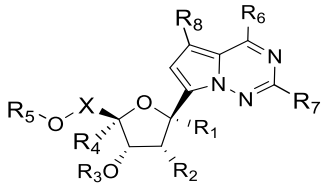
Claims

1. A compound, or a pharmaceutically acceptable salt thereof or a crystalline hydrate thereof or a solvate thereof; wherein the compound is of formula (I):



(I)

wherein,

R_1 is cyano;

R_2 is OR_3;

R_3 is selected from the group consisting of hydrogen, $C_{1\text{-}20}$alkanoyl, amino$C_{1\text{-}20}$alkanoyl;

R_4 is hydrogen;

R_5 is $C_{1\text{-}20}$alkanoyl, or amino$C_{1\text{-}20}$alkanoyl;

R_6 is amino;

R_7 is hydrogen;

R_8 is selected from the group consisting of hydrogen, deuterium, and halogen; and

X is $-CH_2-$, or $-CD_2-$.

2. The compound of claim 1, or the pharmaceutically acceptable salt thereof or the crystalline hydrate thereof or the solvate thereof, wherein,

R_3 is selected from the group consisting of hydrogen, formyl, acetyl, propionyl, butyryl, *iso*butyryl, valeroyl, pivaloyl, hexanoyl, α-aminoisovaleryl, 2-ethylbutanoyl, and 3,3-dimethylbutanoyl; and

R_5 is selected from the group consisting of formyl, acetyl, propionyl, butyryl, *iso*butyryl, valeroyl, pivaloyl, hexanoyl, α-aminoisovaleryl, 2-ethylbutanoyl, and 3,3-dimethylbutanoyl.

3. The compound claim 1, or the pharmaceutically acceptable salt thereof or the crystalline hydrate thereof or the solvate thereof, wherein,

R_8 is deuterium.

4. The compound of claim 1, or the pharmaceutically acceptable salt thereof or the crystalline hydrate thereof or the solvate thereof, wherein,

R_1 is cyano;

R_2 is OR_3;

R_3 is selected from the group consisting of hydrogen, propionyl, *iso*butyryl, pivaloyl, α-aminoisovaleryl, 2-ethylbutanoyl, and 3,3-dimethylbutanoyl;

R_4 is hydrogen;

R_5 is selected from the group consisting of propionyl, *iso*butyryl, pivaloyl, α-aminoisovaleryl, 2-ethylbutanoyl, and 3,3-dimethylbutanoyl;

R_6 is amino;

R_7 is hydrogen;

R_8 is hydrogen, or deuterium; and

X is $-CH_2-$, or $-CD_2-$.

5. The compound of claim 1, or the pharmaceutically acceptable salt thereof or the crystalline hydrate thereof or the solvate thereof, wherein,

R_1 is cyano;

R_2 is OR_3;

R_3 is selected from the group consisting of hydrogen, propionyl, *iso*butyryl, pivaloyl, α-aminoisovaleryl, 2-ethylbutanoyl, and 3,3-dimethylbutanoyl;

R_4 is hydrogen;

R_5 is selected from the group consisting of propionyl, *iso*butyryl, pivaloyl, α-aminoisovaleryl, 2-ethylbutanoyl, and 3,3-dimethylbutanoyl;

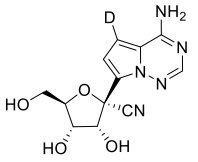
R_6 is amino;

R_7 is hydrogen;

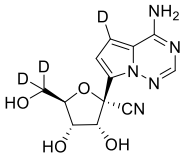
R_8 is deuterium; and

X is $-CH_2-$, or $-CD_2-$.

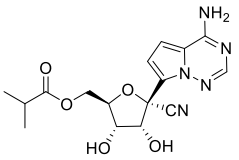
6. A compound, or a pharmaceutically acceptable salt thereof or a crystalline hydrate thereof or a solvate thereof, wherein the compound is selected from the group consisting of:



