



wwPDB X-ray Structure Validation Summary Report ⓘ

May 29, 2020 – 06:20 am BST

PDB ID : 4XGC
Title : Crystal structure of the eukaryotic origin recognition complex
Authors : Bleichert, F.; Botchan, M.R.; Berger, J.M.
Deposited on : 2014-12-30
Resolution : 3.50 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 ⓘ symbol.

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

MolProbity : 4.02b-467
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

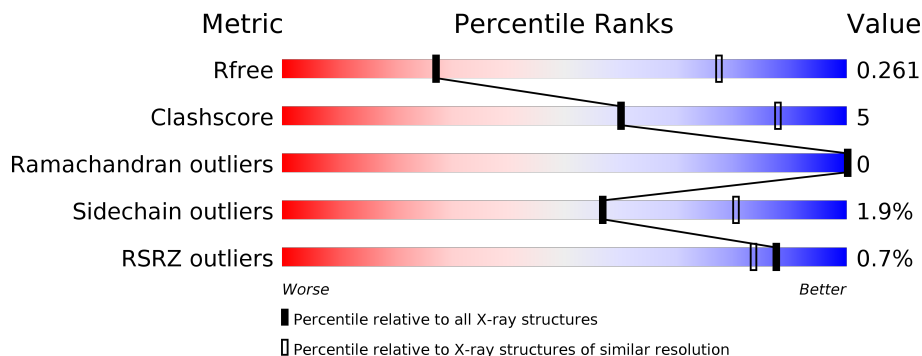
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.50 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	1659 (3.60-3.40)
Clashscore	141614	1036 (3.58-3.42)
Ramachandran outliers	138981	1005 (3.58-3.42)
Sidechain outliers	138945	1006 (3.58-3.42)
RSRZ outliers	127900	1559 (3.60-3.40)

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 $\leq 5\%$. 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	B	354	
2	C	676	
3	E	460	
4	A	393	
5	G	41	
6	F	72	

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Mol	Chain	Length	Quality of chain
7	D	459	 87% 9% .

2 Entry composition [i](#)

There are 9 unique types of molecules in this entry. The entry contains 16338 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 Origin recognition complex subunit 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	B	281	2242	1439	374	416	13	0	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	265	MET	-	initiating methionine	UNP Q24168

- Molecule 2 is a protein called Origin recognition complex subunit 3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	C	567	4581	2940	803	814	24	0	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	46	MET	-	initiating methionine	UNP Q7K2L1

- Molecule 3 is a protein called Origin recognition complex subunit 5.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	E	402	3190	2036	542	594	18	0	0	0

- Molecule 4 is a protein called Origin recognition complex subunit 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
4	A	310	2435	1535	435	450	15	0	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	532	MET	-	initiating methionine	UNP O16810

- Molecule 5 is a protein called Origin recognition complex subunit 2.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
5	G	37	Total	C	N	O	0	0	0
			185	111	37	37			

- Molecule 6 is a protein called Origin recognition complex subunit 6.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
6	F	19	Total	C	N	O	S	0	0	0
			160	104	28	27	1			

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
F	186	MET	-	initiating methionine	UNP Q9Y1B2

- Molecule 7 is a protein called Origin recognition complex subunit 4.

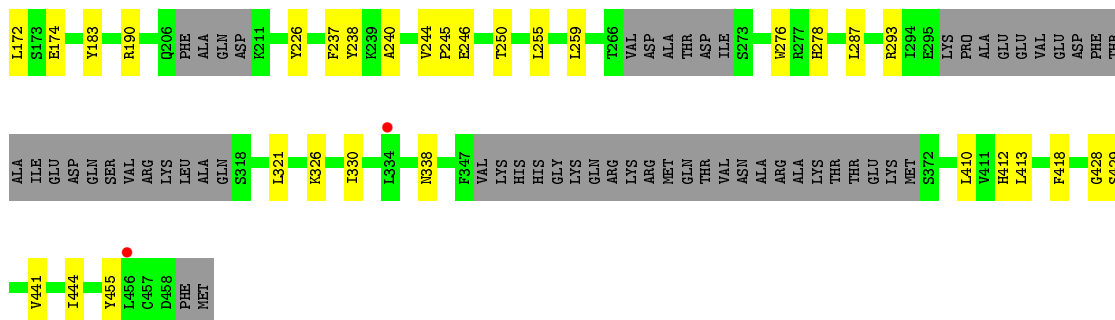
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
7	D	440	Total	C	N	O	S	0	0	0
			3543	2260	624	643	16			

- Molecule 8 is POTASSIUM ION (three-letter code: K) (formula: K).

