wwPDB X-ray Structure Validation Summary Report (i)

May 28, 2020 – 09:29 pm BST

PDB ID	:	2BNL
Title	:	The structure of the N-terminal domain of RsbR
Authors	:	Murray, J.W.; Delumeau, O.; Lewis, R.J.
Deposited on	:	2005-03-28
Resolution	:	2.00 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 (i) symbol.

The following versions of software and data (see references (1)) were used in the production of this report:

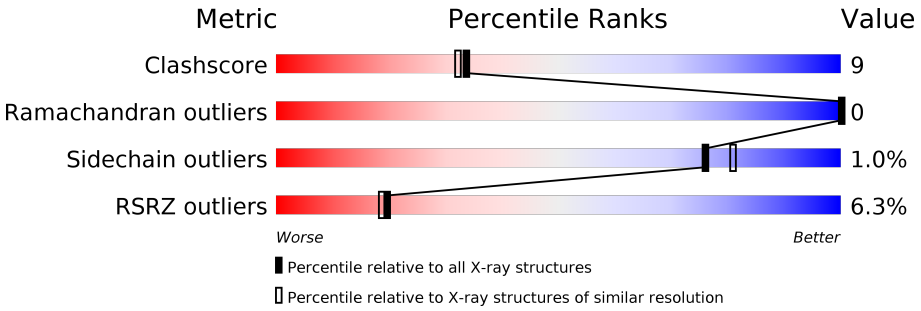
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.11
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

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 2.00 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))
Clashscore	141614	9178 (2.00-2.00)
Ramachandran outliers	138981	9054 (2.00-2.00)
Sidechain outliers	138945	9053 (2.00-2.00)
RSRZ outliers	127900	7900 (2.00-2.00)

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 on 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	A	136	5% 82% 9% • 5%
1	B	136	6% 79% 11% • 6%
1	C	136	6% 85% 11% • •
1	D	136	4% 71% 19% • • 5%
1	E	136	8% 78% 13% • 5%
1	F	136	7% 80% 11% • 5%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 7278 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 MODULATOR PROTEIN RSBR.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	129	Total	C	N	O	Se	0	0	0
			1075	689	168	216	2			
1	B	128	Total	C	N	O	Se	0	0	0
			1066	683	166	215	2			
1	C	134	Total	C	N	O	Se	0	0	0
			1118	715	177	224	2			
1	D	129	Total	C	N	O	Se	0	0	0
			1075	689	168	216	2			
1	E	129	Total	C	N	O	Se	0	0	0
			1075	689	168	216	2			
1	F	129	Total	C	N	O	Se	0	0	0
			1075	689	168	216	2			

- Molecule 2 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	B	1	Total	Na	0	0
			1	1		
2	C	1	Total	Na	0	0
			1	1		
2	F	1	Total	Na	0	0
			1	1		

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	127	Total	O	0	0
			127	127		
3	B	133	Total	O	0	0
			133	133		
3	C	134	Total	O	0	0
			134	134		

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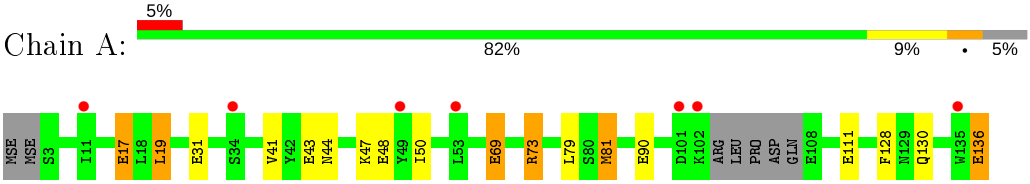
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	D	145	Total O 145 145	0	0
3	E	113	Total O 113 113	0	0
3	F	139	Total O 139 139	0	0

3 Residue-property plots (i)

These plots are drawn for all protein, RNA and DNA 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.

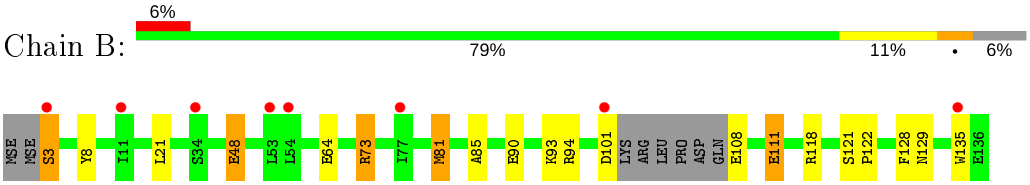
- Molecule 1: MODULATOR PROTEIN RSBR

Chain A:



