



Full wwPDB X-ray Structure Validation Report ⓘ

Feb 1, 2016 – 07:04 PM GMT

PDB ID : 4NOI
Title : 2.17 Angstrom Crystal Structure of DNA-directed RNA Polymerase Subunit Alpha from Campylobacter jejuni.
Authors : Minasov, G.; Shuvalova, L.; Dubrovskaya, I.; Winsor, J.; Grimshaw, S.; Kwon, K.; Anderson, W.F.; Center for Structural Genomics of Infectious Diseases (CSGID)
Deposited on : 2013-11-19
Resolution : 2.17 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
<http://wwpdb.org/validation/2016/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
Mogul : 1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix) : 1.9-1692
EDS : rb-20026688
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac : 5.8.0135
CCP4 : 6.5.0
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : trunk26865

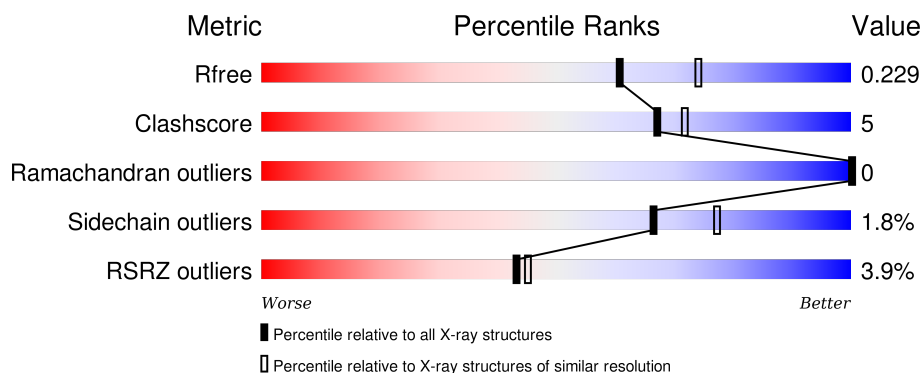
1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.17 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}	91344	5130 (2.20-2.16)
Clashscore	102246	5965 (2.20-2.16)
Ramachandran outliers	100387	5863 (2.20-2.16)
Sidechain outliers	100360	5864 (2.20-2.16)
RSRZ outliers	91569	5142 (2.20-2.16)

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. 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 $\leq 5\%$. 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	361	<div> <div>3%</div> <div>56%</div> <div>7%</div> <div>37%</div> </div>
1	B	361	<div> <div>2%</div> <div>55%</div> <div>6%</div> <div>39%</div> </div>

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
4	CL	A	410[A]	-	-	-	X
4	CL	A	410[B]	-	-	-	X

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 3856 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 DNA-directed RNA polymerase subunit alpha.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	227	Total	C	N	O	Se	0	3	0
			1833	1185	286	359	3			
1	B	219	Total	C	N	O	Se	0	4	0
			1779	1152	277	344	6			

