

H5N1 血凝素蛋白切割位点的序列研究

郭晓莉 朱贻盛* 李亦学 石萍 周豪魁 姚劲松 黄振德 魏冬青*

(上海交通大学生命科学技术学院, 上海 200240. * 联系人, E-mail: yszhu@sjtu.edu.cn; dqwei@sjtu.edu.cn)

摘要 血凝素(hemagglutinin, HA)能否被切割成HA1和HA2是决定禽流感病毒高致病性的重要因素. 分析切割位点的序列, 研究其进化规律可以让我们更深入地了解H5N1的高致病性. 本研究先通过元胞自动机的方法将HA的基因序列转化为图形, 并在图上找到了一段H5N1亚型仅有的特征基因片段. 这个特征基因片段包含30个碱基, 主要由A和G组成, 其对应的氨基酸主要是带正电荷的碱性氨基酸. 这个特征氨基酸片段正好处于HA的酶切位点上. 通过3D结构的同源模拟, 发现H5N1 HA蛋白的切割位点较为暴露, 非常有利于各种酶对其进行剪切. 本研究还构建了切割位点的分子表面, 以进一步分析可能的氨基酸突变将如何影响表面的电荷分布. 结果表明, 某些突变较大地改变了电荷的表面分布, 可能使病毒失去高致病性. H5N1特征氨基酸片段突变情况的统计表明, 在时间上, 2005年突变案例的比例比前几年上升了许多; 而在地域上, 中国大陆的突变病毒案例占了绝大比例. 这些结果都有助于我们研究病毒高致病力的进化情况.

关键词 H5N1 血凝素 切割位点 元胞自动机 特征氨基酸片段 同源模拟

禽流感是一种严重威胁禽类和人类健康的传染病, 高致病性禽流感H5N1亚型病毒更引起了全世界范围的高度警惕. 据世界动物卫生组织(World Organization for Animal Health, OIE)报告, 2004年1月~2007年4月, 40个国家爆发了5080多次H5N1禽流感疫情(http://www.oie.int/downld/AVIAN%20INFLUENZA/A_AI-Asia.htm). 据世界卫生组织(World Health Organization, WHO)统计, 自1997年香港首次出现人感染H5N1病例以来^[1], 到2007年4月11日, 总共发生了291例人感染H5N1病例, 其中有172例死亡(http://www.who.int/csr/disease/avian_influenza/country/en/).

随着禽流感病毒基因序列的不断增多, 对H5N1病毒的基因研究也在不断深入^[2,3]. 到目前为止, GenBank数据库中已有900多个H5N1病毒的基因数据(<http://www.ncbi.nlm.nih.gov>). 禽流感病毒的基因组为单股负链RNA, 由8个独立的RNA节段组成. 每个节段都携带了不同功能的基因, 分别负责编码表面蛋白、复制和组装染色体等功能. 其中血凝素(hemagglutinin, HA)和神经氨酸酶(neuraminidase, NA)基因编码病毒的囊膜蛋白, 负责病毒的吸附和释放^[4]. 血凝素在病毒的入侵过程中起重要作用, 是许多学者高度关注的研究对象. 本研究应用了一种可将基因序列可视化的方法——元胞自动机(cellular auto-

mata, CA), 以直观地寻找HA基因序列的一些关键特征. 这个方法曾成功应用于对SARS病毒的序列分析和蛋白质亚细胞定位等方面的研究^[5-7]. 从H5N1 HA核苷酸序列的元胞自动机图中发现了一些其他亚型都没有的指纹特征, 这些指纹所对应的是一个长约30 bp, 主要由A和G组成的片段, 称为特征基因片段(feature gene segment, FGS). 其中最普遍的一种特征基因片段是5'-CAAAGAGAGAGAAGAAGAAA-AAAGAGAGGA-3'. 特征基因片段翻译得到的氨基酸序列称为特征氨基酸片段(feature amino acid segment, FAAS), 正好对应切割位点插入的氨基酸, 这些氨基酸插入对H5N1病毒的高致病性具有非常重要的作用^[2,8].

