Extended Data for:

Beyond Natural Antibodies: Scaffold-Based Generation of Novel Anti-3CL^{pro} Nanobody Nb01

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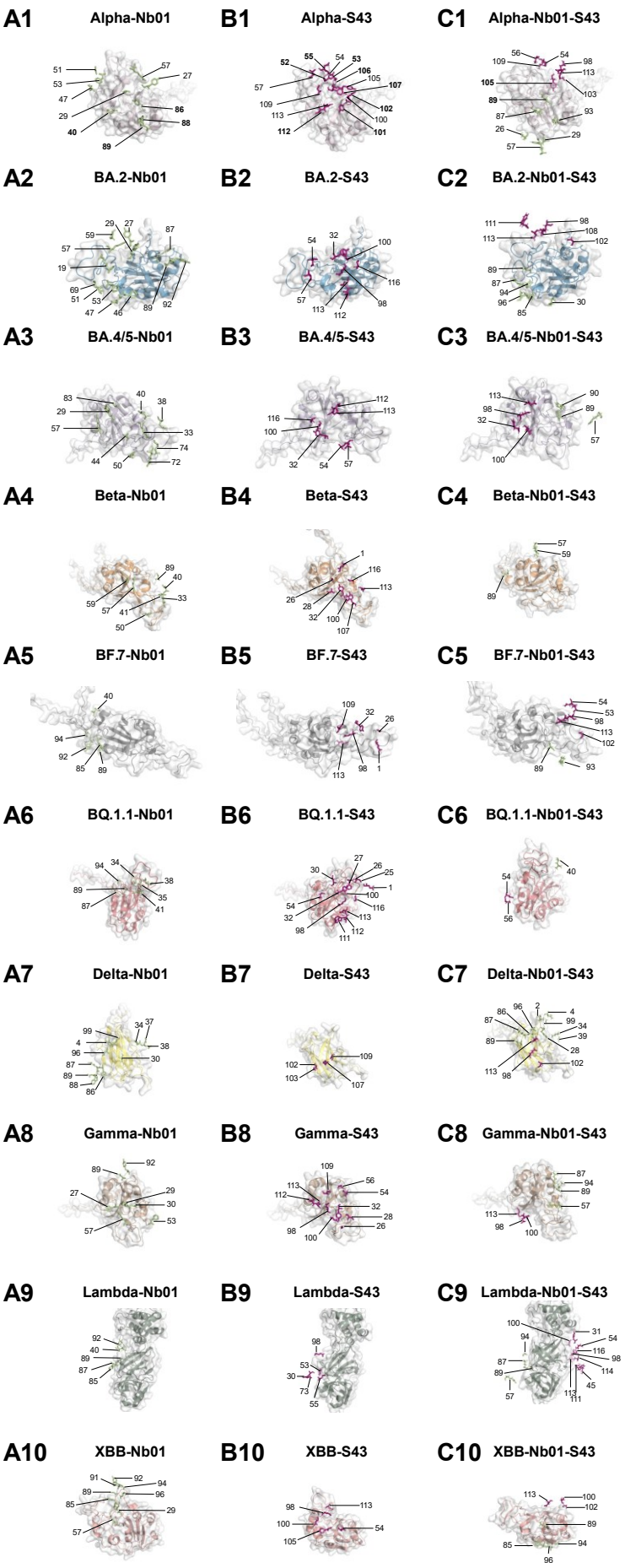
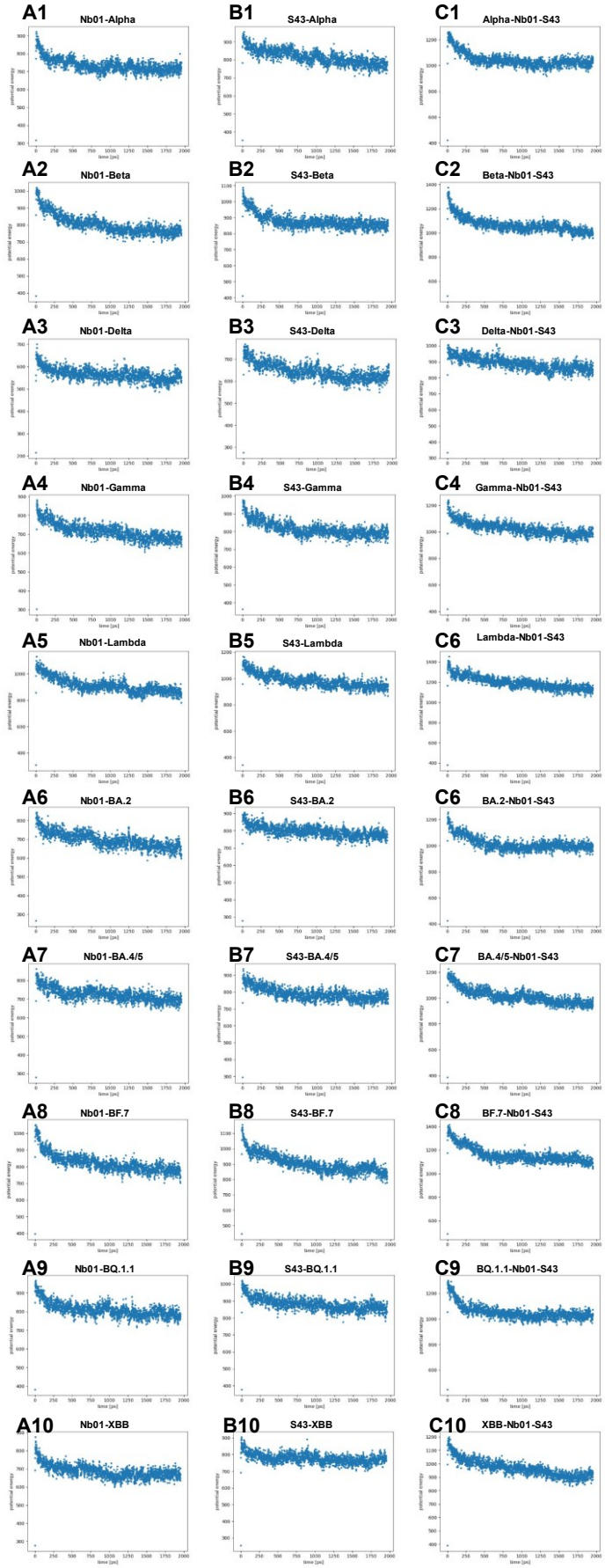
Extended Fig. 1 Toxins Prediction of two sets of sequence sets (Scaffold-based generated nanobodies and nanobody library)



