Evolutionary history of the *ADRB2* gene in humans.

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To the editor: Recently, Cagliani *et al.*[1] reported on the evolutionary history of the human β2-adrenoreceptor gene (*ADRB2*; [MIM 109690]).

The authors presented their analysis of the genealogy of inferred *ADRB2* haplotypes reconstructed through the use of a median-joining network approach. *ADRB2* shows a high level of polymorphism, including three coding variants with altered functional properties (at codons 16, 27 and 164; hereafter referred to as C16, C27 and C164), and several suspected regulatory variants. The network presented by Cagliani *et al.*[1] was prepared using software implementing a model that assumes no recombination, but allows for recurrent mutation. We notice that most SNPs in their network are represented by recurrent mutations in non-reticulated parts of the network, which we find biologically implausible and difficult to interpret in an evolutionary context. We have prepared a network diagram for the evolution of common *ADRB2* haplotypes that can be accounted for by divergence via the accumulation of mutations and rare recombination events between diverged haplotypes (Figure 1). This revised network requires no recurrent mutations (homoplasy) and accounts for the major haplotype groups of Cagliani *et al.*[1], Hawkins *et al.*[2] and Drysdale *et al.*[3], as well as those revealed by the HAPMAP data, with only one recombination event.

To construct this revised network, we generated an alignment of genomic sequences for human, chimpanzee and macaque as an outgroup using GenBank Accession nos. DQ094845, NC_006472 and NC_007863, respectively. The alignment, generated using ClustalX, spanned *ADRB2* from base position -4219 to + 5479 relative to the first base of the initiation codon of the main polypeptide product (Supplementary Figure 1). It was found that the chimpanzee genome sequence used gave poor alignment in the region -600 to -900. We used our own chimpanzee sequence generated by PCR amplification from genomic DNA to replace poorly

aligned regions of NC_006472. In Figure 1 we have shown only the network connecting the major haplogroups. Our network accounts for the generation of the HC1 haplogroup in Cagliani *et al.*[1] (haplogroup 1.1 in Hawkins *et al.*[2]) by recombination between the 5' end of a haplotype containing the ancestral G alleles at each of the common functional coding SNPs, C16 and C27 (i.e. a 'GG' haplotype), and the 3' end of a doubly-derived C16/C27 AC haplotype. This network, produced by eye, satisfies conditions of parsimony, requiring only one recombination event and no homoplasic mutations. Further mutation and recombination events, especially around the 3' end of the coding region, would account for the full spectrum of rare and region-specific haplotypes observed in Cagliani *et al.*[1] and Hawkins *et al.*[2] (not shown).

The major difference in network topology we find in relation to the common functional coding SNPs is that the first divergence from the most recent common ancestor (MRCA) of extant haplotypes separates the C16/C27 GG haplogroup from the remaining (GC and AC) haplogroups, with mutation at the C27 site creating a GC haplotype, followed by divergence of the GC and AC haplogroups, indicating that the C16 mutation that created the AC haplotype occurred on a GC haplotype background (Figure 1). The order of mutation events and consequent high degree of linkage disequilibrium between the neighbouring C16 and C27 sites probably explains why AG haplotypes are never found in well-sequenced datasets worldwide.

All the sites represented in the network in Cagliani *et al.*[1] are currently polymorphic, so their node labeled 'chimp' may thus better be represented as the most recent common ancestral human node for this gene. In our revised network we have used comparison with the macaque outgroup to assign all fixed mutations on the branches leading to the chimpanzee and to the ancestral human. Using our sequence for the chimpanzee, we find fewer fixed differences (50 sites) between the chimpanzee and the human common ancestor haplotype than the number

reported in Cagliani *et al.*[1] (77 sites). Of these 50 differences, 32 occur on the chimpanzee branch and 18 occur on the human branch. The ratio of polymorphic to fixed sites within the human lineage will relate to the relative time to most recent common ancestor (TMRCA) of all extant *ADRB2* haplotypes compared with time since the divergence from chimpanzee, although the true value would be affected by differences in generation times, population parameters and per-generation substitution rates within each species and haplotype lineage. Cagliani *et al.*[1] estimate this TMRCA to be in the range 1.05-1.65Myr. The revised network we have generated points to a significantly more ancient MRCA for this gene, since we find that 11, 8, and 13 currently polymorphic sites are found in the GG, AC and GC haplogroups, respectively, compared with the 18 fixed human mutations that have occurred since the human/chimpanzee common ancestor.

The mutation rate analysis in Cagliani *et al.*[1] is constrained by the use of polymorphism data only. Further evidence that *ADRB2* is unusually polymorphic comes from a comparison between the nucleotide substitution frequency in the lineage to the macaque outgroup and those to the fixed and polymorphic sites along the other branches. To illustrate the changes in substitution frequency across *ADRB2* and the differences between lineages, we counted the number of substitutions (of all mutation categories) in each lineage in 500bp windows across the entire region, moving along the gene in 200bp steps, and plotted these values as substitution frequencies per 1000bp on a line graph (Figure 2). To look for statistical differences in substitution frequency between lineages, we used Fisher's exact test to compare the frequency of substitutions in each 500bp window for chimpanzee fixed, human fixed and human polymorphic sites, respectively, with that in the macaque/outgroup. Individual 500bp windows giving $P<0.05$ in these tests were investigated further by extending the window in each direction and retesting using Fisher's exact test until no further decrease in P value was

observed (i.e. to give the minimum *P* value). The substitution frequency varied significantly (more than 5-fold) across *ADRB2* in the macaque/outgroup (500bp windows, $P<10^{-6}$ for heterogeneity, 18 d.f., χ-squared test). For the other branches, 10 out of 144 individual 500bp windows showed differences in substitution frequency (at $P<0.05$) when compared to the macaque/outgroup branch (Supplementary Table 1). After extension of these 10 windows to find the minimum *P* values, we found that the two most significant regions were the human polymorphic sites from position -50 to +1300 ($P=0.00001$) and from position +1300 to +4050 ($P=0.0013$). The macaque/outgroup substitution frequencies demonstrate a long-term reduction in substitution rate over the coding region, signaling constraint presumably associated with stabilizing selection on the ADRB2 functional phenotype. In agreement with Cagliani *et al.*[1], we note a relative increase in the density of surviving human polymorphic mutations in the coding region relative to the macaque/outgroup branch. This high diversity in our species may be associated with long-term balancing selection or with relaxed constraint. We also note the low diversity downstream of the transcript, which may be indicative of a selective sweep, although the possibility of incomplete SNP ascertainment in this region cannot be discounted.

We have also characterized the haplotype structure at the 3' end of *ADRB2*, which was not addressed in detail by Cagliani *et al.*[1] or by Hawkins *et al.*[2], nor addressed completely by another study by the latter group[4]. Table 1 shows the haplotypes obtained by sequencing 83 European individuals from our earlier study of Greek teenagers[5]. This study was approved by both Greek and UK local Research Ethics Committees and all subjects gave parentally-sanctioned informed consent. All sequenced individuals were homozygous for haplotypic combinations at codons 16 and 27 (i.e. GG homozygotes, GC homozygotes or AC homozygotes), apart from one individual heterozygous for a GCt haplotype. Homozygosity facilitated the reading of the sequence electropherogram across the polyC-tract beginning at

position 1266. We found almost complete linkage disequilibrium between the C16/C27 coding polymorphisms and the 3' polymorphisms within the GG and GC haplotypes, but considerable diversity within the AC haplotype. This 3'-end diversity is best explained by a combination of recombination events between haplotypes and variation in C-tract homopolymer length. In addition to the variability in the length of the C-tract, we would emphasise the hitherto unappreciated insertion of a G at position 1275 within the C-tract in certain haplotypes. The functional importance of length variation in the C-tract in relation to mRNA stability has been highlighted by Panebra *et al.*[4] but no alleles with a C-tract interrupted by the 1275G insertion were tested in their study. The insertion of a G into the homopolymer C-tract would be expected to influence C-tract conformation and interactions involved in mRNA stability at least as much as changes in homopolymer length. Both the C-tract length and the G insertion should be taken into account in future functional studies of variation at the 3' end of the gene.

The degree of linkage disequilibrium between the 3' variants and upstream variants may be a reflection of possible functional interactions between variants in different regions of *ADRB2* in relation to protein function, transcriptional regulation and mRNA stability. There may be additional effects mediated by the polymorphic site at pos. 1239, immediately 5' to the stop codon, affecting translation termination. A complete and accurate picture of variation across the entire gene is required before such interactions can be studied effectively.

References

1. Cagliani, R., Fumagalli, M., Pozzoli, U., Riva, S., Comi, G.P., Torri, F., Macciardi, F., Bresolin, N., and Sironi, M. (2009). Diverse evolutionary histories for β-adrenoreceptor genes in humans. Am. J. Hum. Genet. *85*, 64-75.

2. Hawkins, G.A., Tantisira, K., Meyers, D.A., Ampleford, E.J., Moore, W.C., Klanderman, B.,

Liggett, S.B., Peters, S.P., Weiss, S.T., and Bleecker, E.R. (2006). Sequence, haplotype, and association analysis of ADRβ2 in a multiethnic asthma case-control study. Am. J. Respir. Crit. Care Med. *174*, 1101-9.

3. Drysdale, C.M., McGraw, D.W., Stack, C.B., Stephens, J.C., Judson, R.S., Nandabalan, K., Arnold, K., Ruano, G., and Liggett, S.B. (2000). Complex promoter and coding region β2-adrenergic receptor haplotypes alter receptor expression and predict in vivo responsiveness. Proc Natl Acad Sci U S A. *97*, 10483-8.

4. Panebra, A., Schwarb, M.R., Swift, S.M., Weiss, S.T., Bleecker, E.R., Hawkins, G.A., and Liggett, S.B. (2008). Variable-length poly-C tract polymorphisms of the β2-adrenergic receptor 3'-UTR alter expression and agonist regulation. Am J Physiol Lung Cell Mol Physiol. *294*, L190-5.

5. Moran, C.N., Yang, N., Bailey, M.E.S., Tsiokanos, A., Jamurtas, A., MacArthur, D. J., North, K., Pitsiladis, Y.P., and Wilson, R.H. (2007). Association analysis of the *ACTN3* R577X polymorphism and complex quantitative body composition and performance phenotypes in adolescent Greeks. Eur. J. Hum. Genet. *15*, 88-93.

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Web Resources

OMIM, http://www.ncbi.nlm.nih.gov/sites/entrez?db=omim

dbSNP, http://www.ncbi.nlm.nih.gov/SNP/index.html

HAPMAP, http://www.hapmap.org

Accession Numbers

The chimpanzee *ADRB2* gene sequence generated by us has been given GenBank Accession number GU373723.

Figure Legends

Figure 1 – Evolutionary network for the common haplotypes of human *ADRB2*

Substituted and polymorphic sites in *ADRB2* are listed along the branches the mutation occurred in. Sites different in macaque but identical in human and chimpanzee are counted but not listed. Nodes connecting lines represent common ancestral haplotypes and are labeled. Sites are coded by position in the aligned human sequence relative to the first base of the initiation codon, derived allele, and whether the change involved insertion or deletion. Insertions and deletions were treated as single mutational events for calculation of the network regardless of the number of bases altered. Within the C-tract at pos. 1275, the co-appearance of adjacent G and C inserted bases were treated as a single mutation (see Table 1). Major haplogroups are indicated in shaded boxes. Within each box, these are coded as Cagliani *et al.* haplogroup (e.g. 'HC2'), Hawkins *et al.* haplogroup (e.g. '2.1'), and C16/C27 functional SNP haplogroup (e.g. 'GG'). GCt refers to the rare C164 derived haplotype not considered by Cagliani *et al.*[1]. Branches rejoining below a node represent formation of a new haplotype via recombination. Regions contributed by each parental haplotype and regions of recombination are indicated with '<' and '>'. Rare, population-specific polymorphic sites have not been shown on this network.

Figure 2 – Substitution/polymorphism rates across the *ADRB2* region.

No. of substitutions per kbp are plotted, on a logarithmic scale, vs position along the genomic region analysed for central points in a sliding window of 500 base pairs, with step size of 200bp. Base position 1 is the first base of the initiation codon. The black and white bar represents the *ADRB2* coding region and UTRs, respectively.

Key:

Macaque / outgroup
Chimpanzee / fixed
Human / fixed
Human / polymorphic

Table 1 Allelic composition of 3' polymorphic sites in *ADRB2*

position C16/C27 haplogroup	46	79	491	1053	1239	1263-1282	C-tract[a]	R?	N	% of haplogroup[b]
GG	G	G	C	G	G	AGACCCCCCC**----**CCCAAC	10		2	4
GG	G	G	C	G	G	AGACCCCCCCC**---**CCCAAC	11		48	90
GG	G	G	C	G	**A**	AGACCCCCCCC**---**CCCAAC	11	R	2	4
GG	G	G	C	**C**	**A**	AGACCCCCCCC-**CG**CCCAAC	13 +G	R	1	2
GC	G	**C**	C	**C**	**A**	AGACCCCCCCC-**CG**CCCAAC	13 +G		37	97
GC	G	**C**	C	**C**	G	AGACCCCCCCC-**CG**CCCAAC	13 +G	R	1	3
GCt	G	**C**	**T**	**C**	**A**	AGACCCCCCCC-**CG**CCCAAC	13 +G		3	N/A[c]
AC	**A**	**C**	C	G	G	AGACCCCCCCC**---**CCCAAC	11		35	56
AC	**A**	**C**	C	G	G	AGACCCCCCCC**C--**CCCAAC	12		5	8
AC	**A**	**C**	C	**C**	**A**	AGACCCCCCCC-**CG**CCCAAC	13 +G	R	19	31
AC	**A**	**C**	C	G	**A**	AGACCCCCCCC-**CG**CCCAAC	13 +G	R	1	2
AC	**A**	**C**	C	**C**	**A**	AGACCCCCCCC**CCG**CCCAAC	14 +G	R	1	2

[a]Length of C-tract including polymorphic G insertion if present; '+G' indicates G insertion is present
[b]Proportion of chromosomes from each of the three major haplogroups (GG, GC and AC); GCt indicates the rare haplotype containing the derived T-allele at the third functional non-synonymous site, codon 164, nucleotide position 491
[c]The GCt chromosomes are not counted as part of the GC haplogroup for this analysis as they were specifically selected.
N = no. of chromosomes observed
R – recombinant after position 79. In some rare cases recombination cannot easily be distinguished from back mutation or gene conversion events.
Derived alleles are shown in bold, including additional C residues appearing within the C-tract.

