

## Supplementary Information

### **MATERIALS AND METHODS**

#### **Cells**

Vero.Dog SLAMtag (VDS) cells were grown in Dulbecco's modified Eagle's medium (Invitrogen, California, USA) supplemented with 5% fetal bovine serum. Tissues were collected between 1993 and 1994 from 4 different species, a lion, 2 hyenas, a bat eared fox and a domestic dog which died of CDV infection (Table 1). Samples were obtained from wild animals in the Serengeti Park in Africa which died due to natural infection. Tissues were taken at post mortem. Further details of these samples are given in reference 7. Viruses were isolated by inoculating homogenised tissue onto VDS cells which gave rise to syncytia formation.

#### **Reverse Transcription-PCR and DNA sequencing**

Total RNA was extracted from infected cells using TRIzol reagent (Invitrogen, California, USA). cDNA synthesis was carried out using oligo-dT primers and the Superscript first strand synthesis kit (Invitrogen, California, USA). PCR was performed using the High Fidelity Taq kit (Invitrogen, California, USA). RT-PCR was carried out on the first passage with a range of primers designed to conserved regions of the H and P genes.

H, P and F gene primer sequences for RT-PCR and sequencing were either previously published (1, 15, 16, 17) or designed for this study. Primer sequences for successful primer sets are given in Table 2. DNA sequencing was performed using a Bigdye 3.1 Terminator Cycle sequencing kit (Applied Biosystems, California USA). Completed PCR products were sent to the Genomics Core Facility, Queens University Belfast for chromatographic preparation.

Despite repeated RNA preparations and RT-PCR reactions with additional primer sets we were unable to obtain the total sequence for viruses except for the earliest isolate Hyena 2. This suggests primer mismatch to sequences in later isolates. For the H gene, contigs corresponding to 2,008 nt for the Hyena 2 starting at the end of the F gene and covering the entire H gene; 939 nt for Hyena 1, 948 nt for the lion, 936 nt for the bat eared fox and 1,704 nt for Duramine vaccine were obtained. For the P gene 419 nt for Hyena1, 1613 nt for Hyena 2, 415 nt for the dog, 378 nt for the bat eared fox and 680 nt for Duramine vaccine were obtained. The PCR products were sequenced (submitted to GenBank) and aligned with all CDV sequences previously published in GenBank.

## **Phylogenetic Analysis**

Nucleotide alignments were made using the [NCBI BLAST programme](#). Unrooted neighbour joining phylogenetic and fast minimum evolution trees were constructed using DNASTAR software (Version 7.1) Megalign package with the CLUSTAL W method.

## Supplementary Figure 1

Alignment of CDV P/V amino acid sequences 1 to 250 for selected viruses. Highlighted residues: Yellow- synapomorphies shared by the Serengeti strains; Magenta- differences between Nikolin et al (ref 30) and isolates reported in the current study; Red consensus; Turquoise- residues associated with disease in wildlife; Green-residues associated with vaccine/attenuated strains

|                                |  |    |
|--------------------------------|--|----|
| Dog (MN335914)                 | -----  | 50 |
| Domestic dog (KJ415358)        | MAEEQAYHVSKGLECLKTLRENPPDIKEIQEVSSIRDHTRNPGQENGTTS | 50 |
| Bat eared fox (MN335913)       | -----  | 50 |
| Bat eared fox (KJ415357)       | MAEEQAYHVSKGLECLKTLRENPPDIKEIQEVSSIRDHTRNPGQENGTTS | 50 |
| Lion1 (MN335916)               | -----  | 50 |
| African Lion (KJ415362)        | MAEEQAYHVSKGLECLKTLRENPPDIKEIQEVSSIRDHTRNPGQENGTTS | 50 |
| Hyena1 (MN335918)              | -----  | 50 |
| Hyena2 (MN335915)              | -----  | 50 |
| Spotted hyena (KU578258)       | MAEEQAYHVSKGLECLKTLRENPPDIKEIQEVSSIRDHTRNPGQENGTTS | 50 |
| African_wild_dog_gi 169218409  | -----  | 50 |
| dog_genbank_gi 4204842 gb U537 | -----  | 50 |
| 007japanese_dog_isolategi 787  | -----  | 50 |
| dog_Japan_gi 163838503 dbj AB2 | -----  | 50 |
| Marten_German_gi 34576254 emb  | -----  | 50 |
| Iberian_lynxes_gi 299931630 gb | -----  | 50 |
| German_dog2_gb AY386315.1      | MAEEQAYHVSKGLECLKALRENPPDLEEQEVSSIRDQTRNPGQENGTAS  | 50 |
| Fox_china_gb HQ540293.1 _1694- | MAEEQAYHVSKGLECLKALRENPSDIEEQEVSSIRDQTRNPGQEDGTAS  | 50 |

Dog\_china\_gb|HQ540292.1|\_1694- MAEEQAYHVSKGLECLKALRENPPDIEEIQEVSSIRDQTRNPGQEDGTAS 50

VaccineX\_gi|158702386|gb|EU072 MAEEQAYHVSKGLECLKALRENPPDIEEIQEVSSIRDQTRNPGQENGTAS 50

CDV\_A75/17\_gb|AF164967.1|\_1801 MAEEQAYHVSKGLECLKALRENPPDIEEIQEVSSIRDQTRNPSQANGTAS 50

Dog\_USA\_gb|EU716337.1|\_1801-33 MAEEQAYHVSKGLECLKALRENPPDIEEIQEVSSIRDQTRNPSQANGTAS 50

Onderstepoort\_gb|AF378705.1|\_1 MAEEQAYHVSKGLECLKALRENPPDIEEIQEVSSLRDQTCNPGQENGTG 50

Rockborn\_gb|AF181446.1| MAEEQAYHVSKGLECLKALRENPPDIEEIQEVSSIRDQTRNPSQANGTAS 50

Recombinant\_Snyder\_Hill GU138403 MAEEQAYHVSKGLECLKALRENPPDIEEIQEVSSIRYQTCNPGQENGTG 50

Racoon\_usa\_gb|AY649446.1|\_1801 MAEEQAYHVSKGLECLKALRENPPDIEEIQEVSSIRDQTRNPSQANGTAS 50

Shuskiy\_mink\_gb|HM063009.1|\_18 MAEEQAYHVSKGLECLKALRENPPDIEEIQEVSSIRYQTCNPGQENGTG 50

Monkey CYN07-dV (AB687720.2) MAEEQAYHVSKGLECLKALRENPPDIEEIQEVSSIRDQTRNPGQENGTAS 50

Phoca/Caspian/2007HM046486 MAEEQAYHVSKGLECLKALRENPPDIEEIQEVSSIRYQTCNPGQENGTG 50

|                                |  |     |
|--------------------------------|--|-----|
| Dog (MN335914)                 | -----  | 100 |
| Domestic dog (KJ415358)        | MQEEEVSQDLDESHEPAEGSNYVGHVLQNNPGCGESNTALVEAEQPAKDD   | 100 |
| Bat eared fox (MN335913)       | -----  | 100 |
| Bat eared fox (KJ415357)       | MQEEEVPQDLDESHEPAEGSNYVGHVLQNNPGCGESNTALVEAEQPAKDD   | 100 |
| Lion1 (MN335916)               | -----  | 100 |
| African Lion (KJ415362)        | MQEEEVSQDLDESHEPAEGSNYVGHVLQNNPGCGESNTALVEAEQPAKDD   | 100 |
| Hyena1 (MN335918)              | -----  | 100 |
| Hyena2 (MN335915)              | =-----   | 100 |
| Spotted hyena (KU578258)       | MQEEEVSQDLDESHEPAEGSNYVGHVLQNRPGCGESNTALVEAEQPAKDD   | 100 |
| African_wild_dog_gi 169218409  | -----  | 100 |
| dog_genbank_gi 4204842 gb U537 | -----  | 100 |
| 007japanese_dog_isolategi 787  | -----  | 100 |
| dog_Japan_gi 163838503 dbj AB2 | -----  | 100 |
| Marten_German_gi 34576254 emb  | -----  | 100 |
| Iberian_lynxes_gi 299931630 gb | -----  | 100 |
| German_dog2_gb AY386315.1      | MQEEEV[S]QDLDESHEPAKGSNYVGHVLQNNPGSGKGNTALVEAEQPPGPG | 100 |
| Fox_china_gb HQ540293.1 _1694- | MQEEEV[S]QDLDESHEPAKGSNYVGHVLQNNPGCGESNTALVEAEQPAKDD | 100 |

|                                  |  |
|----------------------------------|--|
| Dog_china_gb HQ540292.1 _1694-   | MQEEEEV <b>S</b> QDLDESHEPAKGSNYVGHVLQNNPGCGESNTALVEAEQPAKDD 100 |
| Vaccine_X_gi 158702386 gb EU072  | MQEEEEV <b>S</b> QDLDESHEPAKGSNYVGHVLQNNPGCGESNTALVEAEQPAKDD 100 |
| CDV_A75/17_gb AF164967.1 _1801   | MQEEEEV <b>S</b> QDLDESHEPAKGSNYVGHVLQNNPGCGESNTALVEAEQPAKDD 100 |
| Dog_USA_gb EU716337.1 _1801-33   | MQEEEEV <b>S</b> QDLDESHEPAKGSNYVGHVLQNNPGCGESNTALVEAEQPAKDD 100 |
| Onderstepoort_gb AF378705.1 _1   | MQEEEE <b>D</b> SQNLDESHEPTKGSNYVGHVPQNNPGCGERNTALVEAEQPPKED 100 |
| Rockborn_gb AF181446.1           | MQEEEEV <b>S</b> QDLDESHEPAKGSNYVGHVLQNNPGCGESNTALVEAEQPAKDD 100 |
| Recombinant_Snyder_Hill_GU138403 | MQEEEE <b>D</b> SQNLDESHEPTKGSNYVGHVLQNNPGCGESNSALVEAEQLPKED 100 |
| Racoon_usa_gb AY649446.1 _1801   | MQEEEEV <b>S</b> QDLDESHEPAKGSNYVGHVLQNNPGSGESNTALVEAEQPAKDD 100 |
| Shuskiy_mink_gb HM063009.1 _     | MQEEEE <b>D</b> SQNLDESHEPTKGSNYVGHVLQNNPGCGESNSALVEAEQLPKED 100 |
| Monkey_CYN07-dV_(AB687720.2)     | MQEEEEV <b>S</b> QDLDESHEPTKGSNYLGHVLQNNPGCGESNTALVEAEQPAKDD 100 |
| Phoca/Caspian/2007HM046486       | MQEEEE <b>D</b> SQNLDESHEPTKGSNYVGHVLQNNPGCGESNSALVEAEQLPKED 100 |