Extended Fig. 2Details of the Interaction of NB01 and S43 in complex with the SARS-CoV2 variant, as well as of NB01 and S43 after simultaneous binding of the same antigen. Image generated with PyMOL.



Extended Fig. 3Potential energy changes when Nb5 and S43 bind to the variants, respectively, and when they compete simultaneously for the same antigen. (A1-10) Potential energy changes when NB01 binds to a variant; (B1-10) Potential energy changes when S43 binds to a variant; (C1-10) Potential energy changes when NB01 and S43 compete to bind the same variant.

Extended Table. 1 THE INTERACTION BINDING SITE BETWEEN NB01 AND SARS-COV-2 ALPHA

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
TYR86[OH]	TYR128[O]	Hydrogen bond	2.53
TRP88[NE1]	TYR128[OH]	Hydrogen bond	3.85
LEU40[O]	GLN175[NE2]	Hydrogen bond	3.85
TRP88[O]	VAL180[N]	Hydrogen bond	2.31
ASN89[OD1]	VAL180[N]	Hydrogen bond	3.76

Extended Table. 2 THE INTERACTION BINDING SITE BETWEEN NB01 AND SARS-COV-2 BETA

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
TYR85[OH]	ASP87[OD2]	Hydrogen bond	3.22
TYR85[OH]	GLU88[OE1]	Hydrogen bond	3.84
ASN89[N]	ASN99[OD1]	Hydrogen bond	3.22
TYR86[OH]	TYR135[O]	Hydrogen bond	3.73
TRP88[N]	TYR135[OH]	Hydrogen bond	3.77
ARG33[NH2]	PHE168[O]	Hydrogen bond	3.44
SER48[N]	CYS170[O]	Hydrogen bond	3.75
ARG57[NH1]	TYR183[OH]	Hydrogen bond	2.10
ALA44[O]	GLN175[NE2]	Hydrogen bond	2.17
ILE45[O]	PHE172[N]	Hydrogen bond	3.41
GLU47[OE2]	GLY167[N]	Hydrogen bond	2.67
TYR86[O]	ASN99[ND2]	Hydrogen bond	2.63
TRP88[O]	TYR103[OH]	Hydrogen bond	3.28

