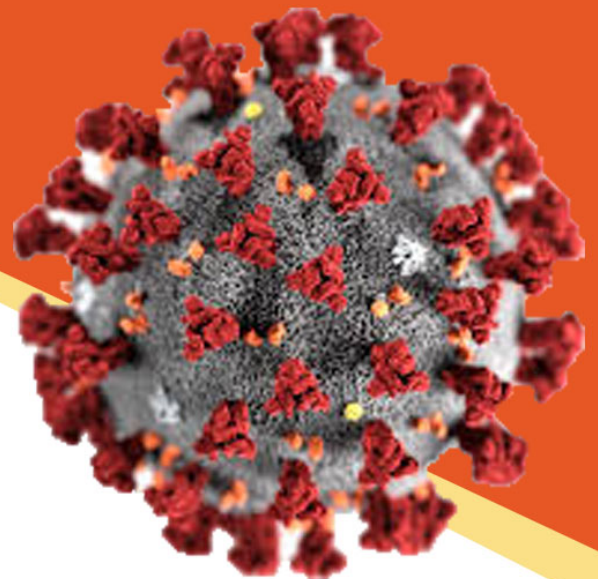




GENEMEDI
Innovation In Gene Therapy & Biologics

COVID-19



DIAGNOSTICS

- Antigen / Antibody
- Pseudotyped Virus
- ORF Plasmids

VACCINE

- Vaccine & Antibody
Candidates Efficacy
Evaluation Solution

[PRODUCT LIST](#)

[DATA POST](#)

[PROTOCOL DOWNLOAD](#)

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Apply for sample FOC (Free of charge)

For Antigens and antibodies for in-vitro diagnostics, Food & Feed & Environmental Safety, animal health test and new drug discovery

Note:

1. The shipping fee is US\$169.00. We bear \$ 69.00. You need to pay US\$100.00.
2. You can apply for up to two samples.



1. How to apply:

Please download the document and fill in the form. Send it to hqq@genemedi.net for application for samples.

 [Application document download](#)

2. The full list of sample FOC

COVID-19 PRODUCT LIST:

 [COVID-19 Diagnostics Vaccine list](#)

IVD PRODUCT LIST:


 [Inflammation & Cardiovascular Disease Antigens & antibodies list](#)

 [Infectious disease \(Influenza A/B, toxoplasma, etc\) Antigens & antibodies list](#)

ANIMAL HEALTH PRODUCT LIST:

 [Animal health \(avian, pig, fish, pet, Ruminant, etc\) Antigens & antibodies list](#)

SMALL MOLECULES PRODUCT LIST:

 [Small molecules \(Erythromycin, Calcitonin, Aflatoxin M1, etc\) Antigens & antibodies list](#)

GeneMedi is a BioTech with strong expertise in Gene&Biogitics discovery. We are cmmitted to providing high-quality antigens and antibodies as core ingredients for in-vitro diagnostics, Food & Feed & Environmental Safety, animal health test and new drug discovery.

Part 1. GeneMedi COVID-19 Diagnostics

1. Validated COVID-19 Antigens

[Products list](#) 1

[Data post](#) 2

2. Validated COVID-19 antibodies

[Products list](#) 3

[Data post](#) 4

3. Pre-made SARS-CoV-2 ORF plasmids & viral particles

[Products list](#) 9-16

4. SARS-CoV-2 Pseudovirus Based Neutralizing assay (wildtype,D614G and so on)

[Products list](#) 17

[Data post](#) 18

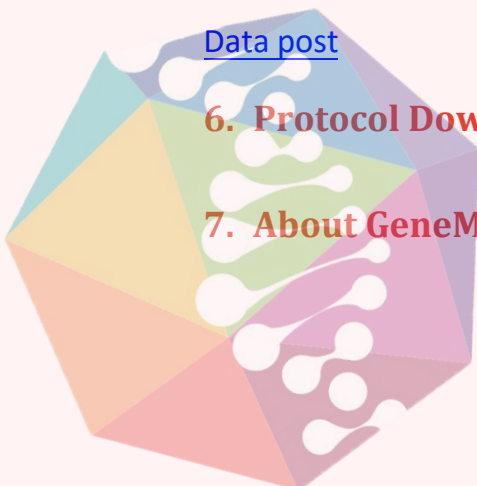
5. Validated SARS-CoV-2 neutralizing antibodies

[Products list](#) 20

[Data post](#) 21

6. Protocol Download 24

7. About GeneMedi 46



Part 2. COVID-19 Vaccine & Antibody Candidates Efficacy Evaluation Solution for new variants of SARS-CoV-2



1. Products & inf collection of SARS-COV-2 (2019nCOV) Alpha variant (B.1.1.7) , Beta variant (B.1.351) , Gamma variant (B.1.1.28.1) , Delta variant (B.1.617.2) , Iota variant (B.1.526) , and Double mutant variant B.1.617 lineage, S:E484Q+L452R (India) lineage .	15
2. Multiple variants of Spike protein&ACE2 competition binding assay (Gamma variant (B.1.1.28.1), Alpha variant (B.1.1.7), 501Y.V2, N501Y, E484K, D614G, Trimer, RBD, etc)	18
3. SARS-CoV2 Pseudovirus-Based Neutralization Assay System (Gamma variant (B.1.1.28.1), Alpha variant (B.1.1.7), 501Y.V2, N501Y, E484K, D614G, Trimer, RBD, etc)	20
4. Multi-Variants mammalian expression vector & Adenoviral vector (Gamma variant (B.1.1.28.1), Alpha variant (B.1.1.7), 501Y.V2, N501Y, E484K, D614G, Trimer, RBD, etc)	23
5. 293T-ACE2 stable cell line & human ACE2 expression vectors	25
6. Validated SARS-CoV-2 neutralizing antibodies -benchmark COVID-19 neutralizing antibodies	26
7. Information collection (including landscape, guidance) of SARS-CoV-2 Vaccine	30

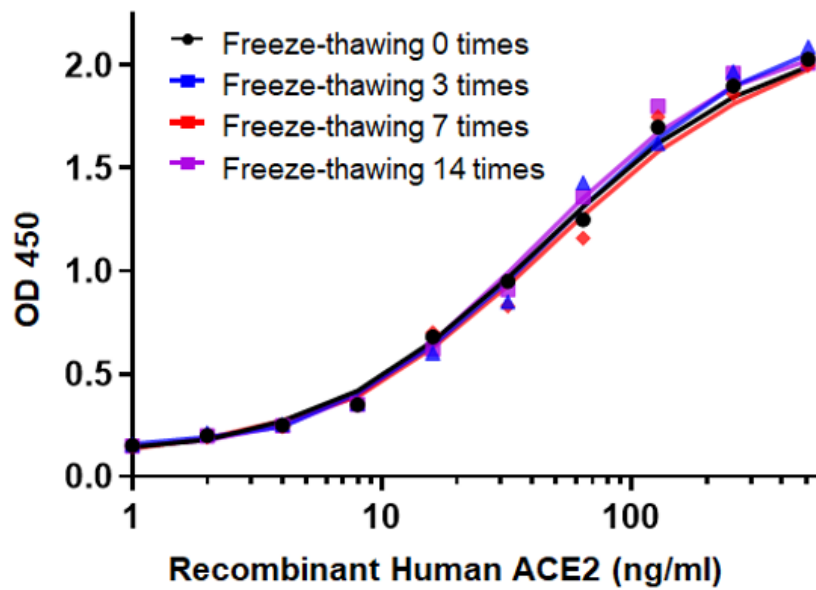


Validated COVID-19 Antigens

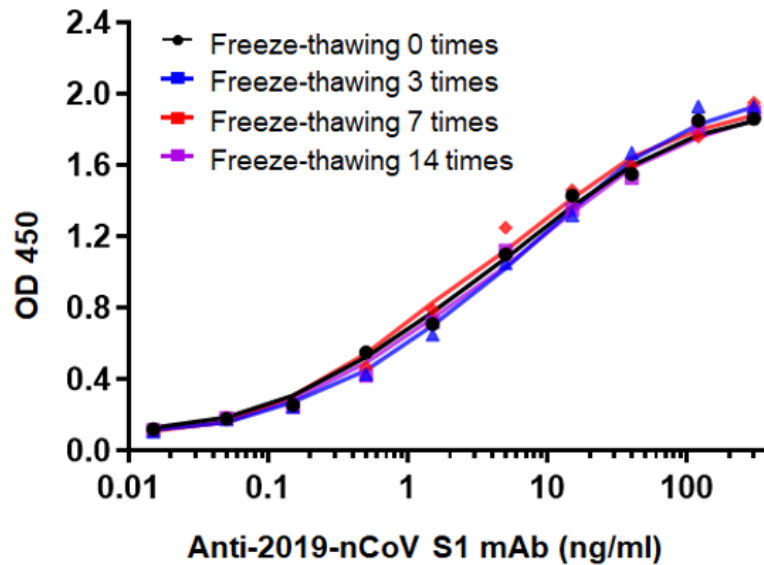
Cat No.	Antigen Name of 2019-nCoV(SARS-CoV-2)	Source (Expression Host)	Tag
GMP-V-2019nCoV- N002	Recombinant 2019-nCoV(SARS-CoV-2) Nucleocapsid Protein (N protein,N-His tag)	E.coli	N-His
GMP-V-2019nCoV- SRBD001	Recombinant 2019-nCoV(SARS-CoV-2) Spike Protein (RBD, C-His Tag)	Mamamlan (human cell)	C-His
GMP-V-2019nCoV- SRBD002	Recombinant 2019-nCoV(SARS-CoV-2) Spike Protein (RBD, C-mFc Tag)	Mamamlan (human cell)	C-mFc
GMP-V-2019nCoV- S1001	Recombinant 2019-nCoV(SARS-CoV-2) Spike Protein (S1, His Tag)	Baculovirus- Insect Cells	C-His
GMP-V-2019nCoV- S1S2001	Recombinant 2019-nCoV(SARS-CoV-2) Spike Protein (S1+S2 ECD, His tag)	Baculovirus- Insect Cells	C-His
GMP-V-2019nCoV- E001	Recombinant 2019-nCoV(SARS-CoV-2) Envelope Protein (E protein,His Tag)	E.coli	N-His
GMP-H-ACE2001	Recombinant human soluble ACE2 protein (soluble hACE2,extracellular hACE2,C-His)	Mamamlan (human cell)	C-His
GMP-H-ACE2002	Recombinant human soluble ACE2 protein (soluble hACE2, extracellular hACE2, C-Fc)	Mamamlan (human cell)	C-Fc
GMP-V-2019nCoV-Mpro001	Recombinant 2019-nCoV(SARS-CoV-2) Main Proteinase (Mpro,3CLpro, His Tag)	E.coli	N-His
GMP-V-2019nCoV-PLpro001	Recombinant 2019-nCoV(SARS-CoV-2) papain-like proteinase (PLpro, Nsp3, His Tag)	E.coli	N-His
GMP-V-2019nCoV- RdRP001	Recombinant 2019-nCoV(SARS-CoV-2) RNA-directed RNA polymerase(RdRP, Nsp12, His Tag)	E.coli	C-His
GMP-V-2019nCoV- Nsp3X-01	Recombinant 2019-nCoV(SARS-CoV-2)Nsp3-X domain(Macro domain, His tag)	E.coli	N-His
GMP-V-2019nCoV- Nsp10-01	Recombinant 2019-nCoV(SARS-CoV-2) nsp10 (nsp10-CysHis,GFL protein,His Tag)	E.coli	N-His
GMP-V-2019nCoV- Nsp16-01	Recombinant 2019-nCoV(SARS-CoV-2) nsp16 (nsp16-OMT,2'-o-MT,His Tag)	E.coli	N-His

Validation data of SRBD001 affinity and stability

SRBD001 Bind with GeneMedi's ACE2-002



SRBD001 Bind with GeneMedi's 2019nCoV-S1Ab-001



Validation data of SRBD001 stability. It shows that SRBD001 still exhibits excellent binding ability with ACE2-002 and S1Ab001 after several freeze-thawing cycles.

[View more data posts for COVID antigens >>](#)

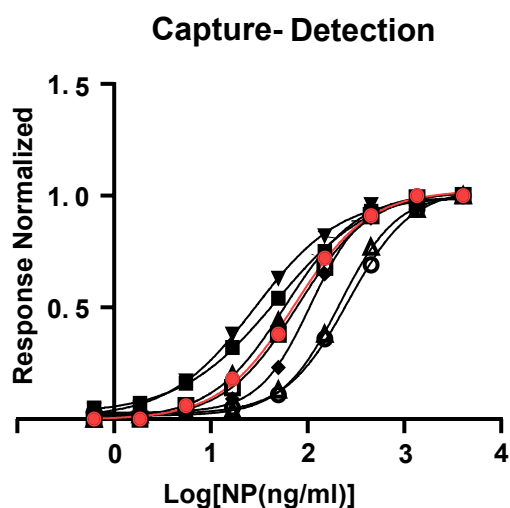
Validated COVID-19 Antibodies

Cat No.	Antibody Name of 2019-nCoV(SARS-CoV-2)	Isotype	Source	Bioactivity validation
GMP-V-2019nCoV-NAb001	Anti-2019-nCoV NP human monoclonal antibody	Human IgG1	Mammalian (human cell)	N protein binding, ELISA validated as capture antibody and detection antibody. Pair recommendation with GMP-V-2019nCoV-NAb002, NAb003, NAb004, NAb005, NAb006, NAb007, Nab008.
GMP-V-2019nCoV-NAb002	Anti-2019-nCoV NP human scFv-Fc antibody	Scfv	Mammalian (human cell)	N protein binding, ELISA validated as capture antibody and detection antibody. Pair recommendation with GMP-V-2019nCoV-NAb001, NAb003, NAb004, NAb005, NAb006, NAb007, Nab008.
GMP-V-2019nCoV-NAb003	Anti-2019-nCoV NP mouse monoclonal antibody(mAb)	Mouse IgG	Hybridoma	N protein binding, ELISA validated as capture antibody and detection antibody. Pair recommendation with GMP-V-2019nCoV-NAb001, NAb002, NAb004, NAb005, NAb006, NAb007, Nab008.
GMP-V-2019nCoV-NAb004	Anti-2019-nCoV NP mouse monoclonal antibody(mAb)	Mouse IgG	Hybridoma	N protein binding, ELISA validated as capture antibody and detection antibody. Pair recommendation with GMP-V-2019nCoV-NAb001, NAb002, NAb003, NAb005, NAb006, NAb007, Nab008.
GMP-V-2019nCoV-NAb005	Anti-2019-nCoV NP human scFv-Fc antibody	Scfv	Mammalian (human cell)	N protein binding, ELISA validated as capture antibody and detection antibody. Pair recommendation with GMP-V-2019nCoV-NAb001, NAb002, NAb003, NAb004, NAb006, NAb007, Nab008.
GMP-V-2019nCoV-NAb006	Anti-2019-nCoV NP Nanobody-Fc antibody	Nanobody (single-domain antibodies, sdAbs)	Mammalian (human cell)	N protein binding, ELISA validated as capture antibody and detection antibody. Pair recommendation with GMP-V-2019nCoV-NAb001, NAb002, NAb003, NAb004, NAb005, NAb007, Nab008.
GMP-V-2019nCoV-NAb007	Anti-2019-nCoV NP human monoclonal antibody	Human IgG	Mammalian (human cell)	N protein binding, ELISA validated as capture antibody and detection antibody. Pair recommendation with GMP-V-2019nCoV-NAb001, NAb002, NAb003, NAb004, NAb005, NAb006, Nab008.

Validated COVID-19 Antibodies

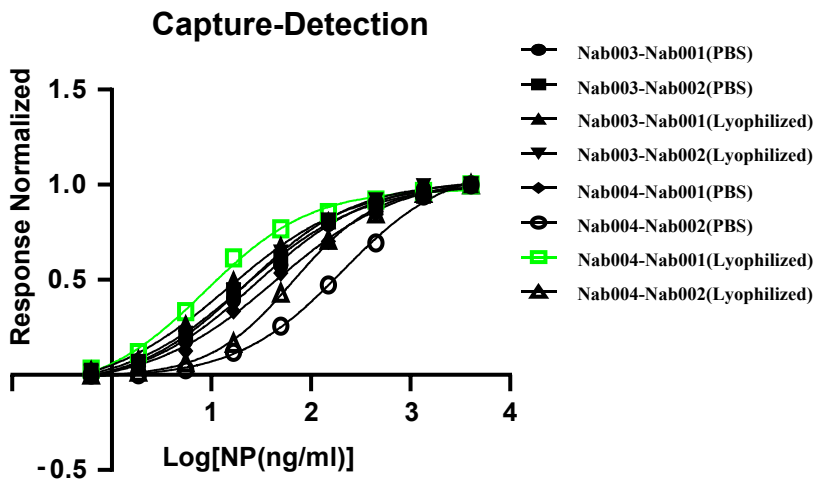
Cat No.	Antibody Name of 2019-nCoV(SARS-CoV-2)	Isotype	Source	Bioactivity validation
GMP-V-2019nCoV-NAb008	Anti-2019-nCoV NP human monoclonal antibody	Human IgG	Mammalian (human cell)	N protein binding, ELISA validated as capture antibody and detection antibody. Pair recommendation with GMP-V-2019nCoV-NAb001, NAb002, NAb003, NAb004, NAb005, NAb006, Nab007.
GMP-V-2019nCoV-S1Ab001	Anti-2019-nCoV Spike (S1 protein) monoclonal antibody	Human IgG1	Mammalian (human cell)	S-RBD protein binding, ELISA validated
GMP-V-2019nCoV-S1Ab002	Anti-2019-nCoV Spike (S1 protein) monoclonal antibody	Human IgG1	Mammalian (human cell)	S-RBD protein binding, ELISA validated, Western Blot validated
GMP-V-2019nCoV-S1Ab003	Anti-2019-nCoV Spike (S1 protein) mouse monoclonal antibody (mAb)	Mouse IgG	Hybridoma	S-RBD protein binding, ELISA validated
GMP-V-2019nCoV-S1Ab004	Anti-2019-nCoV Spike (S1 protein) mouse monoclonal antibody (mAb)	Mouse IgG	Hybridoma	S-RBD protein binding, ELISA validated, Western Blot validated
GMP-h-IL6-Ab01	Anti-human IL-6 mouse monoclonal antibody(mAb)	Mouse IgG	Hybridoma	human IL-6 protein binding, ELISA validated as capture antibody and detection antibody.
GMP-h-IL6-Ab02	Anti-human IL-6 mouse monoclonal antibody(mAb)	Mouse IgG	Hybridoma	human IL-6 protein binding, ELISA validated as capture antibody and detection antibody.
GMP-h-IL6-Ab03	Anti-human IL-6 mouse monoclonal antibody(mAb)	Mouse IgG	Hybridoma	human IL-6 protein binding, ELISA validated as capture antibody and detection antibody.

GeneMedi's SARS-CoV-2 NP Antibody Pair And Stability Validation In Sandwich ELISA



- Nab001-Nab003(PBS)
- Nab001-Nab004(PBS)
- ▲ Nab001-Nab003(Lyophilized)
- ▼ Nab001-Nab004(Lyophilized)
- ◆ Nab002-Nab003(PBS)
- Nab002-Nab004(PBS)
- ▣ Nab002-Nab003(Lyophilized)
- ▴ Nab002-Nab004(Lyophilized)

Capture	Detect	E C 5 0 (ng/ml)
Nab001 in PBS	Nab003 in PBS	73
Nab001 in PBS	Nab004 in PBS	47.12
Nab001 lyophilized	Nab003 lyophilized	58.84
Nab001 lyophilized	Nab004 lyophilized	28.47
NAb002 in PBS	Nab003 in PBS	107.2
NAb002 in PBS	Nab004 in PBS	261.7
Nab002 lyophilized	Nab003 lyophilized	79.31
Nab002 lyophilized	Nab004 lyophilized	212.7



Capture	Detect	EC50 (ng/ml)
Nab003 in PBS	NAb001 in PBS	28.36
Nab003 in PBS	NAb002 in PBS	21.23
Nab003 lyophilized	Nab001 lyophilized	14.65
Nab003 lyophilized	Nab002 lyophilized	22.3
Nab004 in PBS	NAb001 in PBS	44.14
Nab004 in PBS	NAb002 in PBS	206.1
Nab004 lyophilized	Nab001 lyophilized	8.656
Nab004 lyophilized	Nab002 lyophilized	66.43

Figure. GeneMedi's SARS-CoV2 [NP antibody](#)(Nab) pair validation with NP antigen([GMP-V-2019nCoV-N002](#)) in sandwich ELISA. Nabs were either in PBS solution (stocked in -20 for 7days) or **lyophilized** (stock at room temperature for 7 days). GeneMedi's lyophilized antibodies presented excellent stability in the room temperature condition.