Figure 1

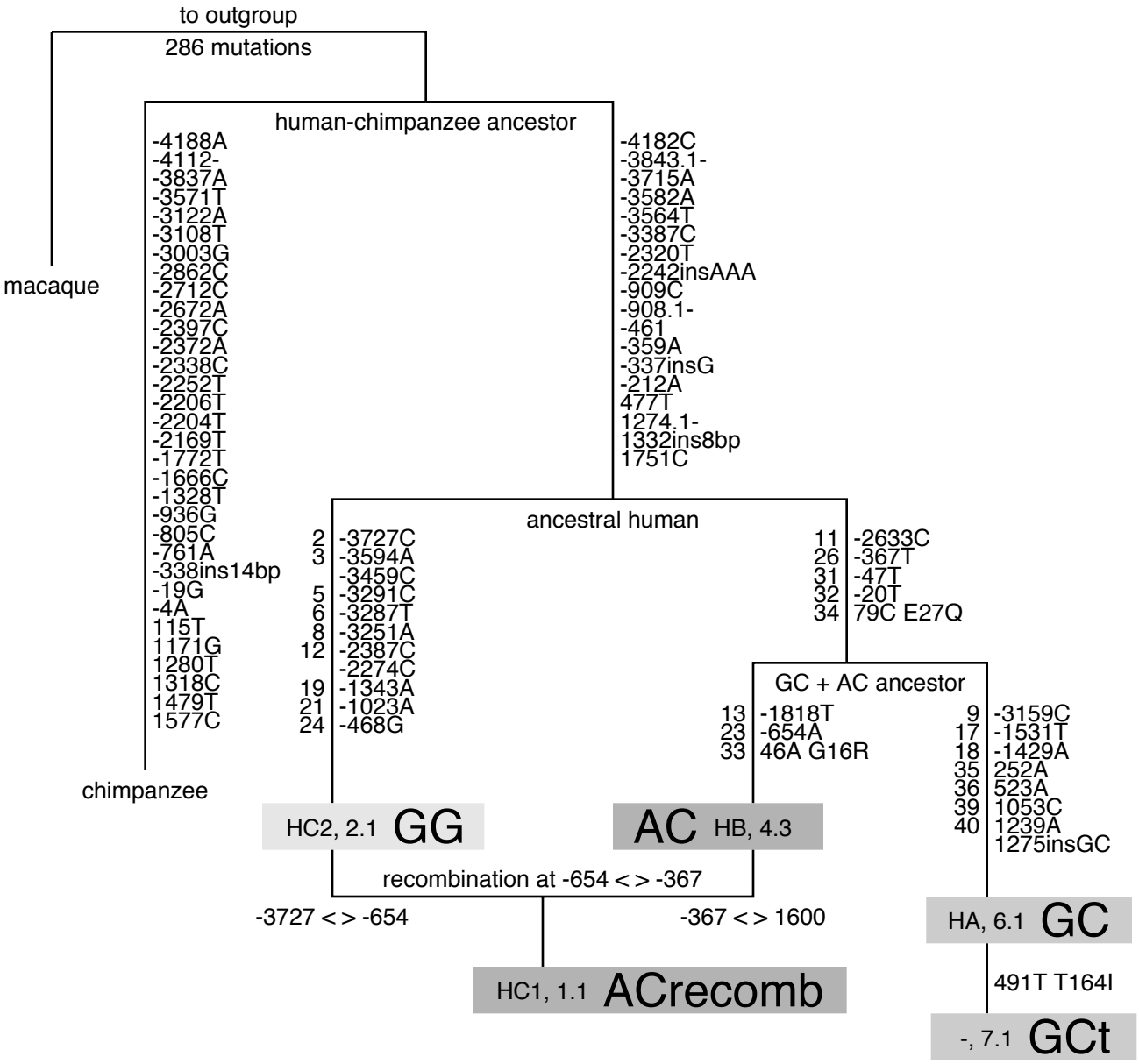
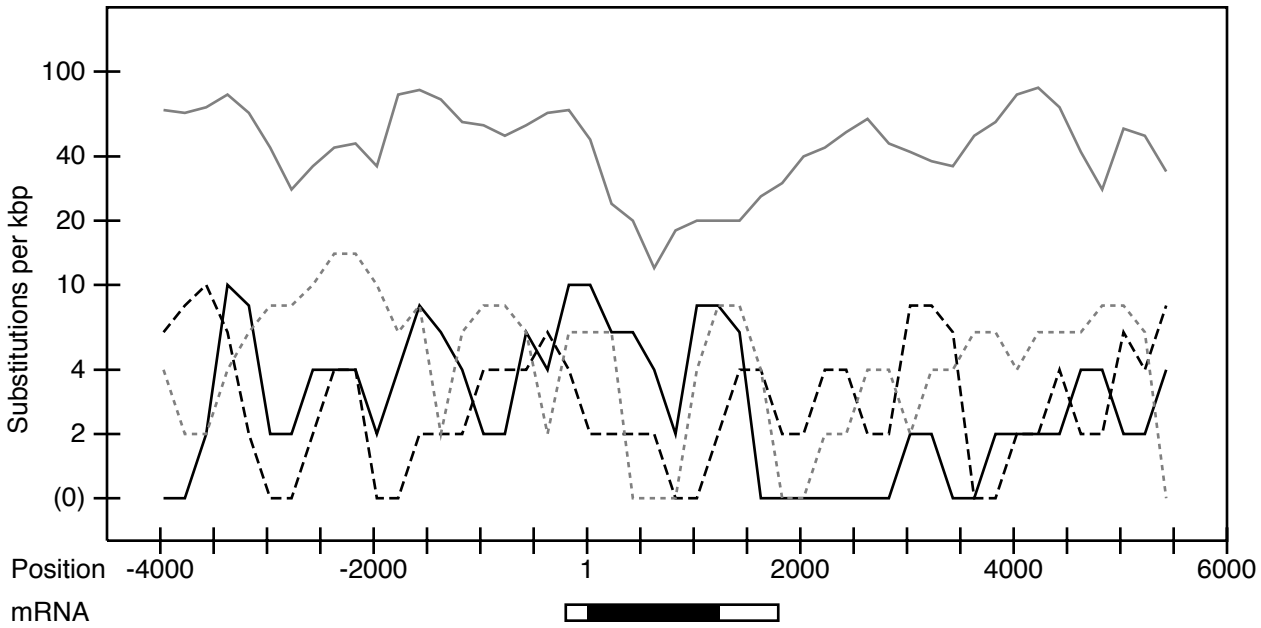

to outgroup
286 mutations
human-chimpanzee ancestor
-4188A
-4112-
-3837A
-3571T
-3122A
-3108T
-3003G
-2862C
-2712C
-2672A
-2397C
-2372A
-2338C
-2252T
-2206T
-2204T
-2169T
-1772T
-1666C
-1328T
-936G
-805C
-761A
-338ins14bp
-19G
-4A
115T
1171G
1280T
1318C
1479T
1577C
-4182C
-3843.1-
-3715A
-3582A
-3564T
-3387C
-2320T
-2242insAAA
-909C
-908.1-
-461
-359A
-337insG
-212A
477T
1274.1-
1332ins8bp
1751C
macaque
chimpanzee
ancestral human
2 -3727C
3 -3594A
-3459C
5 -3291C
6 -3287T
8 -3251A
12 -2387C
-2274C
19 -1343A
21 -1023A
24 -468G
11 -2633C
26 -367T
31 -47T
32 -20T
34 79C E27Q
GC + AC ancestor
13 -1818T
23 -654A
33 46A G16R
9 -3159C
17 -1531T
18 -1429A
35 252A
36 523A
39 1053C
40 1239A
1275insGC
HC2, 2.1 GG
AC HB, 4.3
recombination at -654 < > -367
-3727 < > -654
-367 < > 1600
HA, 6.1 GC
HC1, 1.1 ACrecomb
491T T164I
-, 7.1 GCt

Figure 2


Substitutions per kbp
100
40
20
10
4
2
(0)
Position
-4000
-2000
1
2000
4000
6000
mRNA

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Supplementary Table 1 - Regions around *ADRB2* giving evidence for altered substitution rates.

Species/Site set	Starting pos.	Ending pos.	*P* (Fisher's Exact)	Rate rel. to outgroup branch	Region of gene
Chimpanzee / fixed	-2900	-1700	0.0017	High	Extended Promoter
Chimpanzee / fixed	1150	1650	0.008	High	3' coding and UTR
Human / fixed	5200	5750	0.04	High	Downstream
Human / polymorphic	-50	1300	0.00001	High	Coding region
Human / polymorphic	1300	4050	0.0013	Low	3' UTR and downstream

Substitution frequencies were calculated at central points of 500bp windows across *ADRB2* with a step size of 200bp (see Fig. 2), and tested for differences against the macaque/outgroup using Fisher's Exact Test. Windows with $P < 0.05$ were extended on either side until overall *P* value in repeated tests stopped decreasing. Eight windows initially gave *P* values leading to extensions, and some separate windows became merged into extension regions subsequently. Hence, 5 regions remained, as listed in the Table. Starting and Ending pos. refers to the limits of the extended windows relative to the first base of the initiation codon (+1). The penultimate column states whether the substitution rate is higher or lower than that for the same region in the macaque/outgroup branch. The human polymorphic site set was constrained to contain only sites with minor allele frequency (MAF) > 0.1.

Supplementary Figure 1 - Alignment used for calculations of substitution rates across *ADRB2*

Sequences are based on the following sequence accession numbers in GenBank: Human – DQ094845; Chimpanzee - NC_006472; Macaque - NC_007863; our own chimpanzee sequence is designated as 'chimp5pr'. CLUSTAL 2.0.11 was used to align the sequences.
Position in each sequence is indicated at the end of each line.
Overall position in the human gene is indicated below the alignment (position +1 is the first base of the initiation codon).
'*' indicates identities across all three species.
'-' indicates a gap or deletion.