为了研究氨基酸插入对切割位点结构和性质的影响, 我们通过同源模拟^[9,10]的方法获得了H5N1血凝素蛋白的三维结构, 并比较了H5N1 HA^[11]和1918 H1^[12,13]切割位点的结构差异, 讨论了H5N1血凝素切割位点的多种突变情况. 为进一步了解这些氨基酸的突变对H5N1病毒高致病性产生的影响, 我们分析了切割位点的分子表面和电荷分布, 并详细统计了特征氨基酸片段在时间上和地域上的变化状况.

2006-10-25 收稿, 2007-06-25 接受

国家重点基础研究发展计划(编号: 2005CB724303)、国家自然科学基金(批准号: 10376024)和天津市科委(批准号: 033801911)资助项目

1 方法

(i) 元胞自动机. 本研究运用元胞自动机 [14] 的方法来搜索基因特征. 元胞自动机可以运用简单的规则, 将物理、数学、生物、计算机的复杂体系转为简单、离散、直接、可视化的数学模型. 元胞自动机由一行行状态为 0 或 1 的元胞组成, 在每一步运算中, 元胞的状态由上一步中该元胞的状态以及左右邻居元胞的状态通过简单的规则运算得到. 依照这样的规则不断自动演化(因此称为自动机), 计算机就建立了一幅表示系统复杂度模式的二进制位图.

在本研究中, 初始行为编码的核苷酸序列, 核苷酸 A, C, G, T 分别编码为 00, 01, 10 和 11. 元胞自动机总共有 256 条规则, 本文采用了第 82 号规则, 如图 1 所示. 图中白色和黑色的方块分别表示状态‘0’和‘1’, 其中上面一行表示一个元胞和它左右邻居元胞组成的 8 个可能的状态集合, 下面一行则表示根据上面一行状态值演化得到的新的状态值. 其中‘111’, ‘110’, ‘101’, ‘100’, ‘011’, ‘010’, ‘001’, ‘000’分别演化为‘0’, ‘1’, ‘0’, ‘1’, ‘0’, ‘0’, ‘1’, ‘0’. 如果将二进制数 01010010 转化为十进制数, 数值是 82, 因此称该规则为第 82 号规则. 每次运算, 两个边界元胞的状态都置‘0’以进行下一步的运算. 例如, 序列 010110110 经过第 82 号规则的一步运算后变成了 000010010.

(ii) 同源模拟. 已知一个基因片段的序列信息, 我们就可以用同源模拟的方法构建其 3D 结构 [9,10]. 本研究采用了已知晶体结构信息的 H5N1 血凝素(不包含切割位点结构信息)作为同源模拟的模版 [15]. 序列的高度相似保证了本次同源模拟的准确性. 同源模拟按照以下 4 个步骤进行: (1) 目标链被打断成为短的片段; (2) 根据序列比对和模版链的形状在数据库(由 5200 多个高分辨率的 X-射线蛋白晶体结构组成)里搜索匹配的片段; (3) 在避免出现任何范德华重叠的前提下, 匹配的片段不断插入到目标链结构的相应位置, 直到覆盖目标链的所有原子; (4) 重复 10 次后产生一个平均模型, 再经过能量最小化就得到

了最终的 3D 结构.

2 结果与分析

2.1 H5N1 特征基因片段的识别

基于元胞自动机 [14,16] 用简单规则处理复杂系统的强大功能, 该方法被用来可视化分析现有的 HA 核苷酸全序列, 其中包括 397 条 H5N1 HA 序列和 2098 条其他亚型的 HA 序列. 图 2 对比了结果中两幅典型的元胞自动机图, 上面一幅是 H5N1 的元胞自动机图, 下面一幅是其他亚型(H3N2)的元胞自动机图. 我们发现一块深色斜纹是 H5N1 HA 的一个普遍特征, 而其他的非 H5N1 亚型都不具有这样的图案.

