

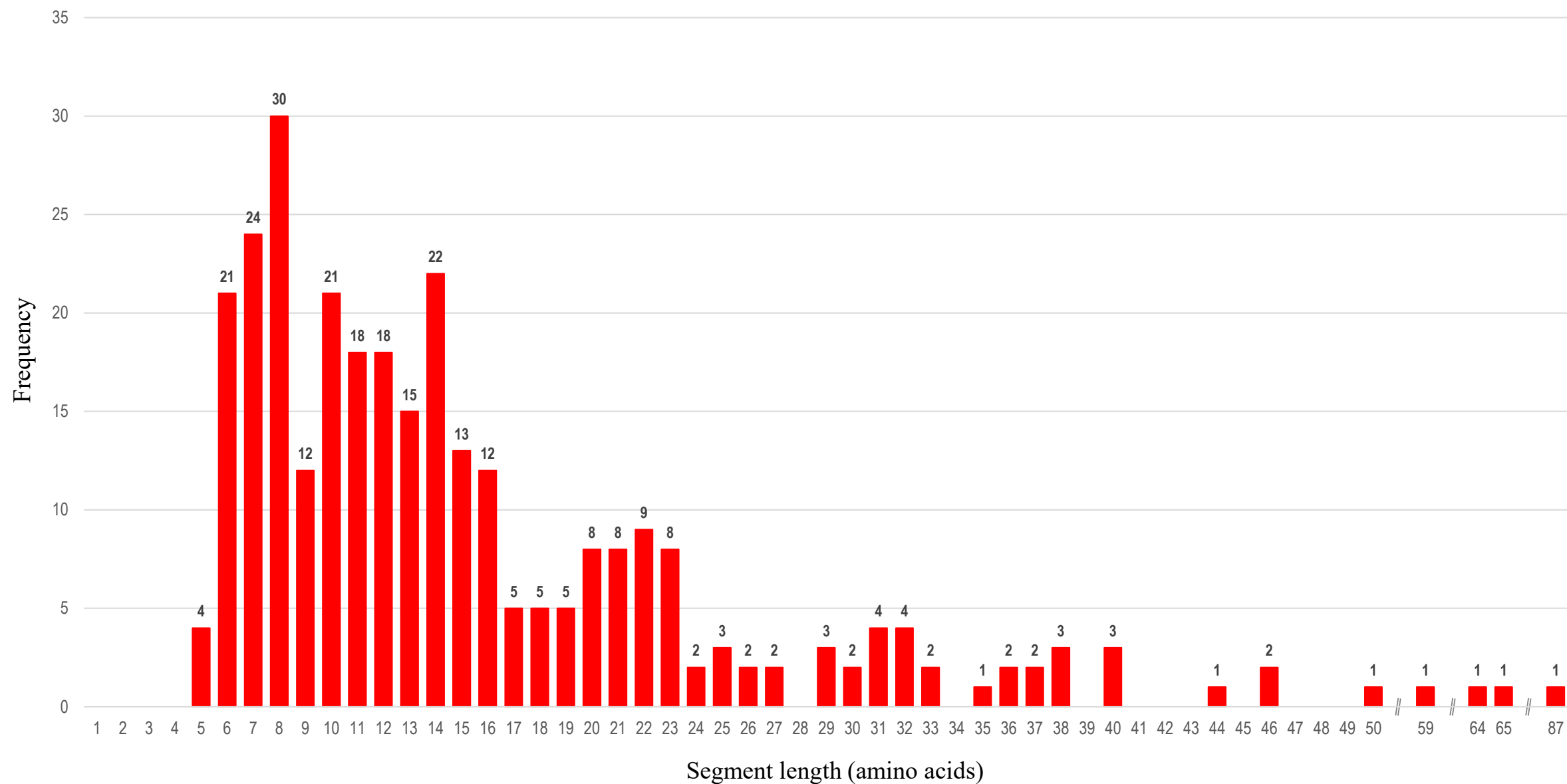
Rapid protein sequence evolution via compensatory frameshift is widespread in RNA virus genomes

Dongbin Park, Yoonsoo Hahn

Department of Life Science, Chung-Ang University, Seoul 06794, Republic of Korea

Additional file 3. Supplementary Figures S1–S5.

