

Supplementary Materials for

Brain gene expression signature on primate genomic sequence evolution

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Supplementary Tables

Supplementary Table 1: Fifty top genomic signature genes based on cerebellum expression. Official gene symbols are reported together with Ensembl gene annotation across the six examined primates.

Gene symbol	Human	Chimp	Marmoset	Mouse Lemur	Babbon	Macaque
MAP3K12	ENSG00000139625	ENSPTRG00000005019	ENSCJAG0000018634	ENSMICG00000011662	ENSPANG00000020580	ENSMMUG00000006613
SLC17A6	ENSG00000091664	ENSPTRG00000003444	ENSCJAG00000006408	ENSMICG00000038594	ENSPANG00000015329	ENSMMUG00000020368
CDH22	ENSG00000149654	ENSPTRG00000013581	ENSCJAG00000017106	ENSMICG00000029501	ENSPANG00000026139	ENSMMUG00000004479
INPP5J	ENSG00000185133	ENSPTRG00000014262	ENSCJAG00000010779	ENSMICG00000008559	ENSPANG00000018617	ENSMMUG00000022395
CNTNAP1	ENSG00000108797	ENSPTRG00000009216	ENSCJAG00000013408	ENSMICG00000010313	ENSPANG00000021426	ENSMMUG00000006091
TFAP2E	ENSG00000116819	ENSPTRG00000000523	ENSCJAG00000001531	ENSMICG00000030619	ENSPANG00000004801	ENSMMUG00000019815
DNASE1L2	ENSG00000167968	ENSPTRG00000007643	ENSCJAG00000014997	ENSMICG00000005898	ENSPANG00000006417	ENSMMUG00000019236
C1QTNF8	ENSG00000184471	ENSPTRG00000007577	ENSCJAG00000002657	ENSMICG00000005932	ENSPANG00000023388	ENSMMUG00000001688
GRM4	ENSG00000124493	ENSPTRG00000018059	ENSCJAG00000015287	ENSMICG00000003131	ENSPANG00000012328	ENSMMUG00000023046
ZNF653	ENSG00000161914	ENSPTRG00000010507	ENSCJAG00000005551	ENSMICG00000034400	ENSPANG00000016446	ENSMMUG00000020617
CACNA1B	ENSG00000148408	ENSPTRG00000021608	ENSCJAG00000013488	ENSMICG00000016743	ENSPANG00000026439	ENSMMUG00000009187
GRIN2C	ENSG00000161509	ENSPTRG00000009619	ENSCJAG00000014754	ENSMICG00000010565	ENSPANG00000020268	ENSMMUG00000005744
NDST4	ENSG00000138653	ENSPTRG00000016386	ENSCJAG00000003443	ENSMICG00000033837	ENSPANG00000008604	ENSMMUG00000002883
ST18	ENSG00000147488	ENSPTRG00000020245	ENSCJAG00000014630	ENSMICG00000003705	ENSPANG00000009233	ENSMMUG00000008439
SPTBN2	ENSG00000173898	ENSPTRG00000003936	ENSCJAG00000001228	ENSMICG00000003823	ENSPANG00000011003	ENSMMUG00000020359

