

Protein	Ac-Sequence-NH ₂	HDAC1	HDAC2	HDAC3	HDAC4	HDAC6	HDAC7	HDAC8	HDAC9
RAI1	KLGGKacQRAA	50	< 20	1700	-	-	-	< 20	< 20
ZRANB2	TEIGKacTLAEK	< 20	< 20	50	<20	270	≤ 20	< 20	< 20
THRAP3	LGDGKacMKS	< 20	30	1600	-	-	-	< 20	< 20
NCOA3	KRILHKacLLQN	70	< 20	2200	< 20	70	140	-	< 20
SRSF5	KLSGKacEING	< 20	< 20	60	70	820	-	< 20	< 20
ARID1A	KLISKacFDKL	50	≤ 20	2500	< 20	1200	< 20	2400	< 20
CSRP2BP	STPVKacFISR	50	< 20	1500	< 20	210	-	740	< 20
MLL2	SKIQKacQLDQ	< 20	30	220	-	-	-	-	< 20

Supplementary Table 3. *In vitro* peptide deacetylation catalyzed by commercially available HDACs. The initial rate for acetate production, determined from 1-2 time points, was measured using commercially available recombinant HDAC 1-9 (0.4 μM, purchased from BPS Biosciences) and acetylated peptide (100 μM) in assay buffer (2.7 mM KCl, 137 mM NaCl, 50 mM HEPES, pH 7.8). The value of k_{cat}/K_M (in $M^{-1}s^{-1}$) was calculated assuming a linear dependence on the substrate concentration. Dashes indicate particular combinations of peptides and enzyme isoforms that were not measured. The HDAC8 purified from baculovirus has higher specific activity than the recombinant enzyme purified from *E. coli*.