We have annotated the alignment, as follows:
'4' etc. indicates sites used to prepare the haplotype network in Cagliani *et al.* (Ref. 1).
'c3' etc. indicate sites from the full set (1-63) referred to in the Supplementary Material from Cagliani *et al.* (Ref. 1), where these were not used to construct the network in that study. Please note that '1' and 'c1' are thus not the same site as they come from different numbering systems.
'c' indicates a chimpanzee-specific change.
'h' indicates a human-specific change.
Sites that are identical in human and chimpanzee and different in macaque are indicated by lack of a '*' in the consensus trace.
'?' indicates that all three sequences are different, so assignment of changes to particular branches in the network is impossible.
'|' indicates a mismatch between chimpanzee genome sequence and our own chimpanzee sequence.
'&' indicates the site of the G insertion into the polyC tract in the 3'-UTR.
'>' indicates the known sites of transcriptional initiation.
'pA' indicates the site of addition of the polyA tail in the *ADRB2* cDNA reference sequence.

```
                                          c     h
                                          |     |
DQ094845        TGCAAAAGACATGAAGTCATCCTTTTTTATGGCTGCACAGTATTCCATGGTGTATATGTG 60
Chimp           TGCAAAAGACATGAAGTCATCCTTTTTTATGACTGCATAGTATTCCATGGTGTATATGTG 60
Macaque         TGCAAAGAGCCTGAACTCACCCTTTTTTATGGCTGCATAGTATTCCATGGTGTATATGTG 60
                ....5....0....5....0....5....0....5....0....5....0....5....0-4160
                ******   * **** *** ********** ***** ********************

                                                              c
                                                              |
DQ094845        CCACATTTTCTTTATCAAGTCTATTCTTGATGGGCATTTGGGTTGGTTCCAAGTCTTTGC 120
Chimp           CCACATTTTCTTTATCAAGTCTATTCTTGATGGGCATTTGGGTTGGT-CCAAGTCTTTGC 119
Macaque         CCACATTTTCTTTGTCAAGTCTATTATTAATGGGCATTTGGGTTGGTTCCTAGTCTTTGC 120
                ....5....0....5....0....5....0....5....0....5....0....5....0-4100
                ************ ********** ** ****************** ** *********

               c1
                |
DQ094845        TATTGTGAACAGTGCTGCAATAAACATACATGTCCATGTGTCTTTATAGTAGAATGATTT 180
Chimp           TATTGTGAACAGTGCTGCAATAAACATACGTGTCCATGTGTCTTTATAGTAGAATGATTT 179
Macaque         TATTGTGAACAGTGCTGCAATAAACATATGTGTCCATGTGTCTTTATAGTAGAATGATTT 180
                ....5....0....5....0....5....0....5....0....5....0....5....0-4040
                ***************************  ******************************
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```
DQ094845        ATAATCCTTAGGGTATATACCAGGTAATGGGATTGCTGGGTCAAATGGTATTTCTTGTTC 240
Chimp           ATAATCCTTAGGGTATATACCAGGTAATGGGATTGCTGGGTCAAATGGTATTTCTTGTTC 239
Macaque         ATAATCCTTTAGGCATATACCCAGTAATGGGATTGCTGGGTCAAATGTTATTTCTTGTTC 240
                ....5....0....5....0....5....0....5....0....5....0....5....0-3980
                *********  ** *******  ********************** ************

DQ094845        TAGATCCTTGAGGGATTGCCACACTGTCTTCCACAATGTTTGAACTAATTTACATTCCTA 300
Chimp           TAGATCCTTGAGGGATTGCCACACTGTCTTCCACAATGTTTGAACTAATTTACATTCCTA 299
Macaque         TAGATCCTTAAGGAATTGCCACATTGTCTTCCACAATGGTTGAACTAATTTACATTCCCA 300
                ....5....0....5....0....5....0....5....0....5....0....5....0-3920
                ********* *** ********* ************** ****************** *

DQ094845        CCAACAGTGTAAAAGTGTTCCTATTTCTCCACATCCTTTCCAGCATCTGTTGTTTCCTGA 360
Chimp           CCAACAGTGTAAAAGTGTTCCTATTTCTCCACATCCTTTCCAGCATCTGTTGTTTCCTGA 359
Macaque         CCAACAGTGTAAAAGTGTTCCTATT---------------------------------- 325
                ....5....0....5....0....5....0....5....0....5....0....5....0-3860
                *************************

                                ?     ?                   1
                                |     |                   |
DQ094845        CTTCCTGTTTTTTTTTT-GAGACGGAGTCTCACTGTGTCACCCCGGATGGAGTGCAGTGG 419
Chimp           CTTCCTGTTTTTTTTTTTGAGACAGAGTCTCACTGTGTCACCCAGGATGGAGTGCAGTGG 419
Macaque         ----------------------------------GTCGCCCAGGCTGGAGTGCGGTGG 349
                ....5....0....5.. ..0....5....0....5....0....5....0....5....-3801
                                                  *** *** ** ******** ****

DQ094845        CACAATCTCGGCTCACTGCAACCTCCACCTCCCAGGTTCAAGCGATTCTCCTGTTTCAGC 479
Chimp           CACAATCTCGGCTCACTGCAACCTCCACCTCCCAGGTTCAAGCGATTCTCCTGTTTCAGC 479
Macaque         CACAATCTCAGCTCACTGCAACCTCCACCTCCCAGGTTCAAGCGATTCTCCTGTCTCGGC 409
                0....5....0....5....0....5....0....5....0....5....0....5....-3741
                ********* ********************************************* ** **

                            2           h
                            |           |
DQ094845        CCCCAGAGTAGGTGAGACTACAGGCATGCCACAACTTCTGGCTAATTTTTGTATTTTTAT 539
Chimp           CCCCAGAGTAGGTGAGACTACAGGCGTGCCACAACTTCTGGCTAATTTTTGTATTTTTAT 539
Macaque         CCC-AGAGTAGCTGAAACTACAGGGGTGCCACAACTTCTGGCTAATTTTTGTATTTTTAT 468
                0....5....0....5....0....5....0....5....0....5....0....5....-3681
                *** ******* *** ********  ***********************************

DQ094845        TAGAGACGAAGTTTCACCATGTTGGTCAGGCTGCTCTCGAAGTCCTGACCTCAGGTGATC 599
Chimp           TAGAGACGAAGTTTCACCATGTTGGTCAGGCTGCTCTCGAAGTCCTGACCTCAGGTGATC 599
Macaque         TAGAGACGAACTTTCACCGTGTTGGTCAGGCTGCTCTCGAACTCCTGACCTTAAGTGATC 528
                0....5....0....5....0....5....0....5....0....5....0....5....-3621
                ********** ******* ********************** ********* * ******

                                          3           h           c      h
                                          |           |           |      |
DQ094845        CACCCACCTCAGCCTCCCAAAGTGCTGGGATTACAGGCATGAGCCACTGCGCCCGGTCTG 659
Chimp           CACCCACCTCAGCCTCCCAAAGTGCTGGGATTACAGGCGTGAGCCACTGTGCCCGGCCTG 659
Macaque         CACCCGCCTCAGCCTCCCAAAGTGCTGGGATTACAGGCGTGAGCCACCGCGCCCTCCCTG 588
                0....5....0....5....0....5....0....5....0....5....0....5....-3561
                ***** ********************************* ******** * ****   ***

DQ094845        TTTCCTGATGTGTTAATGATCGCCATTGTATCTGGTGTGAGATGGTATTTCATTGTGGTT 719
Chimp           TTTCCTGATGTGTTAATGATCGCCATTGTATCTGGTGTGAGATGGTATTTCATTGTGGTT 719
Macaque         TTTCCTGTT---TTAATGATGGCCATTGTATCTGGTGTGAGATGGTATTTCATTGTGGTT 645
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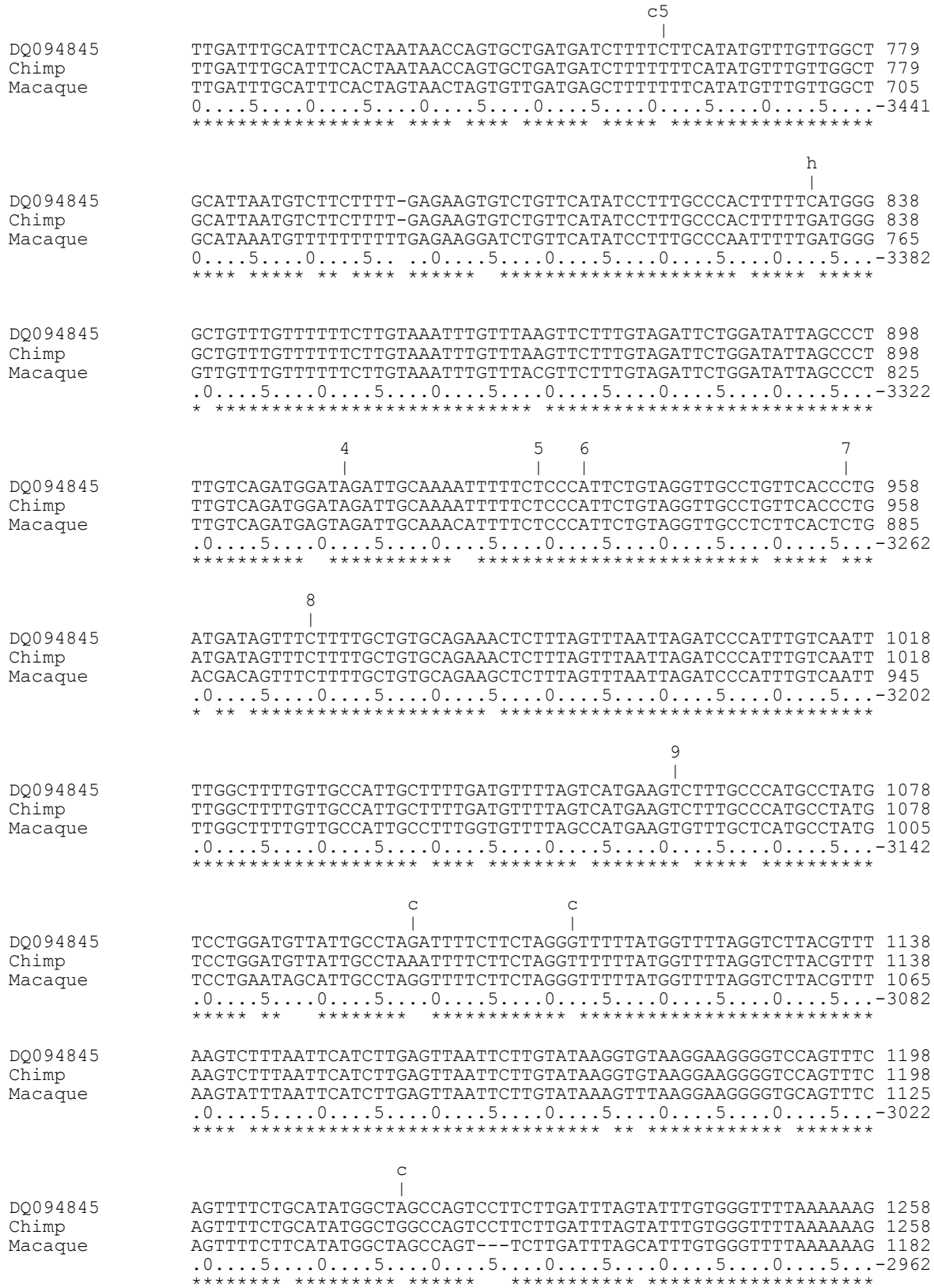
c5
DQ094845 TTGATTTGCATTTCACTAATAACCAGTGCTGATGATCTTTTCTTCATATGTTTGTTGGCT 779
Chimp TTGATTTGCATTTCACTAATAACCAGTGCTGATGATCTTTTTTTCATATGTTTGTTGGCT 779
Macaque TTGATTTGCATTTCACTAGTAACTAGTGTTGATGAGCTTTTTTTCATATGTTTGTTGGCT 705
0....5....0....5....0....5....0....5....0....5....0....5....-3441
h
DQ094845 GCATTAATGTCTTCTTTT-GAGAAGTGTCTGTTCATATCCTTTGCCCACTTTTTCATGGG 838
Chimp GCATTAATGTCTTCTTTT-GAGAAGTGTCTGTTCATATCCTTTGCCCACTTTTTGATGGG 838
Macaque GCATAAATGTTTTTTTTTTGAGAAGGATCTGTTCATATCCTTTGCCCAATTTTTGATGGG 765
0....5....0....5.. ..0....5....0....5....0....5....0....5...-3382
DQ094845 GCTGTTTGTTTTTTCTTGTAAATTTGTTTAAGTTCTTTGTAGATTCTGGATATTAGCCCT 898
Chimp GCTGTTTGTTTTTTCTTGTAAATTTGTTTAAGTTCTTTGTAGATTCTGGATATTAGCCCT 898
Macaque GTTGTTTGTTTTTTCTTGTAAATTTGTTTACGTTCTTTGTAGATTCTGGATATTAGCCCT 825
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4 5 6 7
DQ094845 TTGTCAGATGGATAGATTGCAAAATTTTTCTCCCATTCTGTAGGTTGCCTGTTCACCCTG 958
Chimp TTGTCAGATGGATAGATTGCAAAATTTTTCTCCCATTCTGTAGGTTGCCTGTTCACCCTG 958
Macaque TTGTCAGATGAGTAGATTGCAAACATTTTCTCCCATTCTGTAGGTTGCCTCTTCACTCTG 885
.0....5....0....5....0....5....0....5....0....5....0....5...-3262
8
DQ094845 ATGATAGTTTCTTTTGCTGTGCAGAAACTCTTTAGTTTAATTAGATCCCATTTGTCAATT 1018
Chimp ATGATAGTTTCTTTTGCTGTGCAGAAACTCTTTAGTTTAATTAGATCCCATTTGTCAATT 1018
Macaque ACGACAGTTTCTTTTGCTGTGCAGAAGCTCTTTAGTTTAATTAGATCCCATTTGTCAATT 945
.0....5....0....5....0....5....0....5....0....5....0....5...-3202
9
DQ094845 TTGGCTTTTGTTGCCATTGCTTTTGATGTTTTAGTCATGAAGTCTTTGCCCATGCCTATG 1078
Chimp TTGGCTTTTGTTGCCATTGCTTTTGATGTTTTAGTCATGAAGTCTTTGCCCATGCCTATG 1078
Macaque TTGGCTTTTGTTGCCATTGCCTTTGGTGTTTTAGCCATGAAGTGTTTGCTCATGCCTATG 1005
.0....5....0....5....0....5....0....5....0....5....0....5...-3142
c c
DQ094845 TCCTGGATGTTATTGCCTAGATTTTCTTCTAGGGTTTTTATGGTTTTAGGTCTTACGTTT 1138
Chimp TCCTGGATGTTATTGCCTAAATTTTCTTCTAGGTTTTTTATGGTTTTAGGTCTTACGTTT 1138
Macaque TCCTGAATAGCATTGCCTAGGTTTTCTTCTAGGGTTTTTATGGTTTTAGGTCTTACGTTT 1065
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DQ094845 AAGTCTTTAATTCATCTTGAGTTAATTCTTGTATAAGGTGTAAGGAAGGGGTCCAGTTTC 1198
Chimp AAGTCTTTAATTCATCTTGAGTTAATTCTTGTATAAGGTGTAAGGAAGGGGTCCAGTTTC 1198
Macaque AAGTATTTAATTCATCTTGAGTTAATTCTTGTATAAAGTTTAAGGAAGGGGTGCAGTTTC 1125
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c
DQ094845 AGTTTTCTGCATATGGCTAGCCAGTCCTTCTTGATTTAGTATTTGTGGGTTTTAAAAAAG 1258
Chimp AGTTTTCTGCATATGGCTGGCCAGTCCTTCTTGATTTAGTATTTGTGGGTTTTAAAAAAG 1258
Macaque AGTTTTCTTCATATGGCTAGCCAGT---TCTTGATTTAGCATTTGTGGGTTTTAAAAAAG 1182
.0....5....0....5....0....5....0....5....0....5....0....5...-2962

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                        c12
                         |
DQ094845        GAGTTTCCCAAAATATTCAGTTAAACTTTTAAGTGACTTACGTGTATATCTAAATACATG 1318
Chimp           GAGTTTCCCAAAATATTCAGTTAAACTTTTAAGTGACTTACGTGTATATCTAAATACATG 1318
Macaque         GAGTTTCCCAAAATATTCAGTTAAACTTTTAAGTGACTTATGTGTATATTTAAATACATG 1242
                .0....5....0....5....0....5....0....5....0....5....0....5...-2902
                ************************************ ******** **********

                                                    c
                                                    |
DQ094845        ATCAGTTAATATTTGTCTTAAAGGGGTTTTCTTTGTTCTTTTCTTATTATAGGAAGGTTA 1378
Chimp           ATCAGTTAATATTTGTCTTAAAGGGGTTTTCTTTGTTCTCTTCTTATTATAGGAAGGTTA 1378
Macaque         ATCAGTTAATATTTGTCTTAAAGGGGTTTTCTTTGTTCTTTTCTTATTATAGGAAGGTTA 1302
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DQ094845        AACAATATGCTTATTTATGCCATAGCTTCACAAACAGGAAGGAGGTTTTAAATGGTTTAG 1438
Chimp           AACAATATGCTTATTTATGCCATAGCTTCACAAACAGGAAGGAGGTTTTAAATGGTTTAG 1438
Macaque         AACAATATGCTTATTTATGCCATAGCTTCACAAACAGGAAGGAGGTTTTAAATGGTTTAG 1362
                .0....5....0....5....0....5....0....5....0....5....0....5...-2782
                ************************************************************

DQ094845        TTCCACAATTTGAGTAGATGCATATTTAAAGAAACGTTGTTGCATAATAAATACTGCCTC 1498
Chimp           TTCCACAATTTGAGTAGATGCATATTTAAAGAAACGTTGTTGCATAATAAATACTGCCTC 1498
Macaque         TTCCACAATTTGAGTAGATGTGTATTTAAAGAAACGTTGTTGCATAACAAATACTGCCTC 1422
                .0....5....0....5....0....5....0....5....0....5....0....5...-2722
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                        c                10                   c
                        |                |                    |
DQ094845        TTCCTAAAATGCATCATGCCACAGCCAATTTTGGAAAACACAAATATGAGGTGAGTGTAT 1558