|                                |  |
|--------------------------------|--|
| Dog (MN335914)                 | -----EFIIADADSLVVPAGAVSNRGFERGESEIDD 150               |
| Domestic dog (KJ415358)        | IQPGPGIRCYHVYDHSGEVVKGIADADSLVVPAGAVSNRGFERGESEIDD 150 |
| Bat eared fox (MN335913)       | -----LRIADADSLVVPAGAVSNRGFERGESEIDD 150                |
| Bat eared fox (KJ415357)       | IQPGPGIRCYVYDHSGEVVKGIADADSLVVPAGAVSNRGFERGESEIDC 150  |
| Lion1 (MN335916)               | -----LLIADADSLVVPASAVSNRGFERGESEIDD 150                |
| African Lion (KJ415362)        | IQPGPGIRCYHVYDHSGEVVKGIADADSLVVPASAVSNRGFERGESEIDD 150 |
| Hyena1 (MN335918)              | -----IKGIADADSLVVPASAVSNRGFERGESEIDD 150               |
| Hyena2 (MN335915)              | IQPGPGIRCYHVYDHSGEVVKGIADADSLVVPASAVSNRGFERGESEIDD 150 |
| Spotted hyena (KU578258)       | IQPGPGIRCYHVYDHSGEVVKGIAGADSLVVPASAVSNRGFERGESEIDD 150 |
| African_wild_dog_gi 169218409  | -----EVKGIADADSLVVPAGAVSNRGFERGESEIDD 150              |
| dog_genbank_gi 4204842 gb U537 | -----EVKGIADADSLVVPAGAVSNRGFERGESEIDD 150              |
| 007japanese_dog_isolategi 787  | -----VYDHSGEVVKGIADADSLVVPAGAVSNRGFERGESEIDD 150       |
| dog_Japan_gi 163838503 dbj AB2 | -----EVKGIADADSLVVPAGAVSNRGFERGESELDD 150              |
| Marten_German_gi 34576254 emb  | -----EVKGIADADSLVVPAGAVSNRGFERGESELDD 150              |
| Iberian_lynxes_gi 299931630 gb | --PGPGIRCYHVYDHSGEVVKGIADADSLVVPAGAVSNRGFERGESELDD 150 |
| German_dog2_gb AY386315.1      | IQPGPGIRCYHVYDHSGEVVKGIADADSLVVPAGAVSNRGFERGESELDD 150 |
| German_dog1_gi 34576244 emb AJ | -----EVKGIADADSLVVPAGAVSNRGFERGESELDD 150              |
| German_red_fox_gi 341626873 gb | -----EVKGIADADSLVVPAGAVSNRGFERGESELDD 150              |
| lynx_Canada_gi 229893628 gb FJ | -----EVKGIADADSLVVPAGAVSNRGFERGESELDD 150              |
| Dog_Hungary_gi 34576246 emb AJ | -----EVKGIADADSLVVPAGAVSNRGFERGESELDD 150              |

|                                  |                        |             |                  |     |
|----------------------------------|------------------------|-------------|------------------|-----|
| dog_Thailand_gi 302128145 dbj    | -----EVKGI             | DADSLVVPAG  | AVSNRGFEREGSLDD  | 150 |
| fox_china_gb HQ540293.1 _1694-   | VQPGPGIRCYHVDHSGEEVKGI | DADSLVVPAG  | AVSNRGFEREGSLDD  | 150 |
| Dog_china_gb HQ540292.1 _1694-   | VQPGPGIRCYHVDHSGEEVKGI | DADSLVVPAG  | AVSNRGFEREGSLDD  | 150 |
| Vaccine_X_gi 158702386 gb EU072  | IQPRPGIRCYHVDHSGEEVKGI | DADSLVVPAG  | AVSNRGFEREGSLDD  | 150 |
| CDV_A75/17_gb AF164967.1 _1801   | IQPGPGIRCYHVDHSGEEVKGI | DADSLVVPAG  | AVSNRGFEREGSLDD  | 150 |
| Dog_USA_gb EU716337.1 _1801-33   | IQPGPGIRCYHVDHSGEEVKGI | KDAGSLVVPAG | AVSNREFFEREGSLDD | 150 |
| raccoon_usa_gb AY649446.1 _1801  | IQPGPGIRCYHVDHSGEEVKGI | DADSLVVPAG  | AVSNRGFEREGSLDD  | 150 |
| Onderstepoort_gb AF378705.1 _1   | IQPGPGIRCDHVDHSGEEVKGI | DADSLVVPAG  | TVGNRGFEREGSLDD  | 150 |
| Duramine                         | IQPGPGIRCDHVDHSGEEVKGI | DADSLVVPAG  | TVGNRGFEREGSLDD  | 150 |
| Rockborn_gb AF181446.1           | IQPGPGIRCDHVDHSGEEVKGI | DADSLVVPAG  | TVGNRGFEREGSLDD  | 150 |
| recombinant_Snyder_Hill GU138403 | IQPGPGIRCYHVDHSGEEVKGI | DADSLVVPAG  | TVGNRGFESGEGSPDD | 150 |
| Shuskiy_mink_gb HM063009.1 _18   | IQPGPGIRCYHVDHSGEEVKGI | DADSLVVPAG  | TVGNRGFESGEGSPDD | 150 |
| seal_Kazakhstan_gb HM046486.1    | IQPGPGIRCYHVDHSGEEVKGI | DADSLVVPAG  | TVGNRGFESGEGSPDD | 150 |
| Monkey CYN07-dV (AB687720.2)     | IQPGPGIRCYHVDHSGEEVKGI | DADSLVVPAG  | AVSNRGFEREGSPDD  | 150 |
| Phoca/Caspian/2007HM046486       | IQPGPGIRCYHVDHSGEEVKGI | DADSLVVPAG  | TVGNRGFESGEGSPDD | 150 |

|                                |  |
|--------------------------------|--|
| Dog (MN335914)                 | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLRTSRNV 200 |
| Domestic dog (KJ415358)        | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLRTSRNV 200 |
| Bat eared_fox (MN335913)       | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLRTSRNV 200 |
| Bat eared fox (KJ415357)       | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLRTSRNV 200 |
| African Lion (KJ415362)        | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLRTSRNV 200 |
| Lion1 (MN335916)               | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLRTSRNV 200 |
| Hyena1 (MN335918)              | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLRTSRNV 200 |
| Hyena2 (MN335915)              | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLRTSRNV 200 |
| Spotted hyena (KU578258)       | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLRTSRNV 200 |
| African_wild_dog_gi 169218409  | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLRTSRNV 200 |
| dog_genbank_gi 4204842 gb U537 | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLRTSRNV 200 |
| 007japanese_dog_isolategi 787  | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLRTSRNV 200 |
| dog_Japan_gi 163838503 dbj AB2 | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLRTSRNV 200 |
| Marten_German_gi 34576254 emb  | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLRTSRNV 200 |
| Iberian_lynxes_gi 299931630 gb | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLKTSRNG 200 |
| German_dog2_gb AY386315.1      | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLKTSRNV 200 |
| German_dog1_gi 34576244 emb AJ | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLKTSRNV 200 |
| German_red_fox_gi 341626873 gb | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLKTSRNV 200 |
| lynx_Canada_gi 229893628 gb FJ | STEDSGEDYSEGNASSNRGYSFGLKPDRAADVSMLEEEELSALLKTSRNV 200 |
| Dog_Hungary_gi 34576246 emb AJ | STEDSGEDYSEGNDSSNWGYSFGLKPDRAADVSMLEEEELSALLKTSRNV 200 |

|                                |   |
|--------------------------------|---|
| dog_Thailand_gi 302128145 dbj  | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLKTSRNV 200  |
| fox_china_gb HQ540293.1 _1694- | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLKTSRNV 200  |
| Dog_china_gb HQ540292.1 _1694- | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLKTSRNV 200  |
| vaccineX_gi 158702386 gb EU072 | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLRTRSRNV 200 |
| CDV_A75/17_gb AF164967.1 _1801 | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLRTRSRNV 200 |
| Dog_USA_gb EU716337.1 _1801-33 | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLKTSRTV 200  |
| racoon_usa_gb AY649446.1 _1801 | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLRTRSRNV 200 |
| Onderstepoort_gb AF378705.1 _1 | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLRTRSRNV 200 |
| Duramine                       | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLRTRSKNV 200 |
| Rockborn_gb AF181446.1         | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLRTRSRNV 200 |
| recombinant_Snyder_Hill_gb GU1 | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLKTSRNV 200  |
| Shuskiy_mink_gb HM063009.1 _18 | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLKTSRNV 200  |
| seal_Kazakhstan_gb HM046486.1  | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLKTSRNV 200  |
| Monkey CYN07-dV (AB687720.2)   | STEDSGEDYSEGNASSNWGYSFGLKPDRAADVSMLEEEELSALLKTSRNV 200  |

|                                |  |
|--------------------------------|--|
| Dog (MN335914)                 | GIQKRDGKTLQFPHNPEGKTDPECGTIKKGTGERLASHGMGIVAGSTSG 250  |
| Domestic dog (KJ415358)        | GIQKRDGKTLQFPHNPEGKTDPECGTIKKGTGERLASHGMGIVAGSTNG 250  |
| Bat_earred_fox (MN335913)      | GIQKRDGKTLQFPHNPEGKTDPECGTIKKGTGERLASHGMGIVAGSTSG 250  |
| Bat eared fox (KJ415357)       | GIQKRDGKTLQFPHNPEGKTDPECGTIKKGTGERLASHGMGIVAGSTNG 250  |
| African Lion (KJ415362)        | GIQKRDGKTLQFPHNPEGKTDPECGTIKKGTGERLASHGMGIVAGSTNG 250  |
| Lion1 (MN335916)               | GIQKRDGKTLQFPHNPEGKTDPECGTIKKGTGKRLASHGMGIVAGSTSG 250  |
| Hyena1 (MN335918)              | GIQKRDGKTLQFPHNPEGKTDPECGTIKKGTGERLASHGMGIVAGSTSG 250  |
| Hyena2 (MN335915)              | ----- 250  |
| Spotted hyena (KU578258)       | GIQKRDGKTLQFPHNPEGKTDPECGTIKKGTGERLASHGMGIVAGSTNG 250  |
| African_wild_dog_gi 169218409  | GIQKRDGKTLQFPHNPEGKTDPECGTIKKGTGERLASHGMGIVAGS--- 250  |
| dog_genbank_gi 4204842 gb U537 | GIQKRDGKTLQFPHNPEGKTDPECGTIKKGTGERLASHGMGIVAGS--- 250  |
| 007japanese_dog_isolategi 787  | GVQKRDGKTLQFPHNPEGKTDPECGSIKKGTGEKSAASHGMGIVAGSTSG 250 |
| dog_Japan_gi 163838503 dbj AB2 | GIQKRDGKTLQFPHNPEGKTDPECGSIKKGTGEKSAASHGMGIVAGST-- 250 |
| Marten_German_gi 34576254 emb  | GIQKRDGRTLQFPHNPEGKTDPECGSIKKGTGERSAASHGMGIVAGS--- 250 |
| Iberian_lynxes_gi 299931630 gb | GIQKRDGKTLQFPHNPEGKTDPGCGSIKKGTGERSAASHGMEIVAGSTNG 250 |
| German_dog2_gb AY386315.1      | GIQKRDGKTLQFPHNPEGKTDPECGSIKKGTGERSAASHGMEIVAGSTNG 250 |
| German_dog1_gi 34576244 emb AJ | GIQKRDGKTLQFPHNPEGKTDPECGSIKKGTGERSAASHGMEIVAGS--- 250 |
| German_red_fox_gi 341626873 gb | GIQKRDGKILQFPHNPEGKTDPECGSIKKGTGERSAASHGMEIVAGS--- 250 |
| lynx_Canada_gi 229893628 gb FJ | GIQKRDGKTLQFPHNPEGKTDPECGSIKKGTGERSAASHGMGIVAGS--- 250 |
| Dog_Hungary_gi 34576246 emb AJ | GIQKRDGKTLQFPHNPEGKTDPECGSIKKGTGERSAASHGTGIVAGS--- 250 |