Abbreviation

[Nab001](#)

[Nab002](#)

[Nab003](#)

[Nab004](#)

PBS

lyophilized

[NP](#)

Response Normalized

Description

[GMP-V-2019nCoV-NAb001](#)

[GMP-V-2019nCoV-NAb002](#)

[GMP-V-2019nCoV-NAb003](#)

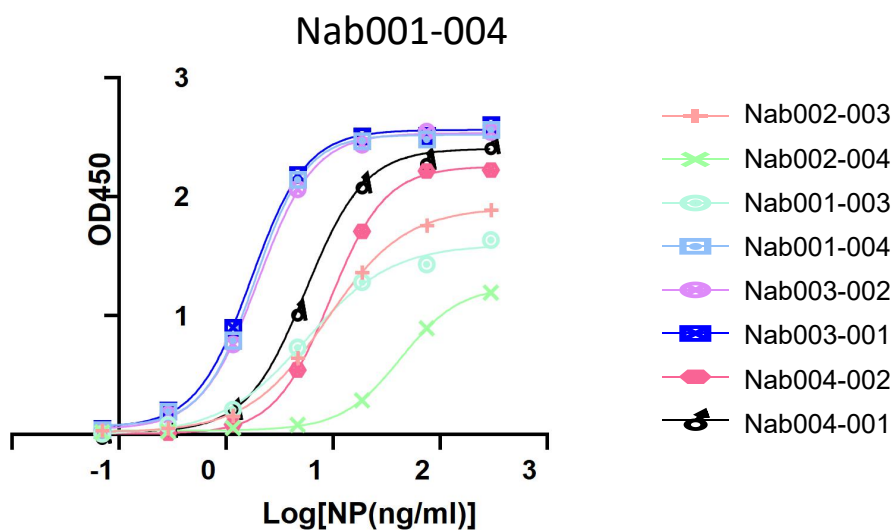
[GMP-V-2019nCoV-NAb004](#)

liquid in PBS buffer

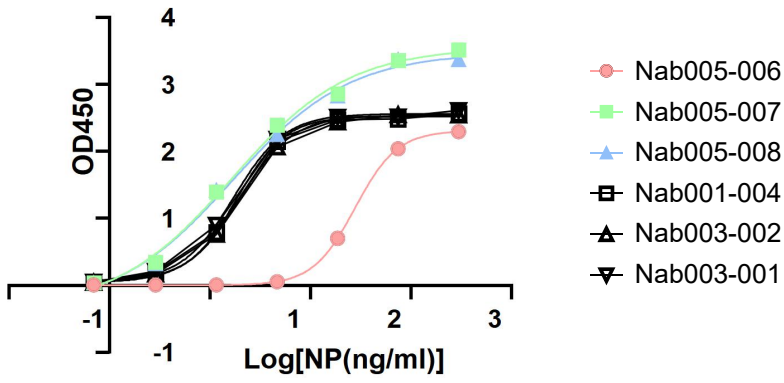
lyophilized and stock at room temperature for 7 days before reconstitution

[SARS-CoV-2 NP antigen \(GMP-V-2019nCoV-N002\)](#)

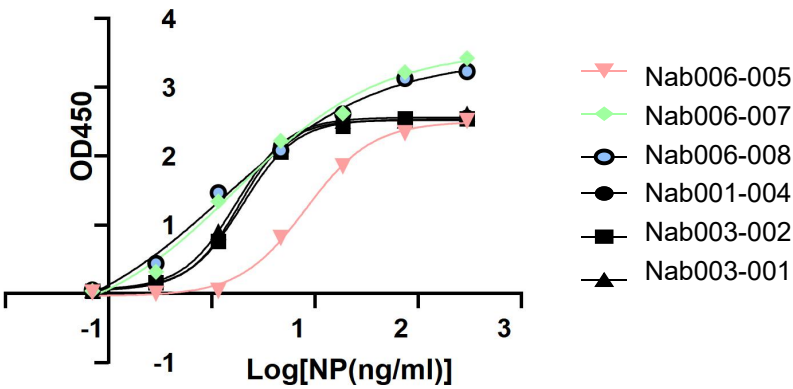
Normalized by Max OD450



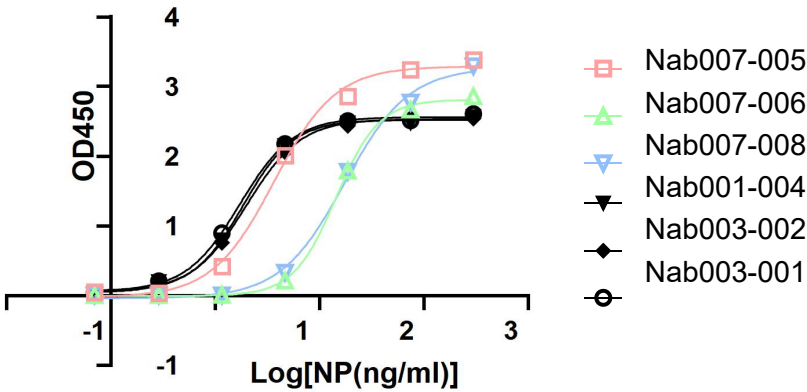
Nab005 (new product)



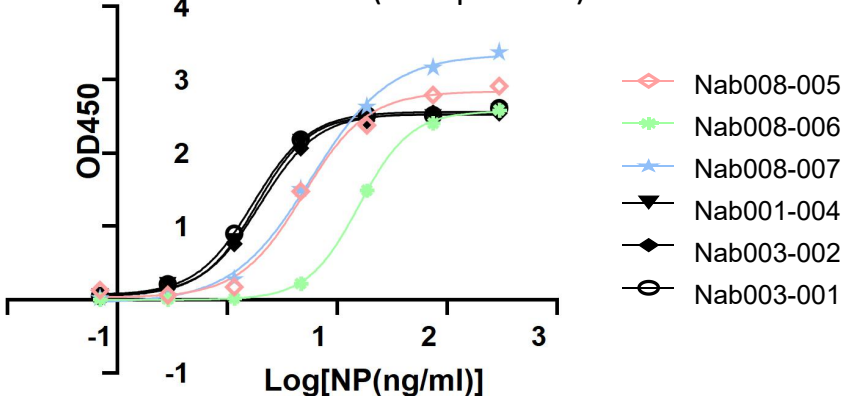
Nab006 (new product)



Nab007 (new product)



Nab008 (new product)



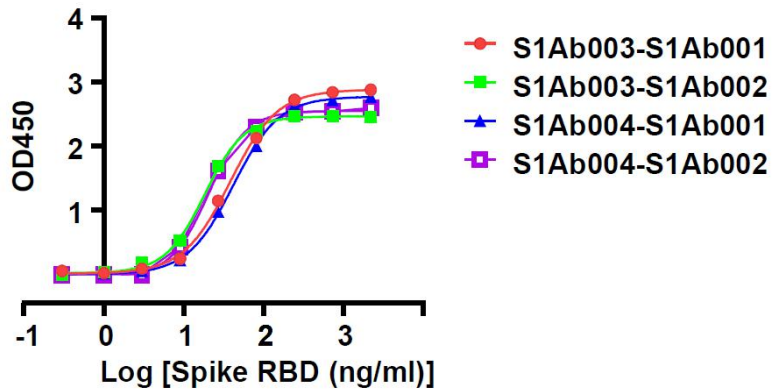
ED50 of Nab pairs validation with NP antigen in sandwich ELISA

Pair (capture-detect)	ED50 (ng/ml)
Nab005-Nab006	280
Nab005-Nab007	16.68
Nab005-Nab008	16.78
Nab006-Nab005	82.51
Nab006-Nab007	17.35
Nab006-Nab008	12.81
Nab007-Nab005	36.87
Nab007-Nab006	145
Nab007-Nab008	175.1
Nab008-Nab005	49.7
Nab008-Nab006	159.6
Nab008-Nab007	58.46
Nab002-Nab003	87.07
Nab002-Nab004	431.8
Nab001-Nab003	56.27
Nab001-Nab004	18.71
Nab003-Nab002	19.97
Nab003-Nab001	17.33
Nab004-Nab002	94.04
Nab004-Nab001	55.9

Figure. GeneMedi's SARS-CoV2 NP antibody (Nab) pairs validation with NP antigen ([GMP-V-2019nCoV-N002](#)) in sandwich ELISA. The [Nab005-007](#), [Nab005-008](#), [Nab006-007](#), [Nab006-008](#) pairs represent the best ED50.

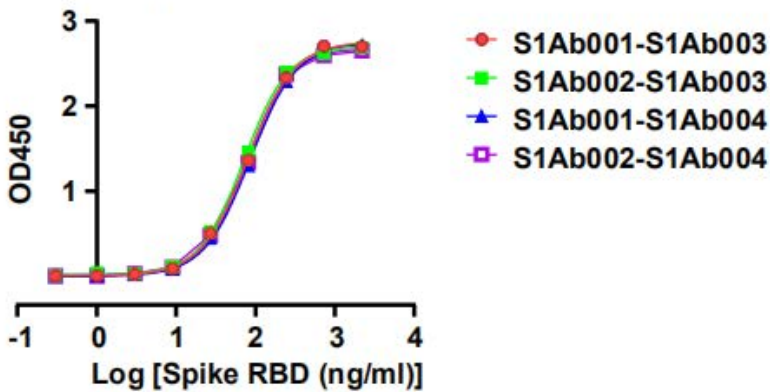
Spike Antibody Pair And Stability Validation with Spike antigen In Sandwich ELISA

Capture-Detection



Capture	Detect	EC50 (ng/ml)
S1Ab003	S1Ab001	38.26
S1Ab003	S1Ab002	18.27
S1Ab004	S1Ab001	41.63
S1Ab004	S1Ab002	20.43

Capture-Detection



Capture	Detect	EC50 (ng/ml)
S1Ab001	S1Ab003	79.79
S1Ab002	S1Ab003	71.61
S1Ab001	S1Ab004	85.63
S1Ab002	S1Ab004	77.81

GeneMedi's SARS-CoV2 [Spike antibody](#) pair validation with Spike RBD antigen(GMP-V-2019nCoV-SRBD001) in sandwich ELISA.

Abbreviation	Description
S1Ab001	GMP-V-2019nCoV-S1Ab001
S1Ab002	GMP-V-2019nCoV-S1Ab002
S1Ab003	GMP-V-2019nCoV-S1Ab003
S1Ab004	GMP-V-2019nCoV-S1Ab004
Spike RBD	GMP-V-2019nCoV-SRBD001

[View more data posts for COVID antibodies >>](#)

3

Pre-made SARS-CoV-2 ORF plasmids & viral particles

Cat No.	2019 nCoV related Gene	Gene & Vector description of 2019 nCoV	Vector	Reporter	Tag	Coden Optimized
GMV-V-2019 nCoV-051	Spike(S1+S2)	pGMLV-2019nCoV-spike (S1+S2,C-6His)	Lentiviral vector	Zsgreen	C-6His	coden optimized for mamamlian
GMV-V-2019 nCoV-001	Spike(S1+S2)	pGMLV-2019nCoV-spike(S1+S2,C-6His)	Lentiviral vector	Zsgreen	C-6His	No
GMV-V-2019 nCoV-017	Spike(S1+S2)	pGM-2019nCoV-spike protein(Sprotein,S1+S2)	pcDNA3.1(+)	null	No tag	No
GMV-V-2019 nCoV-008	Spike(S1+S2)	pGM-2019nCoV-spike protein(S protein,S1+S2)	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019 nCoV-053	Spike(S1+S2)	Ad-2019nCoV-Spike(S1+S2,C-3FLAG)	Pre-made adenovirus	EGFP	C-3FLAG	coden optimized for mamamlian
GMV-V-2019 nCoV-047	Spike(S1+S2)	Ad-2019nCoV-Spike(S1+S2,C-3FLAG)	Pre-made adenovirus	EGFP	C-3FLAG	No
GMV-V-2019 nCoV-052	Spike(S1+S2)	pGMAD-2019nCoV-pGMAD-2019nCoV-spike (S protein,S1+S2,C-3FLAG)	Adenoviral vector	EGFP	C-3FLAG	coden optimized for mamamlian
GMV-V-2019 nCoV-004	Spike(S1+S2)	pGMAD-2019nCoV-pGMAD-2019nCoV-spike (S protein,S1+S2,C-3FLAG)	Adenoviral vector	EGFP	C-3FLAG	No
GMV-V-2019 nCoV-035	Spike(S1+S2)	pGM-2019nCoV-spike protein (S protein, S1+S2)	pET21a	null	C-His	coden optimized for E.coli
GMV-V-2019 nCoV-037	Spike(S1+S2)	pGM-2019nCoV-spike protein (S protein, S1+S2)	pET-28a(+)	null	His	No
GMV-V-2019 nCoV-002	Spike(S1)	pGMLV-2019nCoV-S1(C-6His)	Lentiviral vector	Zsgreen	C-6His	No
GMV-V-2019 nCoV-005	Spike(S1)	pGMAD-2019nCoV-S1(C-3FLAG)	Adenoviral vector	EGFP	C-3FLAG	No
GMV-V-2019 nCoV-048	Spike(S1)	Ad-2019nCoV-Spike(S1 protein, C-3FLAG)	Pre-made adenovirus	EGFP	C-3FLAG	No
GMV-V-2019 nCoV-003	Spike RBD	pGMLV-2019nCoV-Spike RBD(C-6His)	Lentiviral vector	Zsgreen	C-6His	No
GMV-V-2019 nCoV-007	Spike RBD	pGMAAV-2019nCoV-Spike RBD(C-3FLAG)	AAV vector	Zsgreen	C-3FLAG	No
GMV-V-2019 nCoV-050	Spike RBD	AAV-2019nCoV-Spike (S protein RBD, C-3FLAG)	Pre-made AAV	Zsgreen	C-3FLAG	No
GMV-V-2019 nCoV-006	Spike RBD	pGMAD-2019nCoV-Spike RBD(C-3FLAG)	Adenoviral vector	EGFP	C-3FLAG	No
GMV-V-2019 nCoV-049	Spike RBD	Ad-2019nCoV-Spike(S protein RBD, C-3FLAG)	Pre-made adenovirus	EGFP	C-3FLAG	No

Cat No.	2019 nCoV related Gene	Gene & Vector description of 2019 nCoV	Vector	Reporter	Tag	codon Optimized
GMV-V-2019ncov-054	Spike(S1+S2) D614G mutation	pGM-2019ncov-spike D614G protein (S protein,S1+S2,D614G)	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019ncov-055	Spike(S1+S2) D614G mutation	pGMAD-2019ncov-spike D614G (S protein,S1+S2,D614G)	Adenoviral vector	null	C-3FLAG	coden optimized for mamamlian
GMV-V-2019ncov-056	Spike(S1+S2) D614G mutation	Ad-2019ncov-Spike D614G (S protein,S1+S2,D614G)	Pre-made adenovirus	null	C-3FLAG	coden optimized for mamamlian
GMV-V-2019ncov-057	Spike(S1+S2) S943P mutation	pGM-2019ncov-spike S943P protein (S protein,S1+S2,S943P)	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019ncov-058	Spike(S1+S2) V367F mutation	pGM-2019ncov-spike V367F protein (S protein,S1+S2,V367F)	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019ncov-059	Spike(S1+S2) G476S mutation	pGM-2019ncov-spike G476S protein (S protein,S1+S2,G476S)	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019ncov-060	Spike(S1+S2) V483A	pGM-2019ncov-spike V483A protein (S protein,S1+S2,V483A)	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019ncov-061	Spike(S1+S2)H49Y mutation	pGM-2019ncov-spike H49Y protein (S protein,S1+S2,H49Y)	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019ncov-062	Spike(S1+S2) Q239K mutation	pGM-2019ncov-spike Q239K protein (S protein,S1+S2,Q239K)	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019ncov-063	Spike(S1+S2) A831V mutation	pGM-2019ncov-spike A831V protein (S protein,S1+S2,A831V)	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019ncov-064	Spike(S1+S2) P1263L mutation	pGM-2019ncov-spike P1263L protein (S protein,S1+S2,P1263L)	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019ncov-065	Spike(S1+S2) D839Y/N/E-D839Y mutation	pGM-2019ncov-spike D839Y/N/E-D839Y protein (S protein,S1+S2,D839Y/N/E-D839Y)	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019ncov-066	Spike(S1+S2) D839Y/N/E-D839N mutation	pGM-2019ncov-spike D839Y/N/E-D839N protein (S protein,S1+S2,D839Y/N/E-D839N)	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019ncov-067	Spike(S1+S2) D839Y/N/E-D839E mutation	pGM-2019ncov-spike D839Y/N/E-D839E protein (S protein,S1+S2,D839Y/N/E-D839E)	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019ncov-099	P2-mutated Spike protein trimer variant (P2-mutant, S1/S2 cleavage site (furin cleavage sequence)-mutant, trimerization modified)	pGM-2019ncov-Spike trimer (P2-mutant, S1/S2 cleavage site (furin cleavage sequence)-mutant, trimerization modified)	pcDNA3.1(+)	null	No tag	coden optimized for mammalian
GMV-V-2019ncov-100	Spike(S1+S2) - B.1.1.7 lineage whole mutation	pGM-Spike of SARS-COV-2 B.1.1.7 lineage whole mutation	pcDNA3.1(+)	null	No tag	coden optimized for mammalian
GMV-V-2019ncov-101	Spike(S1+S2)-RBD N501Y mutation(B.1.1.7 lineage RBD)	pGM-2019ncov-Spike(S1+S2)-RBD N501Y mutation(B.1.1.7 lineage RBD)	pcDNA3.1(+)	null	No tag	coden optimized for mammalian

Cat No.	2019 nCoV related Gene	Gene & Vector description of 2019 nCoV	Vector	Reporter	Tag	codon Optimized
GMV-V-2019ncov-102	Spike(S1+S2)-S1 HV 69-70 Deletion mutation(Δ H69/ Δ V70, B.1.1.7 lineage)	pGM-2019ncov-Spike(S1+S2)-S1 HV 69-70 Deletion mutation(Δ H69/ Δ V70, B.1.1.7 lineage)	pcDNA3.1(+)	null	No tag	coden optimized for mammalian
GMV-V-2019ncov-103	P2-mutated Spike protein trimer variant (P2-mutant, S1/S2 cleavage site (furin cleavage sequence)-mutant, trimerization modified)	Ad-2019ncov-Spike trimer (P2-mutant, S1/S2 cleavage site (furin cleavage sequence)-mutant, trimerization modified)	Pre-made adenovirus	null	C-3FLAG	coden optimized for mammalian
GMV-V-2019ncov-104	Spike(S1+S2) - B.1.1.7 lineage whole mutation	Ad-Spike of SARS-COV-2 B.1.1.7 lineage whole mutation	Pre-made adenovirus	null	C-3FLAG	coden optimized for mammalian
GMV-V-2019ncov-105	Spike(S1+S2)-RBD N501Y mutation(B.1.1.7 lineage RBD)	Ad-2019ncov-Spike(S1+S2)-RBD N501Y mutation(B.1.1.7 lineage RBD)	Pre-made adenovirus	null	C-3FLAG	coden optimized for mammalian
GMV-V-2019ncov-106	Spike(S1+S2)-S1 HV 69-70 Deletion mutation(	Ad-2019ncov-Spike(S1+S2)-S1 HV 69-70 Deletion mutation(	Pre-made adenovirus	null	C-3FLAG	coden optimized for mammalian
GMV-V-2019ncov-107	Spike(S1+S2)-E484K mutation(501Y.V2 lineage)	pGM-2019ncov-Spike(S1+S2)-E484K mutation(501Y.V2 lineage)	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019ncov-108	Spike(S1+S2)-E484K mutation(501Y.V2 lineage)	Ad-2019ncov-Spike(S1+S2)-E484K mutation(501Y.V2 lineage)	Pre-made adenovirus	null	C-3FLAG	coden optimized for mamamlian
GMV-V-2019ncov-109	Spike(S1+S2)RBD triple mutation of 501Y.V2 lineage(K417N, E484K and N501Y)	pGM-Spike(S1+S2)RBD triple mutation of 501Y.V2 lineage(K417N, E484K and N501Y)	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019ncov-110	Spike(S1+S2)RBD triple mutation of 501Y.V2 lineage(K417N, E484K and N501Y)	Ad-Spike(S1+S2)RBD triple mutation of 501Y.V2 lineage(K417N, E484K and N501Y)	Pre-made adenovirus	null	C-3FLAG	coden optimized for mamamlian
GMV-V-2019ncov-111	Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019ncov) 501Y.V2 lineage	pGM-Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019ncov) 501Y.V2 lineage	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019ncov-112	Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019ncov) 501Y.V2 lineage	Ad-Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019ncov) 501Y.V2 lineage	Pre-made adenovirus	null	C-3FLAG	coden optimized for mamamlian
GMV-V-2019ncov-113	Spike(S1+S2) RBD triple mutation of 501Y.V2 lineage (K417N, E484K and N501Y)	pGM-Spike (S1+S2) RBD triple mutation of Brazilian P.1 lineage (K417T, E484K and N501Y)+D614G	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019ncov-114	Spike(S1+S2) RBD triple mutation of 501Y.V2 lineage (K417N, E484K and N501Y)	Ad-Spike (S1+S2) RBD triple mutation of Brazilian P.1 lineage (K417T, E484K and N501Y) +D614G	Pre-made adenovirus	null	C-3FLAG	coden optimized for mamamlian
GMV-V-2019ncov-115	Spike(S1+S2) - B.1.1.7 lineage whole mutation	pGM-Spike of SARS-COV-2 Brazilian P.1 lineage whole mutation	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian

