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Parallel adaptation of CD4 in SIV-endemic Gorilla and Pan lineages

An honors thesis presented to the Department of Biological Sciences University at Albany State University at New York In partial fulfillment of the Honors Program Requirements

Katie E. Brown 2014

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Student Name:	Katie Elizabeth Brown	Studen	t ID: 001075517
Thesis Title:	Parallel adaptation of CD4 in	n SIV-endemic Gorilla and P	an lineages.
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*Senior Honors Thesis Research Advisor:	Caro-Beth Stewart	Berent	12/10/14
*Honors Thesis	Albert Millis	Signature	Date
Committee Member:	Print name	Signature	Date
Honors Thesis Committee Member (optional):			
*Required	Print name	Signature	Date
CHOOSE ONE: \Box	Department Chair OR	⊠ Director of Department H	Ionors Committee
Biology Honors Committee Director & Department Chair	RICHARD S. ZITOMER	Richt St	12/11/14
	Print name	Signature Signature	Date
Original – Dr. Jeffr	ey Haugaard, Associate Vice Pro	vost and Honors College Directo	or LC-31
Copy – Departn	nent of Biological Sciences		

ABSTRACT

The simian immunodeficiency virus (SIV) is homologous to the human immunodeficiency virus (HIV), and naturally infects chimpanzees and gorillas in the wild. Some African primate species appear to have evolved resistance to SIV, in that the virus no longer is found in the species or, if infected, individuals within the species show no serious symptoms of simian AIDS (SAIDS). In contrast, Asian primate species do not appear to naturally harbor SIV and, like humans, often progress to AIDS following infection. CD4 is the primary T cell receptor that SIV/HIV interacts with to infect host T cells. Domain 1 (D1) of CD4 holds the main interaction with the viral envelope protein, gp120.

During my course in Dr. Stewart's lab, I analyzed 77 primate CD4 gene sequences in comparison to each other and to the *Homo* lineage in search of fixed changes on lineages, as well as sequence variation within species. I found that D1 in the known SIV resistant species, chimpanzee and gorilla, had several notable amino acid replacements on ancestral lineages, as well as variation within the species. These amino acid replacements likely have the potential to prevent SIV gp120 from binding to CD4. In contrast, the *Homo* sequence had no amino acid replacements and little variation within humans. Perhaps these results shed light on why humans suffer with HIV/AIDS today, with little to no resistance to infection.

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INTRODUCTION

HIV and SIV

HIV is a relatively new virus for humans, believed to have emerged within the past 100 years following transmission from chimpanzees and sooty mangabeys (Gifford *et al.*, 2012; Compton *et al.*, 2013; Locatelli *et al.*, 2014). Immunodeficiency viruses are estimated to have infected African monkeys, such as the colobus monkeys, mangabeys, mandrills, and green monkeys, for at least 14 million years, making several jumps to African apes (Compton & Emerman, 2013). Today, most African monkey species harbor strains of SIV (Castro-Nallar *et al.*, 2012).

SIV has co-evolved with host species and has made several species jumps (Castro-Nallar *et al.*, 2012). Importantly for this project, phylogenies of SIV genes suggest that African apes acquired SIV from African monkeys through at least one jump, and that SIV jumped from monkeys and apes to humans several times independently, resulting in HIV-2 and HIV-1, respectively. SIV from sooty mangabeys jumped to humans at least three times, leading to HIV-2, while gorilla SIVs and chimpanzee SIVs jumped to humans at least four times recently resulting in HIV-1. HIV-1 has become a global human pandemic in the past 30 years, killing 33 million people worldwide (Locatelli *et al.*, 2014). These observations raise the question of why this virus is so lethal to humans, yet is endemic and not as lethal to African primate hosts. Why humans progress to AIDS more rapidly than African primate hosts is an unsolved mystery. A major place where one might expect to see differential selection would be on the HIV receptor molecules, CD4 being the primary one. The purpose of my research was to look for evidence of selection on CD4 in African apes.

CD4 Background

The typical function of CD4 in a healthy individual is to bind to MHC class II molecules to enhance the activity of T cells (Harrison, 1993). CD4 is encoded by 10 exons that span over 31,000 basepairs (bp) of DNA. The extracellular portion of the protein is comprised of four immunoglobulin-like domains. Domain 1 (D1) is encoded by two exons that are separated by over 10,000 bp. CD4 is the primary T cell receptor for HIV/SIV (Sharp & Hahn, 2011).

SIV/HIV infects T cells through the binding of gp120, the viral envelope glycoprotein, with the host glycoprotein CD4 and a chemokine co-receptor, such as CCR5 or CXCR4. The viral gp120 protein binds preferentially to the most aminoterminal of the four immunoglobulin-like domains that CD4 possesses, domain 1 (D1), but may also interact with domain 2



Figure 1. Diagram of CD4. CD4 is a T-cell receptor that consists of four immunoglobulin-like domains (D1, D2, D3, and D4), as well as transmembrane and intracellular segments.



Figure 2. CD4/GP120 Ribbon Diagram. A ribbon diagram of HIV gp120 bonded to Human CD4 domain 1. (Source: http://www.ncbi.nlm.nih.gov/Structure/mmdb/mmd bsrv.cgi?uid=79081)

(D2) (Harrison, 1993). Previous research has shown that there is notable variation across species in D1 of CD4 (Hvilsom *et al.*, 2008; Koito *et al.*, 1994; Wyatt *et al.*, 1995). The interaction of SIV/HIV interaction with CD4 primarily involves the D1 region, as well as the complementary determining region (D2) of CD4 (Koito *et al.*, 1994; Wyatt *et al.*, 1995). D1 possesses the highest species-specific variation seen so far in CD4 (Hvilsom *et al.*, 2008).

The binding of CD4 and gp120 causes conformational changes in gp120 that exposes the binding site for the chemokine co-receptor, typically either CCR5 or CXCR4. This conformational change enables the cell membrane and viral membrane to fuse. SIV/HIV is then able to implant its genetic information into the host cell (Freeman & Heron, 2007). When HIV/SIV is bound to CD4 in a host, T-cell activation is reduced. In highly susceptible hosts, SIV and HIV cause the destruction of CD4+ lymphocytes, which leads to the onset of acquired immunodeficiency syndrome (AIDS) (Kwong *et al.*, 1998).

Analysis of the Great Apes CD4 Gene Sequences

For this thesis project, I examined the CD4 sequences of the great apes to see how they differ from each other and from the *Homo* (human, Neanderthal, and Denisovan) lineage. We hypothesized that part of the mystery of SIV resistance in African apes, and the lack of such resistance in humans and Asian apes, was buried within CD4.

The four recognized subspecies of chimpanzee are the western (*Pan troglodytes verus*), Cameroonian (*P.t. ellioti*), central (*P.t. troglodytes*), and eastern (*P.t. schweinfurthii*) chimpanzees (Sharp & Hahn, 2011; Prado-Martinez *et al.*, 2013). Certain central and eastern chimpanzee populations harbor endemic SIV in the wild, whereas the western and Cameroonian chimpanzees do not (reviewed in Sharp & Hahn, 2011). The bonobos, also known as pygmy chimpanzees (*Pan paniscus*), appear to lack endemic SIV (Dooren *et al.*, 2002; Li *et al.*, 2012). Early estimates of the age of SIV in chimpanzees were as low as 500-1000 years (Wertheim & Worobey, 2009), but these dates were recalibrated to a minimum of about 77,000 years using the separation of Bioko Island from mainland Africa (Worobey et al., 2010). Worobey et al. reasoned that since each Bioko SIV lineage shares ancestry with mainland virus that was found in monkeys of the same genus, the mainland and Bioko SIV variants must have been evolving independently since the isolation of Bioko Island (10,000 years before present [B.P.]). They used the ancestor date of 10,000 years B.P. as well as amino acid sequences to recalibrate the molecular clock, and found that the most was recent common ancestor of SIV was 76,794 years B.P. Because of the limited distribution of SIV in the wild, it is widely believed among HIV researchers that central and eastern chimpanzees likely acquired SIV after their divergence from western and Cameroonian chimpanzees (Sharp & Hahn, 2011). Based upon population divergence estimates by Prado-Martinez et al. (2013), this would suggest that SIV infected the ancestor of the central and eastern chimpanzees between about 300-800 thousand years ago (kya). Other researchers have suggested that SIV is much older than this in the *Pan* lineage, with estimates at over 2 million years ago (mya) (Walter et al., 2005; de Groot & Bontrop, 2013). As will be explained in this thesis, my results on CD4 support this older date of initial infection by SIV of the *Pan* and *Gorilla* lineages.

CD4 is conserved in individuals of western chimpanzees but variable in central and eastern chimpanzees (Hvilsom *et al.*, 2008). The CD4 receptor of chimpanzees (Hvilsom *et al.*, 2008), as well as other apes (as shown herein), differs genetically from that of humans, and it is possible that these differences may play roles in SIV resistance in the western and Cameroonian chimpanzee and may explain why humans have less resistance to HIV than do other primates. The two major species of gorillas are the western (*Gorilla gorilla gorilla*) and eastern (*Gorilla beringei graueri*) gorillas. Certain populations of western lowland gorillas have SIV in the wild, but the virus has yet to be found in other populations of gorillas (Neel *et al.*, 2010), although only a few populations of eastern gorillas have been examined to date. Phylogenetic analysis of SIV genes suggests that western gorillas acquired the virus from central chimpanzees (*P.t.t.*) living in the same region in Africa (reviewed in Sharp & Hahn, 2011; Neel *et al.* 2010). This would imply that the strain of SIV currently infecting gorillas is less than 300,000 years old, based upon the same logic used above. However, our analyses suggest that the common ancestor of the two gorilla species was infected by SIV (or some other pathogen that uses CD4 as a receptor), which will later be discussed.

There are two species of orangutans, the Sumatran (*Pongo abelii*) and Bornean (*P. pygmaeus*). Both of these species appear to lack SIV endemically, like other Asian primates



Figure 3. The Great Apes. This image shows a map of equatorial Africa on the upper left, and a map of Malaysia and Indonesia in the box on the bottom right. These maps show the current known locations of the great apes: the Western chimpanzee, Nigeria-Cameroon chimpanzee, Central chimpanzee, Eastern chimpanzee, Western lowland gorilla, Eastern lowland gorilla, bonobo, Sumatran orangutan, and Bornean orangutan. The plus signs (+) denote a species or subspecies in which SIV is endemic. The minus signs (-) denoted the lack of endemic SIV in the species.

(Compton *et al.*, 2013; Locatelli *et al.*, 2014). Thus, the orangutan CD4 sequences should serve as a natural control for the African ape CD4 sequences in our studies.

There have been suggestions that the common ancestral lineage leading to bonobos and chimpanzees shows signs of genetic adaptation to an SIV-like retrovirus (Walter *et al.*, 2005; reviewed in de Groot & Bontrop, 2013). Extensive studies on captive *P.t. verus* have shown this

species to be resistant to infection by HIV or SIV, and if infected, show resistance to progression to AIDS (Gordon *et al.*, 2008). Moreover, extensive surveys of wild *P.t. verus* have not revealed any natural infections by chimpanzee or local monkey SIVs (Reviewed in Sharp *et al.*, 2005; Santiago *et al.*, 2003). Together, these findings suggest that the western chimpanzees likely have natural resistance to SIV infection, but the genetic basis for this resistance is not known. In contrast, the central and eastern chimpanzees are naturally infected with SIV, and eastern chimpanzee populations show evidence of significant impact by this pathogen (Locatelli *et al.* 2014). In contrast to the chimpanzees, experiments have not been reported on captive gorillas, so little is known about their resistance or susceptibility to SIV and AIDS (Locatelli *et al.*, 2014).

The pattern seen in chimpanzees and gorillas is in stark contrast to that seen in humans and orangutans. Being of Asian origin, orangutans are not naturally exposed to SIV, and no SIV has been reported in wild populations. The current consensus appears to be that SIV is restricted to African primates, although a few studies of Asian primate SIV status have been reported in the literature. Macaques, which are Asian monkeys, have been confirmed to not harbor SIV as a natural pathogen. (Sharp & Hahn, 2011). Why humans — which are originally of African origin — are more susceptible to HIV than are African apes is currently unknown.

Focus of this Study

The great apes and humans share much of their genome, especially chimpanzees, humans' closest relatives, who share 98% of their genome with us. The Stewart laboratory suspected than somewhere along the genome, there was enough variation between apes and humans to make a difference in HIV/SIV susceptibility between species. My role in the SIV project was to study the CD4 mRNA gene sequences of the hominoids, and to understand the molecular basis for the potential adaptive evolution of CD4 to SIV. Previous research in the

Stewart laboratory has suggested adaptive evolution of the chimpanzee and gorilla CD4 genes, as well as other adhesion proteins involved in HIV infection and disease progression (Bandla, 2009). However, these studies were limited because sequences were available from only western chimpanzee and western gorilla. That is, we had no information about bonobos, the other subspecies of chimpanzees, or gorillas. Thus, we were not able to infer when the adaptation occurred on the African ape lineages. Furthermore, sequences were not available from multiple individuals within species, and thus information was not available about ongoing adaptation in populations.

The publication in 2013 of whole genome sequences from 79 great ape individuals representing all known subspecies (Prado-Martinez *et al.*, 2013) provided these missing data, and allowed us to study the evolution of CD4 in the great apes at both the phylogenetic and population genetic levels. We obtained CD4 sequences for human, Neanderthal, Denisovan, and the great apes through a variety of public databases, including: GenBank (http://www.ncbi.nlm.nih.gov), the 1000 Genomes Project (http://www.1000genomes.org), Ensembl (http://neandertal.ensemblgenomes.org/index.html), and the UCSC Genome Browser (http://genome.ucsc.edu/). We assembled the ape CD4 gene sequences from short sequence reads, and inferred the haplotypes for each. Analysis of these new data revealed that there were two ancestral episodes of adaptation in D1 of CD4, one on the ancestral *Pan* lineage and the other on the ancestral *Gorilla* lineage. No such episodes were seen on the ancestral *Pongo* or

Homo lineages. Moreover, we found evidence of ongoing selection on D1 of CD4 in populations of gorillas and chimpanzees, but not in humans or orangutans.



Figure 4. Hominoid Phylogeny. A phylogenetic tree depicting SIV infection in hominoids. The red lineages represent Asian primates, whereas the blue lineages represent African primates. The blue bolt depicts known SIV infection, while the gray bolt depicts hypothesized SIV infection. Phylogeny based on Prado-Martinez *et al.* (2013).

MATERIALS AND METHODS

Primary Analysis

The short sequence reads of the following great ape genomes were made available by Prado-Martinez et al. (2013) in the Sequence Read Archive (SRA) database on the National Center for Biotechnology Information (NCBI) website (http://blast.ncbi.nlm.nih.gov/sra) for the following species: Pan troglodytes verus (Western chimpanzee), Pan troglodytes ellioti (Nigerian-Cameroonian chimpanzee), Pan troglodytes troglodytes (Central chimpanzee), Pan troglodytes schweinfurthii (Eastern chimpanzee), Pan paniscus (bonobo), Gorilla gorilla gorilla (Western lowland gorilla), Gorilla beringei graueri (Eastern lowland gorilla), Pongo abelii (Sumatran orangutan), and *Pongo pygmaeus* (Bornean orangutan). A list of all of the individuals used in this study, along with their SRA Experiment Set (SRX) file numbers, is given in Appendix A. For each individual, all of their SRX files were jointly searched for CD4 homologies using the Basic Local Alignment Tool (BLAST) available on the SRA site. The RefSeq mRNA sequence for the given species was used as the query in most searches. For searches that spanned intron-exon boundaries, the human genome sequence was used as the query. The maximum number of aligned sequences selected to display for these BLAST searches was 20,000, and the program was selected to optimize for highly similar sequences to avoid turning up gene paralogs and artifacts. The alignment files returned for each individual were saved as PDF files and archived in the Stewart laboratory. These files were visually examined for polymorphic sites, and annotated accordingly. A site was considered to be polymorphic if a nucleotide sequence difference existed in about half of the short reads, provided that the reads in question were 'clean' and the apparent polymorphism did not show hallmarks of being an artifact of the sequencing method (see below for further discussion). In those cases when more than one

polymorphism existed within a given short sequences read, this information was used to help phase the haplotypes in that individual. The full haplotypes of the CD4 coding regions were inferred using the program BEAGLE by Dr. Randall Collura. The *Homo sapiens* CD4 mRNA sequences analyzed were made available through the 1000 Genomes Project (http://www.1000genomes.org), while the Neanderthal and Denisovan sequences were provided by Ensembl (http://neandertal.ensemblgenomes.org/index.html) and the UCSC Genome Browser (http://genome.ucsc.edu/), respectively.

Sequence variation was scored conservatively, and further analyzed in a master alignment of the sequences of all available individuals across species. CD4 mRNA sequences from 27 Western lowland gorillas, 3 Eastern lowland gorillas, 4 Western chimpanzees, 10 Cameroonian chimpanzees, 6 Eastern chimpanzees, 4 Central chimpanzees, 13 bonobos, 5 Sumatran orangutans, 5 Bornean orangutans, 1 Denisovan, 5 Neanderthals, and over 1000 humans were analyzed. A master alignment of CD4 genes was created from the all individuals' allelic sequences, which had been organized into FASTA files. These FASTA files were imported into *Se-AL* v2.a11 (Rambaut, 2002), a program that can be used to manually align multiple DNA sequences according to codons, and can translate the DNA sequences into protein sequences. The alignments were then imported into the program *MacClade* v. 4.04 (Maddison & Maddison, 2004), which was then used to most parsimoniously assign nucleotide substitutions and amino acid replacements upon the lineages of the CD4 tree (See Figure 9), using the known primate phylogeny as a guide. The gibbon CD4 sequence was used as an outgroup to aid in the assignment of changes to the various great ape lineages.



Figure 5. BLAST return example. Shown above is a clean example of a short span of a chimpanzee CD4 D1 gene sequence from a BLAST search. Two polymorphisms can be seen in this image: T/A and A/C. In this case, the two polymorphisms are on the same runs, so the haplotypes can be determined as "A…A" and "T…C". Note that the polymorphic sites are found on reads in both orientations, a further sign that they are real sequence differences.

Hidden Alleles

During the analysis of the ape CD4 sequences, a notable concern arose. Some of the BLAST returns lacked sequences at the ends of exons, near the exon-intron boundaries, in a manner that looked like the runs had been truncated. A considerable number of sequence runs

had this problem. We suspected that there was a possibility that polymorphisms present in these truncated runs were not being revealed due to the sequence reads being cut off due to mismatches near the ends. To see if this was the case, I redid some of the BLAST searches using query sequences that spanned intron-exon boundaries by about 100 basepairs. This analysis revealed that, indeed, there were several places were apparently real polymorphisms had been hidden by the mRNA-based queries. Thus, I redid all of the BLAST searches including about 100 base pairs of intronic sequence flanking both upstream and downstream from each exon, except for the first and last exons, which had intronic sequence flanking the downstream, and upstream sides of the exons, respectively. This second batch of hominoid CD4 BLAST searches was done using a Homo sapiens CD4 DNA query instead of the respective species' mRNA sequences. This analysis revealed that there had been some missing polymorphisms within the leader sequence of the gene and in domains 3 and 4 in certain individuals, but these did not change the major findings about fixed changes and polymorphism in D1 and D2 of the SIVendemic species. Since the BLAST search setting was set for 'highly similar sequences', the deviating ends of runs at the intron-exon boundary were simply not entirely included in the return. This potential problem is certainly an issue to keep in mind when doing such bioinformatics analyses.

Heterozygosity

Prado-Martinez *et al.* (2013) measured genome-wide heterozygosity of the great ape species and subspecies. To compare the heterozygosities of CD4, particularly D1, between groups and to the genome averages, I measured the heterozygosity of the CD4 gene and D1of each individual. Prado-Martinez and colleagues did not indicate how they calculated genomic heterozygosities, but the values were reported as heterozygotes/bp. I therefore conducted the CD4 measurements by counting the number of polymorphisms in each individual, and then dividing that number by the length of the gene (1377 bp). I thereby calculated the average heterozygosity for each species or subspecies. These values can be found in Appendix C.

RESULTS

Sequence Artifacts

A noteworthy concern that arose was there appeared to be many artifacts riddled throughout the sequence reads in the alignments from the BLAST searches. Some of these were the common G artifacts found in this type of genomic sequencing, which is illustrated in Figure 6 for PTT Doris. Additional problems we encountered were sites that looked like potential polymorphisms, but under closer evaluation seemed likely to be artifacts. Two such examples are also shown in Figure 6. The string of G's and C's depicted in both chimpanzee individuals shown, in nucleotide positions 1264 and 1330, were present in almost all individuals for chimpanzees, bonobos and gorillas. In addition, all of the runs they were located on were in the reverse orientation, and many of the individual runs with these G's and C's on them were also riddled with other 'dirt' (additional nucleotide differences). Lastly, in most of the apes, these nucleotide differences were present in low frequency. For example, PTV Jimmie, as shown in Figure 6, is the only chimpanzee that had such a surplus amount of G's in position 1264. Thus, based on this reasoning, these sites were no longer considered polymorphic in any species, whether or not there were numerous runs with the presumed artifactual nucleotide. This kind of careful scrutiny and visual analysis was applied to all other apparently polymorphic sites to ensure the utmost accuracy in base calls. When in question, we tried to be conservative in calling polymorphisms or substitutions.

P.t.v. Jimmie



Hidden Alleles

An additional concern arose when BLAST searching the primates sequences. Some of the returned sequence runs appeared to be cut off near the end of certain exons. I was not sure why this was so, and was concerned that fixed changes or polymorphism could be hiding within the sequence that was not being shown. To remedy this issue, I re-BLASTED all the apes with a *Homo sapiens* CD4 DNA FASTA sequence, in which I patched together the exons with 100 bp of intron flanking either side. In doing so, some regions of CD4 did reveal polymorphic sites, such as the leader sequence, which contained an A/G nucleotide polymorphism within the first hundred base pairs. These polymorphic sites were of no importance in our major results, and this site in question caused a synonymous substitution. An individual who had this hidden allele was *Pan troglodytes schweinfurthii* Bwambale. This site appeared to be an A against a *Pan troglodytes* mRNA query, but upon re-BLASTing it with a *Homo* mRNA sequence, which contained a G in this position, it appeared to be a G. Including the introns in the BLAST search revealed the polymorphic site to contain both A's and G's (see Figure 7).



Figure 7. Hidden Alleles. From left to right, the data sequences show BLAST returns of PTS Bwambale against a *Pan troglodytes* mRNA query, a *Homo sapien* mRNA query, and a *Homo* DNA query. The last BLAST run reveals the polymorphic site (denoted by the arrow), and shows the most coverage.

Heterozygosity

Upon measuring the heterozygosity, as described in the Materials and Methods section, I found that the heterozygosity of D1 was higher than that of the rest of CD4, and that the African apes who have SIV in the wild (Western lowland gorillas and central chimpanzees) had higher levels of heterozygosity in D1 than in the rest of their genome (Prado-Martinez *et al.*, 2013). The mutations that occurred on these lineages do not seem to be affecting the entire CD4 gene on average, but are instead targeting D1. This suggests ongoing adaptation in these African apes to the SIV virus. For calculated heterozygosity values for CD4, please see Appendix C. For genome averages, please see Figure 1b in Prado-Martinez *et al.* (2013).

Lineage Based Analysis

The hominoid CD4 mRNA sequences that were analyzed had much to reveal. Remarkably, the *Pan* and *Gorilla* ancestral lineages each had several fixed amino acid replacements, most of which reside in D1. Remarkably, similar amino acid replacements happened independently on the ancestral *Pan* and *Gorilla* lineages: both had replacements that created N-glycosylation sites in D1 near the gp120 binding surface, and both had charge changes at the gp120-CD4 interacting face. In addition, chimpanzee and gorilla populations have highly polymorphic CD4 proteins, again with most of the polymorphisms in D1. These changes likely have the potential to prevent gp120 from binding to CD4. This analysis revealed what appears to be parallel adaptation in the chimpanzees and the gorillas in CD4, presumably due to SIV infections over prolonged periods of evolutionary time.

There were notable amino acid changes in D1 among the chimpanzees, bonobos, and gorillas. The chimpanzees and gorillas also contained significant amount of polymorphism in D1

compared to the rest of CD4. In the western lowland gorillas, amino acid site 40 consisted of a fixed change from a Threonine (T) to an Asparagine (N), resulting in the formation of an Nglycosylation site (Asparagine-Cysteine-Threonine). Site 113 in these gorillas contained a change from Aspartic Acid (D) to Glycine (G), resulting in a charge change. The chimpanzees and bonobos shared fixed changes that were just as notable. Amino acid site 59 contained an Isoleucine (I) to Threonine (T) change resulting in an N-glycosylation site (Asparagine-Glutamine-Threonine). Site 93, a polymorphic site in some chimpanzees, forms an Nglycosylation site that is created from the change of a Proline (P) to Threonine (T) (Asparagine-Phenylalanine-Threonine). Site 112 revealed a D to G change, resulting in an alteration of charge. Such structure and binding altering fixed mutations were not found on the Homo and Asian lineages. The detailed visualization of all fixed changes and polymorphisms discovered can be found in the sequences shown in Appendix B. Much of the polymorphism and change was located on the CD4-gp120 interface. Figure 8 shows CD4 models, created by Jennifer Giza, of some individual gorillas and chimpanzees that contain polymorphism, as well as fixed amino acid changes in D1 of CD4.