Extended Table. 3 THE INTERACTION BINDING SITE BETWEEN NB01 AND SARS-COV-2 DELTA

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
GLN100[N]	GLU48[OE1]	Hydrogen bond	3.37
SER30[OG]	GLY110[O]	Hydrogen bond	3.42
MET95[N]	TYR112[OH]	Hydrogen bond	2.15
TYR93[O]	SER39[OG]	Hydrogen bond	3.65
TYR93[O]	TYR112[OH]	Hydrogen bond	2.84

Extended Table. 4 THE INTERACTION BINDING SITE BETWEEN NB01 AND SARS-COV-2 GAMMA

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
TYR28[OH]	ASN127[OD1]	Hydrogen bond	2.04
ASN89[N]	PRO176[O]	Hydrogen bond	3.10
PHE90[N]	PRO176[O]	Hydrogen bond	2.31
TYR91[N]	THR177[O]	Hydrogen bond	3.44
ARG87[O]	THR177[N]	Hydrogen bond	3.32

Extended Table. 5 THE INTERACTION BINDING SITE BETWEEN NB01 AND SARS-COV-2 LAMBDA

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
ALA42[N]	THR169[O]	Hydrogen bond	3.74
TRP88[N]	LEU141[O]	Hydrogen bond	2.95
TRP88[NE1]	CYS145[SG]	Hydrogen bond	2.30
ASN89[N]	GLY143[O]	Hydrogen bond	3.52
TYR91[N]	SER139[OG]	Hydrogen bond	2.58
TYR91[N]	SER139[O]	Hydrogen bond	2.45
TYR92[OH]	GLU288[OE1]	Hydrogen bond	2.08
ASN89[O]	SER139[OG]	Hydrogen bond	3.51
ASN89[OD1]	GLY143[N]	Hydrogen bond	2.20
PHE90[O]	PHE140[N]	Hydrogen bond	2.89
TYR91[O]	SER139[OG]	Hydrogen bond	2.15

Extended Table. 6 THE INTERACTION BINDING SITE BETWEEN NB01 AND SARS-COV-2 OMICRON BA.2

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
ASN89[N]	GLY121[O]	Hydrogen bond	2.40
ARG87[N]	ASN124[OD1]	Hydrogen bond	2.41
TYR93[OH]	ASN124[OD1]	Hydrogen bond	2.42
ASN59[ND2]	GLY156[O]	Hydrogen bond	2.43
ILE55[N]	GLY159[O]	Hydrogen bond	2.44
THR54[OG1]	ASN161[OD1]	Hydrogen bond	2.45
GLY51[N]	TYR163[OH]	Hydrogen bond	2.46
PHE90[N]	PHE171[O]	Hydrogen bond	2.47
PHE53[O]	TYR163[OH]	Hydrogen bond	2.48
ILE55[O]	TYR163[N]	Hydrogen bond	2.49
TYR86[OH]	TYR127[N]	Hydrogen bond	2.50
ARG87[O]	PHE171[N]	Hydrogen bond	2.51
TRP88[O]	ARG172[N]	Hydrogen bond	2.52
PHE90[O]	TYR175[OH]	Hydrogen bond	2.53
TYR92[O]	ASN122[ND2]	Hydrogen bond	2.54

Extended Table. 7 THE INTERACTION BINDING SITE BETWEEN NB01 AND SARS-COV-2 OMICRON BA.4/5

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
TRP88[NE1]	TYR127[OH]	Hydrogen bond	3.03
GLU47[N]	CYS162[O]	Hydrogen bond	3.60
SER26[OG]	ASN122[ND2]	Hydrogen bond	3.80
LEU40[O]	TYR163[OH]	Hydrogen bond	3.66
GLU41[OE2]	ASN161[N]	Hydrogen bond	2.04
GLU41[OE2]	CYS162[N]	Hydrogen bond	3.61
ILE45[O]	PHE164[N]	Hydrogen bond	2.78
GLU47[OE2]	ALA158[N]	Hydrogen bond	3.23
SER48[OG]	VAL160[N]	Hydrogen bond	3.07
ILE55[O]	ARG172[NH1]	Hydrogen bond	2.98
ILE55[O]	ARG172[NH2]	Hydrogen bond	3.13