Cat No.	2019 nCoV related Gene	Gene & Vector description of 2019 nCoV	Vector	Reporter	Tag	codon Optimized
GMV-V-2019ncov-116	Spike(S1+S2) - B.1.1.7 lineage whole mutation	Ad-Spike of SARS-COV-2 Brazilian P.1 whole mutation	Pre-made adenovirus	null	C-3FLAG	coden optimized for mamamlian
GMV-V-2019ncov-117	Spike(S1+S2) D614G mutation	pGMLV-2019ncov-spike D614G protein (S protein,S1+S2,D614G)	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian
GMV-V-2019ncov-118	Spike(S1+S2) S943P mutation	pGMLV-2019ncov-spike S943P protein (S protein,S1+S2,S943P)	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian
GMV-V-2019ncov-119	Spike(S1+S2) V367F mutation	pGMLV-2019ncov-spike V367F protein (S protein,S1+S2,V367F)	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian
GMV-V-2019ncov-120	Spike(S1+S2) G476S mutation	pGMLV-2019ncov-spike G476S protein (S protein,S1+S2,G476S)	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian
GMV-V-2019ncov-121	Spike(S1+S2) V483A	pGMLV-2019ncov-spike V483A protein (S protein,S1+S2,V483A)	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian
GMV-V-2019ncov-122	Spike(S1+S2)H49Y mutation	pGMLV-2019ncov-spike H49Y protein (S protein,S1+S2,H49Y)	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian
GMV-V-2019ncov-123	Spike(S1+S2) Q239K mutation	pGMLV-2019ncov-spike Q239K protein (S protein,S1+S2,Q239K)	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian
GMV-V-2019ncov-124	Spike(S1+S2) A831V mutation	pGMLV-2019ncov-spike A831V protein (S protein,S1+S2,A831V)	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian
GMV-V-2019ncov-125	Spike(S1+S2) P1263L mutation	pGMLV-2019ncov-spike P1263L protein (S protein,S1+S2,P1263L)	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian
GMV-V-2019ncov-126	Spike(S1+S2) D839Y/N/E-D839Y mutation	pGMLV-2019ncov-spike D839Y/N/E-D839Y protein (S protein,S1+S2,D839Y/N/E-D839Y)	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian
GMV-V-2019ncov-127	Spike(S1+S2) D839Y/N/E-D839N	pGMLV-2019ncov-spike D839Y/N/E-D839N	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian
GMV-V-2019ncov-128	Spike(S1+S2) D839Y/N/E-D839E mutation	pGMLV-2019ncov-spike D839Y/N/E-D839E protein (S protein,S1+S2,D839Y/N/E-D839E)	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian
GMV-V-2019ncov-129	P2-mutated Spike protein trimer variant (P2-mutant, S1/S2 cleavage site (furin cleavage sequence)-mutant, trimerization modified)	pGMLV-2019ncov-Spike trimer (P2-mutant, S1/S2 cleavage site (furin cleavage sequence)-mutant, trimerization modified)	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian
GMV-V-2019ncov-130	Spike(S1+S2) - B.1.1.7 lineage whole mutation	pGMLV-Spike of SARS-COV-2 B.1.1.7 lineage whole mutation	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian
GMV-V-2019ncov-131	Spike(S1+S2)-RBD N501Y mutation(B.1.1.7 lineage RBD)	pGMLV-2019ncov-Spike(S1+S2)-RBD N501Y mutation(B.1.1.7 lineage RBD)	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian

Cat No.	2019 nCoV related Gene	Gene & Vector description of 2019 nCoV	Vector	Reporter	Tag	codon Optimized
GMV-V-2019ncov-132	Spike(S1+S2)-S1 HV 69-70 Deletion mutation(	pGMLV-2019ncov-Spike(S1+S2)-S1 HV 69-70 Deletion mutation(	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian
GMV-V-2019ncov-133	pGMLV-2019nCoV-Spike(S1+S2)-E484K mutation (501Y.V2 lineage, B.1.351; P.1 lineage, B.1.1.28.1; Kent variant; B.1.526 lineage)	pGMLV-2019ncov-Spike(S1+S2)-E484K mutation(501Y.V2 lineage)	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian
GMV-V-2019ncov-134	Spike(S1+S2)RBD triple mutation of 501Y.V2 lineage(K417N, E484K and N501Y)	pGMLV-Spike(S1+S2)RBD triple mutation of 501Y.V2 lineage(K417N, E484K and N501Y)	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian
GMV-V-2019ncov-135	Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019ncov) 501Y.V2 lineage	pGMLV-Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019ncov) 501Y.V2 lineage	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian
GMV-V-2019nCoV-136	Spike of SARS-COV-2 Brazilian P.1 lineage whole mutation	pGMLV-Spike of SARS-COV-2 Brazilian P.1 lineage whole mutation	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian
GMV-V-2019nCoV-137	Spike(S1+S2)RBD triple mutation of Brazilian P.1 lineage (K417T, E484K and N501Y) +D614G	pGMLV-Spike(S1+S2)RBD triple mutation of Brazilian P.1 lineage (K417T, E484K and N501Y) +D614G	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian
GMV-V-2019nCoV-138	Spike(S1+S2)-	pGM-2019nCoV-Spike(S1+S2)-S477N mutation(The B.1.526 lineage; 20A.EU2 lineage)	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019nCoV-139	Spike(S1+S2)- S477N mutation(The B.1.526 lineage; 20A.EU2)	Ad-2019nCoV-Spike(S1+S2)-S477N mutation(The B.1.526 lineage; 20A.EU2)	Pre-made adenovirus	null	C-3FLAG	coden optimized for mamamlian
GMV-V-2019nCoV-140	Spike(S1+S2)-S477N mutation(The B.1.526 lineage; 20A.EU2)	pGMLV-2019nCoV-Spike(S1+S2)-S477N mutation(The B.1.526 lineage; 20A.EU2)	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian
GMV-V-2019nCoV-141	Spike(S1+S2)RBD mutation (S477N)+ D253G of B.1.526 lineage	pGM-Spike(S1+S2)RBD mutation (S477N)+ D253G of B.1.526 lineage	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019nCoV-142	Spike(S1+S2)RBD mutation (S477N)+ D253G of B.1.526 lineage	Ad-Spike(S1+S2)RBD mutation (S477N)+ D253G of B.1.526 lineage	Pre-made adenovirus	null	C-3FLAG	coden optimized for mamamlian
GMV-V-2019nCoV-143	Spike(S1+S2)RBD mutation (S477N)+ D253G of B.1.526 lineage	pGMLV-Spike(S1+S2)RBD mutation (S477N)+ D253G of B.1.526 lineage	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian

Cat No.	2019 nCoV related Gene	Gene & Vector description of 2019 nCoV	Vector	Reporter	Tag	codon Optimized
GMV-V-2019nCoV-144	Spike(S1+S2)RBD mutation (E484K)+ D253G of B.1.526 lineage	pGM-Spike(S1+S2)RBD mutation (E484K)+ D253G of B.1.526 lineage	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019nCoV-145	Spike(S1+S2)RBD mutation (E484K)+ D253G of B.1.526 lineage	Ad-Spike(S1+S2)RBD mutation (E484K)+ D253G of B.1.526 lineage	Pre-made adenovirus	null	C-3FLAG	coden optimized for mamamlian
GMV-V-2019nCoV-146	Spike(S1+S2)RBD mutation (E484K)+ D253G of B.1.526 lineage	pGMLV-Spike(S1+S2)RBD mutation (E484K)+ D253G of B.1.526 lineage	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian
GMV-V-2019nCoV-147	Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019nCoV) B.1.526	pGM-Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019nCoV) B.1.526	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019nCoV-148	Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019nCoV) B.1.526	Ad-Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019nCoV) B.1.526	Pre-made adenovirus	null	C-3FLAG	coden optimized for mamamlian
GMV-V-2019nCoV-149	Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019nCoV) B.1.526	pGMLV-Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019nCoV) B.1.526	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian
GMV-V-2019nCoV-150	Spike(S1+S2)-	pGM-2019nCoV-Spike(S1+S2)-E484Q mutation (double mutant EPI_ISL_1360318, S:E484Q+L452R (India))	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019nCoV-151	Spike(S1+S2)- E484Q mutation	Ad-2019nCoV-Spike(S1+S2)-E484Q mutation	Pre-made adenovirus	null	C-3FLAG	coden optimized for mamamlian
GMV-V-2019nCoV-152	Spike(S1+S2)-E484Q mutation	pGMLV-2019nCoV-Spike(S1+S2)-E484Q mutation	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian
GMV-V-2019nCoV-153	Spike(S1+S2)-L452R mutation (double mutant variant EPI_ISL_1360318, S:E484Q+L452R (India))	pGM-2019nCoV-Spike(S1+S2)-L452R mutation (double mutant variant EPI_ISL_1360318, S:E484Q+L452R (India))	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019nCoV-154	Spike(S1+S2)-L452R mutation (double mutant variant EPI_ISL_1360318, S:E484Q+L452R (India))	Ad-2019nCoV-Spike(S1+S2)-L452R mutation (double mutant variant EPI_ISL_1360318, S:E484Q+L452R (India))	Pre-made adenovirus	null	C-3FLAG	coden optimized for mamamlian
GMV-V-2019nCoV-155	Spike(S1+S2)-L452R mutation(double mutant variant EPI_ISL_1360318, S:E484Q+L452R (India))	pGMLV-2019nCoV-Spike(S1+S2)-L452R mutation(double mutant variant EPI_ISL_1360318, S:E484Q+L452R (India))	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian

Cat No.	2019 nCoV related Gene	Gene & Vector description of 2019 nCoV	Vector	Reporter	Tag	codon Optimized
GMV-V-2019nCoV-156	Spike(S1+S2)RBD mutation (E484Q+L452R) of double mutant variant EPI_ISL_1360318, S:E484Q+L452R (India)	pGM-Spike(S1+S2)RBD mutation (E484Q+L452R) of double mutant variant EPI_ISL_1360318, S:E484Q+L452R (India)	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019nCoV-157	Spike(S1+S2)RBD mutation (E484Q+L452R) of double mutant variant EPI_ISL_1360318, S:E484Q+L452R (India)	Ad-Spike(S1+S2)RBD mutation (E484Q+L452R) of double mutant variant EPI_ISL_1360318, S:E484Q+L452R (India)	Pre-made adenovirus	null	C-3FLAG	coden optimized for mamamlian
GMV-V-2019nCoV-158	Spike(S1+S2)RBD mutation (E484Q+L452R) of double mutant variant EPI_ISL_1360318, S:E484Q+L452R (India)	pGMLV-Spike(S1+S2)RBD mutation (E484Q+L452R) of double mutant variant EPI_ISL_1360318, S:E484Q+L452R (India)	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian
GMV-V-2019nCoV-159	Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019nCoV) double mutant variant EPI_ISL_1360318, S:E484Q+L452R (India)	pGM-Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019nCoV) double mutant variant EPI_ISL_1360318, S:E484Q+L452R (India)	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019nCoV-160	Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019nCoV) double mutant variant EPI_ISL_1360318, S:E484Q+L452R (India)	Ad-Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019nCoV) double mutant variant EPI_ISL_1360318, S:E484Q+L452R (India)	Pre-made adenovirus	null	C-3FLAG	coden optimized for mamamlian
GMV-V-2019nCoV-161	Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019nCoV) double mutant variant EPI_ISL_1360318, S:E484Q+L452R (India)	pGMLV-Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019nCoV) double mutant variant EPI_ISL_1360318, S:E484Q+L452R (India)	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian
GMV-V-2019nCoV-168	Spike(S1+S2)- S477G mutation(The B.1.526 lineage)	pGM-2019nCoV-Spike(S1+S2)- S477G mutation(The B.1.526 lineage)	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian

Cat No.	2019 nCoV related Gene	Gene & Vector description of 2019 nCoV	Vector	Reporter	Tag	codon Optimized
GMV-V-2019nCoV-169	Spike(S1+S2)- S477G mutation(The B.1.526 lineage)	Ad-2019nCoV-Spike(S1+S2)-S477G mutation(The B.1.526 lineage)	Pre-made adenovirus	null	C-3FLAG	coden optimized for mamamlian
GMV-V-2019nCoV-170	Spike(S1+S2)- S477G mutation(The B.1.526 lineage)	pGMLV-2019nCoV-Spike(S1+S2)-S477G mutation(The B.1.526 lineage)	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian
GMV-V-2019nCoV-171	Spike(S1+S2)-T478K mutation (delta variant B.1.617.2 lineage)	pGM-2019nCoV-Spike(S1+S2)-T478K mutation (delta variant B.1.617.2 lineage)	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019nCoV-172	Spike(S1+S2)-T478K mutation (delta variant B.1.617.2 lineage)	Ad-2019nCoV-Spike(S1+S2)-T478K mutation (delta variant B.1.617.2 lineage)	Pre-made adenovirus	null	C-3FLAG	coden optimized for mamamlian
GMV-V-2019nCoV-173	Spike(S1+S2)-T478K mutation(delta variant B.1.617.2 lineage)	pGMLV-2019nCoV-Spike(S1+S2)-T478K mutation(delta variant B.1.617.2 lineage)	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian
GMV-V-2019nCoV-174	Spike(S1+S2)RBD mutation (L452R+T478K) of delta variant B.1.617.2 lineage	pGM-Spike(S1+S2)RBD mutation (L452R+T478K) of delta variant B.1.617.2 lineage	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019nCoV-175	Spike(S1+S2)RBD mutation (L452R+T478K) of delta variant B.1.617.2 lineage	Ad-Spike(S1+S2)RBD mutation (L452R+T478K) of delta variant B.1.617.2 lineage	Pre-made adenovirus	null	C-3FLAG	coden optimized for mamamlian
GMV-V-2019nCoV-176	Spike(S1+S2)RBD mutation (L452R+T478K) of delta variant B.1.617.2 lineage	pGMLV-Spike(S1+S2)RBD mutation (L452R+T478K) of delta variant B.1.617.2 lineage	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian
GMV-V-2019nCoV-177	Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019nCoV) delta variant B.1.617.2 lineage	pGM-Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019nCoV) delta variant B.1.617.2 lineage	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019nCoV-178	Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019nCoV) delta variant B.1.617.2 lineage	Ad-Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019nCoV) delta variant B.1.617.2 lineage	Pre-made adenovirus	null	C-3FLAG	coden optimized for mamamlian
GMV-V-2019nCoV-179	Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019nCoV) delta variant B.1.617.2 lineage	pGMLV-Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019nCoV) delta variant B.1.617.2 lineage	Lentiviral vector	Zsgreen	C-3FLAG	coden optimized for mamamlian

Cat No.	2019 nCoV related Gene	Gene & Vector description of 2019 nCoV	Vector	Reporter	Tag	Coden Optimized
GMV-V-2019 nCoV-015	ORF8	pGM-2019nCoV-ORF8	pcDNA3.1(+)	null	No tag	No
GMV-V-2019 nCoV-024	ORF8	pGM-H2019nCoV-ORF8	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019 nCoV-033	ORF8	pGM-E2019nCoV-ORF8	pET21a	null	C-His	coden optimized for E.coli
GMV-V-2019 nCoV-014	ORF7	pGM-2019nCoV-ORF7a	pcDNA3.1(+)	null	No tag	No
GMV-V-2019 nCoV-023	ORF7	pGM-H2019nCoV-ORF7a	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019 nCoV-032	ORF7	pGM-E2019nCoV-ORF7a	pET21a	null	C-His	coden optimized for E.coli
GMV-V-2019 nCoV-013	ORF6	pGM-2019nCoV-ORF6	pcDNA3.1(+)	null	No tag	No
GMV-V-2019 nCoV-022	ORF6	pGM-H2019nCoV-ORF6	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019 nCoV-031	ORF6	pGM-E2019nCoV-ORF6	pET21a	null	C-His	coden optimized for E.coli
GMV-V-2019 nCoV-012	ORF3a	pGM-2019nCoV-ORF3a	pcDNA3.1(+)	null	No tag	No
GMV-V-2019 nCoV-021	ORF3a	pGM-H2019nCoV-ORF3a	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019 nCoV-030	ORF3a	pGM-E2019nCoV-ORF3a	pET21a	null	C-His	coden optimized for E.coli
GMV-V-2019 nCoV-016	ORF10	pGM-2019nCoV-ORF10	pcDNA3.1(+)	null	No tag	No
GMV-V-2019 nCoV-025	ORF10	pGM-H2019nCoV-ORF10	pcDNA3.1(+)	null	No tag	coden optimized or mamamlian
GMV-V-2019 nCoV-034	ORF10	pGM-E2019nCoV-ORF10	pET21a	null	C-His	coden optimized for E.coli
GMV-V-2019 nCoV-011	N protein	pGM-2019nCoV-Nucleocapsid Protein (N protein)	pcDNA3.1(+)	null	No tag	No
GMV-V-2019 nCoV-020	N protein	pGM-2019nCoV-Nucleocapsid Protein (N protein)	pcDNA3.1(+)	null	No tag	coden optimized for mamamlian
GMV-V-2019 nCoV-029	N protein	pGM-2019nCoV-Nucleocapsid Protein (N protein)	pET21a	null	C-His	coden optimized for E.coli

Cat No.	2019 nCoV related Gene	Gene & Vector description of 2019 nCoV	Vector	Reporter	Tag	codon Optimized
GMV-V-2019nCoV-019	M protein	pGM-2019nCoV-Membrane protein (M protein)	pCDNA3.1(+)	null	No tag	Codon Optimized for mammalian
GMV-V-2019nCoV-028	M protein	pGM-2019nCoV-Membrane protein (M protein)	pET21a	null	C-His	Codon Optimized for E.coli
GMV-V-2019nCoV-009	E protein	pGM-2019nCoV-Envelope Protein (E protein)	pCDNA3.1(+)	null	No tag	No
GMV-V-2019nCoV-018	E protein	pGM-2019nCoV-Envelope Protein (E protein)	pCDNA3.1(+)	null	No tag	Codon Optimized for mammalian
GMV-V-2019nCoV-027	E protein	pGM-2019nCoV-Envelope Protein (E protein)	pET21a	null	C-His	Codon Optimized for E.coli
GMV-V-2019nCoV-045	TMPRSS2	pGMLv-hTMPRSS2(C-3FLAG)	Lentiviral vector	Zsgreen	C-3FLAG	No
GMV-V-2019nCoV-041	ACE2	pGMLV-hACE2(C-3FLAG)	Lentiviral vector	Zsgreen	C-3FLAG	No
GMV-V-2019nCoV-042	ACE2	pAD-hACE2(C-3FLAG)	Pre-made Adenovirus	EGFP	C-3FLAG	No
GMV-V-2019nCoV-046	TMPRSS2	pGMLv-mtmprss2(C-3FLAG)	Lentiviral vector	Zsgreen	C-3FLAG	No
GMV-V-2019nCoV-043	ACE2	pAD-mACE2(C-3FLAG)	Pre-made Adenovirus	EGFP	C-3FLAG	No
GMV-V-2019nCoV-044	ACE2	pGMLV-mACE2(C-3FLAG)	Lentiviral vector	Zsgreen	C-3FLAG	No
GMV-V-2019nCoV-069	Nsp1	pGM-2019nCoV-Nsp1	pCDNA6B	null	FLAG	No
GMV-V-2019nCoV-070	Nsp2	pGM-2019nCoV-Nsp2	Lentiviral vector	null	2×Strep	Codon Optimized for mammalian
GMV-V-2019nCoV-071	Nsp2	pGM-2019nCoV-Nsp2	pCDNA6B	null	FLAG	No
GMV-V-2019nCoV-072	Nsp3C	pGM-2019nCoV-Nsp3C	pCDNA6B	null	FLAG	No
GMV-V-2019nCoV-073	Nsp3N	pGM-2019nCoV-Nsp3N	pCDNA6B	null	FLAG	No
GMV-V-2019nCoV-074	Nsp4	pGM-2019nCoV-Nsp4	Lentiviral vector	null	2×Strep	Codon Optimized for mammalian
GMV-V-2019nCoV-075	Nsp4	pGM-2019nCoV-Nsp4	pCDNA6B	null	FLAG	No
GMV-V-2019nCoV-076	Nsp5(Mpro,3CLpro)	pGM-2019nCoV-Nsp5(Mpro,3CLpro)	Lentiviral vector	null	2×Strep	Codon Optimized for mammalian
GMV-V-2019nCoV-077	Nsp5(Mpro,3CLpro)	pGM-2019nCoV-Nsp5(Mpro,3CLpro)	pCDNA6B	null	FLAG	No
GMV-V-2019nCoV-078	Nsp6	pGM-2019nCoV-Nsp6	Lentiviral vector	null	2×Strep	Codon Optimized for mammalian
GMV-V-2019nCoV-079	Nsp6	pGM-2019nCoV-Nsp6	pCDNA6B	null	FLAG	No
GMV-V-2019nCoV-080	Nsp7	pGM-2019nCoV-Nsp7	Lentiviral vector	null	2×Strep	Codon Optimized for mammalian
GMV-V-2019nCoV-081	Nsp7	pGM-2019nCoV-Nsp7	pCDNA6B	null	FLAG	No
GMV-V-2019nCoV-082	Nsp8	pGM-2019nCoV-Nsp8	Lentiviral vector	null	2×Strep	Codon Optimized for mammalian
GMV-V-2019nCoV-083	Nsp8	pGM-2019nCoV-Nsp8	pCDNA6B	null	FLAG	No

