**Additional files**

**Additional file 1**

***CTLA4* gene expression databases**

Since SCZ is a mental disorder originating from abnormal brain function and T cells predominantly in blood can infiltrate into the brain ([Potvin et al., 2008](#_ENREF_2)), we explored the expression pattern of *CTLA4* in various human brain tissues and whole blood using RNA sequencing-based expression data from the genotype-tissue expression Portal (GTEx) (<https://gtexportal.org/home/>), which includes the gene expression and genotype data of 53 normal human tissues from 544 post-mortem donors([Cai et al., 2016](#_ENREF_1)). The GTEx project is supported by the NIH Common Fund and provides a unique opportunity to evaluate the relationships among transcriptomes of different tissues.

Furthermore, we explored the spatial expression profiling of *CTLA4* two isoforms in 10 human brain regions using the BRAINEAC data ([van Kesteren et al., 2017](#_ENREF_3)). Currently, the BRAINEAC dataset comprises of both mRNA and DNA of 134 brains from individuals free of neurodegenerative disorders, which was collected by two branches. In one case of samples originating from the Medical Research Council (MRC) Sudden Death Brain and Tissue Bank, Edinburgh, UK, whole brains were removed as fresh tissue and anatomical regions of interest were sampled from brain coronal slices at autopsy and immediately flash frozen. In the case of samples originating from the Sun Health Research Institute (SHRI) affiliated with Sun Health Corporation, USA, whole brains were removed as fresh tissue at autopsy and brain coronal slices were frozen. Anatomical regions of interest were sampled from brain coronal slices on dry ice. The Affymetrix Exon 1.0 ST Arrays were used for the transcription analysis. Gene expression for each individual on the transcription level was analyzed in up to 10 brain regions, namely cerebellar cortex (CRBL), frontal cortex (FCTX), hippocampus (HIPP), medulla (specifically inferior olivary nucleus, MEDU), occipital cortex (specifically primary visual cortex, OCTX), putamen (PUTM), substantia nigra (SNIG), thalamus (THAL), temporal cortex (TCTX) and intralobular white matter (WHMT). Moreover, all samples were genotyped on the Illumina Infinium Omni1-Quad BeadChip, which was then scanned using an iScan (Illumina, USA) with an AutoLoader (Illumina, USA). GenomeStudio v.1.8.X (Illumina, USA) was used for analysing the data and generating SNP calls.

In addition, we also explored the temporal dynamic transcription level of CTLA4 in the human postmortem dorsolateral prefrontal cortex (DLPFC) using the BrainCloud database (<http://braincloud.jhmi.edu>), which contains gene expression data of 30,176 probes on 269 normal subjects ranging in age from fetal development (negative ages) to the aged (80 years) obtained from custom two-color microarrays ([Verma et al., 2017](#_ENREF_4)). Transcription levels of different genes were determined through using the National Human Genome Research Institute (NHGRI) microarray core facility and using a reference RNA comprised of a pool of all samples. Subjects here have no evidence of macro- or microscopic neuropathology, drug use, alcohol abuse, or psychiatric illness. A 2nd degree basis spline model was created to fit to the expression value at each probe, with knots at across age within each age range. Then, surrogate variable analysis was performed to estimate 31 surrogate variables using the spline model.

