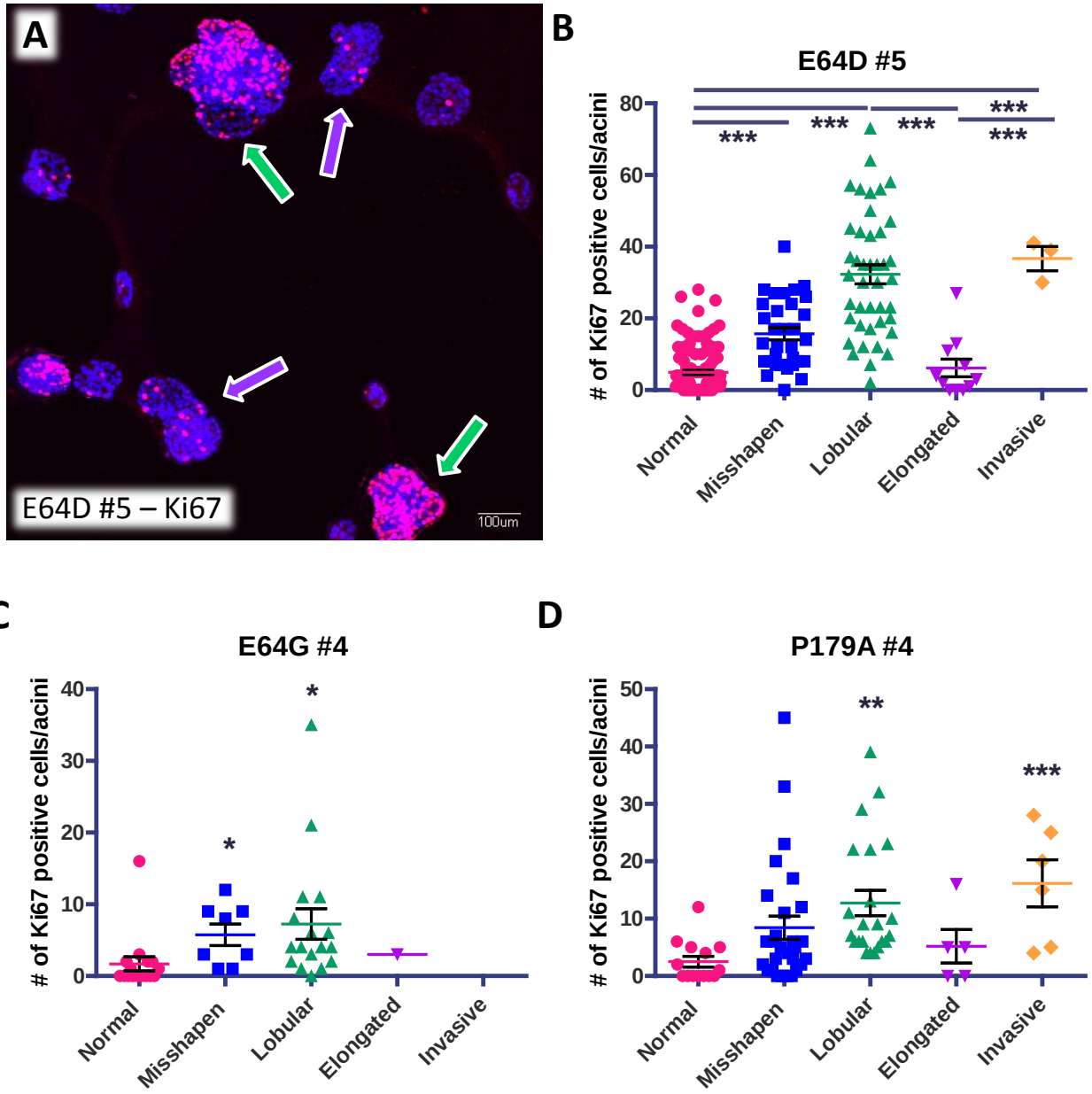
MCF10A cells were transduced with an shRNA sequence that does not encode any known protein sequence. However, for an unknown reason these cells had an altered cellular phenotype under normal cell culture conditions.

Day 20 PP2A-Bα shRNA lobular acini



Appendix 17 PP2A-Bα shRNA acini have small, but cleared lobes protruding from the central acini.

MCF10A-Bα shRNA cells were cultured from single cells on extracellular matrix proteins for 20 days as a model of mammary gland development. Acini were fixed, permeabilised and nuclei were labelled with DAPI (blue). Scale bar = 50µm. Lobes are marked with white arrows.

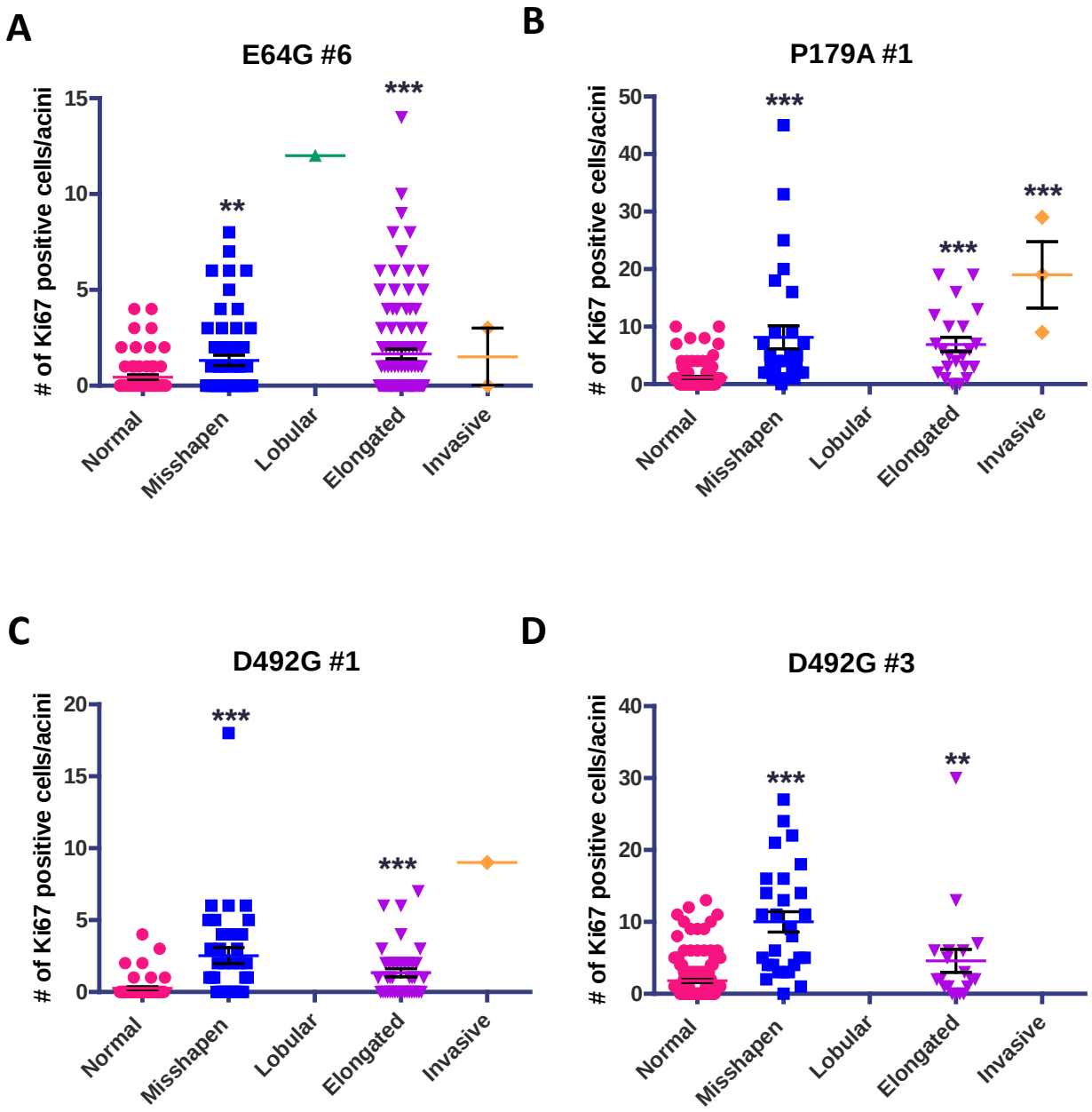


Appendix 18a Proliferation rate of PP2A-Aα mutant acini demonstrating a lobular phenotype.

Acini were cultured from single cells on a bed of extracellular matrix proteins for 20 days as a model of mammary gland development.

A) Acini were fixed, permeabilised and proteins detected with anti-Ki67 antibody as a marker of cellular proliferation, followed by secondary fluorescently labelled antibody (red). Nuclei were labelled with DAPI (blue). Scale bar = 50µm. Green arrows indicate lobular phenotype, purple arrows indicate elongated phenotype. Lobular phenotype have more proliferating cells compared to elongated phenotype.

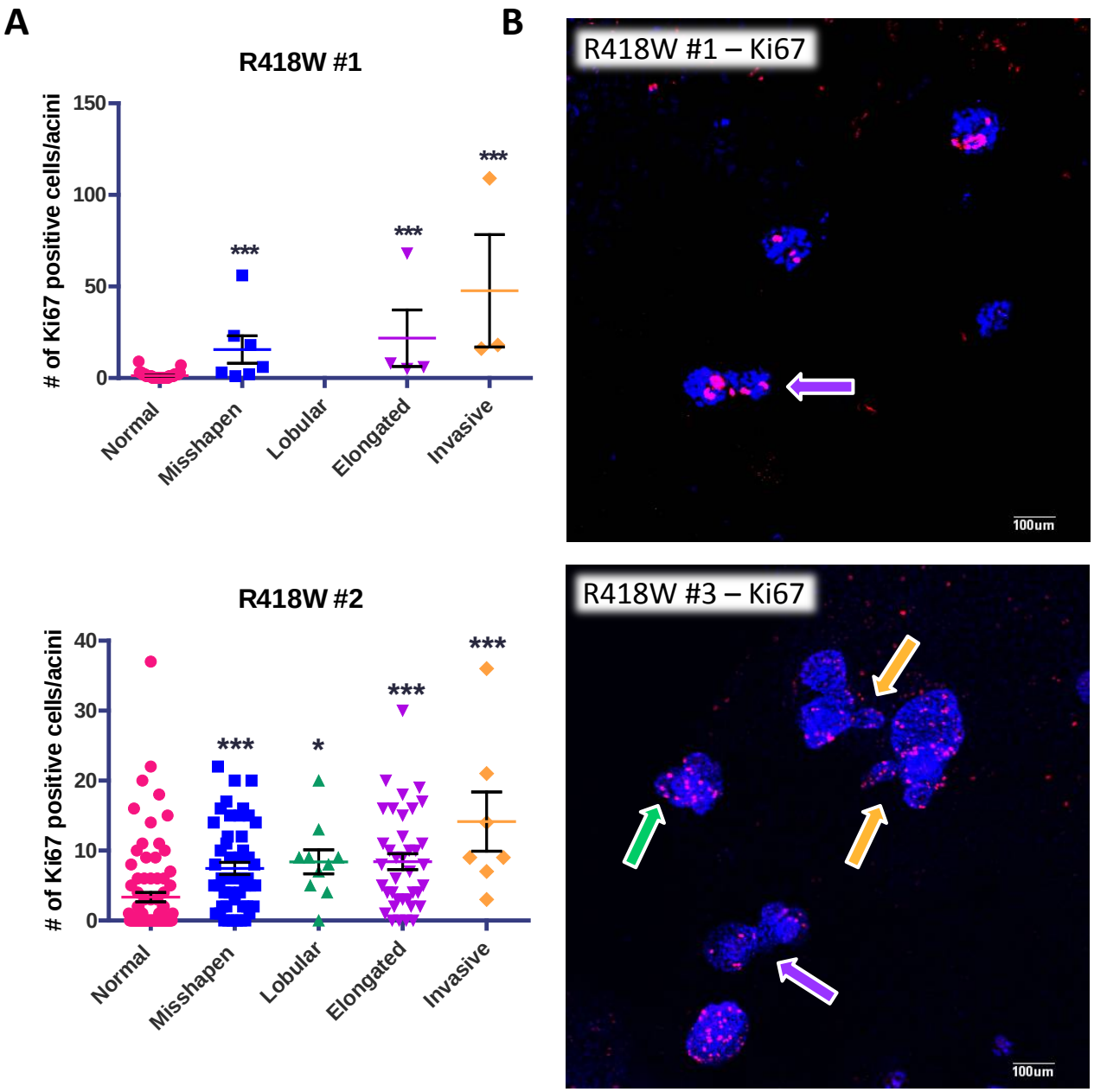
B-D)The proliferation rate of 3D cultures was determined by counting the number of Ki67 positive cells per acini, and plotting according to acini morphology. Error bars are standard error of the mean. *p<0.05, **p<0.01, ***p<0.001 compared to normal morphology for each cell line using a students t-test, or as indicated by horizontal bars in E64D #5. Lobular phenotype have more proliferating cells compared to elongated phenotype for all PP2A-Aα mutants with a predominantly lobular phenotype: E64D #5 (B), E64G #4 (C) and P179A #4 (D).