Cat No.	2019 nCoV related Gene	Gene & Vector description of 2019 nCoV	Vector	Reporter	Tag	codon Optimized
GMV-V-2019 nCoV-084	Nsp9	pGM-2019nCoV-Nsp9	Lentiviral vector	null	2×Strep	Codon Optimized for mammalian
GMV-V-2019 nCoV-085	Nsp9	pGM-2019nCoV-Nsp9	pCDNA6B	null	FLAG	No
GMV-V-2019 nCoV-086	Nsp10	pGM-2019nCoV-Nsp10	Lentiviral vector	null	2×Strep	Codon Optimized for mammalian
GMV-V-2019 nCoV-087	Nsp10	pGM-2019nCoV-Nsp10	pCDNA6B	null	FLAG	No
GMV-V-2019 nCoV-088	Nsp11	pGM-2019nCoV-Nsp11	Lentiviral vector	null	2×Strep	Codon Optimized for mammalian
GMV-V-2019 nCoV-089	Nsp11	pGM-2019nCoV-Nsp11	pCDNA6B	null	FLAG	No
GMV-V-2019 nCoV-090	Nsp12(RdRP)	pGM-2019nCoV-Nsp12(RdRP)	Lentiviral vector	null	2×Strep	Codon Optimized for mammalian
GMV-V-2019 nCoV-091	Nsp12(RdRP)	pGM-2019nCoV-Nsp12(RdRP)	pCDNA6B	null	FLAG	No
GMV-V-2019 nCoV-092	Nsp13	pGM-2019nCoV-Nsp13	Lentiviral vector	null	2×Strep	Codon Optimized for mammalian
GMV-V-2019 nCoV-093	Nsp13	pGM-2019nCoV-Nsp13	pCDNA6B	null	FLAG	No
GMV-V-2019 nCoV-094	Nsp14	pGM-2019nCoV-Nsp14	Lentiviral vector	null	2×Strep	Codon Optimized for mammalian
GMV-V-2019 nCoV-095	Nsp14	pGM-2019nCoV-Nsp14	pCDNA6B	null	FLAG	No
GMV-V-2019 nCoV-096	Nsp15	pGM-2019nCoV-Nsp15	Lentiviral vector	null	2×Strep	Codon Optimized for mammalian
GMV-V-2019 nCoV-097	Nsp15	pGM-2019nCoV-Nsp15	pCDNA6B	null	FLAG	No
GMV-V-2019 nCoV-098	Nsp16	pGM-2019nCoV-Nsp16	pCDNA6B	null	FLAG	No

Validation of Ad-2019nCoV-Spike(S1+S2,C-3FLAG)

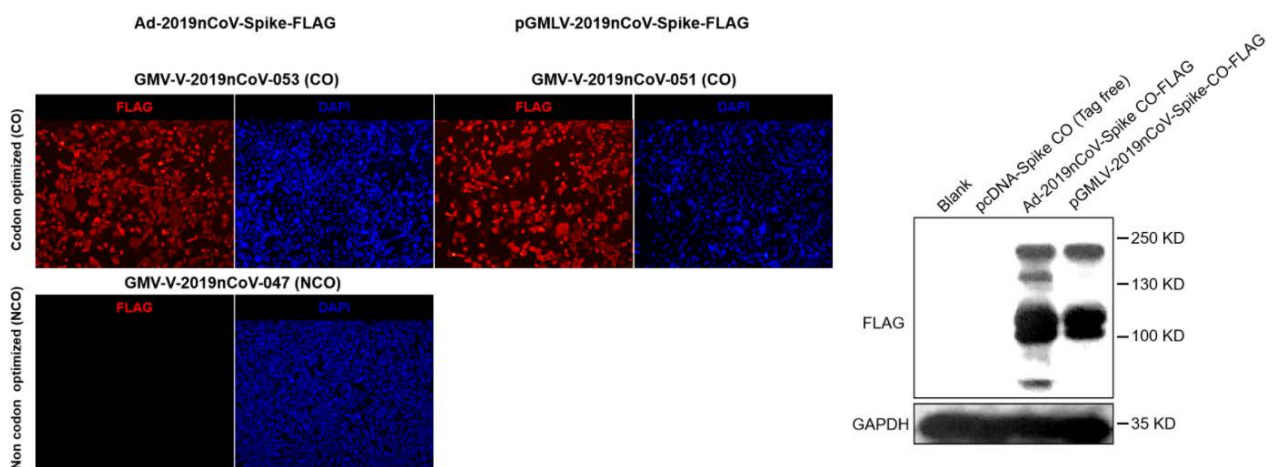


Figure. Validation of SARS-CoV-2 (2019nCoV) codon optimized (CO) Spike expression in HEK293 cell line by GeneMedi's adenoviral vector (GMV-V-2019nCoV-053, GMV-V-2019nCoV-047) and lentiviral vector (GMV-V-2019nCoV-051) with Immunofluorescence (left) and Western Blot (right) by FLAG antibody.

SARS-CoV-2 (2019nCoV) Pseudotyped virus production & Pseudotyped Virus Based Neutralization Assay Service

1. SARS-CoV-2 Pseudotyped virus packaging and production ([Cat.GM-2019nCoV-PSV01](#))
2. Effector cells: human ACE2 overexpression stable HEK293T cell lines ([Cat. GM-SC-293T-hACE2-01](#))
3. SARS-CoV-2(2019nCoV) Pseudotyped Virus Based Neutralization Assay Service for evaluating:
 - 1) Neutralizing antibodies
 - 2) Peptides blockers(peptide inhibitors)
 - 3) Types of Vaccines3(by testing immunized serum from mouse, NHP etc.)
 - 4) Compounds targeting Spike induced cell-fusion.

For details and price please [click here](#) or send email to support@genemedi.net

Pseudotyped virus of SARS-CoV-2 Spike Mutation Variants (D614G, S943P, V367F, G476S, V483A, h39Y, Q239K, A831V, P1263L, D839Y/N/E:D839Y, D839N, D839E)

Catalog No.	Pseudotyped virus of SARS-CoV-2 Spike Mutation Variants
GM-2019nCoV-PSV02	Spike D614G mutation SARS-CoV-2(2019nCoV) Pseudotyped virus
GM-2019nCoV-PSV03	Spike S943P mutation SARS-CoV-2(2019nCoV) Pseudotyped virus
GM-2019nCoV-PSV04	Spike V367F mutation SARS-CoV-2(2019nCoV) Pseudotyped virus
GM-2019nCoV-PSV05	Spike G476S mutation SARS-CoV-2(2019nCoV) Pseudotyped virus
GM-2019nCoV-PSV06	Spike V483A mutation SARS-CoV-2(2019nCoV) Pseudotyped virus
GM-2019nCoV-PSV07	Spike H49Y mutation SARS-CoV-2(2019nCoV) Pseudotyped virus
GM-2019nCoV-PSV08	Spike Q239K mutation SARS-CoV-2(2019nCoV) Pseudotyped virus
GM-2019nCoV-PSV09	Spike A831V mutation SARS-CoV-2(2019nCoV) Pseudotyped virus
GM-2019nCoV-PSV10	Spike P1263L mutation SARS-CoV-2(2019nCoV) Pseudotyped virus
GM-2019nCoV-PSV11	Spike D839Y/N/E-D839Y mutation SARS-CoV-2(2019nCoV) Pseudotyped virus
GM-2019nCoV-PSV12	Spike D839Y/N/E-D839N mutation SARS-CoV-2(2019nCoV) Pseudotyped virus
GM-2019nCoV-PSV13	Spike D839Y/N/E-D839E mutation SARS-CoV-2(2019nCoV) Pseudotyped virus

GeneMedi SARS-CoV-2 Pseudovirus (PSV) Based Cell Entry

[View more data post and protocol for COVID PSV >>](#)

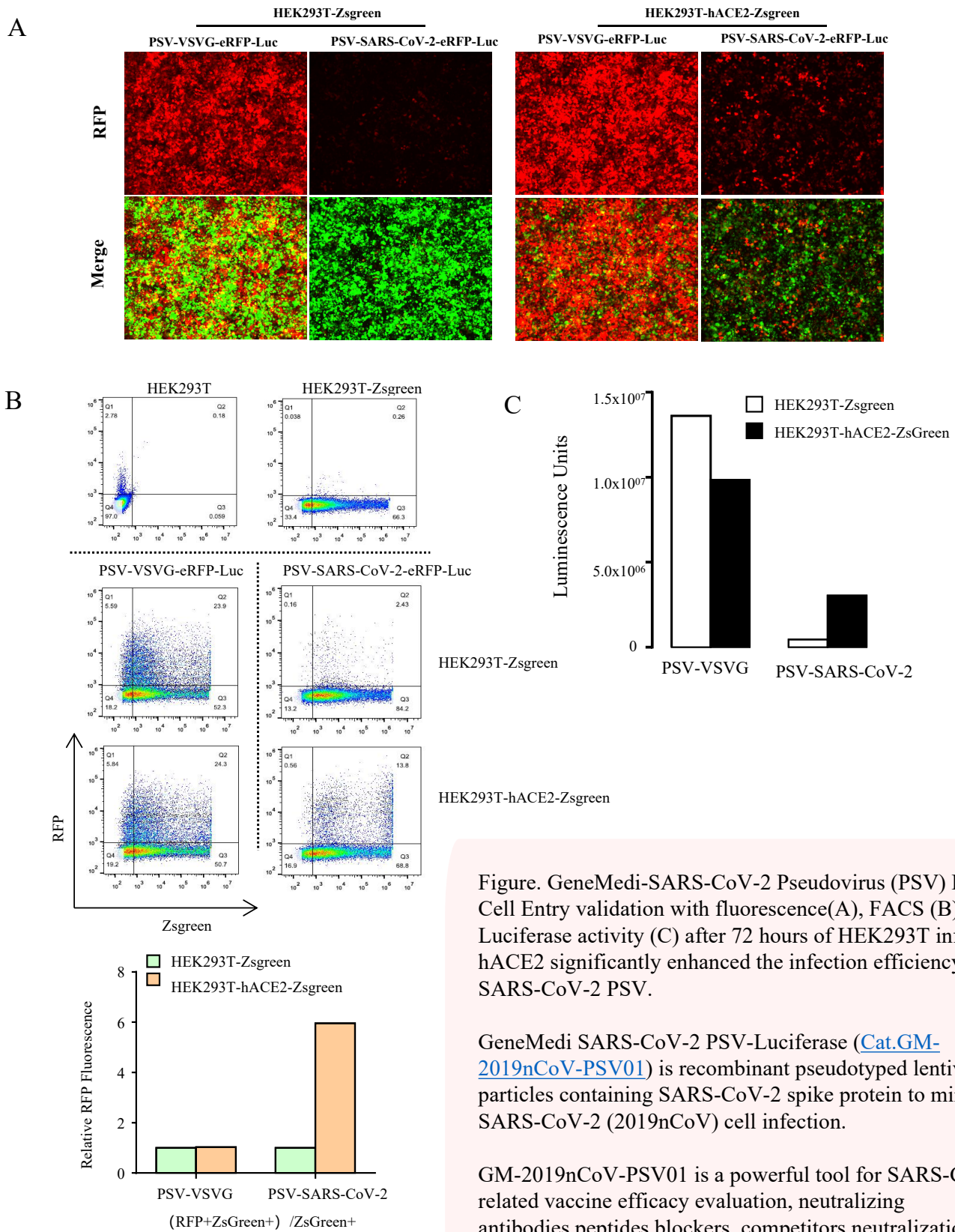


Figure. GeneMedi-SARS-CoV-2 Pseudovirus (PSV) Based Cell Entry validation with fluorescence(A), FACS (B) and Luciferase activity (C) after 72 hours of HEK293T infection. hACE2 significantly enhanced the infection efficiency of the SARS-CoV-2 PSV.

GeneMedi SARS-CoV-2 PSV-Luciferase ([Cat.GM-2019nCoV-PSV01](#)) is recombinant pseudotyped lentiviral particles containing SARS-CoV-2 spike protein to mimic SARS-CoV-2 (2019nCoV) cell infection.

GM-2019nCoV-PSV01 is a powerful tool for SARS-CoV-2 related vaccine efficacy evaluation, neutralizing antibodies, peptides blockers competitors neutralization assay, and tissue-specific infection determination.

Validated SARS-CoV-2 neutralizing antibodies

Cat No.	Antigen Name of 2019-nCoV (SARS- CoV-2)	Source (Expression Host)	Isotype s	Bioactivity validation
GMP-V-2019n CoV- SnAb001	Anti-2019-nCoV Spike (Spike RBD domain) human monoclonal neutralizing antibody (IgG1)	Mammalian (human cell)	human IgG1	Validated in COVID-19 Spike protein and Spike-RBD protein binding affinity. COVID-19 related neutralizing potency is validated by 1. 2019nCoV pseudotyped virus based neutralization assay in 293T-ACE2 effector cell. 2. competitively blocking the binding of ACE-2 receptor with SARS-CoV-2 Spike protein.
GMP-V-2019n CoV- SnAb002	Anti-2019-nCoV Spike (Spike RBD domain) human monoclonal neutralizing antibody (IgM)	Mammalian (human cell)	human IgM	Validated in COVID-19 Spike protein and Spike-RBD protein binding affinity. COVID-19 related neutralizing potency is validated by 1.2019nCoV pseudotyped virus based neutralization assay in 293T-ACE2 effector cell. 2. competitively blocking the binding of ACE-2 receptor with SARS-CoV-2 Spike protein.
GMP-V-2019n CoV- SnAb003	Anti-2019-nCoV Spike (Spike RBD domain) human monoclonal neutralizing antibody (IgA)	Mammalian (human cell)	human IgA	Validated in COVID-19 Spike protein and Spike-RBD protein binding affinity. COVID-19 related neutralizing potency is validated by 1.2019nCoV pseudotyped virus based neutralization assay in 293T-ACE2 effector cell. 2. competitively blocking the binding of ACE-2 receptor with SARS-CoV-2 Spike protein.
GMP-V-2019n CoV- SnAb004	Anti-2019-nCoV Spike (Spike RBD domain) mouse monoclonal neutralizing antibody (IgG1)	Mammalian (human cell)	mouse IgG1	Validated in COVID-19 Spike protein and Spike-RBD protein binding affinity. COVID-19 related neutralizing potency is validated by 1.2019nCoV pseudotyped virus based neutralization assay in 293T-ACE2 effector cell. 2. competitively blocking the binding of ACE-2 receptor with SARS-CoV-2 Spike protein.
GMP-V-2019n CoV- SnAb005	Anti-2019-nCoV Spike (Spike RBD domain) Cynomolgus monoclonal neutralizing antibody (IgG1)	Mammalian (human cell)	Cynomolgus (Non human primate, NHP) IgG1	Validated in COVID-19 Spike protein and Spike-RBD protein binding affinity. COVID-19 related neutralizing potency is validated by 1.2019nCoV pseudotyped virus based neutralization assay in 293T-ACE2 effector cell. 2. competitively blocking the binding of ACE-2 receptor with SARS-CoV-2 Spike protein.

SARS-CoV-2 WT and Spike Mutation Variants Pseudovirus (PSV) Based Neutralizing Assay with GeneMedi's anti-2019-nCoV Spike Neutralizing antibodies (Nabs)

[View more data posts for COVID Nabs antibodies >>](#)

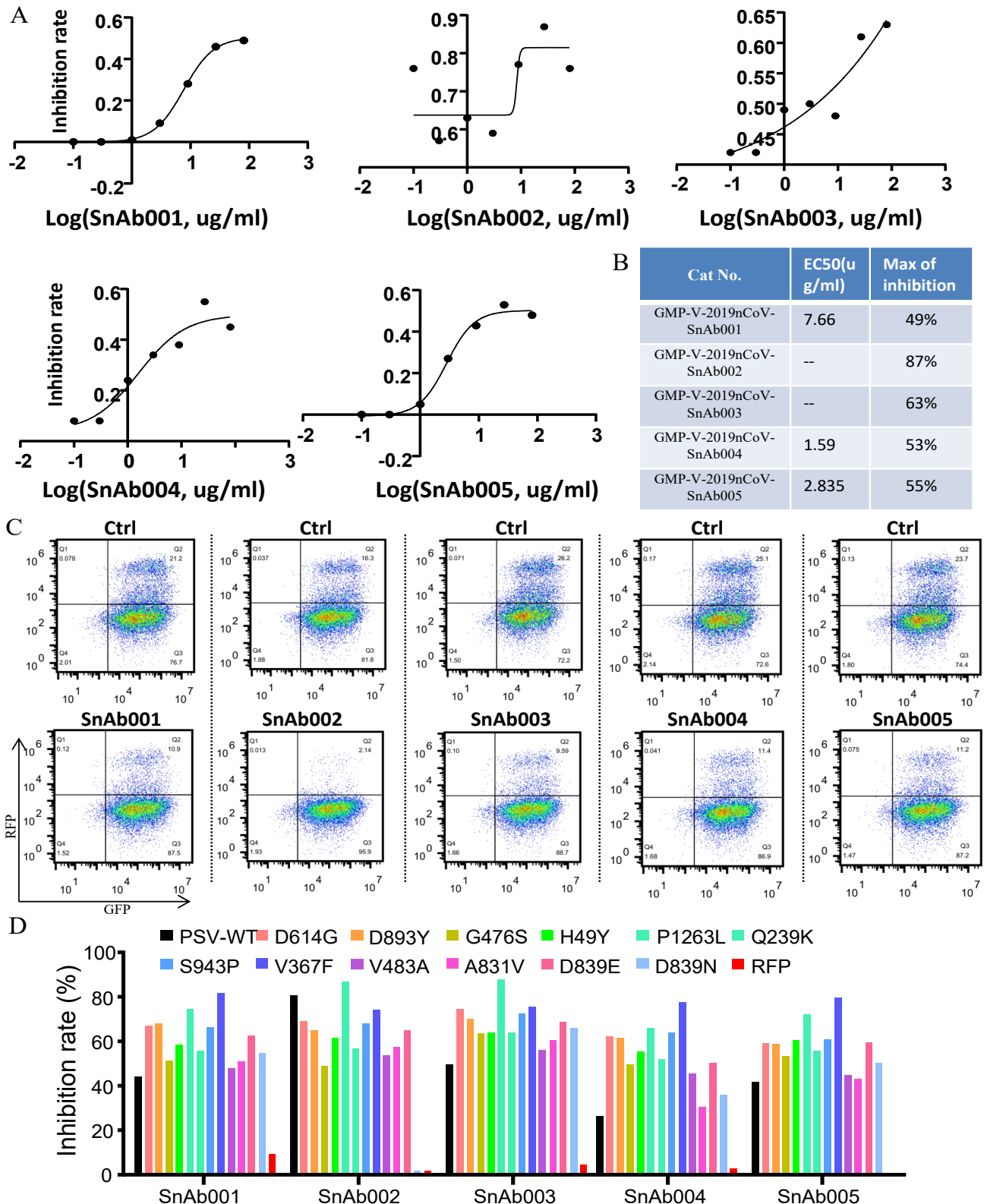



Figure. The Pseudovirus (PSV) Based Neutralizing Assay was performed on 293T-hACE2 cells infected with GeneMedi SARS-CoV-2 WT and Spike Mutation Variants (D614G, S943P, V367F, G476S, V483A, H49Y, Q239K, A831V, P1263L, D839Y/N/E:D839Y, D839N, D839E) Pseudovirus (PSV) under treatment of GeneMedi's anti-2019-nCoV Spike Neutralizing antibodies (Nabs) . Inhibition rate was determined by comparing the relative RFP+GFP+/GFP+ rate.

