



Full wwPDB X-ray Structure Validation Report ⓘ

Feb 28, 2014 – 02:48 PM GMT

PDB ID : 3N4M
Title : E. coli RNA polymerase alpha subunit C-terminal domain in complex with CAP and DNA
Authors : Lara-Gonzalez, S.; Birktoft, J.J.; Lawson, C.L.
Deposited on : 2010-05-21
Resolution : 2.99 Å(reported)

This is a full wwPDB 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/ValidationPDFNotes.html>

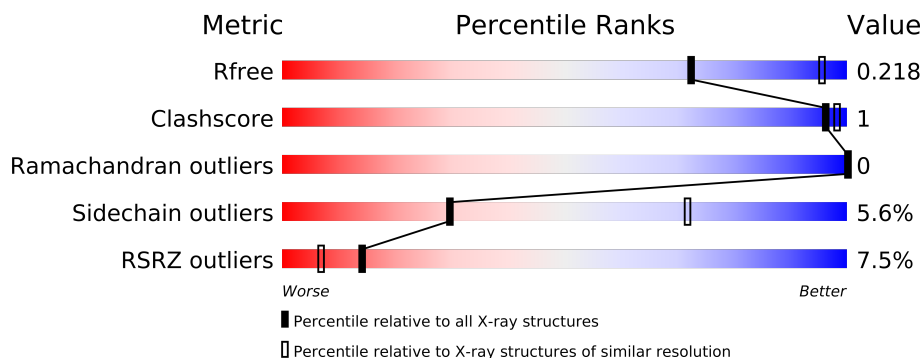
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.15 2013
Xtriage (Phenix) : dev-1323
EDS : stable22639
Percentile statistics : 21963
Refmac : 5.8.0049
CCP4 : 6.3.0 (Settle)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)
Validation Pipeline (wwPDB-VP) : stable22683

1 Overall quality at a glance

The reported resolution of this entry is 2.99 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}	66092	1468 (3.00-2.96)
Clashscore	79885	1894 (3.00-2.96)
Ramachandran outliers	78287	1826 (3.00-2.96)
Sidechain outliers	78261	1829 (3.00-2.96)
RSRZ outliers	66119	1469 (3.00-2.96)

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. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Mol	Chain	Length	Quality of chain
1	A	209	
2	B	84	
2	C	84	
3	D	20	
4	E	24	

The following table lists non-polymeric compounds that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Geometry	Electron density
6	PEG	A	502	-	X

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 3737 atoms, of which 0 are hydrogen and 0 are deuterium.

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 Catabolite gene activator.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	203	Total	C	N	O	S	0	0	0
			1604	1014	282	299	9			

- Molecule 2 is a protein called DNA-directed RNA polymerase subunit alpha.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	74	Total	C	N	O	S	0	0	0
			583	371	101	109	2			
2	C	73	Total	C	N	O	S	0	0	0
			572	362	100	108	2			

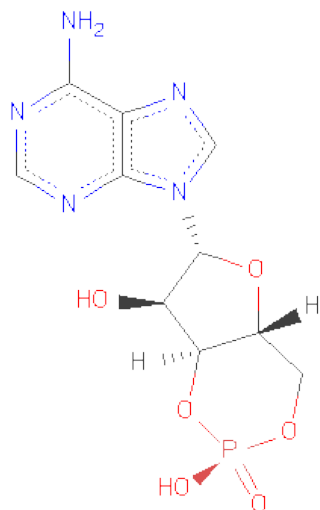
- Molecule 3 is a DNA chain called DNA (5'-D(*CP*TP*TP*TP*TP*TP*TP*CP*CP*TP*AP*AP*AP*AP*TP*GP*TP*GP*AP*T)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	D	20	Total	C	N	O	P	0	0	0
			403	197	64	123	19			

- Molecule 4 is a DNA chain called DNA (5'-D(*CP*TP*AP*GP*AP*TP*CP*AP*CP*AP*TP*TP*TP*TP*AP*GP*GP*AP*AP*AP*AP*AP*AP*G)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	E	24	Total	C	N	O	P	0	0	0
			493	237	96	137	23			

- Molecule 5 is ADENOSINE-3',5'-CYCLIC-MONOPHOSPHATE (three-letter code: CMP) (formula: C₁₀H₁₂N₅O₆P).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	
5	A	1	Total	C	N	O	P	0	0	
			22	10	5	6	1			
5	D	1	Total	C	N				0	0
			11	6	5					

- Molecule 6 is DI(HYDROXYETHYL)ETHER (three-letter code: PEG) (formula: C₄H₁₀O₃).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total	C	O	0	0
			7	4	3		
6	A	1	Total	C	O	0	0
			7	4	3		

- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	11	Total 11	O 11	0	0
7	D	13	Total 13	O 13	0	0
7	E	11	Total 11	O 11	0	0

3 Residue-property plots

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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.

