Full wwPDB X-ray Structure Validation Report ⓘ

Feb 21, 2022 – 07:57 pm GMT

PDB ID	:	7NDF
Title	:	Crystal structure of nanobody Nb_MsbA#1 in complex with the nucleotide binding domain of MsbA
Authors	:	Meier, G.; Seeger, M.
Deposited on	:	2021-02-01
Resolution	:	2.10 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at *validation@mail.wwpdb.org*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the ⓘ symbol.

The following versions of software and data (see references ⓘ) were used in the production of this report:

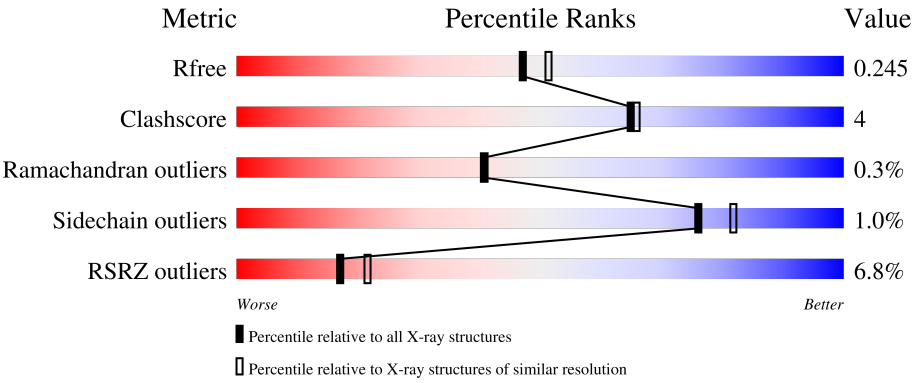
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.26
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0267
CCP4	:	7.1.010 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.26

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.10 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	5197 (2.10-2.10)
Clashscore	141614	5710 (2.10-2.10)
Ramachandran outliers	138981	5647 (2.10-2.10)
Sidechain outliers	138945	5648 (2.10-2.10)
RSRZ outliers	127900	5083 (2.10-2.10)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions <=5% The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	C	116	2% 91% 7% ·
1	D	116	9% 91% 6% ·
2	A	245	7% 87% 10% ••
2	B	245	7% 85% 12% ••

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 5712 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Nb_MsbA 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	C	113	Total	C	N	O	S	0	0	0
			849	529	149	167	4			
1	D	113	Total	C	N	O	S	0	0	0
			849	529	149	167	4			

- Molecule 2 is a protein called Lipid A ABC transporter ATP-binding protein/permease MsbA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	A	241	Total	C	N	O	S	0	0	0
			1880	1167	340	368	5			
2	B	240	Total	C	N	O	S	0	0	0
			1869	1158	339	367	5			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	339	SER	-	expression tag	UNP A0A786F4A3
A	583	ALA	-	expression tag	UNP A0A786F4A3
B	339	SER	-	expression tag	UNP A0A786F4A3
B	583	ALA	-	expression tag	UNP A0A786F4A3

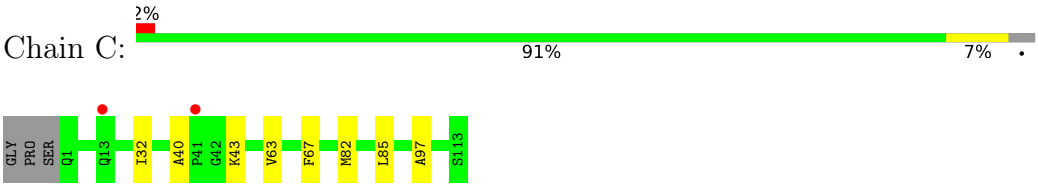
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	C	48	Total	O	0	0
			48	48		
3	D	27	Total	O	0	0
			27	27		
3	A	86	Total	O	0	0
			86	86		
3	B	104	Total	O	0	0
			104	104		