In contrast to the African apes, the ancestral *Pongo* lineage had many fixed changes, but these changes were spread over all domains of CD4 instead of being concentrated in D1. Similarly, there were virtually fixed differences between the two orangutan species, and little polymorphism within the two species. Importantly for understanding HIV infection in humans, there were no inferred amino acid replacements on the ancestral *Homo* lineage, and no significant amount of polymorphism within *Homo* species. That is, in stark contrast to the African apes, the human CD4 protein shows no evidence of adaptation to ongoing immunodeficiency virus infection. This contrast is likely highly attributed the very recent of transmission of SIV/HIV to humans.



Figure 8. Chimpanzee and Gorilla fixed changes and polymorphisms. These webs depict D1 of CD4 in individuals from the *Gorilla* and *Pan* lineages, respectively. The green represents fixed amino acid replacements while the pink represents polymorphism. Much of the adaptation is right at the CD4-gp120 interface. These images were used with the permission of Jennifer Giza, who created these models using Swiss Pdb.



Figure 9. Amino acid substitution tree. This figure shows the most parsimonious assignment of the amino acid replacements on the *Pan, Homo*, and *Gorilla* lineages. *P.pa* is bonobo, *P.tr* is *Pan troglodytes, H.sa* is *Homo sapiens, H.ne* is *Homo neanderthalensis, H.de* is *Homo denisovan, G.go* is *Gorilla gorilla*, and *G.be* is *Gorilla beringei*. The numbers represent amino acid change sites; black text indicates an amino acid change in D1, blue text denotes a change in D2, and purple text denotes a change beyond the first two domains. Note that sites 59 and 40 represent addition of N-glycosylation sites in the *Pan* and *Gorilla* lineages, respectively, while sites 112 and 113 are charge change sites (from negative to neutral) in these lineages, respectively. No changes were found on the *Homo* lineage. Structures of CD4 (blue) bound to gp120 (pink) and their corresponding changes are shown under each lineage.

CONCLUSIONS

The additions of the N-glycosylation sites near the CD4-gp120 interface means that a large complex carbohydrate structure will attach to the asparagine side chain. This attachment would likely be an obstruction that would block gp120 from being able to bind properly to CD4. The fixed charge changes shared by the *Pan* and *Gorilla* lineages are also likely to block gp120 form being able to bind properly to CD4 due to incompatibility. In addition to this study, others have found notable sequence changes in the chimpanzees, as well. Hvilsom and colleagues (Hvilsom *et al.*, 2008) stated that most of the amino acid differences between human and chimpanzee CD4 sequences were located in domain 1, which holds the most interaction with the SIV/HIV virus. Meyerson *et al.* (2014) found that CD4, among three other HIV host factor genes (NUP153, RANBP2/NUP358), showed strong signatures of positive selection in D1 using a sliding window dN/dS analysis across CD4. However, these authors did not perform phylogenetic analysis of the sequences changes in CD4 in the hominoids, and thus did not discover the parallel adaptive episodes and ongoing selection that we report here.

In addition to the fixed changes on the *Pan* and *Gorilla* lineages, within the gorillas and chimpanzees, but not the bonobos, there were numerous polymorphisms in D1 of CD4, suggesting ongoing adaptation against SIV in certain populations of African apes. In contrast, the *Homo* lineage shows no amino acid replacements in CD4, and very few polymorphisms are found within modern humans. Again, this suggests that the ancestral human lineage was likely not infected by SIV, at least not on an ongoing basis like for chimpanzees and gorillas. The lack of exposure of ancestral humans to SIV would have prevented adaptive co-evolution, so that human lack HIV resistance today.

However, it is possible that humans are currently undergoing selection to HIV. One possible form of adaptation is the existence of different isoforms of CD4 in humans and possibly in other primates. We found evidence in various mRNA databases that at least one of the predicted transcript variants for CD4 is likely expressed in humans, gorillas, and macaques, and is perhaps found in New World monkeys, as well. This transcript variant codes for a short version of CD4 that lacks D1 and D2, and thus would not bind gp120. The details of the isoforms have not been looked at in depth by the Stewart lab, nor are these isoforms mentioned in the scientific literature. These variants imply that there are currently uncharacterized 'short' forms of the CD4 protein made in humans (and other primates) that may exhibit unique functions in the immune system.

The higher levels of heterozygosity that were seen in D1 of some species were expected based on all the existing variability in D1 among species. Based upon the parallel amino acid replacements seen in D1 of CD4 on the ancestral Pan and Gorilla lineages, we are led to hypothesize that the ancestors of the chimpanzees and bonobos, as well as the ancestors of the two gorilla species, were infected by SIV. Based upon the phylogeny of the hominoids, this would mean that they were infected for initially over 1-2 million years ago, meaning that SIV is much older in apes than most researchers appear to believe at this time. This long period of co-evolution of apes and SIV has allowed the hosts to adapt genetically to the virus. Humans, in contrast, do not appear to have had this long period of co-evolution with the virus, and are not genetically adapted to it. We believe that the chimpanzee and gorillas ancestors stayed in the region of the retro-viral infections in the rainforests of Africa, while the human ancestors migrated away from the area of exposure to SIV. It is also possible that those hominins who lived in Africa at the time died from the virus. This hypothesis might explain why African apes

have built up a degree of resistance to the SIV virus, while humans and Asian apes have little to no resistance to HIV, and progress to AIDS. Our findings may help explain why the African apes are more resistant to SIV/HIV infection than are humans and Asian primates, as well as help identify regions of CD4 that might be safely targeted by drugs or antibodies.



→ Dispersal between Africa (—) and Eurasia (—).

Figure 10. Hominoid dispersal and estimated infection. This figure shows the phylogenetic relationship between chimpanzee, bonobo, human, and orangutan lineages. The red branches represent the apes that harbor SIV in the wild, while the red downward arrow shows that the Central chimpanzee SIV jumped to the Western lowland gorillas. We hypothesize that monkey SIV spread to the *Pan* and *Gorilla* lineages over 2 million years ago. The divergence dates for the ape lineage was adapted from Prado-Martinez *et al.* (2013).

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APPENDIX A

All data displayed and that was used in this appendix was made publicly available by Prado-Martinez et al. (2013).

Accession	N	
Number	Name	Species
SRX243449	Bosco	Pan troglodytes verus
SRX243448	Bosco	Pan troglodytes verus
SRX243527	Clint	Pan troglodytes verus
SRX243488	Jimmie	Pan troglodytes verus
SRX243487	Jimmie	Pan troglodytes verus
SRX243499	Koby	Pan troglodytes verus
SRX243510	Akwaya-Jean	Pan troglodytes ellioti
SRX243511	Banyo	Pan troglodytes ellioti
SRX243512	Basho	Pan troglodytes ellioti
SRX243513	Damian	Pan troglodytes ellioti
SRX360476	Damian	Pan troglodytes ellioti
SRX243514	Julie_LWC21	Pan troglodytes ellioti
SRX360477	Julie_LWC21	Pan troglodytes ellioti
SRX243515	Kopongo	Pan troglodytes ellioti
SRX243516	Koto	Pan troglodytes ellioti
SRX360478	Koto	Pan troglodytes ellioti
SRX243517	Paquita	Pan troglodytes ellioti
SRX243518	Taweh	Pan troglodytes ellioti
SRX360479	Taweh	Pan troglodytes ellioti
SRX243519	Tobi	Pan troglodytes ellioti
SRX243496	Clara	Pan troglodytes troglodytes
SRX243495	Clara	Pan troglodytes troglodytes
SRX243492	Doris	Pan troglodytes troglodytes
SRX243491	Doris	Pan troglodytes troglodytes
SRX243494	Julie_A959	Pan troglodytes troglodytes
SRX243493	Julie_A959	Pan troglodytes troglodytes
SRX243490	Vaillant	Pan troglodytes troglodytes
SRX243489	Vaillant	Pan troglodytes troglodytes
SRX237492	Andromeda	Pan troglodytes schweinfurthii
SRX237526	Bwambale	Pan troglodytes schweinfurthii
SRX237524	Bwambale	Pan troglodytes schweinfurthii
SRX243451	Harriet	Pan troglodytes schweinfurthii
SRX243450	Harriet	Pan troglodytes schweinfurthii
SRX237539	Kidongo	Pan troglodytes schweinfurthii
SRX237527	Kidongo	Pan troglodytes schweinfurthii
SRX237583	Nakuu	Pan troglodytes schweinfurthii
SRX237541	Nakuu	Pan troglodytes schweinfurthii
SRX237455	Vincent	Pan troglodytes schweinfurthii

Accession Number	Name	Species
SRX243484	Babu	Pongo abelii
SRX243483	Babu	Pongo abelii
SRX243486	Buschi	Pongo abelii
SRX243485	Buschi	Pongo abelii
SRX243482	Dunja	Pongo abelii
SRX243481	Dunja	Pongo abelii
SRX243478	Elsi	Pongo abelii
SRX243477	Elsi	Pongo abelii
SRX243480	Kiki	Pongo abelii
SRX243479	Kiki	Pongo abelii
SRX243476	Napoleon	Pongo pygmaeus
SRX243475	Napoleon	Pongo pygmaeus
SRX243468	Nonja	Pongo pygmaeus
SRX243467	Nonja	Pongo pygmaeus
SRX243472	Sari	Pongo pygmaeus
SRX243471	Sari	Pongo pygmaeus
SRX243470	Temmy	Pongo pygmaeus
SRX243469	Temmy	Pongo pygmaeus
SRX243474	Tilda	Pongo pygmaeus
SRX243473	Tilda	Pongo pygmaeus

Accession Number	Name	Species
SRX242686	Kaisi	Gorilla beringei graueri
SRX242685	Kaisi	Gorilla beringei graueri
SRX242688	Kaisi	Gorilla beringei graueri
SRX242687	Kaisi	Gorilla beringei graueri
SRX243453	Mkubwa	Gorilla beringei graueri
SRX243452	Mkubwa	Gorilla beringei graueri
SRX243533	Victoria	Gorilla beringei graueri
SRX243532	Victoria	Gorilla beringei graueri
SRX243531	Victoria	Gorilla beringei graueri
SRX243530	Victoria	Gorilla beringei graueri
SRX243529	Victoria	Gorilla beringei graueri
SRX243528	Victoria	Gorilla beringei graueri

Accession Number	Name	Species
SRX243502	Abe	Gorilla gorilla gorilla
SRX243504	Akiba	Gorilla gorilla gorilla
SRX243498	Amani	Gorilla gorilla gorilla
SRX243497	Amani	Gorilla gorilla gorilla
SRX243508	Anthal	Gorilla gorilla gorilla
SRX243443	Azizi	Gorilla gorilla gorilla
SRX243442	Azizi	Gorilla gorilla gorilla
SRX243456	Banjo	Gorilla gorilla gorilla
SRX243455	Banjo	Gorilla gorilla gorilla
SRX243441	Bulera	Gorilla gorilla gorilla
SRX243440	Bulera	Gorilla gorilla gorilla
SRX243520	Carolyn	Gorilla gorilla gorilla
SRX243505	Choomba	Gorilla gorilla gorilla
SRX243464	Coco	Gorilla gorilla gorilla
SRX243463	Coco	Gorilla gorilla gorilla
SRX243462	Delphi	Gorilla gorilla gorilla
SRX243461	Delphi	Gorilla gorilla gorilla
SRX243460	Dian	Gorilla gorilla gorilla
SRX243459	Dian	Gorilla gorilla gorilla
SRX243538	Dian	Gorilla gorilla gorilla
SRX243537	Dian	Gorilla gorilla gorilla
SRX243525	Dolly	Gorilla gorilla gorilla
SRX243523	Helen	Gorilla gorilla gorilla
SRX243509	Katie_B650	Gorilla gorilla gorilla
SRX243526	Katie_KB4986	Gorilla gorilla gorilla
SRX243501	Kokomo	Gorilla gorilla gorilla
SRX243500	Kokomo	Gorilla gorilla gorilla
SRX243466	Kolo	Gorilla gorilla gorilla
SRX243465	Kolo	Gorilla gorilla gorilla
SRX243439	Kowali	Gorilla gorilla gorilla
SRX243438	Kowali	Gorilla gorilla gorilla
SRX243458	Mimi	Gorilla gorilla gorilla
SRX243457	Mimi	Gorilla gorilla gorilla
SRX243536	Mimi	Gorilla gorilla gorilla
SRX243535	Mimi	Gorilla gorilla gorilla
SRX243524	Oko	Gorilla gorilla gorilla
SRX243506	Paki	Gorilla gorilla gorilla
SRX243521	Porta	Gorilla gorilla gorilla
SRX243454	Sandra	Gorilla gorilla gorilla
SRX242689	Sandra	Gorilla gorilla gorilla
SRX243445	Suzie	Gorilla gorilla gorilla
SRX243444	Suzie	Gorilla gorilla gorilla
SRX243503	Tzambo	Gorilla gorilla gorilla
SRX243522	Vila	Gorilla gorilla gorilla

Accession Number	Name	Species	
SRX241378	Bono	Pan paniscus	
SRX241367	Bono	Pan paniscus	
SRX241358	Bono	Pan paniscus	
SRX241352	Bono	Pan paniscus	
SRX241416	Bono	Pan paniscus	
SRX241399	Bono	Pan paniscus	
SRX241303	Catherine	Pan paniscus	
SRX241302	Catherine	Pan paniscus	
SRX241312	Chipita	Pan paniscus	
SRX241311	Chipita	Pan paniscus	
SRX241295	Desmond	Pan paniscus	
SRX241294	Desmond	Pan paniscus	
SRX241291	Dzeeta	Pan paniscus	
SRX241290	Dzeeta	Pan paniscus	
SRX241293	Hermien	Pan paniscus	
SRX241292	Hermien	Pan paniscus	
SRX237623	Hortense	Pan paniscus	
SRX237602	Hortense	Pan paniscus	
SRX241308	Kombote	Pan paniscus	
SRX241307	Kombote	Pan paniscus	
SRX241305	Kombote	Pan paniscus	
SRX241304	Kombote	Pan paniscus	
SRX241310	Kombote	Pan paniscus	
SRX241309	Kombote	Pan paniscus	
SRX241289	Kosana	Pan paniscus	
SRX241288	Kosana	Pan paniscus	
SRX242682	Kumbuka	Pan paniscus	
SRX242681	Kumbuka	Pan paniscus	
SRX242684	Kumbuka	Pan paniscus	
SRX242683	Kumbuka	Pan paniscus	
SRX243437	LB502	Pan paniscus	
SRX243436	LB502	Pan paniscus	
SRX241481	Natalie	Pan paniscus	
SRX241477	Natalie	Pan paniscus	
SRX241461	Natalie	Pan paniscus	
SRX241441	Natalie	Pan paniscus	
SRX241541	Natalie	Pan paniscus	
SRX241528	Natalie	Pan paniscus	
SRX241545	Salonga	Pan paniscus	
SRX241544	Salonga	Pan paniscus	

APPENDIX B

2 1	1 5	10 15	20	25 30	35 40 45	; <u>50</u>	.55.60		70 75	80 S	5 90	95 10
Denisova on Human-v	MNRGVP	FRHLLLVLQL	ALLPAATQ	<mark>GKK</mark> VVL <mark>GKK</mark> G	DTVELTCTASQ	KK <mark>S</mark> IQF <mark>H</mark> W	KNSNQIKI	LGNQGSF	LT <mark>K</mark> GPS <mark>K</mark> LNC	RADSRRS	LWDQGNFP	
Neandertal 1 CD 4 1 KG	MNRGVP	FRHLLLVLQL	ALLPAATQ.	G <mark>KK</mark> VVL <mark>GKK</mark> G	DT <mark>VEL</mark> TCTASQ	KK <mark>siqfh</mark> w	KNSNQIKI	LGNQGSF	LT <mark>k</mark> gps <mark>k</mark> lne	RADSRRS	LWDQGN <mark>F</mark> P	LII <mark>K</mark> NL <mark>K</mark> I
Neandertal 2 CD 4 1 KG	MNRGVP	FRHLLLVLQL	ALLPAATQ.	G <mark>KK</mark> VVL <mark>GKK</mark> G	DTVELTCTASQ	KK <mark>SIQFH</mark> W	KNSNQIKI	LGNQGSF	LT <mark>k</mark> gps <mark>k</mark> lne	RADSRR <mark>s</mark>	ILWDQGNFP	LII <mark>K</mark> NL <mark>K</mark> I
Neandertal 3 CD 4 1 KG	MNRGVP	FRHLLLVLQL	ALLPAATQ	g <mark>kk</mark> vvl <mark>gkk</mark> g	DTVELTCTASQ	KK <mark>SIQFH</mark> W	KNSNQIKI	LGNQGSF	LT <mark>K</mark> GPS <mark>K</mark> LNC	RADSRRS	IL N D Q G N F P	LTI <mark>K</mark> NL <mark>K</mark> I
Neandertal 4-allele1 C	MNRGVP	FRHLLLVLQL	ALLPAATQ	GKKVVLGKKG	DTVELTCTASQ	KKSIQFHW	KNSNOIKI	LGNQGSF	LTKGPSKLNE	RADSRRS	LWDQGNFP	LIIKNLKI
Neandertal 4-allele 2 C	MNRGVP	FRHLLLVLQL	ALLPAATO	GKKVVLGKKG	DTVELTCTASQ	KKSIQFHW	KNSNOIKI	LGNOGSF	LTKGPSKLND	RADSRRS	LWDQGNFP	LIIKNLKI
PTV_Bosco_CD4	MNRGVP	FRHLLLVLOL	ALLPARTO	GKKVVLGKKG	DTVELTCTASO	KKSIQFHW	KNSNOTKI	LGNOGSF		RVDSRRS		
PTV_Clint_CD4		FRHLLLVLUL	HELPHHIU		DIVELICIHSU	KKSTUFHW	KNSNUTKI	LENGESF		RVUSRRS		
DTV_Koby_CD4	MNDGUD				DIVELICINSU					DUNEDD		
DTE Abusus- lesp CD4	MNBGVP	FRHILLVIOL	ALL PAATO	GKKVVLGKKG			KNSNOTKI	LONGOSE		RVDSRRS		
PTE Banyo CD4	MNBGVP	FRHLLLVLOL	ALPPAATO	GKKVVLGKKG	DTVELTCTASO	KSIOFHU	KNSNOTKI	LGNOGSE		BVDSBB	LWDOGNE2	
PTE Basho CD4	MNRGVP	FRHLLLVLOL	ALLPAATO	GKKVVLGKKG	DTVELTCTASO	KKSIOFHW	KNSNOTKI	LGNOGSF	LTKGPSKLK	RVDSRRS	LWDOGNET	
PTE_Damian_CD4	MNRGVP	FRHLLLVLQL	ALLPAATO	GKKVVLGKKG	DTVELTCTASO	KKSIQFHW	KNSNOTKI	LGNOGSF	LTKGPSKLNC	RVDSRR		
PTE_Julie_LWC21_C	MNRGVP	FRHLLLVLQL	ALLPAATQ	G <mark>KK</mark> VVLG <mark>KK</mark> G	DTVEL TCTASQ	KK <mark>s</mark> iqf <mark>h</mark> w	KNSNQTKI	LGNQGSF	LT <mark>k</mark> gps <mark>k</mark> lne	RVDSRRS	LWDQGNF?	LII <mark>K</mark> NL <mark>K</mark> I
PTE_Kopongo_CD4	MNRGVP	FRHLLLVLQL	ALLPAATQ.	G <mark>KK</mark> VVL <mark>GKK</mark> G	DTVEL TCTASQ	KK <mark>s</mark> iqf <mark>h</mark> w	KNSNQTKI	LGNQGSF	LT <mark>k</mark> gps <mark>k</mark> lne	RVDSRRS	LWDQGN <mark>F</mark> P	LII <mark>K</mark> NL <mark>K</mark> I
PTE_Koto_CD4	MNRGVP	FRHLLLVLQL	ALLPAATQ.	G <mark>KK</mark> VVL <mark>GKK</mark> G	DTVEL TCTASQ	KK <mark>SIQFH</mark> W	KNSNQTKI	LGNQGSF	LT <mark>K</mark> GPS <mark>K</mark> LK	RVDSRR <mark>s</mark>	ILWDQGN <mark>F</mark> T	LTT <mark>K</mark> NL <mark>K</mark> T
PTE_Paquita_CD4	MNRGVP	FRHLLLVLQL	ALLPAATQ	g <mark>kk</mark> vvl <mark>gkk</mark> g	DTVELTCTASQ	KK <mark>SIQFH</mark> W	KNSNQTKI	LGNQGSF	LT <mark>K</mark> GPS <mark>KLK</mark> E	RVDSRR	IL NDQGNFT	LTT <mark>K</mark> NL <mark>K</mark> T
PTE_Taweh_CD4	MNRGVP	FRHLLLVLQL	ALLPAATQ	g <mark>kk</mark> aar <mark>gkk</mark> g	DTVELTCTASQ	KKSI QFHW	KNSNQTKI	LGNQGSF	LTKGPSKLNC	RVDSRR	LWDQGNFP	LTI <mark>K</mark> NL <mark>K</mark> I
PTE_Tobi_CD4	MNRGVP	FRHLLLVLQL	ALLPAATO	GKKVVLGKKG	DTVELTCTASQ	KKSIQFHW	KNSNOTKI		LTKGPSKLK	RVDSRRS	LWDQGNF?	
PII_Clara_CD4	MNBBVE	FRHLLLVLQL	HELPHHTQ		DIVELICTRSO	KKSTQFHW	KNSNOTKI		LTKGPSKLND	R?USRRS		LTIKNEKI
PTT_UNIA ADED CD 4	MNROUP		HLLPHHIU ALL RAATO							R 2 D S R R S		
PTT_JUNE_A959_LD4	MNBGVP	FRUITIVIOL	ALL PAATO	GREVUL GREG	DTVELTCTHSQ					E I DE E E		
PTS Andromeda CD4	MNBGVP	FRHILLVIOL	ALL PAATO			KKSIOFHU	KNSNOTKI	LONGSE		BVDSBB		
PTS Bwambale CD4	MNRGVP	FRHLLLVLOL	ALLPAATO	GKKVVLGKKG	DTVELTCTASO	KKSIOFHW	KNSNOTKI	LGNOGSE	LTKGPSKLND	RVDSRRS	LWDOGNEP	
PTS_Harriet_CD4	MNRGVP	FRHLLLVLQL	ALLPAATO	GKKVVLGKKG	DTVELTCTASO	KKSIQFHW	KNSNQTKI	LGNOGSF	LTKGPSKLND	RVDSRR	LWDQGNFP	
PTS_Kidongo_CD4	MNRGVP	FRHLLLVLQL	ALLPAATO	G <mark>KK</mark> VVLG <mark>KK</mark> G	DTVEL TCTASQ	KK <mark>SIQFH</mark> W	KNSNQTKI	LGNOGSF	LT <mark>K</mark> GPS <mark>K</mark> L <mark>K</mark> C	RVDSRRS	LWDQGNF?	
PTS_Nakuu_CD4	MNRGVP	FRHLLLVLQL	ALLPAATQ	G <mark>KK</mark> VVLG <mark>KK</mark> G	DT <mark>VEL</mark> TCTASQ	KK <mark>SIQFH</mark> W	KNSNQTKI	LGNQGSF	LT <mark>K</mark> GPS <mark>K</mark> LNC	RVDSRR	LWDQGNFP	LII <mark>K</mark> NL <mark>K</mark> I
PTS_Vincent_CD4	MNRGVP	FRHLLLVLQL	ALLPAATQ.	G <mark>KK</mark> VVL <mark>GKK</mark> G	DTVEL TCTASQ	KK <mark>SIQFH</mark> W	KNSNQTKI	LGNQGSF	LT <mark>k</mark> gps <mark>k</mark> lne	RVDSRR <mark>s</mark>	LWDQGNFP	LTI <mark>K</mark> NL <mark>K</mark> I
PPaniscus_Bono_CD4	MNRGVP	FRHLLLVLQL	ALLPAATQ.	G <mark>KK</mark> VVLG <mark>KK</mark> G	DTVEL TCTASQ	KK <mark>SIQFH</mark> M	KNSNQTKI	LGNQGSF	LT <mark>K</mark> GPS <mark>K</mark> LNC	RVDSRR	LWDQGNFP	LTI <mark>K</mark> NL <mark>K</mark> I
PPaniscus_Catherine	MNRGVP	FRHLLLVLQL	ALLPAATQ	GKKVVLGKKG	DTVELTCTASQ	KKSIQFHW	KNSNQTKI	LGNQGSF	LTKGPSKLNE	RVDSRRS	LWDQGNFP	LIIKNLKI
PPaniscus_Chipita_C	MNRGVP	FRHLLLVLQL	ALLPAATO	GKKVVLGKKG	DTVELTCTASQ	KKSIQFHW	KNSNOTKI	LGNOGSF	LTKGPSKLND	RVDSRRS	LWDQGNFP	LIIKNLKI
PPaniscus_Desmond	MNRGVP	FRHLLLVLOL	HELPHHIU		DIVELICIHSU	KKSTUFHW	KNSNUTKI	LENGESF		RVUSRRS		
PPaniscus_Dzeeta_UD4	MNBGVP		ALLPHHIQ		DIVELICIASO					DUDEDD		
PPaniscus Hortense	MNBGVP	FRHLLLVLOL	ALLPAATO	GKKVVLGKKG	DTVELTCTASO	KKSIOFHW	KNSNOTKI	LGNOGSE	LTKGPSKLNE	BVDSBB	LWDOGNEP	
PPaniscus_Kombote	MNRGVP	FRHLLLVLQL	ALLPAATO	GKKVVLGKKG	DTVELTCTASO	KKSIQFHW	KNSNOTKI	LGNOGSF	LTKGPSKLND	RVDSRR		
PPaniscus_Kosana_CD4	MNRGVP	FRHLLLVLQL	ALLPAATO	G <mark>KK</mark> VVLG <mark>KK</mark> G	DTVELTCTASQ	KKSIQFHW	KNSNQTKI	LGNOGSF	LT <mark>k</mark> gps <mark>k</mark> lne		LWDQGNFP	
PPaniscus_Kumbuka	MNRGVP	FRHLLLVLQL	ALLPAATQ	G <mark>KK</mark> VVLG <mark>KK</mark> G	DT <mark>VEL</mark> TCTASQ	KK <mark>siqfh</mark> w	KNSNQTKI	LGNQGSF	LT <mark>k</mark> gps <mark>k</mark> lnd	RVDSRR	LWDQGNFP	LII <mark>K</mark> NL <mark>K</mark> I
PPaniscus_LB502_CD4	MNRGVP	FRHLLLVLQL	ALLPAATQ.	G <mark>KK</mark> VVL <mark>GKK</mark> G	DTVEL TCTASQ	KK <mark>SIQFH</mark> W	KNSNQTKI	LGNQGSF	LT <mark>k</mark> gps <mark>k</mark> lne	RVDSRR <mark>s</mark>	LWDQGNFP	LTI <mark>K</mark> NL <mark>K</mark> I
PPaniscus_Natalie_CD4	MNRGVP	FRHLLLVLQL	ALLPAATQ	G <mark>KK</mark> VVLG <mark>KK</mark> G	DTVEL TCTASQ	KK <mark>SIQFH</mark> W	KNSNQTKI	LGNQGSF	LT <mark>K</mark> GPS <mark>K</mark> LNC	RVDSRR	ILWDQGNFP	LII <mark>K</mark> NL <mark>K</mark> I
PPaniscus_Salonga_C	MNRGVP	FRHLLLVLQL	ALLPAATQ	g <mark>kk</mark> aaf <mark>gkk</mark> g	DTVELTCTASQ	KKSIQFHW	KNSNQTKI	LGNQGSF	LT <mark>K</mark> GPS <mark>K</mark> LNE	RVDSRR	LWDQGNFP	LTI <mark>K</mark> NL <mark>K</mark> I
GBG_Kaisi_CD4	MNRGVP	FRHLLLVLQL	ALLPAATQ	GNKVVLGKKG	DTVELNCT?SQ	KKSIQFHW	KNSNOWK I	LGNQGSF	LTKGPSKLSD	RADSRRS	LWDQGNFP	
GBG_Mkubwa_CD4	MNRGVP	FRHLLLVLUL	HELPHHIU		DIVELNCTHSU	KKSTUFHW	KNPNUMKI	LENGESF		RHUSERS		
	MNDGUD				DIVELNCIASO				TUCPORT	nnusnns Danebbe		
GGC Akiba CD4	MNBGVP	FRHILLVIOL	ALL PAATO	GNKVVI GKKG	DTVELNCTASO		KNSNORKI	LONGOSE	LTKOPSKLSL	Renser		
GGG Amani CD4	MNRGVP	FRHLLLVLOL	ALLPAATO	GNKVVLGKKG	DTVELNCTASO	KKSIOFHW	KNSNOMKI	LGNOGSE	LTKGPSKLSD	RADSRRS	LWDOGNEP	
GGG_Anthal_CD4	MNRGVP	FRHLLLVLOL	ALLPAATO	GNKVVLGKKG	DTVELNCTASO	KKSIOF?W	KNSNORKI	LGNOGSF	LTKGPSKLSD	RADSRRS		
GGG_Azizi_CD4	MNRGVP	FRHLLLVLQL	ALLPAATO	GN <mark>K</mark> VVL <mark>GKK</mark> G	DTVELNCTASQ	KKSIQFNW	KNSNORK I	LGNOGSF	LT <mark>k</mark> gps <mark>k</mark> lsd	RADSRRS	LWDOGNEP	
GGG_Banjo_CD4	MNRGVP	FRHLLLVLQL	ALLPAATQ	GN <mark>K</mark> VVLG <mark>KK</mark> G	DTVELNCTASQ	KK <mark>SIQFH</mark> W	KNSNQMK I	LGNQGSF	LT <mark>K</mark> GPS <mark>K</mark> LSC	RADSRRS	LWDQGNFP	LII <mark>K</mark> NL <mark>K</mark> I
GGG_Bulera_CD4	MNRGVP	FRHLLLVLQL	ALLPAATQ	GN <mark>K</mark> VVL <mark>GKK</mark> G	DTVELNCTASQ	KKSIQF?W	KNSNQRK I	LGNQGSF	LT <mark>k</mark> gps <mark>k</mark> lse	RADSRRS	LWDQGNFP	LII <mark>K</mark> NL <mark>K</mark> I
GGG_Carolyn_CD4	MNRGVP	FRHLLLVLQL	ALLPAATQ	GNKVVLGKKG	DTVELNCTASQ	KKSIQF?W	KNSNQRK I	LGNQGSF	L T <mark>k</mark> gps <mark>k</mark> l se	RADSRRS	LWDQGNFP	LII <mark>K</mark> NLKI
GGG_Choomba_CD4	MNRGVP	FRHLLLVLQL	ALLPAATQ	GNKVVLGKKG	DTVELNCTASQ	KKSIQFRH	KNSNQMKI		LT <mark>K</mark> GPS <mark>K</mark> LSE	RADSRRS	LWDQGNFP	LIIKNLKI
GGG_Coco_CD4	MNRGVP	FRHLLLVLQL	ALLPAATQ	GNKVVLGKKG	DTVELNCTASQ	KKSIQFHW	KHSHQMKI	LGNQGSF	LTKGPSKLSD	RADSRRS	LWDQGNFP	LIIKNLKI
GGG_Delphi_CD4	MNRGVP	FRHLLLVLQL	ALLPAATQ	GNKVVLGKKG	DTVELNCTASQ	KKSIQF?W	KNSNORKI	LGNQGSF	LTKGPSKLSD	RADSRRS	LWDQGNFP	LIIKNLKI
GGG_Dian_CD4	MNBBVE	FRHLLLVLQL	HELPHHTQ		DTVELNCTASO	KKSTQF?W	KNSNORKI			RHUSERS		LTIKNEKI
CCC Helen CD4	MNROUP		HLLPHHIU ALL DAATA							Persen		
GGG_Katie_B_CD4	MNBGVB			GNKVVL GKKG		KSLOENU	KNSNORKI		TKOPSKLSL	BADSER		
GGG_Katie-K_CD4	MNRGVP	FBHLLLVLOL	ALLPARTO	GNKVVLGKKG	DTVELNCTASO	KSIOFHU	KNSNOMKI	LGNOGSE	TKGPSKLS	RADSRES	LWDOGNER	
GGG_Kokomo_CD4	MNBGVP	FBHLLLVLOL	ALLPAATO	GNKVVLGKKG	DTVELNCTASO	KKSI OF 2W	KNSNORKI	LGNOGSE	TKGPSKLS	RADSER	LWDOGNEP	

