

Genetic insight of the H5N1 hemagglutinin cleavage site

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The cleavability of the hemagglutinin (HA) plays a major role in virulence of avian influenza viruses. Detailed analyses of the cleavage sequences and their evolution would give insights into the high pathogenicity of the H5N1 virus. HA segments were visually identifiable in the cellular automata (CA) image, and a feature gene segment (FGS) was only found in H5N1 rather than any other subtype. This FGS is a 30-bp gene segment mainly consisting of 'A' and 'G'. When translated into amino acids the FGS converted into a sequence of mainly basic amino acids with positive charges. This feature amino acid segment (FAAS) was located in the cleavage site loop of HA which was potentially cleavable by various proteases. The 3D structure of H5N1 HA was reconstructed using homology modelling. It was found that the cleavage site loop was well exposed to potential proteases. The molecular surfaces were reconstructed to study how mutation and deletion of some amino acids in the FAAS affected the charge distribution. It was found that some mutations had severely changed the landscape of the charge distribution. Statistical analyses of FAAS were made with respect to when and where the H5N1 viruses were found. In 2005, there were less un-mutated FAAS than the other years according to temporal evolution, and more mutated FAAS appeared in China than other regions according to geographic distribution. These results are helpful for exploring the evolution of virus high pathogenicity.

H5N1 hemagglutinin, cleavage site, cellular automata, feature amino acid segment, homology modelling

Avian influenza is recognized as a continuing threat to both poultry and human public health. At present, the minatory role is played by highly pathogenic influenza A virus of the H5N1 subtype. The World Organization for Animal Health (OIE) reported that from January 2004 to April 20 2007, there were more than 5080 H5N1 outbreaks in 40 countries all over the world (http://www.oie.int/download/AVIAN%20INFLUENZA/A_AI-Asia.htm). Since the first case of chicken-to-human transmission in 1997 in Hong Kong^[1], by April 11, 2007, there were a total of 291 confirmed human cases of the H5N1 infection, 172 of which were fatal, according to the World Health Organization (WHO) (http://www.who.int/csr/disease/avian_influenza/country/en/).

Good efforts have been made to study the H5N1 viruses from genetic prospective^[2,3]. Up to now, there are

more than 900 genome sequences in NCBI GenBank (<http://www.ncbi.nlm.nih.gov>). The genome of influenza A virus contains 8 single-stranded RNA segments. Each RNA segment carries a particular gene constellation responsible for viral surface proteins, replication and assembly. The hemagglutinin (HA) and neuraminidase (NA) genes encode the viral envelope proteins responsible for viral attachment and spreading from cell to cell^[4]. In this study, we visualized gene sequences based on cellular automata (CA) to get some insight into key features of HA gene sequence. The method we used has been effectively used in analysis of SARS and prediction

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of protein subcellular location^[5-7]. We found some fingerprints of CA image from H5N1-HA nucleotide sequence that is not ever found in any other type of viruses. The corresponding sequence of the fingerprint is called feature gene segment (FGS) dominantly consisting of 'A' and 'G', and roughly 30 bps in length. The most popular one is '5'-CAAAGAGAGAGAAGAAGAAAAAAGAGAGGA-3''. The translation of this segment yielded a feature amino acid segment (FAAS) corresponding to the amino acid insertion in the cleavage site which is very important for the high pathogenicity of the H5N1 virus^[2,8].

To understand the impact of the amino acid insertion on the structure and properties of the cleavage site, we made a homology modelling^[9,10] of the H5N1 HA. We compared the cleavage site loop of H5N1 HA^[11] with that of 1918 H1^[12,13]. Here the possible multiple mutations of the cleavage site were discussed. By studying the charge distribution of molecular surface in the cleavage site we tried to observe how mutation or deletion of some amino acids could affect its high pathogenicity. Detailed statistical analyses were made to find how FAAS changed with temporal evolution and geographic distribution.

1 Methods

1.1 CA approach

The gene segment search was made by CA approach^[14], which is a simple, discrete, deterministic and visualized mathematical model for physical, mathematical, biological or computational systems. The CA consists of a line of cells, each valuing 0 or 1. At every step, the value of a given cell is determined by a simple rule from the values of that cell and its immediate left and right neighbours on the step before. By automatically applying the rule to each line as it evolves (thus the term automata), the computer builds up a binary map indicating a pattern of remarkable complexity.

In the present study, the initial line is a coded nucleotide sequence, i.e. the nucleotides A, C, G and T are coded as 00, 01, 10 and 11, respectively. There are a total of 256 rules in CA. Rule 82 is adopted here, as

demonstrated in Figure 1, where the white and black dots are viewed as '0' and '1', respectively. Eight possible sets of values for a site and its nearest neighbours appear on the upper line, while the lower line gives the values evolving from the upper three sites. '111', '110', '101', '100', '011', '010', '001', '000' transform into '0', '1', '0', '1', '0', '0', '1', '0' respectively. $(01010010)_2$ is decimalized as $(82)_{10}$. So it is called rule 82.

The two end sites are set at '0' for the computation of next time step. For example, the sequence 010110110 becomes 000010010 after one step according to rule 82.

1.2 Homology modelling

With sequence information for a particular gene, we are able to build the 3D structure using homology modelling^[9,10]. The available structure information for the H5N1 HA will be used as the template^[15]. The high similarity according to alignment ensures the accuracy of the homology modelling. The following steps were taken to build a homology model for the H5N1 HA: (1) The target chain was first broken into short segments of sequence; (2) the database (formed by more than 5200 high-resolution X-ray protein structures) for matching segments was searched according to the sequence alignment and the shape of the template protein chain; (3) these segments' coordinates were fitted to the growing target structure under a monitor to avoid any van der Waals overlap until all atomic coordinates of the target structure were obtained; (4) the process was repeated 10 times and an average model was generated, followed by energy minimization to create the final 3D structure.

2 Results

2.1 Identification of the H5N1 FS

Since CA^[14,16] has the power for treating complex systems with simple rules, it is employed to visualize the available full-length nucleotide sequences of 397 H5N1 HA and 2098 HA of other subtypes. Rule 82 is adopted here. Two typical images of H5N1 and other subtypes (i.e. H3N2) are given in Figure 2(a) and (b) for comparison. It is found that a dark diagonal block is a com-

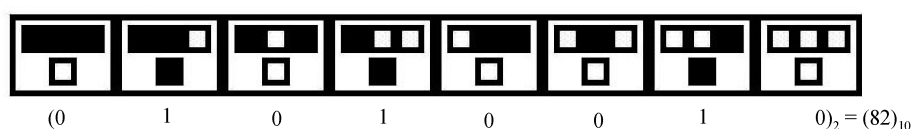


Figure 1 A graphic demonstration of CA rule 82.

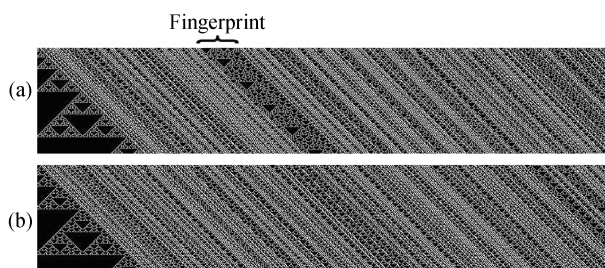


Figure 2 CA images of sample sequences by applying rule 82 with 400 steps evolution. (a) The CA image of gene segment 901–1300 bp of an H5N1 HA (GenBank Accession No. DQ236085). The diagonal dark block (labelled as ‘Fingerprint’) in the middle of the image is a distinct feature for H5N1. (b) The CA image of gene segment 901–1300 bp of an H3N2 HA (GenBank Accession No. CY006163).

mon feature of all H5N1 HA genes, while this specific pattern is not present in any other non-H5N1 virus.

The dark diagonal block, which is considered as the fingerprint of H5N1 HA genes, can be traced back to an FGS of 30 bps mainly composed of ‘A’ and ‘G’ near 1012 bp position. About 65.4% of FGS for all 397 H5N1 HA is exactly the same, i.e. ‘5’-CAAAGAGAGAGAAGA-AGAAAAAGAGAGGA-3’’, while the rest are segments with 1–5 bps mutations, where the percentage of 1–5 mutations are 23.6%, 2.4%, 6.3%, 1.9% and 0.4%, respectively.

2.2 High pathogenicity of the H5N1 virus

If FGS is translated into a polypeptide we can get an FAAS. This is, in fact, an insertion of a few amino acids near the cleavage site of the HA precursor molecule as H0^[2,8], which is approximately 556 residues in length. H0 must be cleaved into two subunits, HA1 and HA2, which is necessary for virus infectivity. For a majority of HAs, the cleavage is carried out by a trypsin-type endoprotease, which has been isolated from rat bronchiolar epithelial Clara cells^[8]. In highly pathogenic strains, an increased number of basic residues at the cleavage site are thought to arise from insertion or substitution. The increase in basic residues, such as K and R, allows proteases in tissues outside the gastro-intestinal and respiratory tracts to cleave and activate the precursor polypeptide and hence render the virus infectious to a greater number of tissues. In fact, quite a few enzymes may cleave this sequence, such as furin-like enzymes, which exist in most tissues of the body^[17]. This enhanced infectivity contributes to the increased systemic effects of viral infection and the multiple organ failure that is characteristic of infection by highly pathogenic viruses.

It has been demonstrated if a mutant is generated, the amino acid sequence at the HA cleavage site is converted into the sequence of typical avirulent avian virus, PQ---RETRG. When tested in mice, the pathogenicity of this HA mutant was highly attenuated, and none of the infected mice showed signs of disease^[2]. It is clear that this sequence deserves detailed and systematic studies.

The 3D structure is reconstructed with the homology modelling for the amino acid sequence of H5N1 HA from Thailand pigeon in 2004 (GenBank Accession No. DQ236085) with the crystal structure of H5N1-Viet04^[15] as the template in order to have a good understanding of the cleavage mechanism and consequence of some specific mutations. Comparison has been made among structures of H5N1-Thailand, H5N1-Viet04 (PDB ID: 2FK0) and H1-1918 (PDB ID: 1RD8)^[13]. The results are shown in Figure 3. In the Viet04 structure, the C-terminal HA1 cleavage site region is interpreted only as far as P and does not account for the remaining QRERRRKKR before G at N-terminal of HA2^[15]. The sequence of H1-1918 in the cleavage site is P---SIQSRG, with only one basic amino acid R. The structure of H5N1-Thailand is well overlapped with that of H5N1-Viet04 except for the insertion of the cleavage site as expected, because only a few amino acids are different. The structures of H5N1 are generally well aligned with that of H1-1918 except for a few specific sites as discussed in ref. [15]. The cleavage site loop of H5N1-Thailand is extended further than that of H1-1918, and the molecular surface shows that it is more exposed to the potential proteases than that of H1-1918.

As shown in Figure 3(b)-1, the molecular surface of H5N1 cleavage site loop carries overwhelming amount of positive charge (in blue). It is the situation of the perfect FAAS. Seven big blue positively charged protuberances on the surface indicate 7 basic amino acids. The basic amino acids in QRERRRKKRG are numbered from 1 to 7 successively. Their corresponding positions are labelled in Figure 3(b)-1. The red area in the middle of the structure is due to the presence of Glu, which is an acidic amino acid. Let it be noted that the presence of basic amino acids as well as positive charge is the key to HA being cleavable by multiple proteases^[2,8]. In some way, we could correlate the integrity of positively charged surface with the high pathogenicity. As indicated previously, some nucleotides in about 35% of the

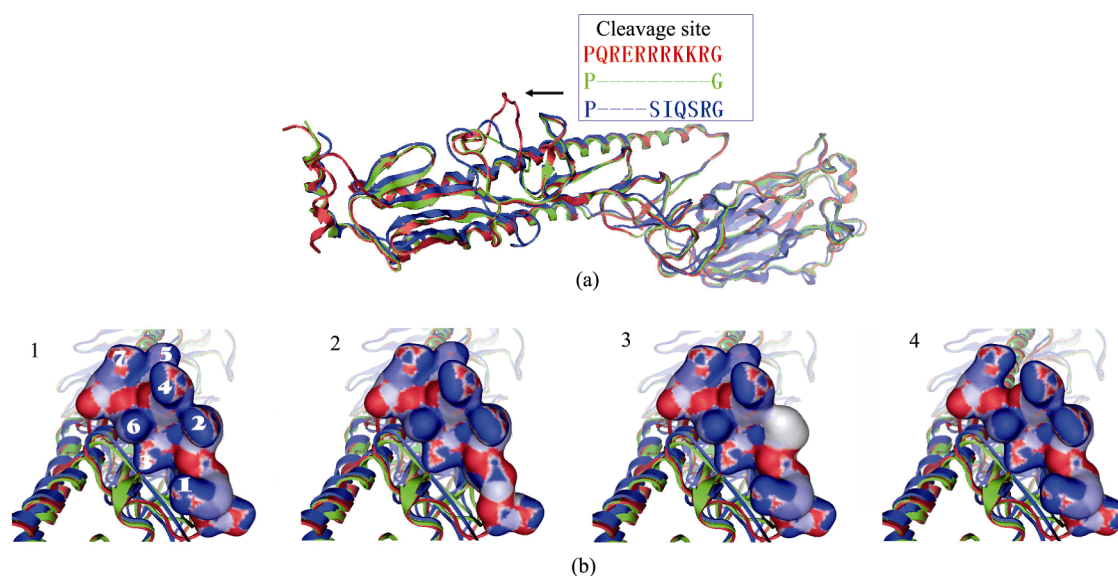


Figure 3 3D structures of H5N1 HA and H1-1918. The backbone is rendered in ribbons, where the red, green and blue chains represent structures of H5N1-Thailand, H5N1-Viet04 and H1N1-1918, respectively. (a) A global view of the whole proteins. (b) A close view of the cleavage site with a molecule surface. The molecules with surface representation are residues of FAAS. The surface is rendered with partial charge, where blue, white and red refer to positive, neutral and negative charges, respectively. (b) 1–4 refer to the molecular surfaces of the perfect FAAS QRERRRKKRG, and various mutations or deletion, i.e. QGERRRKKRG, QREIRRKKRG and QRERRR-KRG, respectively.