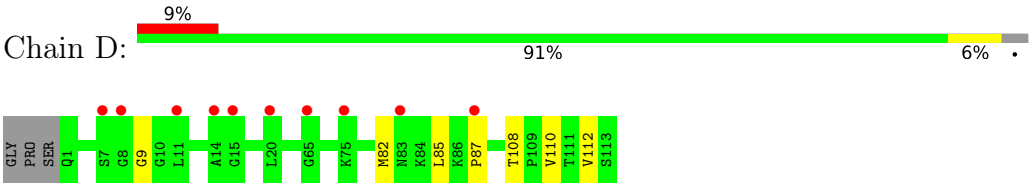
3 Residue-property plots (i)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density (RSRZ > 2). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

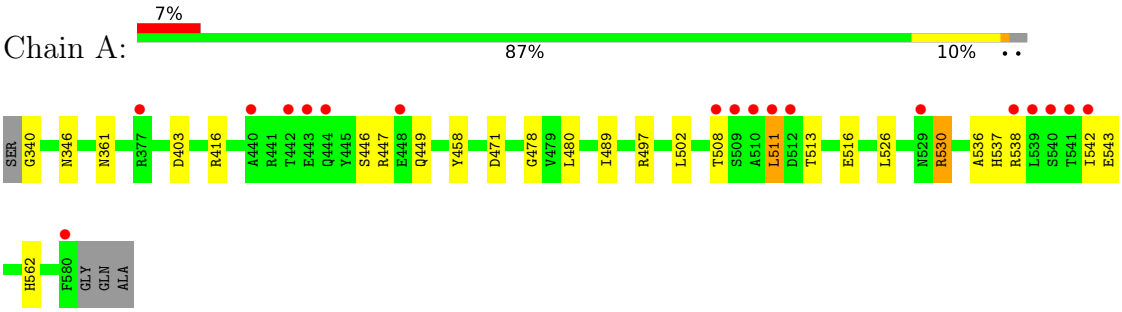
• Molecule 1: Nb_MsbA 1



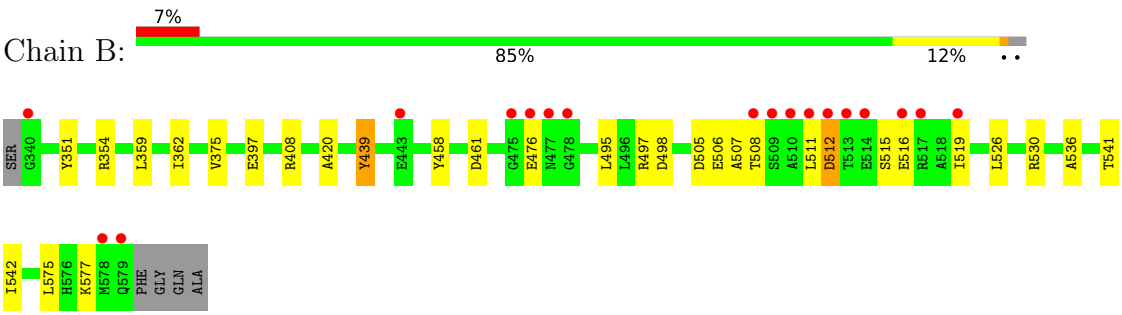
• Molecule 1: Nb_MsbA 1



• Molecule 2: Lipid A ABC transporter ATP-binding protein/permease MsbA



• Molecule 2: Lipid A ABC transporter ATP-binding protein/permease MsbA



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	63.53Å 99.30Å 142.45Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.41 – 2.10 47.41 – 2.10	Depositor EDS
% Data completeness (in resolution range)	100.0 (47.41-2.10) 100.0 (47.41-2.10)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.31 (at 2.10Å)	Xtriage
Refinement program	PHENIX 1.17.1_3660	Depositor
R, R_{free}	0.205 , 0.244 0.205 , 0.245	Depositor DCC
R_{free} test set	2670 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å^2)	36.6	Xtriage
Anisotropy	0.474	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	(Not available) , (Not available)	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	5712	wwPDB-VP
Average B, all atoms (Å^2)	51.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.44% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\#\|Z\| > 5$	RMSZ	$\#\|Z\| > 5$
1	C	0.34	0/865	0.55	0/1170
1	D	0.29	0/865	0.48	0/1170
2	A	0.31	0/1902	0.50	0/2572
2	B	0.33	0/1890	0.50	0/2556
All	All	0.32	0/5522	0.51	0/7468

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	C	849	0	839	6	0
1	D	849	0	839	3	0
2	A	1880	0	1880	17	0
2	B	1869	0	1871	22	0
3	A	86	0	0	0	0
3	B	104	0	0	3	0
3	C	48	0	0	0	0
3	D	27	0	0	0	0
All	All	5712	0	5429	45	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 4.