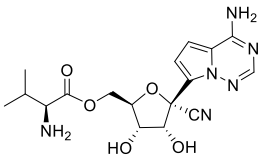
A9



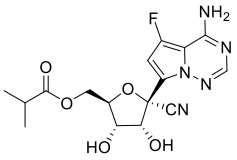
A11



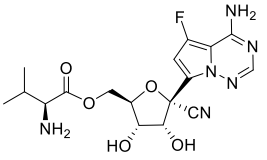
A50



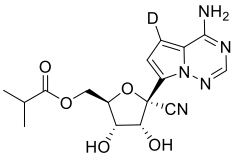
A52



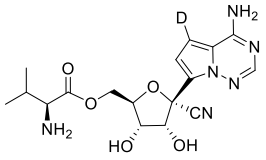
A55



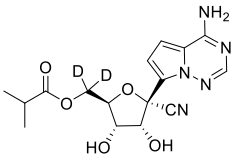
A57



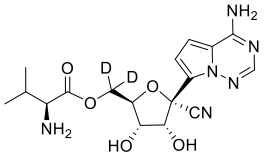
A70



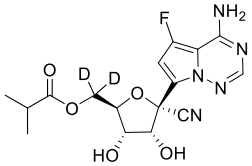
A72



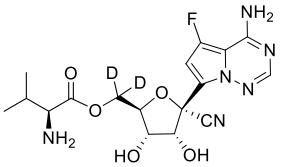
A75



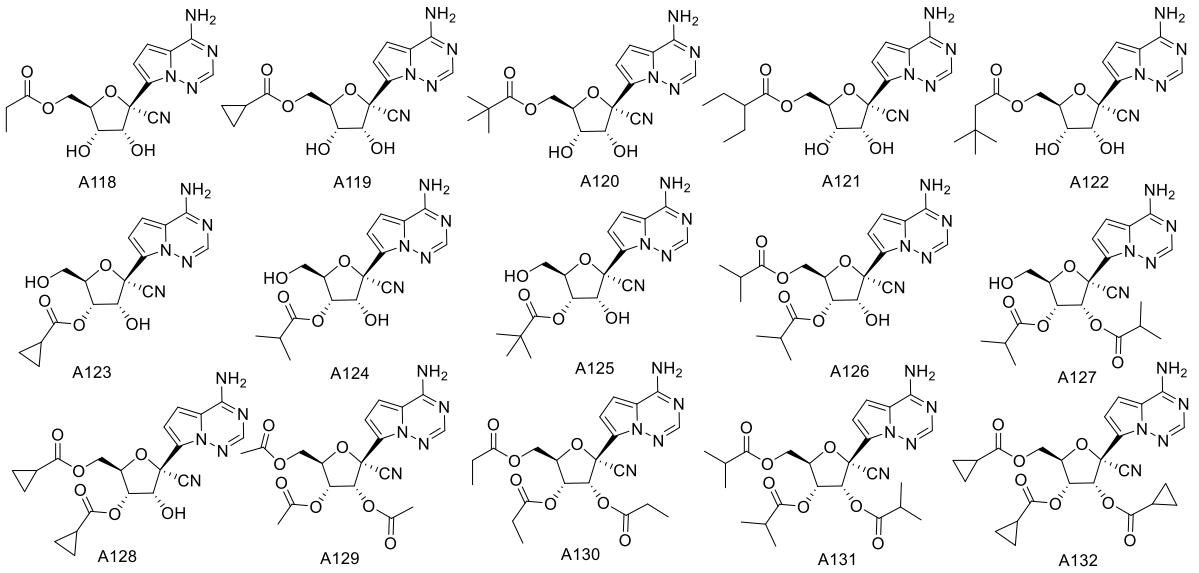
A77