Extended Table. 8 THE INTERACTION BINDING SITE BETWEEN NB01 AND SARS-COV-2 OMICRON BF.7

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
ARG87[N]	ASN70[O]	Hydrogen bond	2.70
TYR93[N]	ASP64[OD2]	Hydrogen bond	3.72
TYR93[N]	SER66[OG]	Hydrogen bond	3.39
TRP88[O]	GLU40[N]	Hydrogen bond	3.77
TYR92[O]	ASN70[ND2]	Hydrogen bond	2.58
TYR92[O]	SER66[OG]	Hydrogen bond	3.04

Extended Table. 9 THE INTERACTION BINDING SITE BETWEEN NB01 AND SARS-COV-2 OMICRON BQ.1.1

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
GLY39[N]	VAL162[O]	Hydrogen bond	3.38
LEU40[N]	TYR152[O]	Hydrogen bond	3.65
GLU41[N]	GLY164[O]	Hydrogen bond	3.64
GLU41[N]	CYS167[O]	Hydrogen bond	2.79
TYR86[OH]	GLN172[OE1]	Hydrogen bond	3.68
ARG87[NH1]	ASP99[OD2]	Hydrogen bond	2.65
ASN89[ND2]	GLY95[O]	Hydrogen bond	2.43
TYR91[OH]	GLU144[OE2]	Hydrogen bond	3.46
TYR92[N]	ASP99[O]	Hydrogen bond	2.53
GLN34[OE1]	TYR168[OH]	Hydrogen bond	3.33
ALA35[O]	VAL165[N]	Hydrogen bond	2.53
ALA35[O]	ASN166[N]	Hydrogen bond	3.29
GLN38[OE1]	ALA163[N]	Hydrogen bond	3.69
GLY39[O]	VAL165[N]	Hydrogen bond	3.08
LEU40[O]	PHE169[N]	Hydrogen bond	2.95
ARG87[NH1]	ASP99[OD2]	Salt bridge	2.65
ARG87[NH1]	ASP99[OD1]	Salt bridge	3.43

Extended Table. 10 THE INTERACTION BINDING SITE BETWEEN NB01 AND SARS-COV-2 OMICRON XBB

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
TYR28[N]	THR167[O]	Hydrogen bond	3.86
TYR28[OH]	ARG165[O]	Hydrogen bond	3.35
TYR86[OH]	HIS172[O]	Hydrogen bond	3.45
ASN89[N]	ASN115[O]	Hydrogen bond	3.55
GLY94[N]	SER113[O]	Hydrogen bond	3.74
GLY84[O]	GLY171[N]	Hydrogen bond	3.71
TYR85[O]	TYR116[N]	Hydrogen bond	2.67
ASN89[O]	SER113[OG]	Hydrogen bond	2.76
ASN89[O]	GLY114[N]	Hydrogen bond	3.57
TYR92[O]	GLY114[N]	Hydrogen bond	3.11

Extended Table. 11 THE INTERACTION BINDING SITE BETWEEN S43 AND SARS-COV-2 ALPHA

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
SER102[N]	ASN125[O]	Hydrogen bond	3.19
TYR106[OH]	GLY159[O]	Hydrogen bond	3.21
ASN55[N]	GLU161[O]	Hydrogen bond	3.59
SER52[OG]	GLU161[O]	Hydrogen bond	2.55
SER53[N]	GLU161[O]	Hydrogen bond	3.77
SER53[OG]	GLU161[OE2]	Hydrogen bond	2.56
THR112[OG1]	GLN170[OE1]	Hydrogen bond	3.22
TYR107[OH]	ASN127[ND2]	Hydrogen bond	3.55
ASP100[OD1]	ASN127[ND2]	Hydrogen bond	3.82

Extended Table. 12 THE INTERACTION BINDING SITE BETWEEN S43 AND SARS-COV-2 BETA

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
SER102[OG]	SER176[O]	Hydrogen bond	2.51
SER102[OG]	SER176[OG]	Hydrogen bond	3.44
TYR101[OH]	PRO181[O]	Hydrogen bond	3.20
TYR32[OH]	ASN130[ND2]	Hydrogen bond	3.49
TYR105[O]	LYS166[NZ]	Hydrogen bond	3.22
TYR106[OH]	GLN175[NE2]	Hydrogen bond	2.53
VAL104[O]	GLY178[N]	Hydrogen bond	3.15
SER102[O]	PHE179[N]	Hydrogen bond	3.22
ASP100[O]	PHE179[N]	Hydrogen bond	2.23
TYR101[OH]	TYR183[N]	Hydrogen bond	3.34

