



Full wwPDB X-ray Structure Validation Report ⓘ

Feb 26, 2014 – 02:22 PM GMT

PDB ID : 4BOC
Title : Structure of mitochondrial RNA polymerase elongation complex
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Deposited on : 2013-05-18
Resolution : 2.65 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>

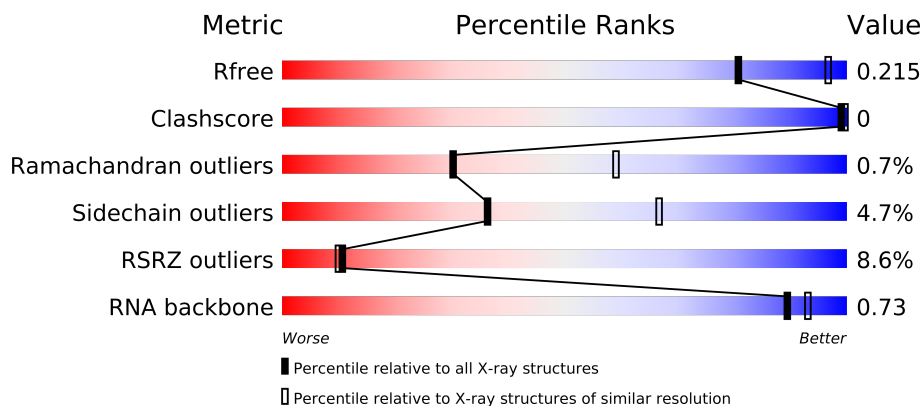
The following versions of software and data (see [references](#)) were used in the production of this report:

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 2.65 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	2232 (2.70-2.62)
Clashscore	79885	2700 (2.70-2.62)
Ramachandran outliers	78287	2657 (2.70-2.62)
Sidechain outliers	78261	2657 (2.70-2.62)
RSRZ outliers	66119	2234 (2.70-2.62)
RNA backbone	1838	1058 (3.20-2.12)

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	1088	
2	N	28	
3	R	14	
4	T	28	

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 9302 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 DNA-DIRECTED RNA POLYMERASE, MITOCHONDRIAL.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	989	Total	C	N	O	S	0	0	0
			7880	5017	1423	1392	48			

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	143	MET	-	EXPRESSION TAG	UNP O00411
A	144	GLY	-	EXPRESSION TAG	UNP O00411
A	145	HIS	-	EXPRESSION TAG	UNP O00411
A	146	HIS	-	EXPRESSION TAG	UNP O00411
A	147	HIS	-	EXPRESSION TAG	UNP O00411
A	148	HIS	-	EXPRESSION TAG	UNP O00411
A	149	HIS	-	EXPRESSION TAG	UNP O00411
A	150	HIS	-	EXPRESSION TAG	UNP O00411

- Molecule 2 is a DNA chain called 5'-D(*CP*AP*TP*GP*GP*GP*GP*TP*AP*AP*TP*T
P*AP*TP*TP*TP*CP*GP*AP*CP*GP*CP*CP*AP*GP*AP*CP*G)-3'.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	N	21	Total	C	N	O	P	0	0	0
			437	205	89	122	21			

- Molecule 3 is a RNA chain called 5'-R(*AP*GP*UP*CP*UP*GP*CP*GP*GP*CP*GP*C
P*GP*CP)-3'.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	R	9	Total	C	N	O	P	0	0	0
			195	86	37	63	9			

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

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	T	27	Total 546	C 258	N 96	O 165	P 27	0	0	0

- Molecule 5 is water.

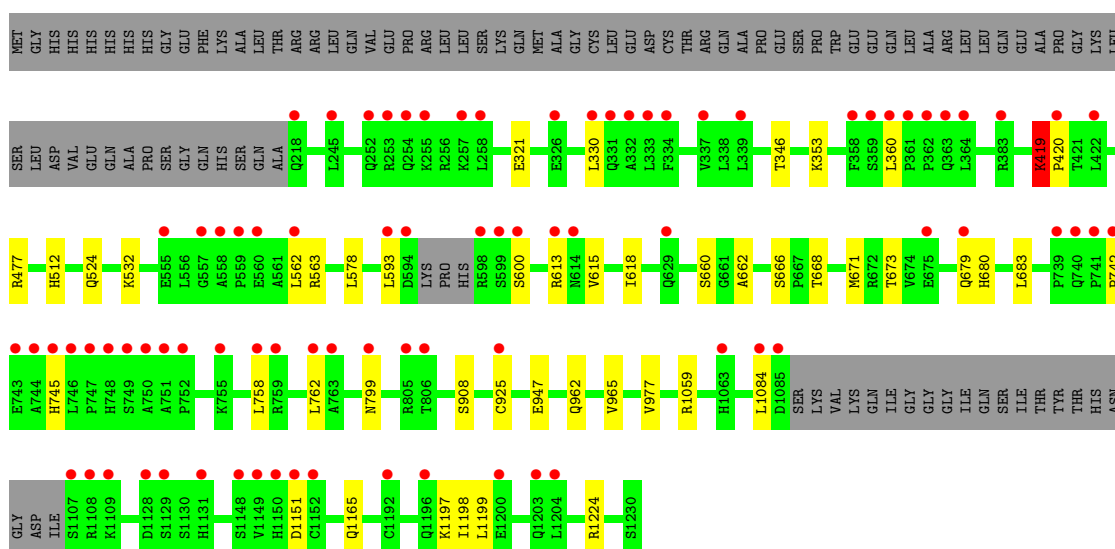
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	227	Total 227	O 227	0	0
5	N	7	Total 7	O 7	0	0
5	R	5	Total 5	O 5	0	0
5	T	5	Total 5	O 5	0	0