All (45) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:498:ASP:OD1	2:B:530:ARG:NH2	2.19	0.76
1:C:40:ALA:H	1:C:43:LYS:HE2	1.56	0.69
2:B:511:LEU:HG	2:B:516:GLU:HB3	1.80	0.64
1:C:63:VAL:HG13	1:C:67:PHE:HB2	1.78	0.63
1:C:82:MET:HE2	1:C:85:LEU:HD21	1.81	0.62
2:A:513:THR:H	2:A:516:GLU:HB3	1.65	0.60
2:B:420:ALA:HA	2:B:497:ARG:HH12	1.65	0.60
2:A:447:ARG:NH2	2:A:471:ASP:OD1	2.36	0.58
2:B:359:LEU:HB3	2:B:362:ILE:HD13	1.87	0.57
2:A:502:LEU:HB2	2:A:530:ARG:HD3	1.88	0.56
2:A:480:LEU:HD21	2:B:507:ALA:HB1	1.87	0.56
2:A:526:LEU:O	2:A:530:ARG:HD2	2.06	0.55
1:D:82:MET:HE2	1:D:85:LEU:HD21	1.88	0.55
2:A:416:ARG:O	2:A:497:ARG:NH1	2.39	0.55
2:B:351:TYR:HB2	2:B:354:ARG:HG3	1.91	0.53
1:C:32:ILE:HD12	1:C:97:ALA:HB1	1.92	0.52
2:B:375:VAL:HG12	2:B:536:ALA:HB3	1.91	0.52
2:A:511:LEU:HG	2:A:516:GLU:HB2	1.92	0.52
2:B:526:LEU:O	2:B:530:ARG:NH1	2.42	0.51
2:A:536:ALA:HB3	2:A:542:ILE:HD11	1.93	0.51
2:A:537:HIS:NE2	2:B:476:GLU:HB3	2.24	0.51
1:D:87:PRO:HA	1:D:112:VAL:HB	1.95	0.49
2:B:458:TYR:HB2	2:B:519:ILE:HD11	1.95	0.48
2:B:505:ASP:O	2:B:507:ALA:N	2.46	0.47
2:B:512:ASP:OD1	2:B:512:ASP:N	2.47	0.46
1:C:40:ALA:N	1:C:43:LYS:HE2	2.28	0.46
2:B:408:ARG:NH1	3:B:607:HOH:O	2.47	0.46
2:B:516:GLU:N	2:B:516:GLU:OE1	2.49	0.46
2:B:515:SER:O	2:B:519:ILE:HG12	2.16	0.46
2:B:461:ASP:HB3	3:B:632:HOH:O	2.16	0.45
2:A:508:THR:OG1	2:A:538:ARG:NH1	2.47	0.45
1:D:9:GLY:HA3	1:D:108:THR:HG22	1.98	0.44
2:A:543:GLU:HG2	2:A:562:HIS:CE1	2.53	0.44
2:A:542:ILE:HD13	2:A:542:ILE:HA	1.65	0.43
2:B:439:TYR:HD2	2:B:497:ARG:NE	2.17	0.42
2:A:446:SER:HB3	2:A:449:GLN:HG3	2.01	0.42
2:B:536:ALA:HB2	2:B:542:ILE:HG21	2.00	0.42
2:A:340:GLY:HA2	2:A:403:ASP:OD1	2.20	0.42
2:B:575:LEU:C	2:B:577:LYS:H	2.22	0.42
2:B:495:LEU:HD23	2:B:526:LEU:HD13	2.02	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:A:346:ASN:OD1	2:A:361:ASN:ND2	2.51	0.41
2:A:489:ILE:HD13	2:A:489:ILE:HA	1.89	0.41
1:C:40:ALA:HB3	1:C:43:LYS:HG2	2.03	0.41
2:A:478:GLY:HA2	2:B:508:THR:HA	2.04	0.40
2:B:397:GLU:OE2	3:B:601:HOH:O	2.21	0.40

There are no symmetry-related clashes.