**Additional Table 1:** CTLA4 SNP genotyping results in BRAINEAC database

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Subject ID | rs733618 | rs231779 | rs231775 | rs3087243 |
| 00\_38 | 2 | 2 | 2 | 2 |
| 002\_08 | 2 | 2 | 2 | 2 |
| 013\_09 | 2 | 2 | 2 | 2 |
| 08\_55 | 2 | 1 | 1 | 2 |
| 98\_27 | 2 | 1 | 1 | 2 |
| 99\_14 | 2 | 1 | 1 | 2 |
| 004\_10 | 2 | 1 | 1 | 2 |
| 008\_10 | 2 | 1 | 1 | 2 |
| 014\_09 | 2 | 1 | 1 | 2 |
| 019\_08 | 2 | 1 | 1 | 2 |
| 024\_09 | 2 | 1 | 1 | 2 |
| 025\_09 | 2 | 1 | 1 | 2 |
| 030\_06 | 2 | 1 | 1 | 2 |
| 032\_09 | 2 | 1 | 1 | 2 |
| 034\_08 | 2 | 1 | 1 | 2 |
| 038\_08 | 2 | 1 | 1 | 2 |
| 98\_34 | 2 | 1 | 0 | 2 |
| 06\_02 | 2 | 0 | 0 | 2 |
| 06\_53 | 2 | 0 | 0 | 2 |
| 07\_73 | 2 | 0 | 0 | 2 |
| 95\_27 | 2 | 0 | 0 | 2 |
| 006\_10 | 2 | 0 | 0 | 2 |
| 009\_09 | 2 | 0 | 0 | 2 |
| 017\_09 | 2 | 0 | 0 | 2 |
| 018\_06 | 2 | 0 | 0 | 2 |
| 020\_07 | 2 | 0 | 0 | 2 |
| 026\_07 | 2 | 0 | 0 | 2 |
| 031\_09 | 2 | 0 | 0 | 2 |
| 033\_09 | 2 | 0 | 0 | 2 |
| 036\_09 | 2 | 0 | 0 | 2 |
| 017\_07 | 2 | 1 | 1 | 1 |
| 09\_56 | 2 | 2 | 2 | 1 |
| 92\_10 | 2 | 2 | 2 | 1 |
| 96\_44 | 2 | 2 | 2 | 1 |
| 006\_09 | 2 | 2 | 2 | 1 |
| 007\_10 | 2 | 2 | 2 | 1 |
| 012\_09 | 2 | 2 | 2 | 1 |
| 012\_10 | 2 | 2 | 2 | 1 |
| 016\_07 | 2 | 2 | 2 | 1 |
| 016\_10 | 2 | 2 | 2 | 1 |
| 018\_05 | 2 | 2 | 2 | 1 |
| 020\_08 | 2 | 2 | 2 | 1 |
| 031\_08 | 2 | 2 | 2 | 1 |
| 040\_08 | 2 | 2 | 2 | 1 |
| 95\_21 | 2 | 2 | 2 | 1 |
| 025\_05 | 2 | 2 | 2 | 1 |
| 005\_09 | 2 | 1 | 1 | 1 |
| 010\_09 | 2 | 2 | 1 | 1 |
| 04\_05 | 2 | 1 | 1 | 1 |
| 05\_10 | 2 | 1 | 1 | 1 |
| 07\_28 | 2 | 1 | 1 | 1 |
| 07\_37 | 2 | 1 | 1 | 1 |
| 94\_35 | 2 | 1 | 1 | 1 |
| 95\_03 | 2 | 1 | 1 | 1 |
| 95\_26 | 2 | 1 | 1 | 1 |
| 97\_17 | 2 | 1 | 1 | 1 |
| 97\_37 | 2 | 1 | 1 | 1 |
| 97\_45 | 2 | 1 | 1 | 1 |
| 002\_10 | 2 | 1 | 1 | 1 |
| 003\_10 | 2 | 1 | 1 | 1 |
| 004\_06 | 2 | 1 | 1 | 1 |
| 004\_08 | 2 | 1 | 1 | 1 |
| 006\_08 | 2 | 1 | 1 | 1 |
| 007\_06 | 2 | 1 | 1 | 1 |
