Equine Influenza A(H3N8) Virus Isolated from Bactrian Camel, Mongolia

Technical Appendix

Technical Appendix Table 1. Virus name, subtype, host species, collection date, and GenBank accession number (PB2 segment) for the 36 H3N8 viruses used in the whole-genome phylogenetic analysis conducted for all eight viral genome segments.

| Virus name                        | Subtype | Host species | Collection date | Accession no.  |
|-----------------------------------|---------|--------------|-----------------|----------------|
| A_camel_Mongolia_335_2012         | H3N8    | Camel        | Nov-2012        | CY164127.1     |
| A_avian_Japan_8KI0102_2008        | H3N8    | Avian        | Oct-08-08       | CY079266       |
| A_avian_Japan_8KI0129_2008        | H3N8    | Avian        | Oct-08-08       | CY079258       |
| A_avian_Japan_8KI0150_2008        | H3N8    | Avian        | Oct-08-08       | CY079242       |
| A_avian_Japan_8KI0162_2008        | H3N8    | Avian        | Oct-08-08       | CY079234       |
| A_chicken_Laos_A0573_2007         | H3N8    | Avian        | 2007            | CY040963       |
| A_chicken_Vietnam_G14_2008        | H3N8    | Avian        | Jan-2008        | AB593452       |
| A_donkey_Xinjiang_5_2007          | H3N8    | Equine       | Dec-2007        | EU794572       |
| A_duck_Beijing_40_04               | H3N8    | Avian        | 2004            | EU492488       |
| A_duck_Beijing_61_05               | H3N8    | Avian        | 2005            | EU492492       |
| A_duck_Hokkaido_8_1980             | H3N8    | Avian        | 1980            | AB274963       |
| A_duck_Hunan_S1256_2012            | H3N8    | Avian        | Mar-23-12       | CY146601       |
| A_duck_Hunan_S1824_2012            | H3N8    | Avian        | Mar-24-12       | CY146625       |
| A_duck_Nanchang_1681_1992          | H3N8    | Avian        | Dec-01-92       | CY054575       |
| A_duck_Vietnam_G119_2006           | H3N8    | Avian        | Nov-2006        | AB593428       |
| A_environment_Hunan_S4350_2011     | H3N8    | Avian        | Nov-13-11       | CY146753       |
| A_equine_Gansu_7_2008              | H3N8    | Equine       | Jan-2008        | EU794492       |
| A_equine_Heilongjiang_1_2010       | H3N8    | Equine       | Apr-23-10       | KF309031       |
| A_equine_Heilongjiang_10_2008      | H3N8    | Equine       | Apr-2008        | EU794508       |
| A_equine_Huabei_1_2007             | H3N8    | Equine       | Dec-03-07       | GU571147       |
| A_equine_Inner_Mongolia_8_2008     | H3N8    | Equine       | Feb-2008        | EU794524       |
| A_equine_Kyonggi_SA1_2011          | H3N8    | Equine       | Jul-01-11       | JX844143       |
| A_equine_Liaoning_9_2008           | H3N8    | Equine       | Apr-2008        | EU794516       |
| A_equine_Qinghai_1_1994            | H3N8    | Equine       | 1994            | EU794532       |
| A_equine_Sachiyama_1_1971          | H3N8    | Equine       | 1971            | CY034941       |
| A_equine_Tokyo_2_1971              | H3N8    | Equine       | 1971            | CY096922       |
| A_equine_Tottori_1_07              | H3N8    | Equine       | 2007            | AB591847       |
| A_equine_Xinjiang_1_2007           | H3N8    | Equine       | Nov-2007        | EU794540       |
| A_equine_Xinjiang_2_2007           | H3N8    | Equine       | Nov-2007        | EU794548       |
| A_equine_Xinjiang_3_2007           | H3N8    | Equine       | Nov-2007        | EU794556       |
| A_equine_Xinjiang_4_2007           | H3N8    | Equine       | Dec-2007        | EU794564       |
Technical Appendix Table 1. Virus name, subtype, host species, collection date, and GenBank accession number (PB2 segment) for the 36 H3N8 viruses used in the whole-genome phylogenetic analysis conducted for all eight viral genome segments.