|                                 |                                      |                 |     |
|---------------------------------|--------------------------------------|-----------------|-----|
| dog_Thailand_gi 302128145 dbj   | GIKKRDGMTLQFPHNPEGKTEDPECGSIKKGTGER  | SASHGMGIVAGS--- | 250 |
| fox_china_gb HQ540293.1 _1694-  | GIKKRDGMTLQFPHNPEGKTEDPECGSIKKGTGER  | SASHGMGIVAGSTNG | 250 |
| Dog_china_gb HQ540292.1 _1694-  | GIKKRDGMTLQFPHNPEGKTEDPECGSIKKGTGER  | SASHGMGIAAGSTNG | 250 |
| vaccineX_gi 158702386 gb EU072  | GIQKRDGKTLQFPHNPEGKTDPECGSIKKGTGER   | SASHGMGIVAGSTNG | 250 |
| CDV_A75/17_gb AF164967.1 _1801  | GIQKRDGKTLQFPFNPEGKTDPECGSIKKGTGER   | SASHGMGIVAGSTNG | 250 |
| Dog_USA_gb EU716337.1 _1801-33  | GIQKRDGKTLQFPHNPEGKTDPGCGSIKKGTGER   | SASHGMGIVAGSTNG | 250 |
| raccoon_usa_gb AY649446.1 _1801 | GTQKRDGKTLQFPHNSESKTDPECGSIKKGTGER   | SASHGTGIVAGSTNG | 250 |
| Hyena2                          | GIQKRDGKTLQFPHNPEGKTDPECGTIKKGTER    | -----           | 250 |
| Onderstepoort_gb AF378705.1 _1  | GIQKRDGKTLQFPHNPEGKTRDPECGSIKKGTEER  | VSHGMGIVAGSTSG  | 250 |
| Duramine                        | GIQKRDGKTLQFPHNPRR                   | -----           | 250 |
| Rockborn_gb AF181446.1          | GIQKRDGKTLQFPHNPEGKTRDPECGSIKKGTEER  | VSHGMGIVAGSTSG  | 250 |
| recombinant_Snyder_Hill_gb GU1  | GIQKRDGKTLQFPHNPEGKTRVPECGSIKKGTEER  | VSHGMGIVAGSTSG  | 250 |
| Shuskiy_mink_gb HM063009.1 _18  | GIQKRDGKTLQFPHNPEGKTRVPECGSIKKGTEER  | VSQGMGIVAGSTSG  | 250 |
| seal_Kazakhstan_gb HM046486.1   | GIQKRDGKTLQFPHNPEGKTRVPECGSIKKGTEER  | VSQGMGIVAGSTSG  | 250 |
| Monkey CYN07-dV (AB687720.2)    | GIKKRDGKTLQFPHNPEGKTEDPECGSIKKGTGERS | SASHGMGIVAGSTNG | 250 |

## Supplementary Figure 2

Alignment of CDV C amino acid sequences. Highlighted residues: yellow, synapomorphies shared by the Serengeti strains; red, consensus sequence; green, differences from the consensus.

|                                 |   |    |
|---------------------------------|---|----|
| Dog_USA_gb EU716337.1 _1801-33  | MSAKGWNASKPSERILLTLRRFKRSAASETKPATQARRMEPQACRKRSL | 50 |
| raccoon_usa_gb AY649446.1 _1801 | MSAKGWNASKPSERILLTLRRFKRSAASETKPATQARRMEPQACRKRSL | 50 |
| CDV_A75/17_gb AF164967.1 _1801  | MSAKGWNASKPSERILLTLRRFKRSAASETKPATQARRMEPQACRKRSL | 50 |
| vaccineX_gi 158702386 gb EU072  | MSVKGWNASKPSERILLTLRRFKRSAASETKPATQAKRMEPQACRKRSL | 50 |
| Rockborn_gb AF181446.1 _43-156  | MSAKGWNASKPSERILLTLRRFKRSAASETKPATQAKRMEPQACRKRSL | 50 |
| Onderstepoort_gb AF378705.1 _1  | MSAKGWNASKPSERILLTLRRFKRSAASETKPATQAKRMEPQACRKRSL | 50 |
| Shuskiy_mink_gb HM063009.1 _18  | MSAKGWNASKPSERILLTLRRFKRSAASDTKPATQAKRMEPQACRKRSL | 50 |
| seal_Kazakhstan_gb HM046486.1   | MSAKGWNASKPSERILLTLRRFKRSAASDTKPATQAKRMEPQACRKRSL | 50 |
| recombinant_Snyder_Hill_gb GU1  | MSAKGWNASKPSERILLTLRRFKRSAASETKPATQAKRMEPQACRKRSL | 50 |
| 007japanease_dog_isolategi 787  | -----   | 50 |
| Vaccine Duramine (MN400967)     | MSARAG-CLKPSERILLTLRRFKRSAASETKPATQAKRMEPQACRKRSL | 50 |
| dog_Japan_gi 163838503 dbj AB2  | -----   | 50 |
| Iberian_lynxes_gi 299931630 gb  | -----   | 50 |
| German_dog1_gi 34576244 emb AJ  | -----   | 50 |
| Marten_German_gi 34576254 emb   | -----   | 50 |
| German_dog2_gb AY386315.1       | MSAKGWNASKPSERILLTLRRFKRSAASETKPATQARRMEPQACRKRSL | 50 |
| lynx_Canada_gi 229893628 gb FJ  | -----   | 50 |
| fox_china_gb HQ540293.1 _1694-  | MSIKGWNASKPSERILLTLRRFKRSVSEIKPATQAKRMEPQACRKRSL  | 50 |
| Dog_china_gb HQ540292.1 _1694-  | MSIKGWNASKPSERILLTLRRFKRSVSEIKPATQAKRMEPQVCRKRSL  | 50 |
| dog_Thailand_gi 302128145 dbj   | -----   | 50 |
| Dog_Hungary_gi 34576246 emb AJ  | -----   | 50 |



|                                |  |    |
|--------------------------------|--|----|
| German_red_fox_gi 341626873 gb | -----  | 50 |
| Dog (MN335914)                 | -----  | 50 |
| Lion 1 (MN335916)              | -----  | 50 |
| Bat_eared_fox (MN335913)       | -----  | 50 |
| Hyena_2 (MN335915)             | -----KPSERILLTLRRFKRSAASEETTPATQVKRMEPQACRKRSL   | 50 |
| Hyena1 (MN335918)              | -----  | 50 |
| African_wild_dog_gi 169218409  | -----  | 50 |
| Monkey CYN-dV (BAM15590.1)     | MSTKGWNASKPSERILLTLRRFKRSVSEIKPATQAKRMEPQACRKRSL | 50 |

|                                 |  |     |
|---------------------------------|--|-----|
| Dog_USA_gb EU716337.1 _1801-33  | RISMNHTSQQKDQTMSAMYSKIIRDVERATLRLWRQSSPLKMTSNQDLEY | 100 |
| raccoon_usa_gb AY649446.1 _1801 | RISMNHTSQQKDQTMSAMYSKIIREVERATLRLWRQSSPLKMTSNQDLEY | 100 |
| CDV_A75/17_gb AF164967.1 _1801  | RISMNHTSQQKDQTMSAMYSKIIRDVERATLRLWRQSSPLKMTSNQDLEY | 100 |
| vaccineX_gi 158702386 gb EU072  | RISMNHTSQQKDQTMSAMYSKIIRDVERATLRLWRQSSPLKMTSNQDLEY | 100 |
| Rockborn_gb AF181446.1 _43-156  | RISMNHTSQQKDQTMSAMYLKIIRDVENAILRLWRRSGPLERTSNQDLEY | 100 |
| Onderstepoort_gb AF378705.1 _1  | RISMNHTSQQKDQTMSAMYPKIIRDVENAILRLWRQSSPLKRTSNQDLEY | 100 |
| Shuskiy_mink_gb HM063009.1 _18  | RISMNHTSQQKDQTMSAMYSKIIRDVEKATLRLWKQSSSLKRTSNQDLEY | 100 |
| seal_Kazakhstan_gb HM046486.1   | RISMNHTSQQKDQTMSAMYSKIIRDVEKATLRLWKQSSSLKRTSNQDLEY | 100 |
| recombinant_Snyder_Hill_gb GU1  | RISMNHTSQQKDQTMSAMYSKIIRDVEKATLRLWKQSSPLKRTSNQDLEY | 100 |
| 007japanese_dog_isolategi 787   | -----  | 100 |
| Vaccine Duramine (MN400967)     | RISMNHTSQQKDQTMSAMYPKIIRDVENAILRLWRQSSPLKRTSNQDLEY | 100 |
| dog_Japan_gi 163838503 dbj AB2  | -----  | 100 |
| Iberian_lynxes_gi 299931630 gb  | -----QDLEY   | 100 |
| German_dog1_gi 34576244 emb AJ  | -----  | 100 |
| Marten_German_gi 34576254 emb   | -----  | 100 |
| German_dog2_gb AY386315.1       | RISMNHTSQQKDQTMSAMYSKIIREVERATLRLWRQSSPLKMSSNQDLEY | 100 |
| lynx_Canada_gi 229893628 gb FJ  | -----  | 100 |
| fox_china_gb HQ540293.1 _1694-  | RISMNHTSQQKDQTMSAMYSKIIRDVERATLRLWRQSSPLKMMSNQDLEY | 100 |
| Dog_china_gb HQ540292.1 _1694-  | RISMNHTSQQKDQTMSAMYSKIIRDVERATLRLWRQSSPPKTMSNQDLEY | 100 |
| dog_Thailand_gi 302128145 dbj   | -----  | 100 |
| Dog_Hungary_gi 34576246 emb AJ  | -----  | 100 |

|                                |   |     |
|--------------------------------|---|-----|
| German_red_fox_gi 341626873 gb | -----   | 100 |
| Dog (MN335914)                 | -----   | 100 |
| Lion 1 (MN335916)              | -----   | 100 |
| Bat_eared_fox (MN335913)       | -----   | 100 |
| hyena_2 (MN335915)             | RISMNHTSQQKDQTSAMYSRIIRDVERATLRLWRQSSPLKMTSNQDLEY   | 100 |
| Hyena1 (MN335918)              | -----   | 100 |
| African_wild_dog_gi 169218409  | -----   | 100 |
| Monkey CYN-dV (BAM15590.1)     | RISMNHTSQQKDQTIISAMYSKIIRDVERATLRLWRQSSPLRMTSNQDLEY | 100 |

|                                 |   |
|---------------------------------|---|
| Dog_USA_gb EU716337.1 _1801-33  | DVIMFMITAVKRLRESKMLAVSWYLQALSVIENSREEKEALMIALRILAK 150  |
| raccoon_usa_gb AY649446.1 _1801 | DVIMFMITAVKRLRESKMLTVSWYLQALSVIEDSREEEREALMIALRILAK 150 |
| CDV_A75/17_gb AF164967.1 _1801  | DVIMFMITAVKRLRESKMLTVSWYLQALSVIEDSREEKEALMIALRILAK 150  |
| vaccineX_gi 158702386 gb EU072  | DVIMFMITAVKRLRESKMLTVSWYLQALSVIEDSREEKEALMIALRILAK 150  |
| Rockborn_gb AF181446.1 _43-156  | DVIMFMITAVKRLRESKMLTVSWSLQALSVIEDSREEKEALMIALRILAK 150  |
| Onderstepoort_gb AF378705.1 _1  | DVIMFMITAVKRLRESKMLTVSWYLQALSVIEDSREEKEALMTALRILAK 150  |
| Shuskiy_mink_gb HM063009.1 _18  | DVIMFMITAVKRLRESKMLTVSWYLQALSVIEDSRAEKEALMIALRILAK 150  |
| seal_Kazakhstan_gb HM046486.1   | DVIMFMITAVKRLRESKMLTVSWYLQALSVIEDSRAEKEALMIALRILAK 150  |
| recombinant_Snyder_Hill_gb GU1  | DVIMFMITAVKRLRESKMLTVSWYLQALSVIEDSRAEKEALMIALRILAK 150  |
| 007japanese_dog_isolategi 787   | ---MFMITAVKRLRESKMLTVSWYLQALSVIEDSREEKEALMIALRILAK 150  |
| Vaccine Duramine (MN400967)     | DVIMFMITAVKRLRESKMLTVSWYLQALSVIEDSREEKEALMIALRILAK 150  |
| dog_Japan_gi 163838503 dbj AB2  | -----KRLRESKMLTVSWYLQALSVIEDSREEKEALMIALRILAK 150       |
| Iberian_lynxes_gi 299931630 gb  | DVIMFMITAVKRLRESKMLTVSWYLQALSVIEDSREEKEALMIALRILAK 150  |
| German_dog1_gi 34576244 emb AJ  | -----KRLRESKMLTVSWYLQALSVIEDSREEKEALMIALRILAK 150       |
| Marten_German_gi 34576254 emb   | -----KRLRESKMLTVSWYLQALSVIEDSREEKEALMIALRILAK 150       |
| German_dog2_gb AY386315.1       | DVIMFMITAVKRLRESKMLTVSWYLQALSVIEDSREEKEALMIALRILAK 150  |
| lynx_Canada_gi 229893628 gb FJ  | -----KRLRESKMLTVSWYLQALSVIEDSREEKEALMIALRILAK 150       |
| fox_china_gb HQ540293.1 _1694-  | DVIMFMITVVKRLRESKMLTVSWYLQALSVIEDSREEKEALMIALRILAK 150  |
| Dog_china_gb HQ540292.1 _1694-  | DVIMFMITVVKRLRESKMLTVSWYLQALSVIEDSREEKEALMIALRILAK 150  |
| dog_Thailand_gi 302128145 dbj   | -----KRLRESKMLTVSWYLQALSVIEDSREEKEALMIALRILAK 150       |
| Dog_Hungary_gi 34576246 emb AJ  | -----KRLRESKMLTVSWYLQALSVIEDSREEKEALMIALRILAK 150       |