H5N1 FGS have been mutated or deleted. Consequently, the corresponding amino acids may be altered, too. Figure 3(b)-2–4 are the molecular surfaces of FAAS with 1 amino acid mutations or deletion corresponding to QGERRRKKRG, QREIRRKKRG and QRERRR-KRG, respectively. For the case of QGERRRKKRG, where the first basic amino acid is replaced by an aliphatic one, No. 1 protuberance covered with positive charge disappears, and the charge over there is changed to red negative and white neutral. For the case of QREIRRKKRG, where the basic amino acid is mutated in the middle part of FAAS, No. 2 protuberance's surface landscape and charge distribution change significantly. For the last case, the 5th basic amino acid is deleted and its corresponding protuberance disappears. Each case of basic amino acids mutations or deletion will change the surface landscape, reducing the blue positive charge and affecting the high pathogenicity of the virus.

2.3 The evolution of the H5N1 FAAS

Given that the mutations of FAAS have impact on the high pathogenicity of the virus, we made further statistical analyses of H5N1 HA FAAS with temporal evolution and geographic distribution. We analyzed 651 available HA protein sequences from the H5N1 viruses

discovered ever since 1997 (Appendix Table 1 at the website: <http://www.SciChina.org>). Alignment was done to localize the cleavage site. The results are summarized in Figure 4. Seq. 1 has the same number of basic amino acids and the charge distribution corresponding to Figure 3(b)-1. Seq. 2 has the first basic amino acid replaced by an aliphatic one as shown in Figure 3(b)-2. Seq. 3 has the fourth amino acid replaced by an aliphatic one and Seq. 4 has a basic amino acid deletion. Seqs. 3 and 4 correspond to mutations specified in Figure 3(b)-3 and -4.

We know that duck (Duck_china_E319-2_03) has a perfect FAAS, to which the viruses found in recent years are related according to phylogenetic analyses. It is very interesting to note that during 1997–2004 the perfect FAAS played the dominant role, while in 2005, there are much less perfect FAAS, i.e. Seq.1, and more mutations, especially Seqs. 2 and 4. The situation was the same in 2006. 18 in all 19 sequences are Seq. 2. An analysis of geographic distribution is shown in Figure 4(b). Viruses in four most serious regions have been studied. Thailand, Viet Nam and Hong Kong had no or very few mutated viruses. But in mainland China the viruses experienced most severe mutations.

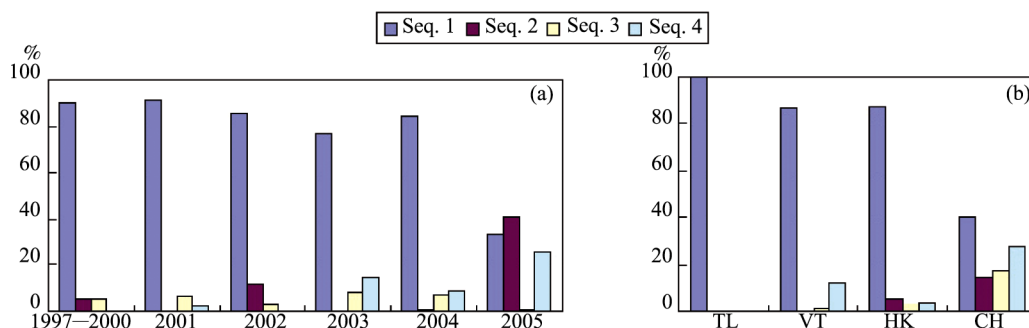


Figure 4 Statistical analyses of the H5N1 HA FAAS. The blue, red, yellow and green bars refer to percentages of the H5N1 viruses with Seqs. 1–4, respectively. (a) Analysis is made with respect to years when the H5N1 viruses were found; (b) analysis is made with respect to the countries and regions where the viruses were found, TL, VT, HK and CH referring to Thailand, Viet Nam, Hong Kong and mainland China, respectively. Seqs. 1–4 are defined as Seq. 1: QRERRRKKRG, QRERKRKKRG, QREKRRKKRG, QRERRKRRG, QRERRRKKRG; Seq. 2: QGERRRKKRG, QIERRRKKRG; Seq. 3, QREGRRKKRG, QREIRRKKRG; Seq. 4: QRERR-KKRG, QRERRR-KRG, QREKR-KKRG.

3 Discussion

The fundamental reason why the H5N1 virus is highly pathogenic is related to the fact that the HA has a cleavage site loop that is cleavable by multiple proteases. We developed a methodology to efficiently locate FGS of HA gene, which is visually identifiable in the gene fingerprint. This FGS is only found in H5N1 but not in any other influenza virus. The FGS is a 30-bp gene segment mainly consisting of ‘A’ and ‘G’. When FGS is translated into protein sequence it converted into a polypeptide of mainly basic amino acids with positive charges. This FAAS is located in the cleavage site loop of HA which is potentially cleavable by various proteases.

We reconstructed the 3D structure of H5N1 HA using homology modelling. It is found that the cleavage site loop is well exposed to potential proteases. Molecular surfaces are reconstructed to study how mutations or

deletion of some amino acids in the FAAS affect the charge distribution. It is found that each case of mutations or deletion of the basic amino acids will surely change the surface landscape, reducing the blue positive charge and affecting the high pathogenicity of the virus. The virus may lose its high pathogenicity if more mutations at proper places occur. Statistical analyses of FAAS are made with respect to when and where the H5N1 are found. Mutations and deletion of FAAS dominate the 2005 distribution, while in earlier years, perfect FAAS was the principal. In China, the FAAS is mostly mutated. China, especially southern China, hosts a combination of circumstances promoting the H5N1 diversification^[18].

Our work contributes to the global efforts to gain the genetic insight of the fundamental reasons why the H5N1 virus is highly pathogenic. It facilitates future efforts to develop immunological and therapeutic^[19–24] solution against the H5N1 virus.

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Appendix Table1 The H5N1 HA sequences used to perform this analysis

Accession	Host	Segment	Subtype	Country & region	Year	Virus strain	FAAS
AAX59694	Avian	4 (HA)	H5N1	Belgium	2004	(A/crested eagle/Belgium/01/2004(H5N1))	Seq.1
ABA70758	Avian	4 (HA)	H5N1	Belgium	2004	(A/crested eagle/Belgium/01/2004(H5N1))	Seq.1
AAK38298	Avian	4 (HA)	H5N1	China	1997	(A/goose/Guangdong/3/1997(H5N1))	Seq.1
AAT12028	Avian	4 (HA)	H5N1	China	1999	(A/duck/Guangxi/07/1999(H5N1))	Seq.1
AAT12024	Avian	4 (HA)	H5N1	China	2000	(A/duck/Fujian/19/2000(H5N1))	Seq.1
AAT12026	Avian	4 (HA)	H5N1	China	2000	(A/duck/Guangdong/12/2000(H5N1))	Seq.1
AAT12036	Avian	4 (HA)	H5N1	China	2000	(A/duck/Zhejiang/11/2000(H5N1))	Seq.1
AAT12038	Avian	4 (HA)	H5N1	China	2000	(A/duck/Guangdong/07/2000(H5N1))	Seq.1
AAT12039	Avian	4 (HA)	H5N1	China	2000	(A/duck/Guangdong/40/2000(H5N1))	Seq.1
ABA54915	Avian	4 (HA)	H5N1	China	2000	(A/Goose/Huadong/1/2000(H5N1))	Seq.1
AAM49555	Avian	4 (HA)	H5N1	China	2001	(A/Duck/Anyang/AVL-1/2001(H5N1))	Seq.1
AAT12025	Avian	4 (HA)	H5N1	China	2001	(A/duck/Guangdong/01/2001(H5N1))	Seq.1
AAT12029	Avian	4 (HA)	H5N1	China	2001	(A/duck/Guangxi/22/2001(H5N1))	Seq.1
AAT12030	Avian	4 (HA)	H5N1	China	2001	(A/duck/Guangxi/35/2001(H5N1))	Seq.1
AAT12032	Avian	4 (HA)	H5N1	China	2001	(A/duck/Shanghai/13/2001(H5N1))	Seq.1
AAT12035	Avian	4 (HA)	H5N1	China	2001	(A/duck/Shanghai/08/2001(H5N1))	Seq.1
AAT12037	Avian	4 (HA)	H5N1	China	2001	(A/duck/Fujian/17/2001(H5N1))	Seq.1
AAT12040	Avian	4 (HA)	H5N1	China	2001	(A/duck/Guangxi/50/2001(H5N1))	Seq.1
AAT12041	Avian	4 (HA)	H5N1	China	2001	(A/duck/Shanghai/38/2001(H5N1))	Seq.1
AAV21163	Avian	4 (HA)	H5N1	China	2001	(A/chicken/Jiande/1218/2001(H5N1))	Seq.1
ABC69149	Avian	4 (HA)	H5N1	China	2001	(A/Chicken/Hong Kong/FY150/01 (H5N1))	Seq.1
AAT12022	Avian	4 (HA)	H5N1	China	2002	(A/duck/Fujian/01/2002(H5N1))	Seq.1
AAT12023	Avian	4 (HA)	H5N1	China	2002	(A/duck/Fujian/13/2002(H5N1))	Seq.1
AAT12027	Avian	4 (HA)	H5N1	China	2002	(A/duck/Guangdong/22/2002(H5N1))	Seq.1
AAT12031	Avian	4 (HA)	H5N1	China	2002	(A/duck/Guangxi/53/2002(H5N1))	Seq.1
AAT12033	Avian	4 (HA)	H5N1	China	2002	(A/duck/Shanghai/35/2002(H5N1))	Seq.1
AAT12034	Avian	4 (HA)	H5N1	China	2002	(A/duck/Shanghai/37/2002(H5N1))	Seq.1
AAV56367	Avian	4 (HA)	H5N1	China	2002	(A/chicken/China/1/02(H5N1))	Seq.1
ABA55715	Avian	4 (HA)	H5N1	China	2002	(A/chicken/zhengzhou/1/02/(H5N1))	Seq.1
ABA55716	Avian	4 (HA)	H5N1	China	2002	(A/chicken/zhoukou/2/02/(H5N1))	Seq.1
ABC69150	Avian	4 (HA)	H5N1	China	2002	(A/chicken/Hebei/108/02(H5N1))	Seq.1
AAT73307	Avian	4 (HA)	H5N1	China	2003	(A/Dk/ST/4003/2003(H5N1))	Seq.1
AAT73308	Avian	4 (HA)	H5N1	China	2003	(A/Ck/ST/4231/2003(H5N1))	Seq.1
ABA55714	Avian	4 (HA)	H5N1	China	2003	(A/chicken/jiyuan/1/03/(H5N1))	Seq.1
ABA55717	Avian	4 (HA)	H5N1	China	2003	(A/chicken/luohuo/3/03/(H5N1))	Seq.1
ABC66556	Avian	4 (HA)	H5N1	China	2003	(A/duck/Shantou/4610/2003(H5N1))	Seq.1
ABD61669	Avian	4 (HA)	H5N1	China	2003	(A/swine/Guangdong/1/2003(H5N1))	Seq.1
AAT37563	Avian	4 (HA)	H5N1	China	2004	(A/chicken/Guangdong/174/04(H5N1))	Seq.1
AAT76166	Avian	4 (HA)	H5N1	China	2004	(A/chicken/Jilin/9/2004(H5N1))	Seq.1
AAT90337	Avian	4 (HA)	H5N1	China	2004	(A/chicken/Yichang/lung-1/04(H5N1))	Seq.1
AAT90832	Avian	4 (HA)	H5N1	China	2004	(A/chicken/Hubei/327/2004(H5N1))	Seq.1
AAV48546	Avian	4 (HA)	H5N1	China	2004	(A/chicken/Hubei/489/2004(H5N1))	Seq.1
AAW19638	Avian	4 (HA)	H5N1	China	2004	(A/blackbird/Hunan/1/2004(H5N1))	Seq.1
AAW19640	Avian	4 (HA)	H5N1	China	2004	(A/tree sparrow/Henan/1/2004(H5N1))	Seq.1
AAW19646	Avian	4 (HA)	H5N1	China	2004	(A/tree sparrow/Henan/4/2004(H5N1))	Seq.1
AAW72226	Avian	4 (HA)	H5N1	China	2004	(A/duck/Shandong/093/2004(H5N1))	Seq.1
AAX53504	Avian	4 (HA)	H5N1	China	2004	(A/chicken/Henan/01/2004(H5N1))	Seq.1
AAX53505	Avian	4 (HA)	H5N1	China	2004	(A/chicken/Henan/210/2004(H5N1))	Seq.1
AAX53506	Avian	4 (HA)	H5N1	China	2004	(A/chicken/Henan/12/2004(H5N1))	Seq.1
AAX53507	Avian	4 (HA)	H5N1	China	2004	(A/chicken/Henan/13/2004(H5N1))	Seq.1