| 009\_07 | 2 | 1 | 1 | 1 |
| 011\_10 | 2 | 1 | 1 | 1 |
| 013\_10 | 2 | 1 | 1 | 1 |
| 014\_10 | 2 | 1 | 1 | 1 |
| 015\_07 | 2 | 1 | 1 | 1 |
| 015\_10 | 2 | 1 | 1 | 1 |
| 016\_08 | 2 | 1 | 1 | 1 |
| 017\_08 | 2 | 1 | 1 | 1 |
| 019\_10 | 2 | 1 | 1 | 1 |
| 020\_10 | 2 | 1 | 1 | 1 |
| 021\_05 | 2 | 1 | 1 | 1 |
| 021\_08 | 2 | 1 | 1 | 1 |
| 021\_10 | 2 | 1 | 1 | 1 |
| 022\_08 | 2 | 1 | 1 | 1 |
| 022\_09 | 2 | 1 | 1 | 1 |
| 023\_10 | 2 | 1 | 1 | 1 |
| 024\_10 | 2 | 1 | 1 | 1 |
| 025\_08 | 2 | 1 | 1 | 1 |
| 025\_10 | 2 | 1 | 1 | 1 |
| 028\_09 | 2 | 1 | 1 | 1 |
| 028\_10 | 2 | 1 | 1 | 1 |
| 032\_08 | 2 | 1 | 1 | 1 |
| 033\_08 | 2 | 1 | 1 | 1 |
| 035\_09 | 2 | 1 | 1 | 1 |
| 043\_06 | 2 | 1 | 1 | 1 |
| 011\_09 | 2 | 1 | 1 | 1 |
| 015\_09 | 2 | 1 | 1 | 1 |
| 01\_37 | 2 | 2 | 2 | 0 |
| 02\_06 | 2 | 2 | 2 | 0 |
| 92\_32 | 2 | 2 | 2 | 0 |
| 96\_03 | 2 | 2 | 2 | 0 |
| 96\_32 | 2 | 2 | 2 | 0 |
| 97\_14 | 2 | 2 | 2 | 0 |
| 001\_06 | 2 | 2 | 2 | 0 |
| 003\_08 | 2 | 2 | 2 | 0 |
| 007\_08 | 2 | 2 | 2 | 0 |
| 007\_09 | 2 | 2 | 2 | 0 |
| 012\_08 | 2 | 2 | 2 | 0 |
| 018\_07 | 2 | 2 | 2 | 0 |
| 018\_08 | 2 | 2 | 2 | 0 |
| 018\_10 | 2 | 2 | 2 | 0 |
| 021\_09 | 2 | 2 | 2 | 0 |
| 022\_06 | 2 | 2 | 2 | 0 |
| 023\_08 | 2 | 2 | 2 | 0 |
| 026\_09 | 2 | 2 | 2 | 0 |
| 029\_09 | 2 | 2 | 2 | 0 |
| 034\_06 | 2 | 2 | 2 | 0 |
| 035\_06 | 2 | 2 | 2 | 0 |
| 036\_08 | 2 | 2 | 2 | 0 |
| 016\_09 | 2 | 2 | 2 | 0 |
| 024\_08 | 2 | 2 | 2 | 0 |
| 97\_02 | 1 | 1 | 1 | 1 |
| 001\_10 | 1 | 1 | 1 | 2 |
| 010\_10 | 1 | 1 | 1 | 2 |
| 03\_28 | 1 | 0 | 0 | 2 |
| 08\_88 | 1 | 0 | 0 | 2 |
| 014\_08 | 1 | 0 | 0 | 2 |
| 018\_09 | 1 | 0 | 0 | 2 |
| 023\_09 | 1 | 0 | 0 | 2 |
| 026\_08 | 1 | 0 | 0 | 2 |
| 028\_08 | 1 | 0 | 0 | 2 |
| 032\_10 | 1 | 0 | 0 | 2 |
| 034\_09 | 1 | 0 | 0 | 2 |
| 037\_08 | 1 | 0 | 0 | 2 |
| 038\_09 | 1 | 0 | 0 | 2 |
| 039\_06 | 1 | 1 | 1 | 1 |
| 027\_09 | 1 | 1 | 1 | 1 |
| 030\_09 | 1 | 1 | 1 | 1 |
| 04\_19 | 1 | 1 | 1 | 1 |
| 96\_13 | 1 | 1 | 1 | 1 |