|                                |                |   |              |               |               |           |     |
|--------------------------------|----------------|---|--------------|---------------|---------------|-----------|-----|
| German_red_fox_gi 341626873 gb | -----KRLR      | V | S            | MLTVSWYLQALS  | SVIEDSREEKEAL | MIALRILAK | 150 |
| Dog (MN335914)                 | -----SS        | S | MLTVSWYLQALS | SVIEDSREEKEAL | MIALRILAK     | 150       |     |
| Lion 1 (MN335916)              | -----SY        | S | MLTVSWYLQALS | SVIEDSREEKEAL | MIALRILAK     | 150       |     |
| Bat_eared_fox (MN335913)       | -----Y         | S | MLTVSWYLQALS | SVIEDSREEKEAL | MIALRILAK     | 150       |     |
| hyena_2 (MN335915)             | DVIMFMITAVKRLR | S | MLTVSWYLQALS | SVIEDSREEKEAL | MIALRILAK     | 150       |     |
| Hyena1 (MN335918)              | -----LR        | S | MLTVSWYLQALS | SVIEDSREEKEAL | MIALRILAK     | 150       |     |
| African_wild_dog_gi 169218409  | -----KRLR      | S | MLTVSWYLQALS | SVIEDSREEKEAL | MIALRILAK     | 150       |     |
| Monkey CYN-dV (BAM15590.1)     | DVIMFMITVVKRLR | S | MLTVSWYLQALS | SVIEDSREEKEAL | MIALRILAK     | 150       |     |

|                                 |                              |
|---------------------------------|------------------------------|
| Dog_USA_gb EU716337.1 _1801-33  | IIPREMLHLTGDILSALNQTEQLM 174 |
| raccoon_usa_gb AY649446.1 _1801 | IIPREMLHLTGDILSALNQTEQLM 174 |
| CDV_A75/17_gb AF164967.1 _1801  | IIPREMLHLTGDILSALNQTEQLM 174 |
| vaccineX_gi 158702386 gb EU072  | IIPREMLHLTGDILSALNQTEQLM 174 |
| Rockborn_gb AF181446.1 _43-156  | IIPKEMLHLTGDILSALNRTEQLM 174 |
| Onderstepoort_gb AF378705.1 _1  | IIPKEMLHLTGDILSALNRTEQLM 174 |
| Shuskiy_mink_gb HM063009.1 _18  | IIPKEMLHLTGDILSALNQTEQLM 174 |
| seal_Kazakhstan_gb HM046486.1   | IIPKEMLHLTGDILSALNQTEQLM 174 |
| recombinant_Snyder_Hill_gb GU1  | IIPKEMLHLTGDILSALNQTEQLM 174 |
| 007japanese_dog_isolategi 787   | IIPKEMLHLTGDILSALNQTEQPM 174 |
| Vaccine_Duramine (MN400967)     | IIPKEMLHLTGDILSALNRTEQLM 174 |
| dog_Japan_gi 163838503 dbj AB2  | IIPKEMLHLTGDILSALNQTEQPM 174 |
| Iberian_lynxes_gi 299931630 gb  | IIPREMLHLTGDILSALNQTEQLM 174 |
| German_dog1_gi 34576244 emb AJ  | IIPREMLHLTGDILSALNQTEQLM 174 |
| Marten_German_gi 34576254 emb   | IIPREMLHLTGDILSALNQTEQLT 174 |
| German_dog2_gb AY386315.1       | IIPREMLHLTGDILSALNQTEQLM 174 |
| lynx_Canada_gi 229893628 gb FJ  | IIPREMLHLTGDILSALNQTEQLM 174 |
| fox_china_gb HQ540293.1 _1694-  | IIPREMLHLTGDILSALNQTERLM 174 |
| Dog_china_gb HQ540292.1 _1694-  | IIPREMLHLTGDILSALNQTERLM 174 |
| dog_Thailand_gi 302128145 dbj   | IIPREMLHLTGDILSALNQTERLM 174 |
| Dog_Hungary_gi 34576246 emb AJ  | IIPREMIHLTGDILSALNQTEQLM 174 |

|                                |                              |
|--------------------------------|------------------------------|
| German_red_fox_gi 341626873 gb | IIPREMLHLTGDILSALNQTQLM 174  |
| Dog (MN335914)                 | IIPREMLHLTGDILSVLNQTQLM 174  |
| Lion 1 (MN335916)              | IIPREMLHLTGDILSVLNQTQLM 174  |
| Bat_eared_fox (MN335913)       | IIPREMLHLTGDILSVLNQTQLM 174  |
| hyena_2 (MN335915)             | IIPREMLHLTGDILSVLNQTQLM 174  |
| Hyena1 (MN335918)              | IIPREMLHLTGDILSVSNQTQLM 174  |
| African_wild_dog_gi 169218409  | IIPREMLHLTGDILSVLNQTQLM 174  |
| Monkey CYN-dV (BAM15590.1)     | IIPREMLHLTGDILSALNQTERLM 174 |

### **Supplementary Figure 3 H Sequence Alignment**

Alignment of CDV H amino acid sequences. Highlighted residues: yellow, synapomorphies shared by the Serengeti strains; red, consensus sequence; magenta, differences from the consensus; turquoise specific to monkey virus. Substitutions in PDV have not been highlighted. Boxes indicate: red, residues critical for SLAM binding; blue, residue critical for Nectin-4 binding; green, site suggested by McCarthy et al.[56] to be associated with spread to non-canine host.



|                                |   |
|--------------------------------|---|
| Rockborn-Candurgb GU266280.1 _ | MLSYQDKVGAFYKDNARANSSKLSLVTEEQGRRPPYLLFVLLILLVGIM 50  |
| Lesser_panda_gi 5870827 gb AAD | MLSYQDKVGAFYKDNARANSSKLSLVTEEQGRRPPYLLFVLLILLVGIM 50  |
| Vanguard_vaccine_gi 239949423  | MLSYQDKVGAFYKDNARANSSKLSLVTEEQGRRPPYLLFVLLILLVGIM 50  |
| Vacc-P_gi 224579344 gb FJ70523 | MLSYQDKVGAFYKDNARANSSKLSLVTEEQGRRPPYLLFVLLILLVGIM 50  |
| Dog_argentina_gi 134801370 emb | ----- 50  |
| German_dog_gi 693948 emb X8500 | MLSYQDKVGAFYKDNARANSSKLSLVTEEQGRRPPYLLFVLLILLVGIM 50  |
| African Lion (JN812975)        | MLSHQDKVGAFYKDNARANSSKLSLMTEERGDRRPPYLLFVLLILLVGIL 50 |
| Lion1 (MN335911)               | -----   |
| Hyena2 (MN335910)              | MLSHQDKVGAFYKDNARANSSKLSLMTEERGDRRPPYLLFVLLILLVGIL 50 |
| Spotted Hyena (KJ415364)       | ----- 50  |
| Bat_Eared_Fox (MN335908)       | -----DNARANSSKLSLMTEERGDRRPPYLLFVLLILLVGIL 50         |
| Bat Eared fox (KC916716)       | MLSHQDKVGAFYKDNARANSSKLSLMTEERGDRRPPYLLFVLLILLVGIL 50 |
| DOG_H.2_1 (MN335909)           | ----- 50  |
| Domestic dog (JN812976)        | MLSHQDKVGAFYKDNARANSSKLSLMTEERGDRRPPYLLFVLLILLVGIL 50 |
| Hyena1 (MN335912)              | ----- 50  |
| Monkey (CYN07-dV(AB687720.2)   | MLSYQDKVGAFYKDNARANSSKLSLVTEEQGRRPPYLLFVLLILLIGIL 50  |
| A75/17 (AF164967.1)            | MLSYQDKVSAFYKDNARANSSKLSLVTEEQGRRPPYLLFVLLILLVGIM 50  |
| Dog_ChinaB_gi 212656655 gb ACJ | MLSYQDKVGAFYKDNARANSSKLSLVTEEQGRRPPYLLFVLLILLIGIL 50  |
| German_ferret_gi 693949 emb X8 | MLSYQDKVGAFYKDNARANSSKLSLVTEEQGRRPPYLLFVLLILLVGIM 50  |
| South_African_dog_gi 239949465 | MLSYQDKVGAFYKDNARANSSKLSLVTEEQGIRPPYLLFVLLILLVGV 50   |
| Dog_South_Africa_c_gi 23994946 | MLSYQDKVGAFYKDNARANSSKLSLVTEEQGIRPPYLLFVLLILLVGV 50   |
| Japanease_dogstrain_007Lmgi 78 | MLSYQDKVGAFYKDNARANSSKLSLVTEEQGRRPPYLLFVLLILLVGIL 50  |

|                                |  |
|--------------------------------|--|
| Onderstepoort_gb AF378705.1    | MLSYQDKVGAFYKDNARANSTKLSLVTEEHGRRPPYLLFVLLILLVGIL 50 |
| Convac_vaccine_gi 517242 emb Z | MLSYQDKAGAFYKDNARANSTKLSLVTEEHGRRPPYLLFVLLVLLVGIL 50 |
| Phoca/Caspian/2007/HM046486    | MLSYQDKVGAFYKDNARANSKLSPVTEEHGRRPPYLLFVLLILLVGIL 50  |
| PDV/ USA/ 2006/HQ007902.1      | MFSHQDKVGAFYKNNARANSKLSLVTDEVEERRSPWFLSILLILLVGIL 50 |