Chimp           TTCCTAAAACGCATCATGCCACAGCCAATTTTGGAAAACACAAATATGAAGTGAGTGTAT 1558
Macaque         TTCCTAAAATGCATCATGCCAGAGCCAATTTTGGAAAACACAAATATGAGGTGAGTATAT 1482
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                ********* *********** *************************** ****** ***

                                      11
                                       |
DQ094845        TTTGAAAACTATGTGAATATAATAGATCCTTAATTCATATTTGTGGATTTTATGGGAAAT 1618
Chimp           TTTGAAAACTATGTGAATATAATAGATCCTTAATTCATATTTGTGGATTTTATGGGAAAT 1618
Macaque         TTTGAAAACTATGTGAATATAATAGATCCTTAATTAATATTTGTGGATTTTATCGGAAAT 1542
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                ********************************** ***************** ******

DQ094845        ACTTGTTTTCTAAGGCATCTGTCTTGCAAAAAGTCAGTTTCTGCTATGAAGGATGTTAAA 1678
Chimp           ACTTGTTTTCTAAGGCATCTGTCTTGCAAAAAGTCAGTTTCTGCTATGAAGGATGTTAAA 1678
Macaque         ACTTGTTTTCTAAGGCATCTGTCTTGCAAAAAGTCAGTTTCTGCTGTGAAGGATGTTAAA 1602
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DQ094845        GGGGATATGTAGGTTAAATTCTGTTTCTGAGCTTTGCTTCCAGAGTAAACACCCAACTTA 1738
Chimp           GGGGATATGTAGGTTAAATTCTGTTTCTGAGCTTTGCTTCCAGAGTAAACACCCAACTTA 1738
Macaque         GGGGACATGTAGGTTAAATTCTGTTTCTGAGTTTTGCTTCCAGAGTAAACACCCAACTTA 1662
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                ***** ************************ ****************************

DQ094845        CTTTTGCCCTAAAGTATTTTATTGTTCTAGTAGAGAAGACTAACAACATATTCTAAACCA 1798
Chimp           CTTTTGCCCTAAAGTATTTTATTGTTCTAGTAGAGAAGACTAACAACATATTCTAAACCA 1798
Macaque         CTTTTGCCCTAAAGTATTTTATTGTTCTAGTAGAGAAGACTAACAATATATTCTAAACCG 1722
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                                c        12             c
                                |        |             |
DQ094845        CTAAGTAATTTATGTAAACTTCGCTTACAAACTATACTTGTGTGACACTTATATGAGCAA 1858
Chimp           CTAAGTAATTTATGTAAACTTCGCCTACAAACTATACTTGTGTGACACTAATATGAGCAA 1858
Macaque         CTAAGTAATTTACATAAACTTCACTTACAAACTGTATTTGTGTGACACTTATATGAGCAA 1782
                .0....5....0....5....0....5....0....5....0....5....0....5...-2362
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                                c                h
                                |                |
DQ094845        AAGCATTTTCATATTTCTTACTATATCATTCAATTCTTGCTTACCCCAATGGAAGTGACT 1918
Chimp           AAGCATTTTCATATTTCTTACTACATCATTCAATTCTTGCTCACCCCAATGGAAGTGACT 1918
Macaque         AAGCATTTTCATATTTCTTACTATATTATTCAATTCTTGCTCACCCCAATGGAAGTGACT 1842
                .0....5....0....5....0....5....0....5....0....5....0....5...-2302
                ********************** ** ************** ******************

                                c16                      c         h
                                  |                      |         |
DQ094845        TTATGCCCCTTTAGAGACAATGGAAATCAGGTACTTCGTGATTTCTCTTAAAAAAAAAAA 1978
Chimp           TTATGCCCCTTTAGAGACAATGGAAATTAGGTACTTCGTGATTTCTCTTTAAAAAAAAA- 1977
Macaque         TTATGCCCCTTTAGAGATAATGGAAATTAGGTACTTT-TGATTTCTCTTAGGAAAAAAA- 1900
                .0....5....0....5....0....5....0....5....0....5....0....5...-2242
                ***************** ********* ********  ***********   *******

                                              c c
                                              | |
DQ094845        AAATGAACTAGAAAGCTCCAAGTTTGGTGAATCTGGAACCTGGGTATTCCAGTTCCAGTT 2038
Chimp           --ATGAACTAGAAAGCTCCAAGTTTGGTGAATCTGTATCCTGGGTATTCCAGTTCCAGTT 2035
Macaque         --ATGAACTAGAAAGCTCCAAGTTTGGTGAATCTGGAACGTGGGTATTCCAATTCCAGTT 1958
                .0....5....0....5....0....5....0....5....0....5....0....5...-2182
                  ********************************* * * *********** ********

                           c
                           |
DQ094845        GTAGCCCTTCCTCCCTATCCATCACTCCTGTCTGCATGTAATTATGCAATACATTGAAAA 2098
Chimp           GTAGCCCTTCCTTCCTATCCATCACTCCTGTCTGCATGTAATTATGCAATACATTGAAAA 2095
Macaque         GTAGTGCTTCCTCCCTGTCCATCACTCCTGTCTGCATGTAATTATGCAATACATTGAAAA 2018
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                ****  ****** *** ****************************************

DQ094845        GATTAAAAGATGGGTCTTGGACTCAGGCAGACCTGGGTCAAATCCAGATTCTGGCACTGC 2158
Chimp           GATTAAAAGATGGGTCTTGGACTCAGGCAGACCTGGGTCAAATCCAGATTCTGGCACTGC 2155
Macaque         GATTAAAAGATGGGTCTTAGACTCAGGCAGACCTGGGTCAAATCCAGATTCTGGCACAGC 2078
                .0....5....0....5....0....5....0....5....0....5....0....5...-2062
                ****************** ************************************* **

DQ094845        CCAGCCATTGCCCCTGGGCAAGCCATTTTCCTCTTTGAACCTCATTTGTGAATTAAGCTA 2218
Chimp           CCAGCCATTGCCCCTGGGCAAGCCATTTTCCTCTTTGAACCTCATTTGTGAATTAAGCTA 2215
Macaque         CCAGCCATTGCCCCTGGGAAGGCCATTTTCCTCTTCGAACCTCATTTGTTAATTAAGCTA 2138
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                ****************** * ************** ************* **********

DQ094845        AAAATAGTCCCCACCCCCATGGGACTGTGGGAAGGATTAAATAGAATAATGCATGAAAAG 2278
Chimp           AAAATAGTCCCCACCCCCATGGGACTGTGGGAAGGATTAAATAGAATAATGCATGAAAAG 2275
Macaque         AAAATAGTCCCCACCCCCATGGGACTGTGGGAAGGATTAAATAGAATAATGCATGAAAAG 2198
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DQ094845        CAAATAGCAGAATGGTCCATAAATGTTAACCATTGTTATGTTATTATGTAATCTACAAAG 2338
Chimp           CAAATAGCAGAATGGTCCATAAATGTTAACCATTGTTATGTTATTATGTAATCTACAAAG 2335
Macaque         CACATAGCAGAATGGTCCATAAATGTTAGCCATTGTTATGTTATTATGTAATCTGCAAAG 2258
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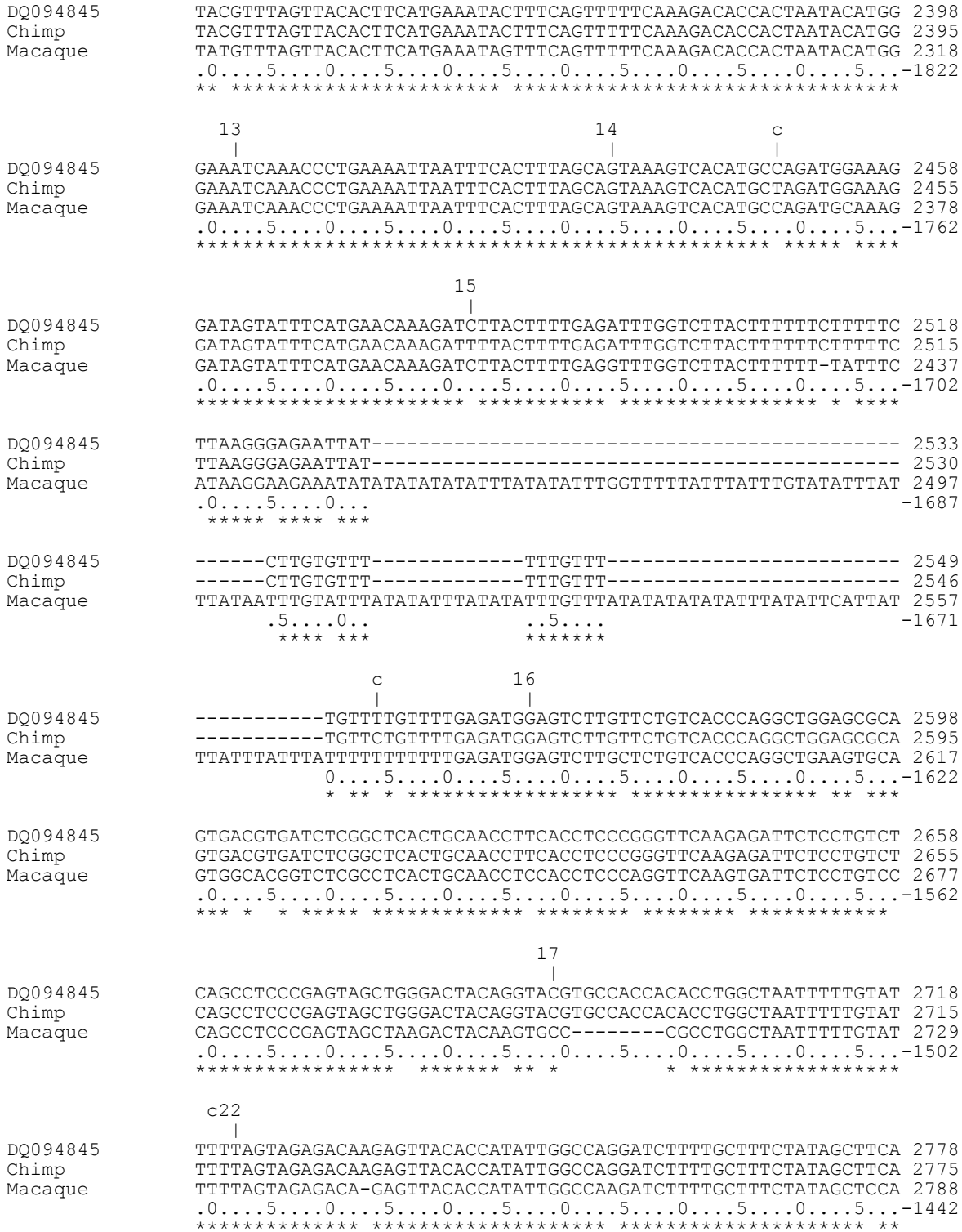
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Chimp TACGTTTAGTTACACTTCATGAAATACTTTCAGTTTTTCAAAGACACCACTAATACATGG 2395
Macaque TATGTTTAGTTACACTTCATGAAATAGTTTCAGTTTTTCAAAGACACCACTAATACATGG 2318
.0....5....0....5....0....5....0....5....0....5....0....5...-1822
13
14
c
DQ094845 GAAATCAAACCCTGAAAATTAATTTCACTTTAGCAGTAAAGTCACATGCCAGATGGAAAG 2458
Chimp GAAATCAAACCCTGAAAATTAATTTCACTTTAGCAGTAAAGTCACATGCTAGATGGAAAG 2455
Macaque GAAATCAAACCCTGAAAATTAATTTCACTTTAGCAGTAAAGTCACATGCCAGATGCAAAG 2378
.0....5....0....5....0....5....0....5....0....5....0....5...-1762
15
DQ094845 GATAGTATTTCATGAACAAAGATCTTACTTTTGAGATTTGGTCTTACTTTTTTCTTTTTC 2518
Chimp GATAGTATTTCATGAACAAAGATTTTACTTTTGAGATTTGGTCTTACTTTTTTCTTTTTC 2515
Macaque GATAGTATTTCATGAACAAAGATCTTACTTTTGAGGTTTGGTCTTACTTTTTT-TATTTC 2437
.0....5....0....5....0....5....0....5....0....5....0....5...-1702
DQ094845 TTAAGGGAGAATTAT---------- 2533
Chimp TTAAGGGAGAATTAT---------- 2530
Macaque ATAAGGAAGAAATATATATATATATTTATATATTTGGTTTTTATTTATTTGTATATTTAT 2497
.0....5....0... -1687
DQ094845 ------CTTGTGTTT----------TTTGTTT---------- 2549
Chimp ------CTTGTGTTT----------TTTGTTT---------- 2546
Macaque TTATAATTTGTATTTATATATTTATATATTTGTTTATATATATATATTTATATTCATTAT 2557
.5....0.. ..5.... -1671
c
16
DQ094845 ----------TGTTTTGTTTTGAGATGGAGTCTTGTTCTGTCACCCAGGCTGGAGCGCA 2598
Chimp ----------TGTTCTGTTTTGAGATGGAGTCTTGTTCTGTCACCCAGGCTGGAGCGCA 2595
Macaque TTATTTATTTATTTTTTTTTTTGAGATGGAGTCTTGCTCTGTCACCCAGGCTGAAGTGCA 2617
0....5....0....5....0....5....0....5....0....5...-1622
DQ094845 GTGACGTGATCTCGGCTCACTGCAACCTTCACCTCCCGGGTTCAAGAGATTCTCCTGTCT 2658
Chimp GTGACGTGATCTCGGCTCACTGCAACCTTCACCTCCCGGGTTCAAGAGATTCTCCTGTCT 2655
Macaque GTGGCACGGTCTCGCCTCACTGCAACCTCCACCTCCCAGGTTCAAGTGATTCTCCTGTCC 2677
.0....5....0....5....0....5....0....5....0....5....0....5...-1562
17
DQ094845 CAGCCTCCCGAGTAGCTGGGACTACAGGTACGTGCCACCACACCTGGCTAATTTTTGTAT 2718
Chimp CAGCCTCCCGAGTAGCTGGGACTACAGGTACGTGCCACCACACCTGGCTAATTTTTGTAT 2715
Macaque CAGCCTCCCGAGTAGCTAAGACTACAAGTGCC--------CGCCTGGCTAATTTTTGTAT 2729
.0....5....0....5....0....5....0....5....0....5....0....5...-1502
c22
DQ094845 TTTTAGTAGAGACAAGAGTTACACCATATTGGCCAGGATCTTTTGCTTTCTATAGCTTCA 2778
Chimp TTTTAGTAGAGACAAGAGTTACACCATATTGGCCAGGATCTTTTGCTTTCTATAGCTTCA 2775
Macaque TTTTAGTAGAGACA-GAGTTACACCATATTGGCCAAGATCTTTTGCTTTCTATAGCTCCA 2788
.0....5....0....5....0....5....0....5....0....5....0....5...-1442

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                      18
                       |
DQ094845        AAATGTTCTTAATGTTAAGACATTCTTAATACTCTGAACCATATGAATTTGCCATTTTGG 2838
Chimp           AAATGTTCTTAATGTTAAGACATTCTTAATACTCTGAACCATATGAATTTGCCATTTTGG 2835
Macaque         AA-TGTTCTTAATGTTAAGACACTCTTAAGACTCTGAACCATATGAATTTGCCATTTTGG 2847
                .0....5....0....5....0....5....0....5....0....5....0....5...-1382
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                                                 19             c
                                                  |             |
DQ094845        TAAGTCACAGACGCCAGATGGTGGCAATTTCACATGGCGCAACCCGAAAGATTAACAAAC 2898
Chimp           TAAGTCACAGACGCCAGATGGTGGCAATTTCACATGGTGCAACCCGAAAGATTTACAAAC 2895
Macaque         TAAGTCACAGACACCAGATGGTGGCAATTTCATATGGTGCAACCCGAAAGATTAACAAAC 2907
                .0....5....0....5....0....5....0....5....0....5....0....5...-1322
                ************ ******************* **** *************** ******

                                                 20
                                                  |
DQ094845        TATCCAGCAGATGAAAGGATTTTTTTTAGTTTCATTGGGTTTACTGAAGAAATTGTTTGA 2958
Chimp           TATCCAGCAGATGAAAGGATTTTTTTTAGTTTCATTGGGTTTACTGAAGAAATTGTTTGA 2955
Macaque         TATCCAGCAGATGAAAGGAATTTTTT-AGTTGCATTGGGATTACTGAAGAAATTGTTTGA 2966
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                ******************* ****** **** ******* ********************

DQ094845        ATTCTCATTGCATCTCCAGTTCAACAGATAATGAGTGAGTGATGCCACACTCTCAAGAGT 3018
Chimp           ATTCTCATTGCATCTCCAGTTCAACAGATAATGAGTGAGTGATGCCACACTCTCAAGAGT 3015
Chimp5pr        ------------------------------------------------------AAGAGT
Macaque         ATTCTCAGTGCATCTCCAGTTCAACAGATAATGAGGGAGTGATGCCACACTCTCAAGAGT 3026
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DQ094845        TAAAAACAAAACAACAA---AAAAATTAAAACAAAAGCACACAACTTTCTCTCTCTGTCC 3075
Chimp           TAAAAACAAAACAACAA---AAAAATTAAAACAAAAGCACACAACTTTCTCTCTCTGTCC 3072
Chimp5pr        TAAAAACAAAACAACAA---AAAAATTAAAACAAAAGCACACAACTTTCTCTCTCTGTCC
Macaque         TAAAAACAAAACAACAACAAAAAAATTAAAACAAAAGTACACAACTTTCTCTCTCCGTCC 3086
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                ******************  ****************** ****************** ****

DQ094845        CAAAATACATACTTGCATACCCCCGCTCCAGATAAAATCCAAAGGGTAAAACTGTCTTCA 3135
Chimp           CAAAATACATACTTGCATACCCCCGCTCCAGATAAAATCCAAAGGGTAAAACTGTCTTCA 3132
Chimp5pr        CAAAATACATACTTGCATACCCCCGCTCCAGATAAAATCCAAAGGGTAAAACTGTCTTCA
Macaque         CGAAATACATACATGCATACTCCTGCTCCAGGTGAAATCCAAAGGGTAAAACTGTCTTCA 3146
                ....0....5....0....5....0....5....0....5....0....5....0....5-1085
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DQ094845        TGCCTGCAAATTCCTAAGGAGGGCACCTAAAGTACTTGACAGCGAGTGTGCTGAGGAAAT 3195
Chimp           TGCCTGCAAATTCCTAAGGAGGGCACCTAAAGTACTTGACAGCGAGTGTGCTGAGGAAAT 3192