这块深色斜纹称为 H5N1 HA 基因的指纹, 其对应的核苷酸序列片段位于 1012 bp 左右, 长约 30 bp, 主要由 A 和 G 组成, 称为特征基因片段(feature gene segment, FGS). 397 条 H5N1 HA 中有 65.4% 的序列具备完全相同的特征基因片段, 即 5'-CAAAGAGAGA-GAAGAAGAAAAAAGAGAGGA-3', 而其他序列的特征基因片段分别具有 1~5 bp 的突变, 其中 1~5 bp 的突变比例分别为 23.6%, 2.4%, 6.3%, 1.9% 和 0.4%.

2.2 H5N1 病毒的高致病性

特征基因片段翻译成多肽后就得到了一个特征氨基酸片段(feature amino acid segment, FAAS). 这个片段其实是血凝素的前体 H0 [2,8] 切割位点附近插入的氨基酸序列. 血凝素前体 H0 的长度大约为 556 个残基, H0 裂解成两个子单元 HA1 和 HA2 是病毒感染的必要条件. 大多数的血凝素前体只能被精氨酸特异的蛋白酶, 如胰蛋白酶类所切割, 这类蛋白酶已经成功地从老鼠的支气管上皮 Clara 细胞中分离得到 [8]. 而在高致病病毒序列中, 切割位点附近的碱性氨基酸通过插入或替换的方式不断增加. 碱性氨基酸(精氨酸和赖氨酸)的增加使得呼吸系统和消化系统以外的蛋白酶也能够剪切和激活前体蛋白, 从而导致大规模组织的病毒感染. 很多蛋白酶, 如体内大多数组织都普遍存在的弗林蛋白酶 [17] 等都可以剪切这种序列. 病毒感染力的加剧导致了全身范围的病毒感染

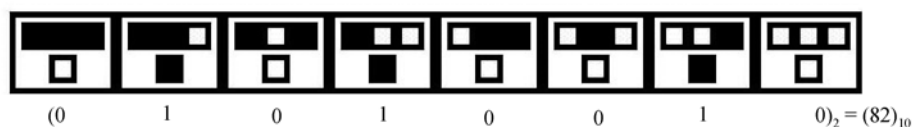


图 1 元胞自动机第 82 号规则的图解

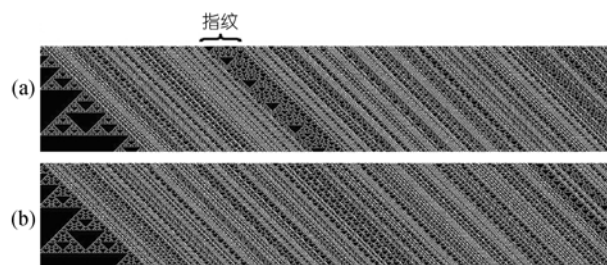


图2 两个样本数据运用第82号规则演化400步得到的元胞自动机图

(a) H5N1 HA (GenBank: DQ236085) 901~1300 bp 基因片段得到的元胞自动机图, 图中央的深色斜纹块(标注为“指纹”)是 H5N1 的一个独有的特征; (b) H3N2 HA (GenBank 登录号: CY006163) 901~1300 bp 基因片段得到的元胞自动机图

和多器官衰竭, 出现了高致病禽流感病毒感染的病理特征. 实验证明, 如果高致病病毒血凝素的切割位点序列替换为一个典型的无毒禽流感病毒血凝素的切割位点序列PQ---RETRG, 病毒的致病力将大大减弱, 没有一只感染的老鼠表现出禽流感的病理特征^[2]. 很明显, 这段切割位点序列值得我们更详细、更系统地研究.