| Virus name                             | Subtype | Host species | Collection date | Accession no. |
|----------------------------------------|---------|--------------|-----------------|---------------|
| A_equine_Xuzhou_01_2013                 | H3N8    | Equine       | Aug-27-13       | KF806992      |
| A_Mallard_SanJiang_90_2006_2006        | H3N8    | Avian        | 2006            | CY100631      |
| A_muscovy_duck_Vietnam_LBM240_2012     | H3N8    | Avian        | 2012            | AB786912      |
| A_swine_Anhui_01_2006                  | H3N8    | Swine        | Jan-06-06       | FJ200417      |
| A_swine_Chibi_01_2005                  | H3N8    | Swine        | Dec-15-05       | FJ200425      |

Technical Appendix Table 2. Virus names for the hemagglutinin sequences of the 155 equine A/H3N8 viruses used in Figure 1. Viruses containing the two amino acid insertion near the beginning of the hemagglutinin are specified.

| Virus name                             | Subtype | Insertion |
|----------------------------------------|---------|-----------|
| A_camel_Mongolia_335_2012              | H3N8    | yes       |
| A_donkey_Xinjiang_5_2007               | H3N8    |           |
| A_equine_Alaska_29759_1991             | H3N8    |           |
| A_equine_Algiers_1_1972                | H3N8    |           |
| A_equine_Almaty_26_2007                | H3N8    | yes       |
| A_equine_Argentina_1_93                | H3N8    |           |
| A_equine_Austria_421_1992              | H3N8    |           |
| A_equine_Bari_2005                     | H3N8    | yes       |
| A_equine_Berlin_1_1989                 | H3N8    |           |
| A_equine_California_1_1980             | H3N8    |           |
| A_equine_California_103_1982           | H3N8    |           |
| A_equine_California_191_2003           | H3N8    |           |
| A_equine_California_4537_1997          | H3N8    |           |
| A_equine_California_83_1982            | H3N8    |           |
| A_equine_California_8560_2002          | H3N8    |           |
| A_equine_Carlow_1_2009                 | H3N8    |           |
| A_equine_Colorado_10_2007              | H3N8    |           |
| A_equine_Cordoba_18_1985               | H3N8    |           |
| A_equine_Donegal_1_2007                | H3N8    | yes       |
| A_equine_Donegal_1_2009                | H3N8    |           |
| A_equine_Down_1_2008                   | H3N8    | yes       |
| A_equine_Egypt_6066NAMRU3-VSVRI_2008   | H3N8    |           |
| A_equine_Florida_1_93                  | H3N8    |           |
| A_equine_Florida_612_2004              | H3N8    |           |
| A_equine_Florida_779_2004              | H3N8    |           |
| A_equine_Fontainbleau_1_1979           | H3N8    |           |
| A_equine_Fontainebleau_1976            | H3N8    |           |
| A_equine_France_1_1976                 | H3N8    |           |
| A_equine_Gansu_7_2008                  | H3N8    |           |
| A_equine_Georgia_1_1981                | H3N8    |           |
| A_equine_Georgia_10_1981               | H3N8    |           |
| Virus name                                | Subtype | Insertion |
|-------------------------------------------|---------|-----------|
| A_camel_Mongolia_335_2012                 | H3N8    | yes       |
| A_equine_Georgia_13_1981                 | H3N8    |           |
| A_equine_Georgia_3_1981                  | H3N8    |           |
| A_equine_Georgia_9_1981                  | H3N8    |           |
| A_equine_Guelph_06-28865_2006            | H3N8    |           |
| A_equine_Guelph_G03-0250_2003            | H3N8    |           |
| A_equine_Guelph_G03-55399_2003           | H3N8    |           |
| A_equine_Guelph_G04-54701_2004           | H3N8    |           |
| A_equine_Heilongjiang_1_2010              | H3N8    | yes       |
| A_equine_Heilongjiang_10_2008             | H3N8    |           |
| A_equine_Hokkaido_I828_2008               | H3N8    |           |
| A_equine_Hong_Kong_1_1992                | H3N8    |           |
| A_equine_Huabei_1_2007                   | H3N8    | yes       |
| A_equine_Hubei_6_2008                    | H3N8    |           |
| A_equine_Ibadan_6_91                     | H3N8    |           |
| A_equine_Ibadan_9_91                     | H3N8    |           |
| A_equine_Ibaraki_1_07                    | H3N8    |           |
| A_equine_Idaho_37875_1991                | H3N8    |           |
| A_equine_Inner_Mongolia_8_2008            | H3N8    |           |
| A_equine_Italy_1062_1991                 | H3N8    |           |
| A_equine_Italy_1199_1992                 | H3N8    |           |
| A_equine_Italy_824_1991                  | H3N8    |           |
| A_equine_Johannesburg_1_1986             | H3N8    |           |
| A_equine_Kanazawa_1_2007                 | H3N8    |           |
| A_equine_Kascakew_1_1978                 | H3N8    |           |
| A_equine_Katra-Jammu_6_2008               | H3N8    | yes       |
| A_equine_Kentucky_1_1981                 | H3N8    |           |
| A_equine_Kentucky_1_1986                 | H3N8    |           |
| A_equine_Kentucky_1_1987                 | H3N8    |           |
| A_equine_Kentucky_1_1990                 | H3N8    |           |
| A_equine_Kentucky_1_1991                 | H3N8    |           |
| A_equine_Kentucky_1_1992                 | H3N8    |           |
| A_equine_Kentucky_1_1994                 | H3N8    |           |
| A_equine_Kentucky_1277_1990              | H3N8    |           |
| A_equine_Kentucky_2_1980                 | H3N8    |           |
| A_equine_Kentucky_2_1981                 | H3N8    |           |
| A_equine_Kentucky_2_1986                 | H3N8    |           |
| A_equine_Kentucky_2_1987                 | H3N8    |           |
| A_equine_Kentucky_211_1987               | H3N8    |           |
| A_equine_Kentucky_3_1981                 | H3N8    |           |
Technical Appendix Table 2. Virus names for the hemagglutinin sequences of the 155 equine A/H3N8 viruses used in Figure 1. Viruses containing the two amino acid insertion near the beginning of the hemagglutinin are specified.