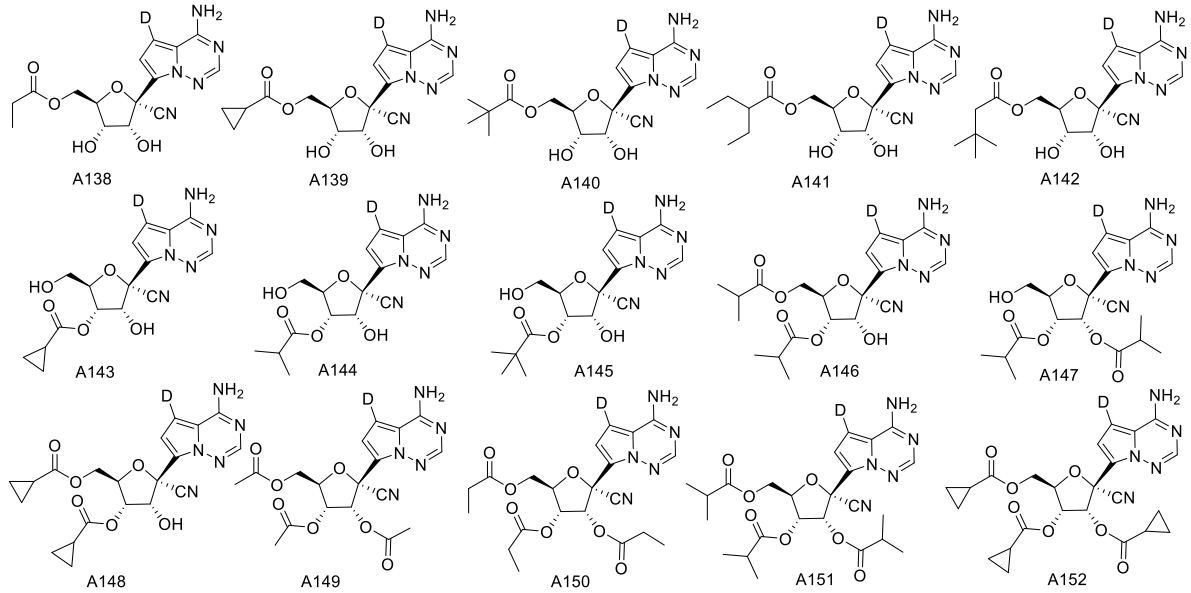


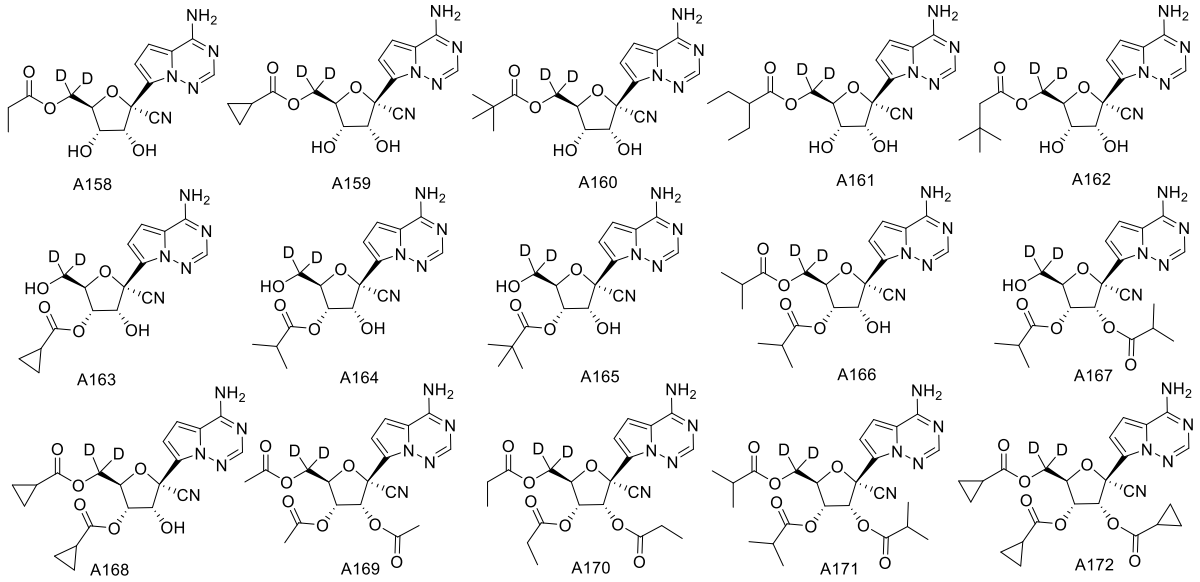
A80

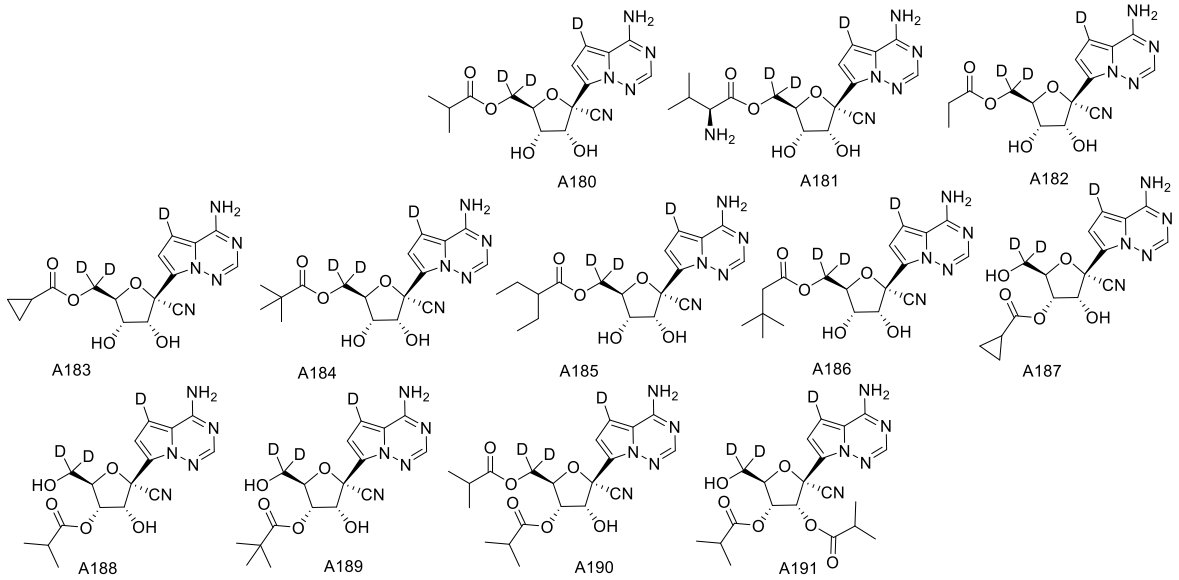


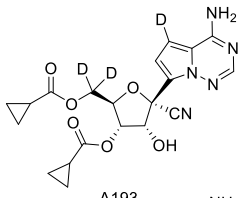
A82

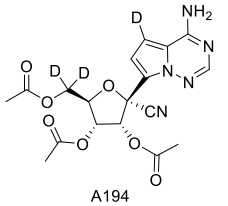

A118
A119
A120
A121
A122
A123
A124
A125
A126
A127
A128
A129
A130
A131
A132

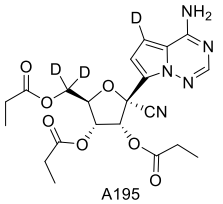

A138
A139
A140
A141
A142
A143
A144
A145
A146
A147
A148
A149
A150
A151
A152

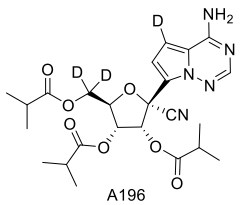

A158
A159
A160