为了深入研究切割机制及几种特定的突变情况对切割位点产生的影响, 我们用H5N1-Viet04^[15]的晶体结构作为模板, 重建了H5N1 HA毒株(GenBank登录号: DQ236085)完整的蛋白质3D结构, 该毒株从2004年的泰国鸽子体内分离得到, 记为H5N1-Thailand. 图3(a)比较了H5N1-Thailand, H5N1-Viet04 (PDB ID: 2FK0)和H1-1918^[13] (PDB ID: 1RD8)结构的差异. H5N1-Viet04的结构中没有包含HA1的C端脯氨酸和HA2的N端甘氨酸之间的切割位点片段QRERRRKKR^[15]. 而H1-1918的切割位点序列P---SIQSRG, 只包含一个碱性氨基酸——精氨酸. 与理论预期一致, 除了切割位点的插入以外, H5N1-Thailand的结构与H5N1-Viet04的结构完美地重合在一起. 而H5N1 HA的结构与H1-1918的结构也排列得非常一致, 除了文献^[15]中所讨论的一些特殊的位置. 在切割位点位置, H5N1-Thailand的切割环比H1-1918的更加舒展, 分子表面结构也显示H5N1的切割位点比H1-1918的更有利于暴露在内切酶中.

图3(b)-1表示经典的特征氨基酸片段, 从图中可以看出, H5N1切割位点的分子表面携带了大量的正电荷(用蓝色表示), 其中7个覆盖了蓝色正电荷的大隆起分别对应7个碱性氨基酸. QRERRRKKRG中的碱性氨基酸依次记为第1~7号碱性氨基酸, 其对应的

位置如图3(b)-1所示. 结构中间红色的区域代表脂肪族氨基酸谷氨酸的存在. 众所周知, 碱性氨基酸及其携带的正电荷是血凝素能被多种蛋白酶剪切的关键因素^[2,8]. 因此从某种角度上, 我们可以将分子表面正电荷的完整性与病毒的高致病性联系起来. 根据前面的分析, 大约35% H5N1的特征基因片段发生了置换或缺失, 因此相应的特征氨基酸片段也可能发生了改变. 图3(b)-2~4表示3种存在的特征氨基酸片段QGERRRKKRG, QREIRKKRG和QRERRR-KRG的分子表面, 分别带有1个氨基酸的置换或缺失. 第1种情况, QGERRRKKRG是第1个碱性氨基酸被脂肪族氨基酸所替代, 覆盖蓝色正电荷的第1号隆起消失, 其对应位置的电荷也变成了红色的负电荷和白色的中性电荷. 第2种情况, QREIRKKRG是特征氨基酸片段中间的一个碱性氨基酸被脂肪族氨基酸所替代, 第2号隆起的分子表面形态和电荷分布均发生了显著的改变. 最后一种情况, 第5个碱性氨基酸的缺失, 导致相应的隆起也消失了. 每种碱性氨基酸突变的情况都会影响分子的表面结构, 减少正电荷的分布, 最终可能会对病毒的高致病性产生影响.

2.3 H5N1 特征氨基酸片段的进化规律

如果特征氨基酸片段的突变会对病毒的高致病性产生影响, 我们就有必要对特征氨基酸片段的突变随时间进化和地域分布的情况进行进一步地统计分析. 统计的数据集为1997年后的651个毒株的血凝素蛋白序列(见网络版附表1). 采用序列比对的方法来定位切割位点片段. 统计结果如图4所示, 其中Seq.1表示具备完整的碱性氨基酸和正电荷分布的一类片段, 与图3(b)-1相对应; Seq.2表示第1个碱性氨基酸被脂肪族氨基酸所取代的一类片段, 与图3(b)-2相对应; Seq.3表示第4个氨基酸被脂肪族氨基酸所取代的一类片段, 与图3(b)-3相对应; Seq.4表示一个碱性氨基酸缺失的情况, 与图3(b)-4相对应.

