Full wwPDB X-ray Structure Validation Report (i)

Jan 13, 2024 – 03:22 pm GMT

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PDB ID	:	6STY
Title	:	Human REXO2 exonuclease in complex with RNA.
Authors	:	Malik, D.; Szewczyk, M.; Szczesny, R.; Nowotny, M.
Deposited on	:	2019-09-12
Resolution	:	3.15 Å(reported)

1   Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION
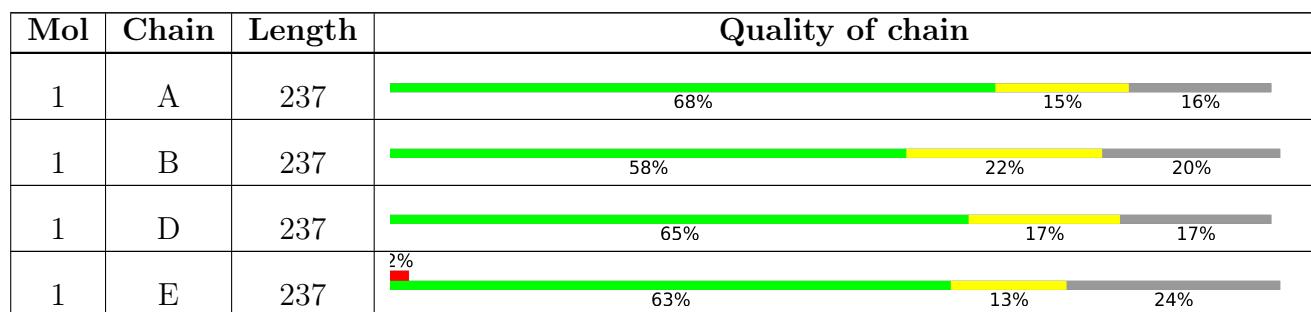
The reported resolution of this entry is 3.15 Å.

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		0.200
Clashscore		9
Ramachandran outliers		0
Sidechain outliers		2.7%
RSRZ outliers		0.8%
RNA backbone		0.51

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	1665 (3.20-3.12)
Clashscore	141614	1804 (3.20-3.12)
Ramachandran outliers	138981	1770 (3.20-3.12)
Sidechain outliers	138945	1769 (3.20-3.12)
RSRZ outliers	127900	1616 (3.20-3.12)
RNA backbone	3102	1073 (3.50-2.82)

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% 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	237	68% 15% 16%
1	B	237	58% 22% 20%
1	D	237	65% 17% 17%
1	E	237	2% 63% 13% 24%

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Full wwPDB X-ray Structure Validation Report

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Mol	Chain	Length	Quality of chain
2	C	11	18%　　9%　　73%
2	F	11	9%　18%　　82%

2 Entry composition ⓘ

There are 4 unique types of molecules in this entry. The entry contains 6021 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 Oligoribonuclease, mitochondrial.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	198	Total	C	N	O	S	0	1	0
			1562	991	257	302	12			
1	B	190	Total	C	N	O	S	0	0	0
			1462	928	243	279	12			
1	D	197	Total	C	N	O	S	0	0	0
			1516	958	255	291	12			
1	E	181	Total	C	N	O	S	0	0	0
			1378	876	230	262	10			

- Molecule 2 is a RNA chain called RNA (5'-R(P*AP*UP*C)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	C	3	Total	C	N	O	P	0	0	0
			53	23	6	21	3			
2	F	2	Total	C	N	O	P	0	0	0
			40	18	5	15	2			

