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Supporting Information

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Supporting Information

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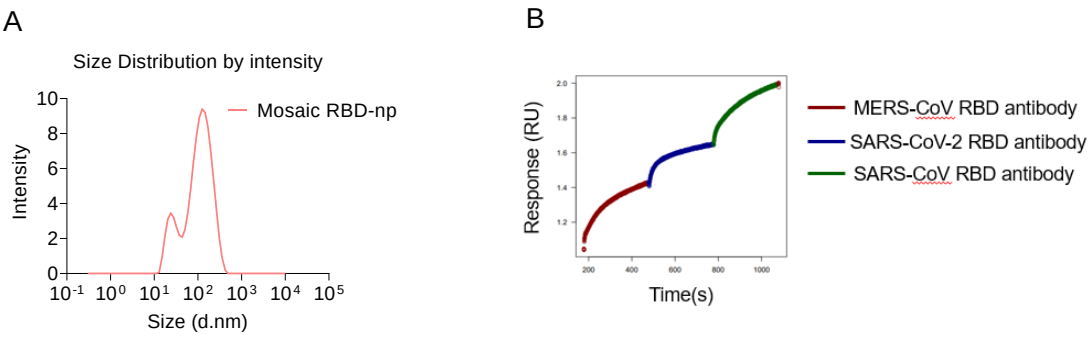


Fig. S1. Related to Fig.1. Construction and characterization of mosaic-RBD nanoparticles. (A) DLS analysis in intensity for the Mosaic RBD-np. (B) the binding assay of Mosaic-RBD nanoparticles with the SARS-CoV-2, SARS-CoV and MERS-CoV RBD-specific monoclonal antibodies by BLI.

SARS-CoV-2 RBD-Ferritin>

SFTVEKGIYQTSNFRVQPTESIVRFPNITNLCPFGEVFNATRFASVYAWNRKRISNCVADYSVLY
NSASFSTFKCYGVSPTKLNDLCFTNVYADSFVIRGDEVRQIAPGQTGKIADYNYKLPDDFTGCVI
AWNSNNLDSKVGGNYNYLYRLFRKSNLKPFERDISTEIYQAGSTPCNGVEGFNCYFPLQSYGF
QPTNGVGYQPYRVVVLSFELLHAPATVCGPKKSSGGGSGGGESQVRQQFSKDIIKLLNEQVNK
EMQSSNLYMSMSSWCYTHSLDGAGLFLFDHAAEEYEHAKKLIIFLNENNVPVQLTSISAPEHKF
EGLTQIFQKAYEHEQHISESINNIVDHAIKSKDHATFNFLQWYVAEQHEEEVLFKDILDKIELIGNE
NHGLYLADQYVKGIAKSRKS

SARS-CoV RBD-Ferritin>

NITNLCPFGEVFNATKFPSVYAWERKKISNCVADYSVLYNSTFFSTFKCYGVSATKLNDLCFSNV
YADSFVVKGDDVRQIAPGQTGVIADYNYKLPDDFMGCVLAWNTRNIDATSTGNYNYKYRYLRH
GKLRPFERDISNVPFSPDGKPCTPPALNCYWPLNDYGFYTTTGIGYQPYRVVVLSFELLNAPAT
VSGGGSGGGESQVRQQFSKDIIKLLNEQVNKEMQSSNLYMSMSSWCYTHSLDGAGLFLFDHA
AEEYEHAKKLIIFLNENNVPVQLTSISAPEHKFEGLTQIFQKAYEHEQHISESINNIVDHAIKSKDH
ATFNFLQWYVAEQHEEEVLFKDILDKIELIGNENHGLYLADQYVKGIAKSRKS

MERS-CoV RBD-Ferritin>

QAEGVECDFSPLLSGTPPQVYNFKRLVFTNCNYNLTKLLSLFSVNDFTCSQISPAAIASNCYSSLI
LDYFSYPLSMKSDLSVSSAGPISQFNYKQSFSNPTCLILATVPHNLTTITKPLKYSYINKCSRLLS
DDRTEVPQLVNANQYSPCVSIVPSTVWEDGDYYRKQLSPLEGGGWLVASGSTVAMTEQLQMG
FGITVQYGTDTNSVCPKLSGGGSGGGESQVRQQFSKDIIKLLNEQVNKEMQSSNLYMSMSSW
CYTHSLDGAGLFLFDHAAEEYEHAKKLIIFLNENNVPVQLTSISAPEHKFEGLTQIFQKAYEHEQH
ISESINNIVDHAIKSKDHATFNFLQWYVAEQHEEEVLFKDILDKIELIGNENHGLYLADQYVKGIAK
SRKS

Table S1. Amino acid sequences for nanoparticles used in this study.