Appendix 18b Proliferation rate of PP2A-Aα mutant acini demonstrating an elongated phenotype.

Acini were cultured from single cells on a bed of extracellular matrix proteins for 20 days as a model of mammary gland development. The proliferation rate of 3D cultures was determined by counting the number of Ki67 positive cells per acini, and plotting according to acini morphology. Error bars are standard error of the mean. **p<0.01, ***p<0.001 compared to normal morphology for each cell line using a students t-test.

The elongated phenotype have a higher proliferation rate than normal acini, but are less proliferative than the lobular pheontype in Appendix 17a.

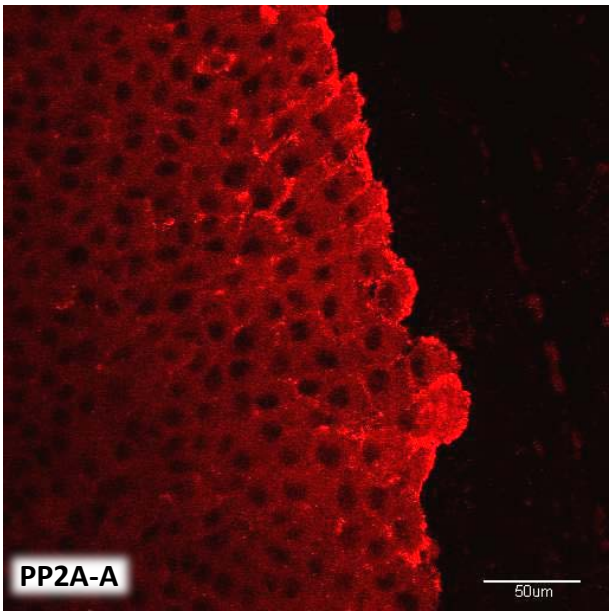


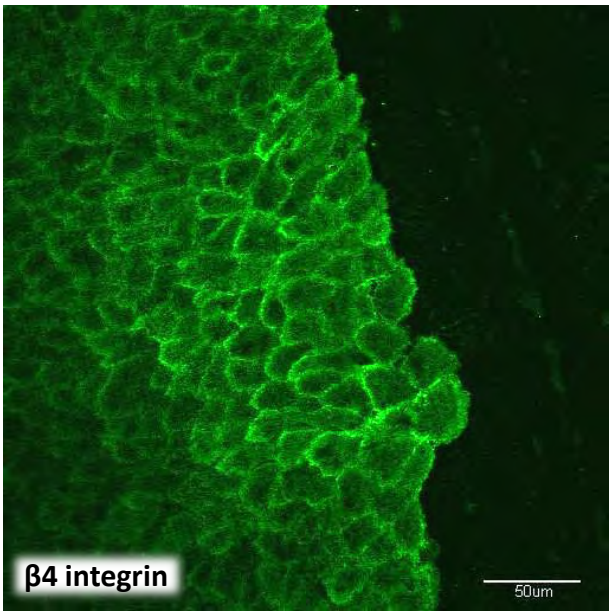
Appendix 18c Proliferation rate of PP2A-Aα R418W mutant acini.

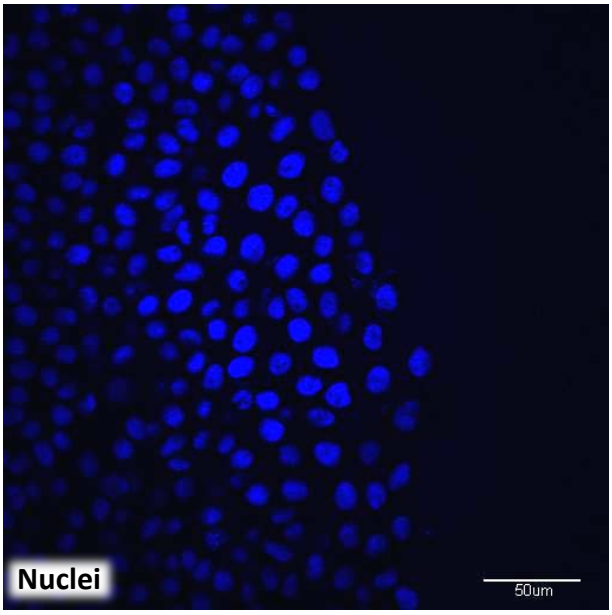
Acini were cultured from single cells on a bed of extracellular matrix proteins for 20 days as a model of mammary gland development.

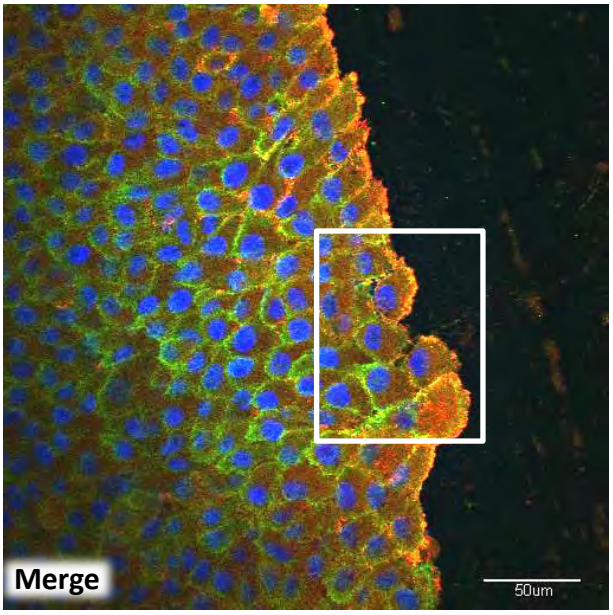
A) The proliferation rate of 3D cultures was determined by counting the number of Ki67 positive cells per acini, and plotting according to acini morphology. Error bars are standard error of the mean. *p<0.05, ***p<0.001 compared to normal morphology for each cell line using a students t-test. The few invasive acini have more proliferating cells compared to both the lobular and elongated phenotypes.

B) Acini were fixed, permeabilised and proteins detected with anti-Ki67 antibody as a marker of cellular proliferation, followed by secondary fluorescently labelled antibody (red). Nuclei were labelled with DAPI (blue). Scale bar = 50µm. Green arrows indicate lobular, purple arrows indicate elongated and orange arrows indicate invasive phenotypes.



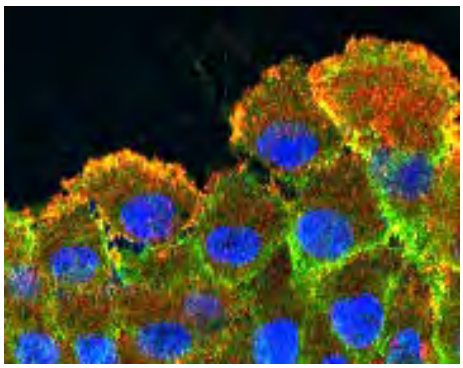






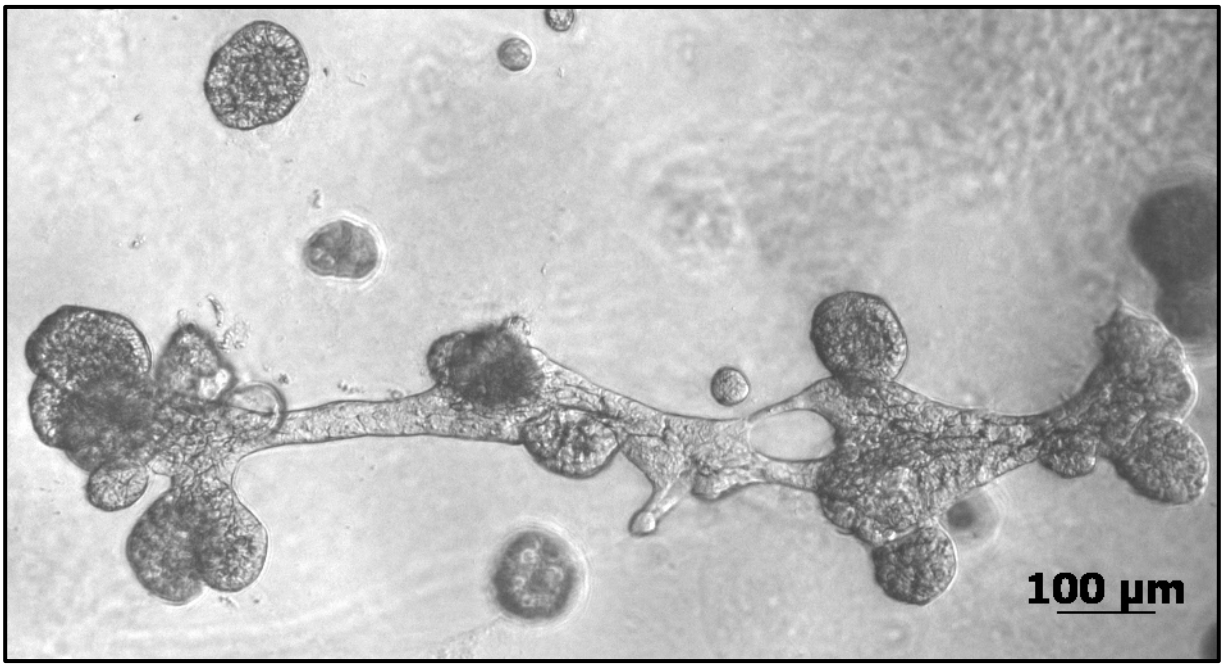
Appendix 19 PP2A co-localises with integrins at the migrating edge of an MCF10A wound healing assay.

Confluent monolayers of MCF10A cells were scratched with pipette tip and then allowed to begin migrating overnight. The following day, cells were fixed, permeabilised and proteins detected with specific antibodies as indicated, followed by secondary fluorescently labelled antibodies. Nuclei were labelled with DAPI (blue). Scale bar = 50µm.



PP2A-A (red) and β4 integrin (green) are upregulated at the migrating edge of a wound.

Day 12 R418W #2 invasive acini



Appendix 20 PP2A-Aα R418W mutants produced a few structures that were very invasive in appearance.

Acini were cultured from single cells on a bed of extracellular matrix proteins for up to 20 days as a model of mammary gland development. In both of the R418W clones examined, a few structures with an invasive appearance, which were able to grow full acini-type structures from the ends of the larger structure were observed. As these structures were very large, they were destroyed during the numerous washing procedures associated with immunofluorescence staining and thus were unable to examined for PP2A expression.

REFERENCES

Abraham, D., K. Podar, et al. (2000). "Raf-1-associated protein phosphatase 2A as a positive regulator of kinase activation." J Biol Chem **275**(29): 22300-4.

Adams, D. G., R. L. Coffee, Jr., et al. (2005). "Positive regulation of Raf1-MEK1/2-ERK1/2 signaling by protein serine/threonine phosphatase 2A holoenzymes." J Biol Chem **280**(52): 42644-54.

Agrawal, A., E. Gutteridge, et al. (2005). "Overview of tyrosine kinase inhibitors in clinical breast cancer." Endocr Relat Cancer **12 Suppl 1**: S135-44.

Ahn, J. H., T. McAvoy, et al. (2007). "Protein kinase A activates protein phosphatase 2A by phosphorylation of the B56delta subunit." Proc Natl Acad Sci U S A **104**(8): 2979-84.

AIHW, Australian Institute of Health and Welfare & National Breast and Ovarian Cancer Centre 2009. Breast cancer in Australia: an overview, 2009. Cancer series no. 50. Cat. no. CAN 46. Canberra: AIHW.

Alessi, D. R., N. Gomez, et al. (1995). "Inactivation of p42 M AP kinase by protein phosphatase 2A and a protein tyrosine phosphatase, but not CL100, in various cell lines." Curr Biol **5**(3): 283-95.

Anderson, W. F., N. Chatterjee, et al. (2002). "Estrogen receptor breast cancer phenotypes in the Surveillance, Epidemiology, and End Results database." Breast Cancer Res Treat **76**(1): 27-36.

Andrabi, S., O. V. Gjoerup, et al. (2007). "Protein phosphatase 2A regulates life and death decisions via Akt in a context-dependent manner." Proc Natl Acad Sci U S A **104**(48): 19011-6.

Antoniou, A. C. and D. F. Easton (2006). "Models of genetic susceptibility to breast cancer." Oncogene **25**(43): 5898-905.

Arnold, H. K. and R. C. Sears (2006). "Protein phosphatase 2A regulatory subunit B56alpha associates with c-myc and negatively regulates c-myc accumulation." Mol Cell Biol **26**(7): 2832-44.

Arnold, H. K. and R. C. Sears (2008). "A tumor suppressor role for PP2A-B56alpha through negative regulation of c-Myc and other key oncoproteins." Cancer Metastasis Rev **27**(2): 147-58.