Chimp5pr        TGCCTGCAAATTCCTAAGGAGGGCACCTAAAGTACTTGACAGCGAGTGTGCTGAGGAAAT
Macaque         TGCCTGCAAATTCCCAAGGAGGGCACCCAAAGTACTTGACAACGAGTGTGCTGAGGAAAT 3206
                ....0....5....0....5....0....5....0....5....0....5....0....5-1025
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                21
                 |
DQ094845        CGGCAGCTGTTGAAGTCACCTCCTGTG--CTCTTGCCAAATGTTTGAAAGGGAATACACT 3253
Chimp           CGGCAGCTGTTGAAGTCACCTCCTGTG--CTCTTGCCAAATGTTTGAAAGGGAATACACT 3250
Chimp5pr        CGGCAGCTGTTCAAGTCACCTCCTGTG--CTCTTGCCAAATGTTTGAAAGGGAATACACT
Macaque         CGGCAGCTGTTGAAGTCACCTCCTGTGTGCTCTTGCCAAATGTTTGAAAGTGAATATACT 3266
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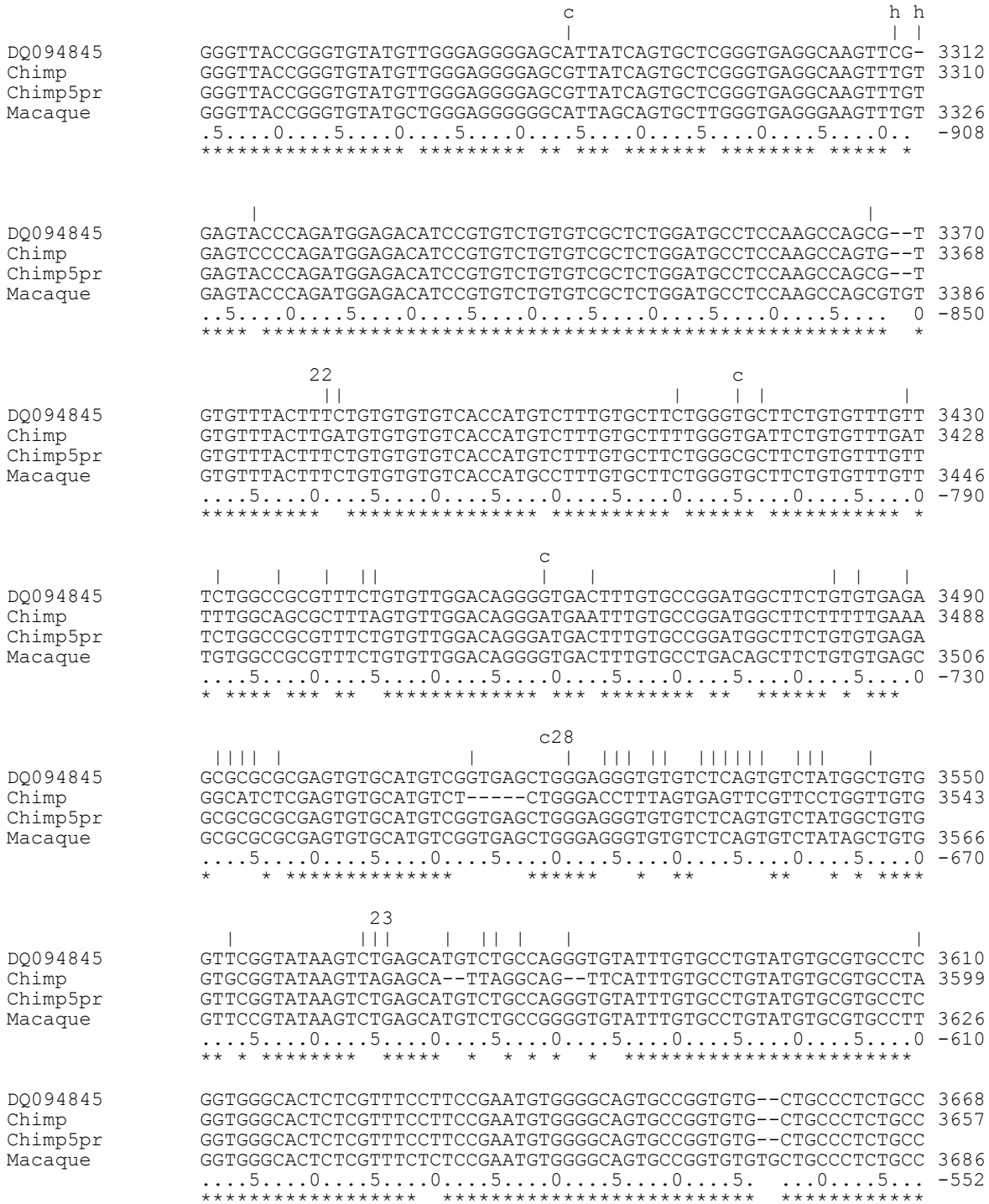
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h h
DQ094845 GGGTTACCGGGTGTATGTTGGGAGGGGAGCATTATCAGTGCTCGGGTGAGGCAAGTTCG- 3312
Chimp GGGTTACCGGGTGTATGTTGGGAGGGGAGCGTTATCAGTGCTCGGGTGAGGCAAGTTTGT 3310
Chimp5pr GGGTTACCGGGTGTATGTTGGGAGGGGAGCGTTATCAGTGCTCGGGTGAGGCAAGTTTGT
Macaque GGGTTACCGGGTGTATGCTGGGAGGGGGGCATTAGCAGTGCTTGGGTGAGGGAAGTTTGT 3326
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DQ094845 GAGTACCCAGATGGAGACATCCGTGTCTGTGTCGCTCTGGATGCCTCCAAGCCAGCG--T 3370
Chimp GAGTCCCCAGATGGAGACATCCGTGTCTGTGTCGCTCTGGATGCCTCCAAGCCAGTG--T 3368
Chimp5pr GAGTACCCAGATGGAGACATCCGTGTCTGTGTCGCTCTGGATGCCTCCAAGCCAGCG--T
Macaque GAGTACCCAGATGGAGACATCCGTGTCTGTGTCGCTCTGGATGCCTCCAAGCCAGCGTGT 3386
..5....0....5....0....5....0....5....0....5....0....5.... 0 -850
22
c
DQ094845 GTGTTTACTTTCTGTGTGTGTCACCATGTCTTTGTGCTTCTGGGTGCTTCTGTGTTTGTT 3430
Chimp GTGTTTACTTGATGTGTGTGTCACCATGTCTTTGTGCTTTTGGGTGATTCTGTGTTTGAT 3428
Chimp5pr GTGTTTACTTTCTGTGTGTGTCACCATGTCTTTGTGCTTCTGGGCGCTTCTGTGTTTGTT
Macaque GTGTTTACTTTCTGTGTGTGTCACCATGCCTTTGTGCTTCTGGGTGCTTCTGTGTTTGTT 3446
....5....0....5....0....5....0....5....0....5....0....5....0 -790
c
DQ094845 TCTGGCCGCGTTTCTGTGTTGGACAGGGGTGACTTTGTGCCGGATGGCTTCTGTGTGAGA 3490
Chimp TTTGGCAGCGCTTTAGTGTTGGACAGGGATGAATTTGTGCCGGATGGCTTCTTTTTGAAA 3488
Chimp5pr TCTGGCCGCGTTTCTGTGTTGGACAGGGATGACTTTGTGCCGGATGGCTTCTGTGTGAGA
Macaque TGTGGCCGCGTTTCTGTGTTGGACAGGGGTGACTTTGTGCCTGACAGCTTCTGTGTGAGC 3506
....5....0....5....0....5....0....5....0....5....0....5....0 -730
c28
DQ094845 GCGCGCGCGAGTGTGCATGTCGGTGAGCTGGGAGGGTGTGTCTCAGTGTCTATGGCTGTG 3550
Chimp GGCATCTCGAGTGTGCATGTCT-----CTGGGACCTTTAGTGAGTTCGTTCCTGGTTGTG 3543
Chimp5pr GCGCGCGCGAGTGTGCATGTCGGTGAGCTGGGAGGGTGTGTCTCAGTGTCTATGGCTGTG
Macaque GCGCGCGCGAGTGTGCATGTCGGTGAGCTGGGAGGGTGTGTCTCAGTGTCTATAGCTGTG 3566
....5....0....5....0....5....0....5....0....5....0....5....0 -670
23
DQ094845 GTTCGGTATAAGTCTGAGCATGTCTGCCAGGGTGTATTTGTGCCTGTATGTGCGTGCCTC 3610
Chimp GTGCGGTATAAGTTAGAGCA--TTAGGCAG--TTCATTTGTGCCTGTATGTGCGTGCCTA 3599
Chimp5pr GTTCGGTATAAGTCTGAGCATGTCTGCCAGGGTGTATTTGTGCCTGTATGTGCGTGCCTC
Macaque GTTCCGTATAAGTCTGAGCATGTCTGCCGGGGGTGTATTTGTGCCTGTATGTGCGTGCCTT 3626
....5....0....5....0....5....0....5....0....5....0....5....0 -610
DQ094845 GGTGGGCACTCTCGTTTCCTTCCGAATGTGGGGCAGTGCCGGTGTG--CTGCCCTCTGCC 3668
Chimp GGTGGGCACTCTCGTTTCCTTCCGAATGTGGGGCAGTGCCGGTGTG--CTGCCCTCTGCC 3657
Chimp5pr GGTGGGCACTCTCGTTTCCTTCCGAATGTGGGGCAGTGCCGGTGTG--CTGCCCTCTGCC
Macaque GGTGGGCACTCTCGTTTCTCTCCGAATGTGGGGCAGTGCCGGTGTGTGCTGCCCTCTGCC 3686
....5....0....5....0....5....0....5....0....5. ...0....5... -552

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DQ094845        TTGAGACCTCAAGCCGCGCAGGCGCCCAGGGCAGGCAGGTAGCGGCCACAGAAGAGCCAA 3728
Chimp           TTGAGACCTCAAGCCGCGCAGGCGCCCAGGGCAGGCAGGTAGCGGCCACAGAAGAGCCAA 3717
Chimp5pr        TTGAGACCTCAAGCCGCGCAGGCGCCCAGGGCAGGCAGGTAGCGG
Macaque         CTGAGACCTCAGGCCGCGCAGGCGCCCAGGGCAGGCAGGTAGCGGCCACAGAAGAGCCAA 3746
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                                         |      |
DQ094845        AAGCTCCCGGGTTGGCTGGTAAGCACACCACCTCCAGCTTTAGCCCTCTGGGGCCAGCCA 3788
Chimp           AAGCTCCCGGGTTGGCTGGTAAGCACACCAGCTCCAGCTTTAGCCCTCTGGGGCCAGCCA 3777
Macaque         AAGCTGCTGGGTTGGCTGGTAAGCACGCCAGCTCCAGCTTTAGCCCTCTGGGGCCAGCCA 3806
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                                        25 c32 c33
                                          \|/
DQ094845        GGGTAGCCGGGAAGCAGTGGTGGCCCGCCCTCCAGGGAGCAGTTGGGCCCCGCCCGGGCC 3848
Chimp           GGGTAGCCGGGAAGCAGTGGTGGCCCGCCCTCCAGGGAGCAGTTGGGCCCCGCCCGGGCC 3837
Macaque         GGGTAGCCGGGAAGGAGTGGTGGCCCGCCCGCCGGGGAGCAGCTGGGCCCCTCCCGGGCC 3866
                .0....5....0....5....0....5....0....5....0....5....0....5... -372
                ************** *************** ** ******** ******** ********

                   26       h                      C             h
                    |       |                      |             |
DQ094845        AGCCTCAGGAGAAGGAGGGCGAGGGGAGGGGAGG--------------GAAAGGGGAGGA 3894
Chimp           AGCCCCAGGAGAGGGAGGGCGAGGGGAGGGGAGGAAAGGGGAGGAGAGGAAAGGGGAGGA 3897
Macaque         AGCCCGAGAAGAGGGAGGGCGAGAGGAGGGGAGG---------------AAAGGGGATGG 3911
                .0....5....0....5....0....5....0..              ..5....0.... -326
                ****  ** *** ********** **********               ******** *

                                        27                      28
                                         |                       |
DQ094845        GTGCCTCGCCCCTTCGCGGCTGCCGGCGTGCCATTGGCCGAAAGTTCCCGTACGTCACGG 3954
Chimp           GTGCCTCGCCCCTTCGCGGCTGCCGGCGTGCCATTGGCCGAAAGTTCCCGTACGTCACGG 3957
Macaque         GTGCCTCGCCCCTTCGGGCCTGCCGGCGTGCCATTGGCCGAAAGTTCCCTTACGTCACGG 3971
                5....0....5....0....5....0....5....0....5....0....5....0.... -266
                ***************** * ****************************** **********

                  29                          30  c39                h
                   |                          |    |          >      >  >>
DQ094845        CGAGGGCAGTTCCCCTAAAGTCCTGTGCACATAACGGGCAGAACGCACTGCGAAGCGGCT 4014
Chimp           CGAGGGCAGTTCCCCTAAAGTCCTGTGCACATAACGGGCAGAACGCACTGCGAGGCGGCT 4017
Macaque         CGAGGGCAGTTCCCCTAAAGTCCTGTGCACATAACGGGCAGAGCGCACTCCGAGGCGGCT 4031
                5....0....5....0....5....0....5....0....5....0....5....0.... -206
                ****************************************** ****** *** ******

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DQ094845        TCTTCAGAGCACGGGCTGGAACTGGCAGGCACCGCGAGCCCCTAGCACCCGACAAGCTGA 4074
Chimp           TCTTCAGAGCACGGGCTGGAACTGGCAGGCACCGCGAGCCCCTAGCACCCGACAAGCTGA 4077
Macaque         TCTCCAGAGCACGGGCTGGAACTGGCGGGCACCGCGAGCCCCTGGCACCCGACAAGCTAA 4091
                5....0....5....0....5....0....5....0....5....0....5....0.... -146
                *** ********************** ***************** ************** *

DQ094845        GTGTGCAGGACGAGTCCCCACCACACCCACACCACAGCCGCTGAATGAGGCTTCCAGGCG 4134
Chimp           GTGTGCAGGACGAGTCCCCACCACACCCACACCACAGCCGCTGAATGAGGCTTCCAGGCG 4137
Macaque         GTGTACAAGACGTGTCCCCACCACACCCACCCCACGGCCGCTGAATGAGGCTTCCAGGAG 4151
                5....0....5....0....5....0....5....0....5....0....5....0....  -86
                **** ** **** ***************** **** ********************** *
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                        c40                          31
                         |                           |
DQ094845        TCCGCTCGCGGCCCGCAGAGCCCCGCCGTGGGTCCGCCTGCTGAGGCGCCCCCAGCCAGT 4194
Chimp           TCCGCTCGCGGCCCGCAGAGCCCCGCCGTGGGTCCGCCCGCTGAGGCGCCCCCAGCCAGT 4197
Macaque         TCCGCTCGCTGCCCGCAGAGCCCCGCCGGGGGTCCGCCCGCTGAGGCGCCTGCAGACAGT 4211
                5....0....5....0....5....0....5....0....5....0....5....0....  -26
                ********* ****************** ********* ***********  *** ****

                c42 32c             c
                  |  ||              |
DQ094845        GCGCTTACCTGCCAGACTGCGCGCCATGGGGCAACCCGGGAACGGCAGCGCCTTCTTGCT 4254
Chimp           GCGCTCGCCTGCCAGACTGCGAGCCATGGGGCAACCCGGGAACGGCAGCGCCTTCTTGCT 4257
Macaque         GCGCTCACCTGCCAGACTGCGCGCCATGGGGCAACCCGGGAACGGCAGCGCCTTCTTGCT 4271
                5....0....5....0....5..-11...5....0....5....0....5....0....5   35
                *****  ************** ************************************

                      c44 33                c46         c47 34
                        | |                   |           |/
DQ094845        GGCACCCAATGGAAGCCATGCGCCGGACCACGACGTCACGCAGCAAAGGGACGAGGTGTG 4314
Chimp           GGCACCCAATGGAAGCCATGCGCCGGACCACGACGTCACGCAGGAAAGGGACGAGGTGTG 4317
Macaque         GGCACCCAACGGAAGCCATGCGCCGGACCACGATGTCACGCAGGAACGGGACGAGGCGTG 4331
                ....0....5....0....5....0....5....0....5....0....5....0....5   95
                ********* ********************** ********* ** ********* ***

                                    c
                                    |
DQ094845        GGTGGTGGGCATGGGCATCGTCATGTCTCTCATCGTCCTGGCCATCGTGTTTGGCAATGT 4374
Chimp           GGTGGTGGGCATGGGCATCTTCATGTCTCTCATCGTCCTGGCCATCGTGTTTGGCAATGT 4377
Macaque         GGTGGTGGGCATGGGCATCGTCATGTCTCTCATCGTCCTGGCCATCGTGTTTGGCAATGT 4391
                ....0....5....0....5....0....5....0....5....0....5....0....5  155
                ******************* ****************************************

DQ094845        GCTGGTCATCACAGCCATTGCCAAGTTCGAGCGTCTGCAGACGGTCACCAACTACTTCAT 4434
Chimp           GCTGGTCATCACAGCCATTGCCAAGTTCGAGCGTCTGCAGACGGTCACCAACTACTTCAT 4437
Macaque         GCTGGTCATCACAGCCATTGCCAAGTTCGAGCGTCTGCAGACGGTCACCAACTACTTCAT 4451
                ....0....5....0....5....0....5....0....5....0....5....0....5  215
                ************************************************************

                                                35
                                                 |
DQ094845        CACTTCACTGGCCTGTGCTGATCTGGTCATGGGCCTGGCAGTGGTGCCCTTTGGGGCCGC 4494
Chimp           CACTTCACTGGCCTGTGCTGATCTGGTCATGGGCCTGGCAGTGGTGCCCTTTGGGGCCGC 4497
Macaque         CACTTCACTGGCCTGTGCTGACTTAGTCATGGGCTTGGCAGTGGTGCCCTTTGGGGCCGC 4511
                ....0....5....0....5....0....5....0....5....0....5....0....5  275
                *********************  * ********* *************************

DQ094845        CCATATTCTTATGAAAATGTGGACTTTTGGCAACTTCTGGTGCGAGTTTTGGACTTCCAT 4554
Chimp           CCATATTCTTATGAAAATGTGGACTTTTGGCAACTTCTGGTGCGAGTTTTGGACTTCCAT 4557
Macaque         CCATATTCTCATGAAAATGTGGACTTTTGGCAACTTCTGGTGCGAGTTTTGGACTTCCAT 4571
                ....0....5....0....5....0....5....0....5....0....5....0....5  335
                ********* ************************************************

DQ094845        TGATGTGCTGTGCGTCACGGCCAGCATTGAGACCCTGTGCGTGATCGCAGTGGATCGCTA 4614
Chimp           TGATGTGCTGTGCGTCACGGCCAGCATTGAGACCCTGTGCGTGATCGCAGTGGATCGCTA 4617
Macaque         TGATGTGCTGTGCGTCACAGCCAGCATTGAGACCCTGTGCGTGATCGCAGTGGATCGCTA 4631
                ....0....5....0....5....0....5....0....5....0....5....0....5  395
                ****************** ****************************************

DQ094845        CTTTGCCATTACTTCACCTTTCAAGTACCAGAGCCTGCTGACCAAGAATAAGGCCCGGGT 4674
Chimp           CTTTGCCATTACTTCACCTTTCAAGTACCAGAGCCTGCTGACCAAGAATAAGGCCCGGGT 4677