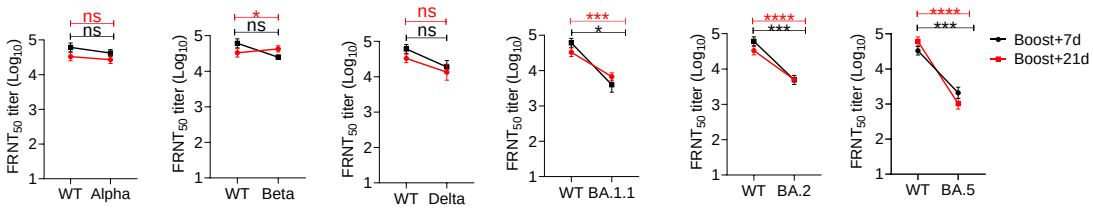


Fig. S2. Comparison of the neutralization titres against SARS-CoV-2 WT strain and its variants. (A) Red and dark line represent the day 7 and day 21 after the boost immunization. All results are expressed as mean ± SEM. Statistical analyses were performed using two-way ANOVA. (B) Realted information about Fig.2.D-F (C) Divergence amino acids in the RBD domain of MERS-CoV Strains used in this study.

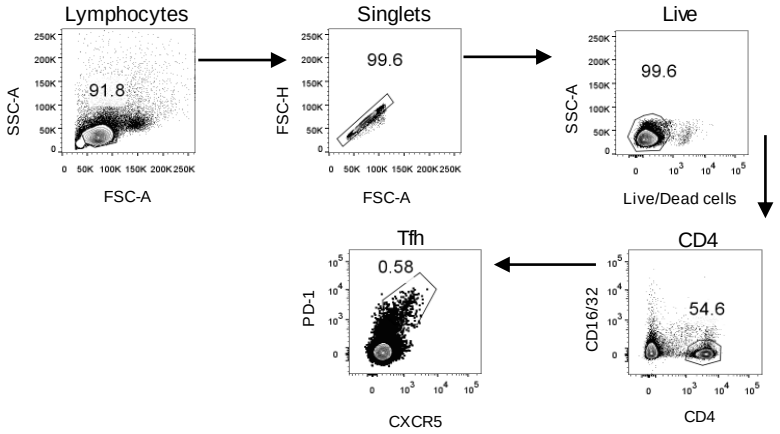
A

	Mean Neutralization titer (boost+7d)	Neutralization assay	Number of mice in this experiment
MERS-CoV EMC	3.34 (Log10)	Focus formation assay	3
MERS-CoV GD01	3.39 (Log_{10})	Pseudovirus assay	3
MERS-CoV Nigeria	3.30 (Log_{10})	Pseudovirus assay	3
SARS-CoV	3.80 (Log_{10})	Plaque formation assay	5
SARS-CoV-2 WT	4.52 (Log_{10})	Focus formation assay	3
SARS-CoV-2 Alpha	4.43 (Log_{10})	Focus formation assay	4
SARS-CoV-2 Beta	4.63 (Log_{10})	Focus formation assay	4
SARS-CoV-2 Delta	4.13 (Log_{10})	Focus formation assay	4
SARS-CoV-2 BA.1	3.83 (Log_{10})	Focus formation assay	4
SARS-CoV-2 BA.2	3.70 (Log_{10})	Focus formation assay	5
SARS-CoV-2 BA.5	3.32 (Log_{10})	Focus formation assay	6

B

MERS-CoV strains	Divergence in the RBD
MERS-CoV EMC/2012	L495, L588
MERS-CoV ChinaGD01	L495, L588
MERS-CoV Nigeria (Nig1675)	F495, F588

Table S2. (A) relevant information about Fig. 2. **(B)** the RBD sequence divergence of MERS CoV EMC, GD01 and Nigeria.



