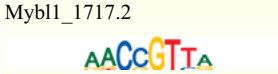
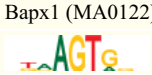
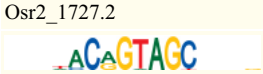
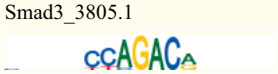
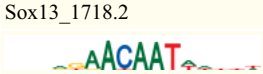
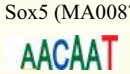
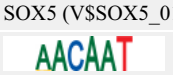
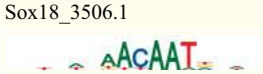
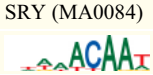
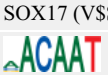
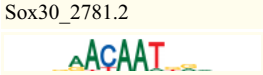
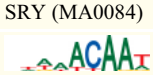
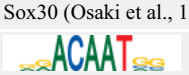
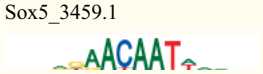
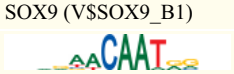
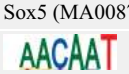
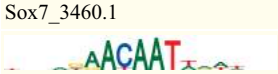
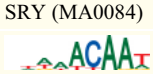
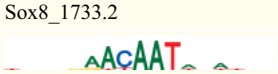
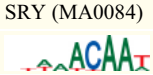
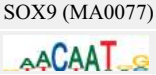
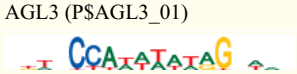
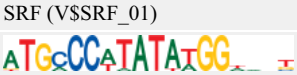
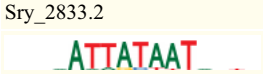
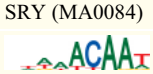
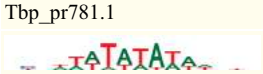
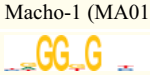
Figure S5: **Agreement of PBM *k*-mer data with prior motif data, in general.** Comparisons were performed as described in **Materials and Methods**. 44 of the 50 proteins (88%) in rings 1, 2, or 3 had their top AUC matches to members of their structural families; 5 of these 44 proteins had their top AUC match to the expected protein (the exact match, paralog, or ortholog referenced by the ring system). Full comparison results (AUC $\geq$ 0.8 and $Q \leq 0.01$) are provided in **Table S3**.