根据系统分析, 近几年发现的H5N1毒株都与毒株Duck_china_E319-2_03有关, 而该毒株具备经典的特征氨基酸片段. 我们发现在1997~2004年期间, 一直是经典的特征氨基酸片段(即Seq.1)占主导地位, 而到了2005年, 经典的特征氨基酸片段的比例明显减少, 突变的特征氨基酸片段, 特别是Seq.2和Seq.4明显增多. 2006年这种情况也一直持续, 统计的19个序列里有18个都具备突变的特征氨基酸片段Seq.2. H5N1病毒在4个病毒疫情最严重的国家和地

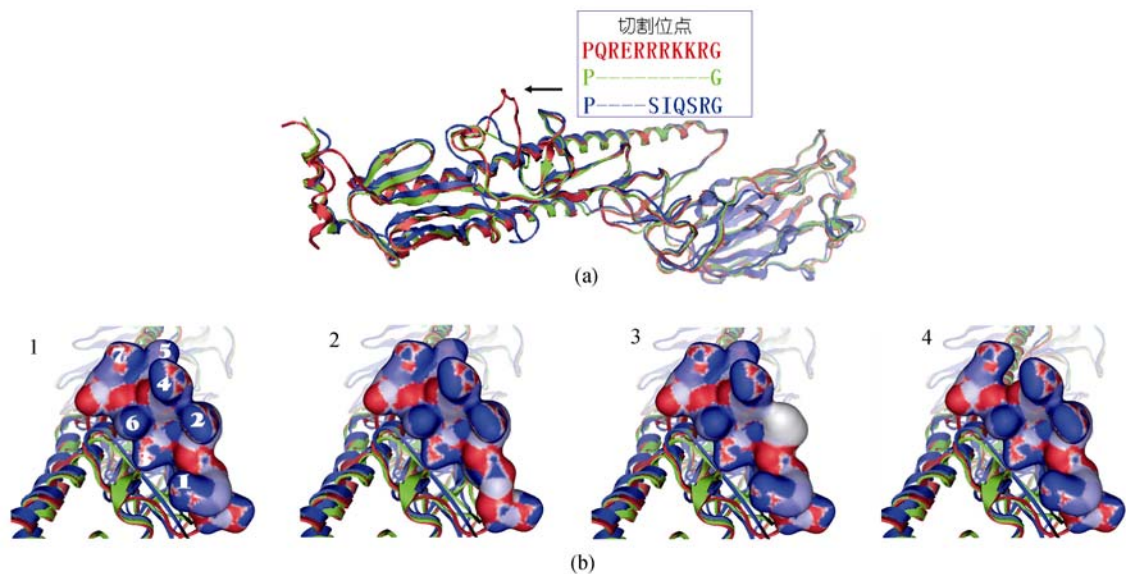


图 3 H5N1 HA 和 H1-1918 的 3D 结构展示

(a) 血凝素蛋白的全局视图; (b) 切割位点的特写视图. 分子表面表示特征氨基酸片段, 表面的颜色表示部分电荷, 其中蓝色、白色和红色分别表示正电荷、中性电荷和负电荷. (b) 1~4 分别对应经典的特征氨基酸片段 QRERRRKKRG 的分子表面和 3 种置换或缺失的特征氨基酸片段 QGERRRKKRG, QREIRR- KKRG, QRERRR-KRG 的分子表面. 分子的骨架由飘带结构表示, 其中红色、绿色和蓝色的飘带分别表示 H5N1-Thailand, H5N1-Viet04 和 H1N1-1918 的结构.