This appendix contains the obtained hominoid sequences used in this project. These Illumina HiSeq runs were obtained as mRNA sequences, and were then analyzed and organized into this master alignment in *Se-Al* v2.0a11 Carbon (Rambaut, 2002). This alignment shows the amino acid sequences in color coding to aid in visualization. A question mark (?) denotes an ambiguity in the amino acid sequence.

GGG_Kolo_CD4	MNRGVPFRHLLLVLQLALLPAATQGNKVVLGKKGDTVELNCTASQKKSIQF7UKNSNQRKILGNQGSFLTKGPSKLSDRADSRRSLUDQGNFPLIIKNL
GGG_Kowali_CD4	MNRGVPFRHLLLVLQLALLPARTQGNKVVLGKKGDTVELNCTASQKKSIQF?WKNSNQRKILGNQGSFLTKGPSKLSDRADSRRSLWDQGNFPLIIKNL
GGG_Mimi_CD4	MNRGYPFRHLLLVLQLALLPAATQGNKYYLGKKGDTYELNCTASQKKSIQFHWKNSNQMKILGNQGSFLTKGPSKLSDRADSRRSLWDQGNFPLIIKNL
GGG_Oko_CD4	MNRGYPFBHLLLVLQLALLPAATQCNKYYLGKKCOTYELNCTASQKKSIQFHWKNSNQMKILGNQGSFLTKGPSKLSDRADSRRSLWDQGNFPLIIKNL
GGG_Paki_CD4	MNRGVPFRHLLLVLOLALPPAATOGNKVVLGKKGDTVELNCTASOKKSIOF2WKNSNORKILGNOGSFLTKGPSKLSDRADSRRSLWDOGNFPLIIKNU
GGG_Porta_CD4	MNRGVPFRHLLLVLOLALLPAATOGNKVVLGKKGDTVELNCTASOKKSIOFHUKNSNOMKILGNOGSFLTKGPSKLSDRADSRRSLWDOGNFPLIIKNU
GGG_Sandra_CD4	MNRGVPFRHLLVLOLALLPAATOGNKVVLGKKGDTVELNCTASOKKSIOFHUKNSNOMKILGNOGSFLTKGPSKLSDRADSRRSLUDOGNFPLIIKNU
GGG_Suzie_CD4	MNRGVPFRHLLVLOLALLPAATOGNKVVLGKKGDTVELNCTASOKKSIOF?UKNSNORKILGNOGSFLTKGPSKLSDRADSRRSLUDOGNFPLIIKNU
GGG Tzambo CD4	MNRGVPFRHLLVLOLALLPAATOGNKVVLGKKGDTVELNCTASOKKSIOFHUKNSNOMKILGNOGSFLTKGPSKLSDRADSBRSLUDOGNFPLIIKNU
GGG Vila CD4	MNRGYPFBHLLVLOLALLPAATOGNKVVLGKKGDTVELNCTASOKKSIOFHUKNSNOMKILGNOBSFLTKGPSKLSDBADSBRSLUDOGNFPLIIKNU
PA Bahu CD4	MNOG I PEBHLLI VLOL VLLPRATPGKKVVLGKKGDTVELTCTRSOKKS I DEHUKNSNOTK I LGNOGSELTKGPSKLSNBADSBSLUDDGNEPLI I KNU
PA Buschi CD4	MNOG PERHITI VLOLVL PRATPOKKVVLOKKOTVELTCTASOKKSI PEHUKNSNOTKI LONOSELTKOPSKI SNRADSBSI UDDONEPLI KNU
PA Dunia CD4	MNOG PERHITI VI OLVI. PRATPOKKVVI OKKOTVELTCTASOKKSI PEHUKNSNOTKI I GNOSELTKOPSKI SNBADSBSI UDOGNEPI I KNU
PA Flei CD4	MNOS PERHILL VI. OLVI. PRATPOKKVVI. OKKODIVELITCISSOKKS I PEHIKNSNOTKI I GNOSELITKOPSKI SNBADSBESI UDOGNEPI I KNU
DA Kiki CDV	MNOG PERHILL VLOLVLI PRATROKKVVI SKKODTVELTCTRSOKKS I DEHUKNSNOTK LLONOSSELTKOPSKI SNRADSRBSLUDOSNEPLI I KNU
DD Nanoleon CD/	MNOG PERHILL VLOLVLI PROTOKKVVI SKKODTVELTCTOSOKKSI OFHUKNSNOTKI LI SNOSSELTKOPSKI SNRADSRRSLUDOSNEPI LI KNU
PP_NapoleON_CD4	
P_NUNJA_CD4	
7P_38F1_004	
PP_Temmy_CD4	THINGIP FRHELEVEL VELEVALE VALEVALE VALE AND A VELEVALE AND A VELEVALE AND A VALEVALEVALEVALEVALEVALEVALEVALEVALEVALE
PP_11Ida_CD4	INNUGTEF BHLLLVLULVLLPHHTPGKKVVLGKKGUTVELTCTHSUKKSTOFHUKNSNOTKTLGNOGSFLTKGESKLSNBHDSBBSLUDOGNEPLTTKNL
Gibbon_ENSNLET000	I MNPGIPFRHLLLVLQLALLPAATQGKKVVLGKKGOTVELTGTASPKKSIQFHUKNSNQIKILGNQGSFLTKGPSKLSDRADSRKSLUDQRNFPLIIKNL

Denisova on Human-v	VEFKIC	
		OT VVL A
Reandertal1 CD4 1KG EDSDTY1CEVEDQKEEVQLLVF6LTANSDTHLLQGQSLTLTLESPP6SSPSVQCRSPR6KN1Q66KTLSVSQLELQDS6THTCTVLQNQK	VEFKIC	IVVLA
Neandertal 2 CD4 1 KG EDSDTY I CEVEDQKEEVQLLYFGLTANSDTHLLQGQSLTLTLESPPGSSPSVQCRSPRGKNI QGGKTLSVSQLELQDSGTHTCTVLQNQK	VEFKIC	DIVVLA
Neandertal 3 CD4 1 KG BDSDTVI CEVEDOKEEVQLLVFGLTRNSDTHLLQGQSLTLTLESPPGSSPSVQCRSPRGKNI QGGKTLSVSQLELQDSGTHTCTVLQNQK	VEFKIC	DI VVL <mark>R</mark>
Neandertal 4-allele1 C EDSDTVICEVEDQKEEVQLLVF6LTANSDTHLLQGQSLTLTLESPP6SSPSVQCBSPB6KNIQ66KTLSVSQLELQDS6THTCTVLQNQK	VEFKIC	
Neandertal 4-ailele2 C EDSDTY I CEVEDOKEEVOLLVFOLTANSDTHLLOGOSLTLTLESPPOSSPSVOCRSPROKNI OGOKTLSVSQLELODSGTHTCTVLQNOK	VEFKIC	IVVLA
	VEFKIC	IVVLA
PTV_Clint_CD4 EDSCTVTCEVGD0KEEV0LLVF6LTANSOTHLL0G0SLTLTLESPPGSSPSV0CRSPR6kNT066KTLSVS0LEL0DS6THTCTVL0N0K	VEFKIC	
	VEFRIL	
	VEEKID	
	VEFKID	IVVLA
PTE_Damian_CD4 EDSDTVICEV600KEEV0LLVF6LTANSDTHLL0G0SLTLTLESPP6SSPSV0CRSPR6KNI066KTLSVS0LEL0DS6THTCTVL0N0KI	VEFKIC	IVVLA
PTE_Julie_LWC21_C EDSDTVICEV600KEEV0LLVF6LTANSDTHLL060SLTLTLESPP6SSPSV0CRSPR6KNI066KTLSVSQLEL0DS6THTCTVL0N0KI	VEFKIC	IVVLA
PTE_Kopongo_CD4 EDSDTVICEVGDQKEEVQLLVF6LTANSDTHLLQGQSLPLTLESPPOSSPSVQCRSPR6KNIQ66KTLSVSQLELQDSGTNTCTVLQNQKI	VEFKIC	IVVLA
PTE_Koto_CD4 EDSDTYICEV600KEEVQLLVF6LTANSDTHLLQ6QSLTLTLESPP6SSPSVQCRSPR6KNIQ66KTLSVSQLELQDS6THTCTVLQNQKI	VEFKIC	DIVVL <mark>a</mark>
PTE_Paquita_CD4 CSDTVICEV600KEEVQLLVF6LTHNSDTHLLQ6QSLTLTLESPP6SSPSVQC8SP86KNIQ66KTLSVSQLELQDS6THTCTVLQNQKI	VEFKIC	IVVLA
PTE_Taweh_CD4 EDSDTVICEV6DQKEEVQLLVF6LTANSDTHLLQGQSLTLTLESPP6SSPSVQCBSPB6KNIQ66KTLSVSQLELQDS6THTCTVLQNQK	VEFKIC	IVVLA
PTE_Tobi_CD4 EDSDTVICEVGDOKEEVQLLVFGLTANSDTHLLQGQSLTLTLESPPGSSPSVQCRSPRGKNIQGGKTLSVSQLELQDSGTUTCTVLQNQK	VEFKIC	IVVLA
PTT_Clara_CD4 EDSUTVICEVGDQKEEVQLLVF6LTANSDTHLL0GQSLTLTLESPPGSSPSVQCRSPR6KNI066KTLSVSQLELQDS6TUTCTVLQNQK	VEFKIC	
	VEFKIL	
	VEFRIL	
TTL-validit_D4	VEEKID	
	VEFKID	IVVLA
PTS_Harriet_CD4 EDSDTVICEV6D0KEEV0LLVF6LTANSDTHLL0G0SLTLTLESPP6SSPSV0CRSPR6KNI066KTLSVS0LEL0DS6THTCTVL0N0KI	VEFKIC	IVVLA
PTS_Kidongo_CD4 EDSDTVICEV6DQKEEVQLLVF6LTANSDTHLLQ6QSLTLTLESPP6SSPSVQCRSPR6KNIQ66KTLSVSQLELQDS6TUTCTVLQNQKI	VEFKIC	IVVLA
PTS_Nakuu_CD4 EDSDTYICEV600KEEV0LLVF6LTANSDTHLL060SLTLTLESPP6SSPSV0CRSPR6KNI066KTLSVSQLELQDS6THTCTVLQNQKI	VEFKIC	DI VVL <mark>R</mark>
PTS_Vincent_CD4 CSSTVICEVSDQKEEVQLLVFSLTHNSDTHLLQSQSLTLTLESPPSSSPSVQC8SP86KNIQS6KTLSVSQLELQDSGTHTCTVLQNQKI	VEFKIC	I VVL <mark>A</mark>
PPaniscus_Bono_CD4	VEFKIC	OTVVLA
PPaniscus_Catherine EDSDTVICEV6DQKEEVQLLVF6LTANSDTHLL0GQSLTLTLESPP6SSPSVQCBSPB6KNIQ66KTLSVSQLELQDS6TUTCTVL0N0K	VEFKIC	
PPaniscus_Chipita_C EDSOTVICEVGDQKEEVQLLVF6LTANSOTHLL0GQSLTLTLESPPGSSPSVQCRSPR6KNI066KTLSVSQLELQDS6TUTCTVLQNQK	VEFKIC	
	VEFKIL	
	VEFRIL	
	VEFKID	IVVLA
	VEFKID	IVVLA
PPaniscus_Kosana_CD4 EDSDTVICEV6D0KEEV0LLVF6LTANSDTHLL0G0SLTLTLESPP6SSPSV0CRSP66KNI066KTLSVS0LEL0DS6THTCTVL0N0KI	VEFKIC	IVVLA
PPaniscus_Kumbuka EDSDTYICEV600KEEVQLLVF6LTANSDTHLLQ6QSLTLTLESPP6SSPSVQCRSPR6KNIQ66KTLSVSQLELQDS6THTCTVLQNQKI	VEFKIC	IVVLA
PPaniscus_LB502_CD4 BD50TVICEV600KEEVQLLVF6LTHNSDTHLLQ60SLTLTLESPP6SSPSVQCRSPR6KNIQ66KTLSVSQLELQDS6THTCTVLQNQKI	VEFKIC	IVVLA
PPaniscus_Natalie_CD4 DD5TVICEV6DQKEEVQLLVF6LTANSDTHLLQGQSLTLTLESPP6SSPSVQCBSPB6KNIQ66KTLSVSQLELQDS6THTCTVLQNQK	VEFKIC	OTVVLA
	VEFKIC	IVVLA
GB6_Kaisi_CD4 EDS0TWTCEVEG0KEEVQLLVF6LTANSOTHLL0G0SLTLTLESPP6SSPSV0CRSPR6KNT066RTLSVS0LEL0DS6THTCTVL0N0E	VEFKID	
	VEFKIL	
	VEENIC	
GGG AVELUA GGG AVEL CD4 EDST VICEVEGOVERVOLVEGITENSOTHLIGGOS TITLESPEGSESVOCESPECKNIOGGKTISVSOLF.ODSGTUTETVICNOF	VEFKID	IVVLA
	VEFKID	IVVLA
GGG_Anthal_CD4 EDSDTVICEVEGOKEEVQLLVFGLTANSDTHLLQGQSLTLTLESPPGSSPSVQCRSPR6KNIQGGRTLSVSQLELQDSGTWTCTVLQNQE	VEFKIC	IVVLA
GGG_AZIZI_CD4 EDSDTYICEVEGOKEEVQLLVFGLTANSDTHLLQGQSLTLTLESPPGSSPSVQCRSPRGKNIQGGRTLSVSQLELQDSGTHTCTVLQNQE	VEFKIC	IVVLA
GGG_Banjo_CD4 GSTYICEVEGQKEEVQLLVFGLTHNSDTHLLQGQSLTLTLESPPGSSPSVQCRSPRGKNIQGGRTLSVSQLELQDSGTHTCTVLQNQE	VEFKIC	DI VVL <mark>A</mark>
GGG_Bulera_CD4 EDSDTVICEVEGQKEEVQLLVFGLTANSDTHLLQGQSLTLTLESPPGSSPSVQCBSPBGKNIQGGBTLSVSQLELQDSGTHTCTVLQNQE	VEFKIC	I VVL A
GGG_Carolyn_CD4	VEFKIC	
GGC DALLY CD4 EDS IV CRUERON FEVOL VERITENSOTH LOGS TITLE SPERSES VICE SPERIN LOGS TITLE VICE AND STRUCT AND S		
	VEFKIC	IVVLA
GGG_Katie-B_CD4 EDSDTVICEVEGOKEEVQLLVFGLTANSDTHLL0GQSLTLTLESPPGSSPSVQCRSPR6KNI0G6RTLSVSQLEL0DS6TUTCTVLQNQE	VEFKID	IVVLA
GGG_Katie-K_CD4 EDSDTYICEVEGOKEEVQLLVFGLTANSDTHLLQGQSLTLTLESPPGSSPSVQCRSPRCKNIQGGRTLSVSQLELQDSGTHTCTVLQNQE	VEFKIC	DI VVL <mark>e</mark>
GGG_Kokomo_CD4 EDSDTYICEVEGQKEEVQLLVF6LTANSDTHLLQGQSLTLTLESPPGSSPSVQCRSPR6KNIQG6RTLSVSQLELQDSGTWTCTVLQNQE	VEFKIC) I VVLA