Application	Product		Protocol Download	Post Download
NP antibody pair validation	N002	NP antibody	 NP antibody sandwich ELISA	 GeneMedi's SARS-CoV-2 NP Antibody Pair And Stability Validation with NP antigen In Sandwich ELISA
Pseudovirus (PSV) Based Cell Entry	PSV	293T-hACE2-01	 Protocol of SARS-CoV-2 Pseudovirus (PSV)-Based Neutralization Assay	 1. Validation of hACE2 overexpression stable HEK293T cell lines
			 2. Genemedi-sars-cov-2 pseudovirus (psv) based cell entry	
Spike antibody pair validation	S-RBD001	Spike antibody	 1. sandwich ELISA  2. S-RBD antibodies standard biopanning and competitive biopanning	 GeneMedi's SARS-CoV-2 Spike Antibody Pair And Stability Validation with Spike antigen In Sandwich ELISA
Spike protein binding	Spike antibody & S-RBD001	ACE2002 and S-RBD001 or S1S2001	 1. sandwich ELISA	 1. GeneMedi's Spike protein & ACE2-Fc Binding Validation In Sandwich ELISA
			 2. S-RBD antibodies standard biopanning and competitive biopanning	 2. GeneMedi's SARS-CoV-2 Spike Antibody Pair And Stability Validation with Spike antigen
ACE2 binding	S1S2001	ACE2002	 1. sandwich ELISA	 GeneMedi's Spike protein & ACE2-Fc Binding Validation In Sandwich ELISA
	S-RBD001		 2. S-RBD antibodies standard biopanning and competitive biopanning	
lateral-flow tests	Antigens		 Preparation of AuNP conjugates	
HRP labeling	Antibodies		 Detection Antibody HRP labeling	
Pseudovirus (PSV)-Based Neutralization Assay	293T-hACE2-01 & PSV	SnAb	 Protocol of SARS-CoV-2 Pseudovirus (PSV)-Based Neutralization Assay	 1. Validation of hACE2 overexpression stable HEK293T cell lines
			 2. GeneMedi-SARS-CoV-2 WT and Spike Mutation Variants Pseudovirus (PSV) Based Neutralizing Assay with GeneMedi's anti-2019-nCoV Spike Neutralizing antibodies (Nabs)	
Neutralizing antibodies (Nabs) binding	S-RBD001	SnAb	 sandwich ELISA	 GeneMedi's anti-2019-nCoV Spike Neutralizing antibodies (Nabs) and Spike RBD protein binding validation
Neutralizing antibodies (Nabs) competitive binding assay	ACE2002 & S-RBD001	SnAb	 Neutralizing antibodies (Nabs) competitive binding assay	 GeneMedi's anti-2019-nCoV Spike Neutralizing antibodies (Nabs) competitive binding assay validation

Part 2: COVID-19 Vaccine & Antibody Candidates Efficacy

Evaluation Solution for new variants of SARS-CoV-2

BACKGROUND

Challenge of COVID-19 vaccine discovery & development: to meet accumulated mutating of SARS-CoV-2 and a long-term viral genome transcription

COVID-19 (Coronavirus Disease 2019) is novel viral pneumonia caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2, also called 2019nCoV). The world is in midst of the COVID-19 pandemic. Effective vaccines are needed to halt the spread of the SARS-CoV-2 pandemic. Based on the data from WHO, there are 52 COVID-19 vaccines in clinical stage ([Supplementary Table 1.](#)) and 162 COVID-19 vaccine candidates in pre-clinical stage ([Supplementary Table 2.](#)) 2 mRNA vaccines, the BNT162b2 from Pfizer&BioNTech and the mRNA-1273 from Moderna, have recently been issued the emergency use authorization (EUA) by the U.S. Food and Drug Administration (FDA) for the prevention of COVID-19 in individuals 16 years of age and older.

The efficacy and safety of COVID-19 vaccine candidates need carefully investigated, from pre-clinical, clinical stage to a long time after BLA. There are 2 important items here:

Firstly, the coronavirus is kept accumulated mutating. The most important mutation occurs in SARS-CoV-2 (2019nCoV) Spike protein (SARS-CoV-2 S protein). The SARS-CoV-2 (2019nCoV) Spike mediates binding and entry into host cells and is a major target of neutralizing antibodies. Most of the COVID-19 vaccines focus on spike protein^{1,4-6}.

Different SARS-CoV-2 lineages with diverse Spike protein mutant variants may yield a heavy impact on the course of the pandemic²⁻³. The United Kingdom (UK) has faced a rapid increase in COVID-19 cases caused by a novel SARS-CoV-2 (2019nCoV) lineage, the B.1.1.7 lineage, which carries a larger than a usual number of coronavirus genetic changes⁷⁻⁸, particularly in the SARS-CoV-2 spike protein (Table 1)⁷.

Secondly, SARS-CoV-2 was reported to integrate into the genome, which means a stable long-term expression of transcript products of SARS-CoV-2⁹.

In conclusion, the Efficacy of COVID-19 vaccines and neutralized antibodies need long-term tracking, which mainly focuses on the novel spike protein mutation occurring in the new lineage variant of SARS-CoV2. The efficacy evaluation solution and tools of COVID-19 vaccines and neutralized antibodies need continually updated.

Table 1 | All mutations and deletions occur in COVID-19 SARS-COV-2 (2019nCoV) B.1.1.7

lineage (Click to more details about B.1.1.7 lineage related products).

Gene	Nucleotide	Amino acid
ORF1ab	C3267T	T1001I
	C5388A	A1708D
	T6954C	I2230T
	11288-11296 deletion	SGF 3675-3677 deletion
spike	21765-21770 deletion	HV 69-70 deletion (Click to more details about HV 69-70 deletion related products)
	21991-21993 deletion	Y144 deletion
	A23063T	N501Y (Click to more details about N501Y related products)
	C23271A	A570D
	C23604A	P681H
	C23709T	T716I
	T24506G	S982A
	G24914C	D1118H
Orf8	C27972T	Q27stop
	G24914C	R52I
	A28111G	Y73C
N	28280 GAT->CTA	D3L
	C28977T	S235F

PRODUCTS & PROCOTOL COLLECTION

GeneMedi Efficacy Assay/Evaluation Solutions for COVID-19 Vaccines and Therapeutic antibodies against SARS-CoV2(2019nCoV)

To meet accumulated mutating of SARS-CoV-2, GeneMedi keeps continually developing novel solutions and tools for efficacy evaluation of COVID-19 vaccines (and neutralized antibodies) against novel mutant SARS-CoV-2 (2019nCoV) lineages. Our scientist's team takes duty in fighting against the COVID-19 pandemic with our global industrial and academic partners.

1

GeneMedi information and products collection of SARS-COV-2 (2019nCoV) UK B.1.1.7 lineage and South Africa 501Y.V2 lineage and Brazilian P.1 lineage(B.1.1.28.1)

Background Reading

Information and products collection of SARS-COV-2 (2019nCoV) UK B.1.1.7 lineage
 Information and products collection of SARS-COV-2 (2019nCoV) South Africa 501Y.V2 lineage
 information and products collection of SARS-COV-2 (2019nCoV) Brazilian P.1 lineage
 (B.1.1.28.1)

GeneMedi pseudotyped virus (pseudovirus) of SARS-COV-2 (2019nCoV) B.1.1.7 lineage

Taking responsibility to help accelerate the COVID-19 vaccine and therapeutic antibody discovery and development, GeneMedi had developed the pseudotype virus (pseudovirus) of SARS-COV-2 (2019nCoV)

B.1.1.7 lineage, which will meet the evaluation of the efficacy of COVID19 vaccines and therapeutic antibodies.

Cat No.	Description
GM-2019nCoV-PSV15	Spike whole mutant SARS-CoV-2(2019nCoV) B.1.1.7 lineage Pseudotyped virus
GM-2019nCoV-PSV16	Spike(S1+S2) B.1.1.7 RBD N501Y mutation SARS-CoV-2(2019nCoV) Pseudotyped virus
GM-2019nCoV-PSV17	Spike(S1+S2) B.1.1.7-S1 HV 69-70 Deletion mutation(Δ H69/ Δ V70) SARS-CoV-2(2019nCoV) Pseudotyped virus

GeneMedi pseudotyped virus (pseudovirus) of SARS-COV-2 (2019nCoV) 501Y.V2 lineage

Taking responsibility to help accelerate the COVID-19 vaccine and therapeutic antibody discovery and development, GeneMedi had developed the pseudotype virus (pseudovirus) of SARS-COV-2

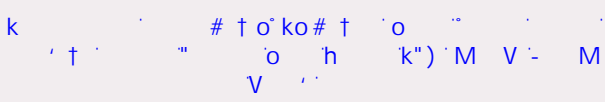
(2019nCoV) S501Y.V2 lineage, which will meet the evaluation of the efficacy of COVID19 vaccines and therapeutic antibodies.

Cat No.	Description
GM-2019nCoV-PSV16	Spike(S1+S2) B.1.1.7 RBD N501Y mutation SARS-CoV-2(2019nCoV) Pseudotyped virus
GM-2019nCoV-PSV18	Spike(S1+S2)-E484K mutation of SARS-CoV-2(2019nCoV) Pseudotyped virus (501Y.V2 lineage,B.1.351)
GM-2019nCoV-PSV19	Spike (S1+S2) RBD triple mutation(K417N, E484K and N501Y) of SARS-CoV-2(2019nCoV) Pseudotyped virus (501Y.V2 lineage)
GM-2019nCoV-PSV20	Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019nCoV) 501Y.V2 lineage(B.1.351) Pseudotyped virus
GM-2019nCoV-PSV02	Spike D614G mutation SARS-CoV-2(2019nCoV) Pseudotyped virus production and D614G Pseudotyped Virus Based Neutralization Assay

GeneMedi pseudotype virus (pseudovirus) of SARS-COV-2 (2019nCOV) P.1 lineage(B.1.1.28.1, Brazilian variant)

Cat No.	Description
GM-2019nCoV-PSV16	Spike(S1+S2) B.1.1.7 RBD N501Y mutation SARS-CoV-2(2019nCoV) Pseudotyped virus production and Pseudovirus Based Neutralization Assay
GM-2019nCoV-PSV18	pike(S1+S2)-E484K mutation of SARS-CoV-2(2019nCoV) Pseudotyped virus (501Y.V2 lineage,B.1.351; Brazilian P.1 lineage) production and Pseudovirus Based Neutralization Assay
GM-2019nCoV-PSV21	Spike (S1+S2) RBD triple mutation(K417T, E484K and N501Y)+D614G of SARS-CoV-2(2019nCoV) Pseudotyped virus (Brazilian P.1 lineage) production and Pseudovirus Based Neutralization Assay
GM-2019nCoV-PSV22	Spike whole mutant SARS-CoV-2(2019nCoV) Brazilian P.1 lineage Pseudotyped virus production and Pseudovirus Based Neutralization Assay
GM-2019nCoV-PSV02	Spike D614G mutation SARS-CoV-2(2019nCoV) Pseudotyped virus production and D614G Pseudotyped Virus Based Neutralization Assay

SARS-COV-2 (2019nCOV) B.1.1.7 lineage & 501Y.V2 lineage(B.1.351) of Spike protein & ACE2 competition binding assay for efficacy evaluation of COVID-19 vaccines and therapeutic antibodies

Cat No.	Antigen Name of 2019-nCoV(SARS-CoV-2)	Source (Expression Host)
GMP-V-2019nCoV-S-trimer-002	Recombinant 2019-nCoV(SARS-CoV-2) Spike S-trimer protein D614G mutant (S1+S2-D614G trimer, C-6His) with furin cleavage site mutation & T4 fibrin trimerization motif	Mammalian (human cell)
GMP-V-2019nCoV-Smu-001	Recombinant 2019-nCoV(SARS-CoV-2) Spike Protein S1 D614G mutant (S1-D614G, C-His Tag)	Mammalian (human cell)
GMP-V-2019nCoV-Smu-002	Recombinant 2019-nCoV(SARS-CoV-2) (UK variant B.1.1.7 lineage) Spike Protein RBD-N501Y mutant (SRBD-N501Y, C-His Tag)	Mammalian (human cell)
GMP-V-2019nCoV-Smu-003		Mammalian (human cell)
GMP-V-2019nCoV-Smu-016	Recombinant 2019-nCoV(SARS-CoV-2) (South African variant 501Y.V2 lineage, B.1.351) Spike Protein RBD (K417N, E484K and N501Y mutant)	Mammalian (human cell)
GMP-H-ACE2001	Recombinant human soluble ACE2 protein (soluble hACE2, extracellular hACE2, C-His)	Mammalian (human cell)
GMP-H-ACE2002	Recombinant human soluble ACE2 protein (soluble hACE2, extracellular hACE2, C-FC)	Mammalian (human cell)

GeneMedi codon-optimized spike mammalian expression vector for SARS-COV-2 (2019nCOV) B.1.1.7 lineage

GeneMedi designed a mammalian expression codon-optimized spike mutation/deletion variant vector for COVID-19 SARS-COV-2 (2019nCOV) B.1.1.7 lineage.

Cat No.	Description	Vector	Tag	Coden Optimized
GMV-V-2019nCoV-100	pGM-Spike of SARS-COV-2 B.1.1.7 lineage whole mutation	pcDNA3.1(+)	No tag	coden optimized for mammalian
GMV-V-2019nCoV-101	pGM-2019nCoV-Spike(S1+S2)-RBD N501Y mutation (B.1.1.7 lineage RBD)	pcDNA3.1(+)	No tag	coden optimized for mammalian
GMV-V-2019nCoV-102	pGM-2019nCoV-Spike(S1+S2)-S1 HV 69-70 Deletion mutation (Δ H69/ Δ V70,B.1.1.7 lineage)	pcDNA3.1(+)	No tag	coden optimized for mammalian
GMV-V-2019nCoV-104	Ad-Spike of SARS-COV-2 B.1.1.7 lineage whole mutation	Pre-made adenovirus	C-3FLAG	coden optimized for mammalian
GMV-V-2019nCoV-105	Ad-2019nCoV-Spike(S1+S2)-RBD N501Y mutation (B.1.1.7 lineage RBD)	Pre-made adenovirus	C-3FLAG	coden optimized for mammalian
GMV-V-2019nCoV-106	Ad-2019nCoV-Spike(S1+S2)-S1 HV 69-70 Deletion mutation(Δ H69/ Δ V70,B.1.1.7 lineage)	Pre-made adenovirus	C-3FLAG	coden optimized for mammalian

GeneMedi codon-optimized spike mammalian expression vector for SARS-COV-2 (2019nCoV) South Africa 501Y.V2 lineage(B.1.351).

GeneMedi designed a mammalian expression codon-optimized spike mutation/deletion variant vector for COVID-19 SARS-COV-2 (2019nCoV) S501Y.V2 lineage.

Cat No.	Description	Vector	Tag	Coden Optimized
GMV-V-2019nCoV-101	pGM-2019nCoV-Spike(S1+S2)-RBD N501Y mutation (B.1.1.7 lineage RBD)	pcDNA3.1(+)	No tag	coden optimized for mammalian
GMV-V-2019nCoV-105	pGM-2019nCoV-Spike(S1+S2)-RBD N501Y mutation(B.1.1.7 lineage RBD)	Pre-made adenovirus	C-3FLAG	coden optimized for mammalian
GMV-V-2019nCoV-107	pGM-2019nCoV-Spike(S1+S2)-E484K mutation(501Y.V2 lineage)	pcDNA3.1(+)	No tag	coden optimized for mammalian
GMV-V-2019nCoV-108	Ad-2019nCoV-Spike(S1+S2)-E484K mutation(501Y.V2 lineage)	Pre-made adenovirus	C-3FLAG	coden optimized for mammalian
GMV-V-2019nCoV-109	pGM-Spike(S1+S2)RBD triple mutation of 501Y.V2 lineage(K417N, E484K and N501Y)	pcDNA3.1(+)	No tag	coden optimized for mammalian
GMV-V-2019nCoV-110	Ad-Spike(S1+S2)RBD triple mutation of 501Y.V2 lineage(K417N, E484K and N501Y)	Pre-made adenovirus	C-3FLAG	coden optimized for mammalian
GMV-V-2019nCoV-111	pGM-Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019nCoV) 501Y.V2 lineage	pcDNA3.1(+)	No tag	coden optimized for mammalian
GMV-V-2019nCoV-112	Ad-Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019nCoV) 501Y.V2 lineage	Pre-made adenovirus	C-3FLAG	coden optimized for mammalian
GMV-V-2019nCoV-054	pGM-2019nCoV-spike D614G protein (S protein,S1+S2, D614G)	pcDNA3.1(+)	No tag	coden optimized for mammalian
GMV-V-2019nCoV-056	Ad-2019nCoV-Spike D614G (S protein,S1+S2, D614G)	Pre-made adenovirus	C-3FLAG	coden optimized for mammalian

2 Multiple variants of Spike protein & ACE2 competition

binding assay for efficacy evaluation of COVID-19 vaccines and therapeutic antibodies

The Spike proteins variants that GeneMedi offer is including:

1) Multiple variants of recombinant Spike protein for Spike protein & ACE2 competition binding assay for efficacy evaluation of COVID-19 vaccines and therapeutic antibodies

Cat No.	Products Name	Source (Expression Host)	Tag	Bioactivity validation
GMP-V-2019nCoV-S-trimer-001	Recombinant 2019-nCoV(SARS-CoV-2) Spike S-trimer protein (S1+S2 trimer, C-6His) with furin cleavage site mutation (R682G, R683S, R685S) & T4 fibrin trimerization motif	Mammalian (human cell)	C-His	ACE2 binding; Immunogen in Sandwich Elisa,lateral-flow tests,and other immunoassays;
GMP-V-2019nCoV-S-trimer-002	Recombinant 2019-nCoV(SARS-CoV-2) Spike S-trimer protein D614G mutant (S1+S2-D614G trimer, C-6His) with furin cleavage site mutation & T4 fibrin trimerization motif	Mammalian (human cell)	C-His	ACE2 binding; Immunogen in Sandwich Elisa,lateral-flow tests,and other immunoassays;
GMP-V-2019nCoV-S-trimer-003	Recombinant 2019-nCoV(SARS-CoV-2) Spike S-trimer protein S6P mutant (F817P,A892P,A899P,A942P,K986P,V987P) with furin cleavage site mutation (R682G,R683S,R685S) & T4 fibrin trimerization motif	Mammalian (human cell)	C-His	ACE2 binding; Immunogen in Sandwich Elisa,lateral-flow tests,and other immunoassays;
GMP-V-2019nCoV-Smu-001	Recombinant 2019-nCoV(SARS-CoV-2) Spike Protein S1 D614G mutant (S1-D614G, C-HisTag)	Mammalian (human cell)	C-His	ACE2 binding; Immunogen in Sandwich Elisa,lateral-flow tests,and other immunoassays;
GMP-V-2019nCoV-Smu-002	Recombinant 2019-nCoV(SARS-CoV-2) (UK variant B.1.1.7 lineage) Spike Protein RBD-N501Y mutant (SRBD-N501Y, C-HisTag)	Mammalian (human cell)	C-His	ACE2 binding; Immunogen in Sandwich Elisa,lateral-flow tests,and other immunoassays;
GMP-V-2019nCoV-Smu-003	Recombinant 2019-nCoV(SARS-CoV-2) (South African Spike Protein RBD (K417N, E484K and N501Y mutant)	Mammalian (human cell)	C-His	ACE2 binding; Immunogen in Sandwich Elisa,lateral-flow tests,and other immunoassays;
GMP-V-2019nCoV-Smu-004	Recombinant 2019-nCoV(SARS-CoV-2) Spike Protein RBD V341I mutant (SRBD-V341I, C-His Tag)	Mammalian (human cell)	C-His	ACE2 binding; Immunogen in Sandwich Elisa,lateral-flow tests,and other immunoassays;
GMP-V-2019nCoV-Smu-005	Recombinant 2019-nCoV(SARS-CoV-2) Spike Protein RBD F342L mutant (SRBD-F342L, C-His Tag)	Mammalian (human cell)	C-His	ACE2 binding; Immunogen in Sandwich Elisa,lateral-flow tests,and other immunoassays;
GMP-V-2019nCoV-Smu-0066	Recombinant 2019-nCoV(SARS-CoV-2) Spike Protein RBD N354D mutant (SRBD N354D, C-His Tag)	Mammalian (human cell)	C-His	ACE2 binding; Immunogen in Sandwich Elisa,lateral-flow tests,and other immunoassays;
GMP-V-2019nCoV-Smu-0077	Recombinant 2019-nCoV(SARS-CoV-2) Spike Protein RBD D364Y mutant (S RBD D364Y, C-His Tag)	Mammalian (human cell)	C-His	ACE2 binding; Immunogen in Sandwich Elisa,lateral-flow tests,and other immunoassays;
GMP-V-2019nCoV-Smu-008	Recombinant 2019-nCoV(SARS-CoV-2) Spike Protein RBD V367F mutant (S RBD V367F, C-His Tag)	Mammalian (human cell)	C-His	ACE2 binding; Immunogen in Sandwich Elisa,lateral-flow tests,and other immunoassays;
GMP-V-2019nCoV-Smu-009	Recombinant 2019-nCoV(SARS-CoV-2) Spike Protein RBD R408I mutant (SRBD R408I, C-His Tag)	Mammalian (human cell)	C-His	ACE2 binding; Immunogen in Sandwich Elisa,lateral-flow tests,and other immunoassays;
GMP-V-2019nCoV-Smu-010	Recombinant 2019-nCoV(SARS-CoV-2) Spike Protein RBD A435S mutant (SRBD A435S, C-His Tag)	Mammalian (human cell)	C-His	ACE2 binding; Immunogen in Sandwich Elisa,lateral-flow tests,and other immunoassays;
GMP-V-2019nCoV-Smu-011	Recombinant 2019-nCoV(SARS-CoV-2) Spike Protein RBD W436R mutant (SRBD W436R, C-His Tag)	Mammalian (human cell)	C-His	ACE2 binding; Immunogen in Sandwich Elisa,lateral-flow tests,and other immunoassays;
GMP-V-2019nCoV-Smu-012	Recombinant 2019-nCoV(SARS-CoV-2) Spike Protein RBD K458R mutant (SRBD K458R, C-His Tag)	Mammalian (human cell)	C-His	ACE2 binding; Immunogen in Sandwich Elisa,lateral-flow tests,and other immunoassays;
GMP-V-2019nCoV-Smu-013	Recombinant 2019-nCoV(SARS-CoV-2) Spike Protein RBD G476S mutant (SRBD G476S, C-HisTag)	Mammalian (human cell)	C-His	ACE2 binding; Immunogen in Sandwich Elisa,lateral-flow tests,and other immunoassays;

