W O R L D W I D E
wwPDB
P R O T E I N   D A T A   B A N K

wwPDB X-ray Structure Validation Summary Report (i)

Mar 6, 2024 – 10:11 PM EST

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PDB ID	:	3NDB
Title	:	Crystal structure of a signal sequence bound to the signal recognition particle
Authors	:	Hainzl, T.; Huang, S.; Sauer-Eriksson, E.
Deposited on	:	2010-06-07
Resolution	:	3.00 Å(reported)

1 Overall quality at a glance ⓘ

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

The reported resolution of this entry is 3.00 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.
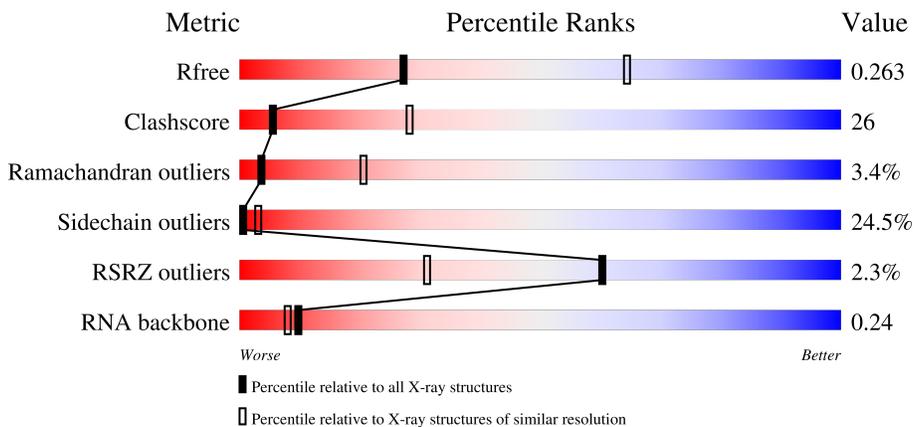
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	2092 (3.00-3.00)
Clashscore	141614	2416 (3.00-3.00)
Ramachandran outliers	138981	2333 (3.00-3.00)
Sidechain outliers	138945	2336 (3.00-3.00)
RSRZ outliers	127900	1990 (3.00-3.00)
RNA backbone	3102	1173 (3.30-2.70)

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	A	87	% 44% 44% 13%
2	B	454	2% 40% 41% 12% 7%
3	M	136	2% 13% 32% 29% 26%

2 Entry composition ⓘ

There are 4 unique types of molecules in this entry. The entry contains 6926 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 Signal recognition particle 19 kDa protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	87	Total	C	N	O	S	0	0	0
			727	468	130	125	4			

- Molecule 2 is a protein called Signal recognition 54 kDa protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	420	Total	C	N	O	S	0	0	0
			3273	2084	561	618	10			

There are 25 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	2	MET	-	insertion	UNP Q57565
B	432	SER	-	expression tag	UNP Q57565
B	433	GLY	-	expression tag	UNP Q57565
B	434	SER	-	expression tag	UNP Q57565
B	435	GLY	-	expression tag	UNP Q57565
B	436	GLY	-	expression tag	UNP Q57565
B	437	SER	-	expression tag	UNP Q57565
B	438	GLY	-	expression tag	UNP Q57565
B	439	SER	-	expression tag	UNP Q57565
B	440	GLY	-	expression tag	UNP Q57565
B	441	LYS	-	expression tag	UNP Q57565
B	442	LEU	-	expression tag	UNP Q57565
B	443	ALA	-	expression tag	UNP Q57565
B	444	LEU	-	expression tag	UNP Q57565
B	445	ALA	-	expression tag	UNP Q57565
B	446	LEU	-	expression tag	UNP Q57565
B	447	LEU	-	expression tag	UNP Q57565
B	448	LEU	-	expression tag	UNP Q57565
B	449	LEU	-	expression tag	UNP Q57565
B	450	LEU	-	expression tag	UNP Q57565

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Chain	Residue	Modelled	Actual	Comment	Reference
B	451	LEU	-	expression tag	UNP Q57565
B	452	ALA	-	expression tag	UNP Q57565
B	453	LEU	-	expression tag	UNP Q57565
B	454	ALA	-	expression tag	UNP Q57565
B	455	LEU	-	expression tag	UNP Q57565

- Molecule 3 is a RNA chain called SRP RNA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
3	M	136	2921	1299	538	949	135	0	0	0

- Molecule 4 is PHOSPHATE ION (three-letter code: PO4) (formula: O_4P).
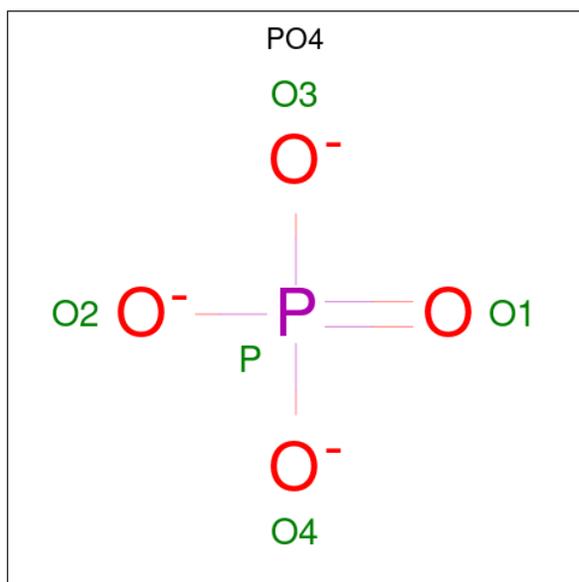
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	O	P		
4	B	1	5	4	1	0	0