WSCD2	ENSG00000075035	ENSPTRG0000005402	ENSCJAG00000015311	ENSMICG00000014280	ENSPANG00000016135	ENSMMUG00000019042
CADM3	ENSG000000162706	ENSPTRG00000001520	ENSCJAG00000006307	ENSMICG00000011231	ENSPANG00000019563	ENSMMUG00000001297
BSN	ENSG000000164061	ENSPTRG00000014927	ENSCJAG00000004003	ENSMICG00000010621	ENSPANG00000010033	ENSMMUG00000014537
NEUROD2	ENSG000000171532	ENSPTRG00000009094	ENSCJAG00000008704	ENSMICG00000035050	ENSPANG00000021818	ENSMMUG00000001404
GBX2	ENSG000000168505	ENSPTRG00000013068	ENSCJAG00000004419	ENSMICG00000028176	ENSPANG00000017536	ENSMMUG00000005911
SSTR2	ENSG000000180616	ENSPTRG00000009594	ENSCJAG00000019937	ENSMICG00000031045	ENSPANG00000020325	ENSMMUG00000020947
RTN4R	ENSG000000040608	ENSPTRG00000014079	ENSCJAG00000010718	ENSMICG00000027043	ENSPANG00000019636	ENSMMUG00000011547
SYT12	ENSG000000173227	ENSPTRG00000003943	ENSCJAG00000001134	ENSMICG00000015472	ENSPANG00000004416	ENSMMUG00000011741
KIAA1984	ENSG000000213213	ENSPTRG00000021573	ENSCJAG00000011036	ENSMICG00000031589	ENSPANG00000026166	ENSMMUG00000005040
TMEM63C	ENSG000000165548	ENSPTRG00000006574	ENSCJAG00000016712	ENSMICG00000017135	ENSPANG00000021770	ENSMMUG00000001092
WDR49	ENSG000000174776	ENSPTRG00000015597	ENSCJAG00000002774	ENSMICG00000026583	ENSPANG00000008048	ENSMMUG00000022925
TTBK1	ENSG000000146216	ENSPTRG00000018193	ENSCJAG00000005343	ENSMICG00000008369	ENSPANG00000021604	ENSMMUG00000017322
CDH20	ENSG000000101542	ENSPTRG00000010069	ENSCJAG00000003409	ENSMICG00000032447	ENSPANG00000003495	ENSMMUG00000001713
SBK1	ENSG000000188322	ENSPTRG00000007921	ENSCJAG00000006098	ENSMICG00000001939	ENSPANG00000017104	ENSMMUG00000000515
MIXL1	ENSG000000185155	ENSPTRG00000002047	ENSCJAG00000012740	ENSMICG00000027230	ENSPANG00000007593	ENSMMUG00000005129
VAT1L	ENSG000000171724	ENSPTRG00000008374	ENSCJAG00000014046	ENSMICG00000009243	ENSPANG00000018199	ENSMMUG00000011797
TMEM229B	ENSG000000198133	ENSPTRG00000030714	ENSCJAG00000015358	ENSMICG00000037311	ENSPANG00000005728	ENSMMUG00000048801
TRIM62	ENSG000000116525	ENSPTRG00000000502	ENSCJAG00000001177	ENSMICG00000028440	ENSPANG00000015281	ENSMMUG00000015097
LURAP1	ENSG000000171357	ENSPTRG00000000688	ENSCJAG00000021078	ENSMICG00000003264	ENSPANG00000006505	ENSMMUG00000005838
ABCG4	ENSG000000172350	ENSPTRG00000004373	ENSCJAG00000013965	ENSMICG00000002738	ENSPANG00000004725	ENSMMUG00000013799
PLP1	ENSG000000123560	ENSPTRG00000022133	ENSCJAG00000003349	ENSMICG00000003053	ENSPANG00000025091	ENSMMUG00000000809
SCRG1	ENSG000000164106	ENSPTRG00000016599	ENSCJAG00000005138	ENSMICG00000008612	ENSPANG00000011779	ENSMMUG00000002399
SLC5A11	ENSG000000158865	ENSPTRG00000007899	ENSCJAG00000020690	ENSMICG00000005905	ENSPANG00000017009	ENSMMUG00000001407
MAST1	ENSG000000105613	ENSPTRG00000010545	ENSCJAG00000004772	ENSMICG00000016221	ENSPANG00000015630	ENSMMUG00000008740
HTR5A	ENSG000000157219	ENSPTRG00000019904	ENSCJAG00000000158	ENSMICG00000030603	ENSPANG00000021639	ENSMMUG00000013084