Cat No.	Products Name	Source (Expression Host)	Tag	Bioactivity validation
GMP-V-2019nCoV-Smu-014	Recombinant 2019-nCoV(SARS-CoV-2) Spike Protein RBD V483R mutant (SRBD V483R, C-His Tag)	Mammalian (human cell)	C-His	ACE2 binding; Immunogen in Sandwich Elisa,lateral-flow tests,and other immunoassays;
GMP-V-2019nCoV-Smu-015	Recombinant 2019-nCoV(SARS-CoV-2) Spike Protein RBD N354D, D364Y mutant (SRBD N354D, D364Y, C-His Tag)	Mammalian (human cell)	C-His	ACE2 binding; Immunogen in Sandwich Elisa,lateral-flow tests,and other immunoassays;
GMP-V-2019nCoV-Smu-016	Recombinant 2019-nCoV(SARS-CoV-2) P.1 lineage(B.1.1.28.1, Brazilian variant) Spike RBD Protein(K417T, E484K and N501Y mutant)	Mammalian (human cell)	C-His	ACE2 binding; Immunogen in Sandwich Elisa,lateral-flow tests,and other immunoassays;

2) Recombinant human ACE2 protein products

Cat No.	Antigen Name of 2019-nCoV(SARS-CoV-2)	Source (Expression Host)
GMP-H-ACE2001	Recombinant human soluble ACE2 protein (soluble hACE2, extracellular hACE2, C-His)	Mammalian (human cell)
GMP-H-ACE2002	Recombinant human soluble ACE2 protein (soluble hACE2, extracellular hACE2, C-His)	Mammalian (human cell)

- Competition assay for neutralizing antibodies, peptides inhibitor and vaccines-immunized serums

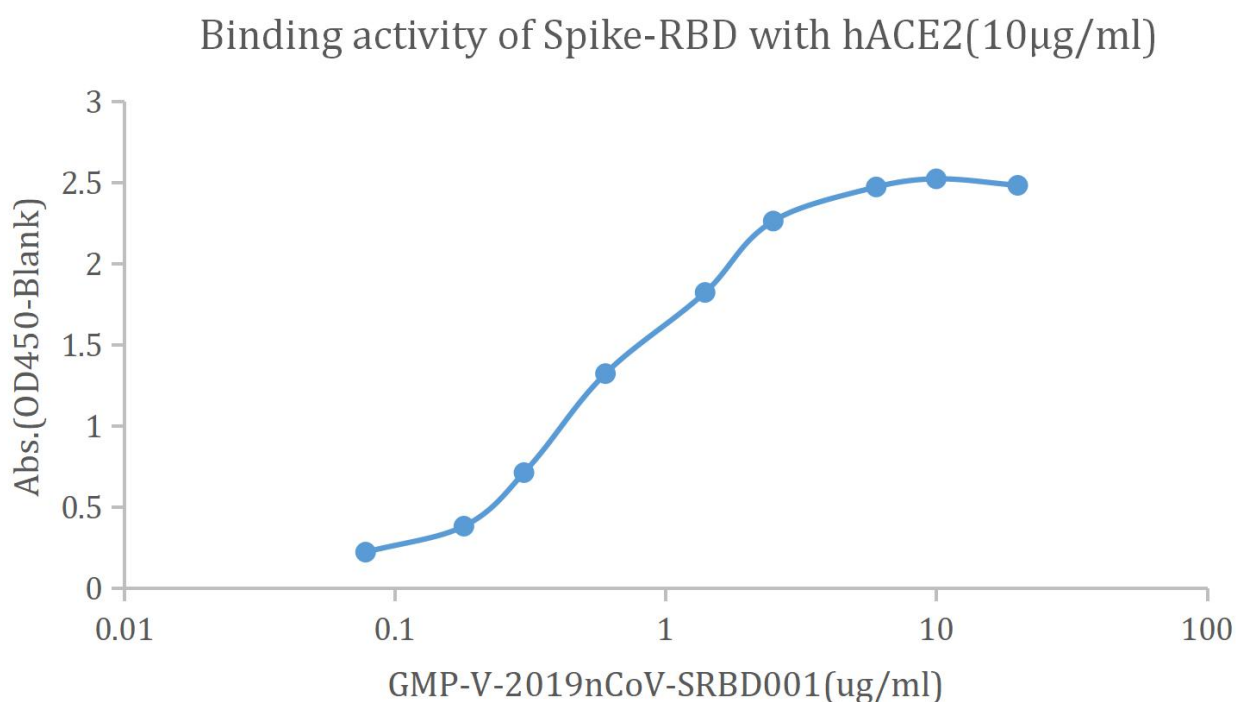


Figure. Immobilized 2019-nCoV S Protein RBD-C-His ([GMP-V-2019nCoV-SRBD001](#)) can bind 10µg/ml of Human ACE-2-Fc ([GMP-H-ACE2002](#)).

Multi-Variants TM SARS-CoV2 (wildtype, D614G, N501Y,E484K, B.1.1.7 lineage, 501Y.V2 lineage, and so on) Pseudotype virus-Based Neutralization Assay System for efficacy evaluation of COVID-19 vaccines and therapeutic antibodies (Lentiviral pseudovirus)

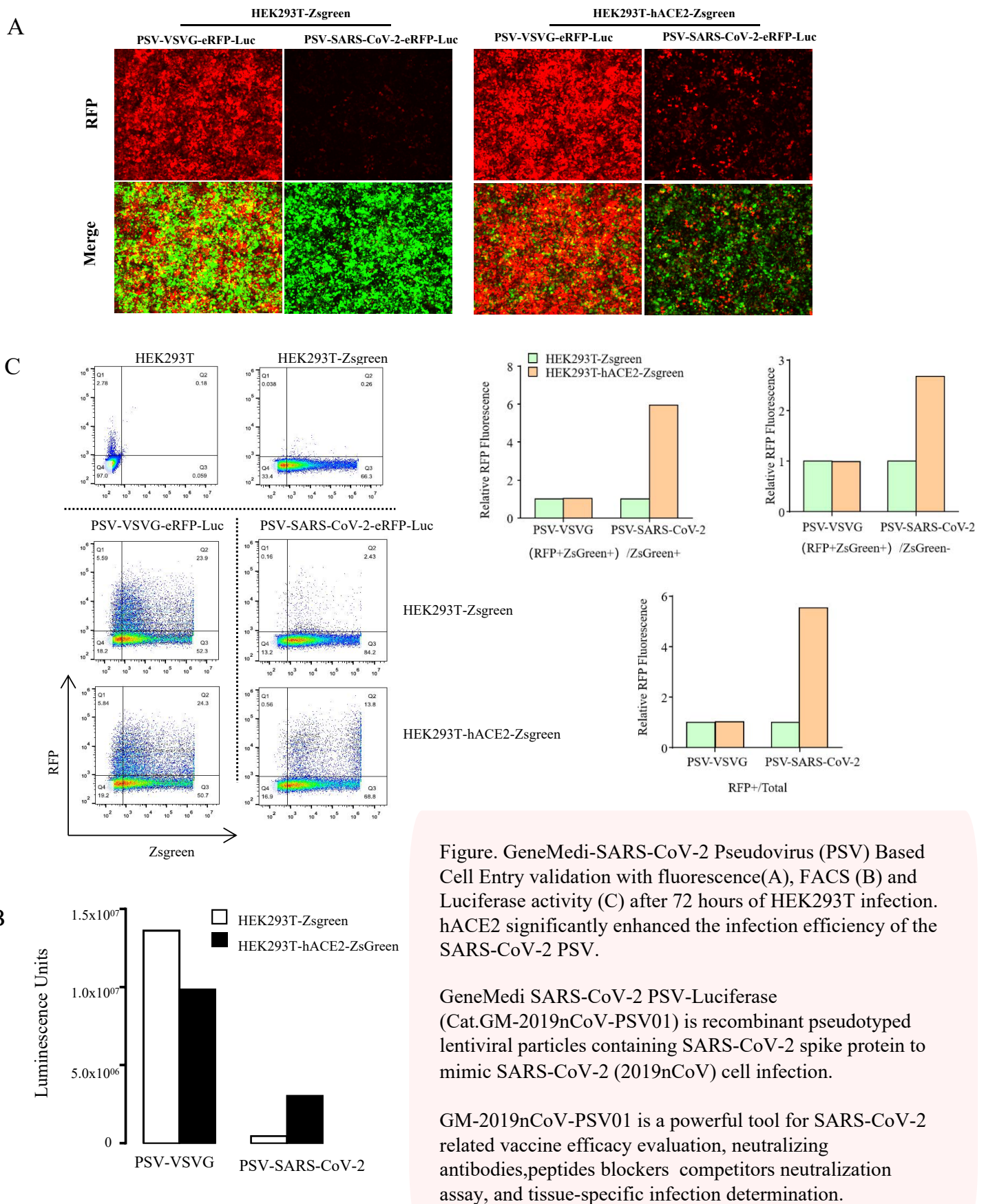
Protocol: [GeneMedi SARS-CoV2 pseudovirus-based neutralization assay-protocol](#)



[Protocol Download](#)

Catalog No.	Pseudotyped virus of SARS-CoV-2 Spike Mutation Variants and Effector cells
GM-2019nCoV-PSV01-2	SARS-CoV-2 Pseudotyped virus packaging and production
GM-2019nCoV-PSV02	Spike D614G mutation SARS-CoV-2(2019nCoV) Pseudotyped virus
GM-2019nCoV-PSV03	Spike S943P mutation SARS-CoV-2(2019nCoV) Pseudotyped virus
GM-2019nCoV-PSV04	Spike V367F mutation SARS-CoV-2(2019nCoV) Pseudotyped virus
GM-2019nCoV-PSV05	Spike G476S mutation SARS-CoV-2(2019nCoV) Pseudotyped virus
GM-2019nCoV-PSV06	Spike V483A mutation SARS-CoV-2(2019nCoV) Pseudotyped virus
GM-2019nCoV-PSV07	Spike H49Y mutation SARS-CoV-2(2019nCoV) Pseudotyped virus
GM-2019nCoV-PSV08	Spike Q239K mutation SARS-CoV-2(2019nCoV) Pseudotyped virus virus
GM-2019nCoV-PSV09	Spike A831V mutation SARS-CoV-2(2019nCoV) Pseudotyped virus
GM-2019nCoV-PSV10	Spike P1263L mutation SARS-CoV-2(2019nCoV) Pseudotyped virus
GM-2019nCoV-PSV11	Spike D839Y/N/E-D839Y mutation SARS-CoV-2(2019nCoV) Pseudotyped virus
GM-2019nCoV-PSV12	Spike D839Y/N/E-D839N mutation SARS-CoV-2(2019nCoV) Pseudotyped virus
GM-2019nCoV-PSV13	Spike D839Y/N/E-D839E mutation SARS-CoV-2(2019nCoV) Pseudotyped virus
GM-2019nCoV-PSV14	P2-mutated Spike protein trimer variant -(K986P,V987P, S1/S2 cleavage site (furin cleavage sequence)-mutant, trimerization modified) mutation SARS-CoV-2(2019nCoV) Pseudotyped virus SARS-CoV-2(2019nCoV) Pseudotyped virus
GM-2019nCoV-PSV15	Spike of SARS-COV-2 B.1.1.7 lineage mutation SARS-CoV-2(2019nCoV) Pseudotyped virus
GM-2019nCoV-PSV16	Spike(S1+S2) B.1.1.7 RBD N501Y mutation SARS-CoV-2(2019nCoV) Pseudotyped virus
GM-2019nCoV-PSV17	Spike(S1+S2) B.1.1.7-S1 HV 69-70 Deletion mutation(Δ H69/ Δ V70) SARS-CoV-2(2019nCoV) Pseudotyped virus
GM-2019nCoV-PSV18	Spike(S1+S2)-E484K mutation of SARS-CoV-2(2019nCoV) Pseudotyped virus (501Y.V2 lineage,B.1.351)
GM-2019nCoV-PSV19	Spike (S1+S2) RBD triple mutation (K417N, E484K and N501Y) of SARS-CoV-2(2019nCoV) Pseudotyped virus (501Y.V2 lineage)
GM-2019nCoV-PSV20	Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019nCoV) 501Y.V2 lineage(B.1.351) Pseudotyped virus
GM-2019nCoV-PSV21	Spike (S1+S2) RBD triple mutation(K417T, E484K and N501Y)+D614G of SARS-CoV-2(2019nCoV) Pseudotyped virus (Brazilian P.1 lineage)
GM-2019nCoV-PSV22	Spike whole mutant SARS-CoV-2(2019nCoV) Brazilian P.1 lineage Pseudotyped virus

GeneMedi SARS-CoV-2 Pseudovirus (PSV) Based Cell Entry



GeneMedi-SARS-CoV-2 WT and Spike Mutation Variants Pseudovirus (PSV) Based Cell Entry

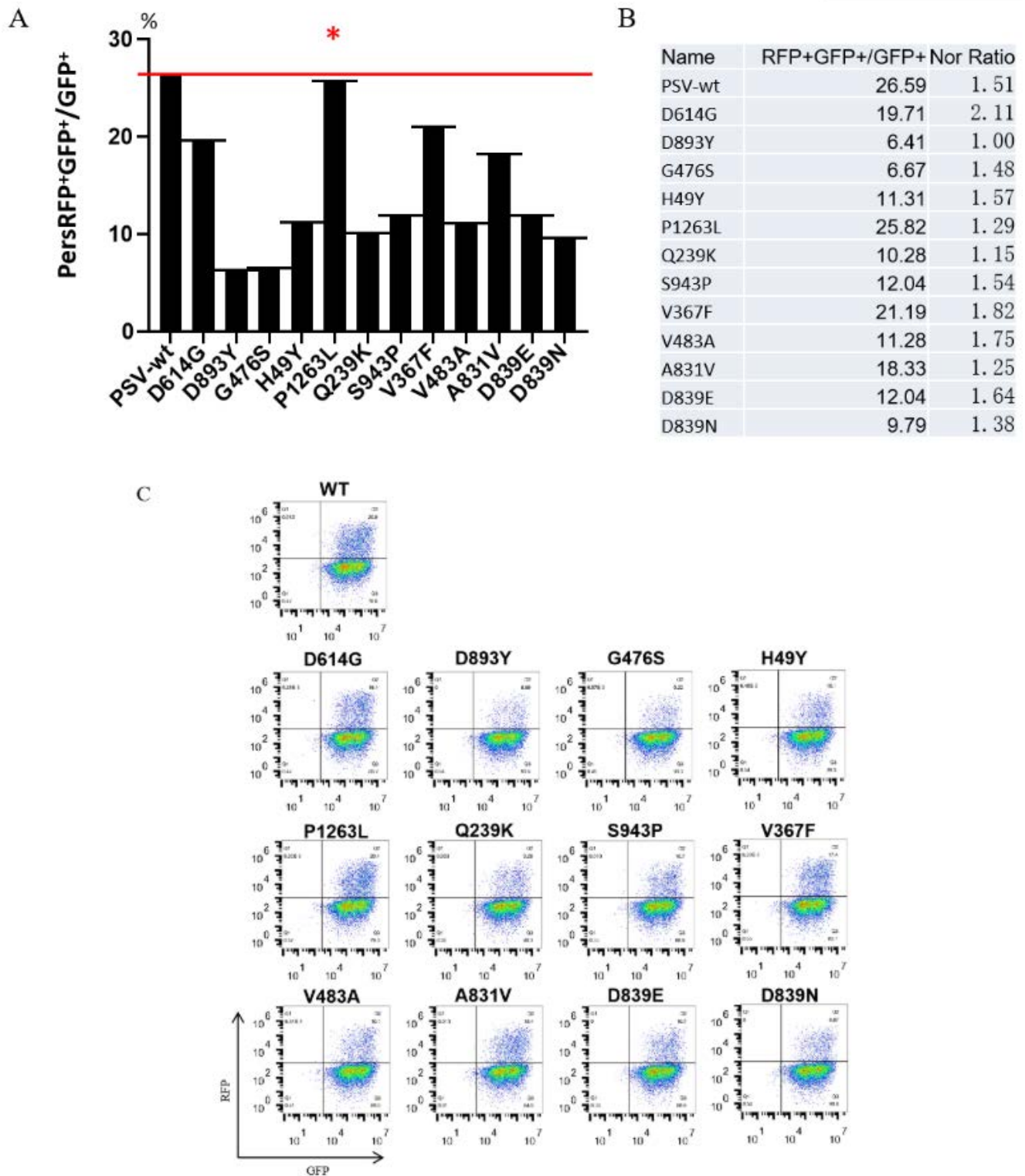


Figure. The Pseudovirus (PSV) Based Cell Entry assay was performed on 293T-hACE2 cells infected with GeneMedi-SARS-CoV-2 WT and Spike Mutation Variants (D614G, S943P, V367F, G476S, V483A, H49Y, Q239K, A831V, P1263L, D839Y/N/E:D839Y, D839N, D839E) Pseudovirus (PSV) Infection rate was determined by RFP+GFP+/GFP+ with FACS validation.