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.

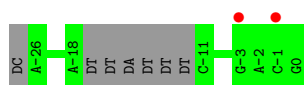
• Molecule 1: DNA-DIRECTED RNA POLYMERASE, MITOCHONDRIAL

Chain A: 



• Molecule 2: 5'-D(*CP*AP*TP*GP*GP*GP*GP*TP*AP*AP*TP*TP*AP*TP*TP*TP*CP*GP*AP*CP*GP*CP*CP*AP*GP*AP*CP*G)-3'

Chain N: 



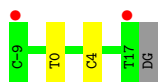
• Molecule 3: 5'-R(*AP*GP*UP*CP*UP*GP*CP*GP*GP*CP*GP*CP*GP*CP)-3'

Chain R: 



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

Chain T: 



4 Data and refinement statistics

Property	Value	Source
Space group	I 2 3	Depositor
Cell constants a, b, c, α , β , γ	225.19Å 225.19Å 225.19Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	39.81 – 2.65 39.81 – 2.65	Depositor EDS
% Data completeness (in resolution range)	100.0 (39.81-2.65) 100.0 (39.81-2.65)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.83 (at 2.65Å)	Xtriage
Refinement program	BUSTER 2.11.5	Depositor
R, R_{free}	0.179 , 0.209 0.187 , 0.215	Depositor DCC
R_{free} test set	2755 reflections (5.25%)	DCC
Wilson B-factor (Å ²)	74.8	Xtriage
Anisotropy	0.000	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 68.0	EDS
Estimated twinning fraction	0.023 for -l,-k,-h	Xtriage
L-test for twinning	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Outliers	1 of 55192 reflections (0.002%)	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	9302	wwPDB-VP
Average B, all atoms (Å ²)	97.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.23% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

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	A	0.44	0/8071	0.65	0/10952
2	N	1.07	0/491	0.94	0/754
3	R	1.13	0/217	0.96	0/337
4	T	1.07	0/609	1.00	3/936 (0.3%)
All	All	0.58	0/9388	0.71	3/12979 (0.0%)

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	T	0	DT	O4'-C4'-C3'	-6.48	101.91	104.50
4	T	4	DC	C4'-C3'-C2'	-5.12	98.49	103.10
4	T	0	DT	P-O3'-C3'	5.09	125.81	119.70

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	7880	0	0	1	0
2	N	437	0	0	0	0
3	R	195	0	0	0	0
4	T	546	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	A	227	0	0	0	0
5	N	7	0	0	0	0
5	R	5	0	0	0	0
5	T	5	0	0	0	0
All	All	9302	0	0	1	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 0.

All (1) close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:A:419:LYS:CB	1:A:420:PRO:CA	2.86	0.53

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	983/1088 (90%)	947 (96%)	29 (3%)	7 (1%)	30 59

All (7) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	419	LYS
1	A	600	SER
1	A	615	VAL
1	A	662	ALA
1	A	673	THR
1	A	745	HIS
1	A	742	PRO

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	857/943 (91%)	817 (95%)	40 (5%)	36 67

All (40) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	321	GLU
1	A	330	LEU
1	A	346	THR
1	A	353	LYS
1	A	360	LEU
1	A	419	LYS
1	A	477	ARG
1	A	512	HIS
1	A	524	GLN
1	A	532	LYS
1	A	562	LEU
1	A	563	ARG
1	A	578	LEU
1	A	593	LEU
1	A	613	ARG
1	A	618	ILE
1	A	660	SER
1	A	666	SER
1	A	668	THR
1	A	671	MET
1	A	679	GLN
1	A	680	HIS
1	A	683	LEU
1	A	758	LEU
1	A	762	LEU
1	A	799	ASN
1	A	908	SER
1	A	925	CYS
1	A	947	GLU
1	A	962	GLN
1	A	965	VAL

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Mol	Chain	Res	Type
1	A	977	VAL
1	A	1059	ARG
1	A	1084	LEU
1	A	1151	ASP
1	A	1165	GLN
1	A	1197	LYS
1	A	1198	ILE
1	A	1199	LEU
1	A	1224	ARG

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

5.3.3 RNA ⓘ

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
3	R	9/14 (64%)	1 (11%)	1 (11%)

All (1) RNA backbone outliers are listed below:

Mol	Chain	Res	Type
3	R	2	C

All (1) RNA pucker outliers are listed below:

Mol	Chain	Res	Type
3	R	1	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 carbohydrates in this entry.