There are 48 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-23	MSE	-	EXPRESSION TAG	UNP Q9PM80
A	-22	HIS	-	EXPRESSION TAG	UNP Q9PM80
A	-21	HIS	-	EXPRESSION TAG	UNP Q9PM80
A	-20	HIS	-	EXPRESSION TAG	UNP Q9PM80
A	-19	HIS	-	EXPRESSION TAG	UNP Q9PM80
A	-18	HIS	-	EXPRESSION TAG	UNP Q9PM80
A	-17	HIS	-	EXPRESSION TAG	UNP Q9PM80
A	-16	SER	-	EXPRESSION TAG	UNP Q9PM80
A	-15	SER	-	EXPRESSION TAG	UNP Q9PM80
A	-14	GLY	-	EXPRESSION TAG	UNP Q9PM80
A	-13	VAL	-	EXPRESSION TAG	UNP Q9PM80
A	-12	ASP	-	EXPRESSION TAG	UNP Q9PM80
A	-11	LEU	-	EXPRESSION TAG	UNP Q9PM80
A	-10	GLY	-	EXPRESSION TAG	UNP Q9PM80
A	-9	THR	-	EXPRESSION TAG	UNP Q9PM80
A	-8	GLU	-	EXPRESSION TAG	UNP Q9PM80
A	-7	ASN	-	EXPRESSION TAG	UNP Q9PM80
A	-6	LEU	-	EXPRESSION TAG	UNP Q9PM80
A	-5	TYR	-	EXPRESSION TAG	UNP Q9PM80
A	-4	PHE	-	EXPRESSION TAG	UNP Q9PM80
A	-3	GLN	-	EXPRESSION TAG	UNP Q9PM80
A	-2	SER	-	EXPRESSION TAG	UNP Q9PM80
A	-1	ASN	-	EXPRESSION TAG	UNP Q9PM80
A	0	ALA	-	EXPRESSION TAG	UNP Q9PM80
B	-23	MSE	-	EXPRESSION TAG	UNP Q9PM80

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Chain	Residue	Modelled	Actual	Comment	Reference
B	-22	HIS	-	EXPRESSION TAG	UNP Q9PM80
B	-21	HIS	-	EXPRESSION TAG	UNP Q9PM80
B	-20	HIS	-	EXPRESSION TAG	UNP Q9PM80
B	-19	HIS	-	EXPRESSION TAG	UNP Q9PM80
B	-18	HIS	-	EXPRESSION TAG	UNP Q9PM80
B	-17	HIS	-	EXPRESSION TAG	UNP Q9PM80
B	-16	SER	-	EXPRESSION TAG	UNP Q9PM80
B	-15	SER	-	EXPRESSION TAG	UNP Q9PM80
B	-14	GLY	-	EXPRESSION TAG	UNP Q9PM80
B	-13	VAL	-	EXPRESSION TAG	UNP Q9PM80
B	-12	ASP	-	EXPRESSION TAG	UNP Q9PM80
B	-11	LEU	-	EXPRESSION TAG	UNP Q9PM80
B	-10	GLY	-	EXPRESSION TAG	UNP Q9PM80
B	-9	THR	-	EXPRESSION TAG	UNP Q9PM80
B	-8	GLU	-	EXPRESSION TAG	UNP Q9PM80
B	-7	ASN	-	EXPRESSION TAG	UNP Q9PM80
B	-6	LEU	-	EXPRESSION TAG	UNP Q9PM80
B	-5	TYR	-	EXPRESSION TAG	UNP Q9PM80
B	-4	PHE	-	EXPRESSION TAG	UNP Q9PM80
B	-3	GLN	-	EXPRESSION TAG	UNP Q9PM80
B	-2	SER	-	EXPRESSION TAG	UNP Q9PM80
B	-1	ASN	-	EXPRESSION TAG	UNP Q9PM80
B	0	ALA	-	EXPRESSION TAG	UNP Q9PM80

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

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total Na 1 1	0	0

- Molecule 3 is IODIDE ION (three-letter code: IOD) (formula: I).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	B	1	Total I 1 1	0	0
3	A	3	Total I 3 3	0	0

- Molecule 4 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	5	Total 5	Cl 5	0	0
4	A	7	Total 9	Cl 9	0	2

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	101	Total 106	O 106	0	5
5	B	116	Total 119	O 119	0	3

4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	99.17Å 62.74Å 93.62Å 90.00° 112.52° 90.00°	Depositor
Resolution (Å)	29.49 – 2.17 29.49 – 2.17	Depositor EDS
% Data completeness (in resolution range)	98.5 (29.49-2.17) 98.5 (29.49-2.17)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	0.08	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.09 (at 2.18Å)	Xtriage
Refinement program	REFMAC 5.8.0046	Depositor
R, R_{free}	0.174 , 0.225 0.181 , 0.229	Depositor DCC
R_{free} test set	1407 reflections (5.32%)	DCC
Wilson B-factor (Å ²)	42.8	Xtriage
Anisotropy	0.236	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 43.9	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Outliers	1 of 27836 reflections (0.004%)	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	3856	wwPDB-VP
Average B, all atoms (Å ²)	49.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.14% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.375 respectively for untwinned datasets, and 0.333, 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, IOD, CL