|                                |  |     |
|--------------------------------|--|-----|
| Rockborn-Candurgb GU266280.1 _ | ALLAITGVRFHQVSTSNMEFSRLLKEDMEKSEAVHHQVIDVLTPLFKIIG | 100 |
| Lesser_panda_gi 5870827 gb AAD | ALLAITGVRFHQVSTSNMEFSRLLKENMEKSEAVHHQVIDVLTPLFKIIG | 100 |
| Vanguard_vaccine_gi 239949423  | ALLAITGVRFHQVSTSNMEFSRLLKEDMEKSEAVHHQVIDVLTPLFKIIG | 100 |
| Vacc-P_gi 224579344 gb FJ70523 | ALLAITGVRFHQVSTSNMEFSRLLKEDMEKSEAVHHQVIDVLTPLFKIIG | 100 |
| Dog_argentina_gi 134801370 emb | -----  | 100 |
| German_dog_gi 693948 emb X8500 | TLLAITGVRFHQVSTSNMEFSRLLKEDMEKSEAVHHQVIDVLTPLFKIIG | 100 |
| African Lion (JN812975)        | ALLAITGVRFHQVSTSNMEFSRLLKEDMEKSEAVHHQVIDVLTPLFKIIG | 100 |
| Lion1 (MN335911)               | -----  | 100 |
| hyena2 (MN335910)              | ALLAITGVRFHQVSTSNMEFSRLLKEDMEKSEAVHHQVIDVLTPLFKIIG | 100 |
| Spotted Hyena (KJ415364)       | -----  | 100 |
| Bat_Eared_Fox (MN335908)       | ALLAITGVRFHQVSTSNMEFSRLLKEDMEKSEAVHHQVIDVLTPLFKIIG | 100 |
| Bat Eared fox (KC916716)       | ALLAITGVRFHQVSTSNMEFSRLLKEDMEKSEAVHHQVIDVLTPLFKIIG | 100 |
| DOG_H.2_1 (MN335909)           | -----  | 100 |
| Domestic dog (JN812976)        | ALLAITGVRFHQVSTSNMEFSRLLKEDMEKSEAVHHQVIDVLTPLFKIIG | 100 |
| hyena1 (MN335912)              | -----  | 100 |
| Monkey(CYN07-dV(AB687720.2)    | ALLAITGVRFHQVSTSNMEFSRLLKEDMEKSEAVHHQVIDVLTPLFKIIG | 100 |
| A75/17 (AF164967.1)            | ALLAITGVRFHQVSTSNMEFSRLLKEDMEKSEAVHHQVIDVLTPLFKIIG | 100 |
| Dog_ChinaB_gi 212656655 gb ACJ | ALLAITGVRFHQVSTSNMEFSRLLKEDMEKSEAVHHQVIDVLTPLFKIIG | 100 |
| German_ferret_gi 693949 emb X8 | ALLAITGVRFHQVSTSNMEFSRLLKEDMDRSEAVHHQVIDVLTPLFKIIG | 100 |
| south_african_dog_gi 239949465 | ALLAITGVRFHQVSTSNMEFSRLLKEDMEKSEAVHHQVIDVLTPLFKIIG | 100 |
| Dog_South_Africa_c_gi 23994946 | ALLAITGVRFHQVSTSNMEFSRLLKEDMEKSEAVHHQVIDVLTPLFKIIG | 100 |
| Japanease_dogstrain_007Lmgi 78 | ALLAIAGVRFQVSTSNVEFGRLKDDLEKSEAVHHQVMDVLTPLFKIIG   | 100 |

|                                |  |
|--------------------------------|--|
| Onderstepoort_gb AF378705.1    | ALLAITGVRFHQVSTSNMEFSRLLKEDMEKSEAVHHQVIDVLTPLFKIIG 100 |
| Convac_vaccine_gi 517242 emb Z | ALLAITGVRFHQVSTSNMEFSRLLKEDMEKSEAVHHQVIDVLTPLFKIIG 100 |
| Phoca/Caspian/2007/HM046486    | ALLAITGVRFHQVSTSNMEFSRLLKEDMEKSEAVHHQVIDVLTPLFKIIG 100 |
| PDV/ USA/ 2006/HQ007902.1      | ILLAITGIRFHQVVKSLEFNKLLIEDMEKTEAVHHQVKDVLTPFKIIG 100   |

|                                |   |     |
|--------------------------------|---|-----|
| Rockborn-Candurgb GU266280.1 _ | DEIGLRLPQKLNEIKQFILQKTNFFNP NREFDFRDLHWCINPPSKIKVNL | 150 |
| lesser_panda_gi 5870827 gb AAD | DEIGSRLPQKLNEIKQFILQKTNFFNP NREFDFRDLHWCINPPSKIKVNL | 150 |
| Vanguard_vaccine_gi 239949423  | DEIGLRLPQKLNEIKQFILQKTNFFNP NREFDFRDLHWCINPPSKIKVNL | 150 |
| Vacc-P_gi 224579344 gb FJ70523 | DEIGLRLPQKLNEIKQFILQKTNFFNP NREFDFRDLHWCINPPSKIKVNL | 150 |
| Dog_argentina_gi 134801370 emb | -----   | 150 |
| German_dog_gi 693948 emb X8500 | DEVGLRLPQKLNEIKQFILQKTNFFNP NREFDFRDLHWCINPPSKIKVNF | 150 |
| African Lion (JN812975)        | DEIGLRLPQKLNEIKQFILQKTNFFNP NREFDFRDLHWCINPPSKIKVNF | 150 |
| Lion 1 (MN335911)              | -----   | 150 |
| Hyena 2 (MN335910)             | DEIGLRLPQKLNEIKQFILQKTNFFNP NREFDFRDLHWCINPPSKIKVNF | 150 |
| Spotted Hyena (KJ415364)       | -----   | 150 |
| Bat_Eared_Fox (MN335908)       | DEIGLRLPQKLNEIKQFILQKTNFFNP NREFDFRDLHWCINPPSKIKVNF | 150 |
| Bat Eared fox (KC916716)       | DEIGLRLPQKLNEIKQFILQKTNFFNP NREFDFRDLHWCINPPSKIKVNF | 150 |
| DOG_H.2_1 (MN335909)           | -----   | 150 |
| Domestic dog (JN812976)        | DEIGLRLPQKLNEIKQFILQKTNFFNP NREFDFRDLHWCINPPSKIKVNF | 150 |
| Hyena1 (MN335912)              | -----   | 150 |
| Monkey (CYN07-dV(AB687720.2)   | DEIGLRLPQKLNEIKQFILQKTNFFNP NREFDFRDLHWCINPPSKIKVNF | 150 |
| A75/17 (AF164967.1)            | DEIGLRLPQKLNEIKQFILQKTNFFNP NREFDFRDLHWCINPPSKIKVNF | 150 |
| Dog_ChinaB_gi 212656655 gb ACJ | DEIGLRLPQKLNEIKQFILQKTNFFNP NREFDFRDLHWCINPPSKIKVNF | 150 |
| German_ferret_gi 693949 emb X8 | DEIGLRLPQKLNEIKQFILQKTNFFNP NREFDFRDLHWCINPPSKIKVNF | 150 |
| south_african_dog_gi 239949465 | DEIGLRLPQKLNEIKQFILQKTNFFNP SREFDFRDLHWCINPPSKIKVNF | 150 |
| Dog_South_Africa_c_gi 23994946 | DEIGLRLPQKLNEIKQFILQKTNFFNP SREFDFRDLHWCINPPSKIKVNF | 150 |

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|--------------------------------|--|-----|
| Japanese_dogstrain_007Imgi 78  | DEIGLRLPQKLNEIKQFILQKTNFFNP NREFDFRDLHWCINPPSKIKVNF    | 150 |
| Onderstepoort_gb AF378705.1    | DEIGLRLPQKLNEIKQFILQKTNFFNP NREFDFRDLHWCINPPSKVKVNF    | 150 |
| Convac_vaccine_gi 517242 emb Z | DEIGSRLPQKLNEIKQFILQKTNFFNP NREFDFRDLHWCINPPSKVKVNF    | 150 |
| Phoca/Caspian/2007/HM046486    | DEIGLRLPQKLNEIKQFILQKTNFFNP NREFDFRDLHWCINPPSKVKVNF    | 150 |
| PDV/ USA/ 2006/HQ007902.1      | DEVGLRLPQKLNEIKQFIVQKTNFFNP NREFDFRELHWCINPPSKVKVNF    | 150 |
| Rockborn-Candurgb GU266280.1 _ | TNYCDTIGLRKSIASAANPILLSALS SRGRGDI FPPYRCSGATT SVGRFFP | 200 |
| lesser_panda_gi 5870827 gb AAD | TNYCDTIGLRKSIASAANPILLSALS SRGRGDI FPPYRCSGATT SVGRFFP | 200 |
| Vanguard_vaccine_gi 239949423  | TNYCDTIGLRKSIASAANPILLSALS SRGRGDI FPPYRCSGATT SVGRFFP | 200 |
| Vacc-P_gi 224579344 gb FJ70523 | TNYCDTIGLRKSIASAANPILLSALS SRGRGDI FPPYRCSGATT SVGRFFP | 200 |
| Dog_argentina_gi 134801370 emb | -----  | 200 |
| German_dog_gi 693948 emb X8500 | TNYCDTIGIKKSIASAANPILLSALS GGRGDI FPPYRCSGATT SVGRVFP  | 200 |
| African Lion (JN812975)        | TNYCDTIGIKKSIASAANPILLSALS GGRGDI FPPYRCSGATT SVGRVFP  | 200 |
| Lion 1 (MN335911)              | -----  | 200 |
| hyena2 (MN335910)              | TNYCDTIGIKKSIASAANPILLSALS GGRGDI FPPYRCSGATT SVGRVFP  | 200 |
| Spotted Hyena (KJ415364)       | -----  | 200 |
| Bat_Eared_Fox (MN335908)       | TNYCDTIGIRKSIASAANPILLSALS GDRGDI FPPYRCSGATT SVGRVFP  | 200 |
| Bat Eared Fox (KC916716)       | TNYCDTIGIRKSIASAANPILLSALS GDRGDI FPPYRCSGATT SVGRVFP  | 200 |
| DOG_H.2_1 (MN335909)           | -----  | 200 |
| Domestic dog (JN812976)        | TNYCDTIGIRKSIASAANPILLSALS GDRGDI FPPYRCSGATT SVGRVFP  | 200 |
| hyena1 (MN335912)              | -----  | 200 |
| Monkey (CYN07-dV (AB687720.2)  | TNYCDTVGVKSIASAANPI ILSALS GARGDI FPPYRCSGATT SVGRVFP  | 200 |
| A75/17 (AF164967.1)            | TNYCDTIGIRKSIASAANPILLSALS GGRGDI FPPYRCSGATT SVGRVFP  | 200 |

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| Dog_ChinaB_gi 212656655 gb ACJ | TNYCDTVGVKKSIIASAANPILLSALSARGDIFPPYRCGATTSVGRVFP 200  |
| German_ferret_gi 693949 emb X8 | TNYCDTIGIRKSIASAANPILLSALSEGRGDIFPPYRCGATTSVGRVFP 200  |
| south_African_dog_gi 239949465 | TSYCDTIGIKKSIASAAPILLSALSGGRGDIFPPYRCGATTSMGRVFP 200   |
| Dog_South_Africa_c_gi 23994946 | TSYCDTVGIRKSIALAAKPILLSALSAGKGDIFPPYRCGATTSIGRVFP 200  |
| Japanease_dogstrain_007Lmgi 78 | TNYCDAIGVRKSIASAANPILLSALSGGRGDIFPPYRCGATTSVGRVFP 200  |
| Onderstepoort_gb AF378705.1    | TNYCESIGIRKAIASAANPILLSALSGGRSDIFPPHRCGATTSVGKVFP 200  |
| Convac_vaccine_gi 517242 emb Z | TNYCESIGIRKAIASAANPILLSALPGGRSDIFPPHRCGATTSVGKVFP 200  |
| Phoca/Caspian/2007/HM046486    | TNYCETIGIRKSIASAANPILLSALSGGRSDIFPPYRCRGATTSVGKVFP 200 |
| PDV/ USA/ 2006/HQ007902.1      | TQYCEITEFKEAIRSVANSILLTLTYRGRDDIFPPYKCRGATTSMGNVFS 200 |