4

Codon-optimized mammalian expression vector for SARS-COV-2 (2019nCoV) spike wide type & mutant variants (D614G, N501Y, E484K, B.1.1.7 lineage, 501Y.V2 lineage, and so on)

Cat No.	Gene & Vector description of 2019 nCoV	Vector
GMV-V-2019nCoV-017	pGM-2019nCoV-spike protein (S protein,S1+S2)	pcDNA3.1(+)
GMV-V-2019nCoV-008	pGM-2019nCoV-spike protein (S protein,S1+S2)	pcDNA3.1(+)
GMV-V-2019nCoV-054	pGM-2019nCoV-spike D614G protein (S protein,S1+S2 , D614G)	pcDNA3.1(+)
GMV-V-2019nCoV-057	pGM-2019nCoV-spike S943P protein (S protein,S1+S2 , S943P)	pcDNA3.1(+)
GMV-V-2019nCoV-058	pGM-2019nCoV-spike V367F protein (S protein,S1+S2 , V367F)	pcDNA3.1(+)
GMV-V-2019nCoV-059	pGM-2019nCoV-spike G476S protein (S protein,S1+S2 , G476S)	pcDNA3.1(+)
GMV-V-2019nCoV-060	pGM-2019nCoV-spike V483A protein (S protein,S1+S2 , V483A)	pcDNA3.1(+)
GMV-V-2019nCoV-061	pGM-2019nCoV-spike H49Y protein (S protein,S1+S2 , H49Y)	pcDNA3.1(+)
GMV-V-2019nCoV-062	pGM-2019nCoV-spike Q239K protein (S protein,S1+S2 , Q239K)	pcDNA3.1(+)
GMV-V-2019nCoV-063	pGM-2019nCoV-spike A831V protein (S protein,S1+S2 , A831V)	pcDNA3.1(+)
GMV-V-2019nCoV-064	pGM-2019nCoV-spike P1263L protein (S protein,S1+S2 , P1263L)	pcDNA3.1(+)
GMV-V-2019nCoV-065	pGM-2019nCoV-spike D839Y/N/E-D839Y protein (S protein,S1+S2 , D839Y/N/E-D839Y)	pcDNA3.1(+)
GMV-V-2019nCoV-066	pGM-2019nCoV-spike D839Y/N/E-D839N protein (S protein,S1+S2 , D839Y/N/E-D839N)	pcDNA3.1(+)
GMV-V-2019nCoV-067	pGM-2019nCoV-spike D839Y/N/E-D839E protein (S protein,S1+S2 , D839Y/N/E-D839E)	pcDNA3.1(+)
GMV-V-2019nCoV-099	pGM-2019nCoV-Spike trimer (P2-mutant,S1/S2 cleavage site (furin cleavage sequence)-mutant,trimerization modified)	pcDNA3.1(+)
GMV-V-2019nCoV-100	pGM-Spike of SARS-COV-2 B.1.1.7 lineage whole mutation	pcDNA3.1(+)
GMV-V-2019nCoV-101	pGM-2019nCoV-Spike(S1+S2)-RBD N501Y mutation(B.1.1.7 lineage RBD)	pcDNA3.1(+)
GMV-V-2019nCoV-102	pGM-2019nCoV-Spike(S1+S2)-S1 HV 69-70 Deletion mutation(Δ H69/ Δ V70,B.1.1.7 lineage)	pcDNA3.1(+)
GMV-V-2019nCoV-107	pGM-2019nCoV-Spike(S1+S2)-E484K mutation(501Y.V2 lineage)	pcDNA3.1(+)
GMV-V-2019nCoV-109	pGM-Spike(S1+S2)RBD triple mutation of 501Y.V2 lineage(K417N, E484K and N501Y)	pcDNA3.1(+)
GMV-V-2019nCoV-111	pGM-Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019nCoV) 501Y.V2 lineage	pcDNA3.1(+)

Codon-optimized viral particle (Adenovirus, Lentivirus, AAV) for SARS-COV-2 (2019nCoV) spike wide type & mutant variants (D614G, N501Y, E484K, B.1.1.7 lineage, 501Y.V2 lineage, and so on)

Cat No.	Gene & Vector description of 2019 nCoV	Vector	Reporter
GMV-V-2019 nCoV-051	pGMLV-2019nCoV-spike (S1 +S2,C-6His)	Lentiviral vector	Zsgreen
GMV-V-2019 nCoV-001	pGMLV-2019nCoV-spike(S1 +S2,C-6His)	Lentiviral vector	Zsgreen
GMV-V-2019 nCoV-053	Ad-2019nCoV-Spike(S1 +S2,C-3FLAG)	Pre-made adenovirus	null
GMV-V-2019 nCoV-047	Ad-2019nCoV-Spike(S1+S2,C-3FLAG)	Pre-made adenovirus	EGFP
GMV-V-2019 nCoV-002	pGMLV-2019nCoV-S1(C-6His)	Lentiviral vector	Zsgreen
GMV-V-2019 nCoV-048	Ad-2019nCoV-Spike(S1 protein,C-3FLAG)	Pre-made adenovirus	EGFP
GMV-V-2019 nCoV-003	pGMLV-2019nCoV-Spike RBD (C-6His)	Pre-made adenovirus	Zsgreen
GMV-V-2019 nCoV-007	pGMAAV-2019nCoV-Spike RBD (C-3FLAG)	AAV vector	Zsgreen
GMV-V-2019 nCoV-050	AAV-2019nCoV-Spike(S protein RBD,C-3FLAG)	Pre-made AAV	Zsgreen
GMV-V-2019 nCoV-049	Ad-2019nCoV-Spike(S protein RBD,C-3FLAG)	Pre-made adenovirus	EGFP
GMV-V-2019 nCoV-056	Ad-2019nCoV-Spike D614G (S protein,S1+S2, D614G)	Pre-made adenovirus	null
GMV-V-2019 nCoV-103	pGM-2019nCoV-Spike trimer (P2-mutant,S1/S2 cleavage site (furin cleavage sequence)-mutant,trimerization modified)	Pre-made adenovirus	null
GMV-V-2019 nCoV-104	pGM-Spike of SARS-COV-2 B.1.1.7 lineage whole mutation	Pre-made adenovirus	null
GMV-V-2019 nCoV-105	Ad-2019nCoV-Spike(S1+S2)-RBD N501Y mutation(B.1.1.7 lineage RBD)	Pre-made adenovirus	null
GMV-V-2019 nCoV-106	Ad-2019nCoV-Spike(S1+S2)-S1 HV 69-70 Deletion mutation(Δ H69/ Δ V70,B.1.1.7 lineage)	Pre-made adenovirus	null
GMV-V-2019 nCoV-108	Ad-2019nCoV-Spike(S1+S2)-E484K mutation(501Y.V2 lineage)	Pre-made adenovirus	null
GMV-V-2019 nCoV-110	Ad-Spike(S1+S2)RBD triple mutation of 501Y.V2 lineage(K417N, E484K and N501Y)	Pre-made adenovirus	null
GMV-V-2019 nCoV-112	Ad-Spike (S1+S2) whole mutation variant of SARS-CoV-2(2019nCoV) 501Y.V2 lineage	Pre-made adenovirus	null

5 293T-ACE2 stable cell line & human ACE2 expression

vectors: Effector cell of pseudotype virus-Based Neutralization Assay System for efficacy evaluation of COVID-19 vaccines and therapeutic antibodies (Lentiviral pseudovirus)

Human ACE2 overexpression stable HEK293T cell lines. Catalog Number GM-SC-293T-hACE2-01 [Click here for details](#)

Product list: Human ACE2 expression vectors

Cat No.	2019 nCoV related Gene	Gene & Vector description of 2019 nCoV	Vector	Reporter	Tag	Codaen Optimized
GMV-V-2019n CoV-045	TMPRSS2	pGMLv-hTMPRSS2(C-3FLAG)	Lentiviral vector	Zsgreen	C-3FLAG	No
GMV-V-2019n CoV-041	ACE2	pGMLV-hACE2(C-3FLAG)	Lentiviral vector	Zsgreen	C-3FLAG	No
GMV-V-2019n CoV-042	ACE2	pAD-hACE2(C-3FLAG)	Pre-made Adenovirus	EGFP	C-3FLAG	No
GMV-V-2019n CoV-046	TMPRSS2	pGMLv-mtmprss2(C-3FLAG)	Lentiviral vector	Zsgreen	C-3FLAG	No
GMV-V-2019n CoV-043	ACE2	pAD-mACE2(C-3FLAG)	Pre-made Adenovirus	EGFP	C-3FLAG	No
GMV-V-2019n CoV-044	ACE2	pGMLV-mACE2(C-3FLAG)	Lentiviral vector	Zsgreen	C-3FLAG	No

Validation of hACE2 overexpression stable HEK293T cell lines (Cat. GM-SC-293T-hACE2-01)

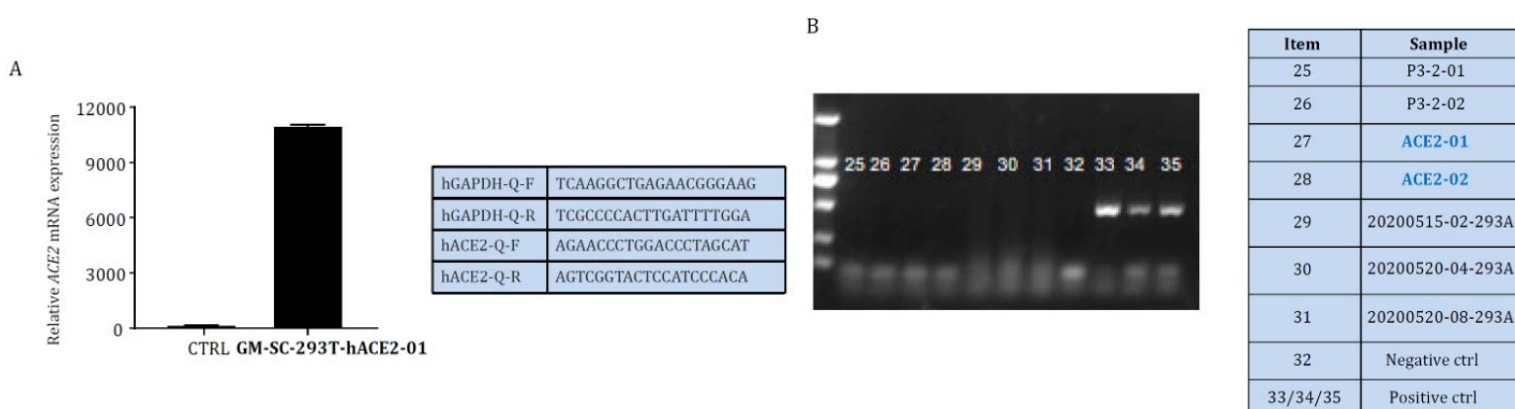


Figure. ACE2 mRNA level Validation in hACE2 overexpression stable HEK293T cell lines: Cat. GM - SC - 293T - hACE2 - 01 (A) and the cell lines were tested as Mycoplasma free (B).

Products list: Human ACE2 overexpression stable HEK293T cell lines

Cat No.	2019 nCoV related Gene	Gene & Vector description of 2019 nCoV	Vector	Reporter	Tag	Codaen Optimized
GMV-V-2019nCoV-041	TMPRSS2	pGMLv-hTMPRSS2(C-3FLAG)	Lentiviral vector	Zsgreen	C-3FLAG	No
GMV-V-2019nCoV-042	ACE2	pGMLV-hACE2(C-3FLAG)	Lentiviral vector	Zsgreen	C-3FLAG	No
GMV-V-2019nCoV-043	ACE2	pAD-hACE2(C-3FLAG)	Pre-made Adenovirus	EGFP	C-3FLAG	No
GMV-V-2019nCoV-044	TMPRSS2	pGMLv-mtmprss2(C-3FLAG)	Lentiviral vector	Zsgreen	C-3FLAG	No

6 Validated SARS-CoV-2 neutralizing antibodies- benchmark COVID-19 neutralizing antibodies.

Cat No.	Antigen Name of 2019-nCoV(SARS-CoV-2)	Source (Expression Host)	Isotypes	Bioactivity validation
GMP-V-2019nCoV-SnAb001	Anti-2019-nCoV Spike (Spike RBD domain) human monoclonal neutralizing antibody (IgG1)	Mammalian (human cell)	human IgG1	Validated in COVID-19 Spike protein and Spike-RBD protein binding affinity. COVID-19 related neutralizing potency is validated by 1. 2019nCoV pseudotyped virus based neutralization assay in 293T-ACE2 effector cell. 2. competitively blocking the binding of ACE-2 receptor with SARS-CoV-2 Spike protein.
GMP-V-2019nCoV-SnAb002	Anti-2019-nCoV Spike (Spike RBD domain) human monoclonal neutralizing antibody (IgM)	Mammalian (human cell)	human IgG1	Validated in COVID-19 Spike protein and Spike-RBD protein binding affinity. COVID-19 related neutralizing potency is validated by 1. 2019nCoV pseudotyped virus based neutralization assay in 293T-ACE2 effector cell. 2. competitively blocking the binding of ACE-2 receptor with SARS-CoV-2 Spike protein.
GMP-V-2019nCoV-SnAb003	Anti-2019-nCoV Spike (Spike RBD domain) human monoclonal neutralizing antibody (IgA)	Mammalian (human cell)	human IgG1	Validated in COVID-19 Spike protein and Spike-RBD protein binding affinity. COVID-19 related neutralizing potency is validated by 1. 2019nCoV pseudotyped virus based neutralization assay in 293T-ACE2 effector cell. 2. competitively blocking the binding of ACE-2 receptor with SARS-CoV-2 Spike protein.

Cat No.	Antigen Name of 2019-nCoV(SARS-CoV-2)	Source (Expression Host)	Isotypes	Bioactivity validation
GMP-V-2019nCoV-SnAb004	Anti-2019-nCoV Spike (Spike RBD domain) human monoclonal neutralizing antibody (IgG1)	Mammalian (human cell)	human IgG1	Validated in COVID-19 Spike protein and Spike-RBD protein binding affinity. COVID-19 related neutralizing potency is validated by 1.2019nCoV pseudotyped virus based neutralization assay in 293T-ACE2 effector cell. 2. competitively blocking the binding of ACE-2 receptor with SARS-CoV-2 Spike protein.
GMP-V-2019nCoV-SnAb005	Anti-2019-nCoV Spike (Spike RBD domain) human monoclonal neutralizing antibody (IgG1)	Mammalian (human cell)	Cynomolgus (Non human primate, NHP) IgG1	Validated in COVID-19 Spike protein and Spike-RBD protein binding affinity. COVID-19 related neutralizing potency is validated by 1.2019nCoV pseudotyped virus based neutralization assay in 293T-ACE2 effector cell. 2. competitively blocking the binding of ACE-2 receptor with SARS-CoV-2 Spike protein.

GeneMedi-SARS-CoV-2 WT and Spike Mutation Variants Pseudovirus (PSV) Based Neutralizing Assay with GeneMedi's anti-2019-nCoV Spike Neutralizing antibodies (Nabs)

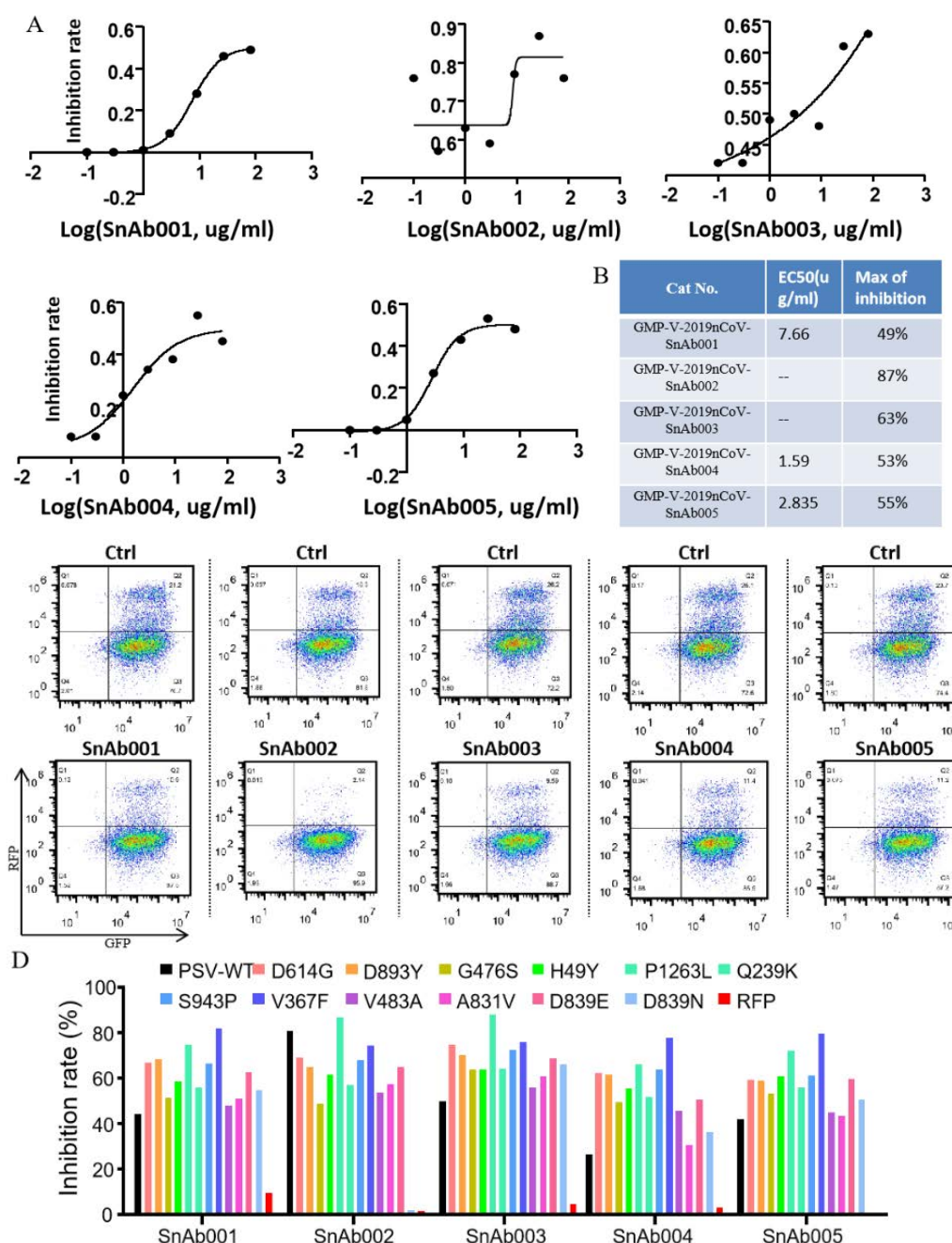


Figure. The Pseudovirus (PSV) Based Neutralizing Assay was performed on 293T-hACE2 cells infected with GeneMedi-SARS-CoV-2 WT and Spike Mutation Variants (D614G, S943P, V367F, G476S, V483A, H49Y, Q239K, A831V, P1263L, D839Y/N/E:D839Y, D839N, D839E) Pseudovirus (PSV) under treatment of GeneMedi's anti-2019-nCoV Spike Neutralizing antibodies (Nabs). Inhibition rate was determined by comparing the relative RFP+GFP+/GFP+ rate.

GeneMedi's anti-2019-nCoV Spike Neutralizing antibodies (Nabs) and Spike RBD protein binding validation

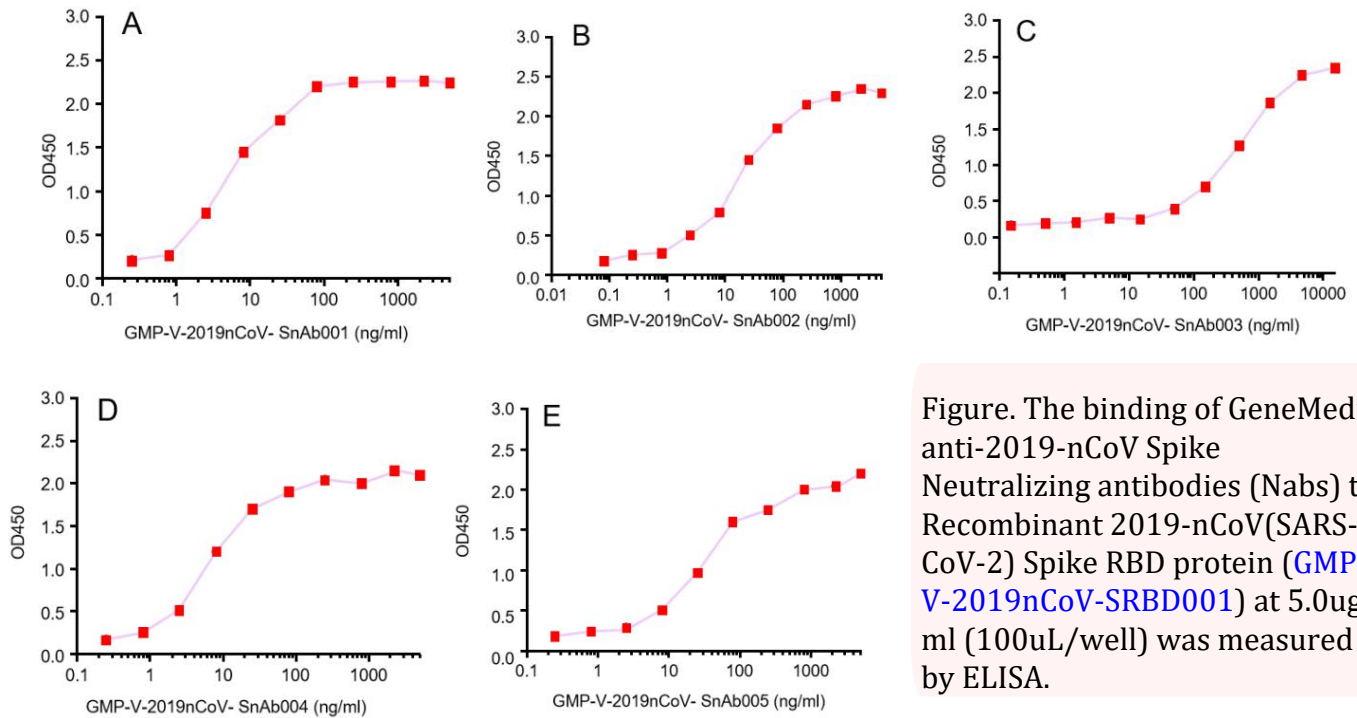


Figure. The binding of GeneMedi's anti-2019-nCoV Spike Neutralizing antibodies (Nabs) to Recombinant 2019-nCoV(SARS-CoV-2) Spike RBD protein (GMP-V-2019nCoV-SRBD001) at 5.0ug/ml (100uL/well) was measured by ELISA.