Arnold, H. K., X. Zhang, et al. (2009). "The Axin1 scaffold protein promotes formation of a degradation complex for c-Myc." EMBO J **28**(5): 500-12.

Bachman, K. E., P. Argani, et al. (2004). "The PIK3CA gene is mutated with high frequency in human breast cancers." Cancer Biol Ther **3**(8): 772-5.

Badache, A. and A. Goncalves (2006). "The ErbB2 signaling network as a target for breast cancer therapy." J Mammary Gland Biol Neoplasia **11**(1): 13-25.

Baharians, Z. and A. H. Schonthal (1998). "Autoregulation of protein phosphatase type 2A expression." J Biol Chem **273**(30): 19019-24.

Barbanti-Brodano, G., S. Sabbioni, et al. (2004). "Simian virus 40 infection in humans and association with human diseases: results and hypotheses." Virology **318**(1): 1-9.

Barisic, S., C. Schmidt, et al. (2010). "Tyrosine phosphatase inhibition triggers sustained canonical serine-dependent NFkappaB activation via Src-dependent blockade of PP2A." Biochem Pharmacol **80**(4): 439-47.

Baselga, J., J. Albanell, et al. (2005). "Phase II and tumor pharmacodynamic study of gefitinib in patients with advanced breast cancer." J Clin Oncol **23**(23): 5323-33.

Baselga, J. and L. Norton (2002). "Focus on breast cancer." Cancer Cell **1**(4): 319-22.

Bennett, H. L., T. Brummer, et al. (2008). "Gab2 and Src co-operate in human mammary epithelial cells to promote growth factor independence and disruption of acinar morphogenesis." Oncogene **27**(19): 2693-704.

Bentzon, N., M. During, et al. (2008). "Prognostic effect of estrogen receptor status across age in primary breast cancer." Int J Cancer **122**(5): 1089-94.

Berns, K., H. M. Horlings, et al. (2007). "A functional genetic approach identifies the PI3K pathway as a major determinant of trastuzumab resistance in breast cancer." Cancer Cell **12**(4): 395-402.

Bertoli, C., T. Copetti, et al. (2009). "Calpain small-1 modulates Akt/FoxO3A signaling and apoptosis through PP2A." Oncogene **28**(5): 721-33.

Bhasin, N., S. R. Cunha, et al. (2007). "Molecular basis for PP2A regulatory subunit B56alpha targeting in cardiomyocytes." Am J Physiol Heart Circ Physiol **293**(1): H109-19.

Bialojan, C. and A. Takai (1988). "Inhibitory effect of a marine-sponge toxin, okadaic acid, on protein phosphatases. Specificity and kinetics." Biochem J **256**(1): 283-90.

Bissell, M. J. and D. Radisky (2001). "Putting tumours in context." Nat Rev Cancer **1**(1): 46-54.

Bissell, M. J., D. C. Radisky, et al. (2002). "The organizing principle: microenvironmental influences in the normal and malignant breast." Differentiation **70**(9-10): 537-46.

Bissell, M. J., A. Rizki, et al. (2003). "Tissue architecture: the ultimate regulator of breast epithelial function." Curr Opin Cell Biol **15**(6): 753-62.

Bissell, M. J., V. M. Weaver, et al. (1999). "Tissue structure, nuclear organization, and gene expression in normal and malignant breast." Cancer Res **59**(7 Suppl): 1757-1763s; discussion 1763s-1764s.

Blackwell, K. L., H. J. Burstein, et al. (2010). "Randomized study of Lapatinib alone or in combination with trastuzumab in women with ErbB2-positive, trastuzumab-refractory metastatic breast cancer." J Clin Oncol **28**(7): 1124-30.

Blatchford, D. R., L. H. Quarrie, et al. (1999). "Influence of microenvironment on mammary epithelial cell survival in primary culture." J Cell Physiol **181**(2): 304-11.

Blume-Jensen, P. and T. Hunter (2001). "Oncogenic kinase signalling." Nature **411**(6835): 355-65.

Boasberg, P. D., C. H. Redfern, et al. (2011). "Pilot study of PD-0325901 in previously treated patients with advanced melanoma, breast cancer, and colon cancer." Cancer Chemother Pharmacol **68**(2): 547-52.

Bocca, C., F. Bozzo, et al. (2010). "CLA reduces breast cancer cell growth and invasion through ERalpha and PI3K/Akt pathways." Chem Biol Interact **183**(1): 187-93.

Bockelman, C., H. Lassus, et al. (2011). "Prognostic role of CIP2A expression in serous ovarian cancer." Br J Cancer **105**(7): 989-95.

Boudreau, R. T., D. M. Conrad, et al. (2007). "Apoptosis induced by protein phosphatase 2A (PP2A) inhibition in T leukemia cells is negatively regulated by PP2A-associated p38 mitogen-activated protein kinase." Cell Signal **19**(1): 139-51.

Brewis, N. D., A. J. Street, et al. (1993). "PPX, a novel protein serine/threonine phosphatase localized to centrosomes." EMBO J 12(3): 987-96.

Brewster, A. and K. Helzlsouer (2001). "Breast cancer epidemiology, prevention, and early detection." Curr Opin Oncol **13**(6): 420-5.

Briand, P. and A. E. Lykkesfeldt (2001). "An in vitro model of human breast carcinogenesis: epigenetic aspects." Breast Cancer Res Treat **65**(2): 179-87.

Briand, P., K. V. Nielsen, et al. (1996). "Trisomy 7p and malignant transformation of human breast epithelial cells following epidermal growth factor withdrawal." Cancer Res **56**(9): 2039-44.

Briand, P., O. W. Petersen, et al. (1987). "A new diploid nontumorigenic human breast epithelial cell line isolated and propagated in chemically defined medium." In Vitro Cell Dev Biol **23**(3): 181-8.

Briggs, M. W. and D. B. Sacks (2003). "IQGAP proteins are integral components of cytoskeletal regulation." EMBO Rep **4**(6): 571-4.

Brummer, T., D. Schramek, et al. (2006). "Increased proliferation and altered growth factor dependence of human mammary epithelial cells overexpressing the Gab2 docking protein." J Biol Chem **281**(1): 626-37.

Cailleau, R., M. Olive, et al. (1978). "Long-term human breast carcinoma cell lines of metastatic origin: preliminary characterization." In Vitro **14**(11): 911-5.

Calin, G. A., M. G. di Iasio, et al. (2000). "Low frequency of alterations of the alpha (PPP2R1A) and beta (PPP2R1B) isoforms of the subunit A of the serine-threonine phosphatase 2A in human neoplasms." Oncogene **19**(9): 1191-5.

Campbell, K. S., K. R. Auger, et al. (1995). "Identification of regions in polyomavirus middle T and small t antigens important for association with protein phosphatase 2A." J Virol **69**(6): 3721-8.

Cantley, L. C. (2002). "The phosphoinositide 3-kinase pathway." Science **296**(5573): 1655-7.

Carlson, S. G., E. Eng, et al. (1998). "Expression of SET, an inhibitor of protein phosphatase 2A, in renal development and Wilms' tumor." J Am Soc Nephrol **9**(10): 1873-80.

Carpten, J. D., A. L. Faber, et al. (2007). "A transforming mutation in the pleckstrin homology domain of AKT1 in cancer." Nature **448**(7152): 439-44.

Cayla, X., K. Ballmer-Hofer, et al. (1993). "Phosphatase 2A associated with polyomavirus small-T or middle-T antigen is an okadaic acid-sensitive tyrosyl phosphatase." Eur J Biochem **214**(1): 281-6.

Cayla, X., J. Goris, et al. (1990). "Isolation and characterization of a tyrosyl phosphatase activator from rabbit skeletal muscle and Xenopus laevis oocytes." Biochemistry **29**(3): 658-67.

Chabottaux, V., N. E. Sounni, et al. (2006). "Membrane-type 4 matrix metalloproteinase promotes breast cancer growth and metastases." Cancer Res **66**(10): 5165-72.

Chambliss, K. L., Q. Wu, et al. (2010). "Non-nuclear estrogen receptor alpha signaling promotes cardiovascular protection but not uterine or breast cancer growth in mice." J Clin Invest **120**(7): 2319-30.

Chao, Y., Y. Xing, et al. (2006). "Structure and mechanism of the phosphotyrosyl phosphatase activator." Mol Cell **23**(4): 535-46.

Chen, J., B. L. Martin, et al. (1992). "Regulation of protein serine-threonine phosphatase type-2A by tyrosine phosphorylation." Science **257**(5074): 1261-4.

Chen, J., S. Parsons, et al. (1994). "Tyrosine phosphorylation of protein phosphatase 2A in response to growth stimulation and v-src transformation of fibroblasts." J Biol Chem **269**(11): 7957-62.

Chen, J., R. T. Peterson, et al. (1998). "Alpha 4 associates with protein phosphatases 2A, 4, and 6." Biochem Biophys Res Commun **247**(3): 827-32.

Chen, J., J. R. St-Germain, et al. (2005a). "B56 regulatory subunit of protein phosphatase 2A mediates valproic acid-induced p300 degradation." Mol Cell Biol **25**(2): 525-32.

Chen, L. P., Y. D. Lai, et al. (2011). "alpha4 is highly expressed in carcinogen-transformed human cells and primary human cancers." Oncogene **30**(26): 2943-53.

Chen, W., J. D. Arroyo, et al. (2005b). "Cancer-associated PP2A Aalpha subunits induce functional haploinsufficiency and tumorigenicity." Cancer Res **65**(18): 8183-92.

Chen, W., R. Possemato, et al. (2004). "Identification of specific PP2A complexes involved in human cell transformation." Cancer Cell **5**(2): 127-36.

Chen, Y., Y. Xu, et al. (2007). "Structural and biochemical insights into the regulation of protein phosphatase 2A by small t antigen of SV40." Nat Struct Mol Biol **14**(6): 527-34.

Chiang, C. W., C. Kanies, et al. (2003). "Protein phosphatase 2A dephosphorylation of phosphoserine 112 plays the gatekeeper role for BAD-mediated apoptosis." Mol Cell Biol **23**(18): 6350-62.

Chlebowski, R. T., L. H. Kuller, et al. (2009). "Breast cancer after use of estrogen plus progestin in postmenopausal women." N Engl J Med **360**(6): 573-87.

Cho, U. S., S. Morrone, et al. (2007a). "Structural basis of PP2A inhibition by small t antigen." PLoS Biol **5**(8): e202.

Cho, U. S. and W. Xu (2007b). "Crystal structure of a protein phosphatase 2A heterotrimeric holoenzyme." Nature **445**(7123): 53-7.

Cohen, P. (1989). "The structure and regulation of protein phosphatases." Annu Rev Biochem **58**: 453-508.

Colella, S., H. Ohgaki, et al. (2001). "Reduced expression of the Aalpha subunit of protein phosphatase 2A in human gliomas in the absence of mutations in the Aalpha and Abeta subunit genes." Int J Cancer **93**(6): 798-804.

Come, C., A. Laine, et al. (2009). "CIP2A is associated with human breast cancer aggressivity." Clin Cancer Res **15**(16): 5092-100.

Coyle, Y. M. (2004). "The effect of environment on breast cancer risk." Breast Cancer Res Treat **84**(3): 273-88.

Creyghton, M. P., G. Roel, et al. (2005). "PR72, a novel regulator of Wnt signaling required for Naked cuticle function." Genes Dev **19**(3): 376-86.

Creyghton, M. P., G. Roel, et al. (2006). "PR130 is a modulator of the Wnt-signaling cascade that counters repression of the antagonist Naked cuticle." Proc Natl Acad Sci U S A **103**(14): 5397-402.

Cristobal, I., L. Garcia-Orti, et al. (2011). "PP2A impaired activity is a common event in acute myeloid leukemia and its activation by forskolin has a potent anti-leukemic effect." Leukemia **25**(4): 606-14.

Cullen, B. R. (2006). "Induction of stable RNA interference in mammalian cells." Gene Ther **13**(6): 503-8.

Dagda, R. K., J. A. Zaucha, et al. (2003). "A developmentally regulated, neuron-specific splice variant of the variable subunit Bbeta targets protein phosphatase 2A to mitochondria and modulates apoptosis." J Biol Chem **278**(27): 24976-85.

Dang, C. V., L. M. Resar, et al. (1999). "Function of the c-Myc oncogenic transcription factor." Exp Cell Res **253**(1): 63-77.

De Baere, I., R. Derua, et al. (1999). "Purification of porcine brain protein phosphatase 2A leucine carboxyl methyltransferase and cloning of the human homologue." Biochemistry **38**(50): 16539-47.

De Wulf, P., F. Montani, et al. (2009). "Protein phosphatases take the mitotic stage." Curr Opin Cell Biol **21**(6): 806-15.

Debnath, J. and J. S. Brugge (2005). "Modelling glandular epithelial cancers in three-dimensional cultures." Nat Rev Cancer **5**(9): 675-88.

Debnath, J., K. R. Mills, et al. (2002). "The role of apoptosis in creating and maintaining luminal space within normal and oncogene-expressing mammary acini." Cell **111**(1): 29-40.

