

Supplementary Materials:

Table S1. Growth of H4 influenza viruses in embryonated chicken eggs.

| Viruses | Group | HA titer of allantoic fluid |
|--|------------------|-----------------------------|
| A/duck/Czechoslovakia/1956 (N4N6) | Eurasian | 32 |
| A/budgerigar/Hokkaido/1/1977 (H4N6) | Eurasian | 128 |
| A/duck/Hokkaido/491003/2014 (H4N2) | Eurasian 1 | 256 |
| A/duck/Mongolia/769/2015 (H4N6) | Eurasian 2 | 128 |
| A/duck/Hokkaido/138/2007 (H4N6) | Eurasian 3 | 128 |
| A/swan/Hokkaido/481102/2017 (H4N6) | Eurasian 4 | 512 |
| A/mallard/Alberta/223/1979 (H4N2) | North American 1 | 256 |
| A/swine/Missouri/A01727926/2015 (H4N6) | North American 2 | 256 |

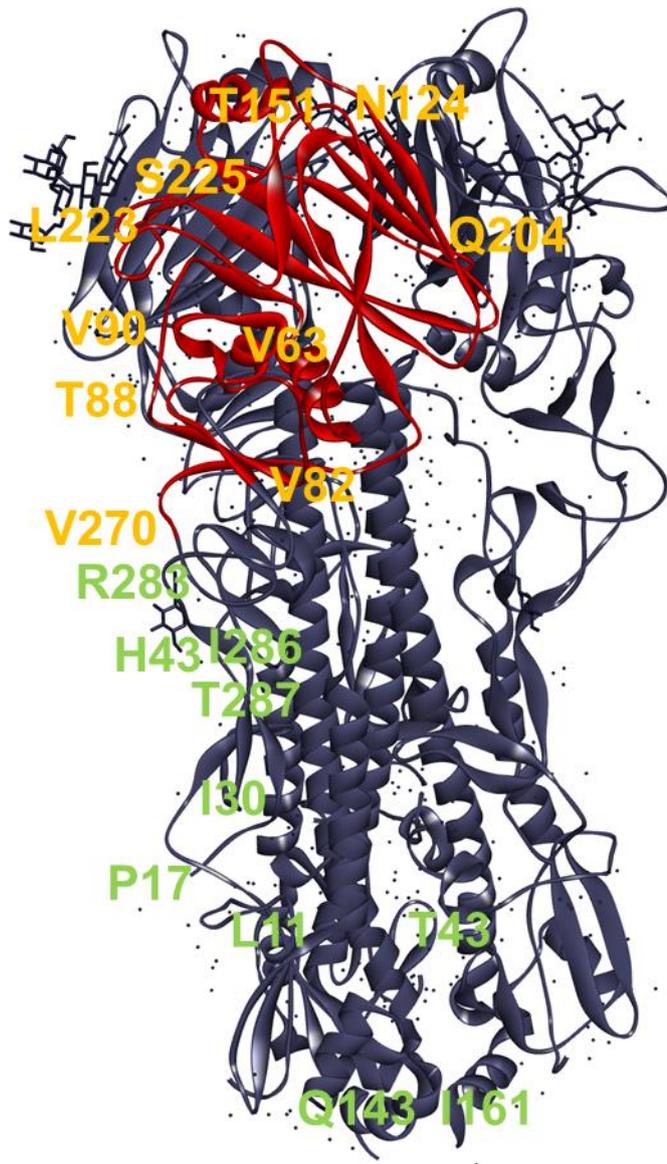


Figure S1. Three-D structure of MO/15 HA trimer and the positions of amino acid substitutions between MO/15 and Swan/Hok. Red: HA1 head domain, Yellow: Different residues at the head domain between MO/15 and Swan/Hok, Green: Different residues at the stalk domain between MO/15 and Swan/Hok.