GGG_Kolo_CD4	EDSDTYICEVECQKEEVQLLVFGLTANSDTHLLQQQSLTLTLESPPGSSPSVQCRSPRGKNIQGGRTLSVSQLELQDSGTHTCTVLQNQEKVEFKIDIVVLA
GGG_Kowali_CD4	EDSDTYICEVECQKEEVQLLVFCLTANSDTHLLQCQSLTLTLESPPGSSPSVQCRSPRGKNIQGGRTLSVSQLELQDSGTHTCTVLQNQEKVEFKIDIVVLA
GGG_Mimi_CD4	EDSDTYICEVECQKEEVQLLVFCLTANSDTHLLQCQSLTLTLESPPGSSPSVQCRSPRCKNIQGGKTLSVSQLELQDSGTHTCTVLQNQEKVEFKIDIVVLA
GGG_Oko_CD4	EDSDTYICEVECQKEEVQLLVFGLTANSDTHLLQGQSLTLTLESPPGSSPSVQCRSPRCKNIQGGRTLSVSQLELQDSGTHTCTVLQNQEKVEFKIDIVVLA
GGG_Paki_CD4	EDSDTYICEVEGQ <mark>K</mark> EEVQLLVFGLTANSDT <mark>H</mark> LLQGQSLTLTLESPPGSSPSVQC <mark>RSPR</mark> GKNIQGGRTLSVSQLELQDSGTHTCTVLQNQE <mark>K</mark> VEFKIDIVVLA
GGG_Porta_CD4	EDSDTYICEVEGQ <mark>K</mark> EEVQLLVFGLTANSDT <mark>H</mark> LLQGQSLTLTLESPPGSSPSVQC <mark>RSPR</mark> GKNIQGGRTLSVSQLELQDSGTHTCTVLQNQE <mark>K</mark> VEFKIDIVVLA
GGG_Sandra_CD4	EDSDTYICEVEGQ <mark>K</mark> EEVQLLVFGLTANSDT <mark>H</mark> LLQGQSLTLTLESPPGSSPSVQC <mark>RSPR</mark> GKNIQGGRTLSVSQLELQDSGTHTCTVLQNQE <mark>K</mark> VEFKIDIVVLA
GGG_Suzie_CD4	EDSDTYICEVEGQ <mark>K</mark> EEVQLLVFGLTANSDT <mark>H</mark> LLQGQSLTLTLESPPGSSPSVQC <mark>RSPR</mark> GKNIQGGRTLSVSQLELQDSGTHTCTVLQNQE <mark>K</mark> VEFKIDIVVLA
GGG_Tzambo_CD4	EDSDTYICEVEGQKEEVQLLVFGLTANSDTHLLQGQSLTLTLESPPGSSPSVQCRSPR6KNIQGGRTLSVSQLELQDSGTHTCTVLQNQEKVEFKIDIVVLA
GGG_Vila_CD4	EDSDTYICEVEGQ <mark>K</mark> EEVQLLVFGLTANSDT <mark>H</mark> LLQGQSLTLTLESPPGSSPSVQC <mark>RSPR</mark> GKNIQGGRTLSVSQLELQDSGTHTCTVLQNQE <mark>K</mark> VEFKIDIVVLA
PA_Babu_CD4	EDSDTYICEVEDQ <mark>K</mark> EEVQLLVFGLTANSDT <mark>H</mark> LLQGQSLTLTLESPPGSSPSVQC <mark>R</mark> SPTGKNIQRGKTLSVSQLELQDSGTHTCTVLQDQKKVEFKIDIVVLA
PA_Buschi_CD4	EDSDTYICEVEDQ <mark>K</mark> EEVQLLVFGLTANSDT <mark>H</mark> LLQGQSLTLTLESPPGSSPSVQC <mark>R</mark> SPTGKNIQRGKTLSVSQLELQDSGTHTCTVLQDQKKVEFKIDIVVLA
PA_Dunja_CD4	EDSDTYICEVEDQ <mark>K</mark> EEVQLLVFGLTANSDT <mark>H</mark> LLQGQSLTLTLESPPGSSPSVQC <mark>R</mark> SPTGKNIQRGKTLSVSQLELQDSGTHTCTVLQDQKKVEFKIDIVVLA
PA_Elsi_CD4	EDSDTYICEVEDQKEEVQLLVFGLTANSDTHLLQGQSLTLTLESPPGSSPSVQCRSPTGKNIQAGKTLSVSQLELQDSGTWTCTVLQDQKKVEFKIDIVVLA
PA_Kiki_CD4	EDSDTYICEVEDQKEEVQLLVFGLTANSDTHLLQGQSLTLTLESPPGSSPSVQCRSPTGKNIQAGKTLSVSQLELQDSGTWTCTVLQDQKKVEFKIDIVVLA
PP_Napoleon_CD4	EDSDTYICEVEDQ <mark>K</mark> EEVQLLVFGLTANSDTHLLQGQSLTLTLESPPGSSPSVQC <mark>R</mark> SPTGKNIQRGKTLSVSQLELQDSGTHTCTVLQDQKKVEFKIDIVVLA
PP_Nonja_CD4	EDSDTYICEVEDQKEEVQLLVFGLTANSDTHLLQGQSLTLTLESPPGSSPSVQCRSPTGKNIQAGKTLSVSQLELQDSGTWTCTVLQDQKKVEFKIDIVVLA
PP_Sari_CD4	EDSDTYICEVEDQ <mark>K</mark> EEVQLLVFGLTANSDTHLLQGQSLTLTLESPPGSSPSVQC <mark>R</mark> SPTGKNIQRGKTLSVSQLELQDSGTHTCTVLQDQKKVEFKIDIVVLA
PP_Temmy_CD4	EDSDTYICEVEDQ <mark>K</mark> EEVQLLVFGLTANSDTHLLQGQSLTLTLESPPGSSPSVQC <mark>R</mark> SPTGKNIQRGKTLSVSQLELQDSGTHTCTVLQDQKKVEFKIDIVVLA
PP_Tilda_CD4	EDSDTYICEVEDQ <mark>K</mark> EEVQLLVFGLTANSDTHLLQGQSLTLTLESPPGSSPSVQC <mark>R</mark> SPTGKNIQRGKTLSVSQLELQDSGTHTCTVLQDQKKVEFKIDIVVLA
Gibbon_ENSNLET000	EDSDTVICEVEDOKEEVQLLVFCLTENSOTHLLQCQSLTLTLEOPPOSSPSVQCRSPRCKNIQCCKTLSVSQLELQDSGTUTCTVLQDQKKVEFKIDIVVLA

2 1	205 210 215 220 225 230 235 240 245 250 255 260 265 270 275 280 285 290 295 300
Denisova on Human-v	AFOKASS I VYKKEGEQVEFSFPLAFTVEKLTOSGEL HAOAERASSSKSHI TFOLKNKEVSVKRVTODPKLOMGKKLPLHLTLPOALPOVAGSGNLTLALEA
Neandertal 1 CD 4 1 KG	AFOKASSIVYKKEGEQVEFSFPLAFTVEKLTOSGELHUQAERASSSKSHITFOLKNKEVSVKRVTQDPKLQMGKKLPLHLTLPQALPQVAGSGNLTLALEA
Neandertal 2 CD 4 1 KG	AFOKASSIVYKKEGEQVEFSFPLAFTVEKLTOSGELNNQAERASSKSNITFOLKNKEVSVKRVTODPKLOMGKKLPLHLTLPOALPOVAGSGNLTLALEA
Neandertal 3 CD 4 1 KG	AFOKASSIVVKKEGEQVEFSFPLAFTVEKLTGSGELNNQAERASSKSNITFOLKNKEVSVKRVTODPKLQMGKKLPLHLTLPQALPQVAGSGNLTLALEA
Neandertal 4-allele 1 C	AFQKASSIVVKKEGEQVEFSFPLAFTVEKLTGSGELNNQAERASSKSNITFOLKNKEVSVKRVTQDPKLQMGKKLPLHLTLPQALPQVAGSGNLTLALEA
Neandertal 4-allele 2 C	AFQKASSIVVKKEGEQVEFSFPLAFTVEKLTGSGELNNQAERASSKSNITFDLKNKEVSVKNVTQDPKLQMGKKLPLHLTLPQALPQVAGSGNLTLALEA
PTV_Bosco_CD4	IAFQKASSIVYKKEGEQVEFSFPLAFTVEKLTGSGELUNQAERASSSK SNITFDL <mark>KNK</mark> EVSVKRVTQDPKLQMGKKLPLHLTLPQALPQYAGSGNLTLALEA
PTY_Clint_CD4	I AFQKASSI VYKKEGEQVEFSFPLAFTVEKLTGSGELHUQAERASSKSUI TFOLKNKEVSVKRVTQDPKLQMGKKLPLHLTLPQALPQVAGSGNLTLALEA
PTY_Jimmie_CD4	AFOKASSIVYKKEGEQVEFSFPLAFTVEKLTGSGELUNQAERASSSSNITFDLKNKEVSVKRVTODPKLOMGKKLPLHLTLPOALPOVAGSGNLTLALEA
PTY_Koby_CD4	AFOKASSIVYKKEGEOVEFSPLAFTVEKLTOSGELUNDAERASSSKSNITFOLKNKEVSVKRVTODPKLOMGKKLPLHLTLPOALPOVAGSGNLTLALEA
PTE_Akwaya-Jean_CD4	AFOKASSIVYKKEGEOVEFSPLAFTVEKLTOSGELUNDAERASSSKSNITFOLKNKEVSVKRVTODPKLOMGKKLPLHLTLPOALPOVAGSGNLTLALEA
DTE_Banyo_CD4	
DTE_Dasho_UU4	
	A CARSE I WERE COUPERFUENCE TO SEE THE CONCERNMENT OF A CARSES WITH THE RECEIPTER OF A CARSES IN THE CARSES INTO A CARSES IN THE CARSES INTO A
PTE Konongo CD4	AFORASS I VYKKEGENVESSEN AFTYEKI, TASAFI JUNAFRASSKSULTEDI, KNKEVSYKRYTOPKI, MAKKI PLALT POAL POVAGSONI TLALFA
PTE Koto CD4	AFOKASSIVYKKEGEOVEFSEPLAFTVEKLTGSGELUUDAEBASSSKSVITEDLKNKEVSVKBVTODPKLOMGKKLPLALTPOALPOVAGSGNLTLALEA
PTE_Paguita_CD4	AFOKASSIVYKKEGEOVEFSFPLAFTVEKLTOSGELUNOAERASSSKSNITFOLKNKEVSVKRVTODPKLOMGKKLPLHLTLPOALPOVAGSGNLTLALEA
PTE_Taweh_CD4	AFOKASSIVYKKEGEQVEFSFPLAFTVEKLTOSGELHUQAERASSSKSHITFOLKNKEVSVKRVTQDPKLQMGKKLPLHLTLPQALPQVAGSGNLTLALEA
PTE_Tobi_CD4	AFOKASSIVYKKEGEOVEFSFPLAFTVEKLTGSGELHUOAERASSSKSUITEDLKNKEVSVKRVTODPKLOMGKKLPLHLTLPOALPOVAGSGNLTLALEA
PTT_Clara_CD4	AFOKASSIVYKKEGEOVEFSFPLAFTVEKLTGSGELHUQAERASSSKSHITFDLKNKEVSVKKVTODPKLOMGKKLPLHLTLPOALPOVAGSGNLTLALEA
PTT_Doris_CD4	I AFOKASSI VYKKEGEOVEFSFPLAFTVEKLTGSGELHUQAE <mark>R</mark> ASSSKSHI TFDLKNKEVSVKRVTODPKLOMGKKLPLHLTLPOALPOVAGSGNLTLALEA
PTT_Julie_A959_CD4	AFOKASSIVYKKEGEOVEFSFPLAFTVEKLTOSGELHUQAERASSSKSUITFOLKNKEVSVKRVTODPKLOMOKKLPLHLTLPOALPOVAOSGNLTLALEA
PTT_Valiant_CD4	AFOKASSIVYKKEGEOVEFSPLAFTVEKLTOSGELUNOAERASSKSNITFDLKNKEVSVKRVTODPKLOMGKKLPLHLTLPOALPOVAGSGNLTLALEA
PTS_Andromeda_CD4	AFOKASSIVYKKEGEOVEFSFPLAFTVEKLTOSGELUNDAERASSSSSITFOLKNKEVSVKRVTODPKLOMGKKLPLHLTLPOHLPOVAGSGNLTLALEA
PTS_Bwambale_CD4	HFURNSSTWRKEGEUVERSPEHFTVERLTUSGELMUHEHNSSSSSTTFDERNREVSVRHVTUDPREUMGRREPEHETEPUHFUVHGSGNLTEHEH
DTS_Harriet_LU4	
DTS_Nakuu_CD4	
PTS Vincent CD4	AFORASS I VYKKEGENVESSEN AFTVEKI, TASAFI JUNAFRASSKSJI TEDI KNKEVSVKRV TOPKI, OMOKKI PI HI TI POHI POVAGSONI TI AL FA
PPaniscus_Bono_CD4	AFOKASSIVYKKEGEOVEFSFPLAFTVEKLTOSGELHHOAEBASSSKSHITFDLKNKEVSVKRVTODPKLOMGKKLPLHLTLPOALPOVAGSGNLTLALEA
PPaniscus_Catherine	AFOKASSIVYKKEGEQVEFSFPLAFTVEKLTOSGELUNDAERASSSKSNITFDLKNKEVSVKNVTQDPKLOMGKKLPLHLTLPOALPQVAGSGNLTLALEA
PPaniscus_Chipita_C	AFOKASSIVVKKEGEOVEFSFPLAFTVEKLTOSGELNNQAERASSKSNITFOLKNKEVSVK7VTODPKLONGKKLPLHLTLPOALPOVAOSGNLTLALEA
PPaniscus_Desmond	AFQKASSIVVKKEGEQVEFSFPLAFTVEKLTGSGELHHQAERASSSKSHITFDLKNKEVSVKRVTQDPKLQMGKKLPLHLTLPQALPQVAGSGNLTLALEA
PPaniscus_Dzeeta_CD4	AFQKASSIVVKKEGEQVEFSFPLAFTVE <mark>K</mark> LTGSGELHHQHE <mark>B</mark> ASSSKSHITFDLKNKEVSVK <mark>B</mark> VTQDPKLQMGKKLPLHLTLPQHLPQYAGSGNLTLALEA
PPaniscus_Hermien	I AFQKASSIVYKKEGEQVEFSFPLAFTVEKLTGSGELHNQAERASSSKSHITFDLKNKEVSVK2VTQDPKLQMGKKLPLHLTLPQALPQVAGSGNLTLALEA
PPaniscus_Hortense	AFOKASSIVYKKEGEOVEFSEPLAFTVEKLTOSGELUNGAERASSKSNITFDLKNKEVSVKRVTODPKLOMGKKLPLHLTLPOALPOVAGSGNLTLALEA
PPaniscus_Kombote	AFOKASSIVYKKEGEOVEFSPLAFTVEKLTOSGELUNDAERASSSSSITFOLKNKEVSVKRVTODPKLOMGKKLPLHLTLPORLPOVAGSGNLTLALEA
PPaniscus_Kosana_CD4	HOURSS WIKE DEUDERSFPERFTWERT GODELINU HERNSSKANT FOLKNIKEVSWRWTUD KLUNKKE FEHLTPUHL WHOSGNETE HER
DDapicous_Kumbuka	
IPPaniscus_LDSU2_CD4	AFORAS I WERE FOVERSED AFVERITISSE UNAFRASSISKI TEL MARKEVY VERTOPEL MARKE FILLE AF AN ANALY I A FA
PPaniscus Salonga C	AFOKASSIVYKKEGEOVEFSEPLAFTVEKLINSGELUUDAEBASSSKSVITEDLKNKEVSVK2VTODPKLOMGKKLPLALTPOALPOVAGSONLTLALEA
GBG_Kaisi_CD4	AFOKASSIVYKKEGEOVEFSFPLAFTVEKLTOSGELUNOAERASSSKSNITFOLKNKEVSVKRVTODPKLOMGKKLPLHLTLPOALPOVAGSGNLTLALEA
GBG_Mkubwa_CD4	AFOKASSIVYKKEGEQVEFSFPLAFTVEKLTOSGELHNGAERASSS2SHITFDLKNKEVSVKRVTQDPKLQMGKKLPLHLTLPGALPQVAGSGNLTLALEA
GBG_Victoria_CD4	AFOKASSIVVKKEGEQVEFSFPLAFTVEKLTGSGELNNQAERASSKSNITFOLKNKEVSVKRVTODPKLQMGKKLPLHLTLPQALPQVAGSGNLTLALEA
GGG_Abe_CD4	AFQKASSIVVKKEGEQVEFSFPLAFTVEKLTGSGELNNQAERASSKSNITFOLKNKEVSVKRVTQDPKLQMGKKLPLHLTLPQALPQVAGSGNLTLALEA
GGG_Akiba_CD4	I AFQKASSIV <mark>VKKE</mark> GEQVEFSFPLAFTVE <mark>K</mark> LTGSGELHNOHE <mark>B</mark> ASSSKSHITFDLKNKEVSVK R VTQDPKLQMGKKLPLHLTLPOHLPQVAGSGNLTLALEA
GGG_Amani_CD4	AFQKASSIVYKKEGEQVEFSFPLAFTVEKLTGSGELUHQAERASSKSHITFOLKNKEVSVKRVTQDPKLQMGKKLPLHLTLPQALPQVAGSGNLTLALEA
GGG_Anthal_CD4	AFOKASSIVYKKEBEOVERSFPLAFTVEKLTGSGELUNDAERASSSKSNITFOLKNKEVSVKRVTODPKLOMGKKLPLHLTLPOALPOVAGSGNLTLALEA
GGG_AZIZI_CD4	HFORMSS IVVKKEGEOVEFSFPLHFIVEKLIGSGELMOHENHSSSKSMITFOLKNKEVSVKHVI ODPKLOMGKKLPLHLILPOHEPOVHGSGNLILHLEH
CCC_Bulara_CD4	
GGG Carolyn CD4	REMARK WYKE RENVES FLIETVERUTINGER UND ERRESSKSUTTEN KONKENTOPKE MARK BEHITTENDER MARKNET HERE
GGG_Choomba_CD4	RECKASSI VYKKE DEDVEFSEPLAFT VEKLTOSGELHJOFERASSK SHI TEDLKNKEVSKEVTOPKI, DIGKK, PLHTTPOLEDVAGSALTTALER
GGG_Coco_CD4	AFOKASSIVYKKEGEOVEFSFPLAFTVEKLTOSGELHJOAERASSKSHITFOLKNKEVSVKRVTOOPKLOMGKKLPLALTLPOALPOVAGSGALTLALEA
GGG_Delphi_CD4	AFOKASSIVYKKEGEOVEFSFPLAFTVEKLTOSGELHUOAERASSSKSUITEOLKNKEVSVKRVTOOPKLOMOKKLPLHLTLPOALPOVAGSGALTLALEA
GGG_Dian_CD4	AFOKASSIVYKKEGEOVEFSFPLAFTVEKLTOSGELHUOAERASSSKSUITFDLKNKEVSVKRVTODPKLOMGKKL <u>PLHLTLPOALPOVAGSGNLTLALEA</u>
GGG_Dolly_CD4	AFOKASSIVYKKEGEOVEFSFPLAFTVEKLTGSGELHUQAERASSSKSHITEDLKNKEVSVKKVTODPKLOMOKKLPLHLTLPOALPOVAGSGNLTLALEA
GGG_Helen_CD4	I AFOKASSI VYKKEGEOVEFSFPLAFTVEKLTGSGELHUOAE <mark>R</mark> ASSSKSHI TFDLKNKEVSVK <mark>R</mark> VTODPKLOMOKKLPLHLTLPOALPOVAGSGNLTLALEA
GGG_Katie-B_CD4	AFOKASSIVYKKEGEOVEFSFPLAFTVEKLTOSGELHUQAERASSSKSUITFOLKNKEVSVKRVTODPKLOMOKKLPLHLTLPOALPOVAOSONLTLALEA
GGG_Katie-K_CD4	AFORASS VYKKEGEOVEFSEPLAFTVEKLTOSGELHUOAERASSSKSUITFOLKNKEVSVKRVTODPKLOMGKKLPLHLTLPOALPOVAOSGNLTLALEA
GGG_Kokomo_CD4	I HEUKHSST VYKKEGEUVEFSEPLHETVEKLTGSGELANDHERASSSKSNTTEDLKNKEVSVKRVTQDPKLQMGKKLPLHLTLPQALPQVAGSGNLTLALEA

GGG_Kowali_CD4	R	FQ	KA	ss	١V	ΥK	KΕ	GE	Q٧	EF	SF	ΡL	AF	т٧	Ek	L	rgs	SG	L	4MI	QA	ER	AS	ss	ĸs	<mark>u</mark> I	ΤF	DL	KΝ	кE	٧s	٧ <mark>ĸ</mark>	RV	TQI	Ρ	< L C	(MG	кк	LΡ	LH	LT	LΡ	QA	LP	QY	AG:	sG	IL T	LA	LE	ЯK
GGG_Mimi_CD4	R	FQ	KA	ss	١V	YK,	KΕ	GE	Q٧	EF	SF	PL	ЯF	T۷	Ek	L	ГGS	SG	L	4MI	QAI	ER	AS	ss	ĸs	ШI	ΤF	DL	ΚN	КE	٧s	۷ <mark>K</mark>	RΥ	TQI	DP	< L C	Q M G	КK	LΡ	LH	LT	LP	QA	LP	QY	AG:	SG	IL T	LA	LE	AK
GGG_Oko_CD4	R	FQ	KA	ss	١V	YK,	KΕ	GE	Q٧	EF	SF	PL	ЯF	T۷	Ek	L	rgs	SG	L	4MI	QAI	ER	AS	ss	ĸs	ШI	ΤF	DL	ΚN	ĸЕ	٧s	٧ <mark>K</mark>	RΥ	TQI	DP	< L C	Q M G	КK	LΡ	LH	LT	LP	QA	LP	QY	AG:	SG	IL T	LA	LE	ЯK
GGG_Paki_CD4	R	FQ	KA	SS	١V	YK,	KΕ	GE	Q٧	EF	SF	PL	ЯF	T۷	Ek	L	rgs	SG	L	4MI	QAI	ER	AS	ss	ĸs	ШI	ΤF	DL	ΚN	ĸЕ	٧s	۷ <mark>K</mark>	RΥ	TQI	DP	< L 0	Q M G	КK	LΡ	LH	LT	LP	QA	LP	QY	AG:	SG	IL T	LA	LE	Аĸ
GGG_Porta_CD4	R	FQ	KA	SS	١V	YK,	KΕ	GE	Q٧	EF	SF	PL	ЯF	T۷	Ek	L	rgs	SG	L	4MI	QAI	ER	AS	ss	ĸs	ШI	ΤF	DL	ΚN	ĸЕ	٧s	۷ <mark>K</mark>	RΥ	TQI	DP	<∟0	Q M G	КK	LΡ	LH	LT	LP	QA	LP	QY	AG:	SG	IL T	LA	LE	Аĸ
GGG_Sandra_CD4	R	FQ	KA	SS	١V	YK,	KΕ	GE	Q٧	EF	SF	PL	ЯF	T۷	Ek	L	rgs	SG	L	4MI	QAI	ER	AS	ss	ĸs	ШI	ΤF	DL	ΚN	ĸЕ	٧s	۷ <mark>K</mark>	RΥ	TQI	DP	<∟0	Q M G	КK	LΡ	LH	LT	LP	QA	LP	QY	AG:	SG	IL T	LA	LE	Аĸ
GGG_Suzie_CD4	R	FQ	KA	SS	١V	YK,	KΕ	GE	Q٧	EF	SF	ΡL	ЯF	T۷	Ek	L	rgs	SG	L	4MI	QAI	ER	AS	ss	ĸs	ШI	ΤF	DL	ΚN	ĸЕ	٧s	۷ <mark>K</mark>	RΥ	TQI	DP	< L C	Q M G	КK	LΡ	LH	LT	LP	QA	LP	QY	AG:	SG	il T	LA	LE	ЯK
GGG_Tzambo_CD4	R	FQ	KA	SS	١V	YK,	KΕ	GE	Q٧	EF	SF	ΡL	ЯF	T۷	Ek	L	rgs	SG	L	4MI	QAI	ER	AS	ss	ĸs	۱	ΤF	DL	KΝ	ĸЕ	٧s	٧ <mark>K</mark>	RΥ	TQI	Ρ	< L C	(MG	КK	LΡ	LH	LT	LP	QA	LP	QY	AG:	SG	HL T	LA	LE	AK
GGG_Vila_CD4	R	FQ	KA	SS	١V	YK,	KΕ	GE	Q٧	EF	SF	ΡL	ЯF	T۷	Ek	L	rgs	SG	L	4MI	QAI	ER	AS	ss	ĸs	۱	ΤF	DL	KΝ	ĸЕ	٧s	٧ <mark>K</mark>	RΥ	TQI	Ρ	< L C	(MG	КK	LΡ	LH	LT	LP	QA	LP	QY	AG:	SG	HL T	LA	LE	AK
PA_Babu_CD4	R	FQ	KA	SS	١V	YK,	KΕ	GE	K۷	EF	SF	ΡL	ΤF	T۷	EF	LĪ	163	SG	L	4MI	QAI	ER	AS	ss	ĸs	ШI	ΤF	DL	ΚN	KΕ	٧s	۷ <mark>K</mark>	Q٧	TQI	P	< L 0	(M <mark>G</mark>	КK	LΡ	LH	LT	LP	QA	LP	QY	AG:	SG	HL T	LA	LE	AK
PA_Buschi_CD4	R	FQ	KA	SS	١V	YK,	KΕ	GE	K۷	EF	SF	ΡL	ΤF	T٧	EF	LI	169	SG	L	4MI	QAI	ER	AS	ss	ĸs	ШI	ΤF	DL	ΚN	KΕ	٧s	۷ <mark>K</mark>	Q٧	TQI	P	< L C	(M <mark>G</mark>	КK	LΡ	LH	LT	LP	QA	LP	QY	AG:	SG	IL T	LA	LE	AK
PA_Dunja_CD4	R	FQ	KA	SS	١V	YK,	KΕ	GE	K۷	EF	SF	ΡL	ΤF	T۷	EF	LI	169	SG	L	4MI	QAI	ER	AS	ss	ĸs	ШI	ΤF	DL	ΚN	KΕ	٧s	۷ <mark>K</mark>	Q٧	TQI	Ρ	< L C	Į M G	КK	LΡ	LH	LT	LP	QA	LP	QY	AG:	SG	IL T	LA	LE	AK
PA_EIsi_CD4	R	FQ	KA	SS	١V	YK,	KΕ	GE	K۷	EF	SF	ΡL	ΤF	T۷	EF	LI	163	SG	L	4MI	QAI	ER	AS	ss	ĸs	ШI	ΤF	DL	ΚN	KΕ	٧s	٧ <mark>K</mark>	Q٧	TQI	Ρ	< L C	Į M G	КK	LΡ	LH	LT	LP	QA	LP	QY	AG:	SG	IL T	LA	LE	AK
PA_Kiki_CD4	A	FQ	KA	SS	١V	YK,	KΕ	GE	K۷	EF	SF	ΡL	ΤF	T۷	EF	LI	163	SG	L	4MI	QAI	ER	AS	ss	ĸs	ШI	ΤF	DL	ΚN	КE	٧s	۷ <mark>K</mark>	Q٧	TQI	Ρ	< L C	Į M G	КK	LΡ	LH	LT	LP	QA	LP	QY	AG:	SG	IL T	LA	LE	AK
PP_Napoleon_CD4	A	FQ	KA	SS	١V	YK,	KΕ	GE	K۷	EF	SF	ΡL	ΤF	T۷	EF	LI	169	SG	L	4MI	QAI	ER	AS	ss	ĸs	ШI	ΤF	DL	ΚN	КE	٧s	٧ <mark>K</mark>	Q٧	TQI	Ρ	< L C	Į M G	КK	LΡ	LH	LT	LP	QA	LP	QY	AG:	SG	IL T	LA	LE	AK
PP_Nonja_CD4	A	FQ	KA	SS	١V	YK,	KΕ	GE	K۷	EF	SF	ΡL	ΤF	T۷	EF	LI	169	SG	L	4MI	QAI	ER	AS	ss	ĸs	ШI	ΤF	DL	ΚN	КE	٧s	۷ <mark>K</mark>	Q٧	TQI	Ρ	< L C	Į M G	КK	LΡ	LH	LT	LP	QA	LP	QY	AG:	SG	IL T	LA	LE	AK
PP_Sari_CD4	A	FQ	KA	SS	١V	YK,	KΕ	GE	K۷	EF	SF	ΡL	ΤF	T۷	EF	LI	163	SG	L	4MI	QAI	ER	AS	ss	ĸs	ШI	ΤF	DL	ΚN	КE	٧s	۷ <mark>K</mark>	Q٧	TQI	DP	< L C	Į M G	КK	LΡ	LH	LT	LP	QA	LP	QY	AG:	SG	IL T	LA	LE	ЯK
PP_Temmy_CD4	R	FQ	KA	SS	١V	YK,	KΕ	GE	K۷	EF	SF	ΡL	ΤF	T۷	EF	LI	163	SG	L	4MI	QAI	ER	AS	ss	ĸs	ШI	ΤF	DL	ΚN	КE	٧s	۷ <mark>K</mark>	Q٧	TQI	DP <mark>I</mark>	< L C	Į M G	КK	LΡ	LH	LT	LP	QA	LP	QY	AG:	SG	IL T	LA	LE	ЯK
PP_Tilda_CD4	A	FQ	KA	SS	١V	YΚ	KE	GE	K۷	EF	SF	PL	ΤF	T٧	EF	LI	163	SG	L	4MI	QAI	ER	AS	ss	ĸs	۱	ΤF	DL	ΚN	ΚE	٧s	٧K	Q٧	TQI	IΡ	< L C	(MG	ĸк	LΡ	LH	LT	LP	QA	LP	QY	A G S	SG	IL T	LA	LE	AK
Gibbon_ENSNLET000	A R	FQ	KA	SS	T۷	ΥK	KΕ	GE	Q٧	ΕF	SF	PL	AF	T۷	Ek	L	rgs	SG	L	CWI	QAI	ER	AS	ss	ĸs	ЫI	ΤF	DL	ΚN	KE	٧s	۷ĸ	RV	TQI	Ρ	<lc< td=""><td>)MC</td><td>КK</td><td>LΡ</td><td>LH</td><td>LT</td><td>LP</td><td>QA</td><td>LP</td><td>QY</td><td>AG:</td><td>SG</td><td>HL T</td><td>LD</td><td>LE</td><td>ЯK</td></lc<>)MC	КK	LΡ	LH	LT	LP	QA	LP	QY	AG:	SG	HL T	LD	LE	ЯK