Debnath, J., S. K. Muthuswamy, et al. (2003a). "Morphogenesis and oncogenesis of MCF-10A mammary epithelial acini grown in three-dimensional basement membrane cultures." Methods **30**(3): 256-68.

Debnath, J., S. J. Walker, et al. (2003b). "Akt activation disrupts mammary acinar architecture and enhances proliferation in an mTOR-dependent manner." J Cell Biol **163**(2): 315-26.

Deng, X., F. Gao, et al. (2009). "Protein phosphatase 2A inactivates Bcl2's antiapoptotic function by dephosphorylation and up-regulation of Bcl2-p53 binding." Blood **113**(2): 422-8.

Denu, J. M., J. A. Stuckey, et al. (1996). "Form and function in protein dephosphorylation." Cell **87**(3): 361-4.

Dhanasekaran, N. and E. Premkumar Reddy (1998). "Signaling by dual specificity kinases." Oncogene **17**(11 Reviews): 1447-55.

Dohoney, K. M., C. Guillerm, et al. (2004). "Phosphorylation of p53 at serine 37 is important for transcriptional activity and regulation in response to DNA damage." Oncogene **23**(1): 49-57.

Dougherty, M. K., J. Muller, et al. (2005). "Regulation of Raf-1 by direct feedback phosphorylation." Mol Cell **17**(2): 215-24.

Dozier, C., M. Bonyadi, et al. (2004). "Regulation of Chk2 phosphorylation by interaction with protein phosphatase 2A via its B' regulatory subunit." Biol Cell **96**(7): 509-17.

Drummond AJ, A. B., Cheung M, Heled J, Kearse M, Moir R, Stones-Havas S, Sturrock S, Thierer T, Wilson A (2010). Geneious v5.0, http://www.geneious.com

Dutertre, M. and C. L. Smith (2000). "Molecular mechanisms of selective estrogen receptor modulator (SERM) action." J Pharmacol Exp Ther **295**(2): 431-7.

Eichhorn, P. J., M. P. Creyghton, et al. (2008). "Protein phosphatase 2A regulatory subunits and cancer." Biochim Biophys Acta.

Elenbaas, B., L. Spirio, et al. (2001). "Human breast cancer cells generated by oncogenic transformation of primary mammary epithelial cells." Genes Dev **15**(1): 50-65.

Elston, C. W., I. O. Ellis, et al. (1999). "Pathological prognostic factors in breast cancer." Crit Rev Oncol Hematol **31**(3): 209-23.

Engel, L. W. and N. A. Young (1978). "Human breast carcinoma cells in continuous culture: a review." Cancer Res **38**(11 Pt 2): 4327-39.

Engelman, J. A. (2009). "Targeting PI3K signalling in cancer: opportunities, challenges and limitations." Nat Rev Cancer **9**(8): 550-62.

Esplin, E. D., P. Ramos, et al. (2006). "The glycine 90 to aspartate alteration in the Abeta subunit of PP2A (PPP2R1B) associates with breast cancer and causes a deficit in protein function." Genes Chromosomes Cancer **45**(2): 182-90.

Favre, B., S. Zolnierowicz, et al. (1994). "The catalytic subunit of protein phosphatase 2A is carboxyl-methylated in vivo." J Biol Chem **269**(23): 16311-7.

Ferlay, J., H. R. Shin, et al. (2010). "Estimates of worldwide burden of cancer in 2008: GLOBOCAN 2008." Int J Cancer **127**(12): 2893-917.

Forester, C. M., J. Maddox, et al. (2007). "Control of mitotic exit by PP2A regulation of Cdc25C and Cdk1." Proc Natl Acad Sci U S A **104**(50): 19867-72.

Franke, T. F. (2008). "PI3K/Akt: getting it right matters." Oncogene **27**(50): 6473-88.

Friedl, P. and K. Wolf (2003). "Tumour-cell invasion and migration: diversity and escape mechanisms." Nat Rev Cancer **3**(5): 362-74.

Fujiki, H. and M. Suganuma (2009). "Carcinogenic aspects of protein phosphatase 1 and 2A inhibitors." Prog Mol Subcell Biol **46**: 221-54.

Gallay, N., C. Dos Santos, et al. (2009). "The level of AKT phosphorylation on threonine 308 but not on serine 473 is associated with high-risk cytogenetics and

predicts poor overall survival in acute myeloid leukaemia." Leukemia **23**(6): 1029-38.

Gharbi-Ayachi, A., J. C. Labbe, et al. (2010). "The substrate of Greatwall kinase, Arpp19, controls mitosis by inhibiting protein phosphatase 2A." Science **330**(6011): 1673-7.

Gjoerup, O., D. Zaveri, et al. (2001). "Induction of p53-independent apoptosis by simian virus 40 small t antigen." J Virol **75**(19): 9142-55.

Goetz, F., Y. J. Tzeng, et al. (2001). "The SV40 small t-antigen prevents mammary gland differentiation and induces breast cancer formation in transgenic mice; truncated large T-antigen molecules harboring the intact p53 and pRb binding region do not have this effect." Oncogene **20**(18): 2325-32.

Gopalakrishna, R., U. Gundimeda, et al. (1999). "Differential distribution of protein phosphatase 2A in human breast carcinoma cell lines and its relation to estrogen receptor status." Cancer Lett **136**(2): 143-51.

Gordon, L. A., K. T. Mulligan, et al. (2003). "Breast cell invasive potential relates to the myoepithelial phenotype." Int J Cancer **106**(1): 8-16.

Gotz, J., A. Probst, et al. (1998). "Delayed embryonic lethality in mice lacking protein phosphatase 2A catalytic subunit Calpha." Proc Natl Acad Sci U S A **95**(21): 12370-5.

Griswold-Prenner, I., C. Kamibayashi, et al. (1998). "Physical and functional interactions between type I transforming growth factor beta receptors and Balpha, a WD-40 repeat subunit of phosphatase 2A." Mol Cell Biol **18**(11): 6595-604.

Groves, M. R., N. Hanlon, et al. (1999). "The structure of the protein phosphatase 2A PR65/A subunit reveals the conformation of its 15 tandemly repeated HEAT motifs." Cell **96**(1): 99-110.

Guarino, M., B. Rubino, et al. (2007). "The role of epithelial-mesenchymal transition in cancer pathology." Pathology **39**(3): 305-18.

Guy, C. T., R. D. Cardiff, et al. (1992). "Induction of mammary tumors by expression of polyomavirus middle T oncogene: a transgenic mouse model for metastatic disease." Mol Cell Biol **12**(3): 954-61.

Haendeler, J., J. Hoffmann, et al. (2003). "Regulation of telomerase activity and anti-apoptotic function by protein-protein interaction and phosphorylation." FEBS Lett **536**(1-3): 180-6.

Hahn, W. C., C. M. Counter, et al. (1999). "Creation of human tumour cells with defined genetic elements." Nature **400**(6743): 464-8.

Hahn, W. C., S. K. Dessain, et al. (2002). "Enumeration of the simian virus 40 early region elements necessary for human cell transformation." Mol Cell Biol **22**(7): 2111-23.

Harari, D. and Y. Yarden (2000). "Molecular mechanisms underlying ErbB2/HER2 action in breast cancer." Oncogene **19**(53): 6102-14.

Hebner, C., V. M. Weaver, et al. (2008). "Modeling Morphogenesis and Oncogenesis in Three-Dimensional Breast Epithelial Cultures" Annual Review of Pathology: Mechanisms of Disease **3**(1).

Hemmings, B. A., C. Adams-Pearson, et al. (1990). "alpha- and beta-forms of the 65-kDa subunit of protein phosphatase 2A have a similar 39 amino acid repeating structure." Biochemistry **29**(13): 3166-73.

Hendrix, M. J., E. A. Seftor, et al. (1997). "Experimental co-expression of vimentin and keratin intermediate filaments in human breast cancer cells results in phenotypic interconversion and increased invasive behavior." Am J Pathol **150**(2): 483-95.

Hendrix, P., R. E. Mayer-Jackel, et al. (1993). "Structure and expression of a 72-kDa regulatory subunit of protein phosphatase 2A. Evidence for different size forms produced by alternative splicing." J Biol Chem **268**(20): 15267-76.

Hennessy, B. T., D. L. Smith, et al. (2005). "Exploiting the PI3K/AKT pathway for cancer drug discovery." Nat Rev Drug Discov **4**(12): 988-1004.

Hirohashi, S. and Y. Kanai (2003). "Cell adhesion system and human cancer morphogenesis." Cancer Sci **94**(7): 575-81.

Hortobagyi, G. N., J. de la Garza Salazar, et al. (2005). "The global breast cancer burden: variations in epidemiology and survival." Clin Breast Cancer **6**(5): 391-401.

Howell, A. (2006). "Pure oestrogen antagonists for the treatment of advanced breast cancer." Endocr Relat Cancer **13**(3): 689-706.

Hunter, D. J., G. A. Colditz, et al. (2010). "Oral contraceptive use and breast cancer: a prospective study of young women." Cancer Epidemiol Biomarkers Prev **19**(10): 2496-502.

Ichaso, N. and S. M. Dilworth (2001). "Cell transformation by the middle T-antigen of polyoma virus." Oncogene **20**(54): 7908-16.

Ikehara, T., S. Ikehara, et al. (2007). "Methylation of the C-terminal leucine residue of the PP2A catalytic subunit is unnecessary for the catalytic activity and the binding of regulatory subunit (PR55/B)." Biochem Biophys Res Commun **354**(4): 1052-7.

Inui, S., H. Sanjo, et al. (1998). "Ig receptor binding protein 1 (alpha4) is associated with a rapamycin-sensitive signal transduction in lymphocytes through direct binding to the catalytic subunit of protein phosphatase 2A." Blood **92**(2): 539-46.

Isakoff, S. J., J. A. Engelman, et al. (2005). "Breast cancer-associated PIK3CA mutations are oncogenic in mammary epithelial cells." Cancer Res **65**(23): 10992-1000.

Ishibe, S., D. Joly, et al. (2003). "Phosphorylation-dependent paxillin-ERK association mediates hepatocyte growth factor-stimulated epithelial morphogenesis." Mol Cell **12**(5): 1275-85.

Ito, A., T. R. Kataoka, et al. (2000). "A truncated isoform of the PP2A B56 subunit promotes cell motility through paxillin phosphorylation." Embo J **19**(4): 562-71.

Ito, A., Y. Koma, et al. (2003). "A truncated isoform of the protein phosphatase 2A B56gamma regulatory subunit may promote genetic instability and cause tumor progression." Am J Pathol **162**(1): 81-91.

Ivaska, J., L. Nissinen, et al. (2002). "Integrin alpha 2 beta 1 promotes activation of protein phosphatase 2A and dephosphorylation of Akt and glycogen synthase kinase 3 beta." Mol Cell Biol **22**(5): 1352-9.

Jackson, J. L. and M. R. Young (2002). "Protein phosphatase-2A modulates the serine and tyrosine phosphorylation of paxillin in Lewis lung carcinoma tumor variants." Clin Exp Metastasis **19**(5): 409-15.

Janssens, V. and J. Goris (2001). "Protein phosphatase 2A: a highly regulated family of serine/threonine phosphatases implicated in cell growth and signalling." Biochem J **353**(Pt 3): 417-39.

Janssens, V., J. Goris, et al. (2005). "PP2A: the expected tumor suppressor." Curr Opin Genet Dev **15**(1): 34-41.

Janssens, V., J. Jordens, et al. (2003). "Identification and functional analysis of two Ca2+-binding EF-hand motifs in the B"/PR72 subunit of protein phosphatase 2A." J Biol Chem **278**(12): 10697-706.

Janssens, V., S. Longin, et al. (2008). "PP2A holoenzyme assembly: in cauda venenum (the sting is in the tail)." Trends Biochem Sci **33**(3): 113-21.

Jaumot, M. and J. F. Hancock (2001). "Protein phosphatases 1 and 2A promote Raf-1 activation by regulating 14-3-3 interactions." Oncogene **20**(30): 3949-58.

Jemal, A., F. Bray, et al. (2011). "Global cancer statistics." CA Cancer J Clin **61**(2): 69-90.

Jeng, M. H., W. Yue, et al. (2000). "Role of MAP kinase in the enhanced cell proliferation of long term estrogen deprived human breast cancer cells." Breast Cancer Res Treat **62**(3): 167-75.

Jiang, Q., C. Zhang, et al. (2011). "The set gene is a potential oncogene in human colorectal adenocarcinoma and oral squamous cell carcinoma." Mol Med Report **4**(5): 993-9.

Jones, C., J. Payne, et al. (2000). "Comparative genomic hybridization reveals extensive variation among different MCF-7 cell stocks." Cancer Genet Cytogenet **117**(2): 153-8.

Jones, J. L., J. E. Royall, et al. (1997). "Modulation of myoepithelial-associated alpha6beta4 integrin in a breast cancer cell line alters invasive potential." Exp Cell Res **235**(2): 325-33.