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| Rockborn-Candurgb GU266280.1 _ | LSVSLSMSLISRTSEIINMLTAISDGVYGKTYLLVPDYIEGEFDTQKIRV | 250 |
| lesser_panda_gi 5870827 gb AAD | LSVSLSMSLISRTSEIINMLTAISDGVYGKTYLLVPDYIEGEFDTQKIRV | 250 |
| Vanguard_vaccine_gi 239949423  | LSVSLSMSLISRTSEIINMLTAISDGVYGKTYLLVPDYIEGEFDTQKIRV | 250 |
| Vacc-P_gi 224579344 gb FJ70523 | LSVSLSMSLISRTSEIINMLTAISDGVYGKTYLLVPDYIEGEFDTQKIRV | 250 |
| Dog_argentina_gi 134801370 emb | -----  | 250 |
| German_dog_gi 693948 emb X8500 | LSVSLSMSLISRTSEIINMLTAISDGVYGKTYLLVPDYIEGEFDTQKIRV | 250 |
| African Lion (JN812975)        | LSVSLSMSLISRTAEIINMLTAISDGVYGKTYLLVPDYIEGEFDTQKIRV | 250 |
| Lion 1 (MN335911)              | -----  | 250 |
| Hyena 2 (MN335910)             | LSVSLSMSLISRTAEIINMLTAISDGVYGKTYLLVPDYIEGEFDTQKIRV | 250 |
| Spotted Hyena (KJ415364)       | -----  | 250 |
| Bat_Eared_Fox (MN335908)       | LSVSLSMSLISRTAEIINMLTAISDGVYGKTYLLVPDYIEGEFDTQKIRV | 250 |
| Bat Eared Fox (KC916716)       | LSVSLSMSLISRTAEIINMLTAISDGVYGKTYLLVPDYIEGEFDTQKIRV | 250 |
| DOG_H.2_1 (MN335909)           | -----  | 250 |
| Domestic dog (JN812976)        | LSVSLSMSLISRTAEIINMLTAISDGVYGKTYLLVPDYIEGEFDTQKIRV | 250 |
| Hyena1 (MN335912)              | -----  | 250 |
| Monkey (CYN07-dV (AB687720.2)  | LSVSLSMSLISRTSEIINMLTAISDGVYGKTYLLVPDYIEGEFDSQKIRV | 250 |
| A75/17 (AF164967.1)            | LSVSLSMSLISRTSEIINMLTAISDGVYGKTYLLVPDYIEGGFDTQKIRV | 250 |
| Dog_ChinaB_gi 212656655 gb ACJ | LSVSLSMSLISRTSEIINMLTAISDGVYGKTYLLVPDYIEGEFDSQKIRV | 250 |
| German_ferret_gi 693949 emb X8 | LSVSLSMSLISRTSEIINMLTAISDGVYGKTYLLVPDYIEGEFDTQKIRV | 250 |
| south_african_dog_gi 239949465 | LSVSLSMSLISRTSEIINMLTAISDGVYGKTYLLVPDYIEGEFDTQKIRV | 250 |
| Dog_South_Africa_c_gi 23994946 | LSVSLSMSLISRTSEIINMLTAVSDGVYGKTYLLVPDYIEGEFDTQKIRV | 250 |
| Japanease_dogstrain_007Lmgi 78 | LSVSLSMSLISRTSEIINMLTAISDGVYGKTYLLVPDYIEREFDTQKIRV | 250 |



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| Onderstepoort_gb AF378705.1    | LSVSLSMSLISRTSEIINMLTAISDGVYGKTYLLVPDDIEREFDTQEIRV 250  |
| Convac_vaccine_gi 517242 emb Z | LSVSLSMSLISRTSEIINMLTAISDGVYGKTYLLAPDDIEREFDTQEIRV 250  |
| Phoca/Caspian/2007/HM046486    | LSVSLSMSLISRTSEIINMLTATS DGVYGKTYLLVPDDIEREFDTQEIRV 250 |
| PDV/ USA/ 2006/HQ007902.1      | LAVSLSMSLISKPSEVITMLTAISEGIYGKTYLLVTDDTEENFETPEIRV 250  |

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| Rockborn-Candurgb GU266280.1 _ | FEIGFIKRWLNDMPLLQTTNYMVLPE | NSKAKVCTIAVGELTLASLCVDES | 300 |
| lesser_panda_gi 5870827 gb AAD | FEIGFIKRWLNDMPSLQTTNYMVLPE | NSKAKVCTIAVGELTLASLCVDES | 300 |
| Vanguard_vaccine_gi 239949423  | FEIGFIKRWLNDMPLLQTTNYMVLPE | NSKAKVCTIAVGELTLASLCVDES | 300 |
| Vacc-P_gi 224579344 gb FJ70523 | FEIGFIKRWLNDMPLLQTTNYMVLPE | NSKAKVCTIAVGELTLASLCVDES | 300 |
| Dog_argentina_gi 134801370 emb | -----                      |                          | 300 |
| German_dog_gi 693948 emb X8500 | FEIGFIKRWLNNMPLLQTTNYMVLPE | NSKAKVCTIAVGELTLASLCVDES | 300 |
| African Lion (JN812975)        | FEIGFIKRWLNNMPLLQTTNYMVLPE | NSKAKVCTIAVGELTLASLCVDES | 300 |
| Lion 1 (MN335911)              | -----                      |                          | 300 |
| Hyena 2 (MN335910)             | FEIGFIKRWLNNMPLLQTTNYMVLPE | NSKAKVCTIAVGELTLASLCVDES | 300 |
| Spotted Hyena (KJ415364)       | -----                      |                          | 300 |
| Bat_Eared_Fox (MN335908)       | FEIGFIKRWLNNMPLLQTFNYMVLPE | NSKAKVCTIAVGELTLAFLCVDES | 300 |
| Bat Eared Fox (KC916716)       | FEIGFIKRWLNNMPLLQTTNYMVLPE | NSKAKVCTIAVGELTLASLCVDS  | 300 |
| DOG_H.2_1 (MN335909)           | -----                      |                          | 300 |
| Domestic dog (JN812976)        | FEIGFIKRWLNNMPLLQTTNYMVLPE | NSKAKVCTIAVGELTLASLCVDES | 300 |
| hyena1 (MN335912)              | -----                      |                          | 300 |
| Monkey(CYN07-dV(AB687720.2)    | FEIGFIKRWLNDMPLLQTTNYMVLPT | SKAKVCTIAVGELTLASLCVDES  | 300 |
| A75/17 (AF164967.1)            | FEIGFIKRWLNDMPLLQTTNYMVLPE | NSKAKVCTIAVGELTLASLCVDES | 300 |
| Dog_ChinaB_gi 212656655 gb ACJ | FEIGFIKRWLNDMPLLQTTNYMVLPE | TSKAKVCTIAVGELTLASLCVDES | 300 |
| German_ferret_gi 693949 emb X8 | FEIGFIKRWLNDMPLLQTTNYMVLPE | NSKAKVCTIAVGELTLASLCVDES | 300 |
| south_african_dog_gi 239949465 | FEIGFIKRWLNDMPLLQTTNYMVLPE | NSKAKVCTIAVDWVTLASLCVDDS | 300 |
| Dog_South_Africa_c_gi 23994946 | FEIGFIKRWLNDMPLLQTTNYMVLPE | NSKAKVCTIAVGELTLASLCVGES | 300 |
| Japanease_dogstrain_007Lmgi 78 | FEIGFIKRWLNDMPLLQTTNYMVLPE | NSKAKVCTIAVGELTLASLCVDES | 300 |

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| Onderstepoort_gb AF378705.1    | FEIGFIKRWLNDMPLLQTTNYMVLPENSKAKVCTIAVGELTLASLCVEES | 300 |
| Convac_vaccine_gi 517242 emb Z | FEIGFIKRWLNDMPSLQTTNYMVLPENSKAKVCTIAVGELTLASLCVEES | 300 |
| Phoca/Caspian/2007/HM046486    | FEIGFIKRWLNDMPLLQTTNYMVLPENSKAKVCTIAVGELTLASLCVEES | 300 |
| PDV/ USA/ 2006/HQ007902.1      | FEIGFINRWLGDMPLFQTTNYRIISDNSNTKICTIAVGELALASLCTKES | 300 |

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| Rockborn-Candurgb GU266280.1 _ | TVLLYHDSNGSQDGILVVTLGIFGATMDQVEEVIPVAHPSVEKIHITNH 350 |
| lesser_panda_gi 5870827 gb AAD | TVLLYHDSNGSQDGILVVTLGIFGATMDQVEEVIPVAHPSVEKIHITNH 350 |
| Vanguard_vaccine_gi 239949423  | TVLLYHDSNGSQDGILVVTLGIFGATMDQVEEVIPVAHPSVEKIHITNH 350 |
| Vacc-P_gi 224579344 gb FJ70523 | TVLLYHDSNGSQDGILVVTLGIFGATMDQVEEVILVAHPSVEKIHITNH 350 |
| Dog_argentina_gi 134801370 emb | ----YHDSNGSQDGILVVTLGIFGATMDQVEEVIPVAHPSVEKIHITNH 350 |
| German_dog_gi 693948 emb X8500 | TVLLYHDSNGSQDGILVVTLGIFGATMDQVEEVIPVAHPSVEKIHITNH 350 |
| African Lion (JN812975)        | TVLLSHDSNGSQDGILVVTLGIFGATMDQVEEVIPVAHPSVEKIHITNH 350 |
| Lion 1 (MN335911)              | -----HSDGSQDGILVVTLGIFGATMDQVEEVIPVAHPSVEKIHITNH 350  |
| Hyena 2 (MN335910)             | TVLLSHDSNGSQDGILVVTLGIFGATMDQVEEVIPVAHPSVEKIHITNH 350 |
| Spotted Hyena (KJ415364)       | ----- 350   |
| Bat_Eared_Fox (MN335908)       | TVLLLLMKHGSQDGILVVTLGIFGATMDQVEEVIPVAHPSVEKIHITNH 350 |
| Bat Eared Fox (KC916716)       | TVLLSHDSNGSQDGILVVTLGIFGATMDQVEEVIPVAHPSVEKIHITNH 350 |
| DOG_H.2_1 (MN335909)           | --TMHLMKHGSQDGILVVTLGIFGATMDQVEEVIPVAHPSVEKIHITNH 350 |
| Domestic dog (JN812976)        | TVLLSHDSNGSQDGILVVTLGIFGATMDQVEEVIPVAHPSVEKIHITNH 350 |
| Hyena1 (MN335912)              | -----DGSPDGILVLTGIFGATMDQVEEVIPVAHPSVEKIHITNH 350     |
| Monkey (CYN07-dV (AB687720.2)  | TVLLYHDSNGSQNGILVVTLGIFGATMDQVEEVIPVAHPSVERIHITNH 350 |
| A75/17 (AF164967.1)            | TVLLYHDSNGSQDGILVVTLGIFGATMDQVEEVIPVAHPSVEKIHITNH 350 |
| Dog_ChinaB_gi 212656655 gb ACJ | TVLLYHDSNGSQDGILVVTLGIFGATMDQVEEVIPIAHPSVERIHITNH 350 |
| German_ferret_gi 693949 emb X8 | TVLLYHDSNGSQDGILVVTLGIFGATMDQVEEVVPAHSSVEKIHITNH 350  |
| south_african_dog_gi 239949465 | TVLLYHDSNGSQGSILVVTLGIFGATMDQVEEVIPIAHPSVEKIHITNH 350 |
| Dog_South_Africa_c_gi 23994946 | TVLLYHDSNGSQDGILVVTLGIFGATMDQVEEVIPVAHPSVEKIHITNH 350 |
| Japanease_dogstrain_007Lmgi 78 | TVLLYHDSNGSQDSILVVTLGIFGATMNQVEEVIPVAHPSVERIHITNH 350 |