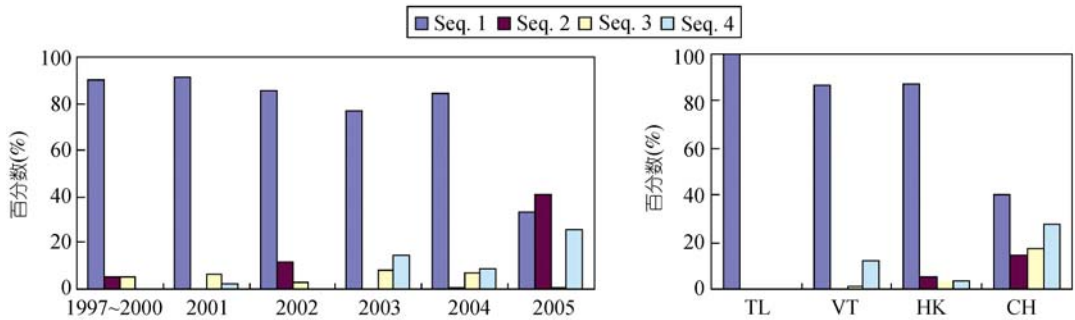


图 4 H5N1 血凝素特征氨基酸片段的统计分析结果

(a) 根据病毒发生年份所做的统计分析; (b) 根据病毒发生国家和地区所做的统计分析, 其中 TL, VT, HK, CH 分别表示泰国、越南、香港和中国大陆. Seq.1: QRERRRKKRG, QREKRKKRG, QREKRKKRG, QRERRRKKRG, QRERRRKKRG; Seq.2: QGERRRKKRG, QIERRRKKRG; Seq.3: QREGRRK-KRG, QREIRRKRG; Seq.4: QRERR-KKRG, QRERRR-KRG, QREKR-KKRG

区的分布情况如图 4(b)所示, 其中泰国、越南和香港几乎没有突变的特征氨基酸片段, 但是在中国大陆, 病毒却经历了严重的突变.

3 讨论

我们开发了一种有效搜索血凝素特征基因片段的方法, 可以在基因指纹中直观地辨认出来. 发现的特征基因片段只存在于 H5N1 病毒中, 而都不存在于其他的禽流感病毒中. 特征基因片段长度为 30 bp, 主要有 A 和 G 组成. 当特征基因片段翻译成蛋白质序列, 就得到了一个由多个带正电荷的碱性氨基酸

组成的多肽——特征氨基酸片段, 正好位于血凝素被多种蛋白酶识别和切割的切割位点. H5N1 高致病的根本原因与血凝素的切割位点能被多种蛋白酶所识别和切割有关.

运用同源模拟的方法重建了 H5N1 血凝素蛋白的 3D 结构, 发现其切割环暴露于蛋白酶中, 更易于其水解. 为了研究特征氨基酸片段的某些氨基酸置换或缺失对电荷分布产生的影响, 我们重建了切割位点的分子表面, 发现每种碱性氨基酸突变的情况都会影响分子的表面形态, 减少正电荷的分布, 并可能会对病毒的高致病性产生影响. 如果某些位点进一

步发生突变,病毒很有可能会丧失其高致病性。进一步地统计分析发现,在时间上,2005年突变的特征氨基酸片段的比例大大增加,而在前几年,一直是经典的特征氨基酸片段占主导地位;在地域上,中国大陆病毒的特征氨基酸片段大部分都发生了突变,这与中国大陆,特别是南方的复杂环境有关,能加快病毒的突变进程^[18]。

本研究详细地分析了H5N1切割位点的结构与性质,有助于进一步挖掘和理解H5N1高致病性的根本原因及基因特征,为将来开发新的H5N1病毒免疫和治疗方法打下了坚实的基础^[19~24]。