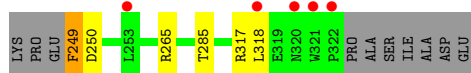
- Molecule 1: Catabolite gene activator

Chain A: 



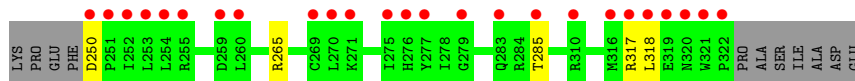
- Molecule 2: DNA-directed RNA polymerase subunit alpha

Chain B: 



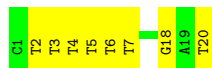
- Molecule 2: DNA-directed RNA polymerase subunit alpha

Chain C: 



- Molecule 3: DNA (5'-D(*CP*TP*TP*TP*TP*TP*TP*CP*CP*TP*AP*AP*AP*AP*TP*GP*TP*GP*AP*T)-3')

Chain D: 



- Molecule 4: DNA (5'-D(*CP*TP*AP*GP*AP*TP*CP*AP*CP*AP*TP*TP*TP*TP*AP*GP*GP*AP*AP*AP*AP*AP*AP*G)-3')

Chain E: 



4 Data and refinement statistics

Property	Value	Source
Space group	P 62 2 2	Depositor
Cell constants a, b, c, α , β , γ	175.73Å 175.73Å 160.10Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	38.51 – 2.99 38.51 – 2.99	Depositor EDS
% Data completeness (in resolution range)	96.5 (38.51-2.99) 96.5 (38.51-2.99)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	0.09	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.89 (at 3.01Å)	Xtriage
Refinement program	PHENIX (phenix.refine)	Depositor
R, R_{free}	0.198 , 0.224 0.196 , 0.218	Depositor DCC
R_{free} test set	1481 reflections (5.10%)	DCC
Wilson B-factor (Å ²)	87.8	Xtriage
Anisotropy	0.378	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.29 , 64.3	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Outliers	0 of 29110 reflections	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	3737	wwPDB-VP
Average B, all atoms (Å ²)	110.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.58% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

5 Model quality

5.1 Standard geometry

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

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	0.29	0/1629	0.47	0/2193
2	B	0.21	0/591	0.41	0/800
2	C	0.21	0/579	0.41	0/784
3	D	0.53	0/449	1.35	11/691 (1.6%)
4	E	0.52	0/555	1.20	2/855 (0.2%)
All	All	0.35	0/3803	0.78	13/5323 (0.2%)

There are no bond length outliers.

All (13) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	18	DG	O4'-C4'-C3'	-6.68	101.83	104.50
3	D	18	DG	C4'-C3'-C2'	-6.01	97.69	103.10
4	E	36	DG	O4'-C1'-C2'	-5.54	101.47	105.90
3	D	2	DT	N3-C4-O4	5.49	123.19	119.90
3	D	7	DT	N3-C4-O4	5.31	123.09	119.90
3	D	4	DT	N3-C4-O4	5.21	123.03	119.90
4	E	33	DT	N3-C4-O4	5.17	123.00	119.90
3	D	2	DT	C5-C4-O4	-5.10	121.33	124.90
3	D	6	DT	N3-C4-O4	5.09	122.95	119.90
3	D	5	DT	O4'-C1'-N1	-5.07	104.45	108.00
3	D	20	DT	N3-C4-O4	5.06	122.94	119.90
3	D	6	DT	C5-C4-O4	-5.02	121.39	124.90
3	D	3	DT	C5-C4-O4	-5.00	121.40	124.90

There are no chirality outliers.

There are no planarity outliers.

5.2 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 hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	1604	0	0	3	0
2	B	583	0	0	1	0
2	C	572	0	0	0	0
3	D	403	0	0	0	0
4	E	493	0	0	0	0
5	A	22	0	0	0	0
5	D	11	0	0	0	0
6	A	14	0	0	0	0
7	A	11	0	0	0	0
7	D	13	0	0	0	0
7	E	11	0	0	0	0
All	All	3737	0	0	4	0

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 1.

All (4) close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:A:169:ARG:NH2	1:A:200:GLY:O	2.38	0.56
1:A:155:ASP:N	1:A:155:ASP:OD1	2.48	0.44
2:B:249:PHE:N	2:B:249:PHE:CD2	2.86	0.44
1:A:69:PHE:O	1:A:123:ARG:NH2	2.55	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	201/209 (96%)	193 (96%)	8 (4%)	0	100	100
2	B	72/84 (86%)	67 (93%)	5 (7%)	0	100	100
2	C	71/84 (84%)	66 (93%)	5 (7%)	0	100	100
All	All	344/377 (91%)	326 (95%)	18 (5%)	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	174/180 (97%)	168 (97%)	6 (3%)	49	87
2	B	66/74 (89%)	60 (91%)	6 (9%)	14	45
2	C	65/74 (88%)	60 (92%)	5 (8%)	18	55
All	All	305/328 (93%)	288 (94%)	17 (6%)	30	72

All (17) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	50	LEU
1	A	59	MET
1	A	70	ILE
1	A	122	ARG
1	A	158	THR
1	A	169	ARG
2	B	249	PHE
2	B	250	ASP
2	B	265	ARG
2	B	285	THR
2	B	317	ARG
2	B	318	LEU
2	C	250	ASP
2	C	265	ARG
2	C	285	THR
2	C	317	ARG
2	C	318	LEU

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

5.3.3 RNA ⓘ

There are no RNA chains in this entry.