| Virus name                                | Subtype | Insertion |
|-------------------------------------------|---------|-----------|
| A_camel_Mongolia_335_2012                 | H3N8    | yes       |
| A_equine_Kentucky_3_1986                  | H3N8    |           |
| A_equine_Kentucky_4_1980                  | H3N8    |           |
| A_equine_Kentucky_5_2002                  | H3N8    |           |
| A_equine_Kentucky_692_1988                | H3N8    |           |
| A_equine_Kentucky_694_1988                | H3N8    |           |
| A_equine_Kentucky_698_1988                | H3N8    |           |
| A_equine_Kentucky_8_1994                  | H3N8    |           |
| A_equine_Kentucky_bitter_boredom5_1976    | H3N8    |           |
| A_equine_Kentucky_magnificent_genius1_1981| H3N8    |           |
| A_equine_Kentucky_pass_the_pepper1_1976   | H3N8    |           |
| A_equine_Kentucky_Rosie100_1981           | H3N8    |           |
| A_equine_Kildare_1_2007                   | H3N8    | yes       |
| A_equine_Kyonggi_SA1_2011                 | H3N8    |           |
| A_equine_Liaoning_9_2008                  | H3N8    |           |
| A_equine_Limerick_1_2010                  | H3N8    |           |
| A_equine_Lincolnshire_1_2007              | H3N8    |           |
| A_equine_Lonquen_1_2006                   | H3N8    |           |
| A_equine_Massachusetts_213_2003           | H3N8    |           |
| A_equine_Miami_1_1963                     | H3N8    |           |
| A_equine_Mongolia_20_2011                 | H3N8    | yes       |
| A_equine_Mongolia_3_2011                  | H3N8    | yes       |
| A_equine_Mongolia_56_2011                 | H3N8    | yes       |
| A_equine_Mongolia_6_2011                  | H3N8    | yes       |
| A_equine_Montana_9233_2007                | H3N8    |           |
| A_equine_Mysore_1_2008                    | H3N8    |           |
| A_equine_New_Market_1_1979                | H3N8    |           |
| A_equine_New_Market_1976                  | H3N8    |           |
| A_equine_New_Market_nasalwash1_1979       | H3N8    |           |
| A_equine_New_York_1_1975                  | H3N8    |           |
| A_equine_New_York_1_1999                  | H3N8    |           |
| A_equine_New_York_146066_2007             | H3N8    |           |
| A_equine_New_York_452_2003                | H3N8    |           |
| A_equine_New_York_VR-297_1983             | H3N8    |           |
| A_equine_Newmarket_5_2003                 | H3N8    |           |
| A_equine_Ohio_1_2003                      | H3N8    |           |
| A_equine_Ohio_113461-1_2005               | H3N8    |           |
| A_equine_Ohio_113461-2_2005               | H3N8    |           |
| A_equine_Ohio_113461-3_2005               | H3N8    |           |
| A_equine_Otar_764_2007                    | H3N8    | yes       |
Table 2. Virus names for the hemagglutinin sequences of the 155 equine A/H3N8 viruses used in Figure 1. Viruses containing the two amino acid insertion near the beginning of the hemagglutinin are specified.