参 考 文 献

- 1 Subbarao K, Klimov A, Katz J, et al. Characterization of an avian influenza A (H5N1) virus isolated from a child with a fatal respiratory illness. *Science*, 1998, 279: 393—396[DOI]
- 2 Hatta M, Gao P, Halfmann P, et al. Molecular basis for high virulence of Hong Kong H5N1 influenza A viruses. *Science*, 2001, 293: 1840—1842[DOI]
- 3 Li K S, Guan Y, Wang J, et al. Genesis of a highly pathogenic and potentially pandemic H5N1 influenza virus in eastern Asia. *Nature*, 2004, 430: 209—213[DOI]
- 4 Kido H, Yokogoshi Y, Sakai K, et al. Isolation and characterization of a novel trypsin-like protease found in rat bronchiolar epithelial Clara cells. A possible activator of the viral fusion glycoprotein. *J Biol Chem*, 1992, 267: 13573—13579
- 5 Xiao X, Shao S, Ding Y, et al. Using cellular automata to generate image representation for biological sequences. *Amino Acids*, 2005, 28: 29—35
- 6 Wang M, Yao J S, Huang Z D, et al. A new nucleotide-composition based fingerprint of SARS-CoV with visualization analysis. *Med Chem*, 2005, 1: 39—47[DOI]
- 7 Xiao X, Shao S, Ding Y, et al. Using cellular automata images and pseudo amino acid composition to predict protein subcellular location. *Amino Acids*, 2006, 30: 49—54
- 8 Kido H, Sakai K, Kishino Y, et al. Pulmonary surfactant is a potential endogenous inhibitor of proteolytic activation of Sendai virus and influenza A virus. *FEBS Lett*, 1993, 322: 115—119[DOI]
- 9 Levitt M. Accurate modeling of protein conformation by automatic segment matching. *J Mol Biol*, 1992, 226: 507—533[DOI]
- 10 Fechteler T, Dengler U, Schomberg D. Prediction of protein three-dimensional structures in insertion and deletion regions: A procedure for searching databases of representative protein fragments using geometric scoring criteria. *J Mo Biol*, 1995, 253: 114—131[DOI]
- 11 Romano J W, van Gemen B, Kievits T. NASBA: A novel, isothermal detection technology for qualitative and quantitative HIV-RNA measurements. *Clin Lab Med*, 1996, 16: 89—103
- 12 Taubenberger J K, Reid A H, Lourens R M, et al. Characterization of the 1918 influenza virus polymerase genes. *Nature*, 2005, 437: 889—893[DOI]
- 13 Stevens J, Corper A L, Basler C F, et al. Structure of the uncleaved human H1 hemagglutinin from the extinct 1918 influenza virus. *Science*, 2004, 303: 1866—1870[DOI]
- 14 Wolfram S. *A New Kind of Science*. Champaign: Wolfram Media Inc, 2002
- 15 Stevens J, Blixt O, Tumpey T M, et al. Structure and receptor specificity of the hemagglutinin from an H5N1 influenza virus. *Science*, 2006, 312: 404—410[DOI]
- 16 Andre D, Koza J. *Advances in Genetic Programming 2*. Cambridge: MIT Press, 1996
- 17 Horimoto T, Kawaoka Y. Pandemic threat posed by avian influenza A viruses. *Clin Microbiol Rev*, 2001, 14: 129—149[DOI]
- 18 Wallace R G, HoDac H M, Lathrop R H, et al. A statistical phylogeography of influenza A H5N1. *Proc Natl Acad Sci USA*, 2007, 104: 4473—4478[DOI]
- 19 Wiley D C, Skehel J J. The structure and function of the hemagglutinin membrane glycoprotein of influenza virus. *Annu Rev Biochem*, 1987, 56: 365—394[DOI]
- 20 Wilson I A, Skehel J J, Wiley D C. Structure of the haemagglutinin membrane glycoprotein of influenza virus at 3 Å resolution. *Nature*, 1981, 289: 366—373[DOI]
- 21 Rosenthal P B, Zhang X, Formanowski F, et al. Structure of the haemagglutinin-esterase-fusion glycoprotein of influenza C virus. *Nature*, 1998, 396: 92—96[DOI]
- 22 Tumpey T M, Garcia-Sastre A, Mikulasova A, et al. Existing antivirals are effective against influenza viruses with genes from the 1918 pandemic virus. *Proc Natl Acad Sci USA*, 2002, 99: 13849—13854[DOI]
- 23 Viseshakul N, Thanawongnuwech R, Amonsin A, et al. The genome sequence analysis of H5N1 avian influenza A virus isolated from the outbreak among poultry populations in Thailand. *Virology*, 2004, 328: 169—176[DOI]
- 24 Hoffmann E, Lipatov A S, Webby R J, et al. Role of specific hemagglutinin amino acids in the immunogenicity and protection of H5N1 influenza virus vaccines. *Proc Natl Acad Sci USA*, 2005, 102: 12915—12920[DOI]