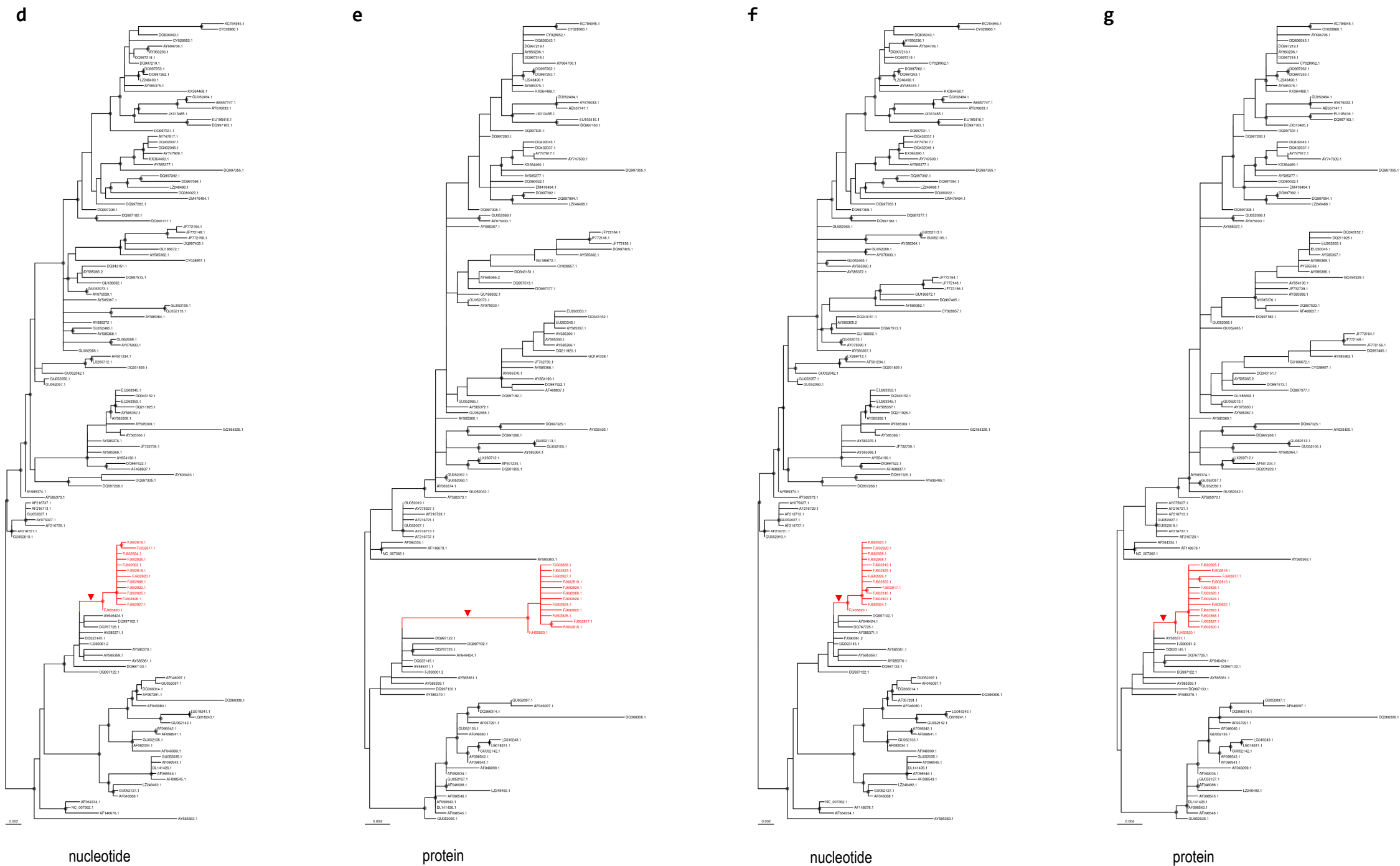
Supplementary Figure S1. Distribution of lengths of segments using an alternative reading frame



Supplementary Figure S2. Multiple alignment of the IAV HA CDS sequences.