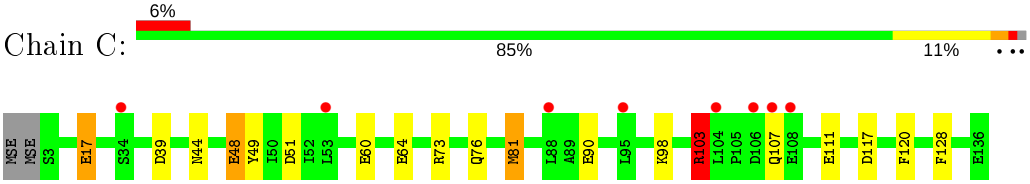
- Molecule 1: MODULATOR PROTEIN RSBR

Chain B:



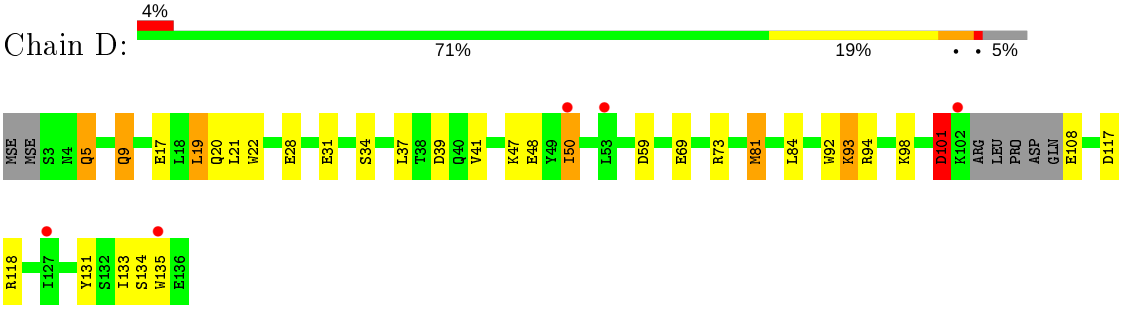
- Molecule 1: MODULATOR PROTEIN RSBR

Chain C:



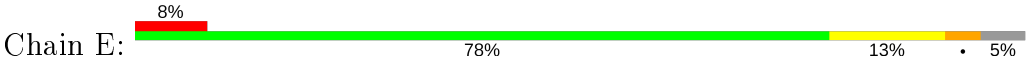
- Molecule 1: MODULATOR PROTEIN RSBR

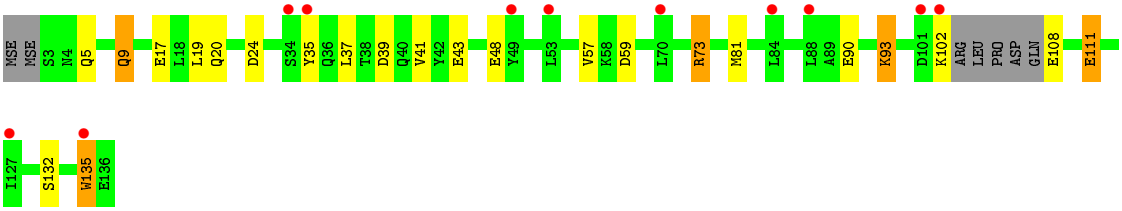
Chain D:



- Molecule 1: MODULATOR PROTEIN RSBR

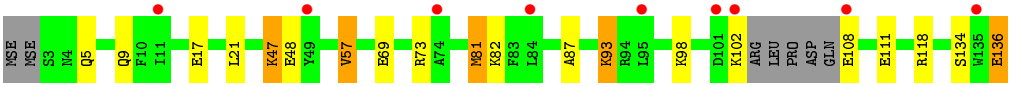
Chain E:





- Molecule 1: MODULATOR PROTEIN RSBR

Chain F:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 32 1 2	Depositor
Cell constants a, b, c, α, β, γ	136.06Å 136.06Å 113.30Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	22.24 – 2.00 22.24 – 2.00	Depositor EDS
% Data completeness (in resolution range)	99.9 (22.24-2.00) 99.9 (22.24-2.00)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	3.79 (at 2.01Å)	Xtriage
Refinement program	REFMAC 5.2.0005	Depositor
R, R_{free}	0.154 , 0.198 0.168 , (Not available)	Depositor DCC
R_{free} test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å^2)	30.6	Xtriage
Anisotropy	0.455	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.38 , 53.6	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	0.029 for -h,-k,l	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	7278	wwPDB-VP
Average B, all atoms (Å^2)	37.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 30.10 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 1.3838e-03. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

[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

Bond lengths and bond angles in the following residue types are not validated in this section: NA

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	A	1.57	16/1092 (1.5%)	1.07	5/1475 (0.3%)
1	B	1.55	15/1083 (1.4%)	1.02	1/1464 (0.1%)
1	C	1.54	10/1137 (0.9%)	1.08	3/1538 (0.2%)
1	D	1.67	18/1092 (1.6%)	1.21	8/1475 (0.5%)
1	E	1.45	13/1092 (1.2%)	1.11	8/1475 (0.5%)
1	F	1.59	13/1092 (1.2%)	1.11	3/1475 (0.2%)
All	All	1.56	85/6588 (1.3%)	1.10	28/8902 (0.3%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand.A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	D	0	1