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Accession	Host	Segment	Subtype	Country & region	Year	Virus strain	FAAS
AAX53508	Avian	4 (HA)	H5N1	China	2004	(A/chicken/Henan/16/2004(H5N1))	Seq.1
AAX53509	Avian	4 (HA)	H5N1	China	2004	(A/wild duck/Guangdong/314/2004(H5N1))	Seq.1
AAX53510	Avian	4 (HA)	H5N1	China	2004	(A/swan/Guangxi/307/2004(H5N1))	Seq.1
AA778953	Avian	4 (HA)	H5N1	China	2004	(A/chicken/Henan/01/2004(H5N1))	Seq.1
ABC66517	Avian	4 (HA)	H5N1	China	2005	(A/duck/Fujian/897/2005(H5N1))	Seq.1
ABC66518	Avian	4 (HA)	H5N1	China	2005	(A/chicken/Fujian/1042/2005(H5N1))	Seq.1
ABC66543	Avian	4 (HA)	H5N1	China	2005	(A/duck/Guangzhou/20/2005(H5N1))	Seq.1
ABC66557	Avian	4 (HA)	H5N1	China	2005	(A/goose/Shantou/2216/2005(H5N1))	Seq.1
ABC66558	Avian	4 (HA)	H5N1	China	2005	(A/migratory duck/Jiangxi/1653/2005(H5N1))	Seq.1
ABC66559	Avian	4 (HA)	H5N1	China	2005	(A/migratory duck/Jiangxi/1657/2005(H5N1))	Seq.1
ABC66560	Avian	4 (HA)	H5N1	China	2005	(A/migratory duck/Jiangxi/1701/2005(H5N1))	Seq.1
ABE68931	Avian	4 (HA)	H5N1	China	2005	(A/Goose/Shantou/1621/05(H5N1))	Seq.1
AAC14418	Avian	4 (HA)	H5N1	Hong Kong	1997	(A/Chicken/Hong Kong/258/97 (H5N1))	Seq.1
AAC32078	Avian	4 (HA)	H5N1	Hong Kong	1997	(A/Chicken/Hong Kong/220/97 (H5N1))	Seq.1
AAC32101	Avian	4 (HA)	H5N1	Hong Kong	1997	(A/Chicken/Hong Kong/728/97 (H5N1))	Seq.1
AAD13566	Avian	4 (HA)	H5N1	Hong Kong	1997	(A/Chicken/Hong Kong/728/97 (H5N1))	Seq.1
AAD13567	Avian	4 (HA)	H5N1	Hong Kong	1997	(A/Chicken/Hong Kong/786/97 (H5N1))	Seq.1
AAD13569	Avian	4 (HA)	H5N1	Hong Kong	1997	(A/chicken/Hong Kong/990/97 (H5N1))	Seq.1
AAF02302	Avian	4 (HA)	H5N1	Hong Kong	1997	(A/Chicken/Hong Kong/1203/97 (H5N1))	Seq.1
AAF02303	Avian	4 (HA)	H5N1	Hong Kong	1997	(A/Chicken/Hong Kong/976/97 (H5N1))	Seq.1
AAF02304	Avian	4 (HA)	H5N1	Hong Kong	1997	(A/Chicken/Hong Kong/y385/97 (H5N1))	Seq.1
AAF02305	Avian	4 (HA)	H5N1	Hong Kong	1997	(A/Chicken/Hong Kong/y388/97 (H5N1))	Seq.1
AAF02306	Avian	4 (HA)	H5N1	Hong Kong	1997	(A/Duck/Hong Kong/p46/97 (H5N1))	Seq.1
AAF02307	Avian	4 (HA)	H5N1	Hong Kong	1997	(A/Duck/Hong Kong/y283/97 (H5N1))	Seq.1
AAF02308	Avian	4 (HA)	H5N1	Hong Kong	1997	(A/Goose/Hong Kong/w355/97 (H5N1))	Seq.1
AAF02309	Avian	4 (HA)	H5N1	Hong Kong	1997	(A/Silky Chicken/Hong Kong/p17/97 (H5N1))	Seq.1
AAG01195	Avian	4 (HA)	H5N1	Hong Kong	1999	(A/Environment/Hong Kong/437-4/99 (H5N1))	Seq.1
AAG01205	Avian	4 (HA)	H5N1	Hong Kong	1999	(A/Environment/Hong Kong/437-6/99 (H5N1))	Seq.1
AAG01215	Avian	4 (HA)	H5N1	Hong Kong	1999	(A/Environment/Hong Kong/437-8/99 (H5N1))	Seq.1
AAG01225	Avian	4 (HA)	H5N1	Hong Kong	1999	(A/Environment/Hong Kong/437-10/99 (H5N1))	Seq.1
AAL31380	Avian	4 (HA)	H5N1	Hong Kong	2000	(A/Goose/Hong Kong/ww26/2000(H5N1))	Seq.1
AAL31381	Avian	4 (HA)	H5N1	Hong Kong	2000	(A/Goose/Hong Kong/ww28/2000(H5N1))	Seq.1
AAL31382	Avian	4 (HA)	H5N1	Hong Kong	2000	(A/Duck/Hong Kong/ww381/2000(H5N1))	Seq.1
AAL31383	Avian	4 (HA)	H5N1	Hong Kong	2000	(A/Duck/Hong Kong/ww382/2000(H5N1))	Seq.1
AAL31387	Avian	4 (HA)	H5N1	Hong Kong	2000	(A/Duck/Hong Kong/2986.1/2000(H5N1))	Seq.1
AAL31388	Avian	4 (HA)	H5N1	Hong Kong	2000	(A/Goose/Hong Kong/3014.8/2000(H5N1))	Seq.1
AAL75843	Avian	4 (HA)	H5N1	Hong Kong	2000	(A/Goose/Hong Kong/3014.5/2000(H5N1))	Seq.1
AAL75839	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Chicken/Hong Kong/317.5/2001(H5N1))	Seq.1
AAL75847	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Duck/Hong Kong/380.5/2001(H5N1))	Seq.1
AAO46799	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Chicken/HongKong/FY150/01-MB(H5N1))	Seq.1
AAO46800	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Chicken/HongKong/FY150/01(H5N1))	Seq.1
AAO46801	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Pheasant/HongKong/FY155/01-MB(H5N1))	Seq.1
AAO46802	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Pheasant/HongKong/FY155/01(H5N1))	Seq.1
AAO46803	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Chicken/HongKong/YU822.2/01-MB(H5N1))	Seq.1
AAO46804	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Chicken/HongKong/YU822.2/01(H5N1))	Seq.1
AAO46805	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Chicken/HongKong/YU562/01(H5N1))	Seq.1
AAO52859	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Chicken/Hong Kong/FY77/01 (H5N1))	Seq.1
AAO52860	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Chicken/Hong Kong/YU562/01 (H5N1))	Seq.1
AAO52861	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Chicken/Hong Kong/YU563/01 (H5N1))	Seq.1
AAO52862	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Chicken/Hong Kong/FY150/01 (H5N1))	Seq.1
AAO52863	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Pheasant/HongKong/FY155/01(H5N1))	Seq.1
AAO52864	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Silky Chicken/Hong Kong/SF189/01 (H5N1))	Seq.1
AAO52865	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Quail/Hong Kong/SF203/01 (H5N1))	Seq.1
AAO52866	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Pigeon/Hong Kong/SF215/01 (H5N1))	Seq.1

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Accession	Host	Segment	Subtype	Country & region	Year	Virus strain	FAAS
AAO52867	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Chicken/Hong Kong/SF219/01 (H5N1))	Seq.1
AAO52868	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Chicken/Hong Kong/715.5/01 (H5N1))	Seq.1
AAO52869	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Chicken/Hong Kong/822.1/01 (H5N1))	Seq.1
AAO52870	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Chicken/Hong Kong/829.2/01 (H5N1))	Seq.1
AAO52871	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Chicken/Hong Kong/830.2/01 (H5N1))	Seq.1
AAO52872	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Chicken/Hong Kong/858.3/01 (H5N1))	Seq.1
AAO52873	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Chicken/Hong Kong/867.1/01 (H5N1))	Seq.1
AAO52874	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Chicken/Hong Kong/879.1/01 (H5N1))	Seq.1
AAO52875	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Chicken/Hong Kong/873.3/01 (H5N1))	Seq.1
AAO52876	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Chicken/Hong Kong/876.1/01 (H5N1))	Seq.1
AAO52877	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Chicken/Hong Kong/891.1/01 (H5N1))	Seq.1
AAO52878	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Chicken/Hong Kong/893.2/01 (H5N1))	Seq.1
AAO52879	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Goose/Hong Kong/76.1/01 (H5N1))	Seq.1
AAO52880	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Goose/Hong Kong/www100/01 (H5N1))	Seq.1
AAO52882	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Duck/Hong Kong/646.3/01 (H5N1))	Seq.1
AAT39067	Avian	4 (HA)	H5N1	Hong Kong	2002	(A/Gs/HK/739.2/02 (H5N1))	Seq.1
AAT39068	Avian	4 (HA)	H5N1	Hong Kong	2002	(A/Eg/HK/757.3/02 (H5N1))	Seq.1
AAT39073	Avian	4 (HA)	H5N1	Hong Kong	2002	(A/G.H/HK/793.1/02 (H5N1))	Seq.1
AAT39075	Avian	4 (HA)	H5N1	Hong Kong	2002	(A/Ck/HK/31.4/02 (H5N1))	Seq.1
AAT39076	Avian	4 (HA)	H5N1	Hong Kong	2002	(A/Ck/HK/61.9/02 (H5N1))	Seq.1
AAT39077	Avian	4 (HA)	H5N1	Hong Kong	2002	(A/Ck/HK/YU777/02 (H5N1))	Seq.1
AAT39078	Avian	4 (HA)	H5N1	Hong Kong	2002	(A/Ck/HK/96.1/02 (H5N1))	Seq.1
AAT39079	Avian	4 (HA)	H5N1	Hong Kong	2002	(A/Ck/HK/409.1/02 (H5N1))	Seq.1
AAT39080	Avian	4 (HA)	H5N1	Hong Kong	2002	(A/Ph/HK/675.14/02 (H5N1))	Seq.1
AAT73285	Avian	4 (HA)	H5N1	Hong Kong	2002	(A/Gf/HK/38/2002(H5N1))	Seq.1
AAT73286	Avian	4 (HA)	H5N1	Hong Kong	2002	(A/Ck/HK/31.2/2002(H5N1))	Seq.1
AAT73287	Avian	4 (HA)	H5N1	Hong Kong	2002	(A/Ck/HK/37.4/2002(H5N1))	Seq.1
AAT73288	Avian	4 (HA)	H5N1	Hong Kong	2002	(A/Sck/HK/YU100/2002(H5N1))	Seq.1
AAT73289	Avian	4 (HA)	H5N1	Hong Kong	2002	(A/Ck/HK/YU22/2002(H5N1))	Seq.1
AAT73290	Avian	4 (HA)	H5N1	Hong Kong	2002	(A/Ck/HK/3176.3/2002(H5N1))	Seq.1
AAT73291	Avian	4 (HA)	H5N1	Hong Kong	2002	(A/Ck/HK/3169.1/2002(H5N1))	Seq.1
AAT73299	Avian	4 (HA)	H5N1	Hong Kong	2002	(A/grey heron/HK/861.1/2002(H5N1))	Seq.1
ABC66568	Avian	4 (HA)	H5N1	Hong Kong	2002	(A/chicken/Hong Kong/3123.1/2002(H5N1))	Seq.1
ABC66569	Avian	4 (HA)	H5N1	Hong Kong	2002	(A/chicken/Hong Kong/86.3/2002(H5N1))	Seq.1
AAT73294	Avian	4 (HA)	H5N1	Hong Kong	2003	(A/Ck/HK/NT93/2003(H5N1))	Seq.1
AAT73295	Avian	4 (HA)	H5N1	Hong Kong	2003	(A/Ck/HK/WF157/2003(H5N1))	Seq.1
AAT73296	Avian	4 (HA)	H5N1	Hong Kong	2003	(A/Ck/HK/SSP141/2003(H5N1))	Seq.1
AAT73297	Avian	4 (HA)	H5N1	Hong Kong	2003	(A/Ck/HK/FY157/2003(H5N1))	Seq.1
AAT73298	Avian	4 (HA)	H5N1	Hong Kong	2003	(A/Ck/HK/YU324/2003(H5N1))	Seq.1
AAT73313	Avian	4 (HA)	H5N1	Hong Kong	2003	(A/black headed gull/HK/12.1/2003(H5N1))	Seq.1
AAV97602	Avian	4 (HA)	H5N1	Hong Kong	2003	(A/egret/Hong Kong/757.2/03(H5N1))	Seq.1
AAT73302	Avian	4 (HA)	H5N1	Hong Kong	2004	(A/peregrine falcon/HK/D0028/2004(H5N1))	Seq.1
ABC66566	Avian	4 (HA)	H5N1	Hong Kong	2004	(A/grey heron/Hong Kong/837/2004(H5N1))	Seq.1
AAT73260	Avian	4 (HA)	H5N1	Indonesia	2003	(A/Ck/Indonesia/PA/2003(H5N1))	Seq.1
AAT73261	Avian	4 (HA)	H5N1	Indonesia	2003	(A/Ck/Indonesia/BL/2003(H5N1))	Seq.1
AAT73263	Avian	4 (HA)	H5N1	Indonesia	2003	(A/Ck/Indonesia/2A/2003(H5N1))	Seq.1
ABC66571	Avian	4 (HA)	H5N1	Indonesia	2003	(A/chicken/Wonosobo/BPPV4/2003(H5N1))	Seq.1
ABE97550	Avian	4 (HA)	H5N1	Indonesia	2003	(A/chicken/Pekalongan/BPPV4/2003(H5N1))	Seq.1
ABE97551	Avian	4 (HA)	H5N1	Indonesia	2003	(A/chicken/Sragen/BPPV4/2003(H5N1))	Seq.1
AAT73262	Avian	4 (HA)	H5N1	Indonesia	2004	(A/Dk/Indonesia/MS/2004(H5N1))	Seq.1
AAT73264	Avian	4 (HA)	H5N1	Indonesia	2004	(A/Ck/Indonesia/4/2004(H5N1))	Seq.1
AAT73265	Avian	4 (HA)	H5N1	Indonesia	2004	(A/Ck/Indonesia/5/2004(H5N1))	Seq.1
ABC66572	Avian	4 (HA)	H5N1	Indonesia	2004	(A/chicken/Yogyakarta/BBVet-IX/2004(H5N1))	Seq.1
ABE97547	Avian	4 (HA)	H5N1	Indonesia	2004	(A/chicken/Malang/BBVet-IV/2004(H5N1))	Seq.1