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| Onderstepoort_gb AF378705.1    | TVLLYH[REDACTED]SSGSQDGILVVTLGIFWAT[REDACTED]MDHIEEVIPVAHPSMEKIHITNH 350 |
| Convac_vaccine_gi 517242 emb Z | TVLLYH[REDACTED]SSGSQDGILVVTLGIFGTT[REDACTED]MDHIEEVIPVAHPSMEKIHITNH 350 |
| Phoca/Caspian/2007/HM046486    | TVLLYH[REDACTED]SRGSQDGILVVTLGIFGAT[REDACTED]MDHIEEVIPVAHPSMEKIHITNH 350 |
| PDV/ USA/ 2006/HQ007902.1      | TILLNLGDEESQNSVLVVILGLFGATHMDQLEEVIPVAHPSIEKIHITNH 350                   |

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| Rockborn-Candurgb GU266280.1 _ | RGFIKDSIATWMPALVSEKQEEQKNCLESACQRKSYPMCQNQTSWEPFVG 400  |
| lesser_panda_gi 5870827 gb AAD | RGFIKDSIATWMPALVSEKQEEQKNCLESACQRKSYPMCQNQTSWEPFVG 400  |
| Vanguard_vaccine_gi 239949423  | RGFIKDSIATWMPALVSEKQEEQKNCLESACQRKSYPMCQNQTSWEPFVG 400  |
| Vacc-P_gi 224579344 gb FJ70523 | RGFIKDSIATWMPALVSEKQEEQKNCLESACQRKSYPMCQNQTSWEPFVG 400  |
| Dog_argentina_gi 134801370 emb | RGFIKDSKAIWMPALVSEKQEEQKNCLESACQRKTYPMCQNQTSWEPFVG 400  |
| German_dog_gi 693948 emb X8500 | RGFIKDSIATWMPALVSEKQEEQKNCLESACQRKTYPMCQNQTSWEPFVG 400  |
| African Lion (JN812975)        | RGFIKDSIATWMPALASEKQEEQKNCLESACQRKSYPMCQNQTSWEPFVG 400  |
| Lion 1 (MN335911)              | RGFIKDSIATWMPALASEKQEEQKNCLESACQRKSYPMCQNQTSWEPFVG 400  |
| Hyena 2 (MN335910)             | RGFIKDSIATWMPALASEKQEEQKNCLESACQRKSYPMCQNQTSWEPFVG 400  |
| Spotted Hyena (KJ415364)       | ----- 400   |
| Bat_Eared_Fox (MN335908)       | RGFIKDSIATWMPALASEKQEEQKNCLESACQRKSYPMCQNQTSWEPFVG 400  |
| Bat Eared Fox (KC916716)       | RGFIKDSIATWMPALASEKQEEQKNCLESACQRKSYPMCQNQTSWEPFVG 400  |
| DOG_H.2_1 (MN335909)           | RGFIKDSIATWMPALASEKQEEQKNCLESACQRKSYPMCQNQTSWEPFVG 400  |
| Domestic dog (JN812976)        | RGFIKDSIATWMPALASEKQEEQKNCLESACQRKSYPMCQNQTSWEPFVG 400  |
| Hyena 1 (MN335912)             | RGFIKDSISTWMPALASEKQEEQKNCLESACQRKSYPMCQNQTSWEPFVG 400  |
| Monkey (CYN07-dV(AB687720.2)   | RGFIKDSIVTWMVPALVSEKQEEQKNCLESACQRKSYPMCNRQTSWEPFVG 400 |
| A75/17 (AF164967.1)            | RGFIKDSIATWMPALVSEKQEEQKNCLESACQRKSYPMCQNQTSWEPFVG 400  |
| Dog_ChinaB_gi 212656655 gb ACJ | RGFIKDSIVTWMVPVLVSEKQEEQKNCLESACHRKSYPMCQNQTSWEPFVG 400 |
| German_ferret_gi 693949 emb X8 | RGFIKDSIATWMPALVSEKQEEQKNCLESACQRKSYPMCQNQTSWEPFVG 400  |
| south_african_dog_gi 239949465 | RGFIKDSIATWMPALVSEKQEEQKNCLESACQRKSYPMCQNQTSWEPFVG 400  |
| Dog_South_Africa_c_gi 23994946 | RGFIKDSIATWMPALVSEKQEEQKNCLESACQRKSYPMCQNQTSWEPFVG 400  |

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| Japanese_dogstrain_007Lmgi 78  | RGFIKDSVATWMVPALVSEQQEGQKNCLESACQRKSYPMCNQTSWEPFGG 400 |
| Onderstepoort_gb AF378705.1    | RGFIKDSIATWMVPALASEKQEEQKGCLESACQRKTYPMCNQTSWEPFGG 400 |
| Convac_vaccine_gi 517242 emb Z | RGFIKDSIATWMVPALASEKQEEQKGCLESACQRKPYPMCNQTSWEPFGG 400 |
| Phoca/Caspian/2007/HM046486    | RGFIKDSIATWMVPALASEKQEEQKGRLESACQRKTYPMCNQTSWEPFGG 400 |
| PDV/ USA/ 2006/HQ007902.1      | RGFIKDSVATWMVPALALSEQGEQINCLRSACKRRTYPMCNQTSWEPFDD 400 |

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| Rockborn-Candurgb GU266280.1 _ | GQLPSYGRLTLPLDPSIDLQLNISFTYGPVILNGDGMYYESPLLD SGWL 450  |
| lesser_panda_gi 5870827 gb AAD | GQLPSYGRLTLPLDPSIDLQLNISFTYGPVILNGDGMYYESPLLD SGWL 450  |
| Vanguard_vaccine_gi 239949423  | GQLPSYGRLTLPLDPSIDLQLNISFTYGPVILNGDGMYYESPLLD SGWL 450  |
| Vacc-P_gi 224579344 gb FJ70523 | GQLPSYGRLTLPLDPSIDLQLNISFTYGPVILNGDGMYYESPLLD SGWL 450  |
| Dog_argentina_gi 134801370 emb | GQLPSYGRLTLPLDPSIDLQLNISFTYGPVILNGDGMYYESPLLD SGWL 450  |
| German_dog_gi 693948 emb X8500 | GQLPSYGRLTLPLDPSIDLQLNISFTYGPVILNGDGMYYESPLSD SGWL 450  |
| African Lion (JN812975)        | RQLPSYGRLTLPIDPSIDLQLNMSFTYGPVILNGDGMYYDSPLLD SGWL 450  |
| Lion 1 (MN335911)              | RQLPSYGRLTLPIDPSIDLQLNISFTYGPVILNGDGMYYDSPLLD SGWL 450  |
| Hyena 2 (MN335910)             | RQLPSYGRLTLPIDPSIDLQLNISFTYGPVILNGDGMYYDSPLLD SGWL 450  |
| Spotted Hyena (KJ415364)       | ----- 450   |
| Bat_Eared_Fox (MN335908)       | RQLPSYGRLTLPIDPSIDLQLNISFTYGPVILNGDGMYYDSPLLD SGWL 450  |
| Bat Eared Fox (KC916716)       | RQLPSYGRLTLPIDPSIDLQLNISFTYGPVILNGDGMYYDSPLLD SGWL 450  |
| DOG_H.2_1 (MN335909)           | RQLPSYGRLTLPIDPSIDLQLNISFTYGPVILNGDGMYYDSPLLD SGWL 450  |
| Domestic dog (JN812976)        | RQLPSYGRLTLPIDPSIDLQLNISFTYGPVILNGDGMYYDSPLLD SGWL 450  |
| Hyena 1 (MN335912)             | RQLPSYGRLTLPIDPSIDLQLNISFTYGPVILNGDGMYYESPLLD SGWL 450  |
| Monkey(CYN07-dV(AB687720.2)    | GQLPSYGRLTLPLDPSIDLQLNISFTYGPVILNGYGMYYESPLLD SGWL 450  |
| A75/17 (AF164967.1)            | GQLPSYGRLTLPLDPSIDLQLNISFTYGPVILNGDGMYYESPLLD SGWL 450  |
| Dog_ChinaB_gi 212656655 gb ACJ | GQLPSYGRLTLPLDPSIDLQLNISFTYGPVILNGDGMYYESPLLD SGWL 450  |
| German_ferret_gi 693949 emb X8 | GQLPSYGRLILPLDPSIDLQLNISFTYGPVILNGDGMYYESPLLD SGWL 450  |
| south_african_dog_gi 239949465 | GQLPSYGRLTLPLDASIDLQLNISFTYGPVILNGDGMYYESPLLD SGWL 450  |
| Dog_South_Africa_c_gi 23994946 | GQLPSYGRLTLPLDASIDLQLNISFTYGPVILNGEGMDYYESPLLE SGWL 450 |



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| Japanese_dogstrain_007 mg 78   | VQLPSYGRLTLPLDASIDLQLNISFTYGPVILNGDGMYYENPLLD SGWL 450 |
| Onderstepoort_gb AF378705.1    | RQLPSYGRLTLPLDASVDLQLNISFTYGPVILNGDGMYYESPLLNSGWL 450  |
| Convac_vaccine_gi 517242 emb Z | RQLPSYGRLTLPLDASVDLQLNISFTYGPVILNGDGMYYESPLLNSGWL 450  |
| Phoca/Caspian/2007/HM046486    | GQLPSYGRLTLPLDASVDLQLNISFTYGPVILNGDGMYYESPLLNSGWL 450  |
| PDV/ USA/ 2006/HQ007902.1      | KRLPSYGRLTSLDVSTDLSINVSVAQGPIILNGDGMYYEGTLLNSGWL 450   |