Macaque         CTTTGCCATTACTTCACCCTTCAAGTATCAGAGCCTGCTGACCAAGAATAAGGCCCGGGT 4691
                ....0....5....0....5....0....5....0....5....0....5....0....5  455
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                                h           c50
                                |            |
DQ094845        GATCATTCTGATGGTGTGGATTGTGTCAGGCCTTACCTCCTTCTTGCCCATTCAGATGCA 4734
Chimp           GATCATTCTGATGGTGTGGATCGTGTCAGGCCTTACCTCCTTCTTGCCCATTCAGATGCA 4737
Macaque         GATCATTCTGATGGTGTGGATCGTGTCAGGCCTTACCTCCTTCTTGCCCATTCAGATGCA 4751
                ....0....5....0....5....0....5....0....5....0....5....0....5  515
                ********************* ************************************

                      36
                       |
DQ094845        CTGGTACCGGGCCACCCACCAGGAAGCCATCAACTGCTATGCCAATGAGACCTGCTGTGA 4794
Chimp           CTGGTACCGGGCCACCCACCAGGAAGCCATCAACTGCTATGCCAATGAGACCTGCTGTGA 4797
Macaque         CTGGTACCGGGCCACCCACCAGGAAGCCATCAACTGCTATGCCAAGGAGACCTGCTGTGA 4811
                ....0....5....0....5....0....5....0....5....0....5....0....5  575
                ******************************************* **************

DQ094845        CTTCTTCACGAACCAAGCCTATGCCATTGCCTCTTCCATCGTGTCCTTCTACGTTCCCCT 4854
Chimp           CTTCTTCACGAACCAAGCCTATGCCATTGCCTCTTCCATCGTGTCCTTCTACGTTCCCCT 4857
Macaque         CTTCTTCACGAACCAAGCCTATGCCATTGCCTCCTCCATCGTGTCCTTCTACGTTCCCCT 4871
                ....0....5....0....5....0....5....0....5....0....5....0....5  635
                ******************************** *************************

                               37
                                |
DQ094845        GGTGATCATGGTCTTCGTCTACTCCAGGGTCTTTCAGGAGGCCAAAAGGCAGCTCCAGAA 4914
Chimp           GGTGATCATGGTCTTCGTCTACTCCAGGGTCTTTCAGGAGGCCAAAAGGCAGCTCCAGAA 4917
Macaque         GGTGATCATGGTCTTCGTCTACTCCAGGGTCTTTCAGGAGGCCAAAAGGCAGCTCCAGAA 4931
                ....0....5....0....5....0....5....0....5....0....5....0....5  695
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DQ094845        GATTGACAAATCTGAGGGCCGCTTCCATGTCCAGAACCTTAGCCAGGTGGAGCAGGATGG 4974
Chimp           GATTGACAAATCTGAGGGCCGCTTCCATGTCCAGAACCTTAGCCAGGTGGAGCAGGATGG 4977
Macaque         GATTGACAAATCTGAGGGCCGCTTCCATGCCCAGAACCTTAGCCAGGTGGAGCAGGATGG 4991
                ....0....5....0....5....0....5....0....5....0....5....0....5  755
                **************************** ******************************

DQ094845        GCGGACGGGGCATGGACTCCGCAGATCTTCCAAGTTCTGCTTGAAGGAGCACAAAGCCCT 5034
Chimp           GCGGACGGGGCATGGACTCCGCAGATCTTCCAAGTTCTGCTTGAAGGAGCACAAAGCCCT 5037
Macaque         GCGGACAGGGCATGGACTCCGCAGATCTTCCAAGTTCTGCTTGAAGGAGCACAAAGCCCT 5051
                ....0....5....0....5....0....5....0....5....0....5....0....5  815
                ****** ******************************************************

                                38
                                 |
DQ094845        CAAGACGTTAGGCATCATCATGGGCACTTTCACCCTCTGCTGGCTGCCCTTCTTCATCGT 5094
Chimp           CAAGACGTTAGGCATCATCATGGGCACTTTCACCCTCTGCTGGCTGCCCTTCTTCATCGT 5097
Macaque         CAAGACGTTAGGCATCATCATGGGCACTTTCACCCTCTGCTGGCTGCCCTTCTTCATCGT 5111
                ....0....5....0....5....0....5....0....5....0....5....0....5  875
                ************************************************************

DQ094845        TAACATTGTGCATGTGATCCAGGATAACCTCATCCGTAAGGAAGTTTACATCCTCCTAAA 5154
Chimp           TAACATTGTGCATGTGATCCAGGATAACCTCATCCGTAAGGAAGTTTACATCCTCCTAAA 5157
Macaque         TAACATTGTGCATGTGATCCAGGATAACCTCATCCCTAAGGAAGTTTACATCCTCCTAAA 5171
                ....0....5....0....5....0....5....0....5....0....5....0....5  935
                ********************************** ************************

DQ094845        TTGGATAGGCTATGTCAATTCTGGTTTCAATCCCCTTATCTACTGCCGGAGCCCAGATTT 5214
Chimp           TTGGATAGGCTATGTCAATTCTGGTTTCAATCCCCTTATCTACTGCCGGAGCCCAGATTT 5217
Macaque         TTGGGTGGGCTATGTCAATTCTGGTTTCAATCCCCTTATCTACTGCCGGAGCCCAGATTT 5231
                ....0....5....0....5....0....5....0....5....0....5....0....5  995
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                                                                      39
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DQ094845        CAGGATTGCCTTCCAGGAGCTTCTGTGCCTGCGCAGGTCTTCTTTGAAGGCCTATGGGAA 5274
Chimp           CAGGATTGCCTTCCAGGAGCTTCTGTGCCTGCGCAGGTCTTCTTTGAAGGCCTATGGGAA 5277
Macaque         CAGGATTGCCTTCCAGGAGCTTCTGTGTCTGCGCAGGTCTTCTTTGAAGGCCTGTGGGAA 5291
                ....0....5....0....5....0....5....0....5....0....5....0....5 1055
                ************************** ************************ ******

DQ094845        TGGCTACTCCAGCAAC------GGCAACACAGGGGAGCAGAGTGGATATCACGTGGAACA 5328
Chimp           TGGCTACTCCAGCAAC------GGCAACACAGGGGAGCAGAGTGGATATCACGTGGAACA 5331
Macaque         TGGCTACTCCAGCAACAGCAATGGCAACACAGGGGAGCAGAGTGGATATCACCTGGAACA 5351
                ....0....5....0.      ...5....0....5....0....5....0....5.... 1109
                ****************      ****************************** *******

DQ094845        GGAGAAAGAAAATAAACTGCTGTGTGAAGACCTCCCAGGCACGGAAGACTTTGTGGGCCA 5388
Chimp           GGAGAAAGAAAATAAACTGCTGTGTGAAGACCTCCCAGGCACGGAAGACTTTGTGGGCCA 5391
Macaque         GGAGAAAGAAAATAAACTGCTGTGTGAAGACCTCCCAGGCACGGAAGACTTTGTGGGCCA 5411
                0....5....0....5....0....5....0....5....0....5....0....5.... 1169
                ************************************************************

              c55 c    c56
                |/       |
DQ094845        TCAAGGTACTGTGCCTAGCGATAACATTGATTCACAAGGGAGGAATTGTAGTACAAATGA 5448
Chimp           TGAAGGTACTGTGCCTAGCGATAACATTGATTCACAAGGGAGGAATTGTAGTACAAATGA 5451
Macaque         TCAAGGTACTGTGCCTAGCGATAACATTGATTCACAAGGGAGGAGTTGTAGTACAAATGA 5471
                0....5....0....5....0....5....0....5....0....5....0....5.... 1229
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                        40                                          c
                         |                                      &    |
DQ094845        CTCACTGCTGTAAAGCAGTTTTTCTACTTTTAAAGACCCCCCCCCGCCCAACAGAACACT 5508
Chimp           CTCACTGCTGTAAAGCAGTTTTTCTACTTTTAAAGACCCCCCCCC-CCCATCAGAACACT 5510
Macaque         CTCACTGCTGTAAAGCAGTTTTTCTACTTTTTAAGACCACCCCCCCCCCCAACAGAACACT 5531
                0....5....0....5....0....5....0....5....0....5....0....5.... 1289
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                                           c            h
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DQ094845        AAACAGACTATTTAACTTGAGGGTAATAAACTTAGAATAAAATTGTAAAATTGTATAGAG 5568
Chimp           AAACAGACTATTTAACTTGAGGGTAATACACTTAGAATAAAA--------TTGTATAGAG 5562
Macaque         AAACAGACTATTTAACTTGAGGGTAATAAACTTAGAATAAAA--------TTGTATAGAG 5583
                0....5....0....5....0....5....0....5....0....5....0....5.... 1349
                ************************** ************        **********

                                                                     41
                                                                      |
DQ094845        ATATGCAGAAGGAAGGGCATCCTTCTGCCTTTTTTATTTTTTTAAGCTGTAAAAAGAGAG 5628
Chimp           ATATGCAGAAGGAAGGGCATCCTTCTGCCTTTTTTATTTTTTTAAGCTGTAAAAAGAGAG 5622
Macaque         ATATGCAGGAGGAGGGGCATCCTTCTGCCTTTTTTATTTTTTTAAGCTGTAAAAAGAGAG 5643
                0....5....0....5....0....5....0....5....0....5....0....5.... 1409
                ******** **** ********************************************

DQ094845        AAAACTTATTTGAGTGATTATTTGTTATTTGTACAGTTCAGTTCCTCTTTGCATGGAATT 5688
Chimp           AAAACTTATTTGAGTGATTATTTGTTATTTGTACAGTTCAGTTCCTCTTTGCATGGAATT 5682
Macaque         AAAACTTATTTG-GTGATTATTTGTTATTTGTACAGTTCAGTTCCTCTTTGCATGGAATT 5702
                0....5....0....5....0....5....0....5....0....5....0....5.... 1469
                ************ ********************************************

                         c
                         |
DQ094845        TGTAAGTTTATGTCTAAAGAGCTTTAGTCCTAGAGGACCTGAGTCTGCTATATTTTCATG 5748
Chimp           TGTAAGTTTTTGTCTAAAGAGCTTTAGTCCTAGAGGACCTGAGTCTGCTATGTTTTCATG 5742
Macaque         TGTAAGTTTATGTCTAAAGGGCTTTAGTCCTAGAGGACCTGAGTCTGCTATGTTTTCATG 5762
                0....5....0....5....0....5....0....5....0....5....0....5.... 1529
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                                                                c
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DQ094845        ACTTTTCCATGTATCTACCTCACTATTCAAGTATTAGGGGTAATATATTGCTGCTGGTAA 5808
Chimp           ACTTTTCCATGTATCTACCTCACTATTCAAGTATTAGGGGTAATATACTGCTGCTGGTAA 5802
Macaque         ACTTTTCCATGTATCTACCTCACTATTCAAGTATTAGGGGTAATATATTGCTGCTGGTAA 5822
                0....5....0....5....0....5....0....5....0....5....0....5.... 1589
                ********************************************** ************

                                       c59 c60
                                         |  |
DQ094845        TTTGTATCTGAAGGAGATTTTCCTTCCTACACCCTTGGACTTGAGGATTTTGAGTATCTC 5868
Chimp           TTTGTATCTGAAGGAGATTTTCCTTCCTACACCCTTGGACTTGAGGATTTTGAGTATCTC 5862
Macaque         TTTGTATCTGAAGGAGATTTTCCTTCCCACACCCTCGGACTTGAGGATTTTGAATATCTC 5882
                0....5....0....5....0....5....0....5....0....5....0....5.... 1649
                *************************** ******* ***************** ******

                        c61                                             c62
                          |                                               |
DQ094845        GGACCTTTCAGCTGTGAACATGGACTCTTCCCCCACTCCTCTTATTTGCTCACACGGGGT 5928
Chimp           GGACCTTTCAGCTGTGAACATGGACTCTTCCCCCACTCCTCTTATTTGCTCACACGGGGT 5922
Macaque         GGACCTTTCAGCTGTGAACATGGACTCTTCCCC-GCTCCTCTTATTTGCTCACACGGGGT 5941
                0....5....0....5....0....5....0....5....0....5....0....5.... 1709
                ********************************  ************************

                                                        h
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DQ094845        ATTTTAGGCAGGGATTTGAGGAGCAGCTTCAGTTGTTTTCCCGAGCAAAGTCTAAAGTTT 5988
Chimp           ATTTTAGGCAGGGATTTGAGGAGCAGCTTCAGTTGTTTTCCTGAGCAAAGTCTAAAGTTT 5982
Macaque         ATTTTAGGCAGGGATTTGAGGAGCAGCTTCAGTTGTTTTCCTGAGCAAAGTCTAAAGTTT 6001
                0....5....0....5....0....5....0....5....0....5....0....5.... 1769
                ****************************************** ******************

                          c63           pA
                            |           /
DQ094845        ACAGTAAATAAATTGTTTGACCATGCCTTCATTGCACCTGTTTCTCCAAAACCCCTTGAC 6048
Chimp           ACAGTAAATAAATTGTTTGACCATGCCTTCATTGCACCTGTTTCTCCAAAACCCCTTGAC 6042
Macaque         ACAGTAAATAAATTGTTTGACCATGCCTTCATTGCACCTGTTTCTCCAAAACCCCTTGTC 6061
                0....5....0....5....0....5....0....5....0....5....0....5.... 1829
                ********************************************************** *

DQ094845        TGGAGTGCTGTTGCCTCCCCCACTGGAAACCGCAGGTAACTACTTGTAATTACTGCCCAT 6108