ğ 1	300 3	805 	310 3	315 33	20 3	325	330 33	5 340	345	i 35	0 35	5 360	365	370	375 38	0 3	85	390	395
Denisova on Human-v	TLALEAK	TG <mark>K</mark> LH	QEVNLY	VVM <mark>B</mark> AT	QLQ <mark>K</mark> I	NLTCE	V <mark>W</mark> GPTS	PKLMLSL	- <mark>K</mark> LEN	KE <mark>R</mark> K\	SKRE	KAV <mark>W</mark> VLN	PEAG	1 <mark>WQC</mark> LLS	SD <mark>SGQVLL</mark> I	SN I K	VLP	т <mark>и</mark> зті	PVQPM
Neandertal 1 CD 4 1 KG	TLALEAK	TG <mark>K</mark> LH	QEVNLV	VVM <mark>B</mark> AT	QLQ <mark>K</mark> I	NLTCE	V <mark>₩</mark> GPTS	PKLMLSL	_ <mark>K</mark> LEN	KE <mark>R</mark> K\	SKRE	K <mark>a</mark> vwvln	PEAG	1 <mark>WQC</mark> LLS	SDSGQVLLI	E <mark>SNIK</mark>	VLP	т <mark>и</mark> зті	PVQPM
Neandertal 2 CD 4 1 KG	TLALEAK	TG <mark>K</mark> LH	QEVNLV	VVM <mark>R</mark> AT	QLQ <mark>K</mark> I	NLTCE	V <mark>₩</mark> GPTS	PKLMLSL	_ <mark>K</mark> LEN	KEAK\	SKRE	KAVWVLN	PEAG	1 <mark>WQC</mark> LLS	SD SGQYLLI	ESN I K	VLP	т <mark>и</mark> зті	PVQPM
Neandertal 3 CD 4 1 KG	TLALEAK	TG <mark>K</mark> LH	QEVNLV	VVM <mark>R</mark> AT	QLQ <mark>K</mark> I	NLTCE	V <mark>₩</mark> GPTS	PKLMLSL	_ <mark>K</mark> LEN	KEAK\	SKRE	K <mark>a</mark> vwvln	PEAG	1 <mark>WQC</mark> LLS	SDSGQVLLI	E <mark>SNIK</mark>	VLP	т <mark>и</mark> зті	PVQPM
Neandertal 4-allele 1 C	TLALEAK	TG <mark>K</mark> LH	QEVNLY	VVM <mark>R</mark> AT	QLQ <mark>K</mark> I	NLTCE	V <mark>₩</mark> GPTS	PKLMLSL	- <mark>K</mark> LEN	KEAK\	/ <mark>SKR</mark> EI	KAVWVLN	PEAG	1WQCLLS	SD SGQVLLI	E <mark>SN I K</mark>	VLP	т <mark>и</mark> зті	PVQPM
Neandertal 4-allele 2 C	TLALEAK	TG <mark>K</mark> LH	QEVNLY	VVM <mark>B</mark> AT	QLQ <mark>K</mark> I	NLTCE	V₩GPTS	PKLMLSI	- <mark>K</mark> LEN	KERK	SKREI	K <mark>a</mark> vwvln	PEAG	1WQCLLS	SDSGQVLLI	ESN I K	VLP	т <mark>и</mark> зті	PVQPM
PTV_Bosco_CD4	TLALEAK	TGKLH	QEVNLY	VVM <mark>R</mark> AT	QLQ <mark>K</mark> I	NLTCE	VWGPTS	PKLMLSL	- <mark>K</mark> LEN	KERK	SKREI	KUAMALN	PEAG	1WQCLLS	SDSGQVLLI	ESNIK	VLP	т <mark>и</mark> зті	PVQPM
PTY_Clint_CD4	TLALEAK	TGKLH	QEVNLY	VVM <mark>B</mark> AT	QLQ <mark>K</mark> I	NLTCE	VWGPTS	PKLMLSI		KEBK	SKRE	KAVWVLN	PEAG	1WQCLLS	BOSGQVLLI	SNIK	VLP	TUSTI	PVQPM
PTV_Jimmie_CD4	TLALEAK	TGKLH	QEVNLY	VVMBAT	QLQKI	NLTCE	VWGPTS	PKLMLSI		KERK	SKRE	KAVWVLN	PEAG	1WQCLLS	SDSGQVLLI	SNIK	VLP	TUSTI	PVQPM
PTV_Koby_CD4	TLALEAK	TGKLF	QEVNLY	VVMBAT			VWGPTS	PKLMLSL		KERK	SKRE	KAVWVLN	PEAG		SDSGQVLLI	SNIK	VLP	TUSTI	PVQPM
PTE_Akwaya-Jean_CD4	TLALEHK	IGKLE	UEVALY	VVMBHI			VNGPTS	PKLMLSL		KEHK)	SKRE		PEHG		IDSGUVLLI		VLP	TUST	VUPM
PIE_Banyo_UU4	TLALEAK	TOKLE	DEVNLY				VWGPTS UNCDIC				JOKRE		PERG		DECOVILI			тисти	PVUPII
PTE_DasilU_UD4	TLALEAN		OEVNL V	UUMBAT			VUGPTO											тиет	PUOPM
DTE Julia LWC21 C	TLALEAK	TGKLL	OEVNLY	VVMBAT			VUGPTS			KEAK	SKREI		PEAG					TUST	PVOPM
PTE Konongo CD4	TLALEAK	ТОКЦЕ	OEVNL V	VVMBAT			VUGPTS	PKIMISI		KEAK	SKRE	KAVUVI N	PEAG		INSCOVILL	SNIK		тизт	PVOPM
PTE Koto CD4	TLALEAK	TGKLH	OEVNLY	VVM <mark>B</mark> AT	OLOK	NLTCE	VWGPTS	PKLMLSL	KLEN	KEAK	SKRE	KAVWVLN	PEAG	1WOCLLS	DSGOVLL	SNIK	VLP	тизт	PVOPM
PTE_Paguita_CD4	TLALEAK	TGKLH	DEVNLY	VVM <mark>B</mark> AT	OLOKI	NLTCE	VWGPTS	PKLMLSL	KLEN	KEAK		KAVWVLN	PEAG	1WOCLLS	DSGOVLL	SNIK	VLP	тизті	PVOPM
PTE_Taweh_CD4	TLALEAK	TGKLH	QEVNLY	VVM <mark>BAT</mark>	QLQK	NLTCE	VWGPTS	PKLMLSL		KEAK	SKRE	KAVWVLN	PEAG	1WOCLLS	DSGQVLL	SNIK	VLP	т <mark>и</mark> зті	PVOPM
PTE_Tobi_CD4	TLALEAK	TG <mark>K</mark> LH	QEVNLY	VVM <mark>B</mark> AT	QLQ <mark>K</mark> I	NLTCE	V <mark>W</mark> GPTS	PKLMLSL		KEAK\	SKRE	KAVWVLN	PEAG	1WQCLLS	DSGQVLLI	SNIK	VLP	т <mark>и</mark> зті	PVOPM
PTT_Clara_CD4	TLALEAK	TG <mark>K</mark> LH	QEVNLY	VVM <mark>R</mark> AT	QLQ <mark>K</mark> I	NLTCE	V <mark>W</mark> GPTS	PKLMLSL	- <mark>K</mark> LEN	KEAK\	SKRE	KAVWVLN	PEAG	1WQCLLS	SD SGQVLLI	SNIK	VLP	т <mark>и</mark> зті	PVQPM
PTT_Doris_CD4	TLALEAK	TG <mark>K</mark> LH	QEVNLY	VVM <mark>B</mark> AT	QLQ <mark>K</mark> I	NLTCE	V <mark>W</mark> GPTS	PKLMLSL	_ <mark>K</mark> LEN	KE <mark>R</mark> K\	/ <mark>SKR</mark> EI	KAVWVLN	PEAG	1 <mark>WQC</mark> LLS	SD SGQVLLI	E <mark>SNIK</mark>	VLP	т <mark>и</mark> зті	PVQPM
PTT_Julie_A959_CD4	TLALEAK	TG <mark>K</mark> LH	QEVNLY	VVM <mark>R</mark> AT	QLQ <mark>K</mark> I	NLTCE	V <mark>₩</mark> GPTS	PKLMLSL	- <mark>K</mark> LEN	KEAK\	SKRE	KAVWVLN	PEAG	1 <mark>WQC</mark> LLS	SD SGQYLLI	ESN I K	VLP	т <mark>и</mark> зті	PVQPM
PTT_Valiant_CD4	TLALEAK	TG <mark>K</mark> LH	QEVNLY	VVM <mark>B</mark> AT	QLQ <mark>K</mark> I	NLTCE	V <mark>W</mark> GPTS	PKLMLSL	- <mark>K</mark> LEN	KEBK/	/ <mark>SKR</mark> EI	K <mark>r</mark> vw?ln	PEAG	1WQCLLS	SDSGQVLLI	ESN I K	VLP	т <mark>и</mark> зті	PVQPM
PTS_Andromeda_CD4	TLALEAK	TG <mark>K</mark> LH	QEVNLY	VVM <mark>B</mark> AT	QLQ <mark>K</mark> I	NLTCE	V₩GPTS	PKLMLSI	- <mark>K</mark> LEN	KEAK	SKREI	KUAMARN	PEAG	1WQCLLS	SDSGQVLLI	ESN I K	VLP	т <mark>и</mark> зті	PVQPM
PTS_Bwambale_CD4	TLALEAK	TGKLH	QEVNLY	VVM <mark>B</mark> AT	QLQ <mark>K</mark> I	NLTCE	VWGPTS	PKLMLSI	- <mark>K</mark> LEN	KERK	SKREI	KUAMAFU	PEAG	1WQCLLS	SDSGQVLLI	SNIK	VLP	TUSTI	PVQPM
PTS_Harriet_CD4	TLALEAK	TGKLH	QEVNLY	VVMBAT	QLQKI	NLTCE	VWGPTS	PKLMLSI		KEAK	SKRE	KAVWVLN	PEAG	1WQCLLS	DSGQVLLI	SNIK	VLP	TUSTI	PVQPM
PTS_Kidongo_CD4	TLALEAK	TGKLF	QEVNLY				VWGPTS			KERKY	SKRE	KHVWVLN	PERG		SDSGOVLLI		VLP	TUSTI	PVQPM
PTS_Nakuu_CD4	TLALEAK		QEVALY								SKHE		PEHG				VLP	TUCT	PVUPM
PIS_VINCENT_CD4	TLALEAK		QEVALY				VNGPIS				SKRE		PERG					TUET	PVUPN
PPaniscus_Dono_CD4			OEVNLY	UUMBAT			UNCETE											тиет	DUODM
PPaniscus Chinita C	TLALEAK	ТОКЦЕ	OEVNL V	VVMBAT			VUGPTS	PKIMISI		KEAK	SKRE	KAVUVI N	PEAG		INSCOVIL	SNIK		тизт	PVOPM
PPaniscus Desmond	TLALEAK	TGKLH	OEVNLY	ихм <mark>ват</mark>	OLOK	NLTCE	VWGPTS	PKLMLSL	KLEN	KEAK	SKRE	KAVWVLN	PEAG	1WOCLLS	DSGOVLL	SNIK	VLP	тизт	PVOPM
PPaniscus_Dzeeta_CD4	TLALEAK	TGKLH	QEVNLY	VVM <mark>RAT</mark>	QLOK	NLTCE	VWGPTS	PKLMLSL		KEAK	SKRE	KAVWVLN	PEAG	1WOCLLS	DSGOVLLI	SNIK	VLP	тизті	PVOPM
PPaniscus_Hermien	TLALEAK	төксн	QEVNLY	им <mark>в</mark> ат	QLQ <mark>K</mark> I	NLTCE	V <mark>W</mark> GPTS	PKLMLSL		KEAK\	SKRE	KAVWVLN	PEAG	1WQCLLS	DSGQVLLI	SNIK	VLP	т <mark>и</mark> зті	PVOPM
PPaniscus_Hortense	TLALEAK	TG <mark>K</mark> LH	QEVNLY	VVM <mark>R</mark> AT	QLQ <mark>K</mark> I	NLTCE	V <mark>₩</mark> GPTS	PKLMLSL	_ <mark>K</mark> LEN	KEAK\	SKRE	KAVWVLN	PEAG	1 <mark>WQC</mark> LLS	SD SGQVLLI	E <mark>snik</mark>	VLP	т <mark>и</mark> зті	PVQPM
PPaniscus_Kombote	TLALEA <mark>K</mark>	TG <mark>K</mark> LH	QEVNLY	VVM <mark>B</mark> AT	QLQ <mark>K</mark> I	NLTCE	V <mark>₩</mark> GPTS	PKLMLSL	_ <mark>K</mark> LEN	KEAK\	/ <mark>SKR</mark> EI	KAVWVLN	PEAG	1 <mark>WQC</mark> LLS	SDSGQVLLI	E <mark>SNIK</mark>	VLP	т <mark>и</mark> зті	PVQPM
PPaniscus_Kosana_CD4	TLALEA <mark>K</mark>	TG <mark>K</mark> LH	QEVNLY	VVM <mark>R</mark> AT	QLQ <mark>K</mark> I	NLTCE	V <mark>₩</mark> GPTS	PKLMLSL	_ <mark>K</mark> LEN	KE <mark>R</mark> K\	SKRE	KAVWVLN	PEAG	1 <mark>WQC</mark> LLS	SD SGQVLLI	E <mark>SNIK</mark>	VLP	т <mark>и</mark> сті	PVQPM
PPaniscus_Kumbuka	TLALEAK	TG <mark>K</mark> LH	QEVNLY	VVM <mark>B</mark> AT	QLQ <mark>K</mark> I	NLTCE	V₩GPTS	PKLMLSI	- <mark>K</mark> LEN	KEAK	SKREI	KUAMARN	PEAG	1WQCLLS	BISGQVLLI	ESN I K	VLP	т <mark>и</mark> зті	PVQPM
PPaniscus_LB502_CD4	TLALEAK.	TGKLH	QEVNLY	VVM <mark>B</mark> AT	QLQ <mark>K</mark> I	NLTCE	VWGPTS	PKLMLSI	- <mark>K</mark> LEN	KERK	SKREI	KUAMAFU	PEAG	1WQCLLS	SDSGQVLLI	SNIK	VLP	TUSTI	PVQPM
PPaniscus_Natalie_CD4	TLALEAK	TGKLH	QEVNLY	VVMBAT	QLQKI	NLTCE	VWGPTS	PKLMLSI		KEAK	SKRE	KAVWVLN	PEAG	1WQCLLS	DSGQVLLI	SNIK	VLP	TUSTI	PVOPM
PPaniscus_Salonga_C	TLALEAK	TGKLF	QEVNLY				VWGPTS			KERKY	SKRE	KAAMALN	PEAG		SDSGQVLLI		VLP		PVOPM
GBG_Kalsi_CD4	TLALEAK		QEVALY								SKUE		PEHG				VLP	TUST	PVUPM
CBC_MKUDW8_CD4	TLALEAK		OFUNL V				UNCETE						PERG		DECOVIL			тист	DUCDM
CGG Abe CD4	TLALEAK	TGKLE	OEVNLY	VVMBAT			VUGPTS			KFAK	SKOF		PEAG					TUST	PVOPM
GGG Akiba CD4	TLALEAK	TGKLH	OEVNLY	VVM <mark>B</mark> AT	OLBEI	NLTCE	VWGPTS	PKLMLSI	KLEN	KEAK	SKOE	KAVWVLN	PEAG	1WOCLLS	DSGOVLL	SNIK	VLP	тизт	PVOPM
GGG_Amani_CD4	TLALEAK	TGKLH	OEVNLY	VVM <mark>B</mark> AT	OLREI	NLTCE	VWGPTS	PKLMLSL		KEAK	SKOE	KAVWVLN	PEAG	1WOCLLS	DSGOVLL	SNIK	VLP	тизті	PVOPM
GGG_Anthal_CD4	TLALEAK	TGKLH	QEVNLY	VVM <mark>RAT</mark>	QLREI	NLTCE	VWGPTS	PKLMLSL		KEAK	SKOE	KAVWVLN	PEAG	1WOCLLS	DSGOVLLI	SNIK	VLP	тизті	PVOPM
GGG_Azizi_CD4	TLALEAK	TG <mark>K</mark> LH	QEVNLV	VVM <mark>R</mark> AT	QL <mark>R</mark> EI	NLTCE	V <mark>W</mark> GPTS	PKLMLSL		KEAK\	SKQE	KAVWVLN	PEAG	1WQCLLS	SD SGQVLLI	SNIK	VLP	т <mark>и</mark> зті	PVQPM
GGG_Banjo_CD4	TLALEAK	TG <mark>K</mark> LH	QEVNLY	VVM <mark>R</mark> AT	QL <mark>R</mark> EI	NLTCE	V <mark>W</mark> GPTS	PKLMLSL	_ <mark>K</mark> LEN	KEAK\	SKQE	KAVWVLN	PEAG	1 <mark>WQC</mark> LLS	SD SGQYLLI	E <mark>snik</mark>	VLP	т <mark>и</mark> зті	PVQPM
GGG_Bulera_CD4	TLALEAK	TG <mark>K</mark> LH	QEVNLY	VVM <mark>B</mark> AT	QL <mark>R</mark> EI	NLTCE	V <mark>W</mark> GPTS	PKLMLSL	- <mark>K</mark> LEN	KEAK\	/ <mark>sk</mark> qe	K <mark>r</mark> vwvln	PEAG	1WQCLLS	SDSGQVLLI	SNIK	VLP	т <mark>и</mark> сті	PVQPM
GGG_Carolyn_CD4	TLALEAK	TG <mark>K</mark> LH	QEVNLY	VVM <mark>BA</mark> T	QL <mark>R</mark> EI	NLTCE	V <mark>W</mark> GPTS	PKLMLSL	- <mark>K</mark> LEN	KEAK	/ <mark>sk</mark> qe	KAVWVLN	PEAG	1 <mark>MQC</mark> LLS	DSGQVLLI	SNIK	VLP	т <mark>и</mark> сті	PVQPM
GGG_Choomba_CD4	TLALEA <mark>K</mark>	TGKLH	QEVNLY	VVM <mark>B</mark> AT	QL <mark>R</mark> EI	NLTCE	V <mark>W</mark> GPTS	PKLMLSI		KERK	/ <mark>sk</mark> qe	KAAMALN	PEAG	1WQCLLS	SDSGQVLL	SNIK	VLP	т <mark>и</mark> зті	PVQPM
GGG_Coco_CD4	TLALEAK	TGKLF	QEVNLY	VVM <mark>B</mark> AT	QL <mark>B</mark> EI	NLTCE	VWGPTS	PKLMLSL		KEAK	/SKQE	KAAMAFU	PEAG	1WQCLLS	DSGQVLL	SNIK	VLP	TNSTI	PVQPM
GGG_Delphi_CD4	TLALEAK	TGKLH	QEVNLY	VVM <mark>BA</mark> T		NLTCE	VWGPTS	PKLMLSI		KEAK	/SKQE	KAVWVLN	PEAG	1WQCLL	DSGQVLL	SNIK	VLP	TUSTI	PVQPM
GGG_Dian_CD4	TLALEAK	IGKLI	QEVNLY	VVMBAT			VNGPTS			KERK\	SKQE	KHVWVEN	PEAG		USCOVEL	SNIK	VLP	TUSTI	VOPM
GGG_Dolly_CD4	TLALEAK	TGKLF	QEVNLY	VMBAT			VNGPTS			KEHK	SKQE	KHVWVEN	PERG		DSGQVLLI	SNIK	VLP	TUSTI	VUPM
GGG_Helen_CD4	TLALEHK	TGKL	QEVALY				VWGPTS			KEHK			PEHG				VLE	TUCT	VUP M
CCC_Katle-B_UU4		TGKLL	OFVNLY	UVMPOT		NI TOE	VUGPTS						PERG				VLE	тисти	V OP N
GGG Kakama CD4		TGKL	OFVNLY	VVMPAT			VUGPTS			KFAK	SKOF		PERC					тиет	VOPM
0001000004		- SHEL	SCINC.		Seuc.														