Jones, S., T. L. Wang, et al. (2010). "Frequent mutations of chromatin remodeling gene ARID1A in ovarian clear cell carcinoma." Science **330**(6001): 228-31.

Jordens, J., V. Janssens, et al. (2006). "The protein phosphatase 2A phosphatase activator is a novel peptidyl-prolyl cis/trans-isomerase." J Biol Chem **281**(10): 6349-57.

Junttila, M. R., S. P. Li, et al. (2008). "Phosphatase-mediated crosstalk between MAPK signaling pathways in the regulation of cell survival." Faseb J **22**(4): 954-65.

Junttila, M. R., P. Puustinen, et al. (2007). "CIP2A inhibits PP2A in human malignancies." Cell **130**(1): 51-62.

Kalinsky, K., L. M. Jacks, et al. (2009). "PIK3CA mutation associates with improved outcome in breast cancer." Clin Cancer Res **15**(16): 5049-59.

Kalla, C., M. O. Scheuermann, et al. (2007). "Analysis of 11q22-q23 deletion target genes in B-cell chronic lymphocytic leukaemia: evidence for a pathogenic role of NPAT, CUL5, and PPP2R1B." Eur J Cancer **43**(8): 1328-35.

Kang, M. H. and C. P. Reynolds (2009). "Bcl-2 inhibitors: targeting mitochondrial apoptotic pathways in cancer therapy." Clin Cancer Res 15(4): 1126-32.

Karakosta, A., C. Golias, et al. (2005). "Genetic models of human cancer as a multistep process. Paradigm models of colorectal cancer, breast cancer, and chronic myelogenous and acute lymphoblastic leukaemia." J Exp Clin Cancer Res **24**(4): 505-14.

Keely, P. J., J. K. Westwick, et al. (1997). "Cdc42 and Rac1 induce integrin-mediated cell motility and invasiveness through PI(3)K." Nature **390**(6660): 632-6.

Keen, J. C., E. Garrett-Mayer, et al. (2004). "Epigenetic regulation of protein phosphatase 2A (PP2A), lymphotactin (XCL1) and estrogen receptor alpha (ER) expression in human breast cancer cells." Cancer Biol Ther **3**(12): 1304-12.

Keen, J. C., Q. Zhou, et al. (2005). "Protein phosphatase 2A regulates estrogen receptor alpha (ER) expression through modulation of ER mRNA stability." J Biol Chem **280**(33): 29519-24.

Kenemans, P., R. A. Verstraeten, et al. (2004). "Oncogenic pathways in hereditary and sporadic breast cancer." Maturitas **49**(1): 34-43.

Kenny, P. A. and M. J. Bissell (2003). "Tumor reversion: correction of malignant behavior by microenvironmental cues." Int J Cancer **107**(5): 688-95.

Kenny, P. A., G. Y. Lee, et al. (2007). "The morphologies of breast cancer cell lines in three-dimensional assays correlate with their profiles of gene expression." Molecular Oncology **1**(1): 84-96.

Keydar, I., L. Chen, et al. (1979). "Establishment and characterization of a cell line of human breast carcinoma origin." Eur J Cancer **15**(5): 659-70.

Khew-Goodall, Y. and B. A. Hemmings (1988). "Tissue-specific expression of mRNAs encoding alpha- and beta-catalytic subunits of protein phosphatase 2A." FEBS Lett **238**(2): 265-8.

Khew-Goodall, Y., R. E. Mayer, et al. (1991). "Structure and transcriptional regulation of protein phosphatase 2A catalytic subunit genes." Biochemistry **30**(1): 89-97.

Kim, D. and J. Rossi (2008). "RNAi mechanisms and applications." Biotechniques **44**(5): 613-6.

Kim, K. Y., A. Baek, et al. (2009). "Adiponectin-activated AMPK stimulates dephosphorylation of AKT through protein phosphatase 2A activation." Cancer Res **69**(9): 4018-26.

Kim, M. S., E. J. Lee, et al. (2003). "p38 kinase is a key signaling molecule for H-Ras-induced cell motility and invasive phenotype in human breast epithelial cells." Cancer Res **63**(17): 5454-61.

Knowlden, J. M., I. R. Hutcheson, et al. (2003). "Elevated levels of epidermal growth factor receptor/c-erbB2 heterodimers mediate an autocrine growth regulatory pathway in tamoxifen-resistant MCF-7 cells." Endocrinology **144**(3): 1032-44.

Kolch, W. (2000). "Meaningful relationships: the regulation of the Ras/Raf/MEK/ERK pathway by protein interactions." Biochem J **351 Pt 2**: 289-305.

Koma, Y. I., A. Ito, et al. (2004). "A truncated isoform of the PP2A B56gamma regulatory subunit reduces irradiation-induced Mdm2 phosphorylation and could contribute to metastatic melanoma cell radioresistance." Histol Histopathol **19**(2): 391-400.

Kong, M., T. V. Bui, et al. (2007). "The PP2A-associated protein alpha4 plays a critical role in the regulation of cell spreading and migration." J Biol Chem **282**(40): 29712-20.

Kong, M., D. Ditsworth, et al. (2009). "Alpha4 is an essential regulator of PP2A phosphatase activity." Mol Cell **36**(1): 51-60.

Kong, M., C. J. Fox, et al. (2004). "The PP2A-associated protein alpha4 is an essential inhibitor of apoptosis." Science **306**(5696): 695-8.

Kranias, G., L. F. Watt, et al. (2010). "Protein phosphatase 2A carboxymethylation and regulatory B subunits differentially regulate mast cell degranulation." Cell Signal.

Kremmer, E., K. Ohst, et al. (1997). "Separation of PP2A core enzyme and holoenzyme with monoclonal antibodies against the regulatory A subunit: abundant expression of both forms in cells." Mol Cell Biol **17**(3): 1692-701.

Kubicek, M., M. Pacher, et al. (2002). "Dephosphorylation of Ser-259 regulates Raf-1 membrane association." J Biol Chem **277**(10): 7913-9.

Kuo, Y. C., K. Y. Huang, et al. (2008). "Regulation of phosphorylation of Thr-308 of Akt, cell proliferation, and survival by the B55alpha regulatory subunit targeting of the protein phosphatase 2A holoenzyme to Akt." J Biol Chem **283**(4): 1882-92.

Kurimchak, A. and X. Grana (2012). "PP2A holoenzymes negatively and positively regulate cell cycle progression by dephosphorylating pocket proteins and multiple CDK substrates." Gene **499**(1): 1-7.

Lacroix, M. and G. Leclercq (2004). "Relevance of breast cancer cell lines as models for breast tumours: an update." Breast Cancer Res Treat **83**(3): 249-89.

Langlois, A. J., W. D. Holder, Jr., et al. (1979). "Morphological and biochemical properties of a new human breast cancer cell line." Cancer Res **39**(7 Pt 1): 2604-13.

Lannigan, D. A. (2003). "Estrogen receptor phosphorylation." Steroids **68**(1): 1-9.

Lechward, K., O. S. Awotunde, et al. (2001). "Protein phosphatase 2A: variety of forms and diversity of functions." Acta Biochim Pol **48**(4): 921-33.

Lee, J., Y. Chen, et al. (1996). "A specific protein carboxyl methylesterase that demethylates phosphoprotein phosphatase 2A in bovine brain." Proc Natl Acad Sci U S A **93**(12): 6043-7.

Lee, J. and J. Stock (1993). "Protein phosphatase 2A catalytic subunit is methyl-esterified at its carboxyl terminus by a novel methyltransferase." J Biol Chem **268**(26): 19192-5.

Lee, T. Y., T. Y. Lai, et al. (2010). "The B56gamma3 regulatory subunit of protein phosphatase 2A (PP2A) regulates S phase-specific nuclear accumulation of PP2A and the G1 to S transition." J Biol Chem **285**(28): 21567-80.

Leighl, N. B., S. Dent, et al. (2008). "A Phase 2 study of perifosine in advanced or metastatic breast cancer." Breast Cancer Res Treat **108**(1): 87-92.

Letourneux, C., G. Rocher, et al. (2006). "B56-containing PP2A dephosphorylate ERK and their activity is controlled by the early gene IEX-1 and ERK." Embo J **25**(4): 727-38.

Leung, C. T. and J. S. Brugge (2012). "Outgrowth of single oncogene-expressing cells from suppressive epithelial environments." Nature **482**(7385): 410-3.

Li, H. H., X. Cai, et al. (2007). "A specific PP2A regulatory subunit, B56gamma, mediates DNA damage-induced dephosphorylation of p53 at Thr55." Embo J **26**(2): 402-11.

Li, M., A. Makkinje, et al. (1996). "The myeloid leukemia-associated protein SET is a potent inhibitor of protein phosphatase 2A." J Biol Chem **271**(19): 11059-62.

Li, W., Z. Ge, et al. (2008). "CIP2A is overexpressed in gastric cancer and its depletion leads to impaired clonogenicity, senescence, or differentiation of tumor cells." Clin Cancer Res **14**(12): 3722-8.

Li, X., A. Scuderi, et al. (2002). "B56-associated protein phosphatase 2A is required for survival and protects from apoptosis in Drosophila melanogaster." Mol Cell Biol **22**(11): 3674-84.

Liao, Y. and M. C. Hung (2004a). "A new role of protein phosphatase 2a in adenoviral E1A protein-mediated sensitization to anticancer drug-induced apoptosis in human breast cancer cells." Cancer Res **64**(17): 5938-42.

Liao, Y., Y. Y. Zou, et al. (2004b). "Enhanced paclitaxel cytotoxicity and prolonged animal survival rate by a nonviral-mediated systemic delivery of E1A gene in orthotopic xenograft human breast cancer." Cancer Gene Ther **11**(9): 594-602.

Lin, E. Y., J. G. Jones, et al. (2003). "Progression to malignancy in the polyoma middle T oncoprotein mouse breast cancer model provides a reliable model for human diseases." Am J Pathol **163**(5): 2113-26.

Liu, H., D. C. Radisky, et al. (2004a). "Polarity and proliferation are controlled by distinct signaling pathways downstream of PI3-kinase in breast epithelial tumor cells." J Cell Biol **164**(4): 603-12.

Liu, J., T. D. Prickett, et al. (2001). "Phosphorylation and microtubule association of the Opitz syndrome protein mid-1 is regulated by protein phosphatase 2A via binding to the regulatory subunit alpha 4." Proc Natl Acad Sci U S A **98**(12): 6650-5.

Liu, Q. and P. A. Hofmann (2004b). "Protein phosphatase 2A-mediated cross-talk between p38 MAPK and ERK in apoptosis of cardiac myocytes." Am J Physiol Heart Circ Physiol **286**(6): H2204-12.

Longin, S., J. Jordens, et al. (2004). "An inactive protein phosphatase 2A population is associated with methylesterase and can be re-activated by the phosphotyrosyl phosphatase activator." Biochem J **380**(Pt 1): 111-9.

Longin, S., K. Zwaenepoel, et al. (2007). "Selection of protein phosphatase 2A regulatory subunits is mediated by the C terminus of the catalytic Subunit." J Biol Chem **282**(37): 26971-80.

Lorusso, P. M., A. A. Adjei, et al. (2005). "Phase I and pharmacodynamic study of the oral MEK inhibitor CI-1040 in patients with advanced malignancies." J Clin Oncol **23**(23): 5281-93.

LoRusso, P. M., S. S. Krishnamurthi, et al. (2010). "Phase I pharmacokinetic and pharmacodynamic study of the oral MAPK/ERK kinase inhibitor PD-0325901 in patients with advanced cancers." Clin Cancer Res **16**(6): 1924-37.

Lowe, M., N. K. Gonatas, et al. (2000). "The mitotic phosphorylation cycle of the cis-Golgi matrix protein GM130." J Cell Biol **149**(2): 341-56.

Lux, M. P., P. A. Fasching, et al. (2006). "Hereditary breast and ovarian cancer: review and future perspectives." J Mol Med (Berl) **84**(1): 16-28.

Ma, L., Z. S. Wen, et al. (2011). "Overexpression and small molecule-triggered downregulation of CIP2A in lung cancer." PLoS One **6**(5): e20159.

Maemura, M., Y. Iino, et al. (1999). "Mitogen-activated protein kinase cascade in breast cancer." Oncology **57 Suppl 2**: 37-44.

Malaney, S. and R. J. Daly (2001). "The ras signaling pathway in mammary tumorigenesis and metastasis." J Mammary Gland Biol Neoplasia **6**(1): 101-13.

Manchado, E., M. Guillamot, et al. (2010). "Targeting mitotic exit leads to tumor regression in vivo: Modulation by Cdk1, Mastl, and the PP2A/B55alpha,delta phosphatase." Cancer Cell **18**(6): 641-54.

Mannava, S., A. R. Omilian, et al. (2011). "PP2A-B56alpha controls oncogene-induced senescence in normal and tumor human melanocytic cells." Oncogene.