CTLA4 = cytotoxic T lymphocyte antigen 4; SNP = single nucleotide polymorphism.

**Additional Table 2**: Expression levels of specific probes targeting *CTLA4* in Hippocampus

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Subject ID | P2523857 | P2523858 | mCTLA44+sCTLA4 | P2523859 | P2523861 | mCTLA44 |
| 00\_38 | 5.33124 | 4.10244 | 4.71684 | 4.06934 | 3.67671 | 3.873025 |
| 001\_06 | 5.46055 | 3.69452 | 4.577535 | 3.54218 | 3.36372 | 3.45295 |
| 001\_10 | 5.63693 | 4.04264 | 4.839785 | 4.35639 | 2.96603 | 3.66121 |
| 002\_08 | 5.73983 | 4.29037 | 5.0151 | 4.55121 | 2.87873 | 3.71497 |
| 002\_10 | 5.2791 | 4.25348 | 4.76629 | 4.26558 | 3.6227 | 3.94414 |
| 003\_08 | 5.42423 | 4.49515 | 4.95969 | 3.1791 | 3.27869 | 3.228895 |
| 003\_10 | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 004\_06 | 5.62475 | 4.91784 | 5.271295 | 4.12778 | 3.3939 | 3.76084 |
| 004\_08 | 5.41995 | 4.74467 | 5.08231 | 4.08572 | 3.74542 | 3.91557 |
| 004\_10 | 5.73007 | 4.76367 | 5.24687 | 3.78969 | 3.80869 | 3.79919 |
| 005\_09 | 5.8704 | 4.29268 | 5.08154 | 3.97128 | 3.76957 | 3.870425 |
| 006\_08 | 5.86294 | 4.306 | 5.08447 | 3.31408 | 2.67432 | 2.9942 |
| 006\_09 | 5.68546 | 4.71789 | 5.201675 | 3.4564 | 3.59455 | 3.525475 |
| 006\_10 | 5.46582 | 4.41666 | 4.94124 | 3.6135 | 3.15879 | 3.386145 |
| 007\_06 | 5.84638 | 4.28307 | 5.064725 | 3.46509 | 3.10257 | 3.28383 |
| 007\_08 | 6.00446 | 4.39356 | 5.19901 | 3.44825 | 3.3252 | 3.386725 |
| 007\_09 | 5.99901 | 4.2237 | 5.111355 | 4.21502 | 3.41117 | 3.813095 |
| 007\_10 | 5.45415 | 4.65695 | 5.05555 | 3.80549 | 3.4689 | 3.637195 |
| 008\_10 | 5.3372 | 4.91322 | 5.12521 | 4.33238 | 2.50924 | 3.42081 |
| 009\_07 | 5.92708 | 4.40952 | 5.1683 | 4.51236 | 3.66373 | 4.088045 |
| 009\_09 | 5.62802 | 4.95785 | 5.292935 | 3.44683 | 3.25169 | 3.34926 |
| 01\_37 | 5.6783 | 3.70699 | 4.692645 | 4.2876 | 3.01215 | 3.649875 |
| 010\_09 | 5.82131 | 4.23344 | 5.027375 | 3.77783 | 2.36478 | 3.071305 |
| 010\_10 | 5.48349 | 4.94367 | 5.21358 | 4.10584 | 4.12728 | 4.11656 |
| 011\_09 | 6.19931 | 3.96487 | 5.08209 | 3.9048 | 3.20915 | 3.556975 |
| 011\_10 | 5.84089 | 3.7728 | 4.806845 | 4.29235 | 3.393 | 3.842675 |
| 012\_08 | 5.75496 | 4.24197 | 4.998465 | 3.88522 | 3.65709 | 3.771155 |
| 012\_09 | 6.19703 | 4.83766 | 5.517345 | 3.93324 | 4.27227 | 4.102755 |
| 012\_10 | 5.77009 | 3.84336 | 4.806725 | 4.1112 | 3.54273 | 3.826965 |
| 013\_09 | 5.69702 | 3.73102 | 4.71402 | 3.9554 | 3.26246 | 3.60893 |
| 013\_10 | 5.51934 | 4.86377 | 5.191555 | 4.6239 | 3.40893 | 4.016415 |
| 014\_08 | 5.50979 | 3.40264 | 4.456215 | 2.97735 | 2.71252 | 2.844935 |
| 014\_09 | 5.38531 | 4.90495 | 5.14513 | 3.45136 | 3.4128 | 3.43208 |
| 014\_10 | 5.79008 | 4.09994 | 4.94501 | 4.52178 | 4.43257 | 4.477175 |
| 015\_07 | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 015\_09 | 6.12373 | 4.44891 | 5.28632 | 4.09558 | 3.89284 | 3.99421 |
| 015\_10 | 6.13916 | 4.43301 | 5.286085 | 4.82585 | 3.14913 | 3.98749 |
| 016\_07 | 6.07259 | 4.61179 | 5.34219 | 3.66547 | 3.03345 | 3.34946 |
| 016\_08 | 6.26886 | 3.57704 | 4.92295 | 3.4266 | 3.91005 | 3.668325 |
| 016\_09 | 5.7098 | 4.3988 | 5.0543 | 4.07656 | 3.11422 | 3.59539 |
| 016\_10 | 5.70898 | 4.87006 | 5.28952 | 3.26134 | 2.45196 | 2.85665 |
| 017\_07 | 5.67736 | 4.26437 | 4.970865 | 4.15537 | 4.64204 | 4.398705 |