PBM TF	Top Lever Match	AUC	Same Struct Class?	Closest Previously Annotated Match	Ring	AUC
Arid3a_3875.1	Pbx-1 (V$PBX1_01)	0.965695	No	dri (I$DRI_01)	ring 3	0.920001
Arid3a_3875.2	Pbx-1 (V$PBX1_01)	0.978981	No	dri (I$DRI_01)	ring 3	0.934148
Atf1_3026.3	TCF11-MafG (MA0089)	0.962233	No	ATF1 (V$ATF1_Q6)	ring 1	0.780575
Bhlhb2_1274.3	c-Myc:Max (V$MYCMAX_B)	0.869423	Yes (HLH)	DEC (V$DEC_Q1)	ring 3	0.648959
E2F2_1022.2	E2F (V$E2F_Q4_01)	0.961466	Yes (E2F family)	E2f1 (MA0024)	ring 3	0.895325
E2F2_1022.4	E2F (V$E2F_Q2)	0.966291	Yes (E2F family)	E2f1 (MA0024)	ring 3	0.901104
E2F3_3752.1	E2F (V$E2F_Q4_01)	0.959812	Yes (E2F family)	E2f1 (MA0024)	ring 3	0.893595
E2F3_3752.2	E2F (V$E2F_Q4_01)	0.960145	Yes (E2F family)	E2F1 (MA0024)	ring 3	0.890967
Egr1_2580.1	ZF5 (V$ZF5_01)	0.939128	Yes (Znf_C2H2)	Egr-1 (V$EGR1_01)	ring 1	0.642253
Egr1_2580.2	ZF5 (V$ZF5_01)	0.936849	Yes (Znf_C2H2)	Egr-1 (V$EGR1_01)	ring 1	0.639174
Ehf_3056.2	ETS1 (MA0098)	0.988278	Yes (ETS)	ELF5 (MA0136)	ring 2	0.984428
Elf3_3876.1	ELF5 (MA0136)	0.97288	Yes (ETS)	ELF5 (MA0136)	ring 2	0.97288
Esrra_2190.2	HNF4A (MA0114)	0.89013	Yes (ZnF_C4)	ERR alpha (V$ERR1_Q2)	ring 1	0.682352
Foxa2_2830.2	HNF3beta (V$HNF3B_01)	0.959604	Yes (Forkhead)	HNF3 (V$HNF3_Q6_01)	ring 1	0.947694
Foxj1_3125.2	DMRT7 (V$DMRT7_01)	0.961358	No	FOXJ1 (V$HFH4_01)	ring 1	0.858688
Foxj3_0982.2	HNF3beta (V$HNF3B_01)	0.963847	Yes (Forkhead)	FOXJ2 (V$FOXJ2_01)	ring 2	0.905563
Foxl1_2809.2	HNF3beta (V$HNF3B_01)	0.979563	Yes (Forkhead)	FOXL1 (MA0033)	ring 3	0.889422
Gabpa_2829.2	ETS1 (MA0098)	0.984335	Yes (ETS)	GABP (V$GABP_B)	ring 1	0.656266
Gata3_1024.3	GATA3 (MA0037)	0.95315	Yes (ZnF_Gata)	GATA3 (MA0037)	ring 3	0.95315
Gata5_3768.1	GATA3 (MA0037)	0.985313	Yes (ZnF_Gata)	GATA-6 (V$GATA6_01)	ring 2	0.935301
Gata6_3769.1	GATA-6 (V$GATA6_01)	0.937566	Yes (ZnF_Gata)	GATA-6 (V$GATA6_01)	ring 1	0.937566
Hic1_2816.2	myogenin (V$MYOGENIN_Q6)	0.833216	No	HIC1 (V$HIC1_02)	ring 3	0.68262
Hnf4a_2640.2	HNF4A (MA0114)	0.918195	Yes (ZnF_C4)	HNF4A (MA0114)	ring 1	0.918195

Hoxa3_2783.2	Ubx (MA0094)	0.986339	Yes (Homeodomain)	HOXA3 (V$HOXA3_01)	ring 1	0.736896
						
Klf7_0974.2	ZF5 (V$ZF5_01)	0.93137	Yes (Znf_C2H2)	Klf4 (MA0039)	ring 2	0.682812
						
Lef1_3504.1	TCF (I$TCF_Q6)	0.887154	Yes (HMG)	LEF1 (V$LEF1_Q2)	ring 1	0.761938
						
Mafb_2914.2	c-Maf (V$CMAF_01)	0.934102	Yes (bZIP)	Mafb (MA0117)	ring 3	0.58046
						
Max_3863.1	c-Myc:Max (V$MYCMAX_02)	0.884495	Yes (HLH)	MAX (MA0058)	ring 3	0.621124
						
Max_3864.1	c-Myc:Max (V$MYCMAX_02)	0.931824	Yes (HLH)	MAX (MA0058)	ring 3	0.605609
						
Myb_1047.3	v-Myb (V$VMYB_01)	0.910701	Yes (SANT)	c-Myb (V$CMYB_01)	ring 2	0.795148
						
Mybl1_1717.2	v-Myb (V$VMYB_01)	0.920978	Yes (SANT)	c-Myb (V$CMYB_01)	ring 2	0.7907
						
Nkx3-1_2923.2	Bapx1 (MA0122)	0.918855	Yes (Homeodomain)	Nkx3-1 (V$NKX3A_01)	ring 1	0.749729
						
Nr2f2_2192.2	HNF4 (V$HNF4_Q6_02)	0.917819	Yes (ZnF_C4)	COUPTF (V$COUPTF_Q6)	ring 1	0.727204
						