| Virus name                                  | Subtype | Insertion |
|---------------------------------------------|---------|-----------|
| A_camel_Mongolia_335_2012                   | H3N8    | yes       |
| A_equine_Qinghai_1_1994                    | H3N8    |           |
| A_equine_Richmond_1_2007                   | H3N8    | yes       |
| A_equine_Romania_1_1980                    | H3N8    |           |
| A_equine_Rome_5_1991                       | H3N8    |           |
| A_equine_Rook_93753_1989                   | H3N8    |           |
| A_equine_Sachiyama_1_1971                  | H3N8    |           |
| A_equine_Santa_Fe_1_1985                   | H3N8    |           |
| A_equine_Sao_Paulo_1_1969                  | H3N8    |           |
| A_equine_Sao_Paulo_6_1963                  | H3N8    |           |
| A_equine_Spain_1_2007                      | H3N8    | yes       |
| A_equine_Suffolk_89                        | H3N8    |           |
| A_equine_Sussex_1_1989                     | H3N8    |           |
| A_equine_Switzerland_1118_1979             | H3N8    |           |
| A_equine_Switzerland_173_1993              | H3N8    |           |
| A_equine_Sydney_6085_2007                  | H3N8    |           |
| A_equine_Taby_1991                         | H3N8    |           |
| A_equine_Tennessee_5_1985                  | H3N8    |           |
| A_equine_Tennessee_5_1986                  | H3N8    |           |
| A_equine_Texas_117793_2005                 | H3N8    |           |
| A_equine_Texas_39655_1991                  | H3N8    |           |
| A_equine_Tiaret_1_2011                     | H3N8    | yes       |
| A_equine_Tiaret_10_2011                    | H3N8    | yes       |
| A_equine_Tiaret_2_2011                     | H3N8    | yes       |
| A_equine_Tiaret_3_2011                     | H3N8    | yes       |
| A_equine_Tiaret_4_2011                     | H3N8    | yes       |
| A_equine_Tiaret_5_2011                     | H3N8    | yes       |
| A_equine_Tiaret_6_2011                     | H3N8    | yes       |
| A_equine_Tiaret_7_2011                     | H3N8    | yes       |
| A_equine_Tiaret_8_2011                     | H3N8    | yes       |
| A_equine_Tiaret_9_2011                     | H3N8    | yes       |
| A_equine_Tokyo_1971                        | H3N8    |           |
| A_equine_Tokyo_2_1971                      | H3N8    |           |
| A_equine_Tottori_1_07                      | H3N8    |           |
| A_equine_Uruguay_1_1963                    | H3N8    |           |
| A_equine_Virginia_131054-3_2005            | H3N8    |           |
| A_equine_Wisconsin_1_03                     | H3N8    |           |
| A_equine_Xinjiang_1_2007                   | H3N8    |           |
| A_equine_Xinjiang_2_2007                   | H3N8    |           |
| A_equine_Xinjiang_3_2007                   | H3N8    |           |
Technical Appendix Table 2. Virus names for the hemagglutinin sequences of the 155 equine A/H3N8 viruses used in Figure 1. Viruses containing the two amino acid insertion near the beginning of the hemagglutinin are specified.