| 017\_08 | 5.4977 | 3.98916 | 4.74343 | 4.08197 | 2.69266 | 3.387315 |
| 017\_09 | 5.80169 | 4.10772 | 4.954705 | 3.87492 | 3.16705 | 3.520985 |
| 018\_05 | 5.28791 | 4.75402 | 5.020965 | 4.48645 | 3.44951 | 3.96798 |
| 018\_06 | 5.83874 | 4.61476 | 5.22675 | 4.22925 | 2.87847 | 3.55386 |
| 018\_07 | 5.87433 | 4.08282 | 4.978575 | 3.42981 | 2.83546 | 3.132635 |
| 018\_08 | 6.17813 | 3.76354 | 4.970835 | 3.83921 | 3.23052 | 3.534865 |
| 018\_09 | 5.56487 | 3.7091 | 4.636985 | 4.44292 | 2.53875 | 3.490835 |
| 018\_10 | 6.04393 | 3.22764 | 4.635785 | 4.22459 | 3.40819 | 3.81639 |
| 019\_08 | 5.94287 | 5.22943 | 5.58615 | 2.99456 | 4.65408 | 3.82432 |
| 019\_10 | 5.6038 | 3.00272 | 4.30326 | 3.93167 | 4.03809 | 3.98488 |
| 02\_06 | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 020\_07 | 5.38326 | 4.21254 | 4.7979 | 4.62284 | 3.89661 | 4.259725 |
| 020\_08 | 5.64272 | 4.8023 | 5.22251 | 3.61236 | 4.16771 | 3.890035 |
| 020\_10 | 5.72911 | 4.71164 | 5.220375 | 2.7341 | 3.00995 | 2.872025 |
| 021\_05 | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 021\_08 | 5.51632 | 4.52878 | 5.02255 | 2.70377 | 2.73385 | 2.71881 |
| 021\_09 | 5.409 | 4.33421 | 4.871605 | 4.32963 | 2.75496 | 3.542295 |
| 021\_10 | 5.88615 | 4.38483 | 5.13549 | 4.10679 | 3.45026 | 3.778525 |
| 022\_06 | 5.72846 | 4.35545 | 5.041955 | 3.90475 | 3.30012 | 3.602435 |
| 022\_08 | 5.33661 | 4.1184 | 4.727505 | 3.68178 | 3.33414 | 3.50796 |
| 022\_09 | 5.25289 | 4.09401 | 4.67345 | 4.71411 | 2.63161 | 3.67286 |
| 023\_08 | 5.95705 | 3.96176 | 4.959405 | 2.74664 | 3.79087 | 3.268755 |
| 023\_09 | 5.74384 | 4.27272 | 5.00828 | 4.04874 | 3.72168 | 3.88521 |
| 023\_10 | 5.47211 | 5.2979 | 5.385005 | 2.88105 | 2.26625 | 2.57365 |
| 024\_08 | 5.3761 | 4.44439 | 4.910245 | 4.57145 | 3.90713 | 4.23929 |
| 024\_09 | 7.0114 | 3.5054 | 5.2584 | 4.29236 | 3.68946 | 3.99091 |
| 024\_10 | 6.3502 | 4.05187 | 5.201035 | 3.81495 | 3.28679 | 3.55087 |
| 025\_05 | 5.5055 | 4.96093 | 5.233215 | 3.94118 | 3.96126 | 3.95122 |
| 025\_08 | 6.25378 | 3.85059 | 5.052185 | 4.81739 | 3.72067 | 4.26903 |
| 025\_09 | 5.37875 | 5.19575 | 5.28725 | 2.8832 | 3.4105 | 3.14685 |
| 025\_10 | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 026\_07 | 5.5243 | 4.3614 | 4.94285 | 4.59893 | 3.0168 | 3.807865 |
| 026\_08 | 5.41829 | 4.2519 | 4.835095 | 3.14023 | 3.0843 | 3.112265 |
| 026\_09 | 5.67496 | 4.80076 | 5.23786 | 4.70587 | 2.16857 | 3.43722 |
| 027\_09 | 5.66649 | 4.10539 | 4.88594 | 3.87266 | 3.37218 | 3.62242 |
| 028\_08 | 5.57801 | 4.12312 | 4.850565 | 3.53799 | 3.30475 | 3.42137 |
| 028\_09 | 5.53225 | 4.56641 | 5.04933 | 4.09184 | 3.46832 | 3.78008 |
| 028\_10 | 5.80669 | 3.79446 | 4.800575 | 4.2068 | 2.76644 | 3.48662 |
| 029\_09 | 6.01742 | 4.31478 | 5.1661 | 4.2606 | 3.2696 | 3.7651 |
| 03\_28 | 5.79986 | 4.18694 | 4.9934 | 4.34452 | 2.83187 | 3.588195 |
| 030\_06 | 6.10295 | 5.06828 | 5.585615 | 4.34317 | 4.20954 | 4.276355 |
| 030\_09 | 5.57633 | 5.13082 | 5.353575 | 3.59549 | 2.64311 | 3.1193 |
| 031\_08 | 5.79005 | 4.49144 | 5.140745 | 4.4589 | 3.9384 | 4.19865 |
| 031\_09 | 5.75333 | 4.33822 | 5.045775 | 3.6372 | 3.0749 | 3.35605 |
| 032\_08 | 6.15377 | 4.6047 | 5.379235 | 4.90328 | 2.83025 | 3.866765 |
| 032\_09 | 6.02895 | 4.73549 | 5.38222 | 3.51536 | 3.26339 | 3.389375 |