Marcotte, R. and W. J. Muller (2008). "Signal transduction in transgenic mouse models of human breast cancer--implications for human breast cancer." J Mammary Gland Biol Neoplasia **13**(3): 323-35.

Margolis, S. S., J. A. Perry, et al. (2006). "Role for the PP2A/B56delta phosphatase in regulating 14-3-3 release from Cdc25 to control mitosis." Cell **127**(4): 759-73.

Martinez-Lacaci, I., S. Kannan, et al. (2000). "RAS transformation causes sustained activation of epidermal growth factor receptor and elevation of mitogen-activated protein kinase in human mammary epithelial cells." Int J Cancer **88**(1): 44-52.

Matsuoka, Y., Y. Nagahara, et al. (2003). "A novel immunosuppressive agent FTY720 induced Akt dephosphorylation in leukemia cells." Br J Pharmacol **138**(7): 1303-12.

Mayer, R. E., P. Hendrix, et al. (1991). "Structure of the 55-kDa regulatory subunit of protein phosphatase 2A: evidence for a neuronal-specific isoform." Biochemistry **30**(15): 3589-97.

McCright, B., A. R. Brothman, et al. (1996a). "Assignment of human protein phosphatase 2A regulatory subunit genes b56alpha, b56beta, b56gamma, b56delta, and b56epsilon (PPP2R5A-PPP2R5E), highly expressed in muscle and brain, to chromosome regions 1q41, 11q12, 3p21 , 6p21.1, and 7p11.2 --> p12." Genomics **36**(1): 168-70.

McCright, B., A. M. Rivers, et al. (1996b). "The B56 family of protein phosphatase 2A (PP2A) regulatory subunits encodes differentiation-induced phosphoproteins that target PP2A to both nucleus and cytoplasm." J Biol Chem **271**(36): 22081-9.

McCright, B. and D. M. Virshup (1995). "Identification of a new family of protein phosphatase 2A regulatory subunits." J Biol Chem **270**(44): 26123-8.

McGlynn, L. M., T. Kirkegaard, et al. (2009). "Ras/Raf-1/MAPK pathway mediates response to tamoxifen but not chemotherapy in breast cancer patients." Clin Cancer Res **15**(4): 1487-95.

Meisinger, J., S. Patel, et al. (1997). "Protein phosphatase-2A association with microtubules and its role in restricting the invasiveness of human head and neck squamous cell carcinoma cells." Cancer Lett **111**(1-2): 87-95.

Mendelsohn, M. E. and R. H. Karas (2010). "Rapid progress for non-nuclear estrogen receptor signaling." J Clin Invest **120**(7): 2277-9.

Mills, K. R., M. Reginato, et al. (2004). "Tumor necrosis factor-related apoptosis-inducing ligand (TRAIL) is required for induction of autophagy during lumen formation in vitro." Proc Natl Acad Sci U S A **101**(10): 3438-43.

Millward, T. A., S. Zolnierowicz, et al. (1999). "Regulation of protein kinase cascades by protein phosphatase 2A." Trends Biochem Sci **24**(5): 186-91.

Miranti, C. K. and J. S. Brugge (2002). "Sensing the environment: a historical perspective on integrin signal transduction." Nat Cell Biol **4**(4): E83-90.

Mirzoeva, O. K., D. Das, et al. (2009). "Basal subtype and MAPK/ERK kinase (MEK)-phosphoinositide 3-kinase feedback signaling determine susceptibility of breast cancer cells to MEK inhibition." Cancer Res **69**(2): 565-72.

Mochida, S., S. Ikeo, et al. (2009). "Regulated activity of PP2A-B55 delta is crucial for controlling entry into and exit from mitosis in Xenopus egg extracts." EMBO J **28**(18): 2777-85.

Mochida, S., S. L. Maslen, et al. (2010). "Greatwall phosphorylates an inhibitor of protein phosphatase 2A that is essential for mitosis." Science **330**(6011): 1670-3.

Moelling, K., K. Schad, et al. (2002). "Regulation of Raf-Akt Cross-talk." J Biol Chem **277**(34): 31099-106.

Moon, A., M. S. Kim, et al. (2000). "H-ras, but not N-ras, induces an invasive phenotype in human breast epithelial cells: a role for MMP-2 in the H-ras-induced invasive phenotype." Int J Cancer **85**(2): 176-81.

Moreno, C. S., S. Park, et al. (2000). "WD40 repeat proteins striatin and S/G(2) nuclear autoantigen are members of a novel family of calmodulin-binding proteins that associate with protein phosphatase 2A." J Biol Chem **275**(8): 5257-63.

Moreno, C. S., S. Ramachandran, et al. (2004). "Signaling and transcriptional changes critical for transformation of human cells by simian virus 40 small tumor antigen or protein phosphatase 2A B56gamma knockdown." Cancer Res **64**(19): 6978-88.

Morgan, D. A., N. A. Refalo, et al. (2011). "Strength of ER-positivity in relation to survival in ER-positive breast cancer treated by adjuvant tamoxifen as sole systemic therapy." Breast **20**(3): 215-9.

Moulder, S. L., B. S. Craft, et al. (2008). "Inhibition of receptor tyrosine kinases in combination with chemotherapy for the treatment of breast cancer." Anticancer Agents Med Chem **8**(5): 481-7.

Moule, M. G., C. H. Collins, et al. (2004). "Role for PP2A in ARF signaling to p53." Proc Natl Acad Sci U S A **101**(39): 14063-6.

Muggerud, A. A., J. A. Ronneberg, et al. (2010). "Frequent aberrant DNA methylation of ABCB1, FOXC1, PPP2R2B and PTEN in ductal carcinoma in situ and early invasive breast cancer." Breast Cancer Res **12**(1): R3.

Mukhopadhyay, A., S. A. Saddoughi, et al. (2009). "Direct interaction between the inhibitor 2 a nd ceramide via sphingolipid-protein binding is involved in the

regulation of protein phosphatase 2A activity and signaling." FASEB J **23**(3): 751-63.

Mulrooney, J., K. Foley, et al. (2000). "Phosphorylation of the beta1 integrin cytoplasmic domain: toward an understanding of function and mechanism." Exp Cell Res **258**(2): 332-41.

Mumby, M. (1995). "Regulation by tumour antigens defines a role for PP2A in signal transduction." Semin Cancer Biol **6**(4): 229-37.

Muneer, S., V. Ramalingam, et al. (2002). "Genomic organization and mapping of the gene encoding the PP2A B56gamma regulatory subunit." Genomics **79**(3): 344-8.

Murata, K., J. Wu, et al. (1997). "B cell receptor-associated protein alpha4 displays rapamycin-sensitive binding directly to the catalytic subunit of protein phosphatase 2A." Proc Natl Acad Sci U S A **94**(20): 10624-9.

Muthuswamy, S. K. (2006). "ErbB2 makes beta 4 i ntegrin an accomplice in tumorigenesis." Cell **126**(3): 443-5.

Muthuswamy, S. K., D. Li, et al. (2001). "ErbB2, but not ErbB1, reinitiates proliferation and induces luminal repopulation in epithelial acini." Nat Cell Biol **3**(9): 785-92.

Nelson, C. M. and M. J. Bissell (2005). "Modeling dynamic reciprocity: engineering three-dimensional culture models of breast architecture, function, and neoplastic transformation." Semin Cancer Biol **15**(5): 342-52.

Neviani, P., R. Santhanam, et al. (2005). "The tumor suppressor PP2A is functionally inactivated in blast crisis CML through the inhibitory activity of the BCR/ABL-regulated SET protein." Cancer Cell **8**(5): 355-68.

NHMRC (2001a). Clinical practice guidelines for the management of advanced breast cancer, AusInfo Government Info Bookshops.

NHMRC (2001b). Clinical practice guidelines for the management of early breast cancer, AusInfo Government Info Bookshops.

Nicholson, R. I. and S. R. Johnston (2005). "Endocrine therapy--current benefits and limitations." Breast Cancer Res Treat **93 Suppl 1**: S3-10.

Normanno, N., A. De Luca, et al. (2006). "The MEK/MAPK pathway is involved in the resistance of breast cancer cells to the EGFR tyrosine kinase inhibitor gefitinib." J Cell Physiol **207**(2): 420-7.

Normanno, N., A. De Luca, et al. (2005). "Epidermal growth factor receptor (EGFR) tyrosine kinase inhibitors in breast cancer: current status and future development." Front Biosci **10**: 2611-7.

Nunbhakdi-Craig, V., L. Craig, et al. (2003). "Simian virus 40 small tumor antigen induces deregulation of the actin cytoskeleton and tight junctions in kidney epithelial cells." J Virol **77**(5): 2807-18.

O'Brien, L. E., K. Tang, et al. (2004). "ERK and MMPs sequentially regulate distinct stages of epithelial tubule development." Dev Cell **7**(1): 21-32.

Oakman, C., G. Viale, et al. (2010). "Management of triple negative breast cancer." Breast **19**(5): 312-21.

Ogawara, Y., S. Kishishita, et al. (2002). "Akt enhances Mdm2-mediated ubiquitination and degradation of p53." J Biol Chem **277**(24): 21843-50.

Okamoto, K., C. Kamibayashi, et al. (1996). "p53-dependent association between cyclin G and the B' subunit of protein phosphatase 2A." Mol Cell Biol **16**(11): 6593-602.

Okamoto, K., H. Li, et al. (2002). "Cyclin G recruits PP2A to dephosphorylate Mdm2." Mol Cell **9**(4): 761-71.

Olsen, C. L., B. Gardie, et al. (2002). "Raf-1-induced growth arrest in human mammary epithelial cells is p16-independent and is overcome in immortal cells during conversion." Oncogene **21**(41): 6328-39.

Olsen, J. V., B. Blagoev, et al. (2006). "Global, in vivo, and site-specific phosphorylation dynamics in signaling networks." Cell **127**(3): 635-48.

Opatrny, L., S. Dell'Aniello, et al. (2008). "Hormone replacement therapy use and variations in the risk of breast cancer." BJOG **115**(2): 169-75; discussion 175.

Ory, S., M. Zhou, et al. (2003). "Protein phosphatase 2A positively regulates Ras signaling by dephosphorylating KSR1 and Raf-1 on critical 14-3-3 binding sites." Curr Biol **13**(16): 1356-64.

Osborne, C. K., A. Wakeling, et al. (2004). "Fulvestrant: an oestrogen receptor antagonist with a novel mechanism of action." Br J Cancer **90 Suppl 1**: S2-6.

Osborne, C. K., M. G. Yochmowitz, et al. (1980). "The value of estrogen and progesterone receptors in the treatment of breast cancer." Cancer **46**(12 Suppl): 2884-8.

Pallas, D. C., L. K. Shahrik, et al. (1990). "Polyoma small and middle T antigens and SV40 small t antigen form stable complexes with protein phosphatase 2A." Cell **60**(1): 167-76.

Park, B. H. and N. E. Davidson (2007). "PI3 Kinase Activation and Response to Trastuzumab Therapy: What's neu with Herceptin Resistance?" Cancer Cell **12**(4): 297-9.

Park, C. C., H. Zhang, et al. (2006). "Beta1 integrin inhibitory antibody induces apoptosis of breast cancer cells, inhibits growth, and distinguishes malignant from normal phenotype in three dimensional cultures and in vivo." Cancer Res **66**(3): 1526-35.

Parkin, D. M. (2001). "Global cancer statistics in the year 2000." Lancet Oncol **2**(9): 533-43.

Patterson, K. I., T. Brummer, et al. (2009). "Dual-specificity phosphatases: critical regulators with diverse cellular targets." Biochem J **418**(3): 475-89.

Pearson, G., F. Robinson, et al. (2001). "Mitogen-activated protein (MAP) kinase pathways: regulation and physiological functions." Endocr Rev **22**(2): 153-83.

Pearson, G. W. and T. Hunter (2007). "Real-time imaging reveals that noninvasive mammary epithelial acini can contain motile cells." J Cell Biol **179**(7): 1555-67.

Perrotti, D. and P. Neviani (2006). "ReSETting PP2A tumour suppressor activity in blast crisis and imatinib-resistant chronic myelogenous leukaemia." Br J Cancer **95**(7): 775-81.

Persons, D. L., E. M. Yazlovitskaya, et al. (2000). "Effect of extracellular signal-regulated kinase on p53 accumulation in response to cisplatin." J Biol Chem **275**(46): 35778-85.

Petersen, O. W., L. Ronnov-Jessen, et al. (1992). "Interaction with basement membrane serves to rapidly distinguish growth and differentiation pattern of normal and malignant human breast epithelial cells." Proc Natl Acad Sci U S A **89**(19): 9064-8.

Pinder, S. E. and I. O. Ellis (2003). "The diagnosis and management of pre-invasive breast disease: ductal carcinoma in situ (DCIS) and atypical ductal hyperplasia (ADH)--current definitions and classification." Breast Cancer Res **5**(5): 254-7.

Podo, F., L. M. Buydens, et al. (2010). "Triple-negative breast cancer: present challenges and new perspectives." Mol Oncol **4**(3): 209-29.