GGG_Kolo_CD4	TLALEAKTGKLHQEVNLVVMRATQLRENLTCEVWGPTSPKLMLSLKLENKEAKVSKQEKA	IVWVLNPEAGM <mark>WQCLLSDSGQVLLESNIK</mark> VLPTWSTPVQPM
GGG_Kowali_CD4	TLALEAKTGKLHQEVNLVVMRATQL <mark>R</mark> ENLTCEVNGPTSPKLML <mark>SLK</mark> LEN <mark>KEAK</mark> VSKQEKA	IVWVLNPEAGMWQCLLSDSGQVLLESNI <mark>K</mark> VLPTWSTPVQPM
GGG_Mimi_CD4	TLALEAKTGKLHQEVNLVVMRATQL <mark>R</mark> ENLTCEVNGPTSPKLML <mark>SLK</mark> LEN <mark>KEAK</mark> VSKQEKA	IV <mark>W</mark> VLNPEAGMWQCLL <mark>SDSGQVLLESNIK</mark> VLPTWSTPVQPM
GGG_Oko_CD4	TLALEAKTGKLHQEVNLVVM <mark>RATQLR</mark> ENLTCEVNGPTSPKLML <mark>SLK</mark> LEN <mark>KEAK</mark> VSKQEKA	IV <mark>W</mark> VLNPEAGMWQCLL <mark>SDSGQVLLESNIK</mark> VLPTWSTPVQPM
GGG_Paki_CD4	TLALEAKTGKLHQEVNLVVM <mark>RATQLR</mark> ENLTCEVNGPTSPKLML <mark>SLK</mark> LEN <mark>KEAK</mark> VSKQEKF	IV <mark>W</mark> VLNPEAGMWQCLL <mark>SDSGQVLLESNIK</mark> VLPTWSTPVQPM
GGG_Porta_CD4	TLALEAKTGKLHQEVNLVVMRATQL <mark>R</mark> ENLTCEVNGPTSPKLML <mark>SLK</mark> LEN <mark>KEAK</mark> VSKQEKA	IVWVLNPEAGMWQCLLSDSGQVLLESNI <mark>K</mark> VLPTWSTPVQPM
GGG_Sandra_CD4	TLALEAKTGKLHQEVNLVVMRATQL <mark>R</mark> ENLTCEVNGPTSPKLML <mark>SLK</mark> LEN <mark>KEAK</mark> VSKQEKA	IV <mark>W</mark> VLNPEAGMWQCLL <mark>SDSG</mark> QVLLESNI <mark>K</mark> VLPTWSTPVQPM
GGG_Suzie_CD4	TLALEAKTGKLHQEVNLVVM <mark>RATQLR</mark> ENLTCEVNGPTSPKLML <mark>SLK</mark> LEN <mark>KEAK</mark> VSKQEKF	IV <mark>W</mark> VLNPEAGMWQCLL <mark>SDSGQVLLESNIK</mark> VLPTWSTPVQPM
GGG_Tzambo_CD4	TLALEAKTGKLHQEVNLVVM <mark>RATQLR</mark> ENLTCEVNGPTSPKLML <mark>SLK</mark> LEN <mark>KEAK</mark> VSKQEKF	IV <mark>W</mark> VLNPEAGMWQCLL <mark>SDSGQVLLESNIK</mark> VLPTWSTPVQPM
GGG_Vila_CD4	TLALEAKTGKLHQEVNLVVM <mark>RATQLR</mark> ENLTCEVNGPTSPKLML <mark>SLK</mark> LEN <mark>KEAKVSK</mark> QEKF	IV <mark>W</mark> VLNPEAGM <mark>WQCLL</mark> SDSGQVLLESNI <mark>K</mark> VLPTWSTPVQPM
PA_Babu_CD4	TLALEAKTGKLRQEVNLVVMRATQLQENLTCEVNGPTSPKLML <mark>SLK</mark> LEN <mark>KEAK</mark> VSKREKF	IV <mark>W</mark> VLNPEAGM <mark>WQCLL</mark> SDSGQVLLQSNVQVLPTWPTPVQPM
PA_Buschi_CD4	TLALEAKTGKLHQEVNLVVMRATQLQENLTCEVNGPTSPKLML <mark>SLK</mark> LEN <mark>KEAK</mark> VSKREKF	IV <mark>W</mark> VLNPEAGM <mark>WQCLL</mark> SDSGQVLLQSNVQVLPT <mark>W</mark> PTPVQPM
PA_Dunja_CD4	TLALEAKTGKLHQEVNLVVM <mark>RATQLQENLTCEVNGPTSPK</mark> LML <mark>SLK</mark> LEN <mark>KEAK</mark> VSKREKF	IV <mark>W</mark> VLNPEAGM <mark>WQCLL</mark> SDSGQVLLQSNVQVLPT <mark>W</mark> PTPVQPM
PA_Elsi_CD4	TLALEAKTGKLHQEVNLVVM <mark>RATQLQENLTCEVNGPTSPK</mark> LML <mark>SLK</mark> LEN <mark>KEAK</mark> VSKREKF	IV <mark>W</mark> VLNPEAGM <mark>WQCLL</mark> SDSGQVLLQSNVQVLPTWPTPVQPM
PA_Kiki_CD4	TLALEAKTGKLRQEVNLVVMRATQLQENLTCEVNGPTSPKLML <mark>SLK</mark> LEN <mark>KEAK</mark> VSKREKF	IV <mark>W</mark> VLNPEAGM <mark>WQCLL</mark> SDSGQVLLQSNVQVLPTWPTPVQPM
PP_Napoleon_CD4	TLALEAKTGKLHQEVNLVVMRATQLQENLTCEVNGPTSPKLML <mark>SLK</mark> LEN <mark>KEAK</mark> VSKREKF	IV <mark>W</mark> VLNPEAGM <mark>WQCLL</mark> SDSGQVLLQSNVQVLPT <mark>W</mark> PTPVQPM
PP_Nonja_CD4	TLALEAKTGKLHQEVNLVVMRATQLQENLTCEVNGPTSPKLML <mark>SLK</mark> LEN <mark>KEAK</mark> VSKREKF	IV <mark>W</mark> VLNPEAGM <mark>WQC</mark> LLSDSGQVLLQSNVQVLPTWPTPVQPM
PP_Sari_CD4	TLALEAKTGKLHQEVNLVVMRATQLQENLTCEVWGPTSPKLML <mark>SLK</mark> LEN <mark>KEAK</mark> VSKREKF	IV <mark>W</mark> VLNPEAGM <mark>WQC</mark> LLSDSGQVLLQSNVQVLPTWPTPVQPM
PP_Temmy_CD4	TLALEAKTGKLHQEVNLVVMRATQLQENLTCEVWGPTSPKLMLSLKLENKEAKVSKREKF	IVWVLNPEAGMWQCLLSDSGQVLLQSNVQVLPTWPTPVQPM
PP_Tilda_CD4	TLALEAKTGKLHQEVNLVVMRATQLQENLTCEVWGPTSPKLMLSLKLENKEAKVSKREK	IVWVLNPEAGMWQCLLSDSGQVLLQSNVQVLPTWPTPVQPM
Gibbon_ENSNLET000	TLDLEAKTGKLRQEVNLVVMTATQLRENLTCEVNGPTSPKLML <mark>SLK</mark> LENKEAKVSKREK	IV <mark>W</mark> VLNPEAGMWQCLLSDSGQVLLESNV <mark>K</mark> VLPTWPTPVQPM

	50 3	365 370	375 38	0 385	390	395	400	405	410	415	420	425	430	435	5 440) 445	450	455	
Denisova on Human-v	LNPER	AG <mark>MWQC</mark> LL	SDSGQVLLI	ESNIKVL	PT <mark>M</mark> ST	PVQPM	ALIVL	66 <mark>V</mark> AGL	_LL <mark>F</mark> 16	LGIF	FCVB	RHRRR	Q <mark>rer</mark> m	I <mark>S</mark> Q I K	RLLSE	KKTCQ	CP <mark>HR</mark> FQ	KTCSP	*•
Neandertal 1 CD 4 1 KG	LNPE	AGM <mark>WQC</mark> LL	SDSGQVLLI	ESNI <mark>k</mark> vl	PT <mark>W</mark> ST	PVQPM	ALIVLO	66 <mark>V</mark> AG <mark>L</mark>	.LL <mark>F</mark> G	LGIF	FCVB	RHRRR	QAERM	ISQ I K	RLLSE	KK TCQ	CP <mark>HR</mark> FQ	KTCSP	1*•
Neandertal 2 CD 4 1 KG	LNPE	AGM <mark>WQC</mark> LL	SDSGQVLLI	ESNI <mark>k</mark> vl	PT <mark>W</mark> ST	PVQPM	ALIVLG	66 <mark>V</mark> AG <mark>L</mark>	_LL <mark>F</mark> G	LGIF	FCVR	RHRRR	QAE <mark>r</mark> m	ISQ I K	RLLSE	KKTCQ	CP <mark>HR</mark> FQ	KTCSP	*•
Neandertal 3 CD 4 1 KG	LNPE	AGM <mark>W</mark> QCLL	SDSGQVLLI	ESNI <mark>k</mark> vl	PT <mark>W</mark> ST	PVQPM	ALIVLG	66 <mark>V</mark> AG <mark>L</mark>	.LL <mark>F</mark> G	LGIF	FCVR	RHRRR	QAE <mark>r</mark> m	ISQ I K	RLLSE	KKTCQ	CP <mark>HR</mark> FQ	KTCSP	*•
Neandertal 4-allele 1 C	LNPE	AG <mark>MWQC</mark> LL	SDSGQVLLI	ESNI <mark>k</mark> vl	PT <mark>W</mark> ST	PVQPM	ALIVLG	66 <mark>V</mark> AG <mark>L</mark>	_LL <mark>F</mark> G	ilgif	FCVB	BHBBB	QAERM	ISQ I K	RLLSE	KK <mark>TCQ</mark>	CP <mark>HR</mark> FQ	KTCSP	*●
Neandertal 4-allele 2 C	LNPE	AG <mark>MWQC</mark> LL	SDSGQVLLI	ESNI <mark>k</mark> vl	PT <mark>W</mark> ST	PVQPM	ALIVLG	66 <mark>V</mark> AG <mark>L</mark>	_LL <mark>F</mark> G	LGIF	FCVB	RHRRR	QAE <mark>r</mark> m	ISQ I K	RLLSE	KKTCQ	op <mark>hr</mark> fq	KTCSP	*•
PTY_Bosco_CD4	LNPE	AGM <mark>WQC</mark> LL	SDSGQVLLI	ESNI <mark>k</mark> vl	PT <mark>W</mark> ST	PVQPM	ALIVLG	66 <mark>V</mark> AG <mark>L</mark>	_LL <mark>F</mark> G	LGIF	FCVB	RHRRR	QAQ <mark>R</mark> M	ISQ I K	RLLSE	KK <mark>TCQ</mark>	CP <mark>HR</mark> FQ	KTCSP	*•
PTY_Clint_CD4	LNPE	16 <mark>MWQC</mark> LL	SDSGQVLLI	ESNI <mark>k</mark> vl	PT <mark>W</mark> ST	PVQPMI	ALIVLG	66 <mark>V</mark> AGL	.LL <mark>F</mark> G	ilgif	FCVB	RHRRR	Q A Q A M	ISQ I K	RLLSE	KKTCQ	CP <mark>HR</mark> FQ	KTCSP	1*•
PTY_Jimmie_CD4	LNPER	AGMMQCLL	SDSGQVLLI	ESNIKVL	PT <mark>W</mark> ST	PVQPM	ALIVLG	6 VAGL	LL <mark>F</mark> IG	LGIF	FCVB	BHBBB	QAQ <mark>R</mark> M	ISQIK	RLLSE	KKTCQ	CP <mark>HR</mark> FQ	KTCSP	*•
PTV_Koby_CD4	LNPE	AGMMQCLL	SDSGQVLLI	ESNIKVL	PT <mark>W</mark> ST	PVQPMI	ALIVLG	GVAGL	LLFIG	ilgif	FCVB	BHBBB	DAOBN	ISQIK	RLLSE	KKTCQ	op <mark>hr</mark> fq	KTCSP	*•
PTE_Akwaya-Jean_CD4	LNPE	AGMWQCLL	SDSGQVLLI	ESNIKVL	PTWST	PVQPM	ALIVLG	GVAGL	LLFIG	LGIF	FCVB	BHBBB	DAOBM	SQIK	BLLSE	кктсо	CPHRFQ	KTCSP	*•
PTE_Banyo_CD4	LNPER	AGMWQCLL	SDSGQVLLI	ESNIKVL	PTWST	PVQPMI	ALIVLO	GVAGL		LGIF	FCVB	BHBBB	DHORM	SQIK	BLLSE	KKTCQ	CPHRFQ	KTCSP	*•
PIE_Basho_CD4	LNPE	IGMWUCLL	SUSGUVELI		PTUST	PVUPMI		GVHGL			FUVE	RHRRR	THAR		HLLSE	KKICU	PHRFU	KIUSP	
PIE_Damian_UD4			SDSGQVLLI		PTWST	PVQPN		SOVHOL				BHBBB			BLLSE	KKICU		KIUSP	
DTE_JUIIE_LWUZI_U			SUSUQVELI SDSCQVELI		ртиот отнет	PVOPNI		CUACE				DUDDD				KKTCU	PHBRU	VTCOD	
PTE_KOPOIIGO_CD4			SDSGQVLLI		PTUST	PVOPM		SCVAC			FCVBC	RHRRR				KKTCO	PRHREO	KTCSP	*
DTE Dequite CD/			SDSGOVLL		PTUST	PVOPM		SUPER			ECVE	RHRRR			BUISE	KKTCO		KTCSP	*
PTE Taweb CD4		I I JONMAR	SDSGOVLL	FSNIKVI	PTUST	PVOPM		ION VOI	LIFIG	IGIE	ECVB	BHBBB	NAUBH	SOIK	BUISE	кктсо	PHREO	KTCSP	*•
PTE Tohi CD4	LNPER	AGMWOCLL	SDSGOVLL	ESNIKVL	ртизт	PVOPM	ALIVE	GVAGL		LGIF	FCVB	BHBBB	DAOBM	SOIK	BLLSE	кктсо	PHRFO	KTCSP	*•
PTT_Clara_CD4	LNPER	AGMWOCLL	SDSGOVLL	ESNIKVL	PTWST	PVOPM	ALIVLO	60VAGL	LLFIG	LGIF	FCVR	BHBBB	DAORM	SOIK	BLLSE	кктсо		KTCSP	1*•
PTT_Doris_CD4	LNPER	AGMWOCLL	SDSGOVLL		PT <mark>W</mark> ST	PVQPM	ALIVLO	60 <mark>VAG</mark> L		LGIF	FCVR	RHRBB	QAORM	SQIK	BLLSE	кктсо		KTCSP	1*•
PTT_Julie_A959_CD4	LNPER	AGMWQCLL	SDSGQVLL	ESNIKVL	PT <mark>W</mark> ST	PVQPM	ALIVLO	60 <mark>V</mark> AGL	LLFIG	LGIF	FCVR	BHBBB	QAQRM	SQIK	RLLSE	кктсо	CP <mark>HR</mark> FQ	KTCSP	1*•
PTT_Valiant_CD4		16 <mark>MWQC</mark> LL	SDSGQVLLI	ESNIKVL	PT <mark>W</mark> ST	PVQPM	ALIVLO	66 <mark>V</mark> AGL	LLL <mark>FI</mark> G	LGIF	FCVR	BHBBB	QAQRM	ISQ I K	RLLSE	кктсо	CP <mark>HR</mark> FQ	KTCSP	1*•
PTS_Andromeda_CD4	LNPE	AGM <mark>WQC</mark> LL	SDSGQVLLI	ESNI <mark>k</mark> vl	PT <mark>W</mark> ST	PVQPM	ALIVLG	66 <mark>V</mark> AG <mark>L</mark>	.LL <mark>F</mark> G	LGIF	FCVB	RHRRR	QAQ <mark>R</mark> M	ISQ I K	RLLSE	KKTCQ	CP <mark>HR</mark> FQ	KTCSP	*•
PTS_Bwambale_CD4	LNPE	AG <mark>MW</mark> QCLL	SDSGQVLLI	ESNI <mark>k</mark> vl	PT <mark>W</mark> ST	PVQPM	ALIVLG	66 <mark>V</mark> AG <mark>L</mark>	.LL <mark>F</mark> G	LGIF	FCVB	RHRRR	Q <mark>rqr</mark> m	ISQ I K	RLLSE	KKTCQ	CP <mark>HR</mark> FQ	KTCSP	*•
PTS_Harriet_CD4	LNPE	AG <mark>MWQC</mark> LL	SDSGQVLLI	ESNI <mark>k</mark> vl	PT <mark>W</mark> ST	PVQPM	ALIVLG	36 <mark>V</mark> AG <mark>L</mark>	_LL <mark>F</mark> G	LGIF	FCVB	RHRRR	QAQ <mark>R</mark> M	ISQIK	RLLSE	KKTCQ	CP <mark>HR</mark> FQ	KTCSP	*•
PTS_Kidongo_CD4	LNPE	AGM <mark>W</mark> QCLL	SDSGQVLLI	ESNI <mark>k</mark> vl	PT <mark>W</mark> ST	PVQPMI	ALIVLG	66 <mark>V</mark> AGL	-LL <mark>F</mark> IG	ilgif	FCVB	RHRBR	Q A Q A M	ISQ I K	RLLSE	KKTCQ	CP <mark>HR</mark> FQ	KTCSP	1*•
PTS_Nakuu_CD4	LNPER	AGMMQCLL	SDSGQVLLI	ESNIKVL	PT <mark>W</mark> ST	PVQPMI	ALIVL <mark>G</mark>	36VAGL	LL <mark>F</mark> IG	LGIF	FCVB	RHRRR	QAQ <mark>r</mark> m	ISQIK	RLLSE	KKTCQ	CP <mark>HR</mark> FQ	KTCSP	*•
PTS_Vincent_CD4	LNPE	AGMWQCLL	SDSGQVLLI	ESNIKVL	PTWST	PVQPM	ALIVLG	GVAGL		LGIF	FCVB	BHBBB	DAOBM	SQIK	RLLSE	кктсо	CPHRFQ	KTCSP	1*•
PPaniscus_Bono_CD4	LNPE	AGMWQCLL	SDSGQVLLI	ESNIKVL	PTWST	PVQPM	ALIVLO	GVAGL		LGIF	FCVB	BHBBB	DAEBM	SQIK	RLLSE	кктсо	CPHRFQ	KTCSP	1*•
PPaniscus_Catherine	LNPE	HEMWOCLL	SDSGQVLLI		PTWST	PVQPMI	ALIVLO	GVAGL		LGIF	FCVR	RHRRR	UHERM		BLLSE	KKTCO	CPHRFQ	KTCSP	
PPaniscus_Chipita_C		IGMWUCLL	SDSGQVLLI		PTWST	PVUPMI		GVHGL			FOVE	RHRRR	UHERN		HLLSE	KKICU	PHRFU	KIUSP	
PPaniscus_Desmond			SUSBUVELI SDSCOULL		PTWST	PVQPN		CUOCI				BHBBB	UHEBN		BLLBE	KKICU		KIUSP	
DDanicous_Dzeeta_CD4			enecovili		гтизт втнет	EVOEM		CUACI								VNTCO		TCOP	
PPaniscus_Herinien DDaniscus Hortanse			SDSGOVLL		PTUST	PVOPM		SUPER			ECVE	2HBBB	NAFRM		BUISE	KKTCO	PHREO	KTCSP	*
PPaniscus Kombote		I I DOMMORIA	SUSCOVIL	FSNIKVI	PTUST	PVOPM		io veci		IGIE	ECVB	BHBBB		SOLK	BUISE	кктсо	PHREO	TCSP	*
PPaniscus Kosana CD4	LNPER	AGMWOCLL	SDSGOVLL	ESNIKVL	PTWST	PVOPM	ALIVLO	GVAGL		LGIE	FCVB	BHBBB	DAEBM	SOIK	BLLSE	кктсо	CPHBEO	KTCSP	*•
PPaniscus_Kumbuka_	LNPER	AGMWOCLL	SDSGOVLL	ESNIKVL	ртизт	PVOPM	ALIVLO	GVAGL	LLFIG	LGIF	FCVB	BHBBB	DAERM	SOIK	BLLSE	кктсо	PHRFO	KTCSP	*•
PPaniscus_LB502_CD4	LNPER	AGMWOCLL	SDSGQVLLI	ESNIKVL	рт <mark>и</mark> зт	PVQPM	ALIVLO	6 VAGL		LGIF	FCVB	BHBBB	DAERM	SÖIK	RLLSE	кктсо	CPHRF0	KTCSP	1*•
PPaniscus_Natalie_CD4	LNPER	AGMWQCLL	SDSGQVLLI	ESNIKVL	рт <mark>и</mark> зт	PVQPM	ALIVLO	66 <mark>VAG</mark> L		LGIF	FCVB	2HBBB	DAERM	SQIK	RLLSE	кктсо	CP <mark>HRF</mark> Q	KTCSP	1*•
PPaniscus_Salonga_C	LNPE	AGM <mark>WQC</mark> LL	SDSGQVLLI	ESNI <mark>k</mark> vl	PT <mark>W</mark> ST	PVQPM	ALIVLG	66 <mark>V</mark> AG <mark>L</mark>	.LL <mark>F</mark> G	LGIF	FCVB	RHRRR	QAE <mark>r</mark> m	ISQ I K	RLLSE	KKTCQ	CP <mark>HR</mark> FQ	KTCSP	1*•
GBG_Kaisi_CD4	LNPE	AGM <mark>WQC</mark> LL	SDSGQVLLI	ESNI <mark>k</mark> vl	PT <mark>W</mark> ST	PVQPM	ALIVLG	66 <mark>V</mark> AG <mark>L</mark>	.LL <mark>F</mark> G	LGIF	FCVB	RHRRR	QAE <mark>r</mark> m	ISQ I K	RLLSE	KKTCQ	CP <mark>HR</mark> FQ	KTCSP	*•
GBG_Mkubwa_CD4	LNPE	16MWQCLL	SDSGQVLLI	ESNIKVL	PT <mark>W</mark> ST	PVQPM	ALIVLG	66 <mark>V</mark> AGL	LLFIG	ilgif	FCVB	BHBBB	QAERM	ISQ I <mark>K</mark>	RLLSE	KKTCQ	CP <mark>HR</mark> FQ	KTCSP	1*•
GBG_Victoria_CD4	LNPER	AGMMQCLL	SDSGQVLLI	ESNIKVL	PT <mark>W</mark> ST	PVQPMI	ALIVLG	36VAGL	-LL <mark>F</mark> IG	LGIF	FCVB	BHBBB	DAERM	ISQIK	RLLSE	KKTCQ	CP <mark>HR</mark> FQ	KTCSP	*•
GGG_Abe_CD4	LNPER	AGMMQCLL	SDSGQVLLI	ESNIKVL	PT <mark>W</mark> ST	PVQPMI	ALIVLG	6 VAGL	-LL <mark>F</mark> IG	LGIF	FCVB	BHBBB	DAERM	ISQIK	RLLSE	KKTCQ	CP <mark>HR</mark> FQ	KTCSP	*•
GGG_Akiba_CD4	LNPE	AGMWQCLL	SDSGQVLLI	ESNIKVL	PTNST	PVQPM	ALIVLO	GVAGL	LLFIG	LGIF	FCVB	BHBBB	DAERM	SQIK	RLLSE	кктсо	CPHRFQ	KTCSP	*•
GGG_Amani_CD4	LNPE	AGMWQCLL	SDSGQVLLI		PTWST	PVQPMI	ALIVLO	GVAGL		LGIF	FCVB	BHBBB	DHERM	SQIK	BLLSE	KKTCO	CPHRFQ	KTCSP	*•
GGG_Anthal_CD4	LNPE	HEMWOCLL	SUSGOVELI		PTWST	PVQPMI		GVHGL			FUVE	RHRRR	JHERM		HLLSE	KKICU	PHRFU	KIUSP	
GGG_AZIZI_CD4		HEMWUCLL	SUSGUVELI		PTWST	PVUPMI		GVHGL			FOVE	RHRBR	UHE BU		HLLSE	KKICU	PHRFU	KIUSP	
CCC_Bulara_CD4			SUSCOVEL		PTHET	DUODM		COVHEL				DUDDD						TCOP	
CCC Carolup CD4			SUSCUVLL		PTHET	PV0PM		RVPC			FOUR	RHPPP				VV TCO	PUPEO	TCOD	
GGG Choomba CD4		16MWOCLL	SDSGOVLL		PTUST	PVOPM		igvagi		IGIE	FCVB	BHBBB	DAEBM	sol	BLISE	кктсо	PHBEO	KTCSP	*
GGG Coco CD4	LNPER	IGMWOCLL	SDSGOVLL	ESNIKVI	PTWST	PVOPM	ALIVES	GVAG		LGIE	FCVB	BHBBB	DAEBM	SOLK	BLLSE	кктсо		TCSP	*•
GGG Delphi CD4	LNPER	IGMWOCLL	SDSGOVLL	ESNIKVI	PTWST	PVOPM	ALIVES	GVAG		LGIE	FCVB	BHBBB	DREBM	SOLK	BLLSE	кктсо		TCSP	*
GGG_Dian_CD4	LNPER	AGMWOCLL	SDSGOVLL	ESNIKVL	PTWST	PVOPM	ALIVE	GVAG	LLEIG	LGIE	FCVB	BHBBB		SOIK	BLLSE	кктсо	PHBEO	KTCSP	1*•
GGG_Dolly_CD4	LNPE	AGMWQCLL	SDSGQVLL	ESNIKVL	PT <mark>W</mark> ST	PVQPM	ALIVLO	60 <mark>V</mark> AGL		LGIF	FCVR	RHRRR	QAERM	SQIK	BLLSE	кктсо	CPHRFQ	K TCSP	1*•
GGG_Helen_CD4	LNPER	AGM <mark>WQC</mark> LL	SDSGQVLLI	ESNI <mark>k</mark> vl	PT <mark>W</mark> ST	PVQPM	ALIVLO	60 <mark>VAGL</mark>	LLFIG	LGIF	FCVR	BHBBB	QAERM	ISQIK	RLLSE	кктсо	CPHRF0	KTCSP	1*•
GGG_Katie-B_CD4	LNPE	10MWQCLL	SDSGQVLLI	ESNIKVL	PT <mark>W</mark> ST	PVQPM	ALIVL	66 <mark>V</mark> AGL	LLL <mark>FI</mark> G	LGIF	FCVR	BHBBB	QAERM	ISQ I K	RLLSE	кктсо	CP <mark>HR</mark> FQ	KTCSP	1*•
GGG_Katie-K_CD4	LNPE	AGMWQCLL	SDSGQVLLI	ESNI <mark>k</mark> vl	PT <mark>W</mark> ST	PVQPM	ALIVLG	G V A G L	LL <mark>F</mark> IG	LGIF	FCVR	BHBBB	QRERM	ISQ I K	RLLSE	KKTCQ	CPHRFQ	KTCSP	*∙
GGG_Kokomo_CD4	LNPE	10MMQCLL	SDSGQVLLI	ESNIKVL	PT <mark>W</mark> ST	PVQPM	ALIVLO	ig <mark>v</mark> agl	LL <mark>F</mark> IG	LGIF	FCVR	RHRRR	Q <mark>aer</mark> m	ISQIK	RLLSE	. <mark>кк</mark> тсо	CPHRFQ	KTCSP	*∙