| 032\_10 | 5.57443 | 3.44512 | 4.509775 | 3.70577 | 2.68397 | 3.19487 |
| 033\_08 | 6.09365 | 4.77794 | 5.435795 | 4.63998 | 4.89836 | 4.76917 |
| 033\_09 | 5.97858 | 4.13525 | 5.056915 | 2.56997 | 3.45466 | 3.012315 |
| 034\_06 | 6.23306 | 4.09544 | 5.16425 | 4.06532 | 3.24597 | 3.655645 |
| 034\_08 | 5.53149 | 4.36217 | 4.94683 | 3.23655 | 2.8463 | 3.041425 |
| 034\_09 | 5.12654 | 3.91486 | 4.5207 | 3.61539 | 2.43202 | 3.023705 |
| 035\_06 | 6.31651 | 4.22396 | 5.270235 | 3.54891 | 2.1519 | 2.850405 |
| 035\_09 | 5.84318 | 3.91999 | 4.881585 | 4.7752 | 3.32445 | 4.049825 |
| 036\_08 | 6.12054 | 4.2087 | 5.16462 | 3.86839 | 3.72908 | 3.798735 |
| 036\_09 | 6.00299 | 4.48488 | 5.243935 | 4.59596 | 3.26855 | 3.932255 |
| 037\_08 | 5.72294 | 4.27172 | 4.99733 | 3.12902 | 3.60171 | 3.365365 |
| 038\_08 | 5.85474 | 4.83083 | 5.342785 | 3.93682 | 4.43112 | 4.18397 |
| 038\_09 | 5.43521 | 4.15631 | 4.79576 | 3.39913 | 2.31961 | 2.85937 |
| 039\_06 | 5.24241 | 3.99766 | 4.620035 | 3.88079 | 2.94977 | 3.41528 |
| 04\_05 | 5.37045 | 4.33328 | 4.851865 | 4.16094 | 3.87079 | 4.015865 |
| 04\_19 | 5.86552 | 4.20576 | 5.03564 | 3.82633 | 3.31536 | 3.570845 |
| 040\_08 | 5.34918 | 4.85206 | 5.10062 | 4.36887 | 3.27751 | 3.82319 |
| 043\_06 | 5.18366 | 5.15147 | 5.167565 | 3.65365 | 3.11571 | 3.38468 |
| 05\_10 | 5.44473 | 4.0069 | 4.725815 | 4.30867 | 2.48718 | 3.397925 |
| 06\_02 | 6.25095 | 4.67063 | 5.46079 | 3.16692 | 3.2541 | 3.21051 |
| 06\_53 | 5.77913 | 5.27255 | 5.52584 | 3.72569 | 4.0847 | 3.905195 |
| 07\_28 | 5.99608 | 4.4409 | 5.21849 | 4.68166 | 2.44327 | 3.562465 |
| 07\_37 | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 07\_73 | 5.28899 | 4.53652 | 4.912755 | 4.3811 | 2.234 | 3.30755 |
| 08\_55 | 5.0378 | 4.11563 | 4.576715 | 4.259 | 2.68958 | 3.47429 |
| 08\_88 | 5.93135 | 4.7333 | 5.332325 | 2.69343 | 3.50762 | 3.100525 |
| 09\_56 | 5.89279 | 4.02793 | 4.96036 | 3.51127 | 4.611 | 4.061135 |
| 92\_10 | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 92\_32 | 5.37787 | 4.46305 | 4.92046 | 3.98869 | 2.98688 | 3.487785 |
| 94\_35 | 5.60451 | 4.26891 | 4.93671 | 3.73072 | 3.36265 | 3.546685 |
| 95\_03 | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 95\_21 | 6.2634 | 4.82105 | 5.542225 | 4.50444 | 4.15842 | 4.33143 |
| 95\_26 | 6.2192 | 4.5483 | 5.38375 | 4.28752 | 3.67199 | 3.979755 |
| 95\_27 | 5.62044 | 4.16613 | 4.893285 | 3.76191 | 2.97929 | 3.3706 |
| 96\_03 | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 96\_13 | 5.67824 | 4.1719 | 4.92507 | 3.97697 | 3.09795 | 3.53746 |
| 96\_32 | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 96\_44 | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 97\_02 | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 97\_14 | 5.68368 | 4.52665 | 5.105165 | 3.55295 | 2.34758 | 2.950265 |
| 97\_17 | 5.64731 | 4.50358 | 5.075445 | 3.77511 | 2.65014 | 3.212625 |
| 97\_37 | 5.77362 | 5.05362 | 5.41362 | 3.86748 | 3.38496 | 3.62622 |
| 97\_45 | 5.44411 | 4.60207 | 5.02309 | 4.46711 | 3.52522 | 3.996165 |
| 98\_27 | 5.78498 | 4.30912 | 5.04705 | 3.1521 | 2.79257 | 2.972335 |
| 98\_34 | 5.26714 | 4.60295 | 4.935045 | 3.56254 | 2.37864 | 2.97059 |
| 99\_14 | 5.97439 | 3.69054 | 4.832465 | 4.00975 | 4.2156 | 4.112675 |
| CTLA4 = cytotoxic T lymphocyte antigen 4; n.a. = not available. | | | | | | |