B GC B cells

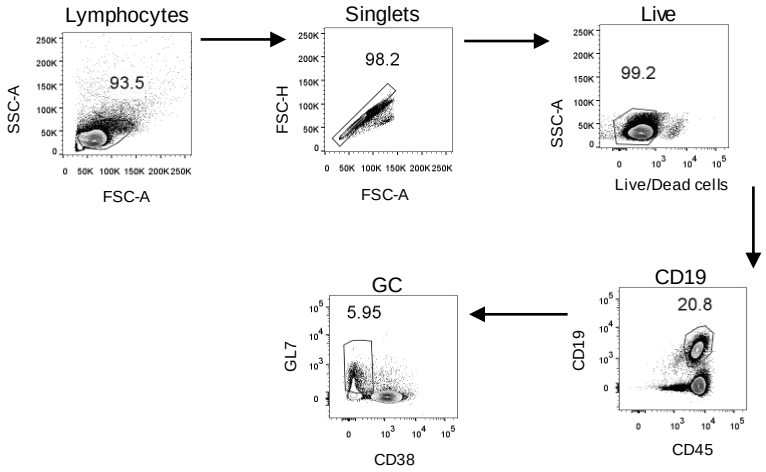


Fig. S3. Tfh and B cell gating strategy. Cells were gated as singlets and live cells on forward and side scatter and a live/dead FVS440 stain. (**A**) CD16/32 negative, CD4 positive cells were then gated on the expression of CXCR5 and PD-1. (**B**) CD45 and CD19 positive cells were gated, and then GC B cells were selected based on lower expression of CD38 and positive expression of GL7.

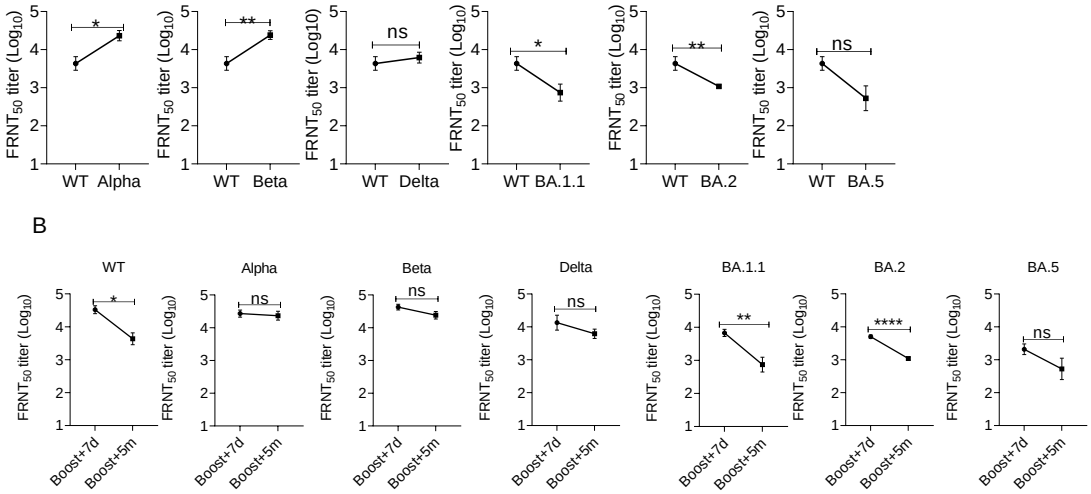


Fig. S4. Comparison of neutralization titres. (**A**) Comparison of neutralization titres between SARS-CoV-2 WT strain and different variants. (**B**) Comparison of neutralization titres between 7 days and 5 months after booster immunization for different strains. All results are expressed as mean ± SEM. Statistical analyses were performed using unpaired t test.