The worst 5 of 85 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	81	MSE	SE-CE	-11.69	1.26	1.95
1	F	81	MSE	SE-CE	-11.51	1.27	1.95
1	C	48	GLU	CD-OE1	11.33	1.38	1.25
1	A	81	MSE	SE-CE	-10.66	1.32	1.95
1	B	81	MSE	SE-CE	-9.85	1.37	1.95

The worst 5 of 28 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	D	93	LYS	CD-CE-NZ	12.62	140.72	111.70
1	F	118	ARG	NE-CZ-NH1	10.60	125.60	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	E	59	ASP	CB-CG-OD1	10.27	127.54	118.30
1	F	81	MSE	CG-SE-CE	-9.13	78.82	98.90
1	E	73	ARG	NE-CZ-NH1	-8.09	116.26	120.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	D	101	ASP	Peptide

5.2 Too-close contacts (i)

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	A	1075	0	1043	25	0
1	B	1066	0	1029	17	0
1	C	1118	0	1086	15	0
1	D	1075	0	1043	23	0
1	E	1075	0	1043	11	0
1	F	1075	0	1042	30	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0
2	F	1	0	0	0	0
3	A	127	0	0	5	0
3	B	133	0	0	1	0
3	C	134	0	0	5	0
3	D	145	0	0	6	1
3	E	113	0	0	3	0
3	F	139	0	0	6	1
All	All	7278	0	6286	109	1

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 9.

The worst 5 of 109 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)
1:E:93:LYS:NZ	1:E:93:LYS:CE	1.68	1.55
1:D:93:LYS:CD	1:D:93:LYS:CG	1.74	1.54
1:F:93:LYS:NZ	1:F:93:LYS:CE	1.68	1.54
1:A:81:MSE:CE	1:A:81:MSE:SE	1.32	1.51
1:D:93:LYS:NZ	1:D:93:LYS:CE	1.73	1.51

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:D:2086:HOH:O	3:F:2063:HOH:O[2_664]	2.07	0.13

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	A	125/136 (92%)	123 (98%)	2 (2%)	0	100	100
1	B	124/136 (91%)	120 (97%)	4 (3%)	0	100	100
1	C	132/136 (97%)	130 (98%)	2 (2%)	0	100	100
1	D	125/136 (92%)	124 (99%)	1 (1%)	0	100	100
1	E	125/136 (92%)	122 (98%)	3 (2%)	0	100	100
1	F	125/136 (92%)	124 (99%)	1 (1%)	0	100	100
All	All	756/816 (93%)	743 (98%)	13 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	A	120/123 (98%)	120 (100%)	0	100 100
1	B	119/123 (97%)	117 (98%)	2 (2%)	60 65
1	C	125/123 (102%)	124 (99%)	1 (1%)	81 86
1	D	120/123 (98%)	118 (98%)	2 (2%)	60 65
1	E	120/123 (98%)	119 (99%)	1 (1%)	81 86
1	F	120/123 (98%)	119 (99%)	1 (1%)	81 86
All	All	724/738 (98%)	717 (99%)	7 (1%)	76 81

5 of 7 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	34	SER
1	F	47	LYS
1	D	81	MSE
1	B	111	GLU
1	E	102	LYS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	76	GLN
1	B	129	ASN
1	D	9	GLN

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 carbohydrates in this entry.

5.6 Ligand geometry

Of 3 ligands modelled in this entry, 3 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.7 Other polymers

There are no such residues in this entry.

5.8 Polymer linkage issues

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	A	127/136 (93%)	0.25	7 (5%)	25	24	27, 34, 47, 65	0
1	B	126/136 (92%)	0.29	8 (6%)	20	19	29, 35, 47, 60	0
1	C	132/136 (97%)	0.19	8 (6%)	21	20	27, 34, 47, 53	0
1	D	127/136 (93%)	0.19	5 (3%)	39	38	27, 32, 46, 63	0
1	E	127/136 (93%)	0.35	11 (8%)	10	9	28, 35, 48, 64	0
1	F	127/136 (93%)	0.24	9 (7%)	16	15	28, 33, 45, 62	0
All	All	766/816 (93%)	0.25	48 (6%)	20	19	27, 34, 47, 65	0

The worst 5 of 48 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	E	35	TYR	4.8
1	C	34	SER	4.4
1	E	34	SER	4.4
1	B	101	ASP	4.3
1	F	101	ASP	4.1

6.2 Non-standard residues in protein, DNA, RNA chains

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

6.3 Carbohydrates

There are no carbohydrates in this entry.

6.4 Ligands

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	NA	C	1137	1/1	0.96	0.29	33,33,33,33	0
2	NA	F	1137	1/1	0.97	0.32	39,39,39,39	0
2	NA	B	1137	1/1	0.98	0.24	36,36,36,36	0

6.5 Other polymers

There are no such residues in this entry.