5.3 Torsion angles (i)

5.3.1 Protein backbone (i)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	C	111/116 (96%)	108 (97%)	3 (3%)	0	100	100
1	D	111/116 (96%)	109 (98%)	2 (2%)	0	100	100
2	A	239/245 (98%)	231 (97%)	8 (3%)	0	100	100
2	B	238/245 (97%)	231 (97%)	5 (2%)	2 (1%)	19	15
All	All	699/722 (97%)	679 (97%)	18 (3%)	2 (0%)	41	41

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	506	GLU
2	B	512	ASP

5.3.2 Protein sidechains (i)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was

analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	C	90/92 (98%)	90 (100%)	0	100 100
1	D	90/92 (98%)	89 (99%)	1 (1%)	73 79
2	A	201/203 (99%)	198 (98%)	3 (2%)	65 71
2	B	200/203 (98%)	198 (99%)	2 (1%)	76 82
All	All	581/590 (98%)	575 (99%)	6 (1%)	76 82

All (6) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	110	VAL
2	A	458	TYR
2	A	511	LEU
2	A	530	ARG
2	B	439	TYR
2	B	541	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA (i)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains (i)

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates (i)

There are no monosaccharides in this entry.

5.6 Ligand geometry (i)

There are no ligands in this entry.

5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95^{th} percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled 'Q< 0.9' lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2			OWAB(Å^2)	Q<0.9
1	C	113/116 (97%)	-0.03	2 (1%)	68	72	28, 43, 71, 79	0
1	D	113/116 (97%)	0.48	10 (8%)	10	12	38, 63, 93, 103	0
2	A	241/245 (98%)	0.13	18 (7%)	14	18	28, 44, 83, 114	0
2	B	240/245 (97%)	0.33	18 (7%)	14	18	27, 40, 108, 133	0
All	All	707/722 (97%)	0.23	48 (6%)	17	21	27, 46, 88, 133	0

All (48) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	510	ALA	7.4
2	B	509	SER	6.8
2	B	508	THR	6.5
2	B	477	ASN	6.5
2	B	511	LEU	5.3
2	B	514	GLU	4.9
2	B	513	THR	4.7
2	B	517	ARG	4.2
2	A	510	ALA	4.2
2	B	579	GLN	4.1
2	B	476	GLU	4.1
2	A	540	SER	4.0
2	A	442	THR	4.0
2	B	516	GLU	3.8
2	A	443	GLU	3.7
2	A	508	THR	3.7
2	A	529	ASN	3.7
1	D	8	GLY	3.6
2	A	511	LEU	3.6
1	D	14	ALA	3.5
1	D	87	PRO	3.5

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Mol	Chain	Res	Type	RSRZ
2	A	538	ARG	3.3
1	D	65	GLY	3.2
2	A	377	ARG	3.2
2	A	580	PHE	3.2
2	A	512	ASP	2.9
2	A	448	GLU	2.9
2	A	444	GLN	2.8
2	B	443	GLU	2.8
1	D	83	ASN	2.7
1	D	15	GLY	2.6
2	B	512	ASP	2.5
1	D	11	LEU	2.5
2	A	541	THR	2.5
2	A	539	LEU	2.4
2	A	542	ILE	2.4
2	B	478	GLY	2.4
2	A	440	ALA	2.3
1	C	41	PRO	2.2
1	C	13	GLN	2.2
1	D	7	SER	2.2
2	B	519	ILE	2.1
1	D	20	LEU	2.1
2	A	509	SER	2.1
2	B	578	MET	2.1
2	B	340	GLY	2.1
1	D	75	LYS	2.0
2	B	475	GLY	2.0

6.2 Non-standard residues in protein, DNA, RNA chains (i)

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates (i)

There are no monosaccharides in this entry.

6.4 Ligands (i)

There are no ligands in this entry.

6.5 Other polymers (i)

There are no such residues in this entry.