Polyak, K. (2007). "Breast cancer: origins and evolution." J Clin Invest **117**(11): 3155-63.

Prickett, T. D. and D. L. Brautigan (2004). "Overlapping binding sites in protein phosphatase 2A for association with regulatory A and alpha-4 (mTap42) subunits." J Biol Chem **279**(37): 38912-20.

Prickett, T. D. and D. L. Brautigan (2006). "The alpha4 regulatory subunit exerts opposing allosteric effects on protein phosphatases PP6 and PP2A." J Biol Chem **281**(41): 30503-11.

Rangarajan, A., S. J. Hong, et al. (2004). "Species- and cell type-specific requirements for cellular transformation." Cancer Cell **6**(2): 171-83.

Renshaw, M. W., X. D. Ren, et al. (1997). "Growth factor activation of MAP kinase requires cell adhesion." EMBO J **16**(18): 5592-9.

Ribeiro, R. C., P. J. Kushner, et al. (1995). "The nuclear hormone receptor gene superfamily." Annu Rev Med **46**: 443-53.

Rinehart, J., A. A. Adjei, et al. (2004). "Multicenter phase II study of the oral MEK inhibitor, CI-1040, in patients with advanced non-small-cell lung, breast, colon, and pancreatic cancer." J Clin Oncol **22**(22): 4456-62.

Rios, J. and S. Puhalla (2011). "PARP inhibitors in breast cancer: BRCA and beyond." Oncology (Williston Park) 25(11): 1014-25.

Rizki, A., V. M. Weaver, et al. (2008). "A human breast cell model of preinvasive to invasive transition." Cancer Res **68**(5): 1378-87.

Roberts, K. G., A. M. Smith, et al. (2010). "Essential Requirement for PP2A Inhibition by the Oncogenic Receptor c-KIT Suggests PP2A Reactivation as a Strategy to Treat c-KIT+ Cancers." Cancer Res.

Roberts, P. J. and C. J. Der (2007). "Targeting the Raf-MEK-ERK mitogen-activated protein kinase cascade for the treatment of cancer." Oncogene **26**(22): 3291-310.

Rocher, G., C. Letourneux, et al. (2007). "Inhibition of B56-containing Protein Phosphatase 2As by the Early Response Gene IEX-1 Leads to Control of Akt Activity." J Biol Chem **282**(8): 5468-77.

Rodriguez-Viciana, P., C. Collins, et al. (2006). "Polyoma and SV40 proteins differentially regulate PP2A to activate distinct cellular signaling pathways involved in growth control." Proc Natl Acad Sci U S A **103**(51): 19290-5.

Rosenberg, L., Y. Zhang, et al. (2009). "A case-control study of oral contraceptive use and incident breast cancer." Am J Epidemiol **169**(4): 473-9.

Ruediger, R., N. Brewis, et al. (1997). "Increasing the ratio of PP2A core enzyme to holoenzyme inhibits Tat-stimulated HIV-1 transcription and virus production." Virology **238**(2): 432-43.

Ruediger, R., K. Fields, et al. (1999). "Binding specificity of protein phosphatase 2A core enzyme for regulatory B subunits and T antigens." J Virol **73**(1): 839-42.

Ruediger, R., M. Hentz, et al. (1994). "Molecular model of the A subunit of protein phosphatase 2A: interaction with other subunits and tumor antigens." J Virol **68**(1): 123-9.

Ruediger, R., H. T. Pham, et al. (2001a). "Alterations in protein phosphatase 2A subunit interaction in human carcinomas of the lung and colon with mutations in the A beta subunit gene." Oncogene **20**(15): 1892-9.

Ruediger, R., H. T. Pham, et al. (2001b). "Disruption of protein phosphatase 2A subunit interaction in human cancers with mutations in the A alpha subunit gene." Oncogene **20**(1): 10-15.

Ruediger, R., J. Ruiz, et al. (2011). "Human Cancer-Associated Mutations in Aα Subunit of Protein Phosphatase 2A Increase Lung Cancer Incidence in Aa Knock-in and Knockout Mice." Mol Cell Biol.

Ruvolo, P. P., W. Clark, et al. (2002). "A functional role for the B56 alpha-subunit of protein phosphatase 2A in ceramide-mediated regulation of Bcl2 phosphorylation status and function." J Biol Chem **277**(25): 22847-52.

Sablina, A. A., W. Chen, et al. (2007a). "The tumor suppressor PP2A Abeta regulates the RalA GTPase." Cell **129**(5): 969-82.

Sablina, A. A. and W. C. Hahn (2007b). "The role of PP2A A subunits in tumor suppression." Cell Adh Migr **1**(3): 140-1.

Sablina, A. A. and W. C. Hahn (2008). "SV40 small T antigen and PP2A phosphatase in cell transformation." Cancer Metastasis Rev **27**(2): 137-46.

Sablina, A. A., M. Hector, et al. (2010). "Identification of PP2A complexes and pathways involved in cell transformation." Cancer Res **70**(24): 10474-84.

Sainsbury, J. R., T. J. Anderson, et al. (2000). "ABC of breast diseases: breast cancer." Bmj **321**(7263): 745-50.

Salh, B., A. Marotta, et al. (1999). "Investigation of the Mek-MAP kinase-Rsk pathway in human breast cancer." 731-40Anticancer Res **19**(1B): 731-40.

Salomoni, P. and P. P. Pandolfi (2002). "The role of PML in tumor suppression." Cell **108**(2): 165-70.

Samuels, Y., Z. Wang, et al. (2004). "High frequency of mutations of the PIK3CA gene in human cancers." Science **304**(5670): 554.

Santen, R. J., R. X. Song, et al. (2002). "The role of mitogen-activated protein (MAP) kinase in breast cancer." J Steroid Biochem Mol Biol **80**(2): 239-56.

Saraf, A., E. A. Oberg, et al. (2010). "Molecular determinants for PP2A substrate specificity: charged residues mediate dephosphorylation of tyrosine hydroxylase by the PP2A/B' regulatory subunit." Biochemistry **49**(5): 986-95.

Saraf, A., D. M. Virshup, et al. (2007). "Differential expression of the B'beta regulatory subunit of protein phosphatase 2A modulates tyrosine hydroxylase phosphorylation and catecholamine synthesis." J Biol Chem **282**(1): 573-80.

Sarbassov, D. D., D. A. Guertin, et al. (2005). "Phosphorylation and regulation of Akt/PKB by the rictor-mTOR complex." Science **307**(5712): 1098-101.

Sarkisian, C. J., B. A. Keister, et al. (2007). "Dose-dependent oncogene-induced senescence in vivo and its evasion during mammary tumorigenesis." Nat Cell Biol **9**(5): 493-505.

Schlessinger, J. (2000). "Cell signalling by receptor tyrosine kinases." Cell **103**(2): 211-25.

Schmitz, M. H., M. Held, et al. (2010). "Live-cell imaging RNAi screen identifies PP2A-B55alpha and importin-beta1 as key mitotic exit regulators in human cells." Nat Cell Biol **12**(9): 886-93.

Sears, R., G. Leone, et al. (1999). "Ras enhances Myc protein stability." Mol Cell **3**(2): 169-79.

Sears, R., F. Nuckolls, et al. (2000). "Multiple Ras-dependent phosphorylation pathways regulate Myc protein stability." Genes Dev **14**(19): 2501-14.

Seeling, J. M., J. R. Miller, et al. (1999). "Regulation of beta-catenin signaling by the B56 subunit of protein phosphatase 2A." Science **283**(5410): 2089-91.

Serra, V., M. Scaltriti, et al. (2011). "PI3K inhibition results in enhanced HER signaling and acquired ERK dependency in HER2-overexpressing breast cancer." Oncogene **30**(22): 2547-57.

Setiawan, V. W., K. R. Monroe, et al. (2009). "Breast cancer risk factors defined by estrogen and progesterone receptor status: the multiethnic cohort study." Am J Epidemiol **169**(10): 1251-9.

Shen, Q. and P. H. Brown (2003). "Novel agents for the prevention of breast cancer: targeting transcription factors and signal transduction pathways." J Mammary Gland Biol Neoplasia **8**(1): 45-73.

Shi, Y. (2009). "Serine/threonine phosphatases: mechanism through structure." Cell **139**(3): 468-84.

Shin, S. I., V. H. Freedman, et al. (1975). "Tumorigenicity of virus-transformed cells in nude mice is correlated specifically with anchorage independent growth in vitro." Proc Natl Acad Sci U S A **72**(11): 4435-9.

Shouse, G. P., X. Cai, et al. (2008). "Serine 15 phosphorylation of p53 directs its interaction with B56gamma and the tumor suppressor activity of B56gamma-specific protein phosphatase 2A." Mol Cell Biol **28**(1): 448-56.

Shouse, G. P., Y. Nobumori, et al. (2010). "A B56gamma mutation in lung cancer disrupts the p53-dependent tumor-suppressor function of protein phosphatase 2A." Oncogene **29**(27): 3933-41.

Sim, A. T., E. Collins, et al. (1998). "Developmental regulation of protein phosphatase types 1 and 2A in post-hatch chicken brain." Neurochem Res **23**(4): 487-91.

Singletary, S. E. (2002). "A working model for the time sequence of genetic changes in breast tumorigenesis." J Am Coll Surg **194**(2): 202-16.

Sivaraman, V. S., H. Wang, et al. (1997). "Hyperexpression of mitogen-activated protein kinase in human breast cancer." J Clin Invest **99**(7): 1478-83.

Slamon, D. J., G. M. Clark, et al. (1987). "Human breast cancer: correlation of relapse and survival with amplification of the HER-2/neu oncogene." Science **235**(4785): 177-82.

Sontag, E. (2001). "Protein phosphatase 2A: the Trojan Horse of cellular signaling." Cell Signal **13**(1): 7-16.

Sontag, E., S. Fedorov, et al. (1993). "The interaction of SV40 small tumor antigen with protein phosphatase 2A stimulates the map kinase pathway and induces cell proliferation." Cell **75**(5): 887-97.

Sontag, E., V. Nunbhakdi-Craig, et al. (1995). "A novel pool of protein phosphatase 2A is associated with microtubules and is regulated during the cell cycle." J Cell Biol **128**(6): 1131-44.

Sontag, J. M. and E. Sontag (2006). "Regulation of cell adhesion by PP2A and SV40 small tumor antigen: an important link to cell transformation." Cell Mol Life Sci **63**(24): 2979-91.

Soule, H. D., T. M. Maloney, et al. (1990). "Isolation and characterization of a spontaneously immortalized human breast epithelial cell line, MCF-10." Cancer Res **50**(18): 6075-86.

Soule, H. D., J. Vazguez, et al. (1973). "A human cell line from a pleural effusion derived from a breast carcinoma." J Natl Cancer Inst **51**(5): 1409-16.

Stanevich, V., L. Jiang, et al. (2011). "The structural basis for tight control of PP2A methylation and function by LCMT-1." Mol Cell **41**(3): 331-42.

Stevens, I., V. Janssens, et al. (2003). "Identification and characterization of B"-subunits of protein phosphatase 2 A in Xenopus laevis oocytes and adult tissues." Eur J Biochem **270**(2): 376-87.

Strack, S., J. T. Cribbs, et al. (2004). "Critical role for protein phosphatase 2A heterotrimers in mammalian cell survival." J Biol Chem **279**(46): 47732-9.

Strack, S., R. Ruediger, et al. (2002). "Protein phosphatase 2A holoenzyme assembly: identification of contacts between B-family regulatory and scaffolding A subunits." J Biol Chem **277**(23): 20750-5.

Strack, S., J. A. Zaucha, et al. (1998). "Brain protein phosphatase 2A: developmental regulation and distinct cellular and subcellular localization by B subunits." J Comp Neurol **392**(4): 515-27.

Stratton, M. R. and N. Rahman (2008). "The emerging landscape of breast cancer susceptibility." Nat Genet **40**(1): 17-22.

Sun, M., G. Wang, et al. (2001). "AKT1/PKBalpha kinase is frequently elevated in human cancers and its constitutive activation is required for oncogenic transformation in NIH3T3 cells." Am J Pathol **159**(2): 431-7.

Suzuki, K., Y. Chikamatsu, et al. (2005). "Requirement of protein phosphatase 2A for recruitment of IQGAP1 to Rac-bound beta1 integrin." J Cell Physiol **203**(3): 487-92.

Suzuki, K. and K. Takahashi (2003a). "Reduced cell adhesion during mitosis by threonine phosphorylation of beta1 integrin." J Cell Physiol **197**(2): 297-305.

Suzuki, K. and K. Takahashi (2003b). "Reduced expression of the regulatory A subunit of serine/threonine protein phosphatase 2A in human breast cancer MCF-7 cells." Int J Oncol **23**(5): 1263-8.

Suzuki, K. and K. Takahashi (2006). "Induction of E-cadherin endocytosis by loss of protein phosphatase 2A expression in human breast cancers." Biochem Biophys Res Commun **349**(1): 255-60.