- Molecule 3 is CALCIUM ION (three-letter code: CA) (formula: Ca) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	B	1	Total	Ca	0	0
			1	1		
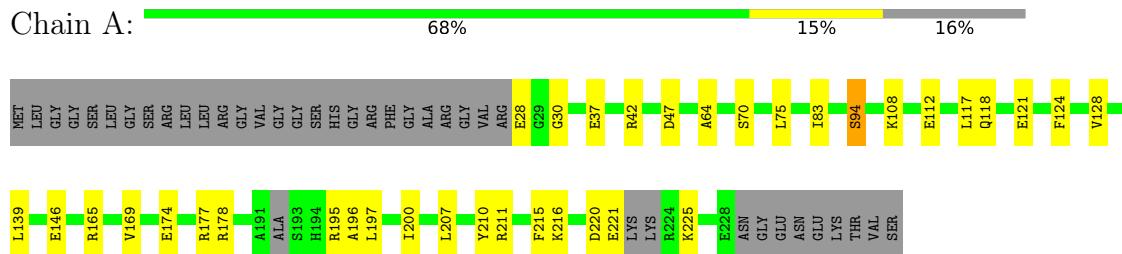
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	7	Total	O	0	0
			7	7		
4	D	2	Total	O	0	0
			2	2		
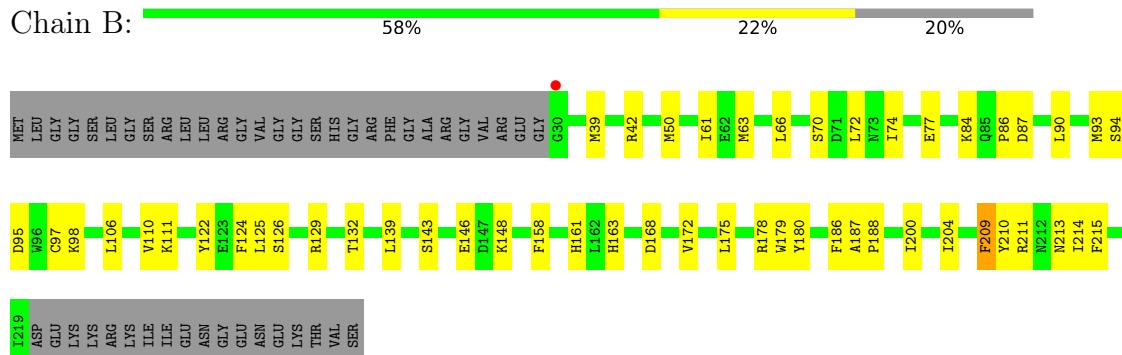
3 Residue-property plots ⓘ

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 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.
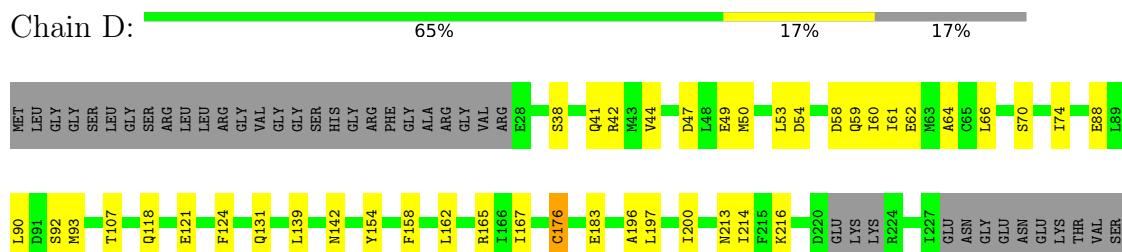
- Molecule 1: Oligoribonuclease, mitochondrial

Chain A:

- Molecule 1: Oligoribonuclease, mitochondrial

Chain B:

- Molecule 1: Oligoribonuclease, mitochondrial

Chain D:

- Molecule 1: Oligoribonuclease, mitochondrial

Chain E:

● Molecule 2: RNA (5'-R(P*AP*UP*C)-3')

Chain C:

● Molecule 2: RNA (5'-R(P*AP*UP*C)-3')