(To be continued on the next page)

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Accession	Host	Segment	Subtype	Country & region	Year	Virus strain	FAAS
ABE97549	Avian	4 (HA)	H5N1	Indonesia	2004	(A/chicken/Ngawi/BPPV4/2004(H5N1))	Seq.1
ABE97552	Avian	4 (HA)	H5N1	Indonesia	2004	(A/quail/Boyolali/BPPV4/2004(H5N1))	Seq.1
ABE97554	Avian	4 (HA)	H5N1	Indonesia	2004	(A/quail/Yogyakarta/BBVet-IX/2004(H5N1))	Seq.1
ABE97558	Avian	4 (HA)	H5N1	Indonesia	2004	(A/chicken/Purwakarta/BBVet-IV/2004(H5N1))	Seq.1
ABE97559	Avian	4 (HA)	H5N1	Indonesia	2004	(A/quail/Tasikmalaya/BPPV4/2004(H5N1))	Seq.1
ABE97560	Avian	4 (HA)	H5N1	Indonesia	2004	(A/chicken/Bangli Bali/BBPV6-1/2004(H5N1))	Seq.1
ABE97561	Avian	4 (HA)	H5N1	Indonesia	2004	(A/chicken/Bangli Bali/BPPV6-2/2004(H5N1))	Seq.1
ABE97562	Avian	4 (HA)	H5N1	Indonesia	2004	(A/chicken/Jembrana/BPPV6/2004(H5N1))	Seq.1
ABE97563	Avian	4 (HA)	H5N1	Indonesia	2004	(A/chicken/Mangarai-NTT/BPPV6/2004(H5N1))	Seq.1
ABE97565	Avian	4 (HA)	H5N1	Indonesia	2004	(A/chicken/Kupang-2-NTT/BPPV6/2004(H5N1))	Seq.1
ABE97566	Avian	4 (HA)	H5N1	Indonesia	2004	(A/chicken/Kupang-3-NTT/BPPV6/2004(H5N1))	Seq.1
ABE97567	Avian	4 (HA)	H5N1	Indonesia	2004	(A/chicken/Kupang-1-NTT/BPPV6/2004(H5N1))	Seq.1
ABE97568	Avian	4 (HA)	H5N1	Indonesia	2004	(A/chicken/Pangkalpinang/BPPV3/2004(H5N1))	Seq.1
ABE97569	Avian	4 (HA)	H5N1	Indonesia	2004	(A/turkey/Kedaton/BPPV3/2004(H5N1))	Seq.1
ABC66570	Avian	4 (HA)	H5N1	Indonesia	2005	(A/chicken/Salatiga/BBVet-I/2005(H5N1))	Seq.1
ABC66574	Avian	4 (HA)	H5N1	Indonesia	2005	(A/chicken/Bantul/BBVet-I/2005(H5N1))	Seq.1
ABC66575	Avian	4 (HA)	H5N1	Indonesia	2005	(A/chicken/Wajo/BBVM/2005(H5N1))	Seq.1
ABE97548	Avian	4 (HA)	H5N1	Indonesia	2005	(A/chicken/Magetan/BBVW/2005(H5N1))	Seq.1
ABE97553	Avian	4 (HA)	H5N1	Indonesia	2005	(A/chicken/Purworejo/BBVW/2005(H5N1))	Seq.1
ABE97556	Avian	4 (HA)	H5N1	Indonesia	2005	(A/chicken/Gunung Kidul/BBVW/2005(H5N1))	Seq.1
ABE97557	Avian	4 (HA)	H5N1	Indonesia	2005	(A/chicken/Kulon Progo/BBVW/2005(H5N1))	Seq.1
ABE97564	Avian	4 (HA)	H5N1	Indonesia	2005	(A/duck/Parepare/BBVM/2005(H5N1))	Seq.1
ABE97570	Avian	4 (HA)	H5N1	Indonesia	2005	(A/chicken/Simalanggang/BPPVI/2005(H5N1))	Seq.1
ABE97571	Avian	4 (HA)	H5N1	Indonesia	2005	(A/chicken/Tebing Tinggi/BPPVI/2005(H5N1))	Seq.1
ABE97572	Avian	4 (HA)	H5N1	Indonesia	2005	(A/chicken/Dairi/BPPVI/2005(H5N1))	Seq.1
ABE97573	Avian	4 (HA)	H5N1	Indonesia	2005	(A/chicken/Deli Serdang/BPPVI/2005(H5N1))	Seq.1
ABE97574	Avian	4 (HA)	H5N1	Indonesia	2005	(A/chicken/Tarutung/BPPVI/2005(H5N1))	Seq.1
BAE07155	Avian	4 (HA)	H5N1	Japan	2003	(A/duck/Yokohama/aaq10/2003(H5N1))	Seq.1
ABC66576	Avian	4 (HA)	H5N1	Malaysia	2004	(A/chicken/Malaysia/5858/2004(H5N1))	Seq.1
ABC66577	Avian	4 (HA)	H5N1	Malaysia	2004	(A/quail/Malaysia/6309/2004(H5N1))	Seq.1
AAS50166	Avian	4 (HA)	H5N1	Thailand	2004	(A/quail/Thailand/KTHF/2004(H5N1))	Seq.1
AAS50167	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Thailand/KHHF/4NP25/2004(H5N1))	Seq.1
AAS57876	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Thailand/CKF1/2004(H5N1))	Seq.1
AAS84247	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Thailand/Phitsanulok-01/2004(H5N1))	Seq.1
AAS84248	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Thailand/Sukhothai-01/2004(H5N1))	Seq.1
AAS84249	Avian	4 (HA)	H5N1	Thailand	2004	(A/duck/Thailand/Phichit-01/2004(H5N1))	Seq.1
AAS84250	Avian	4 (HA)	H5N1	Thailand	2004	(A/partridge/Thailand/Uttaradit-01/2004(H5N1))	Seq.1
AAS84251	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Thailand/Uttaradit-01/2004(H5N1))	Seq.1
AAS84252	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Thailand/Uttaradit-02/2004(H5N1))	Seq.1
AAS84253	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Thailand/Uthaitani-01/2004(H5N1))	Seq.1
AAS84254	Avian	4 (HA)	H5N1	Thailand	2004	(A/partridge/Thailand/Sukhothai-01/2004(H5N1))	Seq.1
AAS84255	Avian	4 (HA)	H5N1	Thailand	2004	(A/duck/Thailand/Sukhothai-01/2004(H5N1))	Seq.1
AAS84256	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Thailand/Phitsanulok-02/2004(H5N1))	Seq.1
AAS84257	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Thailand/Phitsanulok-03/2004(H5N1))	Seq.1
AAS84258	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Thailand/Phichit-01/2004(H5N1))	Seq.1
AAS84259	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Thailand/Kamphaengphet-01/2004(H5N1))	Seq.1
AAS84260	Avian	4 (HA)	H5N1	Thailand	2004	(A/duck/Thailand/Kamphaengphet-01/2004(H5N1))	Seq.1
AAS84261	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Thailand/Nakornsawan-02/2004(H5N1))	Seq.1
AAS84262	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Thailand/Phetchabun-01/2004(H5N1))	Seq.1
AAS84263	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Thailand/Phetchabun-02/2004(H5N1))	Seq.1
AAS84264	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Thailand/Sukhothai-02/2004(H5N1))	Seq.1
AAS84265	Avian	4 (HA)	H5N1	Thailand	2004	(A/little grebe/Thailand/Phichit-01/2004(H5N1))	Seq.1
AAS84266	Avian	4 (HA)	H5N1	Thailand	2004	(A/muscovy duck/Thailand/Tak-01/2004(H5N1))	Seq.1
AAS84267	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Thailand/Pathumthani-01/2004(H5N1))	Seq.1

(To be continued on the next page)

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Accession	Host	Segment	Subtype	Country & region	Year	Virus strain	FAAS
AAS84268	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Thailand/Bangkok-01/2004(H5N1))	Seq.1
AAS84269	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Thailand/Bangkok-02/2004(H5N1))	Seq.1
AAS84270	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Thailand/Udonthani-01/2004(H5N1))	Seq.1
AAS84271	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Thailand/Udonthani-02/2004(H5N1))	Seq.1
AAS84272	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Thailand/Udonthani-03/2004(H5N1))	Seq.1
AAS84273	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Thailand/Mahasarakham-01/2004(H5N1))	Seq.1
AAS84274	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Thailand/Khonkaen-01/2004(H5N1))	Seq.1
AAS84275	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Thailand/Nakornsawan-01/2004(H5N1))	Seq.1
AAS84276	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Thailand/Tak-01/2004(H5N1))	Seq.1
AAS89267	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Thailand/CU-K1/2004(H5N1))	Seq.1
AAS89268	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Nakorn-Patom/Thailand/CU-K2/2004(H5N1))	Seq.1
AAS89269	Avian	4 (HA)	H5N1	Thailand	2004	(A/kalij pheasant/Thailand/CU-4/2004(H5N1))	Seq.1
AAS89270	Avian	4 (HA)	H5N1	Thailand	2004	(A/white peafowl/Thailand/CU-11/2004(H5N1))	Seq.1
AAS89272	Avian	4 (HA)	H5N1	Thailand	2004	(A/crow/Thailand/CU-KAF3/2004(H5N1))	Seq.1
AAS89273	Avian	4 (HA)	H5N1	Thailand	2004	(A/openbill/Thailand/CU-2/2004(H5N1))	Seq.1
AAT73266	Avian	4 (HA)	H5N1	Thailand	2004	(A/Ck/Thailand/1/2004(H5N1))	Seq.1
AAT73267	Avian	4 (HA)	H5N1	Thailand	2004	(A/Ck/Thailand/73/2004(H5N1))	Seq.1
AAT73268	Avian	4 (HA)	H5N1	Thailand	2004	(A/Ck/Thailand/9.1/2004(H5N1))	Seq.1
AAT73269	Avian	4 (HA)	H5N1	Thailand	2004	(A/Qa/Thailand/57/2004(H5N1))	Seq.1
AAT73270	Avian	4 (HA)	H5N1	Thailand	2004	(A/bird/Thailand/3.1/2004(H5N1))	Seq.1
AAT73271	Avian	4 (HA)	H5N1	Thailand	2004	(A/Dk/Thailand/71.1/2004(H5N1))	Seq.1
AAT73272	Avian	4 (HA)	H5N1	Thailand	2004	(A/Gs/Thailand/79/2004(H5N1))	Seq.1
AAV41002	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Ayutthaya/Thailand/CU-23/04(H5N1))	Seq.1
AAV48778	Avian	4 (HA)	H5N1	Thailand	2004	(A/duck/Thailand/CU-2/2004 (H5N1))	Seq.1
AAV48780	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Thailand/CU-21/2004 (H5N1))	Seq.1
AAV65826	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Thailand/CH-2/2004(H5N1))	Seq.1
AAV46328	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Kamphaengphet-2-01/2004(H5N1))	Seq.1
AAV46329	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Nakornsawan-2-04/2004(H5N1))	Seq.1
AAV46330	Avian	4 (HA)	H5N1	Thailand	2004	(A/duck/Phitsanulok-2-01/2004(H5N1))	Seq.1
AAV46331	Avian	4 (HA)	H5N1	Thailand	2004	(A/duck/Nakornsawan-2-01/2004(H5N1))	Seq.1
AAV46332	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Kamphaengphet-2-03/2004(H5N1))	Seq.1
AAV46333	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Kamphaengphet-2-06/2004(H5N1))	Seq.1
AAV46334	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Sukhothai-2-02/2004(H5N1))	Seq.1
AAV46335	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Sukhothai-2-01/2004(H5N1))	Seq.1
AAV46336	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Uthaithani-2-05/2004(H5N1))	Seq.1
AAV46337	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Uttaradit-2-03/2004(H5N1))	Seq.1
AAV46338	Avian	4 (HA)	H5N1	Thailand	2004	(A/littlecuckoo-dove/Tak-2-01/2004(H5N1))	Seq.1
AAV46339	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Uttaradit-2-01/2004(H5N1))	Seq.1
AAV46340	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Uttaradit-2-02/2004(H5N1))	Seq.1
AAV46341	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Phitsanulok-2-03/2004(H5N1))	Seq.1
AAV46342	Avian	4 (HA)	H5N1	Thailand	2004	(A/duck/Phichit-2-01/2004(H5N1))	Seq.1
AAV46343	Avian	4 (HA)	H5N1	Thailand	2004	(A/duck/Phichit-2-02/2004(H5N1))	Seq.1
AAV46344	Avian	4 (HA)	H5N1	Thailand	2004	(A/duck/Phitsanulok-2-02/2004(H5N1))	Seq.1
AAV46345	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Uthaithani-2-04/2004(H5N1))	Seq.1
AAV46346	Avian	4 (HA)	H5N1	Thailand	2004	(A/duck/Uthaithani-2-01/2004(H5N1))	Seq.1
AAV46347	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Uthaithani-2-03/2004(H5N1))	Seq.1
AAV46348	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Nakornsawan-2-01/2004(H5N1))	Seq.1
AAV46349	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Phitsanulok-2-04/2004(H5N1))	Seq.1
AAV46350	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Phetchabun-2-02/2004(H5N1))	Seq.1
AAV46351	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Uthaithani-2-02/2004(H5N1))	Seq.1
AAV46352	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Nakornsawan-2-05/2004(H5N1))	Seq.1
AAV46353	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Phitsanulok-2-02/2004(H5N1))	Seq.1
AAV46354	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Uthaithani-2-01/2004(H5N1))	Seq.1
AAV46355	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Kamphaengphet-2-05/2004(H5N1))	Seq.1

