wwPDB X-ray Structure Validation Summary Report (i)

Dec 10, 2023 – 06:46 pm GMT

PDB ID	:	2C4R
Title	:	Catalytic domain of E. coli RNase E
Authors	:	Marcaida, M.J.; Callaghan, A.J.; Luisi, B.F.
Deposited on	:	2005-10-21
Resolution	:	3.60 Å(reported)

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

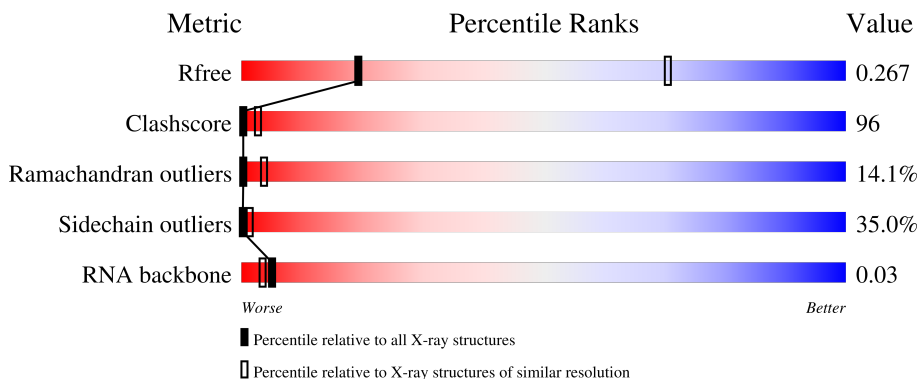|		
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.36
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

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 3.60 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	Percentile Ranks	Value
Rfree		0.267
Clashscore		96
Ramachandran outliers		14.1%
Sidechain outliers		35.0%
RNA backbone		0.03

Worse   *Better*

▌Percentile relative to all X-ray structures

▯Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R$_{free}$	130704	1257 (3.70-3.50)
Clashscore	141614	1353 (3.70-3.50)
Ramachandran outliers	138981	1307 (3.70-3.50)
Sidechain outliers	138945	1307 (3.70-3.50)
RNA backbone	3102	1017 (4.20-3.00)

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%

Mol	Chain	Length	Quality of chain
1	L	517	20% 43% 28% • 5%
2	R	10	40% 60%

2 Entry composition ⓘ

There are 5 unique types of molecules in this entry. The entry contains 3778 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 RIBONUCLEASE E.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	L	491	Total 3557	C 2223	N 649	O 674	S 11	0	0	0

- Molecule 2 is a RNA chain called SSRNA MOLECULE: 5'-R(*AP*CP*AP*GP*UP*AP*UP*UP*UP*GP)-3'.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	R	10	Total 212	C 95	N 36	O 71	P 10	0	0	0

- Molecule 3 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	L	2	Total 2	Mg 2	0	0

- Molecule 4 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	L	1	Total 1	Zn 1	0	0
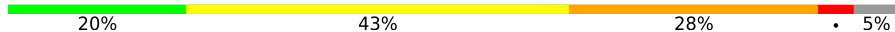
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	L	5	Total 5	O 5	0	0
5	R	1	Total 1	O 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. 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. 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: RIBONUCLEASE E

Chain L:
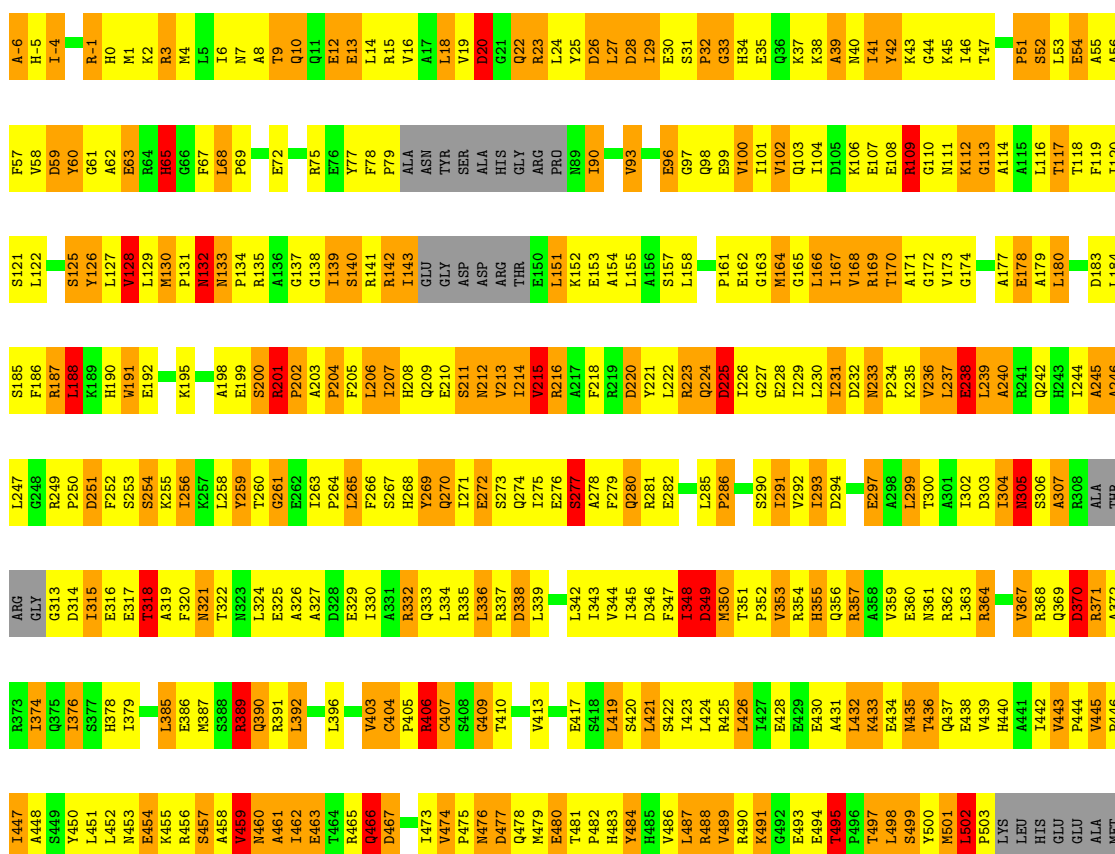
• Molecule 2: SSRNA MOLECULE: 5'-R(*AP*CP*AP*GP*UP*AP*UP*UP*UP*GP)-3'