Chimp           TGGAGTGCTGTTGCCTCCCCCACTGGAAACCGCAGGTAACTACTTGTAATTACTGCCCAT 6102
Macaque         TGGAGTGCCATTGCCTCCCCGACTGGAAACCACAGGTAACTACTTGTAATAACTGCCCAT 6121
                0....5....0....5....0....5....0....5....0....5....0....5.... 1889
                ********  ********** ********** ****************** *********

DQ094845        GACTTAATGTAGAATGATACAAGAATGACATGCACAGATTGCTTAACCCTTTCATTTGCC 6168
Chimp           GACTTAATGTAGAATGATACAAGAATGACATGCACAGATTGCTTAACCCTTTCATTTGCC 6162
Macaque         GACTTAATGTAGAATGATACAAGAATGACATGCACAGATTGCTTAACCCTTTCATTTGCC 6181
                0....5....0....5....0....5....0....5....0....5....0....5.... 1949
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DQ094845        TTTGAGTCTGCTGCTGCAAAGCTGCATCTCTCCTGACACTTGTGCCCCAAATCAGTTCTG 6228
Chimp           TTTGAGTCTGCTGCTGCAAAGCTGCATCTCTCCTGACACTTGTGCCCCAAATCAGTTCTG 6222
Macaque         TTTGAATCTGCTGCTGCAAAGCTGCATCTCTCCTGACACTCATGCCCCAAATCAGTTCTG 6241
                0....5....0....5....0....5....0....5....0....5....0....5.... 2009
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DQ094845        CCTGCTCTTAGTATAGCTCAACTCTCCCTATGGTTATTGTTCTGTGTTGTTACCTCAGAA 6288
Chimp           CCTGCTCTTAGTATAGCTCAACTCTCCCTATGGTTATTGTTCTGTGTTGTTACCTCAGAA 6282
Macaque         CCTGCTCTTAGTATAGCTCAACTCTCCCTATGGTTATTGTTCTGTGTTGTTACCTCGGAA 6301
                0....5....0....5....0....5....0....5....0....5....0....5.... 2069
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DQ094845        ACACTGACTCACAGAAGCGGAGTTAAGGGGATATGTTTTTTT-CTCTCCACGTGCACCCA 6347
Chimp           ACACTGACTCACAGAAGCGGAGTTAAGGGGATATGTTTTTTT-CTCTCCACGTGCACCCA 6341
Macaque         ACACTGACTCACAGAAGCGGAGTTATGGGCATATGTTTTTTTTCTCTCCACGCGCCCCCA 6361
                0....5....0....5....0....5....0....5....0. ...5....0....5... 2128
                ************************ *** ************ ********* ** ****

DQ094845        CCACCCACCTTCCAGTTCTACTTGTTTCAAAACTGTTTATATTTCTGTCTTGGCCATGTG 6407
Chimp           CCACCCACCTTCCAGTTCTACTTGTTTCAAAACTGTTTATATTTCTGTCTTGGCCATGTG 6401
Macaque         CCACCCACCTTCCAGTTCTACTTGTTTCATAACTGTTTATATTTATGTCTTGGCCATGTG 6421
                .0....5....0....5....0....5....0....5....0....5....0....5... 2188
                **************************** ************** ***************

DQ094845        TTACAGTGGAGCTCTTTGTACTGCATCAGGGCTTGGCATTTTAGGGATAAGGAAGATGTT 6467
Chimp           TTACAGTGGAGCTCTTTGTACTGCATCAGGGCTTGGCATTTTAGGGATAAGGAAGATGTT 6461
Macaque         TTATAGTGGAGCTCTTTGTACTGCATCAGGGCTTGGCATTTTAGGGATAAGGAAGATGTT 6481
                .0....5....0....5....0....5....0....5....0....5....0....5... 2248
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DQ094845        CTTATGAGGAAGCTACTCAGACATGGCCCCGTAATTCTGAGGGAAAATTCAAAAGGCATT 6527
Chimp           CTTATGAGGAAGCTACTCAAACATGGCCCCGTAATTCTGAGGGAAAATTCAGAAGGCATT 6521
Macaque         CTTGTGAGGAAGCTACTCGAACATGGCCCCGTAATTCCGAGGGAAAATTAAAAAGGCATT 6541
                .0....5....0....5....0....5....0....5....0....5....0....5... 2308
                *** **************  ***************** *********** * ********

DQ094845        GGTCATGGGGAGAAAAGCTGGAGAACACATAACTGATGGATACCTCATGAACTAGAAACA 6587
Chimp           GGTCATGGGGAGAAAAGCTGGAGAACACATAACTGATGGATACCTCATGACCTAGAAACA 6581
Macaque         GGTCATGGGGAGAAAAACTGGAGAACACATAACTGATGGATACCACGTGACCTAGAAATA 6601
                .0....5....0....5....0....5....0....5....0....5....0....5... 2368
                **************** *************************** * *** ******* *

DQ094845        GAATTTTAACCCCTTTTCCTTCTTTCCTTTGGTCCCTGTTTTCTTCTCCCACTGACTCTC 6647
Chimp           GAATTTTAACCCCTTTTCCTTCTTTCCTTTGGTCCCTGTTTTCTTCTCCCACTGACTCTC 6641
Macaque         GAATTTTAACCCCTTTTCCTTCTTTCCTTTGGTCCCTGTTTTCTTCTCCCACTGACTCTC 6661
                .0....5....0....5....0....5....0....5....0....5....0....5... 2428
                ************************************************************

DQ094845        CTCGATTCAGTGTAAACCAAGGTTCTGAGTCTTAGCACTGTTAGCATTTTGGACCAGATA 6707
Chimp           CTCGATTCAGTGTAAACCAAGGTTCTGAGTCTTAGCACTGTTAGCATTTTGGACCAGATA 6701
Macaque         CTCGGTTCAGTATAAACCAAGGTTCTGAGTCTTGGCACTGTTAGCATTTTGGACCAGATA 6721
                .0....5....0....5....0....5....0....5....0....5....0....5... 2488
                **** ****** ********************* *************************

DQ094845        ACTCTTTGTTATGGGGGCTGCATCATTGTATGTGTAGCACCTCTGGCCTCTGTTCATTAG 6767
Chimp           ACTCTTTGTTATGGGGGCTGCATCATTGTATGTGTAGCACCTCTGGCCTCTGTTCATTAG 6761
Macaque         ACTCTTTGTTGTGAGGGCTGCATCATTGGATGTTTAGCACCTCTGGCCTCTATTCATTAG 6781
                .0....5....0....5....0....5....0....5....0....5....0....5... 2548
                ********** ** ************** **** ***************** ********

DQ094845        ATGCCAATAGCACCCCCTGCTTATAACAAGCAAAAATGTTTCCAGACATTGCAAAAGAGC 6827
Chimp           ATGCCAATAGCACCCCCTGCTTATAACAAGCAAAAATGTTTCCAGACATTGCAAAAGAGC 6821
Macaque         ATGCCAGGAGCATCCCCTGCTTATAACAGGCAAAAATGTTTCCAGATATTGCAAAAGAGC 6841
                .0....5....0....5....0....5....0....5....0....5....0....5... 2608
                ******  **** *************** ***************** *************

DQ094845        CCCTGAGGTGCGAATTAGCCCCTGGTTGAGAGTCACTGGTAGAAACTGTAAAAATCTCAG 6887
Chimp           CCCTGAGGTGCGAATTAGCCCCTGGTTGAGAGTCACTGGTAGAAACTGTAAAAATCTCAG 6881
Macaque         CCCTGAGGTGTGAATTAGCCCCTGATTGAGAGTCACTGGTAGAAACT--AAAAATCTCAG 6899
                .0....5....0....5....0....5....0....5....0....5....0....5... 2668
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                                        h        cc
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DQ094845        CAGATACATACATTCTTTCTAATGCAAGCGCTTGATTGTGCAGAGCCTTAGAGAGGGATT 6947
Chimp           CAGATACATACATTCTTTCTAATGCAAGCACTTGATTGCACAGAGCCTTAGAGAGGGATT 6941
Macaque         CAGATATATACATTCTTTCT---GCAAGCACTTGATTGTGCCGAGCCTTGGAGAGGGATT 6956
                .0....5....0....5....0....5....0....5....0....5....0....5... 2728
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DQ094845        TTCACAGTTCACCTAGGCAGTAACAGACCCTCACCAGCACTCTTTCCATTCCATCATGCT 7007
Chimp           TTCACAGTTCACCTAGGCAGTAACAGACCCTCACCAGCACTCTTTCCATTCCATCATGCT 7001
Macaque         TTCACAGTTCACCTAGGCAGTAACACACCCTCATCAGCACTCTTTCCATTCCATCATGCT 7016
                .0....5....0....5....0....5....0....5....0....5....0....5... 2788
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DQ094845        GCCTTCTAAACTTGTTTTCTAGCTGCCCAAATAGTGATCATGAAATGTTAAGAAGGCTTT 7067
Chimp           GCCTTCTAAACTTGTTTTCTAGCTGCCCAAATAGTGATCATGAAATGTTAAGAAGGCTTT 7061
Macaque         GCCTCCTAAACTTGCTTTCTAGCTGCCCAAATAGTGACCCTGAAGTGTTAAGAAGGCTTC 7076
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DQ094845        AAGTCTGTACATGAATTGTTTGAGAGGGTTTATCAATGGAGGTGAGGCCTGTGGGCCATG 7127
Chimp           AAGTCTGTACATGAATTGTTTGAGAGGGTTTATCAATGGAGGTGAGGCCTGTGGGCCATG 7121
Macaque         AGGTCTGTACATGAATTGT--------------CAATGGAGGTGAGGCCTGTGGCCCATG 7122
                .0....5....0....5....0....5....0....5....0....5....0....5... 2908
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DQ094845        ACTCCTGTTTGTGAAGAGATTATAATACTGTCAAGAGGCACGTTAGGGGAAATCACAAAA 7187
Chimp           ACTCCTGTTTGTGAAGAGATTATAATACTGTCAAGAGGCACGTTAGGGGAAATCACAAAA 7181
Macaque         GCTCCTGCTTGTGAAGAGATTAGAATACTGTCAAGAGGCACGTTAGGGGAAATCACAAAA 7182
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DQ094845        GTAAACACATTTCTTCTCCCAGCCCCTTTCTATTTTTGCCTGTGTGTCTGAGCCAGAGCT 7247
Chimp           GTAAACACATTTCTTCTCCCAGCCCCTTTCTATTTTTGCCTGTGTGTCTGAGCCAGAGCT 7241
Macaque         GTAAACACATTTCTTCTCCCAGCCCCTTTCTATTTTTGCCTGTGTGTCTGAGCCAGAGCT 7242
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DQ094845        TGGCCCAGGTTTGATGAAGTGGATCGTCCTCCTTGGCAACGCCAGGCTAGAGCAGATCAG 7307
Chimp           TGGCCCAGGTTTGATGAAGTGGATCGTCCTCCTTGGCAACGCCAGGCTAGAGCAGATCAG 7301
Macaque         TGGCCCAGGTTTGATGAAGTGGATCGTCCTCCTTGGCAACGCCAGGCTAGGGCAGATCGG 7302
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DQ094845        CCTGCAGGGTTCATTGCCATTCCACTGGCTCATGAAGCTGACTCCACTCCCCTCTTCCTT 7367
Chimp           CCTGCAGGGTTCATTGCCATTTCACTGGCTCATGAAGCTGACTCCACTCCCCTCTTCCTT 7361
Macaque         CCTACAGGGTTCATTGCCATTTCACTGGCTCATGAAGCTGACTCCACTCCTCTCTTCCTT 7362
                .0....5....0....5....0....5....0....5....0....5....0....5... 3148
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DQ094845        TCTGTTGCAGCCAAGGTCCCCAACCAGAAAAGCATTGGCCTTCTCTGCTTCCTGTCAACT 7427
Chimp           TCTGTCGCAGCCAAGGTCCCCAACCAGAAAAGCATTGGCCTTCTCTGCTTCCTGTCAACT 7421
Macaque         TCTATCCCAGCCAAGGTCCCCAACCAGAAAAGCATTGGCCTTCTCTGCTTCCTGTCAGCT 7422
                .0....5....0....5....0....5....0....5....0....5....0....5... 3208
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DQ094845        CAATGATGGGATGTTTGGGTGAGCACCGAGCTATCAGGAGAAGGTTAGGCGCCTGTGATT 7487
Chimp           CAATGATGGGACGTTTGGGTGAGCACTGAGCTATCAGGAGAGTGTTAGGCGCCTGTGATT 7481
Macaque         CAATGATGGGACGTTTGGGTGAGCACTGAGCTCTCAGGAGAATGTTAGGCGCCTGTGATT 7482
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DQ094845        TTGGAACATGCCATGGCAAATTGGAGAATGTGTGTCATTCAGTGCTTTTACTTTTTTCCA 7547
Chimp           TTGGAACATGCCATGGCAAATTGGAGAATGTGTGTCATTCAGTGCTTTTACTTTTTTCCA 7541
Macaque         TTGGAACATGCCGTGGCAAATTGGGGAATGTGTGTCATTCGGTGCTTTCACTTTTTTCCA 7542
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DQ094845        AGGGTTTTCATACCTATTGAAAACCCTTATTACACATTATCACCTTCTCTTTCTACTGCT 7607
Chimp           AGGGTTTTCATACCTATTGAAAACCCTTATTACACATTATCACATTCTCCTTCTACTGCT 7601
Macaque         AGGGTTTGCATACCTATT---------------------------------------- 7560
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DQ094845        ATTATCACATTCTCTTTCTACTGCTCTGGTCTCCACACTCAGAGATTTGGGCAGCTTCTT 7667
Chimp           ATTATCACATTCTCTTTCTACTGCTCTGGTCTCCACACTCAGAGATTTGGGCAGCTTCTT 7661
Macaque         ---ATCACATTCTCTCTCTACTGCTCTGGTCCCCACACTCAGAGATTTGGGCAGCTTCTT 7617
                .0....5....0....5....0....5....0....5....0....5....0....5... 3448
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DQ094845        TGGCTAATATTCATGCTCCCTGTAGCCTCATAAGATCTCAGACATGGAAGAGCCCATAGA 7727
Chimp           TGGCTAATATTTATGCTCCCTGTAGCCTCATAAGATCTCAGACATGGAAGAGCCCATAGA 7721
Macaque         TGGCTAATCTTCATACTCCCGGTAGCCTCATAAAATCTCAGACATGGAAGAGCCCATAGA 7677
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DQ094845        AAGTATTTAACATCTGATGAGACTGAAACGCTGTGAGGTGAAGGGCTTGCCCAAGGTAAG 7787
Chimp           AAGTATTTAACATCTGATGAGACTGAAACGCTGTGAGGTGAAGGGCTTGCCCAAGGTAAG 7781
Macaque         AAGTATTTAACATCTGAAGAGACTGAAACGCTGTGAGGCGAAGGGCTTGCCCAAGGTAAG 7737
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DQ094845        CAGCCAAGGATGTCAGAGTGGGA-CTCAAGCCAGGGAACCCAACTGCTATTCCAGGAACT 7846
Chimp           CAGCCAAGGATGTCAGAGTGGGA-CTCAAGCCAGGGAACCCAACTGCTATTCCAGGAACT 7840
Macaque         CAGCCAAGGATGTCAGAGTGGGAACTCAAGCCAGGGAACCCAACTGCTATTCCAGGAACT 7797
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DQ094845        GCTGCATTCTCTCCACCACATTAGCATTGCGTTCTTTCCTCACCCTCAACTGGGGCTATA 7906
Chimp           GCTGCATTCTCTCCACCACATTAGCATTGCGTTCTTTCCTCACCCTCAACTGGGGCTATA 7900