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Accession	Host	Segment	Subtype	Country & region	Year	Virus strain	FAAS
AAAY46356	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Phitsanulok-2-01/2004(H5N1))	Seq.1
AAAY46357	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Phetchabun-2-01/2004(H5N1))	Seq.1
AAAY46358	Avian	4 (HA)	H5N1	Thailand	2004	(A/duck/Nakornsawan-2-02/2004(H5N1))	Seq.1
AAAY46359	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Nakornsawan-2-02/2004(H5N1))	Seq.1
AAAY46360	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Nakornsawan-2-06/2004(H5N1))	Seq.1
AAAY46361	Avian	4 (HA)	H5N1	Thailand	2004	(A/duck/Uthaitani-2-02/2004(H5N1))	Seq.1
AAAY46362	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Kamphaengphet-2-04/2004(H5N1))	Seq.1
AAAY46363	Avian	4 (HA)	H5N1	Thailand	2004	(A/duck/Uttaradit-2-01/2004(H5N1))	Seq.1
AAAY46364	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Nakornsawan-2-03/2004(H5N1))	Seq.1
AAAY46365	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Nakornsawan-2-07/2004(H5N1))	Seq.1
AAAY46366	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Kamphaengphet-2-02/2004(H5N1))	Seq.1
AAAY68363	Avian	4 (HA)	H5N1	Thailand	2004	(A/Ck/Thailand/73/2004(H5N1))	Seq.1
AAZ29946	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Suphanburi/Thailand/CU-1/04(H5N1))	Seq.1
AAZ29947	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Bangkok/Thailand/CU-3/04(H5N1))	Seq.1
AAZ29948	Avian	4 (HA)	H5N1	Thailand	2004	(A/crow/Bangkok/Thailand/CU-4/04(H5N1))	Seq.1
AAZ29949	Avian	4 (HA)	H5N1	Thailand	2004	(A/duck/Chonburi/Thailand/CU-5/04(H5N1))	Seq.1
AAZ29950	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Bangkok/Thailand/CU-6/04(H5N1))	Seq.1
AAZ29951	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Chonburi/Thailand/CU-7/04(H5N1))	Seq.1
AAZ29952	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Prachinburi/Thailand/CU-8/04(H5N1))	Seq.1
AAZ29953	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Suphanburi/Thailand/CU-9/04(H5N1))	Seq.1
AAZ29954	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Chachoengsao/Thailand/CU-10/04(H5N1))	Seq.1
AAZ29955	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Chachoengsao/Thailand/CU-11/04(H5N1))	Seq.1
AAZ29956	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Nakhon Sawan/Thailand/CU-12/04(H5N1))	Seq.1
AAZ29957	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Nakhon Sawan/Thailand/CU-13/04(H5N1))	Seq.1
AAZ29958	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Nakhon Pathom/Thailand/CU-14/04(H5N1))	Seq.1
AAZ29959	Avian	4 (HA)	H5N1	Thailand	2004	(A/crow/Bangkok/Thailand/CU-15/04(H5N1))	Seq.1
AAZ29960	Avian	4 (HA)	H5N1	Thailand	2004	(A/white peafowl/Bangkok/Thailand/CU-16/04(H5N1))	Seq.1
AAZ29961	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Saraburi/Thailand/CU-17/04(H5N1))	Seq.1
AAZ29962	Avian	4 (HA)	H5N1	Thailand	2004	(A/Kalji Pheasant/Bangkok/Thailand/CU-18/04(H5N1))	Seq.1
AAZ29963	Avian	4 (HA)	H5N1	Thailand	2004	(A/Ostrich/Samut Prakan/Thailand/CU-19/04(H5N1))	Seq.1
AAZ29964	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Bangkok/Thailand/CU-20/04(H5N1))	Seq.1
AAZ29965	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Ayutthaya/Thailand/CU-24/04(H5N1))	Seq.1
AAZ29966	Avian	4 (HA)	H5N1	Thailand	2004	(A/crow/Bangkok/Thailand/CU-25/04(H5N1))	Seq.1
AAZ29967	Avian	4 (HA)	H5N1	Thailand	2004	(A/rollers/Bangkok/Thailand/CU-26/04(H5N1))	Seq.1
AAZ29968	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Saraburi/Thailand/CU-27/04(H5N1))	Seq.1
AAZ29969	Avian	4 (HA)	H5N1	Thailand	2004	(A/white peafowl/Bangkok/Thailand/CU-29/04(H5N1))	Seq.1
AAZ29970	Avian	4 (HA)	H5N1	Thailand	2004	(A/ostrich/Samut Prakan/Thailand/CU-31/04(H5N1))	Seq.1
AAZ29971	Avian	4 (HA)	H5N1	Thailand	2004	(A/crow/Bangkok/Thailand/CU-35/04(H5N1))	Seq.1
AAZ29972	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Lopburi/Thailand/CU-38/04(H5N1))	Seq.1
AAZ29973	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Nakhon Sawan/Thailand/CU-39/04(H5N1))	Seq.1
AAZ29974	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Ratchaburi/Thailand/CU-68/04(H5N1))	Seq.1
AAZ29975	Avian	4 (HA)	H5N1	Thailand	2004	(A/duck/Nakhon Pathom/Thailand/CU-71/04(H5N1))	Seq.1
AAZ29976	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Chonburi/Thailand/CU-73/04(H5N1))	Seq.1
AAZ29977	Avian	4 (HA)	H5N1	Thailand	2004	(A/duck/Saraburi/Thailand/CU-74/04(H5N1))	Seq.1
AAZ29978	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Prachinburi/Thailand/CU-104/04(H5N1))	Seq.1
AAZ29979	Avian	4 (HA)	H5N1	Thailand	2004	(A/pigeon/Samut Prakan/Thailand/CU-202/04(H5N1))	Seq.1
AAZ29980	Avian	4 (HA)	H5N1	Thailand	2004	(A/sparrow/Phang-Nga/Thailand/CU-203/04(H5N1))	Seq.1
AAZ29981	Avian	4 (HA)	H5N1	Thailand	2004	(A/Mynas/Ranong/Thailand/CU-209/04(H5N1))	Seq.1
ABB43127	Avian	4 (HA)	H5N1	Thailand	2004	(A/pigeon/Thailand/KU-03/04(H5N1))	Seq.1
AAZ82496	Avian	4 (HA)	H5N1	Thailand	2005	(A/chicken/Thailand/Kamphaengphet-3-01/2005(H5N1))	Seq.1
AAZ82497	Avian	4 (HA)	H5N1	Thailand	2005	(A/chicken/Thailand/Kamphaengphet-3-02/2005(H5N1))	Seq.1
ABB58817	Avian	4 (HA)	H5N1	Thailand	2005	(A/chicken/Thailand/Kamphaengphet-3-03/2005(H5N1))	Seq.1
ABB58818	Avian	4 (HA)	H5N1	Thailand	2005	(A/chicken/Thailand/Kamphaengphet-3-04/2005(H5N1))	Seq.1
ABB58819	Avian	4 (HA)	H5N1	Thailand	2005	(A/chicken/Thailand/Kamphaengphet-3-05/2005(H5N1))	Seq.1

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Accession	Host	Segment	Subtype	Country & region	Year	Virus strain	FAAS
ABB58820	Avian	4 (HA)	H5N1	Thailand	2005	(A/chicken/Thailand/Kamphaengphet-3-06/2005(H5N1))	Seq.1
ABB58821	Avian	4 (HA)	H5N1	Thailand	2005	(A/chicken/Thailand/Kamphaengphet-3-07/2005(H5N1))	Seq.1
ABC69216	Avian	4 (HA)	H5N1	Thailand	2005	(A/chicken/Thailand/Kanchanaburi/CK-160/2005(H5N1))	Seq.1
ABC69224	Avian	4 (HA)	H5N1	Thailand	2005	(A/quail/Thailand/Nakhon Pathom/QA-161/2005(H5N1))	Seq.1
ABC69232	Avian	4 (HA)	H5N1	Thailand	2005	(A/chicken/Thailand/Nontaburi/CK-162/2005(H5N1))	Seq.1
ABC66580	Avian	4 (HA)	H5N1	Viet Nam	2003	(A/chicken/Vietnam/27/2003(H5N1))	Seq.1
ABE97575	Avian	4 (HA)	H5N1	Viet Nam	2003	(A/duck/Vietnam/15/2003(H5N1))	Seq.1
ABE97576	Avian	4 (HA)	H5N1	Viet Nam	2003	(A/mallard/Vietnam/16/2003(H5N1))	Seq.1
ABE97577	Avian	4 (HA)	H5N1	Viet Nam	2003	(A/duck/Vietnam/17/2003(H5N1))	Seq.1
ABE97583	Avian	4 (HA)	H5N1	Viet Nam	2003	(A/chicken/Vietnam/19/2003(H5N1))	Seq.1
ABE97584	Avian	4 (HA)	H5N1	Viet Nam	2003	(A/chicken/Vietnam/20/2003(H5N1))	Seq.1
ABE97585	Avian	4 (HA)	H5N1	Viet Nam	2003	(A/mallard/Vietnam/21/2003(H5N1))	Seq.1
ABE97586	Avian	4 (HA)	H5N1	Viet Nam	2003	(A/chicken/Vietnam/28/2003(H5N1))	Seq.1
ABE97587	Avian	4 (HA)	H5N1	Viet Nam	2003	(A/chicken/Vietnam/30/2003(H5N1))	Seq.1
ABE97595	Avian	4 (HA)	H5N1	Viet Nam	2003	(A/mallard/Vietnam/3/2003(H5N1))	Seq.1
ABE97596	Avian	4 (HA)	H5N1	Viet Nam	2003	(A/chicken/Vietnam/4/2003(H5N1))	Seq.1
ABE97597	Avian	4 (HA)	H5N1	Viet Nam	2003	(A/chicken/Vietnam/5/2003(H5N1))	Seq.1
ABE97598	Avian	4 (HA)	H5N1	Viet Nam	2003	(A/chicken/Vietnam/8/2003(H5N1))	Seq.1
AAS79356	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Vietnam/CM/2004(H5N1))	Seq.1
AAS79359	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/muscovy duck/Vietnam/MdGL/2004(H5N1))	Seq.1
AAS87577	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Vietnam/HD1/2004(H5N1))	Seq.1
AAS87580	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Vietnam/HD2/2004(H5N1))	Seq.1
AAT73277	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Viet Nam/33/2004(H5N1))	Seq.1
AAT73278	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/Ck/Viet Nam/35/2004(H5N1))	Seq.1
AAT73279	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/Ck/Viet Nam/36/2004(H5N1))	Seq.1
AAT73280	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/Ck/Viet Nam/37/2004(H5N1))	Seq.1
AAT73281	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/Ck/Viet Nam/38/2004(H5N1))	Seq.1
AAT73282	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/Ck/Viet Nam/39/2004(H5N1))	Seq.1
AAT73283	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/Ck/Viet Nam/C57/2004(H5N1))	Seq.1
AAT73284	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/Dk/Viet Nam/11/2004(H5N1))	Seq.1
AAU08349	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Viet Nam/HauGiang-178/2004(H5N1))	Seq.1
AAV73972	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Viet Nam/DT-171/2004(H5N1))	Seq.1
AAV73975	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/duck/Viet Nam/TG-007A/2004(H5N1))	Seq.1
AAW59548	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Viet Nam/HCM-022/2004(H5N1))	Seq.1
AAW59550	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Viet Nam/DN-045/2004(H5N1))	Seq.1
AAW59552	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Viet Nam/VL-008/2004(H5N1))	Seq.1
AAW59554	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Viet Nam/AG-010/2004(H5N1))	Seq.1
AAW59556	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Viet Nam/DT-015/2004(H5N1))	Seq.1
AAW59558	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Viet Nam/CT-018/2004(H5N1))	Seq.1
AAW59559	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Viet Nam/LA-024/2004(H5N1))	Seq.1
AAW80718	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Vietnam/C58/04(H5N1))	Seq.1
AAW80719	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/quail/Vietnam/36/04(H5N1))	Seq.1
AAZ72734	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Viet Nam/TN-025/2004(H5N1))	Seq.1
AAZ72735	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/duck/Viet Nam/TG-007A/2004(H5N1))	Seq.1
AAZ72736	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/quail/Viet Nam/TG-007B/2004(H5N1))	Seq.1
AAZ72737	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Viet Nam/TG-023/2004(H5N1))	Seq.1
AAZ72738	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Viet Nam/DT-171/2004(H5N1))	Seq.1
AAZ72739	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Viet Nam/LD-080/2004(H5N1))	Seq.1
ABC66579	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Vietnam/DT171/2004(H5N1))	Seq.1
ABC66582	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/Mallard duck/Vietnam/133/2004(H5N1))	Seq.1
ABE97578	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/duck/Vietnam/40/2004(H5N1))	Seq.1
ABE97588	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/duck/Vietnam/48/2004(H5N1))	Seq.1
ABE97600	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Vietnam/135/2004(H5N1))	Seq.1
ABE97601	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Vietnam/149/2004(H5N1))	Seq.1