| Virus name                             | Subtype | Insertion |
|----------------------------------------|---------|-----------|
| A_camel_Mongolia_335_2012              | H3N8    | yes       |
| A_equine_Xinjiang_4_2007               | H3N8    |           |
| A_equine_Xuzhou_01_2013                | H3N8    | yes       |
| A_equine_Yokohama_aq13_2010            | H3N8    | yes       |
| A_equine_Yokohama_aq19_2009            | H3N8    |           |
| A_equine_Yokohama_aq29_2011            | H3N8    |           |
| A_equine_Yokohama_aq5_2011             | H3N8    |           |
| A_equine_Yokohama_aq53_2011            | H3N8    |           |
| A_equine_Yokohama_aq79_2011            | H3N8    |           |

Technical Appendix Table 3. Position of the two amino acid insertion at the beginning of the hemagglutinin sequence.

Example of virus with insertion:
A/equine/Almaty/26/2007/H3N8
MKTTIIFIFILLTHW

Example of virus without insertion:
A/equine/Alaska/29759/1991/H3N8
MKTTIIL--ILLTHW
Technical Appendix Figure 1. Evolutionary relationships of the PB2 segment of 36 influenza A viruses of the H3N8 subtype collected in Asia from horses (n = 17), avian species (n = 16), swine (n = 2), and a camel (A/camel/Mongolia/335/2012(H3N8), highlighted in bold). The tree is midpoint rooted for clarity, and all branch lengths are drawn to scale. High bootstrap values (> 70) are provided for key nodes. Scale bar indicates nucleotide substitutions per site.
Technical Appendix Figure 2. Evolutionary relationships of the PB1 segment of 36 influenza A viruses of the H3N8 subtype collected in Asia from horses (n = 17), avian species (n = 16), swine (n = 2), and a camel (A/camel/Mongolia/335/2012(H3N8), highlighted in bold). The tree is midpoint rooted for clarity, and all branch lengths are drawn to scale. High bootstrap values (> 70) are provided for key nodes. Scale bar indicates nucleotide substitutions per site.
Technical Appendix Figure 3. Evolutionary relationships of the PA segment of 36 influenza A viruses of the H3N8 subtype collected in Asia from horses (n = 17), avian species (n = 16), swine (n = 2), and a camel (A/camel/Mongolia/335/2012(H3N8), highlighted in bold). The tree is midpoint rooted for clarity, and all branch lengths are drawn to scale. High bootstrap values (> 70) are provided for key nodes. Scale bar indicates nucleotide substitutions per site.
Technical Appendix Figure 4. Evolutionary relationships of the NP segment of 36 influenza A viruses of the H3N8 subtype collected in Asia from horses (n = 17), avian species (n = 16), swine (n = 2), and a camel (A/camel/Mongolia/335/2012(H3N8), highlighted in bold). The tree is midpoint rooted for clarity, and all branch lengths are drawn to scale. High bootstrap values (> 70) are provided for key nodes. Scale bar indicates nucleotide substitutions per site.
Technical Appendix Figure 5. Evolutionary relationships of the NA segment of 142 influenza A viruses of the H3N8 subtype collected from horses and A/camel/Mongolia/335/2012(H3N8), highlighted in bold. The tree is midpoint rooted for clarity, and all branch lengths are drawn to scale. High bootstrap values (> 70) are provided for key nodes. Scale bar indicates nucleotide substitutions per site.

Technical Appendix Figure 6. Evolutionary relationships of the MP segment of 36 influenza A viruses of the H3N8 subtype collected in Asia from horses (n = 17), avian species (n = 16), swine (n = 2), and a camel (A/camel/Mongolia/335/2012(H3N8), highlighted in bold). The tree is midpoint rooted for clarity, and all branch lengths are drawn to scale. High bootstrap values (> 70) are provided for key nodes. Scale bar indicates nucleotide substitutions per site.
Technical Appendix Figure 7. Evolutionary relationships of the NS segment of 36 influenza A viruses of the H3N8 subtype collected in Asia from horses (n = 17), avian species (n = 16), swine (n = 2), and a camel (A/camel/Mongolia/335/2012(H3N8), highlighted in bold). The tree is midpoint rooted for clarity, and all branch lengths are drawn to scale. High bootstrap values (> 70) are provided for key nodes.