AQP4	ENSG00000171885	ENSPTRG00000009936	ENSCJAG00000020734	ENSMICG00000002328	ENSPANG00000024708	ENSMMUG00000014934
ANLN	ENSG00000011426	ENSPTRG00000019084	ENSCJAG00000012416	ENSMICG00000008936	ENSPANG00000006301	ENSMMUG00000021186
TMEM178A	ENSG00000152154	ENSPTRG00000011859	ENSCJAG00000014915	ENSMICG00000008025	ENSPANG00000022194	ENSMMUG00000043458
GLRA2	ENSG00000101958	ENSPTRG00000021679	ENSCJAG00000004058	ENSMICG00000015578	ENSPANG00000003157	ENSMMUG00000003482
CACNG7	ENSG00000105605	ENSPTRG00000011436	ENSCJAG00000018478	ENSMICG00000027690	ENSPANG00000025512	ENSMMUG00000007975
CHRNA2	ENSG00000120903	ENSPTRG00000020105	ENSCJAG00000019690	ENSMICG00000007702	ENSPANG00000015733	ENSMMUG00000021514
ACSBG1	ENSG00000103740	ENSPTRG00000007337	ENSCJAG00000010176	ENSMICG00000008772	ENSPANG00000015826	ENSMMUG00000011839
MAB21L1	ENSG00000180660	ENSPTRG00000005777	ENSCJAG00000022569	ENSMICG00000031296	ENSPANG00000011126	ENSMMUG00000005425
NMNAT2	ENSG00000157064	ENSPTRG00000001763	ENSCJAG00000005105	ENSMICG00000007134	ENSPANG00000011948	ENSMMUG00000001481
SNAP25	ENSG00000132639	ENSPTRG00000013246	ENSCJAG00000021350	ENSMICG00000003556	ENSPANG00000003900	ENSMMUG00000011064

Supplementary Table 2: Fifty top genomic signature genes based on frontal cortex expression. Official gene symbols are reported together with Ensembl gene annotation across the six examined primates.

Gene symbol	Human	Chimp	Marmoset	Mouse Lemur	Babbon	Macaque
SNTG1	ENSG00000147481	ENSPTRG00000020240	ENSCJAG00000015678	ENSMICG00000001818	ENSPANG00000017058	ENSMMUG00000002811
BAI1	ENSG00000181790	ENSPTRG00000020635	ENSCJAG00000010346	ENSMICG00000015976	ENSPANG00000015392	ENSMMUG00000019877
RALYL	ENSG00000184672	ENSPTRG00000020381	ENSCJAG000000000402	ENSMICG00000005558	ENSPANG00000019755	ENSMMUG00000007115
KCNF1	ENSG00000162975	ENSPTRG00000030563	ENSCJAG00000022930	ENSMICG00000017370	ENSPANG00000015920	ENSMMUG00000002825
EFR3B	ENSG00000084710	ENSPTRG00000011720	ENSCJAG00000008127	ENSMICG00000001606	ENSPANG00000004979	ENSMMUG00000016461
HES5	ENSG00000197921	ENSPTRG00000024233	ENSCJAG00000002549	ENSMICG00000038417	ENSPANG00000022730	ENSMMUG00000044043
PRKCG	ENSG00000126583	ENSPTRG00000011435	ENSCJAG00000018393	ENSMICG00000015697	ENSPANG00000015248	ENSMMUG00000007972
NLGN3	ENSG00000196338	ENSPTRG00000022007	ENSCJAG00000013566	ENSMICG00000014073	ENSPANG00000015903	ENSMMUG00000032427
OLIG2	ENSG00000205927	ENSPTRG00000013863	ENSCJAG00000009439	ENSMICG00000031221	ENSPANG00000007664	ENSMMUG00000017652
RTN4RL1	ENSG00000185924	ENSPTRG00000008541	ENSCJAG00000001844	ENSMICG00000012885	ENSPANG00000001706	ENSMMUG00000046616