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Accession	Host	Segment	Subtype	Country & region	Year	Virus strain	FAAS
ABE97603	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Vietnam/52/2004(H5N1))	Seq.1
ABE97605	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Vietnam/133/2004(H5N1))	Seq.1
ABE97607	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/duck/Vietnam/148/2004(H5N1))	Seq.1
ABE97611	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Vietnam/260/2004(H5N1))	Seq.1
ABE97612	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/goose/Vietnam/264/2004(H5N1))	Seq.1
ABE97615	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Vietnam/53/2004(H5N1))	Seq.1
ABE97618	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Vietnam/159/2004(H5N1))	Seq.1
ABE97619	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Vietnam/134/2004(H5N1))	Seq.1
ABE97620	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/quail/Vietnam/177/2004(H5N1))	Seq.1
ABE97621	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/duck/Vietnam/258/2004(H5N1))	Seq.1
ABE97623	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Vietnam/132/2004(H5N1))	Seq.1
CAI29278	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/Hatay/2004/(H5N1))	Seq.1
ABC66578	Avian	4 (HA)	H5N1	Viet Nam	2005	(A/duck/Vietnam/S654/2005(H5N1))	Seq.1
ABE97599	Avian	4 (HA)	H5N1	Viet Nam	2005	(A/duck/Vietnam/S640/2005(H5N1))	Seq.1
ABE97602	Avian	4 (HA)	H5N1	Viet Nam	2005	(A/duck/Vietnam/286/2005(H5N1))	Seq.1
ABE97608	Avian	4 (HA)	H5N1	Viet Nam	2005	(A/chicken/Vietnam/398/2005(H5N1))	Seq.1
ABE97609	Avian	4 (HA)	H5N1	Viet Nam	2005	(A/duck/Vietnam/376/2005(H5N1))	Seq.1
ABE97610	Avian	4 (HA)	H5N1	Viet Nam	2005	(A/wild bird/Vietnam/434/2005(H5N1))	Seq.1
ABE97613	Avian	4 (HA)	H5N1	Viet Nam	2005	(A/duck/Vietnam/283/2005(H5N1))	Seq.1
ABE97614	Avian	4 (HA)	H5N1	Viet Nam	2005	(A/duck/Vietnam/557/2005(H5N1))	Seq.1
ABE97616	Avian	4 (HA)	H5N1	Viet Nam	2005	(A/quail/Vietnam/282/2005(H5N1))	Seq.1
ABE97617	Avian	4 (HA)	H5N1	Viet Nam	2005	(A/chicken/Vietnam/393/2005(H5N1))	Seq.1
ABE97622	Avian	4 (HA)	H5N1	Viet Nam	2005	(A/duck/Vietnam/543/2005(H5N1))	Seq.1
ABF84066	Avian	4 (HA)	H5N1	Afghanistan	2006	(A/chicken/Afghanistan/1207/2006(H5N1))	Seq.2
AAV91149	Avian	4 (HA)	H5N1	China	2004	(A/chick/Macheng/2004(H5N1))	Seq.2
AAZ16275	Avian	4 (HA)	H5N1	China	2005	(A/Great Black-headed Gull/Qinghai/2/05(H5N1))	Seq.2
AAZ16276	Avian	4 (HA)	H5N1	China	2005	(A/Bar-headed Goose/Qinghai/75/05(H5N1))	Seq.2
AAZ16277	Avian	4 (HA)	H5N1	China	2005	(A/Bar-headed Goose/Qinghai/62/05(H5N1))	Seq.2
AAZ16278	Avian	4 (HA)	H5N1	China	2005	(A/Bar-headed Goose/Qinghai/65/05(H5N1))	Seq.2
AAZ16279	Avian	4 (HA)	H5N1	China	2005	(A/Bar-headed Goose/Qinghai/67/05(H5N1))	Seq.2
AAZ17522	Avian	4 (HA)	H5N1	China	2005	(A/black-headed goose/Qinghai/1/2005(H5N1))	Seq.2
AAZ17523	Avian	4 (HA)	H5N1	China	2005	(A/black-headed goose/Qinghai/2/2005(H5N1))	Seq.2
AAZ17524	Avian	4 (HA)	H5N1	China	2005	(A/black-headed gull/Qinghai/1/2005(H5N1))	Seq.2
AAZ23154	Avian	4 (HA)	H5N1	China	2005	(A/great black-headed gull/Qinghai/1/2005(H5N1))	Seq.2
ABA29447	Avian	4 (HA)	H5N1	China	2005	(A/bar-headed goose/Qinghai/0510/05(H5N1))	Seq.2
ABC66561	Avian	4 (HA)	H5N1	China	2005	(A/migratory duck/Jiangxi/2136/2005(H5N1))	Seq.2
ABC66562	Avian	4 (HA)	H5N1	China	2005	(A/migratory duck/Jiangxi/2295/2005(H5N1))	Seq.2
ABC66563	Avian	4 (HA)	H5N1	China	2005	(A/migratory duck/Jiangxi/2300/2005(H5N1))	Seq.2
ABE68921	Avian	4 (HA)	H5N1	China	2005	(A/Bar-headed Goose/Qinghai/59/05(H5N1))	Seq.2
ABE68922	Avian	4 (HA)	H5N1	China	2005	(A/Bar-headed Goose/Qinghai/68/05(H5N1))	Seq.2
ABE68923	Avian	4 (HA)	H5N1	China	2005	(A/Bar-headed Goose/Qinghai/60/05(H5N1))	Seq.2
ABE68924	Avian	4 (HA)	H5N1	China	2005	(A/Brown-headed Gull/Qinghai/3/05(H5N1))	Seq.2
ABE68925	Avian	4 (HA)	H5N1	China	2005	(A/Bar-headed Goose/Qinghai/5/05(H5N1))	Seq.2
ABE68926	Avian	4 (HA)	H5N1	China	2005	(A/Bar-headed Goose/Qinghai/61/05(H5N1))	Seq.2
ABE68927	Avian	4 (HA)	H5N1	China	2005	(A/Bar-headed Goose/Qinghai/12/05(H5N1))	Seq.2
ABD85374	Avian	4 (HA)	H5N1	Croatia	2005	virus (A/mute swan/Croatia/1/2005(H5N1))	Seq.2
ABF56528	Avian	4 (HA)	H5N1	Czech Republic	2006	(A/Cygnus olor/Czech Republic/5170/2006(H5N1))	Seq.2
ABD85144	Avian	4 (HA)	H5N1	Egypt	2006	(A/chicken/Egypt/960N3-004/2006(H5N1))	Seq.2
CAJ77761	Avian	4 (HA)	H5N1	France	2006	(A/common pochard/France/06167/2006(H5N1))	Seq.2
CAJ84721	Avian	4 (HA)	H5N1	France	2006	(A/turkey/France/06222/2006(H5N1))	Seq.2
ABD95991	Avian	4 (HA)	H5N1	Germany	2006	(A/mallard/Bavaria/1/2006(H5N1))	Seq.2
AAL31384	Avian	4 (HA)	H5N1	Hong Kong	2000	(A/Duck/Hong Kong/ww461/2000(H5N1))	Seq.2
AAL31385	Avian	4 (HA)	H5N1	Hong Kong	2000	(A/Duck/Hong Kong/ww487/2000(H5N1))	Seq.2

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Accession	Host	Segment	Subtype	Country & region	Year	Virus strain	FAAS
AAL31386	Avian	4 (HA)	H5N1	Hong Kong	2000	(A/Goose/Hong Kong/ww491/2000(H5N1))	Seq.2
AAT39074	Avian	4 (HA)	H5N1	Hong Kong	2002	(A/Dk/HK/821/02 (H5N1))	Seq.2
AAT73300	Avian	4 (HA)	H5N1	Hong Kong	2002	(A/feral pigeon/HK/862.7/2002(H5N1))	Seq.2
AAT73301	Avian	4 (HA)	H5N1	Hong Kong	2002	(A/tree sparrow/HK/864/2002(H5N1))	Seq.2
AAV97601	Avian	4 (HA)	H5N1	Hong Kong	2002	(A/duck/Hong Kong/821/02(H5N1))	Seq.2
ABD73804	Avian	4 (HA)	H5N1	Iran	2006	(A/Cygnus cygnus/Iran/754/2006(H5N1))	Seq.2
ABD66292	Avian	4 (HA)	H5N1	Iraq	2006	(A/domestic goose/Iraq/812/2006(H5N1))	Seq.2
ABD52284	Avian	4 (HA)	H5N1	Italy	2006	(A/Cygnus olor/Italy/742/2006(H5N1))	Seq.2
ABD83818	Avian	4 (HA)	H5N1	Italy	2006	(A/mallard/Italy/835/2006(H5N1))	Seq.2
BAE48315	Avian	4 (HA)	H5N1	Mongolia	2005	(A/bar-headed goose/Mongolia/1/05(H5N1))	Seq.2
BAE48316	Avian	4 (HA)	H5N1	Mongolia	2005	(A/whooper swan/Mongolia/3/05(H5N1))	Seq.2
BAE48317	Avian	4 (HA)	H5N1	Mongolia	2005	(A/whooper swan/Mongolia/4/05(H5N1))	Seq.2
BAE48318	Avian	4 (HA)	H5N1	Mongolia	2005	(A/whooper swan/Mongolia/6/05(H5N1))	Seq.2
BAE96961	Avian	4 (HA)	H5N1	Mongolia	2006	(A/whooper swan/Mongolia/2/06(H5N1))	Seq.2
ABF72802	Avian	4 (HA)	H5N1	Niger	2006	(A/duck/Niger/914/2006(H5N1))	Seq.2
ABD46740	Avian	4 (HA)	H5N1	Nigeria	2006	(A/chicken/Nigeria/641/2006(H5N1))	Seq.2
ABA39516	Avian	4 (HA)	H5N1	Russia	2005	(A/grebe/Novosibirsk/29/2005(H5N1))	Seq.2
ABA39517	Avian	4 (HA)	H5N1	Russia	2005	(A/duck/Novosibirsk/56/2005(H5N1))	Seq.2
ABA39518	Avian	4 (HA)	H5N1	Russia	2005	(A/chicken/Novosibirsk/64/05(H5N1))	Seq.2
ABA39519	Avian	4 (HA)	H5N1	Russia	2005	(A/chicken/Novosibirsk/65/05(H5N1))	Seq.2
ABA39520	Avian	4 (HA)	H5N1	Russia	2005	(A/chicken/Novosibirsk/66/05(H5N1))	Seq.2
ABB00582	Avian	4 (HA)	H5N1	Russia	2005	(A/goose/Novosibirsk/4/2005(H5N1))	Seq.2
ABB22773	Avian	4 (HA)	H5N1	Russia	2005	(A/turkey/Suzdalka/Nov-01/05(H5N1))	Seq.2
ABB22774	Avian	4 (HA)	H5N1	Russia	2005	(A/chicken/Suzdalka/Nov-12/05(H5N1))	Seq.2
ABB22775	Avian	4 (HA)	H5N1	Russia	2005	(A/chicken/Suzdalka/Nov-11/05(H5N1))	Seq.2
ABB43058	Avian	4 (HA)	H5N1	Russia	2005	(A/grebe/Novosibirsk/29/2005(H5N1))	Seq.2
ABB43059	Avian	4 (HA)	H5N1	Russia	2005	(A/duck/Novosibirsk/56/2005(H5N1))	Seq.2
ABB86287	Avian	4 (HA)	H5N1	Russia	2005	(A/chicken/Tula/10/2005(H5N1))	Seq.2
ABC48787	Avian	4 (HA)	H5N1	Russia	2005	(A/chicken/Kurgan/3/2005(H5N1))	Seq.2
ABC59833	Avian	4 (HA)	H5N1	Russia	2005	(A/swan/Astrakhan/1/2005(H5N1))	Seq.2
ABC70712	Avian	4 (HA)	H5N1	Russia	2005	(A/Cygnus olor/Astrakhan/Ast05-2-2/2005(H5N1))	Seq.2
ABC87315	Avian	4 (HA)	H5N1	Russia	2005	(A/Cygnus olor/Astrakhan/Ast05-2-3/2005(H5N1))	Seq.2
ABC88573	Avian	4 (HA)	H5N1	Russia	2005	(A/Cygnus olor/Astrakhan/Ast05-2-6/2005(H5N1))	Seq.2
ABC88583	Avian	4 (HA)	H5N1	Russia	2005	(A/Cygnus olor/Astrakhan/Ast05-2-5/2005(H5N1))	Seq.2
ABD32123	Avian	4 (HA)	H5N1	Russia	2005	(A/Cygnus olor/Astrakhan/Ast05-2-4/2005(H5N1))	Seq.2
ABD32128	Avian	4 (HA)	H5N1	Russia	2005	(A/Cygnus olor/Astrakhan/Ast05-2-7/2005(H5N1))	Seq.2
ABD49489	Avian	4 (HA)	H5N1	Russia	2005	(A/Cygnus olor/Astrakhan/Ast05-2-1/2005(H5N1))	Seq.2
ABD60336	Avian	4 (HA)	H5N1	Russia	2005	(A/Cygnus olor/Astrakhan/Ast05-2-8/2005(H5N1))	Seq.2
ABD60345	Avian	4 (HA)	H5N1	Russia	2005	(A/Cygnus olor/Astrakhan/Ast05-2-9/2005(H5N1))	Seq.2
ABD65415	Avian	4 (HA)	H5N1	Russia	2005	(A/Cygnus olor/Astrakhan/Ast05-2-10/2005(H5N1))	Seq.2
ABD92945	Avian	4 (HA)	H5N1	Russia	2005	(A/chicken/Kurgan/05/2005(H5N1))	Seq.2
ABD92953	Avian	4 (HA)	H5N1	Russia	2005	(A/duck/Kurgan/08/2005(H5N1))	Seq.2
ABG20476	Avian	4 (HA)	H5N1	Russian	2005	(A/chicken/Dovolnoe/03/2005(H5N1))	Seq.2
ABG20478	Avian	4 (HA)	H5N1	Russian	2005	(A/goose/Krasnoozerka/627/2005(H5N1))	Seq.2
ABG20468	Avian	4 (HA)	H5N1	Russian	2006	(A/chicken/Mahachkala/05/2006(H5N1))	Seq.2
ABG20472	Avian	4 (HA)	H5N1	Russian	2006	(A/chicken/Krasnodar/01/2006(H5N1))	Seq.2
ABD73284	Avian	4 (HA)	H5N1	Turkey	2005	(A/turkey/Turkey/1/2005(H5N1))	Seq.2
ABC70167	Avian	4 (HA)	H5N1	Ukraine	2005	(A/chicken/Crimea/1/2005(H5N1))	Seq.2
ABG38185	Avian	4 (HA)	H5N1	Ukraine	2005	(A/chicken/Crimea/04/2005(H5N1))	Seq.2
ABG38189	Avian	4 (HA)	H5N1	Ukraine	2005	(A/chicken/Crimea/08/2005(H5N1))	Seq.2
AAT12042	Avian	4 (HA)	H5N1	China	2000	(A/duck/Zhejiang/52/2000(H5N1))	Seq.3
AAT73292	Avian	4 (HA)	H5N1	China	2002	(A/teal/China/2978.1/2002(H5N1))	Seq.3
ABD61670	Avian	4 (HA)	H5N1	China	2003	(A/swine/Guangdong/2/2003(H5N1))	Seq.3
ABD61671	Avian	4 (HA)	H5N1	China	2003	(A/swine/Guangdong/4/2003(H5N1))	Seq.3