GGG_Kolo_CD4	LNPEAG <mark>MWQCLLSDSGQVLLESNIK</mark> VLPTWSTPVQPMALIVLGGVAGLLL <mark>F</mark> IGLGIFFCV	RCRHRRRQAERMSQIKRLLSEKKTCQCPHRFQKTCSPI*•
GGG_Kowali_CD4	LNPEAGMWQCLLSDSGQVLLESNI <mark>K</mark> VLPTWSTPVQPMALIVLGGVAGLLL <mark>F</mark> IGLGIFFCV	RCRHRRRQAERMSQIKRLLSEKKTCQCPHRFQKTCSPI*•
GGG_Mimi_CD4	LNPERGMWQCLLSDSGQVLLESNI <mark>K</mark> VLPTWSTPVQPMRLIVLGGVRGLLLFIGLGIFFCV	R <mark>CRHRRRQAER</mark> MSQIKRLLSEKK <mark>TCQCPHRFQ</mark> KTCSPI*•
GGG_Oko_CD4	LNPEAGMWQCLLSDSGQVLLESNI <mark>K</mark> VLPTWSTPVQPMALIVLGGVAGLLL <mark>F</mark> IGLGIFFCV	R <mark>CRHRRRQAER</mark> MSQIKRLLSEKKTCQCPHRFQKTCSPI*•
GGG_Paki_CD4	LNPEAGMWQCLLSDSGQVLLESNI <mark>K</mark> VLPTWSTPVQPMALIVLGGVAGLLLFIGLGIFFCV	RCRHRRRQAERMSQIKRLLSEKKTCQCPHRFQKTCSPI*•
GGG_Porta_CD4	LNPEAGMWQCLLSDSGQVLLESNIKVLPTWSTPVQPMALIVLGGVAGLLLFIGLGIFFCV	RCRHRRRQAERMSQIKRLLSEKKTCQCPHRFQKTCSPI*0
GGG_Sandra_CD4	LNPERGMWQCLLSDSGQVLLESNIK <mark>VLPTWSTPVQPMALIVLGGVAGLLLFIGLGIFFC</mark> V	RCRHRRRQAERMSQIKRLLSEKKTCQCPHRFQKTCSPI*0
GGG_Suzie_CD4	LNPERGMNQCLLSDSGQVLLESNIKVLPTWSTPVQPMRLIVLGGVRGLLLFIGLGIFFCV	RCRHRRRQAERMSQIKRLLSEKKTCQCPHRFQKTCSPI*•
GGG_Tzambo_CD4	LNPERGMWQCLLSDSGQVLLESNIKVLPTWSTPVQPMALIVLGGVAGLLLFIGLGIFFCV	RCRHRRRQAERMSQIKRLLSEKKTCQCPHRFQKTCSPI*•
GGG_Vila_CD4	LNPERGMWQCLLSDSGQVLLESNIKVLPTWSTPVQPMRLIVLGGVRGLLLFIGLGIFFCV	RCRHRRRQAERMSQIKRLLSEKKTCQCPHRFQKTCSPI*•
PA_Babu_CD4	LNPERGMWQCLLSDSGQVLLQSNVQVLPTWPTPVQPMRLIALGGVAGLLLFIGLGIFFCV	RCRHRRRQAERMSQIKRLLSEKKTCQCPHRFQKTCSPI*•
PA_Buschi_CD4	LNPERGMWQCLLSDSGQVLLQSNVQVLPTWPTPVQPMRLIALGGVAGLLLFIGLGIFFCV	RCRHRRRQAERMSQIKRLLSEKKTCQCPHRFQKTCSPI*•
PA_Dunja_CD4	LNPEAGMWQCLLSDSGQVLLQSNVQVLPTWPTPVQPMALIALGGVAGLLLFIGLGIFFCV	RCRHRRRQAERMSQIKRLLSEKKTCQCPHRFQKTCSPI*•
PA_EIsi_CD4	LNPERGMWQCLLSDSGQVLLQSNVQVLPTWPTPVQPMRLIALGGVRGLLLFIGLGIFFCV	RCRHRRRQAERMSQIKRLLSEKKTCQCPHRFQKTCSPI*•
PA_Kiki_CD4	LNPERGMWQCLLSDSGQVLLQSNVQVLPTWPTPVQPMRLIALGGVRGLLLFIGLGIFFCV	RCRHRRRQAERMSQIKRLLSEKKTCQCPHRFQKTCSPI*•
PP_Napoleon_CD4	LNPERGMWQCLLSDSGQVLLQSNVQVLPTWPTPVQPMRLIALGGVRGLLLFIGLGIFFCV	RCRHRRRQAERMSQIKRLLSEKKTCQCPHRFQKTCSPI*•
PP_Nonja_CD4	LNPERGMWQCLLSDSGQVLLQSNVQVLPTWPTPVQPMRLIALGGVAGLLLFIGLGIFFCV	RCRHRRRQAERMSQIKRLLSEKKTCQCPHRFQKTCSPI*•
PP_Sari_CD4	LNPEAGMWQCLLSDSGQVLLQSNVQVLPTWPTPVQPMALIALGGVAGLLLFIGLGIFFCV	RCRHRRRQAERMSQIKRLLSEKKTCQCPHRFQKTCSPI*•
PP_Temmy_CD4	LNPEAGMWQCLLSDSGQVLLQSNVQVLPTWPTPVQPMALIALGGVAGLLLFIGLGIFFCV	RCRHRRRQAERMSQIKRLLSEKKTCQCPHRFQKTCSPI*•
PP_Tilda_CD4	LNPEAGMWQCLLSDSGQVLLQSNVQVLPTWPTPVQPMALIALGGVAGLLLFIGLGIFFCV	RCRHRRRQAERMSQIKRLLSEKKTCQCPHRFQKTCSPI*•
Gibbon ENSNLETCOC	LNPEAGMWOOLLSDSGOVLLESNVKVLPTWPTPVOPMALIVLGGVAGLLLFIGLGIFFCV	RCRHRRRORERMSOIKRLLSEKKTCOCPHRFOKTCSPI*C

APPENDIX C

CD4 D1	Ambiguity Code						Cono		Average			
Species Individual	v	R	м	к	S	w	Size	Heterozygosity	Heterozygosity			
Species_mainauda				Ň	5	•••	0.20		by Sub-Species			
PTV Bosco							288	0.00E+00	0.00E+00			
PTV Clint							288	0.00E+00				
PTV Jimmie							288	0.00E+00				
PTV Koby							288	0.00E+00				
PTE Akwaya-Jean							288	0.00E+00	1.74E-03			
PTE Banyo			1			1	288	6.94E-03				
PTE Basho							288	0.00E+00				
PTE Damian							288	0.00E+00				
PTE Julie_LWC21			1				288	3.47E-03				
PTE Kopongo							288	0.00E+00				
PTE Koto							288	0.00E+00				
PTE Paquita							288	0.00E+00				
PTE Taweh							288	0.00E+00				
PTE Tobi			1			1	288	6.94E-03				
PTT Clara							288	0.00E+00	2.60E-03			
PTT Doris		1					288	3.47E-03				
PTT Julie		1					288	3.47E-03				
PTT Valliant			1				288	3.47E-03				
PTS Andromeda							288	0.00E+00	1.16E-03			
PTS Bwambale							288	0.00E+00				
PTS Harriet							288	0.00E+00				
PTS Kindongo			1			1	288	6.94E-03				
PTS Nakuu							288	0.00E+00				
PTS Vincent							288	0.00E+00				

This appendix contains the heterozygosity analysis and calculation values for all the great apes analyzed in this study for D1 of CD4, CD4 minus D1, and CD4 as a whole.

CD4 D1		Am	bigu	ity (Cod	e	Gono		Average			
Species Individual	Y	R	м	к	s	w	Size	Heterozygosity	Heterozygosity			
opecies_individual	<u> </u>			Ň	Ŭ				by Sub-Species			
Bonobo Bono							288	0.00E+00	0.00E+00			
Bonobo Catherine							288	0.00E+00				
Bonobo Chipita							288	0.00E+00				
Bonobo Desmond							288	0.00E+00				
Bonobo Dzeeta							288	0.00E+00				
Bonobo Hermien							288	0.00E+00				
Bonobo Hortense							288	0.00E+00				
Bonobo Kombote							288	0.00E+00				
Bonobo Kosana							288	0.00E+00				
Bonobo Kumbuka							288	0.00E+00				
Bonobo LB502							288	0.00E+00				
Bonobo Natalie							288	0.00E+00				
Bonobo Salonga							288	0.00E+00				
GBG Kaisi	1	1			1		288	1.04E-02	3.47E-03			
GBG Mkubwa							288	0.00E+00				
GBG Victoria							288	0.00E+00				

CD4 D1		Am	bigu	ity (Cod	e	Gono		Average
Species Individual	v	р	Ν.Λ	V	c	14/	Sizo	Heterozygosity	Heterozygosity
species_individual	Ť	ĸ	IVI	ĸ	3	vv	5120		by Sub-Species
GGG Abe			1	1			288	6.94E-03	4.22E-03
GGG Akiba			1	1			288	6.94E-03	
GGG Amani		1					288	3.47E-03	
GGG Anthal			1	1			288	6.94E-03	
GGG Azizi							288	0.00E+00	
GGG Banjo							288	0.00E+00	
GGG Bulera		1	1	1			288	1.04E-02	
GGG Carolyn			1	1			288	6.94E-03	
GGG Choomba							288	0.00E+00	
GGG Coco		1					288	3.47E-03	
GGG Delphi			1	1			288	6.94E-03	
GGG Dian			1	1			288	6.94E-03	
GGG Dolly							288	0.00E+00	
GGG Helen		1					288	3.47E-03	
GGG Katie B							288	0.00E+00	
GGG Katie K							288	0.00E+00	
GGG Kokomo		1	1	1			288	1.04E-02	
GGG Kolo			1	1			288	6.94E-03	
GGG Kowali		1	1	1			288	1.04E-02	
GGG Mimi							288	0.00E+00	
GGG Oko		1					288	3.47E-03	
GGG Paki			1	1			288	6.94E-03	
GGG Porta							288	0.00E+00	
GGG Sandra							288	0.00E+00	
GGG Suzie		1	1	1			288	1.04E-02	
GGG Tzambo	1	1					288	6.94E-03	
GGG Vila							288	0.00E+00	
PA Babu							288	0.00E+00	0.00E+00
PA Buschi							288	0.00E+00	
PA Dunja							288	0.00E+00	
PA Elsi							288	0.00E+00	
PA Kiki							288	0.00E+00	
PP Napoleon							288	0.00E+00	0.00E+00
PP Nonja							288	0.00E+00	
PP Sari							288	0.00E+00	
PP Temmy							288	0.00E+00	
PP Tila							288	0.00E+00	

CD4-D1		Ar	nbigu	ity C	Code				Average
Species_Individual	Y	R	M K S		S	W	Gene Size	Heterozygosity	Heterozygosity by Sub-Species
PTV Bosco							1377	0.00E+00	3.63E-04
PTV Clint		1					1377	7.26E-04	
PTV Jimmie				1			1377	7.26E-04	
PTV Koby							1377	0.00E+00	
PTE Akwaya-Jean							1377	0.00E+00	2.90E-04
PTE Banyo	1		2				1377	2.18E-03	
PTE Basho							1377	0.00E+00	
PTE Damian							1377	0.00E+00	
PTE Julie_LWC21			1				1377	7.26E-04	
PTE Kopongo							1377	0.00E+00	
PTE Koto							1377	0.00E+00	
PTE Paquita							1377	0.00E+00	
PTE Taweh							1377	0.00E+00	
PTE Tobi							1377	0.00E+00	
PTT Clara	1	2	1				1377	2.90E-03	1.63E-03
PTT Doris				1			1377	7.26E-04	
PTT Julie	1		1				1377	1.45E-03	
PTT Valliant		2					1377	1.45E-03	
PTS Andromeda							1377	0.00E+00	2.42E-04
PTS Bwambale		1					1377	7.26E-04	
PTS Harriet							1377	0.00E+00	
PTS Kindongo		1					1377	7.26E-04	
PTS Nakuu							1377	0.00E+00	
PTS Vincent							1377	0.00E+00	

CD4-D1		Ar	nbigu	ity C	Code				Average
Species_Individual	Y	R	М	к	S	W	Gene Size	Heterozygosity	Heterozygosity by Sub-Species
Bonobo Bono							1377	0.00E+00	5.59E-04
Bonobo Catherine							1377	0.00E+00	
Bonobo Chipita	1						1377	7.26E-04	
Bonobo Desmond							1377	0.00E+00	
Bonobo Dzeeta							1377	0.00E+00	
Bonobo Hermien	2	1					1377	2.18E-03	
Bonobo Hortense	1	1					1377	1.45E-03	
Bonobo Kombote							1377	0.00E+00	
Bonobo Kosana							1377	0.00E+00	
Bonobo Kumbuka							1377	0.00E+00	
Bonobo LB502	1						1377	7.26E-04	
Bonobo Natalie	1	1					1377	1.45E-03	
Bonobo Salonga	1						1377	7.26E-04	
GBG Kaisi							1377	0.00E+00	1.45E-03
GBG Mkubwa	1	2	1	2			1377	4.36E-03]
GBG Victoria							1377	0.00E+00	