Extended Table. 13 THE INTERACTION BINDING SITE BETWEEN S43 AND SARS-COV-2 DELTA

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
TYR105[N]	GLY61[O]	Hydrogen bond	3.74
SER102[O]	SER58[OG]	Hydrogen bond	3.43
GLY103[O]	GLY59[N]	Hydrogen bond	3.76
GLY103[O]	ASP60[N]	Hydrogen bond	3.39
VAL104[O]	ARG57[N]	Hydrogen bond	2.04
VAL104[O]	SER58[N]	Hydrogen bond	3.12
TYR105[OH]	VAL54[N]	Hydrogen bond	3.60

Extended Table. 14 THE INTERACTION BINDING SITE BETWEEN S43 AND SARS-COV-2 GAMMA

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
TYR105[OH]	GLY162[O]	Hydrogen bond	3.25
TYR31[OH]	ASN164[OD1]	Hydrogen bond	2.36
VAL104[N]	PHE167[O]	Hydrogen bond	3.55
CYS109[O]	TYR126[OH]	Hydrogen bond	3.45
TYR105[OH]	TYR166[N]	Hydrogen bond	2.56
TYR105[OH]	PHE167[N]	Hydrogen bond	3.49

Extended Table. 15 THE INTERACTION BINDING SITE BETWEEN S43 AND SARS-COV-2 LAMBDA

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
SER53[OG]	GLN189[O]	Hydrogen bond	3.89
ASN54[ND2]	THR190[OG1]	Hydrogen bond	3.63
THR108[N]	ALA191[O]	Hydrogen bond	2.14
GLY103[O]	GLY170[N]	Hydrogen bond	2.96
GLY103[O]	VAL171[N]	Hydrogen bond	2.98
ASN54[OD1]	ARG188[NH1]	Hydrogen bond	3.86
TYR106[O]	ALA193[N]	Hydrogen bond	3.52

Extended Table. 16 THE INTERACTION BINDING SITE BETWEEN S43 AND SARS-COV-2 OMICRON BA.2

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
ASN54[ND2]	GLY159[O]	Hydrogen bond	2.10
ASN54[ND2]	CYS162[O]	Hydrogen bond	3.33
TYR105[N]	SER168[OG]	Hydrogen bond	3.46
SER102[OG]	TYR169[O]	Hydrogen bond	2.01
SER102[N]	PHE171[O]	Hydrogen bond	3.74
ASP100[O]	ASN122[ND2]	Hydrogen bond	2.12
TYR105[O]	ARG167[NH2]	Hydrogen bond	3.53
SER102[OG]	TYR169[N]	Hydrogen bond	2.94
SER102[OG]	GLY170[N]	Hydrogen bond	3.36
PHE114[O]	ARG172[NH1]	Hydrogen bond	3.54
ASP113[OD1]	ARG172[NE]	Salt bridge	2.79
ASP113[OD1]	ARG172[NH2]	Salt bridge	3.05
ASP113[OD2]	ARG172[NH2]	Salt bridge	3.89

Extended Table. 17 THE INTERACTION BINDING SITE BETWEEN S43 AND SARS-COV-2 OMICRON BA.4/5

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
VAL104[N]	TRP27[O]	Hydrogen bond	3.79
TYR105[OH]	ARG126[O]	Hydrogen bond	2.56
TYR106[OH]	ILE142[O]	Hydrogen bond	3.83
TYR32[OH]	ARG20[NH1]	Hydrogen bond	3.16
SER56[OG]	GLY156[N]	Hydrogen bond	3.44
ASP100[O]	ARG20[NH1]	Hydrogen bond	3.37
SER102[O]	SER23[N]	Hydrogen bond	2.36
SER102[OG]	SER23[N]	Hydrogen bond	3.05
VAL104[O]	ARG128[NE]	Hydrogen bond	3.33
ASP113[OD1]	ARG126[NH2]	Hydrogen bond	2.70
ASP113[OD2]	ARG126[NH1]	Hydrogen bond	3.01
ASP100[OD2]	ARG20[NH1]	Salt bridge	3.70
ASP113[OD1]	ARG126[NE]	Salt bridge	3.79
ASP113[OD1]	ARG126[NH1]	Salt bridge	3.28
ASP113[OD1]	ARG126[NH2]	Salt bridge	2.70
ASP113[OD2]	ARG126[NH1]	Salt bridge	3.01
ASP113[OD2]	ARG126[NH2]	Salt bridge	3.92