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Accession	Host	Segment	Subtype	Country & region	Year	Virus strain	FAAS
ABD61672	Avian	4 (HA)	H5N1	China	2003	(A/swine/Guangdong/5/2003(H5N1))	Seq.3
AAT65209	Avian	4 (HA)	H5N1	China	2004	(A/goose/China/F3/2004(H5N1))	Seq.3
AAW19642	Avian	4 (HA)	H5N1	China	2004	(A/tree sparrow/Henan/2/2004(H5N1))	Seq.3
AAW19644	Avian	4 (HA)	H5N1	China	2004	(A/tree sparrow/Henan/3/2004(H5N1))	Seq.3
ABC66521	Avian	4 (HA)	H5N1	China	2004	(A/duck/Guangxi/668/2004(H5N1))	Seq.3
ABC66522	Avian	4 (HA)	H5N1	China	2004	(A/goose/Guangxi/914/2004(H5N1))	Seq.3
ABC66523	Avian	4 (HA)	H5N1	China	2004	(A/goose/Guangxi/1097/2004(H5N1))	Seq.3
ABC66524	Avian	4 (HA)	H5N1	China	2004	(A/goose/Guangxi/1198/2004(H5N1))	Seq.3
ABC66525	Avian	4 (HA)	H5N1	China	2004	(A/duck/Guangxi/1311/2004(H5N1))	Seq.3
ABC66526	Avian	4 (HA)	H5N1	China	2004	(A/duck/Guangxi/1378/2004(H5N1))	Seq.3
ABC66527	Avian	4 (HA)	H5N1	China	2004	(A/duck/Guangxi/1586/2004(H5N1))	Seq.3
ABC66528	Avian	4 (HA)	H5N1	China	2004	(A/duck/Guangxi/1681/2004(H5N1))	Seq.3
ABC66529	Avian	4 (HA)	H5N1	China	2004	(A/duck/Guangxi/1793/2004(H5N1))	Seq.3
ABC66530	Avian	4 (HA)	H5N1	China	2004	(A/goose/Guangxi/1832/2004(H5N1))	Seq.3
ABC66531	Avian	4 (HA)	H5N1	China	2004	(A/goose/Guangxi/2112/2004(H5N1))	Seq.3
ABC66532	Avian	4 (HA)	H5N1	China	2004	(A/duck/Guangxi/2291/2004(H5N1))	Seq.3
ABC66533	Avian	4 (HA)	H5N1	China	2004	(A/goose/Guangxi/2383/2004(H5N1))	Seq.3
ABC66534	Avian	4 (HA)	H5N1	China	2004	(A/duck/Guangxi/2396/2004(H5N1))	Seq.3
ABC66535	Avian	4 (HA)	H5N1	China	2004	(A/chicken/Guangxi/2439/2004(H5N1))	Seq.3
ABC69148	Avian	4 (HA)	H5N1	China	2005	(A/chicken/Hebei/326/2005(H5N1))	Seq.3
AAL59142	Avian	4 (HA)	H5N1	Hong Kong	2000	(A/Goose/Hong Kong/385.3/2000(H5N1))	Seq.3
AAL59143	Avian	4 (HA)	H5N1	Hong Kong	2000	(A/Goose/Hong Kong/385.5/2000(H5N1))	Seq.3
AAO46797	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Chicken/HongKong/NT873.3/01-MB(H5N1))	Seq.3
AAO46798	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Chicken/HongKong/NT873.3/01(H5N1))	Seq.3
ABE97606	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Vietnam/147/2004(H5N1))	Seq.3
AAR99628	Avian	4 (HA)	H5N1	China	2003	(A/duck/China/E319-2/03(H5N1))	Seq.4
AAT73303	Avian	4 (HA)	H5N1	China	2003	(A/Dk/HN/5806/2003(H5N1))	Seq.4
AAT73309	Avian	4 (HA)	H5N1	China	2003	(A/Dk/YN/6255/2003(H5N1))	Seq.4
AAT73310	Avian	4 (HA)	H5N1	China	2003	(A/Dk/YN/6445/2003(H5N1))	Seq.4
AAT73304	Avian	4 (HA)	H5N1	China	2004	(A/Dk/HN/303/2004(H5N1))	Seq.4
AAT73305	Avian	4 (HA)	H5N1	China	2004	(A/Dk/HN/101/2004(H5N1))	Seq.4
AAT73306	Avian	4 (HA)	H5N1	China	2004	(A/Ph/ST/44/2004(H5N1))	Seq.4
AAT73311	Avian	4 (HA)	H5N1	China	2004	(A/Ck/YN/374/2004(H5N1))	Seq.4
AAT73312	Avian	4 (HA)	H5N1	China	2004	(A/Ck/YN/115/2004(H5N1))	Seq.4
AAW59390	Avian	4 (HA)	H5N1	China	2004	(A/chicken/Guangdong/191/04(H5N1))	Seq.4
AAW59398	Avian	4 (HA)	H5N1	China	2004	(A/chicken/Guangdong/178/04(H5N1))	Seq.4
AAW59408	Avian	4 (HA)	H5N1	China	2004	(A/duck/Guangdong/173/04(H5N1))	Seq.4
ABC66519	Avian	4 (HA)	H5N1	China	2004	(A/duck/Guangxi/351/2004(H5N1))	Seq.4
ABC66520	Avian	4 (HA)	H5N1	China	2004	(A/duck/Guangxi/380/2004(H5N1))	Seq.4
ABC66536	Avian	4 (HA)	H5N1	China	2004	(A/chicken/Guangxi/2448/2004(H5N1))	Seq.4
ABC66537	Avian	4 (HA)	H5N1	China	2004	(A/chicken/Guangxi/2461/2004(H5N1))	Seq.4
AAZ16280	Avian	4 (HA)	H5N1	China	2005	(A/Chicken/Shantou/810/05(H5N1))	Seq.4
AAZ16281	Avian	4 (HA)	H5N1	China	2005	(A/duck/Hunan/114/05(H5N1))	Seq.4
AAZ16282	Avian	4 (HA)	H5N1	China	2005	(A/Duck/Hunan/191/05(H5N1))	Seq.4
ABC66538	Avian	4 (HA)	H5N1	China	2005	(A/goose/Guangxi/345/2005(H5N1))	Seq.4
ABC66539	Avian	4 (HA)	H5N1	China	2005	(A/quail/Guangxi/575/2005(H5N1))	Seq.4
ABC66540	Avian	4 (HA)	H5N1	China	2005	(A/chicken/Guangxi/604/2005(H5N1))	Seq.4
ABC66541	Avian	4 (HA)	H5N1	China	2005	(A/duck/Guangxi/793/2005(H5N1))	Seq.4
ABC66542	Avian	4 (HA)	H5N1	China	2005	(A/duck/Guangxi/951/2005(H5N1))	Seq.4
ABC66544	Avian	4 (HA)	H5N1	China	2005	(A/duck/Hunan/127/2005(H5N1))	Seq.4
ABC66545	Avian	4 (HA)	H5N1	China	2005	(A/duck/Hunan/139/2005(H5N1))	Seq.4
ABC66546	Avian	4 (HA)	H5N1	China	2005	(A/duck/Hunan/149/2005(H5N1))	Seq.4
ABC66547	Avian	4 (HA)	H5N1	China	2005	(A/duck/Hunan/152/2005(H5N1))	Seq.4
ABC66548	Avian	4 (HA)	H5N1	China	2005	(A/duck/Hunan/157/2005(H5N1))	Seq.4