CD4-D1 Ambiguity Code Gene Size Heterozygosity Average Species_Individual Y R M K S W Gene Size Heterozygosity Heterozygosity GGG Abe 1 I I I377 0.00E+00 6.22E-04 GGG Amani 1 I I I377 0.00E+00 6.22E-04 GGG Amani 1 I										
Species_Individual Y R M K S W Gene Size Heterozygosity by Sub-Species Heterozygosity by Sub-Species GGG Akiba 1 1 1377 0.00E+00 6.22E-04 GGG Antali 1 1377 7.26E-04 6.22E-04 GGG Anthal 1 1 1377 7.26E-04 GGG Anthal 1 1 1377 7.26E-04 GGG Carolyn 1 1 1377 7.26E-04 GGG Caco 1 1377 7.26E-04 6.22E-04 GGG Caco 1 1377 7.26E-04 6.62 Ce-04 GGG Coco 1 1377 7.26E-04 6.62 Ce-04 GGG Coco 1 1377 7.26E-04 6.62 Ce-04 GGG Coco 1 1377 7.26E-04 6.62 Ce-04 GGG Colphi 1 1377 7.26E-04 6.62 Ce-04 GGG Kate K 1377 0.00E+00 6.66 Kou 1 GGG Kate K 1377 1.45E	CD4-D1		Ar	nbigu	iity (Code				Average
Special information I	Species Individual	v	R	М	к	s	\٨/	Gene Size	Heterozygosity	Heterozygosity
GGG Abe 1377 0.00E+00 6.22E-04 GGG Akiba 1 1377 7.26E-04 6.22E-04 GGG Amani 1 1377 7.26E-04 6.22E-04 GGG Anthal 1 1377 7.26E-04 6.22E-04 GGG Azizi 1377 7.26E-04 6.22E-04 6.22E-04 GGG Anthal 1 1377 7.26E-04 6.22E-04 GGG Carolyn 1 1377 7.26E-04 6.62 Cod GGG Caco 1 1377 7.26E-04 6.62 Cod GGG Coco 1 1377 7.26E-04 6.62 Kate & GGG Katie B 1377 0.00E+00 6.63 Kate & 1377 7.26E-04 GGG Kokomo 1 1377 7.26E-04 6.62 Cod 6.63 Cod 1 1377 7.26E-	Species_individual	•	IN .	141	ĸ	5	vv			by Sub-Species
GGG Aktha 1 1377 7.26E-04 GGG Ammai 1377 0.00E+000 GGG Anthal 1 1377 0.00E+00 GGG Azizi 1377 0.00E+00 GGG Carizi 1377 2.18E-03 GGG Carolyn 1 1377 7.26E-04 GGG Carolyn 1 1377 7.26E-04 GGG Coco 1 1377 0.00E+00 GGG Katie B 1377 0.00E+00 GGG Katie K 1377 0.00E+00 GGG Kokomo 1 1377 7.26E-04 GGG Kokomi 1 1377 7.26E-04 GGG Kokomi 1 1377 7.26E-04 GGG Kokomi 1 1377 7.26E-04	GGG Abe							1377	0.00E+00	6.22E-04
GGG Amani 1377 0.00E+00 GGG Anthal 1 1377 7.26E-04 GGG Azizi 1377 0.00E+00 GGG Banjo 1 2 1377 2.18E-03 GGG Bulera 1 1377 7.26E-04 GGG Caclyn 1 GGG Choomba 1377 7.26E-04 GGG Choomba 1377 7.26E-04 GGG Choomba 1 1377 7.26E-04 GGG Choomba 1 1377 GGG Choomba 1 1377 7.26E-04 GGG Choomba 1 1377 GGG Choomba 1 1377 7.26E-04 GGG Chod 1 1377 GGG Chomba 1 1377 0.00E+00 GGG Katie B 1377 0.00E+00 GGG Katie B 1377 0.00E+00 GGG Katie K 1377 7.26E-04 GGG Kokomo 1 1377 7.26E-04 GGG Kokom 1 1377 GGG Kokomi 1 1377 7.26E-04 GGG Sadra 2 1377	GGG Akiba		1					1377	7.26E-04	
GGG Anthal 1 1377 7.26E-04 GGG Azizi 1377 0.00E+00 GGG Banjo 1 2 1377 2.18E-03 GGG Bulera 1 1377 7.26E-04 GGG Carolyn 1 1377 7.26E-04 GGG Choomba 1 1377 7.26E-04 GGG Coco 1 1377 7.26E-04 GGG Katie B 1377 0.00E+00 GGG Katie B 1377 0.00E+00 GGG Katie B 1377 0.00E+00 GGG Kokomo 1 1377 7.26E-04 GGG Kokomo 1 1377 7.26E-04 GGG Nimi 1 1377 1.45E-03 GGG Paki 1 1377 7.26E-04 GGG Sandra 2 1377 7.26E-04 GGG Sandra 1 1377	GGG Amani							1377	0.00E+00	
GGG Azizi 1377 0.00E+00 GGG Banjo 1 2 1377 2.18E-03 GGG Bulera 1 1377 7.26E-04 GGG Carolyn 1 1377 7.26E-04 GGG Carolyn 1 1377 7.26E-04 GGG Coco 1 1377 7.26E-04 GGG Dian 1 1377 7.26E-04 GGG Dian 1 1377 7.26E-04 GGG Mimi 1 1377 7.26E-04 GGG Katie B 1377 0.00E+00 GGG Katie B 1377 0.00E+00 GGG Katie B 1377 0.00E+00 GGG Kokomo 1 1377 7.26E-04 GGG Kokomo 1 1377 7.26E-04 GGG Koko 1 1377 7.26E-04 GGG Nimi 1 1377 7.26E-04 GGG Paki 1 1377 7.26E-04 GGG Sandra 2 1377 7.26E-04 GGG Suzie 1	GGG Anthal		1					1377	7.26E-04	
GGG Banjo 1 2 1377 2.18E-03 GGG Bulera 1 1377 7.26E-04 GGG Carolyn 1 1377 7.26E-04 GGG Choomba 1377 7.26E-04 GGG Choomba 1377 7.26E-04 GGG Delphi 1 1377 7.26E-04 GGG Dolly 1 1377 7.26E-04 GGG Dolly 1 1377 7.26E-04 GGG Coco 1 1377 0.00E+00 GGG Katie B 1 1377 0.00E+00 GGG Katie K 1 1377 0.00E+00 GGG Kokomo 1 1377 7.26E-04 GGG Kokomo 1 1377 7.26E-04 GGG Kokomo 1 1377 7.26E-04 GGG Porta 1 1377 7.26E-04 GGG Sandra 2 1377 1.45E-03 GGG Suzie 1 1377 7.26E-04 GGG Suzie 1 1377 7.26E-04	GGG Azizi							1377	0.00E+00	
GGG Bulera 1 1377 7.26E-04 GGG Carolyn 1 1377 7.26E-04 GGG Chomba 1377 0.00E+00 GGG Coco 1 1377 7.26E-04 GGG Delphi 1 1377 7.26E-04 GGG Delphi 1 1377 7.26E-04 GGG Coco 1 1377 7.26E-04 GGG Coco 1 1377 0.00E+00 GGG Katie B 1 1377 0.00E+00 GGG Katie B 1377 0.00E+00 GGG Katie B 1377 GGG Kokomo 1 1377 7.26E-04 GGG Katie B GGG Kolo 1 1377 7.26E-04 GGG Katie B GGG Kokomi 1 1377 7.26E-04 GGG Katie B GGG Kowali 1 1377 7.26E-04 GGG Seg GG Coko 1 1377 7.26E-04 GGG Paki 1 1377 7.26E-04 GGG Sandra 2 1377 7.26E-04 GGG Suia <td< td=""><td>GGG Banjo</td><td>1</td><td>2</td><td></td><td></td><td></td><td></td><td>1377</td><td>2.18E-03</td><td></td></td<>	GGG Banjo	1	2					1377	2.18E-03	
GGG Carolyn 1 1377 7.26E-04 GGG Choomba 1377 0.00E+00 GGG Coco 1 1377 7.26E-04 GGG Delphi 1 1377 7.26E-04 GGG Dan 1 1377 7.26E-04 GGG Dan 1 1377 7.26E-04 GGG Coco 1 1377 0.00E+00 GGG Katie B 1 1377 0.00E+00 GGG Katie B 1377 0.00E+00 GGG Koomo 1 1377 0.00E+00 GGG Kokomo 1 1377 0.00E+00 GGG Kokomo 1 1377 7.26E-04 GGG Kowali 1 1377 7.26E-04 GGG Paki 1 1377 7.26E-04 GGG Sandra 2 1377 1.45E-03 GGG Sandra 2 1377 7.26E-04 GGG Sandra 2 1377 7.26E-04 GGG Sandra 1 1377 7.26E-04 GGG Sandra	GGG Bulera	1						1377	7.26E-04	
GGG Choomba 1377 0.00E+00 GGG Coco 1 1377 7.26E-04 GGG Delphi 1 1377 7.26E-04 GGG Dolly 1 1377 7.26E-04 GGG Dolly 1 1377 7.26E-04 GGG Dolly 1 1377 0.00E+00 GGG Katie B 1 1377 0.00E+00 GGG Katie K 1 1377 0.00E+00 GGG Kokomo 1 1377 0.00E+00 GGG Kokomo 1 1377 7.26E-04 GGG Kokomo 1 1377 0.00E+00 GGG Kokomi 1 1377 7.26E-04 GGG Roko 1 1377 7.26E-04 GGG Porta 1 1377 7.26E-04 GGG Suzie 1 1377 7.26E-04 GGG Suzie 1 1377 7.26E-04 GGG Suzie 1 1377 0.00E+00 PA Babu 1 1377 0.26E-04 P	GGG Carolyn	1						1377	7.26E-04	
GGG Coco 1 1377 7.26E-04 GGG Delphi 1 1377 7.26E-04 GGG Dian 1 1377 7.26E-04 GGG Dolly 1377 7.26E-04 GGG Dolly 1377 7.26E-04 GGG Katie B 1377 0.00E+00 GGG Katie K 1377 0.00E+00 GGG Kokomo 1 1377 7.26E-04 GGG Kokomo 1 1377 0.00E+00 GGG Kokomo 1 1377 7.26E-04 GGG Kokomi 1 1377 7.26E-04 GGG Kowali 1 1377 7.26E-04 GGG Nomini 1 1377 7.26E-04 GGG Paki 1 1377 7.26E-04 GGG Suzie 1 1377 0.00E+00 PA Babu 1 1377	GGG Choomba							1377	0.00E+00	
GGG Delphi 1 1377 7.26E-04 GGG Dian 1 1377 7.26E-04 GGG Dolly 1 1377 0.00E+00 GGG Helen 1 1377 0.00E+00 GGG Katie B 1 1377 0.00E+00 GGG Katie K 1377 0.00E+00 GGG Kokomo 1 1377 0.00E+00 GGG Kokomo 1 1377 7.26E-04 GGG Kokomo 1 1377 7.26E-04 GGG Kokomi 1 1377 7.26E-04 GGG Kowali 1 1377 7.26E-04 GGG Paki 1 1377 7.26E-04 GGG Paki 1 1377 7.26E-04 GGG Sandra 2 1377 7.26E-04 GGG Sandra 2 1377 7.26E-04 GGG Vila 1 1377 7.26E-04 GGG Vila 1 1377 0.00E+00 PA Babu 1377 0.00E+00 PA Buschi	GGG Coco		1					1377	7.26E-04	
GGG Dian 1 1377 7.26E-04 GGG Dolly 1377 0.00E+00 GGG Helen 1 1377 0.00E+00 GGG Katie B 1 1377 0.00E+00 GGG Katie K 1 1377 0.00E+00 GGG Katie K 1 1377 0.00E+00 GGG Kokomo 1 1377 7.26E-04 GGG Kowali 1 1377 7.26E-04 GGG Kowali 1 1377 0.00E+00 GGG Kowali 1 1377 0.45E-03 GGG Oko 1 1377 7.26E-04 GGG Paki 1 1377 7.26E-04 GGG Sandra 2 1377 7.26E-04 GGG Suzie 1 1377 7.26E-04 GGG Suzie 1 1377 7.26E-04 GGG Vila 1 1377 0.00E+00 PA Babu 1377 0.00E+00 2.90E-04 PA Buschi 1 1377 0.00E+00 <	GGG Delphi			1				1377	7.26E-04	
GGG Dolly 1377 0.00E+00 GGG Helen 1 1377 7.26E-04 GGG Katie B 1 1377 0.00E+00 GGG Katie K 1 1377 0.00E+00 GGG Kokomo 1 1377 0.00E+00 GGG Kokomo 1 1377 7.26E-04 GGG Kokomi 1 1377 7.26E-04 GGG Kokomi 1 1377 7.26E-04 GGG Kokomi 1 1377 7.26E-04 GGG Oko 1 1377 7.26E-04 GGG Porta 1 1377 7.26E-04 GGG Sandra 2 1377 7.26E-04 GGG Suzie 1 1377 7.26E-04 GGG Suzie 1 1377 7.26E-04 GGG Vila 1 1377 7.26E-04 PA Babu 1377 0.00E+00 2.90E-04 PA Buschi 1 1377 7.26E-04 PA Lisi 1 1377 0.00E+00 <t< td=""><td>GGG Dian</td><td></td><td>1</td><td></td><td></td><td></td><td></td><td>1377</td><td>7.26E-04</td><td></td></t<>	GGG Dian		1					1377	7.26E-04	
GGG Helen 1 1377 7.26E-04 GGG Katie B 1377 0.00E+00 GGG Katie K 1 1377 0.00E+00 GGG Kokomo 1 1377 0.00E+00 GGG Kokomo 1 1377 0.00E+00 GGG Kokomo 1 1377 7.26E-04 GGG Kokomi 1 1377 7.26E-04 GGG Kowali 1 1377 7.26E-04 GGG Koko 1 1377 7.26E-04 GGG Paki 1 1377 7.26E-04 GGG Paki 1 1377 7.26E-04 GGG Sandra 2 1377 7.26E-04 GGG Sandra 2 1377 7.26E-04 GGG Sandra 2 1377 7.26E-04 GGG Sandra 1 1377 7.26E-04 GGG Vila 1 1377 7.26E-04 PA Babu 1 1377 0.00E+00 PA Buschi 1 1377 0.00E+00 P	GGG Dolly							1377	0.00E+00	
GGG Katie B I 1377 0.00E+00 GGG Katie K I 1377 0.00E+00 GGG Kokomo 1 I 1377 0.00E+00 GGG Kokomo 1 I 1377 7.26E-04 GGG Kolo 1 I 1377 7.26E-04 GGG Kowali I I 1377 0.00E+00 GGG Kowali I I 1377 1.45E-03 GGG Oko 1 I 1377 7.26E-04 GGG Paki 1 I 1377 1.45E-03 GGG Porta 1 I 1377 7.26E-04 GGG Sandra 2 I 1377 7.26E-04 GGG Suzie 1 I 1377 7.26E-04 GGG Vila 1 I 1377 2.90E-04 PA Babu I I 1377 2.90E-04 PA Lsi 1 I I 1.45E-04 PA Kiki I I I I </td <td>GGG Helen</td> <td></td> <td>1</td> <td></td> <td></td> <td></td> <td></td> <td>1377</td> <td>7.26E-04</td> <td></td>	GGG Helen		1					1377	7.26E-04	
GGG Katie K I 1377 0.00E+00 GGG Kokomo 1 1377 7.26E-04 GGG Kolo 1 1377 7.26E-04 GGG Kowali 1 1377 7.26E-04 GGG Kowali 1 1377 7.26E-04 GGG Kowali 1 1377 0.00E+00 GGG Kowali 1 1377 1.45E-03 GGG Oko 1 1377 7.26E-04 GGG Paki 1 1377 7.26E-04 GGG Sandra 2 1377 1.45E-03 GGG Suzie 1 1377 7.26E-04 GGG Suzie 1 1377 7.26E-04 GGG Vila 1 1377 7.26E-04 GGG Vila 1 1377 0.00E+00 PA Babu 1 1377 0.00E+00 PA Buschi 1 1377 0.00E+00 PA Kiki 1 1377 0.00E+00 PP Napoleon 1 1377 0.00E+00	GGG Katie B							1377	0.00E+00	
GGG Kokomo 1 1377 7.26E-04 GGG Kolo 1 1377 7.26E-04 GGG Kowali 1 1377 7.26E-04 GGG Kowali 1 1377 0.00E+00 GGG Mimi 1 1377 0.00E+00 GGG Oko 1 1377 1.45E-03 GGG Paki 1 1377 7.26E-04 GGG Sandra 2 1377 1.45E-03 GGG Suzie 1 1377 7.26E-04 GGG Suzie 1 1377 7.26E-04 GGG Vila 1 1377 7.26E-04 GGG Vila 1 1377 7.26E-04 GGG Vila 1 1377 7.26E-04 PA Babu 1377 0.00E+00 2.90E-04 PA Babu 1 1377 7.26E-04 PA Lsi 1 1377 0.00E+00 PA Kiki 1 1377 0.00E+00 PP Naja 1 1377 0.00E+00 <	GGG Katie K							1377	0.00E+00	
GGG Kolo 1 1377 7.26E-04 GGG Kowali 1377 0.00E+00 GGG Mimi 1 1 1377 GGG Oko 1 1377 1.45E-03 GGG Paki 1 1377 7.26E-04 GGG Paki 1 1377 7.26E-04 GGG Porta 1 1377 7.26E-04 GGG Sandra 2 1377 1.45E-03 GGG Suzie 1 1377 7.26E-04 GGG Suzie 1 1377 7.26E-04 GGG Vila 1 1377 7.26E-04 GGG Vila 1 1377 7.26E-04 PA Babu 1377 0.00E+00 2.90E-04 PA Babu 1377 0.00E+00 2.90E-04 PA Bunja 1377 0.00E+00 1.45E-04 PA Kiki 1 1377 0.00E+00 PA Kiki 1 1377 0.00E+00 PP Nonja 1 1377 0.00E+00 PP Temmy </td <td>GGG Kokomo</td> <td></td> <td>1</td> <td></td> <td></td> <td></td> <td></td> <td>1377</td> <td>7.26E-04</td> <td></td>	GGG Kokomo		1					1377	7.26E-04	
GGG Kowali 1 1 1377 0.00E+00 GGG Mimi 1 1 1377 1.45E-03 GGG Oko 1 1377 7.26E-04 GGG Paki 1 1377 1.45E-03 GGG Porta 1 1377 1.45E-03 GGG Soccie 1 1377 7.26E-04 GGG Sucie 1 1377 7.26E-04 GGG Tzambo 1 1377 7.26E-04 GGG Vila 1 1377 7.26E-04 GGG Vila 1 1377 7.26E-04 PA Babu 1377 7.26E-04 PA Babu 1377 0.00E+00 2.90E-04 PA Buschi 1 1377 0.00E+00 PA Lisi 1 1377 0.00E+00 PA Kiki 1 1377 0.00E+00 PP Nonja 1 1377 0.00E+00 PP Nonja 1 1377 0.00E+00 PP Temmy 1377 0.00E+00 1.45E-04	GGG Kolo		1					1377	7.26E-04	
GGG Mimi 1 1 1377 1.45E-03 GGG Oko 1 1377 7.26E-04 GGG Paki 1 1377 1.45E-03 GGG Porta 1 1377 1.45E-03 GGG Sandra 2 1377 1.45E-03 GGG Sandra 2 1377 1.45E-03 GGG Suzie 1 1377 7.26E-04 GGG Vila 1 1377 7.26E-04 GGG Vila 1 1377 7.26E-04 PA Babu 1377 7.26E-04 PA Babu 1377 0.00E+00 2.90E-04 PA Buschi 1 1377 7.26E-04 PA Dunja 1377 0.00E+00 2.90E-04 PA Kiki 1377 0.00E+00 1.45E-04 PP Napoleon 1377 0.00E+00 1.45E-04 PP Nonja 1 1377 0.00E+00 1.45E-04 PP Sari 1 1377 0.00E+00 1.45E-04 PP Temmy 1377 <td>GGG Kowali</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>1377</td> <td>0.00E+00</td> <td></td>	GGG Kowali							1377	0.00E+00	
GGG Oko 1 1377 7.26E-04 GGG Paki 1 1377 1.45E-03 GGG Porta 1 1377 7.26E-04 GGG Sandra 2 1377 1.45E-03 GGG Suzie 1 1377 7.26E-04 GGG Suzie 1 1377 7.26E-04 GGG Tzambo 1 1377 7.26E-04 GGG Vila 1 1377 7.26E-04 PA Babu 1 1377 0.00E+00 PA Buschi 1 1377 7.26E-04 PA Dunja 1 1377 0.00E+00 PA Elsi 1 1377 0.00E+00 PA Kiki 1 1377 0.00E+00 PP Napoleon 1377 0.00E+00 1.45E-04 PP Nonja 1 1377 0.00E+00 PP Napoleon 1377 0.00E+00 1.45E-04 PP Sari 1 1377 0.00E+00 1.45E-04 PP Temmy 1377 0.00E+00	GGG Mimi		1		1			1377	1.45E-03	
GGG Paki 1 1 1377 1.45E-03 GGG Porta 1 1377 7.26E-04 GGG Sandra 2 1377 1.45E-03 GGG Sandra 2 1377 7.26E-04 GGG Suzie 1 1377 7.26E-04 GGG Vila 1 1377 7.26E-04 GGG Vila 1 1377 7.26E-04 PA Babu 1 1377 0.00E+00 PA Buschi 1 1377 7.26E-04 PA Buschi 1 1377 0.00E+00 PA Kiki 1 1377 7.26E-04 PA Llsi 1 1377 0.00E+00 PA Kiki 1 1377 0.00E+00 PP Napoleon 1377 0.00E+00 1.45E-04 PP Nonja 1 1377 0.00E+00 1.45E-04 PP Sari 1 1377 0.00E+00 1.45E-04 PP Temmy 1 1377 0.00E+00 1.45E-04 PP Tila 1377 0.00E+00 1.45E-04 PP Tila 1377	GGG Oko		1					1377	7.26E-04	
GGG Porta 1 1377 7.26E-04 GGG Sandra 2 1377 1.45E-03 GGG Suzie 1 1377 7.26E-04 GGG Tzambo 1 1377 7.26E-04 GGG Vila 1 1377 7.26E-04 GGG Vila 1 1377 7.26E-04 PA Babu 1377 0.00E+00 2.90E-04 PA Buschi 1 1377 7.26E-04 PA Buschi 1 1377 0.00E+00 2.90E-04 PA Llsi 1 1377 0.00E+00 2.90E-04 PA Kiki 1 1377 0.00E+00 1.45E-04 PP Napoleon 1 1377 0.00E+00 1.45E-04 PP Nonja 1 1377 0.00E+00 1.45E-04 PP Sari 1 1377 0.00E+00 1.45E-04 PP Temmy 1377 0.00E+00 1.45E-04 PP Tila 1377 0.00E+00 1.45E-04	GGG Paki	1	1					1377	1.45E-03	
GGG Sandra 2 1377 1.45E-03 GGG Suzie 1 1377 7.26E-04 GGG Tzambo 1 1377 7.26E-04 GGG Vila 1 1377 7.26E-04 PA Babu 1 1377 7.26E-04 PA Babu 1 1377 7.26E-04 PA Babu 1 1377 0.00E+00 2.90E-04 PA Buschi 1 1377 7.26E-04 2.90E-04 PA Buschi 1 1377 0.00E+00 2.90E-04 PA Kiki 1 1377 0.00E+00 1.45E-04 PA Kiki 1 1377 0.00E+00 1.45E-04 PP Napoleon 1377 0.00E+00 1.45E-04 PP Sari 1 1377 0.00E+00 1.45E-04 PP Temmy 1377 0.00E+00 1.45E-04 PP Temmy 1377 0.00E+00 1.45E-04 PP Tila 1377 0.00E+00 1.45E-04	GGG Porta		1					1377	7.26E-04	
GGG Suzie 1 1377 7.26E-04 GGG Tzambo 1 1377 7.26E-04 GGG Vila 1 1377 7.26E-04 PA Babu 1 1377 7.26E-04 PA Babu 1377 0.00E+00 2.90E-04 PA Buschi 1 1377 7.26E-04 PA Buschi 1 1377 0.00E+00 2.90E-04 PA Lisi 1 1377 0.00E+00 1.90E-04 PA Kiki 1 1377 0.00E+00 1.45E-04 PP Napoleon 1377 0.00E+00 1.45E-04 PP Sari 1 1377 0.00E+00 1.45E-04 PP Sari 1 1377 0.00E+00 1.45E-04 PP Temmy 1377 0.00E+00 1.45E-04 PP Temmy 1377 0.00E+00 1.45E-04 PP Tila 1377 0.00E+00 1.45E-04	GGG Sandra		2					1377	1.45E-03	
GGG Tzambo 1 1 1377 7.26E-04 GGG Vila 1 1377 7.26E-04 2.90E-04 PA Babu 1 1377 0.00E+00 2.90E-04 PA Buschi 1 1377 7.26E-04 2.90E-04 PA Buschi 1 1377 7.26E-04 2.90E-04 PA Dunja 1 1377 0.00E+00 2.90E-04 PA Kiki 1 1377 0.00E+00 1.45E-04 PA Kiki 1 1377 0.00E+00 1.45E-04 PP Napoleon 1 1377 0.00E+00 1.45E-04 PP Sari 1 1377 0.00E+00 1.45E-04 PP Temmy 1 1377 0.00E+00 1.45E-04 PP Tila 1377 0.00E+00 1.45E-04	GGG Suzie	1						1377	7.26E-04	
GGG Vila 1 1377 7.26E-04 PA Babu 1377 0.00E+00 2.90E-04 PA Buschi 1 1377 7.26E-04 PA Dunja 1 1377 0.00E+00 PA Elsi 1 1377 0.00E+00 PA Kiki 1 1377 0.00E+00 PA Kiki 1 1377 0.00E+00 PP Napoleon 1377 0.00E+00 1.45E-04 PP Nonja 1 1377 0.00E+00 1.45E-04 PP Sari 1 1377 0.00E+00 1.45E-04 PP Temmy 1 1377 0.00E+00 1.45E-04 PP Tila 1377 0.00E+00 1.45E-04	GGG Tzambo	1						1377	7.26E-04	
PA Babu 1 1377 0.00E+00 2.90E-04 PA Buschi 1 1377 7.26E-04 2.90E-04 PA Dunja 1377 0.00E+00 2.90E-04 PA Elsi 1 1377 0.00E+00 PA Kiki 1 1377 0.00E+00 PP Napoleon 1377 0.00E+00 1.45E-04 PP Nonja 1 1377 0.00E+00 1.45E-04 PP Sari 1 1377 0.00E+00 1.45E-04 PP Temmy 1 1377 0.00E+00 1.45E-04 PP Tila 1377 0.00E+00 1.45E-04	GGG Vila		1					1377	7.26E-04	
PA Buschi 1 1377 7.26E-04 PA Dunja 1377 0.00E+00 PA Elsi 1 1377 7.26E-04 PA Kiki 1 1377 0.00E+00 PA Kiki 1 1377 0.00E+00 PP Napoleon 1377 0.00E+00 1.45E-04 PP Nonja 1 1377 0.00E+00 1.45E-04 PP Sari 1 1377 0.00E+00 1.45E-04 PP Temmy 1377 0.00E+00 1.45E-04 PP Tila 1377 0.00E+00 1.45E-04	PA Babu							1377	0.00E+00	2.90E-04
PA Dunja 1 1377 0.00E+00 PA Elsi 1 1377 7.26E-04 PA Kiki 1377 0.00E+00 PP Napoleon 1377 0.00E+00 PP Nonja 1 1377 0.00E+00 PP Sari 1 1377 0.00E+00 PP Temmy 1377 0.00E+00 1.45E-04 PP Tila 1377 0.00E+00 1.45E-04	PA Buschi		1					1377	7.26E-04	
PA Elsi 1 1377 7.26E-04 PA Kiki 1377 0.00E+00 1377 0.00E+00 PP Napoleon 1377 0.00E+00 1.45E-04 PP Nonja 1 1377 7.26E-04 PP Sari 1377 0.00E+00 1.45E-04 PP Temmy 1377 0.00E+00 1.45E-04 PP Tila 1377 0.00E+00 1.45E-04	PA Dunja							1377	0.00E+00	
PA Kiki 1377 0.00E+00 PP Napoleon 1377 0.00E+00 1.45E-04 PP Nonja 1 1377 7.26E-04 PP Sari 1377 0.00E+00 1.45E-04 PP Temmy 1377 0.00E+00 1.45E-04 PP Tila 1377 0.00E+00 1.45E-04	PA Elsi		1					1377	7.26E-04	
PP Napoleon 1377 0.00E+00 1.45E-04 PP Nonja 1 1377 7.26E-04 PP Sari 1377 0.00E+00 1.45E-04 PP Temmy 1377 0.00E+00 1.45E-04 PP Tila 1377 0.00E+00 1.45E-04 PP Tila 1377 0.00E+00 1.45E-04	PA Kiki							1377	0.00E+00	
PP Nonja 1 1377 7.26E-04 PP Sari 1377 0.00E+00 PP Temmy 1377 0.00E+00 PP Tila 1377 0.00E+00 PP Tila 1377 0.00E+00	PP Napoleon							1377	0.00E+00	1.45E-04
PP Sari 1377 0.00E+00 PP Temmy 1377 0.00E+00 PP Tila 1377 0.00E+00 PP Tila 1377 0.00E+00	PP Nonia	1						1377	7.26E-04	
PP Temmy 1377 0.00E+00 PP Tila 1377 0.00E+00 PP Tila 1377 0.00E+00	PP Sari							1377	0.00E+00	
PP Tila 1377 0.00E+00 PP Tila 1377 0.00E+00	PP Temmy				1			1377	0.00E+00	
PP Tila 1377 0.00E+00	, PP Tila				1	1		1377	0.00E+00	
	PP Tila	1		1				1377	0.00E+00	

CD4	Ambiguity Code						Gene		Average
Species_Individual	Y	R	м	к	S	w	Size	Heterozygosity	Heterozygosity by Sub-Species
PTV Bosco							1377	0.00E+00	3.63E-04
PTV Clint		1					1377	7.26E-04	
PTV Jimmie				1			1377	7.26E-04	
PTV Koby							1377	0.00E+00	
PTE Akwaya-Jean							1377	0.00E+00	6.54E-04
PTE Banyo	1		2			1	1377	2.90E-03	
PTE Basho			1				1377	7.26E-04	
PTE Damian							1377	0.00E+00	
PTE Julie_LWC21			2				1377	1.45E-03	
PTE Kopongo							1377	0.00E+00	
PTE Koto							1377	0.00E+00	
PTE Paquita							1377	0.00E+00	
PTE Taweh							1377	0.00E+00	
PTE Tobi			1			1	1377	1.45E-03	
PTT Clara	1	2	1				1377	2.90E-03	2.18E-03
PTT Doris		1		1			1377	1.45E-03	
PTT Julie	1	1	1				1377	2.18E-03	
PTT Valliant		2	1				1377	2.18E-03	
PTS Andromeda							1377	0.00E+00	4.84E-04
PTS Bwambale		1					1377	7.26E-04	
PTS Harriet							1377	0.00E+00	
PTS Kindongo		1	1			1	1377	2.18E-03	
PTS Nakuu							1377	0.00E+00	
PTS Vincent							1377	0.00E+00	

CD4	Ambiguity Code					e	Gene		Average
Species_Individual	Y	R	м	к	S	w	Size	Heterozygosity	Heterozygosity by Sub-Species
Bonobo Bono							1377	0.00E+00	5.59E-04
Bonobo Catherine							1377	0.00E+00	
Bonobo Chipita	1						1377	7.26E-04	
Bonobo Desmond							1377	0.00E+00	
Bonobo Dzeeta							1377	0.00E+00	
Bonobo Hermien	2	1					1377	2.18E-03	
Bonobo Hortense	1	1					1377	1.45E-03	
Bonobo Kombote							1377	0.00E+00	
Bonobo Kosana							1377	0.00E+00	
Bonobo Kumbuka							1377	0.00E+00	
Bonobo LB502	1						1377	7.26E-04	
Bonobo Natalie	1	1					1377	1.45E-03	
Bonobo Salonga	1						1377	7.26E-04	
GBG Kaisi	1	1			1		1377	2.18E-03	2.18E-03
GBG Mkubwa	1	2	1		2		1377	4.36E-03	
GBG Victoria							1377	0.00E+00	

CD4	Ambiguity Code			e	Cono		Average		
Cracios Individual	v	р	N /	V	c	14/	Sizo	Heterozygosity	Heterozygosity by
species_individual	Ť	ĸ	IVI	ĸ	3	vv	5120		Sub-Species
GGG Abe			1	1			1377	1.45E-03	1.53E-03
GGG Akiba		1	1	1			1377	2.18E-03	
GGG Amani		1					1377	7.26E-04	
GGG Anthal		1	1	1			1377	2.18E-03	
GGG Azizi							1377	0.00E+00	
GGG Banjo	1	1	1				1377	2.18E-03	
GGG Bulera	1	1	1	1			1377	2.90E-03	
GGG Carolyn	1		1	1			1377	2.18E-03	
GGG Choomba							1377	0.00E+00	
GGG Coco		2					1377	1.45E-03	
GGG Delphi			1	1			1377	1.45E-03	
GGG Dian		1	1	1			1377	2.18E-03	
GGG Dolly							1377	0.00E+00	
GGG Helen		2					1377	1.45E-03	
GGG Katie B							1377	0.00E+00	
GGG Katie K							1377	0.00E+00	
GGG Kokomo		2	1	1			1377	2.90E-03	
GGG Kolo		1	1	1			1377	2.18E-03	
GGG Kowali		1	1	1			1377	2.18E-03	
GGG Mimi		1		1			1377	1.45E-03	
GGG Oko		2					1377	1.45E-03	
GGG Paki	1	1	1	1			1377	2.90E-03	
GGG Porta		1					1377	7.26E-04	
GGG Sandra		2					1377	1.45E-03	
GGG Suzie	1	1	1	1			1377	2.90E-03	
GGG Tzambo	2	1					1377	2.18E-03	
GGG Vila		1					1377	7.26E-04	
PA Babu							1377	0.00E+00	2.90E-04
PA Buschi		1					1377	7.26E-04	
PA Dunja							1377	0.00E+00	
PA Elsi		1					1377	7.26E-04	
PA Kiki							1377	0.00E+00	
PP Napoleon							1377	0.00E+00	1.45E-04
PP Nonja	1						1377	7.26E-04	
PP Sari							1377	0.00E+00	
PP Temmy							1377	0.00E+00	
PP Tila							1377	0.00E+00	