Chain F:
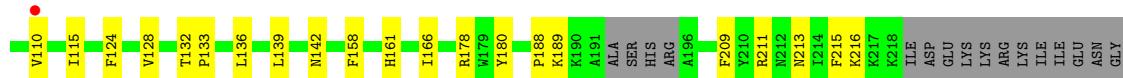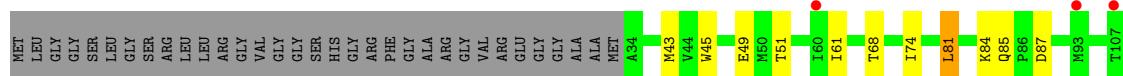
4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 32	Depositor
Cell constants a, b, c, α, β, γ	88.30Å 88.30Å 123.77Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	48.11 – 3.15 48.11 – 3.15	Depositor EDS
% Data completeness (in resolution range)	99.9 (48.11-3.15) 99.8 (48.11-3.15)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	107.73 (at 3.12Å)	Xtriage
Refinement program	PHENIX 1.15.2_3472, PHENIX 1.15.2_3472	Depositor
R, R_{free}	0.163 , 0.222 0.166 , 0.200	Depositor DCC
R_{free} test set	932 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å^2)	90.7	Xtriage
Anisotropy	0.078	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 65.8	EDS
L-test for twinning[2]	$< |L| > = 0.44, < L^2 > = 0.26$	Xtriage
Estimated twinning fraction	0.099 for -h,-k,l 0.076 for h,-h-k,-l 0.055 for -k,-h,-l	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	6021	wwPDB-VP
Average B, all atoms (Å^2)	84.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.70% 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: CA

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	0.25	0/1597	0.41	0/2161
1	B	0.25	0/1493	0.44	0/2026
1	D	0.24	0/1547	0.43	0/2098
1	E	0.25	0/1406	0.42	0/1912
2	C	0.20	0/57	0.92	0/86
2	F	0.19	0/43	0.80	0/64
All	All	0.25	0/6143	0.43	0/8347

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	1562	0	1469	25	1
1	B	1462	0	1371	37	0
1	D	1516	0	1405	29	0
1	E	1378	0	1262	21	0
2	C	53	0	29	2	0
2	F	40	0	22	3	0
3	B	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	A	7	0	0	1	0
4	D	2	0	0	0	0
All	All	6021	0	5558	103	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 9.