A161
A162
A163
A164
A165
A166
A167
A168
A169
A170
A171
A172

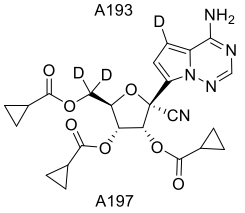

A180
A181
A182
A183
A184
A185
A186
A187
A188
A189
A190
A191

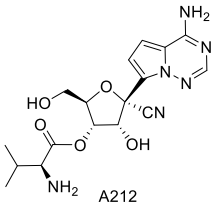

A193

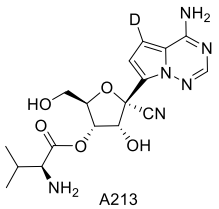

A194

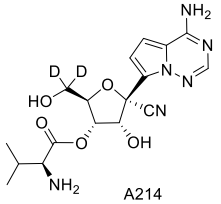

A195

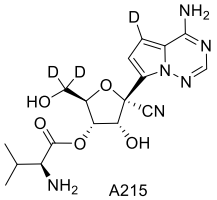

A196


A197


A212

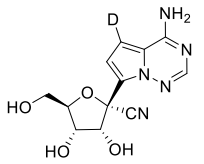

A213


A214

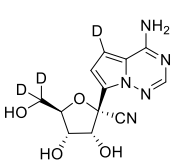

A215

.