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 carbohydrates in this entry.

5.6 Ligand geometry ⓘ

4 ligands are 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	$\# Z > 2$
5	CMP	A	210	-	25,25,25	1.32	3 (12%)	39,39,39	1.82	9 (23%)
6	PEG	A	501	-	6,6,6	0.59	0	5,5,5	0.55	0
6	PEG	A	502	-	6,6,6	0.61	0	5,5,5	0.56	0
5	CMP	D	100	-	11,12,25	1.46	2 (18%)	15,17,39	2.74	6 (40%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the chemical component dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	CMP	A	210	-	-	0/4/31/31	0/0/4/4
6	PEG	A	501	-	-	0/4/4/4	0/0/0/0

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
6	PEG	A	502	-	-	0/4/4/4	0/0/0/0
5	CMP	D	100	-	-	0/0/0/31	0/0/2/4

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	A	210	CMP	C5-C4	3.32	1.48	1.40
5	D	100	CMP	C5-C4	3.30	1.47	1.40
5	A	210	CMP	C4-N9	-2.71	1.33	1.37
5	D	100	CMP	C4-N9	-2.13	1.34	1.37
5	A	210	CMP	O5'-C5'	-2.02	1.42	1.46

All (15) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	D	100	CMP	N3-C2-N1	-6.44	123.33	128.71
5	A	210	CMP	N3-C2-N1	-5.83	123.84	128.71
5	D	100	CMP	N3-C4-N9	5.61	135.56	125.43
5	A	210	CMP	N3-C4-N9	5.02	134.50	125.43
5	D	100	CMP	C5-C4-N3	-3.34	118.42	125.70
5	A	210	CMP	C4-C5-N7	-2.99	106.96	109.52
5	D	100	CMP	C4-C5-N7	-2.90	107.04	109.52
5	A	210	CMP	C5-C4-N3	-2.90	119.39	125.70
5	D	100	CMP	C2-N3-C4	2.65	121.55	114.01
5	A	210	CMP	C2'-C1'-N9	-2.31	107.33	113.27
5	D	100	CMP	C8-N9-C4	2.23	108.46	105.12
5	A	210	CMP	C8-N9-C4	2.20	108.58	106.90
5	A	210	CMP	C2-N3-C4	2.17	120.19	114.01
5	A	210	CMP	O5'-P-O3'	-2.11	102.91	105.81
5	A	210	CMP	O3'-C3'-C4'	-2.02	109.11	110.73

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

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	203/209 (97%)	0.01	0 100 100	55, 80, 123, 151	0
2	B	74/84 (88%)	0.35	5 (6%) 17 8	87, 121, 183, 198	0
2	C	73/84 (86%)	1.51	25 (34%) 1 0	96, 187, 269, 343	0
3	D	20/20 (100%)	-0.47	0 100 100	75, 92, 115, 131	0
4	E	24/24 (100%)	-0.63	0 100 100	75, 92, 112, 119	0
All	All	394/421 (93%)	0.29	30 (7%) 14 7	55, 99, 206, 343	0

All (30) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	C	321	TRP	5.4
2	C	259	ASP	4.8
2	C	317	ARG	4.7
2	C	254	LEU	4.7
2	C	275	ILE	4.5
2	C	320	ASN	4.5
2	C	318	LEU	4.5
2	C	276	HIS	4.1
2	C	316	MET	4.0
2	C	277	TYR	3.7
2	C	250	ASP	3.5
2	C	283	GLN	3.5
2	B	322	PRO	3.4
2	C	251	PRO	3.3
2	C	322	PRO	3.2
2	C	255	ARG	3.2
2	B	318	LEU	3.1
2	B	321	TRP	3.0
2	C	269	CYS	3.0
2	C	319	GLU	2.8

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Mol	Chain	Res	Type	RSRZ
2	C	253	LEU	2.8
2	C	279	GLY	2.7
2	C	271	LYS	2.6
2	C	252	ILE	2.6
2	B	320	ASN	2.4
2	C	270	LEU	2.4
2	C	285	THR	2.2
2	C	260	LEU	2.2
2	B	253	LEU	2.1
2	C	310	ARG	2.1

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. 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	RSR	LLDF	B-factors(Å ²)	Q<0.9
6	PEG	A	502	7/7	0.32	5.29	115,125,153,155	0
5	CMP	D	100	11/22	0.15	1.58	102,113,132,132	0
6	PEG	A	501	7/7	0.18	1.12	97,102,107,107	0
5	CMP	A	210	22/22	0.23	0.31	56,66,78,89	0

6.5 Other polymers ⓘ

There are no such residues in this entry.