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| Rockborn-Candurgb GU266280.1 _ | TIPPKNGTVLGLINKASRGDQFTVIPHVLTTFAPRESSGNCYLPIQTFQIM 500 |
| lesser_panda_gi 5870827 gb AAD | TIPPKNGTVLGLINKASRGDQFTVIPHVLTTFAPRESSGNCYLPIQTFQIM 500 |
| Vanguard_vaccine_gi 239949423  | TIPPKNGTVLGLINKASRGDQFTVIPHVLTTFAPRESSGNCYLPIQTFQIM 500 |
| Vacc-P_gi 224579344 gb FJ70523 | TIPPKNGTVLGLINKASRGDQFTVIPHVLTTFAPRESSGNCYLPIQTFQIM 500 |
| Dog_argentina_gi 134801370 emb | TIPPKNGTVLGLINKASRGDQFTVIPHVLTTFAPRESSGNCYLPIQTSQIM 500 |
| German_dog_gi 693948 emb X8500 | TIPPRNGTVLGLINKASRGDQFTVIPHVLTTFAPRESSGNCYLPIQTSQIM 500 |
| African Lion (JN812975)        | TIPPKNGTVLGLINKASRGDQFTVIPHVLTTFAPRESSGNCYLPIQTSQIM 500 |
| Lion 1 (MN335911)              | TIPPKNGTVLGLINKASRGDQFTVIPHVLTTFAPRESSGNCYLPIQTSQIM 500 |
| Hyena 2 (MN335910)             | TIPPKNGTVLGLINKASRGDQFTVIPHVLTTFAPRESSGNCYLPIQTSQIM 500 |
| Spotted Hyena (KJ415364)       | -----GNCYLPIQTSQIM 500                                  |
| Bat_Eared_Fox (MN335908)       | TIPPKNGTVLGLINKASRGDQFTVIPHVLTTFAPRESSGNCYLPIQTSQIM 500 |
| Bat Eared fox (KC916716)       | TIPPKNGTVLGLINKASRGDQFTVIPHVLTTFAPRESSGNCYLPIQTSQIM 500 |
| DOG_H.2_1 (MN335909)           | TIPPKNGTVLGLINKASRGDQFTVIPHVLTTFAPRESSGKCYLPIQTSQIM 500 |
| Domestic dog (JN812976)        | TIPPKNGTVLGLINKASRGDQFTVIPHVLTTFAPRESSGKCYLPIQTSQIM 500 |
| Hyena 1 (MN335912)             | TIPPKNGTVLGLINKASRGDQFTVIPHVLTTFAPRESSGNCYLPIQTSQIM 500 |
| Monkey (CYN07-dV (AB687720.2)  | TIPPKNGTVLGLINKASRGDQFTVTPHVLTTFAPRESSGNCYLPIQTSQIM 500 |
| A75/17 (AF164967.1)            | TIPPKNGTVLGLINKASRGDQFTVIPHVLTTFAPRESSGNCYLPIQTSQIM 500 |
| Dog_ChinaB_gi 212656655 gb ACJ | TIPPKNGTVLGLINKASRGDQFTVTPHVLTTFAPRESSGNCYLPIQTSQIM 500 |
| German_ferret_gi 693949 emb X8 | TIPPRNGTILGMINKASRGDQFTVTPHVLTTFAPRESSGNCYLPIQTSQIM 500 |
| south_african_dog_gi 239949465 | TIPPKNGTILGLINKASRGDQFTVIPHVLTTFSPRESSGSCYLPIQTSQIM 500 |
| Dog_South_Africa_c_gi 23994946 | TIPPKNGTILGLINKASRGDQFTVIPHVLTTFAPRGSSGSCYLPIQTSQIM 500 |
| Japanese_dogstrain_007Lmgi 78  | TIPPKNGTILGLINKASRGDQFTVTPHVLTTFAPRESSGNCYLPIQTSQIM 500 |

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| Onderstepoort_gb AF378705.1    | TIPPKNGTIVGLINKAGRGDQFTVLPVLTTFAPWESSGNCYLPIQTSQII 500  |
| Convac_vaccine_gi 517242 emb Z | TIPPKNGTILGLINKAGRGDQFTVIPHVLTTFAPMESSGNCYLPIQTSQII 500 |
| Phoca/Caspian/2007/HM046486    | TIPPKNGTILGLINKASRGDQFTVIPQVLTTFAPRESCGNCYLPIQTSQII 500 |
| PDV/ USA/ 2006/HQ007902.1      | TIPPKNGTILGLINQASKGDQFIVTPHILTFAPRESNTDCHLPIQTSQIQ 500  |

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| Rockborn-Candurgb GU266280.1 _ | DKDVLTESNLVVLPTQNFRIYVIATYDISFDDHAIVYYVYDPIRTISFTY?  | 550 |
| lesser_panda_gi 5870827 gb AAD | DKDVLTESNLVVLPTQNFRIYVIATYDISFDDHAIVYYVYDPIRTISFTY?  | 550 |
| Vanguard_vaccine_gi 239949423  | DKDVLTESNLVVLPTQKFRYVIATYDISFDDHAIVYYVYDPIRKISFTY?   | 550 |
| Vacc-P_gi 224579344 gb FJ70523 | DKDVLTESNLVVLPTQNFRIYVIAYKIDISFDDHAIVYYVYDPIRKISFTY? | 550 |
| Dog_argentina_gi 134801370 emb | DKDVLAEESNLVVLPTQNFRIYVIATYDISFDDHAIVYYVYDPIRTISYTY? | 550 |
| German_dog_gi 693948 emb X8500 | DKDVLTESNLVVLPTQNFRIYVIATYDISFGDHAIVYYVYDPIRTISYTY?  | 550 |
| African Lion (JN812975)        | DKDVLTESNLVVLPTQNFRIYVIATYDVSFDDHAIVYYVYDPIRTISYTH?  | 550 |
| Lion 1 (MN335911)              | DKDVLTESNLVVLPTQNFRIYVIATYDVSFDDHAIVYYVYDPIRTISYTH?  | 550 |
| Hyena 2 (MN335910)             | DKDVLTESNLVVLPTQNFRIYVIATYDVSFDDHAIVYYVYDPIRTISYTH?  | 550 |
| Spotted Hyena (KJ415364)       | DKDVLTESNLVVLPTQNFRIYVIATYDVSFDDHAIVYYVYDPIRTISYTH?  |     |
| Bat_Eared_Fox (MN335908)       | DKDVLTESNLVVLPTQNFRIYVIATYDVSFDDHAIVYYVYDPIRTISYTY?  | 550 |
| Bat Eared Fox (KC916716)       | DKDVLTESNLVVLPTQNFRIYVIATYDVSFDDHAIVYYVYDPIRTISYTH?  | 550 |
| DOG_H.2_1 (MN335909)           | DKDVLTESNLVVLPTQNFRIYVIATYDVSFDDHAIVYYVYDPIRTISYTY?  | 550 |
| Domestic dog (JN812976)        | DKDVLTESNLVVLPTQNFRIYVIATYGVSFDDHAIVYYVYDPIRAISYTY?  | 550 |
| Hyena 1 (MN335912)             | DKDVLTESNLVVLPTQNFRIYVIATYDISFGDHAIVYYVYDPIRAISYTY?  | 550 |
| Monkey (CYN07-dV (AB687720.2)  | DKDVLTESNLVVLPTQNFRIYVIATYDISFGDHAIVYYVYDPIRTISYTY?  | 550 |
| A75/17 (AF164967.1)            | DKDVLTESNLVVLPTQNFRIYVIATYDISFGDHAIVYYVYDPIRAISYTY?  | 550 |
| Dog_ChinaB_gi 212656655 gb ACJ | DKDVLTESNLVVLPTQNFRIYVIATYDISFGDHAIVYYVYDPIRTISYTY?  | 550 |
| German_ferret_gi 693949 emb X8 | DKDVLIESNLVVLPTQNFRIYVIATYDISFDDHAIVYYVYDPIRTISYMY?  | 550 |
| south_african_dog_gi 239949465 | DKDVLTESNLVVLPTQNFRIYVVATYDISFDDHAIVYYVYDPIRTISYTY?  | 550 |
| Dog_South_Africa_c_gi 23994946 | DKDVLTESNLVVLPTQNFRIYVVATYDISFDDHAIVYYVYDPIRTISYTY?  | 550 |
| Japanease_dogstrain_007Lmgi 78 | DKDVLTESNLVVLPTQNFRIYVVATYDISRENHAIVYYVYDPIRTISYTY?  | 550 |

Onderstepoort\_gb|AF378705.1|

DRDVLIESNIVVLPTQSFYVIATYDIERSDHAIVYYVYDPIRTISYTHP 550

Convac\_vaccine\_gi|517242|emb|Z

DRDVLIESNLVVLPTQSFYVIATYDIERSDHAIVYYVYDPIRTISYTHP 550

Phoca/Caspian/2007/HM046486

DRDVLIESNVVLPTQSFYVIATYDIERNHAIVYYVYDPIRTISYTHP 550

PDV/ USA/ 2006/HQ007902.1

DDVLLESNLVVLPTQSFYVIVATYDIERSDHAIVYYVYDPAITVSYTHP 550

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| Rockborn-Candurgb GU266280.1 _ | FRLTTKGRPDFLRIECFVWDDDLWCHQFYRFEADITNFTTSVENLVRIRF   | 600 |
| lesser_panda_gi 5870827 gb AAD | FQLTTKGRPDFLRIECFVWDDDLWCHQFYRFEADITNFTTSVENLVRIRF   | 600 |
| Vanguard_vaccine_gi 239949423  | FRLTTKGRPDFLRIECFVWDDDLWCHQFYRFEADITDSTTSVENLVRIRF   | 600 |
| Vacc-P_gi 224579344 gb FJ70523 | FRLTTKGRPDFLRIECFVWDDDLWCHQFYRFEADITNFTTSVENLVRIRF   | 600 |
| Dog_argentina_gi 134801370 emb | FRLTTKGRPDFLRIECFVWDDDLWCHQFYRFEADITNSTTTSIED-----   | 600 |
| German_dog_gi 693948 emb X8500 | FRLTTKGRPDFLRIECFVWDDDLWCHQFYRFEADITNSTTTSVENLVRIRF  | 600 |
| African Lion (JN812975)        | FRLTTKGRPDFLRIECFVWDDDLWCHQSYRFEADVNTNSTTTSVENLVCIRF | 600 |
| Lion 1 (MN335911)              | FRLTTKGRPDFLRIECFVWDDDLWCHQFYRFEADVNTNSTTTSVENLVCIRF | 600 |
| Hyena 2 (MN335910)             | FRLTTKGRPDFLRIECFVWDDDLWCHQFYRFEADVNTNSTTTSVENLVCIRF | 600 |
| Spotted Hyena (KJ415364)       | FRLTTKGRPDFLRIECFVWDDDVWCHQFYRFEADVNTNSTTTSVENLVCIRF | 600 |
| Bat_Eared_Fox (MN335908)       | FRLTTKGRPDFLRIECFVWDDDLWCHQFYRFEADVNTNSTTTSVENLVCIRF | 600 |
| Bat Eared Fox (KC916716)       | FRLTTKGRPDFLRIECFVWDDDLWCHQFYRFEADVNTNSTTTSVENLVCIRF | 600 |
| DOG_H.2_1 (MN335909)           | FRLTTKR-----   | 600 |
| Domestic dog (JN812976)        | FRLTTKGRPDFLRIECFVWDDDLWCHQFYRFEADVNTNSTTTSVENLVCIRF | 600 |
| Hyena 1 (MN335912)             | FRLTTKGRPDFLRIECFVWDDDLWCHQFYRFEADSTNSTTTSVENLVRIRF  | 600 |
| Monkey (CYN07-dV(AB687720.2)   | FRLTTKGRPDFLRIECFVWDDDLWCHQFYRFEANITNSTTTSVENLVRIRF  | 600 |
| A75/17 (AF164967.1)            | FRLTTKGRPDFLRIECFVWDDDLWCHQFYRFEADSTNSTTTSVENLVRIRF  | 600 |
| Dog_ChinaB_gi 212656655 gb ACJ | FRLTTKGRPDFLRIECFVWDDDLWCHQFYRFEANITNSTTTSVENLVRIRF  | 600 |
| German_ferret_gi 693949 emb X8 | FRLTTKGRPDFLRIECFVWDNDLWCHQFYRFEADITNSTSSVENLVRIRF   | 600 |
| south_african_dog_gi 239949465 | FRLTTKGRPDFLRIECFVWDDDLWCHQFYRFETDITNSTTTSVENLVRIRF  | 600 |
| Dog_South_Africa_c_gi 23994946 | FRLTTKGPDLRIECFVWDDDLWCHQFYRFEADITNSTTTSVENLVRIRF    | 600 |
| Japanease_dogstrain_007Lmgi 78 | FRLTTKGRPDFLRIECFVWDDDLWCHQFYRFESDITNSTTSVEDLVRIRF   | 600 |

Onderstepoort\_gb|AF378705.1|

FRLTTKGRPDFLRIECFVWDDNLWCHQFYRFEADIANSTTSVENLVRIRF 600

Phoca/Caspian/2007/ADG96017.1

FLRIECFVWDDNLWCHQFYRYEANIANSTTSVENLVRIRFSCNRSNP 600

PDV/ USA/ 2006/HQ007902.1

FRLRTKGRPDILRIECFVWDGHLWCHQFYRFQLDATNSTSVVENLIRIRF 600