Extended Table. 18 THE INTERACTION BINDING SITE BETWEEN S43 AND SARS-COV-2 OMICRON BF.7

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
TYR107[OH]	TYR201[OH]	Hydrogen bond	3.19
TRP111[N]	THR200[OG1]	Hydrogen bond	3.01
GLY26[O]	ASN187[N]	Hydrogen bond	3.26
GLU98[OE2]	TYR201[OH]	Hydrogen bond	2.51
PRO99[O]	ARG103[NH1]	Hydrogen bond	3.48
PRO99[O]	ARG103[NH2]	Hydrogen bond	3.90
TYR101[O]	ASN117[ND2]	Hydrogen bond	2.82
SER102[OG]	HIS205[NE2]	Hydrogen bond	3.20
VAL104[O]	ASN105[ND2]	Hydrogen bond	2.70
VAL104[O]	HIS205[NE2]	Hydrogen bond	3.43
GLY110[O]	ARG198[NH1]	Hydrogen bond	2.14
GLY110[O]	TYR201[OH]	Hydrogen bond	3.09
ASP113[OD1]	ARG198[NE]	Salt bridge	2.10
ASP113[OD1]	ARG198[NH2]	Salt bridge	3.44
ASP113[OD2]	ARG198[NE]	Salt bridge	2.83

Extended Table. 19 THE INTERACTION BINDING SITE BETWEEN S43 AND SARS-COV-2 OMICRON BQ.1.1

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance(Å)
SER102[OG]	TYR132[O]	Hydrogen bond	2.05
VAL104[N]	TYR132[O]	Hydrogen bond	3.85
THR28[OG1]	ALA154[O]	Hydrogen bond	3.59
TYR31[N]	ASN166[OD1]	Hydrogen bond	3.51
VAL104[N]	TYR168[O]	Hydrogen bond	3.22
THR112[OG1]	ASN127[ND2]	Hydrogen bond	3.31
SER102[OG]	TYR132[N]	Hydrogen bond	3.59
PHE27[O]	LYS157[NZ]	Hydrogen bond	3.43
TYR101[O]	GLY164[N]	Hydrogen bond	3.17
TYR107[OH]	VAL165[N]	Hydrogen bond	2.04
ASP100[OD2]	ASN166[N]	Hydrogen bond	2.02
THR28[O]	ASN166[ND2]	Hydrogen bond	2.62
THR28[OG1]	ASN166[ND2]	Hydrogen bond	2.28
ASP100[OD1]	TYR168[N]	Hydrogen bond	3.49
ASP100[OD2]	TYR168[N]	Hydrogen bond	3.85
GLY103[O]	PHE169[N]	Hydrogen bond	2.53

Extended Table. 20 THE INTERACTION BINDING SITE BETWEEN S43 AND SARS-COV-2 OMICRON XBB

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
ASN54[ND2]	ASN115[OD1]	Hydrogen bond	2.16
TYR101[OH]	VAL150[O]	Hydrogen bond	2.99
VAL104[N]	ARG165[O]	Hydrogen bond	2.75
TYR105[N]	PRO166[O]	Hydrogen bond	3.37
THR112[OG1]	ASN148[O]	Hydrogen bond	2.88
SER102[O]	THR167[N]	Hydrogen bond	2.41

Extended Table. 21 THE INTERACTION BINDING SITE OF NB01 WHEN THE COMPLEX WITH THE VARIANT

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
ASN89[HD22]	GLY162[O]	Hydrogen bond	2.13
ASN89[HD21]	GLU161[O]	Hydrogen bond	2.04

Extended Table. 22 THE INTERACTION BINDING SITE OF NB01 WHEN THE COMPLEX WITH THE VARIANT

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
ARG57[HH11]	ASN122[OD1]	Hydrogen bond	2.17
ARG57[HH21]	ASN122[OD1]	Hydrogen bond	2.50

Extended Table. 23 THE INTERACTION BINDING SITE OF NB01 WHEN THE COMPLEX WITH THE VARIANT

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
GLN34[OE1]	ARG49[HH22]	Hydrogen bond	2.23
TYR93[O]	TYR112[HH]	Hydrogen bond	1.83
GLN100[HE21]	GLY46[O]	Hydrogen bond	1.88
TRP98[H]	ARG49[O]	Hydrogen bond	2.42
ARG87[HH12]	ASP66[OD1]	Hydrogen bond	1.72
ARG87[HH22]	ASP66[OD2]	Hydrogen bond	1.73
TYR28[HH]	TYR108[O]	Hydrogen bond	1.84
ARG87[NH1]	ASP66[OD1]	Salt bridge	2.71
ARG87[NH2]	ASP66[OD1]	Salt bridge	3.43
ARG87[NH1]	ASP66[OD2]	Salt bridge	3.54
ARG87[NH2]	ASP66[OD2]	Salt bridge	2.72