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Accession	Host	Segment	Subtype	Country & region	Year	Virus strain	FAAS
ABC66549	Avian	4 (HA)	H5N1	China	2005	(A/duck/Hunan/160/2005(H5N1))	Seq.4
ABC66550	Avian	4 (HA)	H5N1	China	2005	(A/duck/Hunan/166/2005(H5N1))	Seq.4
ABC66551	Avian	4 (HA)	H5N1	China	2005	(A/duck/Hunan/182/2005(H5N1))	Seq.4
ABC66552	Avian	4 (HA)	H5N1	China	2005	(A/chicken/Hunan/999/2005(H5N1))	Seq.4
ABC66553	Avian	4 (HA)	H5N1	China	2005	(A/duck/Hunan/1265/2005(H5N1))	Seq.4
ABC66554	Avian	4 (HA)	H5N1	China	2005	(A/duck/Hunan/1608/2005(H5N1))	Seq.4
ABC66555	Avian	4 (HA)	H5N1	China	2005	(A/duck/Hunan/1652/2005(H5N1))	Seq.4
ABE68928	Avian	4 (HA)	H5N1	China	2005	(A/Chicken/Yunnan/447/05(H5N1))	Seq.4
ABE68929	Avian	4 (HA)	H5N1	China	2005	(A/Chicken/Yunnan/493/05(H5N1))	Seq.4
ABE68930	Avian	4 (HA)	H5N1	China	2005	(A/Quail/Shantou/911/05(H5N1))	Seq.4
ABE68932	Avian	4 (HA)	H5N1	China	2005	(A/Duck/Fujian/1734/05(H5N1))	Seq.4
AAO52881	Avian	4 (HA)	H5N1	Hong Kong	2001	(A/Duck/Hong Kong/573.4/01 (H5N1))	Seq.4
AAT73293	Avian	4 (HA)	H5N1	Hong Kong	2003	(A/Ck/HK/2133.1/2003(H5N1))	Seq.4
AAV97603	Avian	4 (HA)	H5N1	Hong Kong	2003	(A/chicken/Korea/ES/03(H5N1))	Seq.4
ABC66565	Avian	4 (HA)	H5N1	Hong Kong	2004	(A/grey heron/Hong Kong/728/2004(H5N1))	Seq.4
ABC66567	Avian	4 (HA)	H5N1	Hong Kong	2005	(A/Chinese pond heron/Hong Kong/18/2005(H5N1))	Seq.4
ABC66573	Avian	4 (HA)	H5N1	Indonesia	2004	(A/chicken/Kulon Progo/BBVet-XII-1/2004(H5N1))	Seq.4
ABE97555	Avian	4 (HA)	H5N1	Indonesia	2004	(A/chicken/Kulon Progo/BBVet-XII-2/2004(H5N1))	Seq.4
BAD89305	Avian	4 (HA)	H5N1	Japan	2004	(A/chicken/Yamaguchi/7/2004(H5N1))	Seq.4
BAD89315	Avian	4 (HA)	H5N1	Japan	2004	(A/chicken/Oita/8/2004(H5N1))	Seq.4
BAD89325	Avian	4 (HA)	H5N1	Japan	2004	(A/chicken/Kyoto/3/2004(H5N1))	Seq.4
BAD89335	Avian	4 (HA)	H5N1	Japan	2004	(A/crow/Kyoto/53/2004(H5N1))	Seq.4
BAD89345	Avian	4 (HA)	H5N1	Japan	2004	(A/crow/Osaka/102/2004(H5N1))	Seq.4
BAE47131	Avian	4 (HA)	H5N1	Japan	2004	(A/blow fly/Kyoto/93/2004(H5N1))	Seq.4
AAV97604	Avian	4 (HA)	H5N1	South Korea	2003	(A/duck/Korea/ESD1/03(H5N1))	Seq.4
AAU08351	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Viet Nam/HauGiang-617/2004(H5N1))	Seq.4
ABE97589	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/duck/Vietnam/219/2004(H5N1))	Seq.4
ABE97590	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/duck/Vietnam/220/2004(H5N1))	Seq.4
ABE97591	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/duck/Vietnam/N-XX/2004(H5N1))	Seq.4
ABE97592	Avian	4 (HA)	H5N1	Viet Nam	2004	(A/chicken/Vietnam/32/2004(H5N1))	Seq.4
ABC66581	Avian	4 (HA)	H5N1	Viet Nam	2005	(A/duck/Vietnam/568/2005(H5N1))	Seq.4
ABE97579	Avian	4 (HA)	H5N1	Viet Nam	2005	(A/duck/Vietnam/272/2005(H5N1))	Seq.4
ABE97580	Avian	4 (HA)	H5N1	Viet Nam	2005	(A/mallard/Vietnam/347/2005(H5N1))	Seq.4
ABE97581	Avian	4 (HA)	H5N1	Viet Nam	2005	(A/chicken/Vietnam/348/2005(H5N1))	Seq.4
ABE97582	Avian	4 (HA)	H5N1	Viet Nam	2005	(A/mallard/Vietnam/352/2005(H5N1))	Seq.4
ABE97593	Avian	4 (HA)	H5N1	Viet Nam	2005	(A/duck/Vietnam/N-TB/2005(H5N1))	Seq.4
ABE97594	Avian	4 (HA)	H5N1	Viet Nam	2005	(A/duck/Vietnam/317/2005(H5N1))	Seq.4
ABB43119	Cat	4 (HA)	H5N1	Thailand	2004	(A/cat/Thailand/KU-02/04(H5N1))	Seq.1
ABD66291	Cat	4 (HA)	H5N1	Iraq	2006	(A/domestic cat/Iraq/820/2006(H5N1))	Seq.2
ABC66564	Environment	4 (HA)	H5N1	China	2005	(A/Environment/Qinghai/31/2005(H5N1))	Seq.2
ABG23657	Human	4 (HA)	H5N1	China	2006	(A/human/Zhejiang/16/2006(H5N1))	Seq.1
AAC32088	Human	4 (HA)	H5N1	Hong Kong	1997	(A/Hong Kong/156/97(H5N1))	Seq.1
AAC32098	Human	4 (HA)	H5N1	Hong Kong	1997	(A/Hong Kong/481/97(H5N1))	Seq.1
AAC32099	Human	4 (HA)	H5N1	Hong Kong	1997	(A/Hong Kong/483/97(H5N1))	Seq.1
AAC32100	Human	4 (HA)	H5N1	Hong Kong	1997	(A/Hong Kong/482/97(H5N1))	Seq.1
AAC34263	Human	4 (HA)	H5N1	Hong Kong	1997	(A/Hong Kong/156/97(H5N1))	Seq.1
AAC40508	Human	4 (HA)	H5N1	Hong Kong	1997	(A/Hong Kong/156/97(H5N1))	Seq.1
AAD21153	Human	4 (HA)	H5N1	Hong Kong	1997	(A/Hong Kong/486/97(H5N1))	Seq.1
AAD21154	Human	4 (HA)	H5N1	Hong Kong	1997	(A/Hong Kong/488/97(H5N1))	Seq.1
AAD21155	Human	4 (HA)	H5N1	Hong Kong	1997	(A/Hong Kong/516/97(H5N1))	Seq.1
AAD21156	Human	4 (HA)	H5N1	Hong Kong	1997	(A/Hong Kong/538/97(H5N1))	Seq.1
AAD21157	Human	4 (HA)	H5N1	Hong Kong	1997	(A/Hong Kong/507/97(H5N1))	Seq.1

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Accession	Host	Segment	Subtype	Country & region	Year	Virus strain	FAAS
AAD21159	Human	4 (HA)	H5N1	Hong Kong	1997	(A/Hong Kong/491/97(H5N1))	Seq.1
AAD21160	Human	4 (HA)	H5N1	Hong Kong	1997	(A/Hong Kong/542/97(H5N1))	Seq.1
AAD21161	Human	4 (HA)	H5N1	Hong Kong	1997	(A/Hong Kong/503/97(H5N1))	Seq.1
AAD21162	Human	4 (HA)	H5N1	Hong Kong	1997	(A/Hong Kong/532/97(H5N1))	Seq.1
AAD21163	Human	4 (HA)	H5N1	Hong Kong	1997	(A/Hong Kong/485/97(H5N1))	Seq.1
AAD21164	Human	4 (HA)	H5N1	Hong Kong	1997	(A/Hong Kong/514/97(H5N1))	Seq.1
AAD52043	Human	4 (HA)	H5N1	Hong Kong	1997	(A/Hong Kong/485/97(H5N1))	Seq.1
AAF74329	Human	4 (HA)	H5N1	Hong Kong	1997	(A/Hong Kong/481/97(H5N1))	Seq.1
AAF74330	Human	4 (HA)	H5N1	Hong Kong	1997	(A/Hong Kong/483/97(H5N1))	Seq.1
AAF74331	Human	4 (HA)	H5N1	Hong Kong	1997	(A/Hong Kong/486/97(H5N1))	Seq.1
AAD21158	Human	4 (HA)	H5N1	Hong Kong	1998	(A/HongKong/97/98(H5N1))	Seq.1
AAT39065	Human	4 (HA)	H5N1	Hong Kong	2003	(A/HK/212/03 (H5N1))	Seq.1
AAT39066	Human	4 (HA)	H5N1	Hong Kong	2003	(A/HK/213/03 (H5N1))	Seq.1
BAE07201	Human	4 (HA)	H5N1	Hong Kong	2003	(A/Hong Kong/213/03(H5N1))	Seq.1
AAS65615	Human	4 (HA)	H5N1	Thailand	2004	(A/Thailand/1(KAN-1)/2004(H5N1))	Seq.1
AAS65618	Human	4 (HA)	H5N1	Thailand	2004	(A/Thailand/2(SP-33)/2004(H5N1))	Seq.1
AAS89004	Human	4 (HA)	H5N1	Thailand	2004	(A/Thailand/3(SP-83)/2004(H5N1))	Seq.1
AAT84153	Human	4 (HA)	H5N1	Thailand	2004	(A/Thailand/LFPN-2004/2004(H5N1))	Seq.1
AAV32636	Human	4 (HA)	H5N1	Thailand	2004	(A/Thailand/5(KK-494)/2004(H5N1))	Seq.1
AAV34704	Human	4 (HA)	H5N1	Thailand	2004	(A/Thailand/4(SP-528)/2004(H5N1))	Seq.1
AAV74400	Human	4 (HA)	H5N1	Thailand	2004	(A/Thailand/Kamphaengphet-Nontaburi/04(H5N1))	Seq.1
ABD16284	Human	4 (HA)	H5N1	Thailand	2005	(A/Thailand/NK165/2005(H5N1))	Seq.1
AAR98819	Human	4 (HA)	H5N1	Viet Nam	2004	(A/Vietnam/1196/2004(H5N1))	Seq.1
AAT73273	Human	4 (HA)	H5N1	Viet Nam	2004	(A/Viet Nam/1194/2004(H5N1))	Seq.1
AAT73274	Human	4 (HA)	H5N1	Viet Nam	2004	(A/Viet Nam/1203/2004(H5N1))	Seq.1
AAT73275	Human	4 (HA)	H5N1	Viet Nam	2004	(A/Viet Nam/3046/2004(H5N1))	Seq.1
AAT73276	Human	4 (HA)	H5N1	Viet Nam	2004	(A/Viet Nam/3062/2004(H5N1))	Seq.1
AAV73980	Human	4 (HA)	H5N1	Viet Nam	2004	(A/Viet Nam/DN-33/2004(H5N1))	Seq.1
AAW80717	Human	4 (HA)	H5N1	Viet Nam	2004	(A/Viet Nam/1203/2004(H5N1))	Seq.1
ABE97624	Human	4 (HA)	H5N1	Viet Nam	2004	(A/human/Vietnam/CL01/2004(H5N1))	Seq.1
ABE97625	Human	4 (HA)	H5N1	Viet Nam	2004	(A/human/Vietnam/CL02/2004(H5N1))	Seq.1
ABE97626	Human	4 (HA)	H5N1	Viet Nam	2004	(A/human/Vietnam/CL17/2004(H5N1))	Seq.1
ABE97627	Human	4 (HA)	H5N1	Viet Nam	2004	(A/human/Vietnam/CL20/2004(H5N1))	Seq.1
ABE97628	Human	4 (HA)	H5N1	Viet Nam	2004	(A/human/Vietnam/CL26/2004(H5N1))	Seq.1
ABE97629	Human	4 (HA)	H5N1	Viet Nam	2004	(A/human/Vietnam/CL36/2004(H5N1))	Seq.1
ABE97630	Human	4 (HA)	H5N1	Viet Nam	2004	(A/human/Vietnam/CL100/2004(H5N1))	Seq.1
CAG29661	Human	4 (HA)	H5N1	Viet Nam	2004	(A/Hanoi/03/2004(H5N1))	Seq.1
ABE97631	Human	4 (HA)	H5N1	Viet Nam	2005	(A/human/Vietnam/CL105/2005(H5N1))	Seq.1
ABE97632	Human	4 (HA)	H5N1	Viet Nam	2005	(A/human/Vietnam/CL115/2005(H5N1))	Seq.1
ABE97633	Human	4 (HA)	H5N1	Viet Nam	2005	(A/human/Vietnam/CL119/2005(H5N1))	Seq.1
ABE97634	Human	4 (HA)	H5N1	Viet Nam	2005	(A/human/Vietnam/CL2009/2005(H5N1))	Seq.1
ABE01046	Human	4 (HA)	H5N1	Egypt	2006	(A/Egypt/2782-NAMRU3/2006(H5N1))	Seq.2
ABD66293	Human	4 (HA)	H5N1	Iraq	2006	(A/human/Iraq/207-NAMRU3/2006(H5N1))	Seq.2
ABD28180	Human	4 (HA)	H5N1	China	2005	(A/Anhui/1/2005(H5N1))	Seq.4
ABD28181	Human	4 (HA)	H5N1	China	2005	(A/Anhui/2/2005(H5N1))	Seq.4
ABD28182	Human	4 (HA)	H5N1	China	2005	(A/Guangxi/1/2005(H5N1))	Seq.4
BAE46949	Human	4 (HA)	H5N1	Viet Nam	2005	(A/Hanoi/30408/2005(H5N1))	Seq.4
AAS57873	Leopard	4 (HA)	H5N1	Thailand	2004	(A/leopard/Thailand/TM3/2004(H5N1))	Seq.1
AAS57874	Leopard	4 (HA)	H5N1	Thailand	2004	(A/leopard/Thailand/TLV3/2004(H5N1))	Seq.1
AAS89271	Leopard	4 (HA)	H5N1	Thailand	2004	(A/leopard/Thailand/CU-MD/2004(H5N1))	Seq.1
AAT70218	Leopard	4 (HA)	H5N1	Thailand	2004	(A/leopard/Suphanburi/Thailand/Leo-1/04(H5N1))	Seq.1
AAT72505	Swine	4 (HA)	H5N1	China	2003	(A/swine/Shandong/2/03(H5N1))	Seq.1
AAV30836	Swine	4 (HA)	H5N1	China	2001	(A/swine/Fujian/F1/2001(H5N1))	Seq.3
AAV30828	Swine	4 (HA)	H5N1	China	2003	(A/swine/Fujian/1/2003(H5N1))	Seq.3

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Accession	Host	Segment	Subtype	Country & region	Year	Virus strain	FAAS
ABD61673	Swine	4 (HA)	H5N1	China	2004	(A/swine/Anhui/2004(H5N1))	Seq.3
AAS57875	Tiger	4 (HA)	H5N1	Thailand	2004	(A/tiger/Thailand/TLV1/2004(H5N1))	Seq.1
AAT70210	Tiger	4 (HA)	H5N1	Thailand	2004	(A/tiger/Suphanburi/Thailand/Ti-1/04(H5N1))	Seq.1
AAV97886	Tiger	4 (HA)	H5N1	Thailand	2004	(A/tiger/Thailand/SPB-1(H5N1))	Seq.1
AAW30657	Tiger	4 (HA)	H5N1	Thailand	2004	(A/tiger/Thailand/CU-T3/2004(H5N1))	Seq.1
AAW66002	Tiger	4 (HA)	H5N1	Thailand	2004	(A/tiger/Thailand/CU-T7/2004(H5N1))	Seq.1
AAX83395	Tiger	4 (HA)	H5N1	Thailand	2004	(A/tiger/Thailand/CU-T4/04(H5N1))	Seq.1
AAX83396	Tiger	4 (HA)	H5N1	Thailand	2004	(A/tiger/Thailand/CU-T5/04(H5N1))	Seq.1
AAX83397	Tiger	4 (HA)	H5N1	Thailand	2004	(A/tiger/Thailand/CU-T6/04(H5N1))	Seq.1
AAX83398	Tiger	4 (HA)	H5N1	Thailand	2004	(A/tiger/Thailand/CU-T8/04(H5N1))	Seq.1