Osr1_3033.2	Odd-skipped (Wolfe et al., 2005)	0.947458	Yes (Znf_C2H2)	Odd-skipped (Wolfe et al., 2005)	ring 3	0.947458
						
Osr2_1727.2	Odd-skipped (Wolfe et al., 2005)	0.974839	Yes (Znf_C2H2)	Odd-skipped (Wolfe et al., 2005)	ring 3	0.974839
						
Smad3_3805.1	MAD (I$MAD_Q6)	0.802327	Yes (MAD)	SMAD3 (V$SMAD3_Q6)	ring 1	0.757946
						
Sox13_1718.2	Sox5 (MA0087)	0.980609	Yes (HMG)	SOX5 (V$SOX5_01)	ring 2	0.975989
						
Sox17_2837.2	SRY (V$SRY_02)	0.946124	Yes (HMG)	Sox17 (MA0078)	ring 1	0.84448
						
Sox18_3506.1	SRY (MA0084)	0.968292	Yes (HMG)	SOX17 (V$SOX17_01)	ring 2	0.958906
						
Sox30_2781.2	SRY (MA0084)	0.948422	Yes (HMG)	Sox30 (Osaki et al., 1999)	ring 1	0.753482
						
Sox5_3459.1	SOX9 (V$SOX9_B1)	0.972955	Yes (HMG)	Sox5 (MA0087)	ring 1	0.955712
						
Sox7_3460.1	SRY (MA0084)	0.962653	Yes (HMG)	Sox17 (MA0078)	ring 2	0.887095
						
Sox8_1733.2	SRY (MA0084)	0.946788	Yes (HMG)	SOX9 (MA0077)	ring 3	0.92127
						
Srf_3509.1	AGL3 (P$AGL3_01)	0.99214	Yes (MAD)	SRF (V$SRF_01)	ring 1	0.82962
						
Sry_2833.2	SRY (MA0084)	0.970784	Yes (HMG)	SRY (V$SRY_01)	ring 1	0.871343
						
Tbp_pr781.1	TATA (V$TATA_01)	0.979028	Yes (TBP)	TBP (V$TBP_01)	ring 1	0.951961
						
Tcf1_2666.2	Ubx (MA0094)	0.893147	Yes (Homeodomain)	HNF1 (V$HNF1_01)	ring 3	0.834492

						
Tcf1_2666.3	C1 (P$C1_Q2)	0.917045	Yes (Homeodomain)	HNF1 (V$HNF1_01)	ring 3	0.854438
						
Tcf3_3787.1	TCF (I$TCF_Q6)	0.950095	Yes (Homeodomain)	E12 (V$E12_Q6)	ring 3	0.266878
						
Tcf7_0950.2	TCF (I$TCF_Q6)	0.955304	Yes (Homeodomain)	LEF1 (V$LEF1_Q2_01)	ring 1	0.750827
						
Tcfe2a_3865.1	USF (V$USF_Q6_01)	0.885149	Yes (bHLH)	E2A (V$E2A_Q2)	ring 3	0.711049
						
Zfp105_2634.2	HNF1 (V$HNF1_Q6)	0.982651	No	Znf35 (Pengue et al., 1993)	ring 3	0.57543
						
Zfp161_2858.2	c-Myc:Max (V$MYCMAX_B)	0.915214	No	ZF5 (V$ZF5_01)	ring 1	0.88187
						
Zic1_0991.2	Macho-1 (MA0118)	0.898683	Yes (ZnF_C2H2)	Zic1 (V$ZIC1_01)	ring 1	0.76883
						
Zic2_2895.2	Macho-1 (MA0118)	0.926914	Yes (ZnF_C2H2)	Zic2 (V$ZIC2_01)	ring 1	0.686375
						
Zic3_3119.2	Macho-1 (MA0118)	0.899988	Yes (ZnF_C2H2)	Zic3 (V$ZIC3_01)	ring 1	0.792524