序列号	宿主	片段	亚型	国家或地区	年份	毒株	特征氨基酸片段
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
AAY21163	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
AAY56367	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

序列号	宿主	片段	亚型	国家或地区	年份	毒株	特征氨基酸片段
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
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
AAY78953	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

序列号	宿主	片段	亚型	国家或地区	年份	毒株	特征氨基酸片段
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
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/ww100/01 (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

序列号	宿主	片段	亚型	国家或地区	年份	毒株	特征氨基酸片段
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
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 Kidal/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/aq10/2003(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

序列号	宿主	片段	亚型	国家或地区	年份	毒株	特征氨基酸片段
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
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/Maharakham-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

序列号	宿主	片段	亚型	国家或地区	年份	毒株	特征氨基酸片段
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/Uthaitani-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/Uthaitani-2-04/2004(H5N1))	Seq.1
AAV46346	Avian	4 (HA)	H5N1	Thailand	2004	(A/duck/Uthaitani-2-01/2004(H5N1))	Seq.1
AAV46347	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Uthaitani-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/Uthaitani-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/Uthaitani-2-01/2004(H5N1))	Seq.1
AAV46355	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Kamphaengphet-2-05/2004(H5N1))	Seq.1
AAV46356	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Phitsanulok-2-01/2004(H5N1))	Seq.1
AAV46357	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Phetchabun-2-01/2004(H5N1))	Seq.1
AAV46358	Avian	4 (HA)	H5N1	Thailand	2004	(A/duck/Nakornsawan-2-02/2004(H5N1))	Seq.1
AAV46359	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Nakornsawan-2-02/2004(H5N1))	Seq.1
AAV46360	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Nakornsawan-2-06/2004(H5N1))	Seq.1
AAV46361	Avian	4 (HA)	H5N1	Thailand	2004	(A/duck/Uthaitani-2-02/2004(H5N1))	Seq.1
AAV46362	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Kamphaengphet-2-04/2004(H5N1))	Seq.1
AAV46363	Avian	4 (HA)	H5N1	Thailand	2004	(A/duck/Uttaradit-2-01/2004(H5N1))	Seq.1
AAV46364	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Nakornsawan-2-03/2004(H5N1))	Seq.1
AAV46365	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Nakornsawan-2-07/2004(H5N1))	Seq.1
AAV46366	Avian	4 (HA)	H5N1	Thailand	2004	(A/chicken/Kamphaengphet-2-02/2004(H5N1))	Seq.1
AAV68363	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

序列号	宿主	片段	亚型	国家或地区	年份	毒株	特征氨基酸片段
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
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

序列号	宿主	片段	亚型	国家或地区	年份	毒株	特征氨基酸片段
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
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

序列号	宿主	片段	亚型	国家或地区	年份	毒株	特征氨基酸片段
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

序列号	宿主	片段	亚型	国家或地区	年份	毒株	特征氨基酸片段
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/Krasnoozerk/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

序列号	宿主	片段	亚型	国家或地区	年份	毒株	特征氨基酸片段
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
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

序列号	宿主	片段	亚型	国家或地区	年份	毒株	特征氨基酸片段
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
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

序列号	宿主	片段	亚型	国家或地区	年份	毒株	特征氨基酸片段
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
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

序列号	宿主	片段	亚型	国家或地区	年份	毒株	特征氨基酸片段
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
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