NC_007362.1/YP_308669.1	1612	ACAGTG-GCGAGTTC	1659
AB557747.1		ACAGTG-GCGAGTTC	
AF046080.1		ACAGTG-GCGAGTTC	
AF046088.1		ACAGTG-GCGAGTTC	
AF046097.1		ACAGTG-GCGAGTTC	
AF046099.1		ACAGTG-GCGAGTTC	
AF057291.1		ACAGTG-GCGAGTTC	
AF082034.1		ACAGTG-GCGAGTTC	
AF098541.1		ACAGTG-GCGAGTTC	
AF098542.1		ACAGTG-GCGAGTTC	
AF098543.1		ACAGTG-GCGAGTTC	
AF098545.1		ACAGTG-GCGAGTTC	
AF098546.1		ACAGTG-GCGAGTTC	
AF148678.1		ACAGTG-GCGAGTTC	
AF216713.1		ACAGTG-GCGAGTTC	
AF216721.1		GCAGTG-GCGAGTTC	
AF216729.1		ACAGTG-GCGAGTTC	
AF216737.1		ACAGTG-GCGAGTTC	
AF364334.1		ACAGTG-GCGAGTTC	
AF468837.1		ACAGTG-GCGAGTTC	
AF501234.1		ACAGTG-GCGAGTTC	
AY075027.1		ACAGTG-GCGAGTTC	
AY075030.1		ACAGTG-GCGAGTTC	
AY075033.1		ACAGTG-GCGAGTTC	
AY585357.1		ACAGTG-GCGAGTTC	
AY585358.1		ACAGTG-GCGAGTTC	
AY585359.1		ACAGTG-GCGAGTTC	
AY585360.1		ACAGTG-GCGAGTTC	
AY585361.1		ACAGTG-GCGAGTTC	
AY585362.1		ACAGTG-GCGAGTTC	
AY585363.1		ACAGTG-GCGAGTTC	
AY585364.1		ACAGTG-GCGAGTTC	
AY585365.2		ACAGTG-GCGAGTTC	
AY585366.1		ACAGTG-GCGAGTTC	
AY585367.1		ACAGTG-GCGAGTTC	
AY585368.1		ACAGTG-GCGAGTTC	
AY585369.1		ACAGTG-GCGAGTTC	
AY585370.1		ACAGTG-GCGAGTTC	
AY585371.1		ACAGTG-GCGAGTTC	
AY585372.1		ACAGTG-GCGAGTTC	
AY585373.1		ACAGTG-GCGAGTTC	
AY585374.1		ACAGTG-GCGAGTTC	
AY585375.1		ACAGTG-GCGAGTTC	
AY585376.1		ACAGTG-GCGAGTTC	
AY585377.1		ACAGTG-GCGAGTTC	
AY639405.1		ACAGTG-GCGAGTTC	
AY646424.1		ACAGTG-GCGAGTTC	
AY676033.1		ACAGTG-GCGAGTTC	
AY684706.1		ACAGTG-GCGAGTTC	
AY747609.1		ACAGTG-GCGAGTTC	
AY747617.1		ACAGTG-GCGAGTTC	
AY854190.1		ACAGTG-GCGAGTTC	
AY950230.1		ACAGTG-GCGAGTTC	
AY950236.1		ACAGTG-GCGAGTTC	
CY028952.1		ACAGTG-GCGAGTTC	
CY028957.1		ACAGTG-GCGAGTTC	
CY028960.1		ACAGTG-GCGAGTTC	
DL141426.1		ACAGTG-GCGAGTTC	
DM476494.1		ACAGTG-GCGAGTTC	
DQ023145.1		ACAGTG-GCGAGTTC	
DQ080022.1		ACAGTG-GCGAGTTC	
DQ201829.1		ACAGTG-GCGAGTTC	
DQ211925.1		ACAGTG-GCGAGTTC	
DQ343151.1		ACAGTG-GTGA	
DQ343152.1		ACAGTG-GCGAGTTC	
DQ366314.1		ACAGTG-GCGAGTTC	
DQ432037.1		ACAGTG-GCGAGTTC	
DQ432045.1		ACAGTG-GCGAGTTC	
DQ767725.1		ACAGTG-GCGAGTTC	
DQ836043.1		ACAGTG-GCGAGTTC	
DQ997094.1		ACAGTG-GCGAGTTC	
DQ997102.1		ACAGTG-GCGAGTTC	
DQ997122.1		ACAGTG-GCGAGTTC	
DQ997133.1		ACAGTG-GCGAGTTC	
DQ997147.1		ACAGTG-GCGAGTTC	
DQ997163.1		ACAGTG-GCGAGTTC	
DQ997182.1		ACAGTG-GCGAGTTC	
DQ997218.1		ACAGTG-GCGAGTTC	
DQ997219.1		ACAGTG-GCGAGTTC	
DQ997253.1		ACAGTG-GCGAGTTC	
DQ997262.1		ACAGTG-GCGAGTTC	
DQ997268.1		ACAGTG-GCGAGTTC	
DQ997283.1		ACAGTG-GCGAGTTC	
DQ997308.1		ACAGTG-GCGAGTTC	
DQ997318.1		ACAGTG-GCGAGTTC	
DQ997325.1		ACAGTG-GCGAGTTC	
DQ997355.1		ACAGTG-GCGAGTTC	
DQ997377.1		ACAGTG-GCGAGTTC	
DQ997392.1		ACAGTG-GCGAGTTC	
DQ997405.1		ACAGTG-GCGAGTTC	
DQ997513.1		ACAGTG-GCGAGTTC	
DQ997522.1		ACAGTG-GCGAGTTC	
DQ997531.1		ACAGTG-GCGAGTTC	
EU195416.1		ACAGTG-GCGAGTTC	
EU263345.1		ACAGTG-GCGAGTTC	
EU263353.1		ACAGTG-GCGAGTTC	
FJ390061.2		ACAGTG-GCGAGTTC	
GQ184328.1		ACAGTG-GCGAGTTC	
GU052019.1		ACAGTG-GCGAGTTC	
GU052027.1		ACAGTG-GCGAGTTC	
GU052035.1		ACAGTG-GCGAGTTC	
GU052042.1		ACAGTG-GCGAGTTC	
GU052050.1		ACAGTG-GCGAGTTC	
GU052057.1		ACAGTG-GCGAGTTC	
GU052065.1		ACAGTG-GCGAGTTC	
GU052073.1		ACAGTG-GCGAGTTC	
GU052089.1		ACAGTG-GCGAGTTC	
GU052097.1		ACAGTG-GCGAGTTC	
GU052105.1		ACAGTG-GCGAGTTC	
GU052113.1		ACAGTG-GCGAGTTC	
GU052127.1		ACAGTG-GCGAGTTC	
GU052135.1		ACAGTG-GCGAGTTC	
GU052142.1		ACAGTG-GCGAGTTC	
GU052465.1		ACAGTG-GCGAGTTC	
GU052494.1		ACAGTG-GCGAGTTC	
GU186672.1		ACAGTG-GCGAGTTC	
GU186692.1		ACAGTG-GCGAGTTC	
JF732739.1		ACAGTG-GCGAGTTC	
JF772148.1		ACAGTG-GCGAGTTC	
JF772156.1		ACAGTG-GCGAGTTC	
JF772164.1		ACAGTG-GCGAGTTC	
JX013485.1		ACAGTG-GCGAGTTC	
KC784945.1		ACAGTG-GCGAGTTC	
KX364460.1		ACAGTG-GCGAGTTC	
KX364468.1		ACAGTG-GCGAGTTC	
LG018241.1		ACAGTG-GCGAGTTC	
LG018243.1		ACAGTG-GCGAGTTC	
LX269712.1		ACAGTG-GCGAGTTC	
LZ248488.1		ACAGTG-GTGA	
LZ248490.1		ACAGTG-GCGAGTTC	
LZ248492.1		ACAGTG-GCGAGTTC	
FJ455820.1		ACAGTG	
FJ602816.1		ACAGTG	
FJ602817.1		ACAGTG	
FJ602819.1		ACAGTG	
FJ602820.1		ACAGTG	
FJ602822.1		ACAGTG	
FJ602823.1		ACAGTG	
FJ602824.1		ACAGTG	
FJ602825.1		ACAGTG	
FJ602826.1		ACAGTG	
FJ602827.1		ACAGTG	
FJ602828.1		ACAGTG	
FJ602868.1		ACAGTG	