Extended Table. 24 THE INTERACTION BINDING SITE OF NB01 WHEN THE COMPLEX WITH THE VARIANT

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
LYS50[HZ1]	SER154[OG]	Hydrogen bond	1.98
ASN89[HD22]	ASP82[OD2]	Hydrogen bond	2.24
PHE90[H]	TYR130[OH]	Hydrogen bond	2.31

Extended Table. 25 THE INTERACTION BINDING SITE OF NB01 WHEN THE COMPLEX WITH THE VARIANT

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
LYS50[HZ1]	SER154[OG]	Hydrogen bond	1.98
ASN89[HD22]	ASP82[OD2]	Hydrogen bond	2.24
PHE90[H]	TYR130[OH]	Hydrogen bond	2.31

Extended Table. 26 THE INTERACTION BINDING SITE OF NB01 WHEN THE COMPLEX WITH THE VARIANT

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
TYR28[OH]	TYR175[HH]	Hydrogen bond	1.99
PHE90[O]	ARG167[HH22]	Hydrogen bond	1.94
PHE90[H]	ASN161[OD1]	Hydrogen bond	1.81
TYR91[HH]	VAL157[O]	Hydrogen bond	1.78
TYR92[H]	ASN161[OD1]	Hydrogen bond	1.72

Extended Table. 27 THE INTERACTION BINDING SITE OF NB01 WHEN THE COMPLEX WITH THE VARIANT

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
TYR91[HH]	A:ASN 124[OD1]	Hydrogen bond	2.28

Extended Table. 28 THE INTERACTION BINDING SITE OF NB01 WHEN THE COMPLEX WITH THE VARIANT

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
TYR85[OH]	GLY146[H]	Hydrogen bond	1.92
TYR86[O]	ASN150[HD21]	Hydrogen bond	2.29
TYR93[OH]	ARG152[HH22]	Hydrogen bond	2.36
TRP88[H]	GLY147[O]	Hydrogen bond	2.37

Extended Table. 29 THE INTERACTION BINDING SITE OF NB01 WHEN THE COMPLEX WITH THE VARIANT

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
TYR86[OH]	ARG131[HH11]	Hydrogen bond	1.91

Extended Table. 30 THE INTERACTION BINDING SITE OF NB01 WHEN THE COMPLEX WITH THE VARIANT

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
TYR91[OH]	LYS111[H]	Hydrogen bond	2.23
TYR86[HH]	TYR168[O]	Hydrogen bond	2.32
ASN89[H]	GLY163[O]	Hydrogen bond	1.66
TYR91[H]	GLY114[O]	Hydrogen bond	2.47

Extended Table. 31 THE INTERACTION BINDING SITE OF S43 WHEN THE COMPLEX WITH THE VARIANT

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
TYR105[OH]	ALA25[H]	Hydrogen bond	2.22
TYR105[HH]	ARG23[O]	Hydrogen bond	1.78

Extended Table. 32 THE INTERACTION BINDING SITE OF S43 WHEN THE COMPLEX WITH THE VARIANT

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
TYR101[O]	ASN163[HD22]	Hydrogen bond	1.76
SER102[OG]	ARG28[HE]	Hydrogen bond	2.32
SER102[OG]	ARG28[HH21]	Hydrogen bond	1.95
THR108[OG1]	GLY167[H]	Hydrogen bond	1.98
ASP113[OD2]	THR160[H]	Hydrogen bond	1.76
TYR106[HH]	GLU22[OE1]	Hydrogen bond	1.71
GLY110[H]	SER159[O]	Hydrogen bond	2.47
TYR107[H]	CYS162[O]	Hydrogen bond	2.32
GLY103[H]	ASN163[OD1]	Hydrogen bond	2.48
SER53[H]	GLY164[O]	Hydrogen bond	2.42
THR108[H]	CYS170[SG]	Hydrogen bond	2.38