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	0.55	0/1867	0.72	0/2528
1	B	0.63	0/1811	0.76	0/2446
All	All	0.59	0/3678	0.74	0/4974

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	A	1833	0	1822	17	0
1	B	1779	0	1778	19	0
2	A	1	0	0	0	0
3	A	3	0	0	0	0
3	B	1	0	0	0	0
4	A	9	0	0	0	0
4	B	5	0	0	0	0
5	A	106	0	0	0	0
5	B	119	0	0	4	0
All	All	3856	0	3600	35	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 5.

All (35) 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:A:108:SER:HB2	1:A:135:GLU:HG3	1.71	0.71
1:B:74[A]:MSE:SE	1:B:133:ILE:HG12	2.41	0.70
1:A:51:THR:HG21	1:A:207:ILE:HD13	1.78	0.66
1:A:61[A]:ILE:HD13	1:A:141:PHE:CB	2.39	0.53
1:B:151:TYR:HD1	1:B:172:PHE:CD1	2.27	0.52
1:A:229:LYS:O	1:A:230:ILE:C	2.49	0.51
1:A:98:LYS:HE2	1:A:100:ILE:HD11	1.93	0.50
1:A:106:LYS:HG2	1:A:107:GLY:H	1.76	0.50
1:B:74[A]:MSE:HE3	1:B:132:THR:O	2.12	0.50
1:B:101:VAL:HG13	1:B:118:ASN:HD21	1.77	0.49
1:A:51:THR:HG21	1:A:207:ILE:CD1	2.43	0.49
1:B:181:TYR:HB3	1:B:199:LEU:HD23	1.95	0.48
1:B:186:VAL:HG22	5:B:561:HOH:O	2.13	0.48
1:B:151:TYR:CE1	1:B:172:PHE:CE1	3.01	0.48
1:A:101:VAL:CG1	1:A:118:ASN:HD21	2.27	0.47
1:B:151:TYR:CD1	1:B:172:PHE:CD1	3.03	0.47
1:B:108:SER:OG	1:B:135:GLU:HG3	2.14	0.46
1:B:74[A]:MSE:SE	1:B:139:LEU:HD22	2.66	0.46
1:A:61[A]:ILE:HD13	1:A:141:PHE:HB2	1.98	0.45
1:A:61[A]:ILE:HD13	1:A:141:PHE:HB3	1.98	0.45
1:B:151:TYR:CD1	1:B:172:PHE:CE1	3.04	0.45
1:B:108:SER:OG	1:B:135:GLU:CG	2.65	0.45
1:A:222:LYS:HE2	1:B:10:THR:HG21	1.98	0.45
1:A:208:THR:OG1	1:A:211:GLU:HG3	2.17	0.45
1:B:101:VAL:CG1	1:B:118:ASN:HD21	2.31	0.44
1:B:67:GLU:HG3	5:B:526:HOH:O	2.18	0.43
1:B:14:PHE:HA	1:B:27:SER:O	2.19	0.43
1:B:67:GLU:HG3	5:B:592:HOH:O	2.19	0.43
1:A:11:PRO:HG3	1:A:31:PHE:CE1	2.54	0.43
1:B:67:GLU:CG	5:B:526:HOH:O	2.68	0.41
1:A:119:ASP:N	1:A:119:ASP:OD1	2.53	0.41
1:B:41:HIS:CD2	1:B:181:TYR:HH	2.38	0.41
1:A:155:GLU:H	1:A:155:GLU:CD	2.24	0.41
1:A:61[A]:ILE:HB	1:A:64:VAL:HB	2.02	0.40
1:A:29:TRP:HB2	1:A:30:PRO:HA	2.03	0.40