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**Additional Figure 1.** Expression patterns of *CTLA4* in human brain and whole blood. RNA sequencing-based expression data in human brain showed that *CTLA4* has the highest expression level in spinal cord, followed by hypothalamus, cereellum and cortex. *CTLA4*=cytotoxic T lymphocyte antigen 4.



**Additional Figure 2.** There exist two isoforms of *CTLA4* based on array data. The distribution of the total *CTLA4* including membrane CTLA4 (*mCTLA4*) and soluble CTLA4 (*sCTLA4*) is significantly higher than *mCTLA4*. *CTLA4*=cytotoxic T lymphocyte antigen 4.



**Additional Figure 3:** Temporal expression profiling of membrane CTLA4 (*mCTLA4*) and soluble CTLA4 (*sCTLA4*) throughout the lifespan. *CTLA4*=cytotoxic T lymphocyte antigen 4.



**Additional Figure 4.** Gene expression stability values (M) and pairwise variation (V) of the candidate reference genes calculated by geNorm. (A) Ranking of the gene expression stability performed in all the samples. The least stable genes are on the left and the most stable genes on the right. (B) Pairwise variation (Vn/Vn+1) was analyzed between the normalization factors NFn and NFn+1. Asterisk indicates the optimal number of reference genes required for normalization.

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