NANOS3	ENSG0000 0187556	ENSPTRG000 00010568	ENSCJAG000 00004388	ENSMICG000 00030950	ENSPANG000 00015037	ENSMMUG00 000008316
UNC5A	ENSG0000 0113763	ENSPTRG000 00017569	ENSCJAG000 00007237	ENSMICG000 00033115	ENSPANG000 00011858	ENSMMUG00 000002649
SPRED3	ENSG0000 0188766	ENSPTRG000 00010928	ENSCJAG000 00013614	ENSMICG000 00027687	ENSPANG000 00006214	ENSMMUG00 000022975
GAD1	ENSG0000 0128683	ENSPTRG000 00012626	ENSCJAG000 00006984	ENSMICG000 00015011	ENSPANG000 00024165	ENSMMUG00 000015198
GABRA4	ENSG0000 0109158	ENSPTRG000 00016029	ENSCJAG000 00018992	ENSMICG000 00017780	ENSPANG000 00014209	ENSMMUG00 000009526
NPY	ENSG0000 0122585	ENSPTRG000 00018992	ENSCJAG000 00007671	ENSMICG000 00000511	ENSPANG000 00021597	ENSMMUG00 000009818
CLEC2L	ENSG0000 0236279	ENSPTRG000 00039273	ENSCJAG000 00013258	ENSMICG000 00036417	ENSPANG000 00004966	ENSMMUG00 000037714
RGS7BP	ENSG0000 0186479	ENSPTRG000 00016921	ENSCJAG000 00015655	ENSMICG000 00030250	ENSPANG000 00016503	ENSMMUG00 000021131
STMN3	ENSG0000 0197457	ENSPTRG000 00030476	ENSCJAG000 00010324	ENSMICG000 00029780	ENSPANG000 00024130	ENSMMUG00 000021297
NDP	ENSG0000 0124479	ENSPTRG000 00021818	ENSCJAG000 00010835	ENSMICG000 00034006	ENSPANG000 00016329	ENSMMUG00 000018001
LPPR4	ENSG0000 0117600	ENSPTRG000 00000994	ENSCJAG000 00018252	ENSMICG000 00032022	ENSPANG000 00006691	ENSMMUG00 000021030
CACNG3	ENSG0000 0006116	ENSPTRG000 00007896	ENSCJAG000 00020656	ENSMICG000 00008055	ENSPANG000 00023573	ENSMMUG00 000013560
TRIM9	ENSG0000 0100505	ENSPTRG000 00006338	ENSCJAG000 00006884	ENSMICG000 00013634	ENSPANG000 00025018	ENSMMUG00 000011051
MAST1	ENSG0000 0105613	ENSPTRG000 00010545	ENSCJAG000 00004772	ENSMICG000 00016221	ENSPANG000 00015630	ENSMMUG00 000008740
C1QTNF 4	ENSG0000 0172247	ENSPTRG000 00003572	ENSCJAG000 00020211	ENSMICG000 00027804	ENSPANG000 00000111	ENSMMUG00 000004294
CCDC85 A	ENSG0000 0055813	ENSPTRG000 00011940	ENSCJAG000 00009663	ENSMICG000 00029777	ENSPANG000 00016914	ENSMMUG00 000015888
LINGO2	ENSG0000 0174482	ENSPTRG000 00020840	ENSCJAG000 00022711	ENSMICG000 00004873	ENSPANG000 00015960	ENSMMUG00 000017199
ATL1	ENSG0000 0198513	ENSPTRG000 00023829	ENSCJAG000 00006480	ENSMICG000 00005443	ENSPANG000 00014239	ENSMMUG00 000009577
MARCH 4	ENSG0000 0144583	ENSPTRG000 00012897	ENSCJAG000 00012374	ENSMICG000 00027749	ENSPANG000 00022150	ENSMMUG00 000020824
CDH9	ENSG0000 0113100	ENSPTRG000 00016759	ENSCJAG000 00007662	ENSMICG000 00008404	ENSPANG000 00012091	ENSMMUG00 000019846
SV2B	ENSG0000 0185518	ENSPTRG000 00007469	ENSCJAG000 00019298	ENSMICG000 00017792	ENSPANG000 00014252	ENSMMUG00 000008399
RORB	ENSG0000 0198963	ENSPTRG000 00021025	ENSCJAG000 00001216	ENSMICG000 00007512	ENSPANG000 00024927	ENSMMUG00 000012571
PSD2	ENSG0000 0146005	ENSPTRG000 00017305	ENSCJAG000 00016848	ENSMICG000 00012647	ENSPANG000 00002492	ENSMMUG00 000014636