Extended Table. 33 THE INTERACTION BINDING SITE OF S43 WHEN THE COMPLEX WITH THE VARIANT

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
GLU98[OE2]	TYR108[HH]	Hydrogen bond	1.68
VAL104[O]	THR106[H]	Hydrogen bond	2.18
TYR106[O]	PHE107[H]	Hydrogen bond	2.08
TYR106[H]	ASP105[O]	Hydrogen bond	1.77

Extended Table. 34 THE INTERACTION BINDING SITE OF S43 WHEN THE COMPLEX WITH THE VARIANT

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
ASP113[OD1]	ARG34[H]	Hydrogen bond	1.82

Extended Table. 35 THE INTERACTION BINDING SITE OF S43 WHEN THE COMPLEX WITH THE VARIANT

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
GLU98[OE1]	LYS102[HZ2]	Hydrogen bond	2.03
GLU98[OE1]	LYS102[HZ3]	Hydrogen bond	2.33
GLU98[OE2]	LYS102[HZ3]	Hydrogen bond	2.29
ASP100[O]	ARG298[HH22]	Hydrogen bond	2.20
VAL104[O]	GLN110[HE22]	Hydrogen bond	2.27
THR108[O]	LYS102[HZ3]	Hydrogen bond	2.46
THR108[OG1]	ARG105[H]	Hydrogen bond	1.96
GLY110[O]	LYS102[HZ1]	Hydrogen bond	2.22
THR112[O]	LYS100[HZ2]	Hydrogen bond	1.74
ASP113[OD1]	CYS156[HG]	Hydrogen bond	1.76
VAL104[H]	GLY109[O]	Hydrogen bond	2.41
THR108[OG1]	ARG105[O]	Hydrogen bond	3.46
GLU98[OE1]	LYS102[NZ]	Salt bridge	2.71
GLU98[OE2]	LYS102[NZ]	Salt bridge	2.78
ASP113[OD2]	LYS102[NZ]	Salt bridge	3.28

Extended Table. 36 THE INTERACTION BINDING SITE OF S43 WHEN THE COMPLEX WITH THE VARIANT

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
GLU98[OE1]	ASN155[HD22]	Hydrogen bond	1.74
TYR101[O]	ASN122[HD22]	Hydrogen bond	1.79
SER102[O]	ASN122[H]	Hydrogen bond	2.07
VAL104[O]	ARG20[HH21]	Hydrogen bond	1.84
VAL104[O]	ARG20[HE]	Hydrogen bond	2.12
ASP113[OD1]	ASN155[H]	Hydrogen bond	1.85
ASP113[OD2]	GLN148[HE22]	Hydrogen bond	2.05

Extended Table. 37 THE INTERACTION BINDING SITE OF S43 WHEN THE COMPLEX WITH THE VARIANT

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
TYR32[OH]	ARG20[HH11]	Hydrogen bond	2.06
TYR101[O]	ALA158[H]	Hydrogen bond	1.70
VAL104[H]	ALA158[O]	Hydrogen bond	2.07
TYR105[H]	ALA158[O]	Hydrogen bond	1.82

Extended Table. 38 THE INTERACTION BINDING SITE OF S43 WHEN THE COMPLEX WITH THE VARIANT

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
TYR105[O]	GLN193[HE22]	Hydrogen bond	1.75
TYR106[O]	ARG198[HE]	Hydrogen bond	1.84
GLU98[OE1]	ARG198[HH11]	Hydrogen bond	1.87
TYR105[O]	ARG198[HH22]	Hydrogen bond	1.76
GLU98[OE1]	TYR201[HH]	Hydrogen bond	1.74
GLU98[OE1]	ARG198[NH1]	Salt bridge	2.68
GLU98[OE1]	ARG198[NH2]	Salt bridge	3.77
GLU98[OE2]	ARG198[NH2]	Salt bridge	3.94

Extended Table. 39 THE INTERACTION BINDING SITE OF S43 WHEN THE COMPLEX WITH THE VARIANT

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
VAL104[O]	ASN96[HD21]	Hydrogen bond	1.77
TYR105[HH]	LEU134[O]	Hydrogen bond	2.17

Extended Table. 40 THE INTERACTION BINDING SITE OF S43 WHEN THE COMPLEX WITH THE VARIANT

Nanobody Res. Info.	Antigen Res. Info.	Interaction Info.	Distance (Å)
ASP100[O]	LYS111[HZ2]	Hydrogen bond	2.45
VAL104[O]	ASN21[HD22]	Hydrogen bond	1.84