Cat No.	Product	EC50 (ng/ml)
GMP-V-2019nCoV-SnAb001	Anti-2019-nCoV Spike (Spike RBD domain) human monoclonal neutralizing antibody (IgG1)	5
GMP-V-2019nCoV-SnAb002	Anti-2019-nCoV Spike (Spike RBD domain) human monoclonal neutralizing antibody (IgM)	18
GMP-V-2019nCoV-SnAb003	Anti-2019-nCoV Spike (Spike RBD domain) human monoclonal neutralizing antibody (IgA)	410
GMP-V-2019nCoV-SnAb004	Anti-2019-nCoV Spike (Spike RBD domain) mouse monoclonal neutralizing antibody (IgG1)	6.8
GMP-V-2019nCoV-SnAb005	Anti-2019-nCoV Spike (Spike RBD domain) Cynomolgus monoclonal neutralizing antibody (IgG1)	28

- A.GMP-V-2019nCoV-SnAb001:Anti-2019-nCoV Spike (Spike RBD domain) human monoclonal neutralizing antibody (IgG1)
- B.GMP-V-2019nCoV-SnAb002:Anti-2019-nCoV Spike (Spike RBD domain) human monoclonal neutralizing antibody (IgM)
- C.GMP-V-2019nCoV-SnAb003:Anti-2019-nCoV Spike (Spike RBD domain) human monoclonal neutralizing antibody (IgA)
- D.GMP-V-2019nCoV-SnAb004:Anti-2019-nCoV Spike (Spike RBD domain) mouse monoclonal neutralizing antibody (IgG1)
- E.GMP-V-2019nCoV-SnAb005:Anti-2019-nCoV Spike (Spike RBD domain) Cynomolgus monoclonal neutralizing antibody (IgG1)

GeneMedi's anti-2019-nCoV Spike Neutralizing antibodies (Nabs) competitive binding assay validation

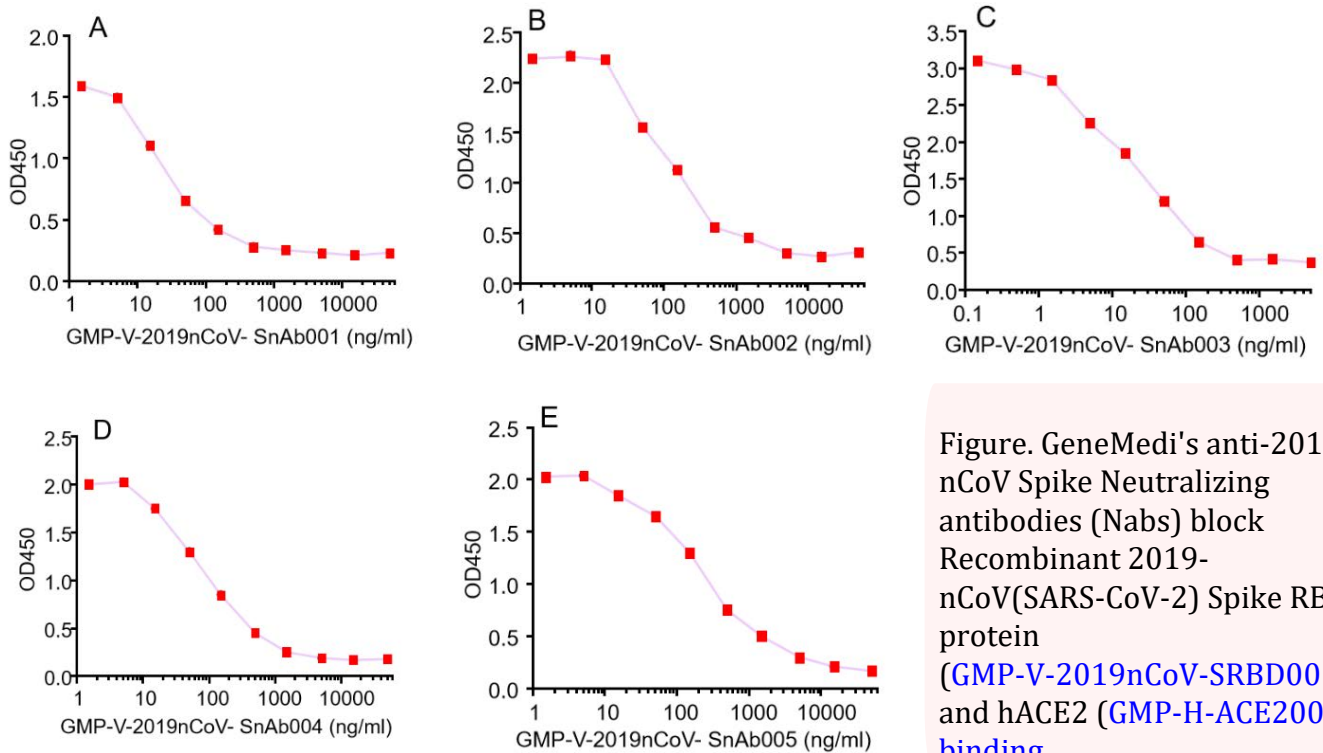


Figure. GeneMedi's anti-2019-nCoV Spike Neutralizing antibodies (Nabs) block Recombinant 2019-nCoV(SARS-CoV-2) Spike RBD protein (GMP-V-2019nCoV-SRBD001) and hACE2 (GMP-H-ACE2002) binding.

Cat No.	Product	EC50 (ng/ml)
GMP-V-2019nCoV-SnAb001	Anti-2019-nCoV Spike (Spike RBD domain) human monoclonal neutralizing antibody (IgG1)	26.3
GMP-V-2019nCoV-SnAb002	Anti-2019-nCoV Spike (Spike RBD domain) human monoclonal neutralizing antibody (IgM)	84.2
GMP-V-2019nCoV-SnAb003	Anti-2019-nCoV Spike (Spike RBD domain) human monoclonal neutralizing antibody (IgA)	20.5
GMP-V-2019nCoV-SnAb004	Anti-2019-nCoV Spike (Spike RBD domain) mouse monoclonal neutralizing antibody (IgG1)	81.9
GMP-V-2019nCoV-SnAb005	Anti-2019-nCoV Spike (Spike RBD domain) Cynomolgus monoclonal neutralizing antibody (IgG1)	243

A.GMP-V-2019nCoV-SnAb001:Anti-2019-nCoV Spike (Spike RBD domain) human monoclonal neutralizing antibody (IgG1)

B.GMP-V-2019nCoV-SnAb002:Anti-2019-nCoV Spike (Spike RBD domain) human monoclonal neutralizing antibody (IgM)

C.GMP-V-2019nCoV-SnAb003:Anti-2019-nCoV Spike (Spike RBD domain) human monoclonal neutralizing antibody (IgA)

D.GMP-V-2019nCoV-SnAb004:Anti-2019-nCoV Spike (Spike RBD domain) mouse monoclonal neutralizing antibody (IgG1)

E.GMP-V-2019nCoV-SnAb005:Anti-2019-nCoV Spike (Spike RBD domain) Cynomolgus monoclonal neutralizing antibody (IgG1)

GeneMedi's efficacy evaluation solutions will be useful for your anti-COVID-19 candidates functional assay and evaluation, which is including:

- 1) Types of Vaccines (by testing immunized serum from human, mouse, NHP etc.)
- 2) Neutralizing antibodies
- 3) Peptides blockers (peptide inhibitors)
- 4) Compounds targeting Spike induced cell-fusion.

INFORMATION COLLECTION

1 Landscape of global COVID-19 vaccine candidates development

52 candidate vaccines in clinical evaluation

COVID-19 Vaccine developer/manufacturer	Vaccine platform	Type of candidate vaccine	Number of doses	Timing of doses	Clinical Stage			
					Phase 1	Phase 1/2	Phase 2	Phase 3
Sinovac	Inactivated	Inactivated	2	0,14 days		NCT04383574 NCT04352608		NCT04456595 669/UN6.KEP /
Wuhan Institute of Biological Products/Sinopharm	Inactivated	Inactivated	2	0,21 days		ChiCTR200003 1809 Interim Report		ChiCTR200003 4780 ChiCTR200003 9000 NCT04612972
Beijing Institute of Biological Products/Sinopharm	Inactivated	Inactivated	2	0,21 days		ChiCTR200003 2459 Study Report		ChiCTR200003 4780 NCT04560881
Bharat Biotech	Inactivated	Whole-Virion Inactivated	2	0, 28 days		CTRI/2020/07 /026300 CTRI/2020/09 /027674		CTRI/2020/11 /028976 NCT04641481
University of Oxford/AstraZeneca	Non-Replicating Viral Vector	ChAdOx1-S	2	0,28 days		PACTR202006 922165132 2020-001072-	2020-001228- 32 Study Report	ISRCTN899514 24 NCT04516746
CanSino Biological Inc./Beijing Institute of Biotechnology	Non-Replicating Viral Vector	Adenovirus Type 5 Vector	1		ChiCTR200003 0906 NCT04568811 Study Report			

[More details and total list of candidate vaccines, click here to check>>](#)

162 candidate vaccines in preclinical evaluation

Platform	Type of candidate vaccine	Developer	Coronavirus target	Current stage of clinical evaluation/regulatory status- Coronavirus candidate
DNA	DNA plasmids containing S-gene	Biosun Pharmed	SARS-CoV2	Pre-Clinical
DNA	DNA plasmid vaccine	Globe Biotech Limited, Bangladesh	SARS-CoV2	Pre-Clinical
DNA	Plasmid DNA, nanostructured RBD	National institute of Chemistry, Slovenia	SARS-CoV2	Pre-Clinical
DNA	DNA, engineered vaccine inserts compatible with multiple delivery	DIOSynVax Ltd / University of Cambridge	SARS-CoV-2 and Sarbeco-CoV	Pre-Clinical
DNA	DNA vaccine	Ege University	SARS-CoV2	Pre-Clinical
DNA	DNA plasmid vaccine RBD&N	Scancell/University of Nottingham/ Nottingham Trent University	SARS-CoV2	Pre-Clinical
DNA	DNA plasmid vaccine S,S1,S2,RBD &N	National Research Centre, Egypt	SARS-CoV2	Pre-Clinical
DNA	DNA with electroporation	Karolinska Institute / Cobra Biologics (OPENCORONA Project)	SARS-CoV2	Pre-Clinical

[More details and total list of candidate vaccines, click here to check>>](#)

2 COVID-19 Guidance and information collection on the new mutant variants of the SARS-CoV-2 (2019nCoV) virus

- COVID-19 (SARS-CoV-2): information about the new virus variant
- New SARS-COV-2 variant: information and risk assessment
- Central Alerting System (CAS) alert
- New variant clustering in households analysis (ONS)

- SARS-CoV-2 lateral flow antigen tests: evaluation of VUI-202012/01
- WTO: Statement of the WHO Working Group on COVID-19 Animal Models (WHO-COM) about the UK and South African SARS-CoV-2 new variants.
- EMA guidance for COVID-19 vaccine

- Investigation of novel SARS-CoV-2 variant: Variant of Concern 202012/01
 - Investigation of novel SARS-CoV-2 variant: 202012/01. Technical briefing 2
 - Investigation of novel SARS-CoV-2 variant: 202012/01. Technical briefing 1

New variant of SARS-COV-2 (2019nCoV) B.1.1.7 lineage spreaded in UK

The world is in midst of the COVID-19 pandemic. Recently a novel SARS-COV-2 (2019nCoV) lineage, the B.1.1.7 lineage, with serials of site mutation, shows stronger infection ability in the UK. The SARS-COV-2 B.1.1.7 lineage carries a larger than a usual number of coronavirus genetic changes.

Extended Reading: [Preliminary genomic characterisation of an emergent SARS-CoV-2 lineage in the UK defined by a novel set of spike mutations](#)

Relative products collection:
[GeneMedi products for New variant of SARS-COV-2 \(2019nCoV\) UK B.1.1.7 lineage](#)

New variant of SARS-COV-2 (2019nCoV) 501Y.V2 lineage(B.1.351) spreaded in South African SARS-CoV-2

The South African variant is characterized by eight lineage-defining mutations in the spike protein including three key residues in the receptor binding domain (K417N, E484K and N501Y) and is referred to as lineage 501Y.V2.

Extended Reading: [Alert Notification: New SARS-CoV-2 variant with multiple spike protein mutations](#)

Relative products collection:
[GeneMedi products for New variant of SARS-COV-2 \(2019nCoV\) South Africa 501Y.V2 lineage\(B.1.351\)](#)

3 COVID-19 News and announcements collection on the new mutant variants of the SARS-CoV-2 (2019nCoV) virus

- PHE investigating a novel variant of COVID-19
- Rapid evaluation confirms lateral flow devices effective in detecting new COVID-19 variant
- Confirmed cases of COVID-19 variant from South Africa identified in UK
- Statement from Chief Medical Officer, Professor Chris Whitty, about new strain of COVID-19
- NERVTAG statements on COVID-19 (SARS-CoV-2)
 - NERVTAG/SPI-M Extraordinary meeting on SARS-CoV-2 variant of concern 202012/01 (variant B.1.1.7)
 - NERVTAG meeting on SARS-CoV-2 variant under investigation VUI-202012/01
 - CPR as an AGP - Evidence review and NERVTAG consensus

4 About COVID-19 Pandemic and SARS-CoV-2 Vaccine

Coronavirus Disease 2019 (COVID-19) is a novel viral pneumonia caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2).

First discovered in Wuhan, a city in Hubei province of China, COVID-19 has already broken out throughout the world and posed a great threat to the public health, especially in Europe and North America now. Additionally, person-to-person transmission of COVID-19 disease is reported to be extremely rapid [158-160].

To date, more than one million cases were infected with COVID-19 and over 55,000 deaths occurred. Therefore, it is really urgent and noteworthy to develop the vaccines specific to COVID-19/SARS-CoV-2.

Belonging to the Betacoronavirus genus family, SARS-CoV-2 is 60 ~ 200nm in diameter and encapsidates a large positive-sense, single-stranded RNA virus (26-32kb) with many spikes on the virus capsid (Fig. 17A).

The RNA genome of SARS-CoV-2 encodes several accessory proteins and structural proteins, such as nucleocapsid (N) protein, envelope (E) protein, membrane (M) protein, and spike (S) protein (Fig. 10B).

Although the detailed mechanism of SARS-CoV-2 infection has not been clearly illuminated, several studies demonstrated that SARS-CoV-2 enters human cells via utilizing spike (S) protein to bind to the angiotensin converting enzyme (ACE2) on the surface of target cell [161, 162].

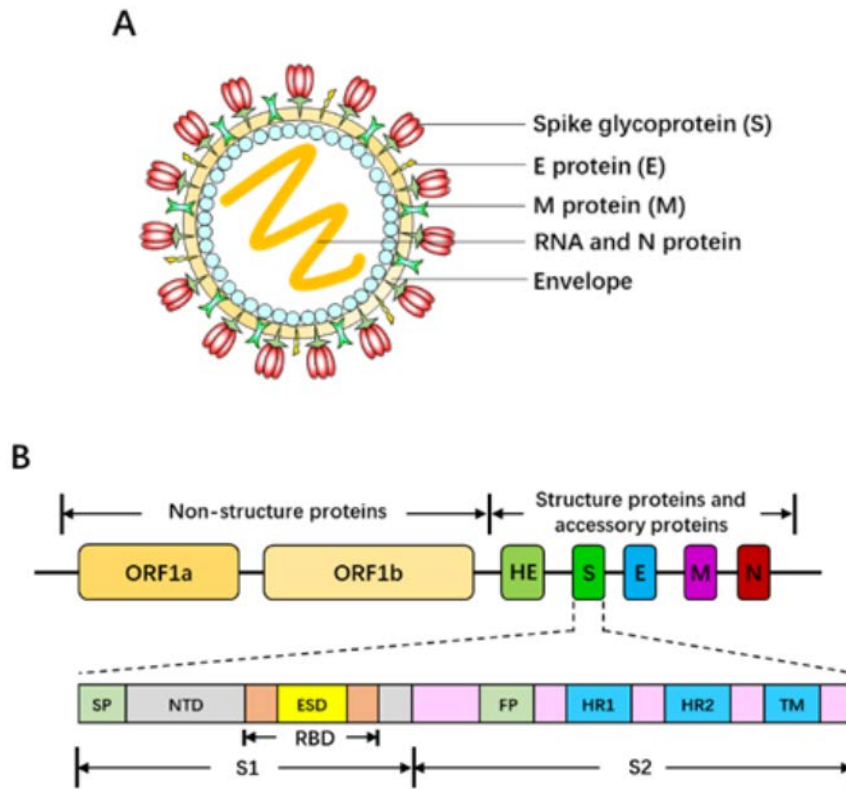


Figure S1. SARS-CoV-2 capsid structure and genome map. (A) Three-dimensional structure diagram of SARS-CoV-2. (B) Genome organization of SARS-CoV-2 [158]. ORF: open reading frame. E: envelope. M: membrane. N: nucleocapsid. HR1: heptad repeat 1. HR2: heptad repeat 2. SP: signal peptide. NTD: N-terminal domain. RBD: receptor binding domain. S: spike. S1: subunit 1. S2: subunit 2. TM: transmembrane domain.

Since the genome sequences of SARS-CoV were discovered and reported (<https://www.gisaid.org/CoV2020/>), a large number of pharmaceutical enterprises and research organizations are sparing all efforts to the vaccine development.

Different companies utilize different targets and antigen epitopes. Some of the advances are listed in the following Table 10 (from WHO), and most of them focus on viral vector-based vaccines (replicating or non-replicating viral vector-based vaccines), recombinant protein (Spike), and nucleic acid-based vaccines.

To date, two COVID-19 vaccines have entered Phase I clinical testing to assess the safety and potency of vaccines. One is mRNA-1273, was developed by Moderna Therapeutics, encoding a prefusion-stabilized form of Spike (S) protein [163] (<https://www.nature.com/articles/d41587-020-00005-z>).

Another vaccine is recombinant protein of SARS-CoV-2 antigen, developed by Chinese Academy of Military Sciences, Institute of Military Medicine.

It was predicted that these vaccines can be applied in clinics in a large scale as early as 2021 if they can successfully pass the clinical testing.

Although there is a long way for these vaccines to be applied for prevention and therapy of COVID-19, they indeed bring great hope and light to people all over the world.

GeneMedi

GeneMedi is a BioTech company with strong expertise in Gene&Biogitics discovery, artificail design, and State-of-the-Art Manufacturing.

Our scientists and experts serve global clients in biologics discovery including antibodies, recombinant protein and multiple types of viral vectors. GeneMedi offers Pre-made and custom-made recombian protein and antibodies for drug discovery and diagnostic ingredients. GeneMedi help scientists from academic to industry in vectors optimization, cell line development, scalable production, process development and technology transfer. GeneMedi GeneTherapy center also help in gene therapy&gene editing discovery and development.

Our Responsibility

1. Pre-made and custom-made recombinant proteins (Antibodies, Enzymes, Membrane protein, Factors and other antigens) for drug discovery and diagnostics ingredients, high quality, bulk in stock.
2. Membrane Protein & antibodies artificail design, discovery and State-of-the-Art Manufacturing.
3. High quality, scalable, State-of-the-Art Manufacturing in gene therapy vectors including adeno-associated virus (AAV) vector, lentivirus vector and adenovirus vector.
4. AAV gene therapy innovation: AAV capsid evolution and novel AAV generation for next-generation vector of gene therapy.



Email: support@genemedi.net | sales@genemedi.net

Telephone: [+86-21-50478399](tel:+86-21-50478399) **Fax:** [86-21-50478399](tel:86-21-50478399)

Address: 6th Floor, Building No.2, KangXin Road 3377, Shanghai, China

Fine more products of GeneMedi at www.genemedi.net