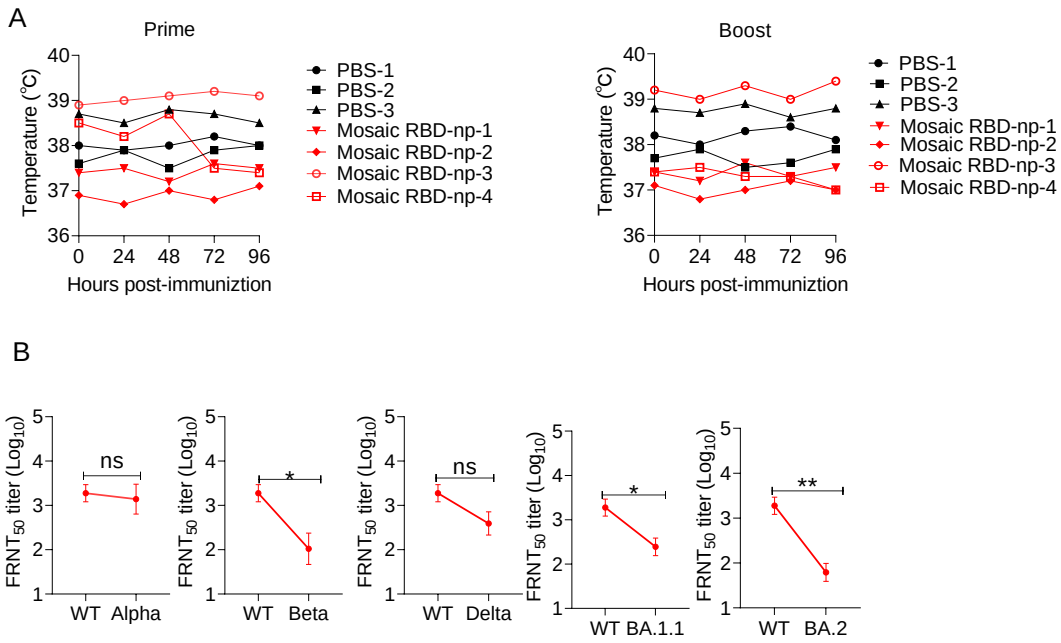


Fig. S5. Temperature change after immunization of RBD-np vaccine in cynomolgus monkeys and comparison of neutralization titres induced by immunization. (**A**) Temperature was monitored within 96 hours of primary and booster immunizations. (**B**) Comparison of the neutralization titres against SARS -CoV-2 WT strain and its variants. All results are expressed as mean ± SEM. Statistical analyses were performed using unpaired t test.

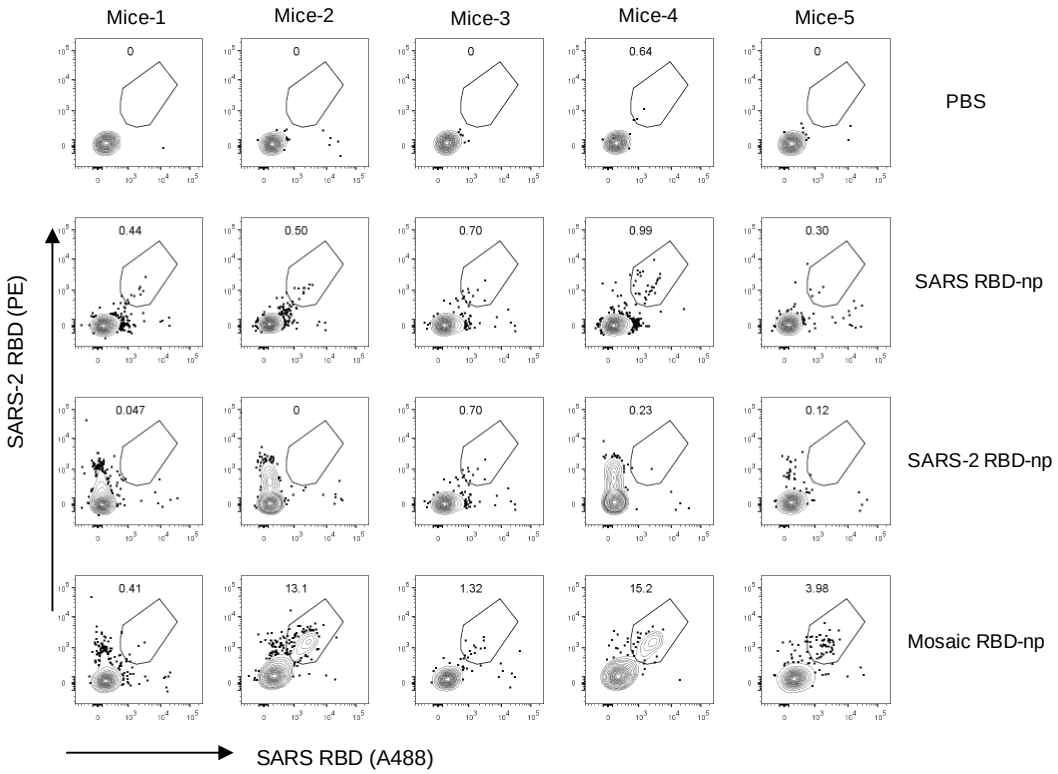


Fig. S6. Complete flow cytometry analysis for cross reactive-RBD^{+} GC B cells isolated from mice immunized with heterotypic mosaic-RBD nanoparticles or homotypic RBD nanoparticles (SARS-CoV RBD-np and SARS-CoV-2 RBD-np).