5.6 Ligand geometry ⓘ

There are no ligands in this entry.

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	989/1088 (90%)	0.34	84 (8%) 11 10	51, 84, 152, 198	0
2	N	21/28 (75%)	0.13	2 (9%) 8 8	87, 145, 199, 230	0
3	R	9/14 (64%)	0.35	2 (22%) 1 1	63, 72, 105, 116	0
4	T	27/28 (96%)	0.15	2 (7%) 14 14	73, 111, 233, 238	0
All	All	1046/1158 (90%)	0.33	90 (8%) 11 10	51, 85, 158, 238	0

All (90) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	744	ALA	7.0
1	A	364	LEU	6.8
1	A	218	GLN	6.5
1	A	254	GLN	6.4
1	A	745	HIS	6.3
1	A	253	ARG	6.2
1	A	749	SER	6.0
1	A	743	GLU	6.0
1	A	362	PRO	5.3
1	A	679	GLN	5.3
1	A	742	PRO	5.2
1	A	594	ASP	5.2
1	A	1107	SER	4.8
1	A	258	LEU	4.8
1	A	746	LEU	4.6
1	A	750	ALA	4.6
1	A	747	PRO	4.5
1	A	598	ARG	4.5
1	A	1084	LEU	4.5
1	A	748	HIS	4.4
1	A	614	ASN	4.0

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Mol	Chain	Res	Type	RSRZ
1	A	741	PRO	3.9
1	A	363	GLN	3.9
1	A	333	LEU	3.8
1	A	1108	ARG	3.8
1	A	599	SER	3.8
1	A	758	LEU	3.7
1	A	1085	ASP	3.6
1	A	752	PRO	3.6
1	A	762	LEU	3.6
1	A	1196	GLN	3.5
1	A	600	SER	3.5
1	A	255	LYS	3.5
1	A	252	GLN	3.2
4	T	17	DT	3.2
1	A	755	LYS	3.2
1	A	739	PRO	3.2
1	A	559	PRO	3.1
1	A	332	ALA	3.0
1	A	558	ALA	3.0
1	A	613	ARG	3.0
1	A	361	PRO	3.0
4	T	-9	DC	2.9
1	A	1149	VAL	2.9
1	A	1204	LEU	2.9
3	R	9	C	2.8
3	R	8	G	2.8
1	A	358	PHE	2.8
1	A	360	LEU	2.7
1	A	383	ARG	2.7
1	A	562	LEU	2.7
1	A	740	GLN	2.7
1	A	1109	LYS	2.7
1	A	1200	GLU	2.6
1	A	326	GLU	2.6
1	A	629	GLN	2.6
1	A	1148	SER	2.5
1	A	1150	HIS	2.5
1	A	1192	CYS	2.5
1	A	359	SER	2.5
1	A	759	ARG	2.4
1	A	331	GLN	2.4
1	A	799	ASN	2.4

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Mol	Chain	Res	Type	RSRZ
1	A	334	PHE	2.4
1	A	925	CYS	2.4
1	A	1152	CYS	2.4
1	A	805	ARG	2.4
1	A	330	LEU	2.3
1	A	1063	HIS	2.3
1	A	420	PRO	2.3
1	A	560	GLU	2.2
1	A	763	ALA	2.2
1	A	337	VAL	2.2
1	A	1203	GLN	2.2
1	A	1131	HIS	2.2
1	A	557	GLY	2.2
1	A	555	GLU	2.1
1	A	1129	SER	2.1
1	A	245	LEU	2.1
1	A	422	LEU	2.1
1	A	593	LEU	2.1
1	A	675	GLU	2.1
2	N	-1	DC	2.0
1	A	257	LYS	2.0
1	A	751	ALA	2.0
1	A	339	LEU	2.0
1	A	806	THR	2.0
1	A	1128	ASP	2.0
2	N	-3	DG	2.0
1	A	1151	ASP	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 ⓘ

There are no carbohydrates in this entry.

6.4 Ligands ⓘ

There are no ligands in this entry.

6.5 Other polymers ⓘ

There are no such residues in this entry.