Switzer, C. H., R. Y. Cheng, et al. (2011). "Targeting SET/I(2)PP2A oncoprotein functions as a multi-pathway strategy for cancer therapy." Oncogene.

Switzer, C. H., L. A. Ridnour, et al. (2009). "Dithiolethione compounds inhibit Akt signaling in human breast and lung cancer cells by increasing PP2A activity." Oncogene **28**(43): 3837-46.

Takagi, Y., M. Futamura, et al. (2000). "Alterations of the PPP2R1B gene located at 11q23 in human colorectal cancers." Gut **47**(2): 268-71.

Takahashi, K., E. Nakajima, et al. (2006a). "Involvement of protein phosphatase 2A in the maintenance of E-cadherin-mediated cell-cell adhesion through recruitment of IQGAP1." J Cell Physiol **206**(3): 814-20.

Takahashi, K. and K. Suzuki (2006b). "Regulation of protein phosphatase 2A-mediated recruitment of IQGAP1 to beta1 integrin by EGF through activation of Ca2+/calmodulin-dependent protein kinase II." J Cell Physiol **208**(1): 213-9.

Tamaki, M., T. Goi, et al. (2004). "PPP2R1B gene alterations inhibit interaction of PP2A-Abeta and PP2A-C proteins in colorectal cancers." Oncol Rep **11**(3): 655-9.

Tan, Y., C. Wu, et al. (2006). "Ubiquitous calpains promote both apoptosis and survival signals in response to different cell death stimuli." J Biol Chem **281**(26): 17689-98.

ten Klooster, J. P., I. Leeuwen, et al. (2007). "Rac1-induced cell migration requires membrane recruitment of the nuclear oncogene SET." EMBO J **26**(2): 336-45.

Tolstykh, T., J. Lee, et al. (2000). "Carboxyl methylation regulates phosphoprotein phosphatase 2A by controlling the association of regulatory B subunits." Embo J **19**(21): 5682-91.

Torres, J. Z., K. H. Ban, et al. (2010). "A specific form of phospho protein phosphatase 2 regulates anaphase-promoting complex/cyclosome association with spindle poles." Mol Biol Cell **21**(6): 897-904.

Trockenbacher, A., V. Suckow, et al. (2001). "MID1, mutated in Opitz syndrome, encodes an ubiquitin ligase that targets phosphatase 2A for degradation." Nat Genet **29**(3): 287-94.

Trotman, L. C., A. Alimonti, et al. (2006). "Identification of a tumour suppressor network opposing nuclear Akt function." Nature **441**(7092): 523-7.

Ugi, S., T. Imamura, et al. (2002). "Protein phosphatase 2A forms a molecular complex with Shc and regulates Shc tyrosine phosphorylation and downstream mitogenic signaling." Mol Cell Biol **22**(7): 2375-87.

Underwood, J. M., K. M. Imbalzano, et al. (2006). "The ultrastructure of MCF-10A acini." J Cell Physiol **208**(1): 141-8.

Van Kanegan, M. J., D. G. Adams, et al. (2005). "Distinct protein phosphatase 2A heterotrimers modulate growth factor signaling to extracellular signal-regulated kinases and Akt." J Biol Chem **280**(43): 36029-36.

Vazquez, A., D. Kulkarni, et al. (2011). "A genetic variant in a PP2A regulatory subunit encoded by the PPP2R2B gene associates with altered breast cancer risk and recurrence." Int J Cancer **128**(10): 2335-43.

Vivanco, I. and C. L. Sawyers (2002). "The phosphatidylinositol 3-Kinase AKT pathway in human cancer." Nat Rev Cancer **2**(7): 489-501.

Vlahovic, G. and J. Crawford (2003). "Activation of tyrosine kinases in cancer." Oncologist **8**(6): 531-8.

Vogel, C. L., M. A. Cobleigh, et al. (2002). "Efficacy and safety of trastuzumab as a single agent in first-line treatment of HER2-overexpressing metastatic breast cancer." J Clin Oncol **20**(3): 719-26.

von Lintig, F. C., A. D. Dreilinger, et al. (2000). "Ras activation in human breast cancer." Breast Cancer Res Treat **62**(1): 51-62.

Wang, F., R. K. Hansen, et al. (2002). "Phenotypic reversion or death of cancer cells by altering signaling pathways in three-dimensional contexts." J Natl Cancer Inst **94**(19): 1494-503.

Wang, F., V. M. Weaver, et al. (1998a). "Reciprocal interactions between beta1-integrin and epidermal growth factor receptor in three-dimensional basement membrane

breast cultures: a different perspective in epithelial biology." Proc Natl Acad Sci U S A **95**(25): 14821-6.

Wang, S. S., E. D. Esplin, et al. (1998b). "Alterations of the PPP2R1B gene in human lung and colon cancer." Science **282**(5387): 284-7.

Wang, Y. and T. Y. Ng (2006). "Phosphatase 2A negatively regulates mitotic exit in Saccharomyces cerevisiae." Mol Biol Cell **17**(1): 80-9.

Watanabe, G., A. Howe, et al. (1996). "Induction of cyclin D1 by simian virus 40 small tumor antigen." Proc Natl Acad Sci U S A **93**(23): 12861-6.

Weaver, V. M., A. R. Howlett, et al. (1995). "The development of a functionally relevant cell culture model of progressive human breast cancer." Semin Cancer Biol **6**(3): 175-84.

Weaver, V. M., O. W. Petersen, et al. (1997). "Reversion of the malignant phenotype of human breast cells in three-dimensional culture and in vivo by integrin blocking antibodies." J Cell Biol **137**(1): 231-45.

Webb, D. J., K. Donais, et al. (2004). "FAK-Src signalling through paxillin, ERK and MLCK regulates adhesion disassembly." Nat Cell Biol **6**(2): 154-61.

Webb, D. J., J. T. Parsons, et al. (2002). "Adhesion assembly, disassembly and turnover in migrating cells -- over and over and over again." Nat Cell Biol **4**(4): E97-100.

Weigelt, B., J. L. Peterse, et al. (2005). "Breast cancer metastasis: markers and models." Nat Rev Cancer **5**(8): 591-602.

Widmann, C., S. Gibson, et al. (1999). "Mitogen-activated protein kinase: conservation of a three-kinase module from yeast to human." Physiol Rev **79**(1): 143-80.

Wodarz, A. and I. Nathke (2007). "Cell polarity in development and cancer." Nat Cell Biol **9**(9): 1016-24.

Wong, L. L., C. F. Chang, et al. (2009). "Tyrosine phosphorylation of PP2A is regulated by HER-2 signalling and correlates with breast cancer progression." Int J Oncol **34**(5): 1291-301.

Worsham, M. J., G. Pals, et al. (2006). "High-resolution mapping of molecular events associated with immortalization, transformation, and progression to breast cancer in the MCF10 model." Breast Cancer Res Treat **96**(2): 177-86.

Wozniak, M. A., R. Desai, et al. (2003). "ROCK-generated contractility regulates breast epithelial cell differentiation in response to the physical properties of a three-dimensional collagen matrix." J Cell Biol **163**(3): 583-95.

Wozniak, M. A., K. Modzelewska, et al. (2004). "Focal adhesion regulation of cell behavior." Biochim Biophys Acta **1692**(2-3): 103-19.

Wu, J., T. Tolstykh, et al. (2000). "Carboxyl methylation of the phosphoprotein phosphatase 2A catalytic subunit promotes its functional association with regulatory subunits in vivo." Embo J **19**(21): 5672-81.

Wu, M. X. (2003). "Roles of the stress-induced gene IEX-1 in regulation of cell death and oncogenesis." Apoptosis **8**(1): 11-8.

Wurzenberger, C. and D. W. Gerlich (2011). "Phosphatases: providing safe passage through mitotic exit." Nat Rev Mol Cell Biol **12**(8): 469-82.

Xin, M. and X. Deng (2006). "Protein phosphatase 2A enhances the proapoptotic function of Bax through dephosphorylation." J Biol Chem **281**(27): 18859-67.

Xing, Y., Z. Li, et al. (2008). "Structural mechanism of demethylation and inactivation of protein phosphatase 2A." Cell **133**(1): 154-63.

Xing, Y., Y. Xu, et al. (2006). "Structure of protein phosphatase 2A core enzyme bound to tumor-inducing toxins." Cell **127**(2): 341-53.

Xu, Y., Y. Chen, et al. (2008). "Structure of a protein phosphatase 2A holoenzyme: insights into B55-mediated Tau dephosphorylation." Mol Cell **31**(6): 873-85.

Xu, Y., Y. Xing, et al. (2006). "Structure of the protein phosphatase 2A holoenzyme." Cell **127**(6): 1239-51.

Xu, Z. and B. R. Williams (2000). "The B56alpha regulatory subunit of protein phosphatase 2A is a target for regulation by double-stranded RNA-dependent protein kinase PKR." Mol Cell Biol **20**(14): 5285-99.

Yagata, H., Y. Kajiura, et al. (2011). "Current strategy for triple-negative breast cancer: appropriate combination of surgery, radiation, and chemotherapy." Breast Cancer **18**(3): 165-73.

Yamamoto, M., Y. Suzuki, et al. (1999). "Expressions of four major protein Ser/Thr phosphatases in human primary leukemic cells." Leukemia **13**(4): 595-600.

Yan, Z., S. A. Fedorov, et al. (2000). "PR48, a novel regulatory subunit of protein phosphatase 2A, interacts with Cdc6 and modulates DNA replication in human cells." Mol Cell Biol **20**(3): 1021-9.

Yang, J. and C. Phiel (2010). "Functions of B56-containing PP2As in major developmental and cancer signaling pathways." Life Sci **87**(23-26): 659-66.

Yang, S. I., R. L. Lickteig, et al. (1991). "Control of protein phosphatase 2A by simian virus 40 small-t antigen." Mol Cell Biol **11**(4): 1988-95.

Yang, Y., X. Q. Li, et al. (2011). "[Influence of PP2A activator on proliferation of HL-60 cells and analysis of PP2A activity changes in patients with acute myeloid leukemia]." Zhongguo Shi Yan Xue Ye Xue Za Zhi **19**(3): 594-7.

Yeh, E., M. Cunningham, et al. (2004). "A signalling pathway controlling c-Myc degradation that impacts oncogenic transformation of human cells." Nat Cell Biol **6**(4): 308-18.

Young, M. R., K. Kolesiak, et al. (2002). "Protein phosphatase-2A regulates endothelial cell motility and both the phosphorylation and the stability of focal adhesion complexes." Int J Cancer **100**(3): 276-82.

Young, M. R., S. W. Liu, et al. (2000). "Differences in association of the serine/threonine protein phosphatase PP-2A with microtubules of metastatic and nonmetastatic tumor cells." Clin Exp Metastasis **18**(5): 407-13.

Young, M. R., S. W. Liu, et al. (2003). "Protein phosphatase-2A restricts migration of Lewis lung carcinoma cells by modulating the phosphorylation of focal adhesion proteins." Int J Cancer **103**(1): 38-44.

Yu, J., A. Boyapati, et al. (2001a). "Critical role for SV40 small-t antigen in human cell transformation." Virology **290**(2): 192-8.

Yu, X. X., X. Du, et al. (2001b). "Methylation of the protein phosphatase 2A catalytic subunit is essential for association of Balpha regulatory subunit but not SG2NA, striatin, or polyomavirus middle tumor antigen." Mol Biol Cell **12**(1): 185-99.

Yuan, H., T. Veldman, et al. (2002). "Simian virus 40 small tumor antigen activates AKT and telomerase and induces anchorage-independent growth of human epithelial cells." J Virol **76**(21): 10685-91.

Zamir, E. and B. Geiger (2001). "Molecular complexity and dynamics of cell-matrix adhesions." J Cell Sci **114**(Pt 20): 3583-90.

Zhang, W., J. Yang, et al. (2009). "PR55 alpha, a regulatory subunit of PP2A, specifically regulates PP2A-mediated beta-catenin dephosphorylation." J Biol Chem **284**(34): 22649-56.

Zhao, J. J., O. V. Gjoerup, et al. (2003). "Human mammary epithelial cell transformation through the activation of phosphatidylinositol 3-kinase." Cancer Cell **3**(5): 483-95.

Zhou, B., Z. X. Wang, et al. (2002). "The specificity of extracellular signal-regulated kinase 2 de phosphorylation by protein phosphatases." J Biol Chem **277**(35): 31818-25.

Zhou, J., H. T. Pham, et al. (2003). "Characterization of the Aalpha and Abeta subunit isoforms of protein phosphatase 2A: differences in expression, subunit interaction, and evolution." Biochem J **369**(Pt 2): 387-98.

Zimmermann, S. and K. Moelling (1999). "Phosphorylation and regulation of Raf by Akt (protein kinase B)." Science **286**(5445): 1741-4.

Zolnierowicz, S., C. Csortos, et al. (1994). "Diversity in the regulatory B-subunits of protein phosphatase 2A: identification of a novel isoform highly expressed in brain." Biochemistry **33**(39): 11858-67.