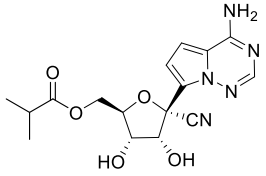
7. The compound of claim 6, or the pharmaceutically acceptable salt thereof or the crystalline hydrate thereof or the solvate thereof, wherein the compound is selected from the group consisting of:


A9

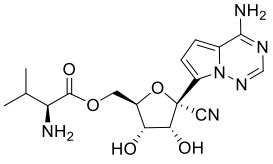
,


A11

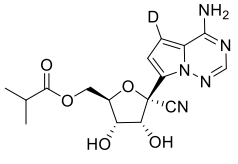
,


A50

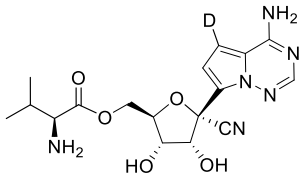
,


A52

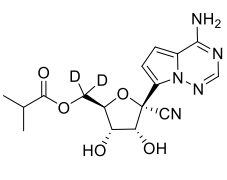
,


A70

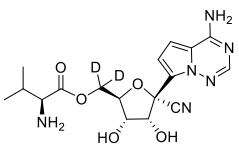
,


A72

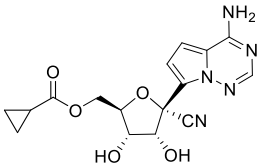
,


A75

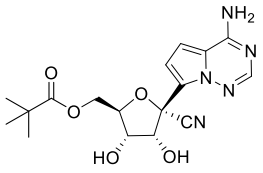
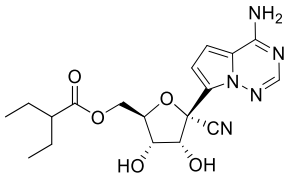
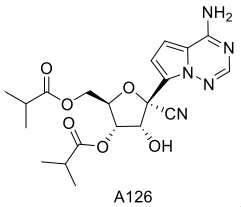
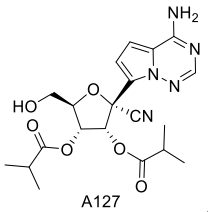
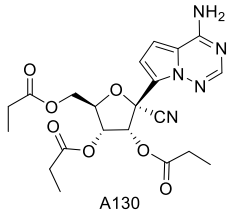
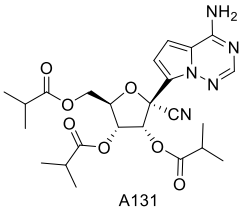
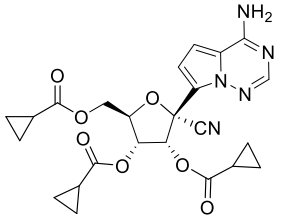
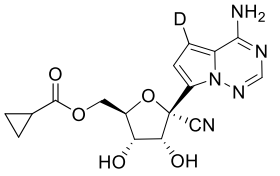
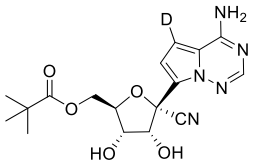
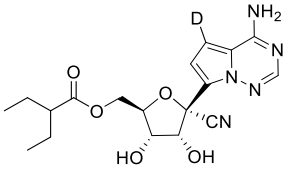
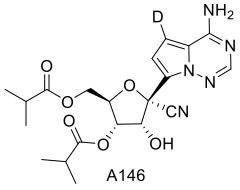
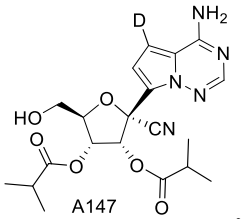
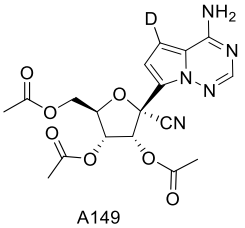
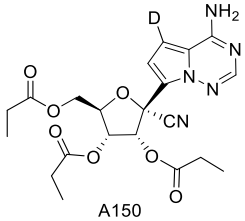
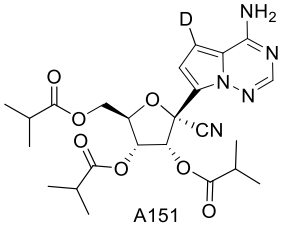
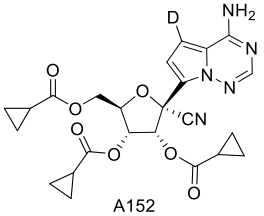
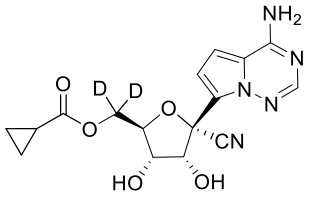
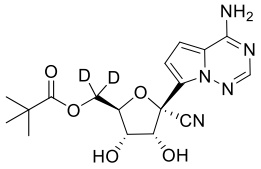
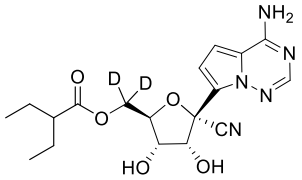
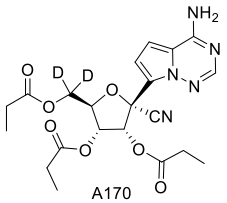
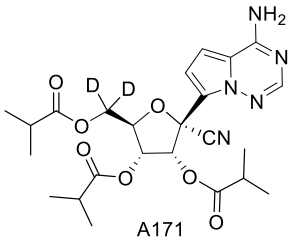
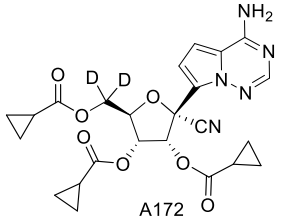
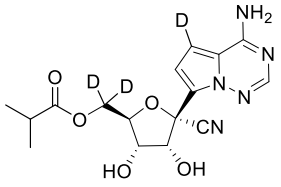
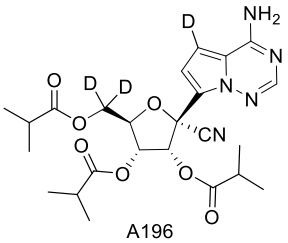
,