3 Residue-property plots ⓘ

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: Signal recognition particle 19 kDa protein

Chain A:

• Molecule 2: Signal recognition 54 kDa protein

Chain B:

• Molecule 3: SRP RNA

Chain M:

4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	I 2 2 2	Depositor
Cell constants a, b, c, α, β, γ	108.83Å 126.28Å 201.76Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	20.00 – 3.00 19.92 – 3.00	Depositor EDS
% Data completeness (in resolution range)	98.4 (20.00-3.00) 98.4 (19.92-3.00)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	0.09	Depositor
$< I/\sigma(I) >$ [1]	1.80 (at 2.98Å)	Xtriage
Refinement program	REFMAC 5.5.0109	Depositor
R, R_{free}	0.228 , 0.267 0.233 , 0.263	Depositor DCC
R_{free} test set	1385 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å^2)	93.3	Xtriage
Anisotropy	0.213	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.27 , 49.0	EDS
L-test for twinning[2]	$< |L| > = 0.46, < L^2 > = 0.29$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.93	EDS
Total number of atoms	6926	wwPDB-VP
Average B, all atoms (Å^2)	99.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.98% of the height of the origin peak. No significant pseudotranslation is detected.*

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[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.

WORLDWIDE
wwPDB
PROTEIN DATA BANK

5 Model quality ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: PO4

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	0.73	0/740	0.84	0/984
2	B	0.71	0/3299	0.93	4/4411 (0.1%)
3	M	1.15	2/3267 (0.1%)	2.05	155/5099 (3.0%)
All	All	0.94	2/7306 (0.0%)	1.57	159/10494 (1.5%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	M	245	C	N1-C2	-5.30	1.34	1.40
3	M	215	G	N3-C4	5.11	1.39	1.35

The worst 5 of 159 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(º)	Ideal(º)
3	M	193	G	P-O3'-C3'	13.48	135.88	119.70
3	M	186	A	C1'-O4'-C4'	-13.37	99.20	109.90
3	M	236	C	N1-C1'-C2'	-12.18	98.17	114.00
3	M	130	C	O4'-C1'-N1	10.53	116.62	108.20
3	M	130	C	C4'-C3'-C2'	-9.31	93.29	102.60

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	A	727	0	786	37	0
2	B	3273	0	3522	196	0
3	M	2921	0	1478	98	0
4	B	5	0	0	0	0
All	All	6926	0	5786	323	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 26.

The worst 5 of 323 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:412:GLU:HG2	2:B:415:ARG:NH2	1.52	1.24
2:B:176:MET:SD	2:B:210:THR:CG2	2.37	1.11
2:B:166:LYS:HB3	2:B:171:ILE:HG21	1.24	1.11
2:B:196:GLU:O	2:B:197:LYS:HG3	1.50	1.11
2:B:164:ARG:O	2:B:164:ARG:HG2	1.44	1.09

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	85/87 (98%)	77 (91%)	6 (7%)	2 (2%)	6	29
2	B	414/454 (91%)	338 (82%)	61 (15%)	15 (4%)	3	19
All	All	499/541 (92%)	415 (83%)	67 (13%)	17 (3%)	3	20

5 of 17 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	24	LYS

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Mol	Chain	Res	Type
2	B	211	ASN
2	B	88	GLU
2	B	181	LYS
2	B	182	ALA

5.3.2 Protein sidechains ⓘ

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	80/80 (100%)	58 (72%)	22 (28%)	0	2
2	B	352/376 (94%)	268 (76%)	84 (24%)	0	3
All	All	432/456 (95%)	326 (76%)	106 (24%)	0	3

5 of 106 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	B	152	GLU
2	B	197	LYS
2	B	411	ARG
2	B	163	THR
2	B	183	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 6 such sidechains are listed below:

Mol	Chain	Res	Type
2	B	230	GLN
2	B	329	ASN
2	B	387	ASN
2	B	101	ASN
2	B	73	HIS

5.3.3 RNA ⓘ

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
3	M	135/136 (99%)	68 (50%)	14 (10%)

5 of 68 RNA backbone outliers are listed below:

Mol	Chain	Res	Type
3	M	125	C
3	M	127	C
3	M	130	C
3	M	131	C
3	M	132	C

5 of 14 RNA pucker outliers are listed below:

Mol	Chain	Res	Type
3	M	195	A
3	M	223	G
3	M	256	G
3	M	251	U
3	M	255	G

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

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

5.5   Carbohydrates ⓘ

There are no monosaccharides in this entry.

5.6   Ligand geometry ⓘ

1 ligand is modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	#$|Z|$ > 2	Counts	RMSZ	#$|Z|$ > 2
4	PO4	B	501	-	4,4,4	0.85	0	6,6,6	1.30	2 (33%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	B	501	PO4	O3-P-O2	-2.32	100.54	107.97
4	B	501	PO4	O4-P-O2	2.18	114.97	107.97

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, 95th 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	87/87 (100%)	-0.18	1 (1%)	80	56	54, 84, 112, 144	0
2	B	420/454 (92%)	-0.01	11 (2%)	56	27	44, 86, 144, 213	0
3	M	136/136 (100%)	-0.07	3 (2%)	62	33	44, 92, 216, 235	0
All	All	643/677 (94%)	-0.05	15 (2%)	60	31	44, 87, 185, 235	0

The worst 5 of 15 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	455	LEU	5.6
2	B	365	LEU	5.2
2	B	341	MET	4.2
1	A	87	ASN	3.7
3	M	128	G	3.6

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 monosaccharides 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, 95th 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(Å²)	Q<0.9
4	PO4	B	501	5/5	0.96	0.11	55,57,59,60	0

6.5 Other polymers ⓘ

There are no such residues in this entry.