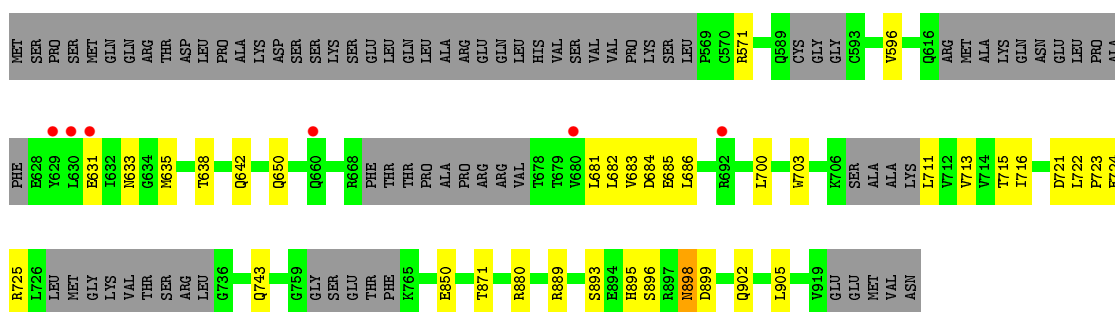
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	B	1	Total	K	0	0
			1	1		

- Molecule 9 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

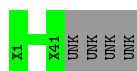
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
9	E	1	Total	Cl	0	0
			1	1		



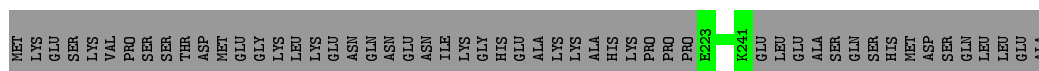
- Molecule 4: Origin recognition complex subunit 1



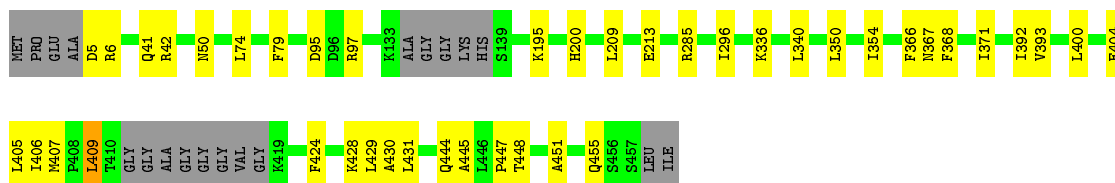
- Molecule 5: Origin recognition complex subunit 2



- Molecule 6: Origin recognition complex subunit 6



- Molecule 7: Origin recognition complex subunit 4



4 Data and refinement statistics

Property	Value	Source
Space group	I 2 2 2	Depositor
Cell constants a, b, c, α , β , γ	145.54Å 258.98Å 257.00Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.80 – 3.50 48.80 – 3.50	Depositor EDS
% Data completeness (in resolution range)	100.0 (48.80-3.50) 100.0 (48.80-3.50)	Depositor EDS
R_{merge}	0.21	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.31 (at 3.48Å)	Xtrriage
Refinement program	PHENIX (phenix.refine: dev_1760)	Depositor
R, R_{free}	0.224 , 0.258 0.227 , 0.261	Depositor DCC
R_{free} test set	1738 reflections (2.83%)	wwPDB-VP
Wilson B-factor (Å ²)	118.7	Xtrriage
Anisotropy	0.187	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.29 , 89.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.46$, $\langle L^2 \rangle = 0.28$	Xtrriage
Estimated twinning fraction	0.019 for -h,-l,-k	Xtrriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	16338	wwPDB-VP
Average B, all atoms (Å ²)	118.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.55% 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, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: K, 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	B	0.25	0/2287	0.40	0/3094
2	C	0.27	0/4673	0.39	0/6319
3	E	0.31	0/3237	0.42	0/4372
4	A	0.30	0/2463	0.44	0/3325
6	F	0.20	0/162	0.26	0/214
7	D	0.32	0/3608	0.42	0/4866
All	All	0.29	0/16430	0.41	0/22190