A77

,


A119

,


A120 ,

A121 ,

A126 ,

A127 ,

A130 ,

A131 ,

A132 ,

A139 ,

A140 ,

A141 ,

A146 ,

A147 ,

A149 ,

A150 ,

A151 ,

A152 ,

A159 ,

A160 ,

A161 ,

A170 ,

A171 ,

A172 ,

A180 , and

A196 .

8. A pharmaceutical composition comprising

(a) the compound of any one of claims 1 to 7, or the pharmaceutically acceptable

salt thereof or the crystalline hydrate thereof or the solvate thereof; and

(b) pharmaceutically acceptable carriers.

9. A use of the compound of any one of claims 1 to 7, or the pharmaceutically acceptable salt thereof or the crystalline hydrate thereof or the solvate thereof, or the pharmaceutical composition of claim 8 for preparing medicaments for treating, preventing, or alleviating virus infection or diseases associated with virus infection;

wherein

the virus is selected from the group consisting of:

(1) coronavirus infecting human;

(2) human respiratory syncytial virus (RSV);

(3) human influenza virus;

(4) flaviviridae virus;

(5) filoviridae virus; and

(6) coronavirus infecting other mammals; or

the virus is selected from the group consisting of:

severe acute respiratory syndrome coronavirus (SARS-CoV), 2019 novel coronavirus (2019-nCoV or SARS-CoV-2), Middle East respiratory syndrome coronavirus (MERS-CoV), Human coronavirus OC43, Human coronvirus 229E, Human coronvirus NL63, and Human coronvirus HKUL;

and,

the diseases associated with virus infection is selected from the group consisting of:

(D1) common cold, high-risk symptom infection, respiratory tract infection, pneumonia and the complications thereof caused by human coronavirus infection;

(D2) common cold, high-risk symptom infection, respiratory tract infection, pneumonia and the complications thereof caused by human respiratory syncytial virus (RSV) infection;

(D3) common cold, high-risk symptom infection, respiratory tract infection, pneumonia and the complications thereof caused by human influenza virus infection;

(D6) infection and the complications thereof caused by Zika virus (Zika);

(D7) hemorrhagic fever and the complications thereof caused by Marburg virus (MBV) and Ebola virus (EBV);

(D8) novel coronavirus pneumonia (Corona Virus Disease 2019，COVID-19) caused by SARS-CoV-2 (COVID-19);

(D9) Porcine epidemic diarrhea caused by porcine epidemic diarrhea virus (PEDV); and

(D10) any combination of the above diseases.

10. The use of claim 9, wherein:

the human influenza virus is selected from the group consisting of influenza A virus, influenza B virus and influenza C virus;

the flaviviridae virus is selected from the group consisting of: hepatitis C virus (HCV), dengue virus (DENV), Zika virus (Zika);

the filoviridae virus is selected from the group consisting of Marburg virus (MBV) and Ebola virus (EBV); and

the coronavirus infecting other mammals is porcine epidemic diarrhea virus (PEDV).