Macaque         GCTGCATTCTCTCCACCACATTAGCATTGAGTTCTTTCCTCACCCTCAACTGGGGCTATA 7857
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DQ094845        ACATAACACATTCATTTCAGCCAATATATTTTTCTTTTGTCCTTAACACAAAATTTAGAG 7966
Chimp           ACATAACACATTCATTTCAGCCAATATATTTTTCTTTTGTTCTTAACACAAAATTTAGAG 7960
Macaque         ACATAACACATTCATTTCGGCCAAGGTATTTTTCTTTTGTCCTTAACACAAAATTTGGAG 7917
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DQ094845        CATAAACAAATAATCTGCAATAGAGACAAAAGAAATAATTGTTCATTTAACTCAACAAGC 8026
Chimp           CATAAACAAATAATCTGCAATAGAGACAAAAGAAATAATTGTTCATTTAACTCAACAAGC 8020
Macaque         CATAAACAAATAATCTGCAATAGGAACAAAAGAAACAATTGCTCATTTAACTCAGCAAGA 7977
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DQ094845        ATCCACTAGGATATCTTCTGCATTTAGGGAAGCTGGGAGATTCCTTAGCTCTTTATAACC 8086
Chimp           ATCCACTAGGATATCTTCTGCATTTAGGGAAGCTGGGAGATTCCTTAGCTCTTTATAACT 8080
Macaque         GTCCACTAAGATATCTTCTGCATTTAGGGAAGCTGGGAGATTCCTTAGCCCTTTATAACC 8037
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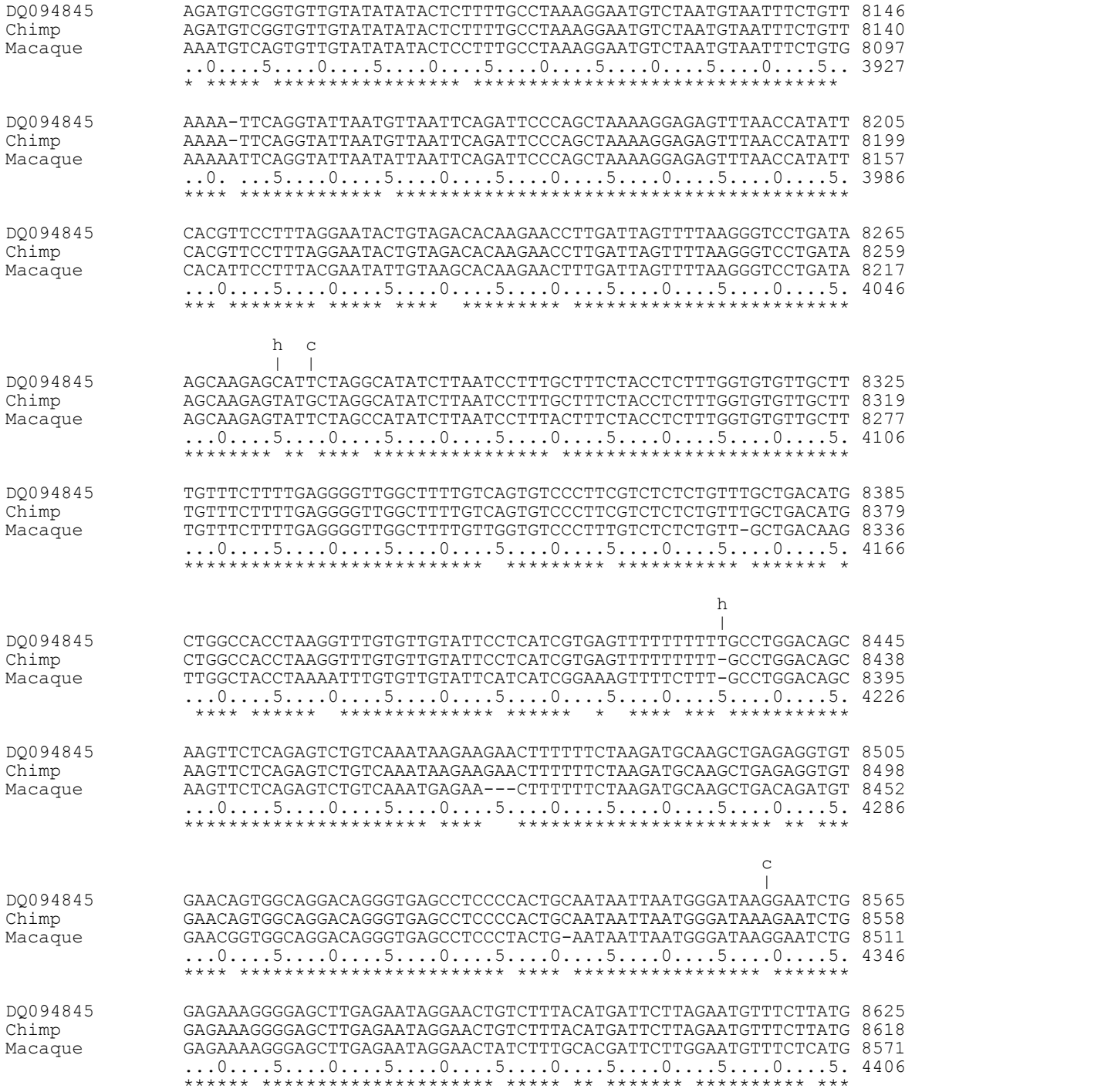
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Chimp AGATGTCGGTGTTGTATATATACTCTTTTGCCTAAAGGAATGTCTAATGTAATTTCTGTT 8140
Macaque AAATGTCAGTGTTGTATATATACTCCTTTGCCTAAAGGAATGTCTAATGTAATTTCTGTG 8097
..0....5....0....5....0....5....0....5....0....5....0....5.. 3927
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DQ094845 AAAA-TTCAGGTATTAATGTTAATTCAGATTCCCAGCTAAAAGGAGAGTTTAACCATATT 8205
Chimp AAAA-TTCAGGTATTAATGTTAATTCAGATTCCCAGCTAAAAGGAGAGTTTAACCATATT 8199
Macaque AAAAATTCAGGTATTAATATTAATTCAGATTCCCAGCTAAAAGGAGAGTTTAACCATATT 8157
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DQ094845 CACGTTCCTTTAGGAATACTGTAGACACAAGAACCTTGATTAGTTTTAAGGGTCCTGATA 8265
Chimp CACGTTCCTTTAGGAATACTGTAGACACAAGAACCTTGATTAGTTTTAAGGGTCCTGATA 8259
Macaque CACATTCCTTTACGAATATTGTAAGCACAAGAACTTTGATTAGTTTTAAGGGTCCTGATA 8217
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DQ094845 AGCAAGAGCATTCTAGGCATATCTTAATCCTTTGCTTTCTACCTCTTTGGTGTGTTGCTT 8325
Chimp AGCAAGAGTATGCTAGGCATATCTTAATCCTTTGCTTTCTACCTCTTTGGTGTGTTGCTT 8319
Macaque AGCAAGAGTATTCTAGCCATATCTTAATCCTTTACTTTCTACCTCTTTGGTGTGTTGCTT 8277
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DQ094845 TGTTTCTTTTGAGGGGTTGGCTTTTGTCAGTGTCCCTTCGTCTCTCTGTTTGCTGACATG 8385
Chimp TGTTTCTTTTGAGGGGTTGGCTTTTGTCAGTGTCCCTTCGTCTCTCTGTTTGCTGACATG 8379
Macaque TGTTTCTTTTGAGGGGTTGGCTTTTGTTGGTGTCCCTTTGTCTCTCTGTT-GCTGACAAG 8336
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DQ094845 CTGGCCACCTAAGGTTTGTGTTGTATTCCTCATCGTGAGTTTTTTTTTTGCCTGGACAGC 8445
Chimp CTGGCCACCTAAGGTTTGTGTTGTATTCCTCATCGTGAGTTTTTTTTT-GCCTGGACAGC 8438
Macaque TTGGCTACCTAAAATTTGTGTTGTATTCATCATCGGAAAGTTTTCTTT-GCCTGGACAGC 8395
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DQ094845 AAGTTCTCAGAGTCTGTCAAATAAGAAGAACTTTTTTCTAAGATGCAAGCTGAGAGGTGT 8505
Chimp AAGTTCTCAGAGTCTGTCAAATAAGAAGAACTTTTTTCTAAGATGCAAGCTGAGAGGTGT 8498
Macaque AAGTTCTCAGAGTCTGTCAAATGAGAA---CTTTTTTCTAAGATGCAAGCTGACAGATGT 8452
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DQ094845 GAACAGTGGCAGGACAGGGTGAGCCTCCCCACTGCAATAATTAATGGGATAAGGAATCTG 8565
Chimp GAACAGTGGCAGGACAGGGTGAGCCTCCCCACTGCAATAATTAATGGGATAAAGAATCTG 8558
Macaque GAACGGTGGCAGGACAGGGTGAGCCTCCCTACTG-AATAATTAATGGGATAAGGAATCTG 8511
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DQ094845 GAGAAAGGGGAGCTTGAGAATAGGAACTGTCTTTACATGATTCTTAGAATGTTTCTTATG 8625
Chimp GAGAAAGGGGAGCTTGAGAATAGGAACTGTCTTTACATGATTCTTAGAATGTTTCTTATG 8618
Macaque GAGAAAAGGGAGCTTGAGAATAGGAACTATCTTTGCACGATTCTTGGAATGTTTCTCATG 8571
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DQ094845        GTGAACCTATTGCCAAATGGAGCCTAAACCAGAATCAGTCAGAAAGTATTTATGGAGCAC 8685
Chimp           GTGAACCTATTGCCAAATGAAGCCTAAACCAGAATCAGTCAGAAAGTATTTATGGAGCAC 8678
Macaque         GTGAACCTACTGCCAAATGGAGCCTAAACCAGAATCAATCAGAAAGTATTTTTGGAGAAC 8631
                ...0....5....0....5....0....5....0....5....0....5....0....5. 4466
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DQ094845        CTACTGTATGCAGCATGAGAAAAGTATAGGTTTCCATTTCTGCCTTTTGGATCATGATAT 8745
Chimp           CTACTGTATGCAGCATGAGAAAAGTATAGGTTTCCATTTCTGCCTTTTGGAGCATGATAT 8738
Macaque         CTACTGTGTGTAGCATGAGAAAAGTATAGGTTTCAGTTTCTGCCTTTTGGAGCATGATAT 8691
                ...0....5....0....5....0....5....0....5....0....5....0....5. 4526
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DQ094845        TAAGGATACTAAGCAGATACCTTTTATGGAATCTTACTAAAAGTTAGTGACTATGTTAGA 8805
Chimp           TAAGGATACTAAGCAGATACCTTTTATGGAATCTTACTAAAAGTTAGTGACTATGTTAGA 8798
Macaque         TAATGATACTAAGCAGATAGCTTTTATGGAATCTTACTAAATGTTAGTGACTATATTAGA 8751
                ...0....5....0....5....0....5....0....5....0....5....0....5. 4586
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DQ094845        CACCTGTTAGGCGTTATGTCCTC---ACAACTGTATGATGTAGGTAGCATAATTGTCCTC 8862
Chimp           CACCTGTTAGGCGTTATGTCCTC---ACAACTGTATGATGTAGGTAGCATACTTGTCCTC 8855
Macaque         CACCTGTTAGGCATTATGTCCTCTTCACAACTGTATGATGTAGGTAGCATAATTGTCCTC 8811
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DQ094845        ATCTAACAAATGAGGGAGCTGAGGCTCAGAAAGCTTCAGTAACTTTCCAAAGCCATACAA 8922
Chimp           ATCTAACAAATGAGGGAGCTGAGGCTCAGAAAGCTTCAGTAACTTTCCAAAGCCATACAA 8915
Macaque         ATCTAACAAACGAGGGAGCTGAGGCTCAGAAAGCTTCAGTAACTTTCCAAAGCCATACCA 8871
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DQ094845        CCAACTAGTTGCAGAGTCAGGACGAGAACCCAGGTCTCTGTGATTCCAGGATCCATGGAG 8982
Chimp           CCAACTAGTTGCAGAGTCAGGACGAGAACCCAGGTCTCTGTGATTCCAGGATCCATGGAG 8975
Macaque         CCAACTAGTTGCAGAGTCAGGACGAGAACCCAGGTCTCTGTGATTCCAGGATCCATGGAG 8931
                .5....0....5....0....5....0....5....0....5....0....5....0... 4763
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DQ094845        CCTAGCACCCAGGCAAACCAGGAAGCAGCACGAGGTAGCTTAGAATCTGTGCCAGAACAA 9042
Chimp           CCTAGCACCCAGGCAAACCAGGAAGCAGCACGAGGTAGCTTAGAATCTGTGCCAGAACAA 9035
Macaque         CCTAGCACCCAGGCAAAACAGGAAGCAGCACGAGGTAGCTTAGAATCTGTGCCAGAACAA 8991
                .5....0....5....0....5....0....5....0....5....0....5....0... 4823
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DQ094845        GTGTAAGAACTGGAAATGCAATACTTTGTTGAGAGAAGACGGAGACTGCTGTGGGTTGAG 9102
Chimp           GTGTAAGAACTGGAAATGCAATACTTTGTGGAGAGAAGAGGGAGACTGCTGTGGGTTGAG 9095
Macaque         GTGTAAGAACTGGAAATGCAATACTTTGTTGAGAGAAGAGGGAGATTGCTGTGGGTTGAG 9051
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DQ094845        GCAGGGAGGAATGTTCCCTTCCAAGCATGTGACTGCAGGGTTTCTGGGGACTGACACAAA 9162
Chimp           GCAGGGAGGAATGTTCCCTTCCAAGCATGTGACTGCAGGGTTTCTGGGGACTGACACAAA 9155
Macaque         GCAGGGAGGAATGTTCCCTTCCAAGCATGTTACTGCAGTGTTTCTGGGGACTGGGACAAA 9111
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DQ094845        AAA-CCAATCACTGAAGTGCCTAGTTTGCTTCTCCAAGTCTTTGTTTTGTCTTCTCATCA 9221
Chimp           AAA-CCAATCACTGAAGTGCCTAGTTTGCTTCTCCGAGTCTTTGTTTTGTCTTCTCATCA 9214
Macaque         AAAACCGATCACTGAAGTGCCTAGTTTGCTTCTCCGAGTCTTTGTTTTGTCTTCTCATCA 9171
                .5. ...0....5....0....5....0....5....0....5....0....5....0.. 5002
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DQ094845        GAGAATCAGACCAAAATGGAAAGAGGATATGAAACTCTAAAACGAACACAGCAGAGTAAA 9281
Chimp           GAGAATCAGACCAAAATGGAAAGAGGATATGAAACTCTAAAATGAACACAGCAGACTAAA 9274
Macaque         GAGAATCAGACCAAAATGGAAAGAGGATGTGAAACTCTAAAACGAACACAGCAGAGTGAA 9231
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DQ094845        GCAGAAACACAGGCTGCCCTACGTCCTGGCACTCTTTCTCAGCTCCAAAGTTGGGAAGGC 9341
Chimp           GCAGAAACACAGGCTGCCCTACGTCCTGGCACTCTTTCTCAGCTCCAAAGTTGGGAAGGC 9334
Macaque         GCAGAAACACAGGCTGCCCTACATCCTGCAACTCTTTCTCAGCCCCAGCGTTGGAAAGGT 9291
                ..5....0....5....0....5....0....5....0....5....0....5....0.. 5122
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DQ094845        CTCCTAAATTGAGTGGGTAGCCAGACCTTATGGAAATTTGATAGGCCTGGGTAGCCATAT 9401
Chimp           CTCCTAAATTAAGTGGGTAGCCAGACCTTATGGAAATTTGATAGGCCTGGGTAGCCATAT 9394
Macaque         CTCCTAAATTGAGTGGGTGGCCGGATTTTATGGAAATTTGATAGGTCTGGGTAGCCATAT 9351
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DQ094845        AGGTATGTTTTCCATCTTGAGCTAGCATTCTAGATCAAAGGAGATGATTTTCTGACAGCA 9461
Chimp           AGGTATGTTGTCCATCTTGAGCTAGCATTCTAGAGCAAAGGAGATGATTTTCTGACAGCA 9454
Macaque         AGGTATGTTGTCCATCTTGAGCTAGCATTCTAGAGCAAAGGAGATGATTTTCTGACAACA 9411
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DQ094845        GAGAGCAAGGAAGCTTAATATGCTTTGAATGATACTTTCCATTGACAGTATAACCTCTAC 9521
Chimp           GAGAGCAAGGAAGCTTAATATGCTTTGAATGATACTTTCCATTGACAGTATAACCTCTAC 9514
Macaque         GAGAGCAAGGAAAGTTAATATGCTTTCAATGATACTTTTAATTGACAGTATAACCTCTAC 9471
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DQ094845        TAAATTCAGTCTGTGCTAATCCATACTTCACTGACAGTGCAAATATAATTTGAAGGAGGG 9581
Chimp           TAAATTCAGTCTGTGCTAATCCATACTTCACTGACAGTGCAAATATAATTTGAAGGAGGG 9574
Macaque         TAAATTCAGTCTGTGCTAATCCGTACTTCACTGACAGTGCAAATATAATTTGAAGGAGGG 9531
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DQ094845        ATTTTTCTAAATGCGTAAGAGAACAAACTTCCTAAGCACTTTCAAGAACTTGAGAAATTC 9641
Chimp           ATTTTTCTAAATGCGTAAGAGAACAAACTTCCTAAGCACTTTCAAGAACTTGAGAAATTC 9634
Macaque         ATTTTTCTAAATGCCTAAGAGAACAAACTTCCTAAGCACTTTCAAGAACTTGAGAAATTC 9591
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DQ094845        TGGTGTTTTGTGAATAATAGGAGGCAGGGTGAGGTGAAAAGAGCCCCCCTCCAACCTCCC 9701
Chimp           TGGTGTTTTGTGAATAATAGGAGGCAGGGTGAGGTGAAAAGAGCCCCCCTCCAACCTCCC 9694
Macaque         TGGTGTTTTATGAATAATAGGAGGCAGGGTGAGGTGAAAAAAGCCCCCCTCCAACCTCCC 9651
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DQ094845        ACCCACCACCCCACTCTCTCTCTCTCTGAAGTTGGGTGAGGCGGTTTTCTTCAGCCGACT 9761
Chimp           ACCCACCATCCCACTCTCTCTCTCTCTGAAGTTGGGTGAGGCAGTTTTCTTCAGCCGACT 9754
Macaque         GCCCACC--CCCACTCTCTCTCTCTCTGAAGTTGGGTGAGGCAGTTTTCCTCAGCAGACT 9709
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DQ094845        TCCGTTTACTCATCTGTAATTTGAGGCCAGTACAGGTGGTATCTAAGCTCTGCTCCCCTC 9821
Chimp           TCCGTTTACTCATCTGTAATTTGAGGCCAGTACAGGTGGTATCTAAGCTCTGCTCCACTC 9814
Macaque         TCCGTTTGCTCATCTGTAATTTGAGGCCAGTACAGGTGGTATCTAAGCTCTGCTCCACTC 9769
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DQ094845        TGAAT------TTATACAGTTGTTAATTTACAGGCTAGAGATAATCATTTATATTTCTAA 9875
Chimp           TGAAT------TTATACAGTTGTTAATTTAGAGGCTAGATATAATCATTTATATTTCTAA 9868
Macaque         TAAATGTAAATTTATACAGTTGTTAATTTAGAGGCTAGAGATAATCATTTATATTTCTAA 9829
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DQ094845        TTAGAGTTGATGACATTTGCCATATAAACAATGGTTGAATATTCTGAAGGTTGTCAGCCT 9935
Chimp           TTAGAGTTGATGACATTTGCCATATAAACAATGGTTGAATATTCTGAAGGTTGTCAGCCT 9928
Macaque         TTAGAGTTGATGACATTTGCCATATAAACAATGGTTGAATATTCTGAAGGTTGTCAGCCT 9889
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DQ094845        GCAGAAGAGAATGCTGTGAAGTACTATTTGGTG 9968
Chimp           GCAGAAGAGAATGCTGTGAAGTACTATTTGGTG 9961
Macaque         GCAGAAGAGAATGCTGTGAAGTACTATTTCGTG 9922
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