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 [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	B	2242	0	2244	23	0
2	C	4581	0	4649	40	0
3	E	3190	0	3251	42	0
4	A	2435	0	2502	28	0
5	G	185	0	43	0	0
6	F	160	0	169	0	0
7	D	3543	0	3587	29	1

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
8	B	1	0	0	0	0
9	E	1	0	0	0	0
All	All	16338	0	16445	149	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 5.

The worst 5 of 149 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:C:106:ASN:N	2:C:106:ASN:HD22	1.53	0.99
2:C:129:VAL:HG12	2:C:206:VAL:HB	1.55	0.87
2:C:106:ASN:ND2	2:C:106:ASN:N	2.25	0.84
4:A:633:ASN:HD22	4:A:684:ASP:HB3	1.44	0.83
4:A:681:LEU:HB3	4:A:713:VAL:HG12	1.66	0.77

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)
7:D:6:ARG:CD	7:D:6:ARG:CD[3_555]	1.95	0.25

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	B	273/354 (77%)	248 (91%)	25 (9%)	0	100	100
2	C	555/676 (82%)	505 (91%)	50 (9%)	0	100	100
3	E	392/460 (85%)	369 (94%)	23 (6%)	0	100	100
4	A	296/393 (75%)	277 (94%)	19 (6%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
6	F	17/72 (24%)	17 (100%)	0	0	100	100
7	D	434/459 (95%)	410 (94%)	24 (6%)	0	100	100
All	All	1967/2414 (82%)	1826 (93%)	141 (7%)	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	B	252/316 (80%)	248 (98%)	4 (2%)	62	83
2	C	500/601 (83%)	492 (98%)	8 (2%)	62	83
3	E	352/402 (88%)	339 (96%)	13 (4%)	34	65
4	A	263/335 (78%)	257 (98%)	6 (2%)	50	77
6	F	15/62 (24%)	15 (100%)	0	100	100
7	D	390/398 (98%)	387 (99%)	3 (1%)	81	91
All	All	1772/2114 (84%)	1738 (98%)	34 (2%)	57	80

5 of 34 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	E	127	ASN
3	E	190	ARG
7	D	41	GLN
3	E	164	GLU
2	C	215	PHE

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

Mol	Chain	Res	Type
3	E	127	ASN
7	D	441	GLN

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Mol	Chain	Res	Type
3	E	150	ASN
3	E	119	GLN
3	E	424	ASN

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 2 ligands modelled in this entry, 2 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](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
5	G	2

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	G	14:UNK	C	16:UNK	N	6.41
1	G	27:UNK	C	31:UNK	N	5.00

6 Fit of model and data [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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	B	281/354 (79%)	-0.17	1 (0%) 92 90	73, 131, 185, 201	0
2	C	567/676 (83%)	-0.18	6 (1%) 80 75	61, 124, 188, 237	0
3	E	402/460 (87%)	-0.23	2 (0%) 91 88	49, 108, 172, 199	0
4	A	310/393 (78%)	-0.14	6 (1%) 66 61	52, 110, 186, 218	0
5	G	0/41	-	-	-	-
6	F	19/72 (26%)	0.20	0 100 100	166, 185, 201, 202	0
7	D	440/459 (95%)	-0.45	0 100 100	52, 91, 142, 182	0
All	All	2019/2455 (82%)	-0.24	15 (0%) 87 83	49, 112, 182, 237	0

The worst 5 of 15 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
4	A	630	LEU	3.7
2	C	690	GLN	3.4
4	A	660	GLN	3.0
4	A	631	GLU	2.9
4	A	629	TYR	2.6

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

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. 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(Å ²)	Q<0.9
9	CL	E	501	1/1	0.82	0.39	108,108,108,108	0
8	K	B	701	1/1	0.92	0.23	110,110,110,110	0

6.5 Other polymers [i](#)

There are no such residues in this entry.