HMGCLL 1	ENSG0000 0146151	ENSPTRG000 00018299	ENSCJAG000 00010832	ENSMICG000 00015183	ENSPANG000 00000755	ENSMMUG00 000001399
MAP3K1 9	ENSG0000 0176601	ENSPTRG000 00012490	ENSCJAG000 00011631	ENSMICG000 00013841	ENSPANG000 00000669	ENSMMUG00 000017121
PDXP	ENSG0000 0241360	ENSPTRG000 00041879	ENSCJAG000 00012519	ENSMICG000 00003819	ENSPANG000 00017416	ENSMMUG00 000049216
KCNK4	ENSG0000 0182450	ENSPTRG000 00003832	ENSCJAG000 00018060	ENSMICG000 00016981	ENSPANG000 00018628	ENSMMUG00 000017802
BSN	ENSG0000 0164061	ENSPTRG000 00014927	ENSCJAG000 00004003	ENSMICG000 00010621	ENSPANG000 00010033	ENSMMUG00 000014537
SLC2A13	ENSG0000 0151229	ENSPTRG000 00004827	ENSCJAG000 00017922	ENSMICG000 00034052	ENSPANG000 00019087	ENSMMUG00 000010078
KCNIP3	ENSG0000 0115041	ENSPTRG000 00012213	ENSCJAG000 00018883	ENSMICG000 00010744	ENSPANG000 00018833	ENSMMUG00 000000199
TTBK1	ENSG0000 0146216	ENSPTRG000 00018193	ENSCJAG000 00005343	ENSMICG000 00008369	ENSPANG000 00021604	ENSMMUG00 000017322
CACNG7	ENSG0000 0105605	ENSPTRG000 00011436	ENSCJAG000 00018478	ENSMICG000 00027690	ENSPANG000 00025512	ENSMMUG00 000007975
CADM2	ENSG0000 0175161	ENSPTRG000 00015120	ENSCJAG000 00008885	ENSMICG000 00014503	ENSPANG000 00006775	ENSMMUG00 000000583
GPR151	ENSG0000 0173250	ENSPTRG000 00017376	ENSCJAG000 00021711	ENSMICG000 00009365	ENSPANG000 00016847	ENSMMUG00 000023287
SLC30A3	ENSG0000 0115194	ENSPTRG000 00011757	ENSCJAG000 00001114	ENSMICG000 00017103	ENSPANG000 00016958	ENSMMUG00 000010272
RAB3A	ENSG0000 0105649	ENSPTRG000 00010697	ENSCJAG000 00014111	ENSMICG000 00014724	ENSPANG000 00009376	ENSMMUG00 000005027
FSD1	ENSG0000 0105255	ENSPTRG000 00010302	ENSCJAG000 00014650	ENSMICG000 00000316	ENSPANG000 00019255	ENSMMUG00 000000268
MGAT4 C	ENSG0000 0182050	ENSPTRG000 00005275	ENSCJAG000 00019762	ENSMICG000 00037297	ENSPANG000 00014454	ENSMMUG00 000023103
RPRM	ENSG0000 0177519	ENSPTRG000 00012545	ENSCJAG000 00023133	ENSMICG000 00038767	ENSPANG000 00016888	ENSMMUG00 000022529
SST	ENSG0000 0157005	ENSPTRG000 00015727	ENSCJAG000 00014415	ENSMICG000 00036921	ENSPANG000 00015209	ENSMMUG00 000000850