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	228/361 (63%)	221 (97%)	7 (3%)	0	100	100
1	B	219/361 (61%)	216 (99%)	3 (1%)	0	100	100
All	All	447/722 (62%)	437 (98%)	10 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	202/309 (65%)	199 (98%)	3 (2%)	72	82
1	B	196/309 (63%)	190 (97%)	6 (3%)	47	56
All	All	398/618 (64%)	389 (98%)	9 (2%)	66	69

All (9) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	62	ASP
1	A	119	ASP
1	A	185	LYS
1	B	71[A]	MSE
1	B	71[B]	MSE
1	B	74[A]	MSE
1	B	74[B]	MSE
1	B	106	LYS

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Mol	Chain	Res	Type
1	B	177	ARG

Some 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 carbohydrates in this entry.

5.6 Ligand geometry [i](#)

Of 19 ligands modelled in this entry, 19 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 [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, 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	224/361 (62%)	0.10	10 (4%) 37 39	36, 49, 75, 106	0
1	B	216/361 (59%)	0.00	7 (3%) 51 53	28, 42, 75, 104	0
All	All	440/722 (60%)	0.05	17 (3%) 43 45	28, 46, 77, 106	0

All (17) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	136	ASP	5.0
1	B	136	ASP	4.5
1	B	192	PRO	4.2
1	B	187	LEU	3.9
1	A	19	ILE	3.2
1	A	229	LYS	2.9
1	B	72	ARG	2.9
1	A	107	GLY	2.7
1	A	95	ASP	2.7
1	A	160	LEU	2.3
1	B	73	GLY	2.3
1	B	159	GLU	2.2
1	A	138	GLU	2.2
1	A	230	ILE	2.2
1	A	5	THR	2.1
1	A	52	ILE	2.1
1	B	9	TYR	2.0

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 [i](#)

There are no carbohydrates in this entry.

6.4 Ligands [i](#)

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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	LLDF	B-factors(Å ²)	Q<0.9
4	CL	A	410[B]	1/1	0.98	0.18	8.50	37,37,37,37	1
4	CL	A	410[A]	1/1	0.98	0.18	6.69	35,35,35,35	1
4	CL	A	405	1/1	0.91	0.20	1.49	66,66,66,66	0
3	IOD	A	403	1/1	0.96	0.04	-2.80	68,68,68,68	1
4	CL	A	408	1/1	0.98	0.06	-4.12	58,58,58,58	0
3	IOD	A	402	1/1	0.99	0.09	-4.26	51,51,51,51	0
4	CL	B	403	1/1	0.91	0.07	-	60,60,60,60	0
4	CL	B	405	1/1	0.95	0.06	-	50,50,50,50	0
4	CL	A	406	1/1	0.97	0.17	-	55,55,55,55	0
3	IOD	B	401	1/1	0.99	0.09	-	50,50,50,50	1
4	CL	A	407	1/1	0.97	0.06	-	52,52,52,52	0
2	NA	A	401	1/1	0.98	0.09	-	53,53,53,53	0
4	CL	A	409	1/1	0.96	0.08	-	62,62,62,62	0
4	CL	B	402	1/1	0.92	0.18	-	51,51,51,51	0
4	CL	A	411[A]	1/1	0.88	0.10	-	55,55,55,55	1
4	CL	A	411[B]	1/1	0.88	0.10	-	63,63,63,63	1
3	IOD	A	404	1/1	0.98	0.04	-	62,62,62,62	1
4	CL	B	404	1/1	0.98	0.05	-	51,51,51,51	0
4	CL	B	406	1/1	0.94	0.07	-	57,57,57,57	0

6.5 Other polymers [i](#)

There are no such residues in this entry.