Chain R:

4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 62 2 2	Depositor
Cell constants a, b, c, α, β, γ	196.59Å 196.59Å 140.77Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	25.00 – 3.60 49.15 – 3.60	Depositor EDS
% Data completeness (in resolution range)	99.7 (25.00-3.60) 99.7 (49.15-3.60)	Depositor EDS
R_{merge}	0.13	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.91 (at 3.57Å)	Xtriage
Refinement program	REFMAC 5.2.0005	Depositor
R, R_{free}	0.319 , 0.347 0.238 , 0.267	Depositor DCC
R_{free} test set	980 reflections (5.16%)	wwPDB-VP
Wilson B-factor (Å^2)	122.6	Xtriage
Anisotropy	0.305	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.28 , 94.8	EDS
L-test for twinning[2]	$< |L| > = 0.49, < L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.90	EDS
Total number of atoms	3778	wwPDB-VP
Average B, all atoms (Å^2)	64.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.63% 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.

5   Model quality ⓘ

5.1   Standard geometry ⓘ

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

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	L	0.77	2/3610 (0.1%)	0.90	15/4917 (0.3%)
2	R	1.58	2/236 (0.8%)	3.16	36/363 (9.9%)
All	All	0.84	4/3846 (0.1%)	1.20	51/5280 (1.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	L	0	21

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	L	407	CYS	CB-SG	-23.96	1.41	1.82
2	R	1	A	OP3-P	-10.74	1.48	1.61
1	L	407	CYS	C-N	-7.04	1.17	1.34
2	R	4	G	C3'-O3'	6.39	1.51	1.42

The worst 5 of 51 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	R	6	A	O4'-C1'-N9	12.97	118.58	108.20
1	L	406	ARG	O-C-N	-12.54	102.63	122.70
2	R	6	A	O4'-C4'-C3'	-12.54	91.47	104.00
2	R	1	A	O4'-C1'-N9	12.43	118.14	108.20
2	R	4	G	C1'-O4'-C4'	-12.09	100.23	109.90

There are no chirality outliers.

5 of 21 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	L	-6	ALA	Peptide
1	L	109	ARG	Peptide
1	L	113	GLY	Peptide
1	L	56	ALA	Peptide
1	L	61	GLY	Peptide

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	L	3557	0	3325	649	0
2	R	212	0	107	67	0
3	L	2	0	0	0	0
4	L	1	0	0	0	0
5	L	5	0	0	4	0
5	R	1	0	0	1	0
All	All	3778	0	3432	690	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 96.

The worst 5 of 690 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:L:222:LEU:HD23	1:L:226:ILE:CD1	1.28	1.58
1:L:206:LEU:HD12	1:L:207:ILE:N	1.24	1.41
1:L:222:LEU:CD2	1:L:226:ILE:CD1	1.98	1.41
1:L:222:LEU:CD2	1:L:226:ILE:HD12	1.49	1.41
1:L:128:VAL:CG1	1:L:167:ILE:CD1	2.02	1.35

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	L	483/517 (93%)	324 (67%)	91 (19%)	68 (14%)	0 4

5 of 68 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	L	13	GLU
1	L	26	ASP
1	L	32	PRO
1	L	34	HIS
1	L	63	GLU

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	L	337/439 (77%)	219 (65%)	118 (35%)	0 1

5 of 118 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	L	267	SER
1	L	487	LEU
1	L	321	ASN
1	L	477	ASP
1	L	436	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 15

such sidechains are listed below:

Mol	Chain	Res	Type
1	L	233	ASN
1	L	460	ASN
1	L	305	ASN
1	L	466	GLN
1	L	416	ASN

5.3.3 RNA ⓘ

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
2	R	10/10 (100%)	8 (80%)	7 (70%)

5 of 8 RNA backbone outliers are listed below:

Mol	Chain	Res	Type
2	R	2	C
2	R	3	A
2	R	4	G
2	R	5	U
2	R	6	A

5 of 7 RNA pucker outliers are listed below:

Mol	Chain	Res	Type
2	R	4	G
2	R	5	U
2	R	7	U
2	R	6	A
2	R	3	A

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 ⓘ

Of 3 ligands modelled in this entry, 3 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 ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	L	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	L	407:CYS	C	408:SER	N	1.17

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

Unable to reproduce the depositors R factor - this section is therefore empty.

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

Unable to reproduce the depositors R factor - this section is therefore empty.

6.3 Carbohydrates ⓘ

Unable to reproduce the depositors R factor - this section is therefore empty.

6.4 Ligands ⓘ

Unable to reproduce the depositors R factor - this section is therefore empty.

6.5 Other polymers ⓘ

Unable to reproduce the depositors R factor - this section is therefore empty.