Supplementary Figures

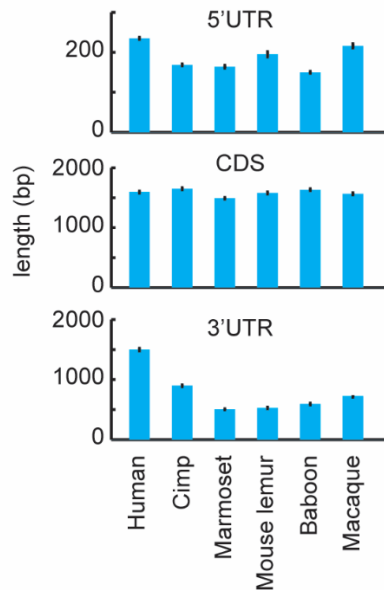


Fig. S1. Length analysis of genomic regions. Bar graph showing average and standard error of the mean (s.e.m) for lengths of the examined genomic regions: 5'UTR, CDS and 3'UTR, across the 6 examined primates. The significantly longer length of human 3'UTR (One-Way-ANOVA $P < 0.05$ and post hoc Tuckey test $P < 0.05$ for human compared to all other species) was reported before by ¹³.

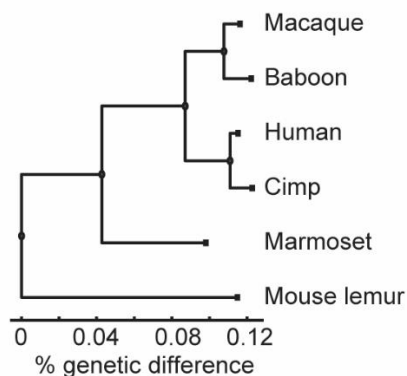


Fig. S2. Normalizing tree. General genetic distance-based phylogenetic tree for the 6 examined species. This tree was used to normalize the sequence distance-based phylogenetic trees produced for each genomic region separately. The normalizing tree was downloaded from <http://www.gate.net/~rwms/primegendist.html#Msp> where the distances between the nodes were calculated by the PAUP*4.0 software.

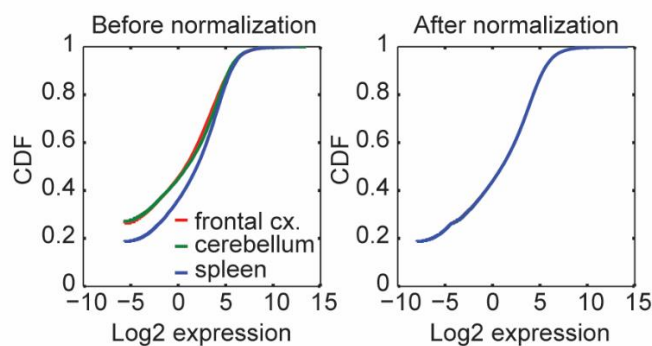


Fig. S3. Quantile normalization of expression data. Cumulative distribution functions (CDF) for three example human tissues; frontal cortex (frontal cx.), cerebellum and spleen, before and after quantile normalization. Note that after normalization distributions of different tissues overlap. In the right graph, the red and green curves are behind the blue curve.

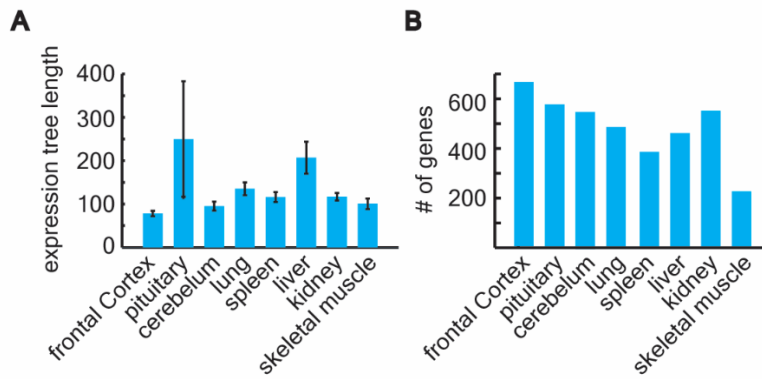


Fig. S4. (A) Total length of expression-based trees for each tissue (average and s.e.m). The smaller expression distance between primates for brain regions was reported before by ^{7,8}. **(B)** Number of genes analyzes in each tissue, after filtering out gene regions with unidentified nucleotides in any species and non-expressed genes.