Supplementary Figure S3. Phylogenetic trees of the IAV HA.



Supplementary Figure S4. Multiple alignment of the SEOV S segment CDS sequences.

NC_005236.1/NP_942556.1	197	CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	230
AB618116.1		CCGACAGGATTGCAGCAGGGAAGAAATATC -GGGCA	
AF187082.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
AF329389.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
AY627049.2		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
FJ803207.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
FJ803208.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
FJ803211.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
FJ803213.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
FJ803214.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
FJ803216.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
FJ803217.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
GQ279379.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
GQ279381.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
GQ279384.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
GQ279385.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
GQ279392.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
GQ279393.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
GU592941.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
GU592942.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
GU592945.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
GU592950.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
GU592951.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
GU592953.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
JF693884.2		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
JQ665917.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
JQ665919.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
JQ665926.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
KU204960.2		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
KY639632.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
KY639666.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
KY639670.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
KY639672.1		CTGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
KY639673.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
KY639683.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
KY639689.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
KY639701.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
KY639706.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
KY639710.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
KY639711.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
MF149947.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
MF149948.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
MF149949.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
MF149950.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
MF149954.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
MF149956.1		CCGACAGGATTGCAGCAGGGAAGAACATC -GGGCA	
HC494660.1		CCGACAGA -TTGCAGCAGGGAAGAAATCCGGGCA	
M34881.1		CCGACAGA -TTGCAGCAGGGAAGAAATCCGGGCA	
		* ***** ** ** ** *	

Supplementary Figure S5. Phylogenetic trees of the SEOV S segment.