All (103) 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:B:90:LEU:HD21	1:B:110:VAL:HG11	1.70	0.73
1:E:49:GLU:HA	2:F:2:C:H4'	1.70	0.73
1:D:216:LYS:O	1:E:180:TYR:OH	2.09	0.71
1:B:188:PRO:HD3	1:B:209:PHE:HD2	1.59	0.68
1:D:59:GLN:HA	1:D:154:TYR:HE2	1.58	0.68
1:A:28:GLU:HG2	1:A:30:GLY:H	1.57	0.68
1:B:66:LEU:HD11	1:B:74:ILE:HD13	1.75	0.67
1:A:165:ARG:NH1	2:C:1:U:OP1	2.29	0.65
1:A:146:GLU:OE1	1:B:148:LYS:NZ	2.30	0.64
1:D:42:ARG:NH2	1:D:131:GLN:O	2.29	0.64
1:D:66:LEU:HD21	1:D:74:ILE:HD12	1.81	0.61
1:A:118:GLN:HA	1:A:121:GLU:HB3	1.81	0.61
1:B:186:PHE:HB2	1:B:209:PHE:HZ	1.65	0.60
1:D:54:ASP:N	1:D:58:ASP:OD2	2.31	0.60
1:A:28:GLU:N	4:A:304:HOH:O	2.35	0.59
1:B:188:PRO:HD3	1:B:209:PHE:CD2	2.38	0.59
1:D:41:GLN:O	1:E:178:ARG:NH1	2.36	0.59
1:D:90:LEU:HD22	1:D:107:THR:HG23	1.84	0.59
1:B:84:LYS:HE2	1:B:111:LYS:HA	1.84	0.58
1:E:68:THR:HA	1:E:74:ILE:HA	1.85	0.57
1:E:132:THR:OG1	1:E:161:HIS:NE2	2.34	0.57
1:D:176:CYS:HB2	1:D:214:ILE:HD13	1.87	0.57
1:D:165:ARG:NH2	2:F:1:U:OP1	2.38	0.56
1:D:47:ASP:HB2	1:D:200:ILE:HG12	1.88	0.56
1:D:59:GLN:HA	1:D:154:TYR:CE2	2.40	0.56
1:D:60:ILE:HG13	1:D:154:TYR:HD2	1.69	0.56
1:A:70:SER:O	1:B:179:TRP:NE1	2.30	0.56
1:A:64:ALA:HB1	1:A:197:LEU:HD13	1.86	0.55
1:B:39:MET:HE3	1:B:42:ARG:HH22	1.73	0.53
1:E:68:THR:HG22	1:E:74:ILE:HG22	1.90	0.53
1:D:90:LEU:HA	1:D:93:MET:HE3	1.91	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:174:GLU:OE1	1:A:177:ARG:NH2	2.30	0.53
1:B:125:LEU:HD13	1:B:158:PHE:HA	1.91	0.53
1:B:132:THR:OG1	1:B:161:HIS:NE2	2.42	0.52
1:A:70:SER:HB2	1:B:178:ARG:HB3	1.93	0.51
1:D:58:ASP:O	1:D:154:TYR:OH	2.29	0.51
1:B:50:MET:SD	1:B:50:MET:N	2.83	0.51
1:D:183:GLU:N	1:D:183:GLU:OE2	2.44	0.51
1:D:53:LEU:N	1:D:58:ASP:OD2	2.43	0.50
1:E:188:PRO:HD3	1:E:209:PHE:CD2	2.46	0.50
1:D:118:GLN:HA	1:D:121:GLU:HB3	1.94	0.50
1:E:211:ARG:HA	1:E:215:PHE:CD2	2.48	0.49
1:D:49:GLU:HB2	1:D:62:GLU:HB3	1.94	0.49
1:A:169:VAL:HG13	1:A:207:LEU:HB2	1.95	0.48
1:E:142:ASN:ND2	2:F:1:U:OP2	2.46	0.48
1:D:139:LEU:O	1:D:167:ILE:N	2.45	0.48
1:B:84:LYS:NZ	1:B:87:ASP:OD1	2.47	0.48
1:B:200:ILE:O	1:B:204:ILE:HG13	2.14	0.47
1:D:64:ALA:HB1	1:D:197:LEU:HG	1.95	0.47
1:A:83:ILE:HD13	1:A:117:LEU:HD12	1.96	0.47
1:A:207:LEU:HA	1:A:210:TYR:HD2	1.78	0.47
1:B:211:ARG:HA	1:B:215:PHE:CD1	2.49	0.47
1:E:84:LYS:HD3	1:E:85:GLN:N	2.29	0.47
1:B:129:ARG:HA	1:B:161:HIS:CE1	2.51	0.46
1:A:196:ALA:O	1:A:200:ILE:HG13	2.16	0.46
1:B:172:VAL:HA	1:B:175:LEU:HB2	1.98	0.46
1:B:63:MET:HG2	1:B:124:PHE:CZ	2.51	0.46
1:B:61:ILE:HG21	1:B:106:LEU:HD21	1.98	0.46
1:A:178:ARG:HB3	1:B:70:SER:HB2	1.97	0.45
1:D:44:VAL:HG11	1:D:162:LEU:HD21	1.99	0.45
1:B:210:TYR:O	1:B:214:ILE:HB	2.16	0.45
1:E:209:PHE:O	1:E:213:ASN:ND2	2.50	0.45
1:E:81:LEU:HD12	1:E:115:ILE:HG21	1.99	0.45
1:A:47:ASP:HB3	1:A:196:ALA:HB1	1.99	0.45
1:E:139:LEU:HB2	1:E:166:ILE:HG22	1.98	0.45
1:B:143:SER:N	1:B:168:ASP:OD1	2.43	0.45
1:A:211:ARG:HA	1:A:215:PHE:CD1	2.51	0.44
1:E:124:PHE:O	1:E:128:VAL:HG12	2.18	0.44
1:A:139:LEU:HD23	1:A:139:LEU:HA	1.88	0.43
1:B:187:ALA:HA	1:B:209:PHE:CE2	2.53	0.43
1:D:124:PHE:HB3	1:D:158:PHE:HE2	1.83	0.43
1:E:133:PRO:HB2	1:E:136:LEU:HD12	2.00	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:146:GLU:HG3	2:C:1:U:O2	2.18	0.43
1:A:216:LYS:O	1:B:180:TYR:OH	2.32	0.43
1:B:86:PRO:O	1:B:90:LEU:HD12	2.19	0.43
1:A:108:LYS:O	1:A:112:GLU:HG2	2.19	0.42
1:B:209:PHE:HD1	1:B:209:PHE:C	2.23	0.42
1:B:66:LEU:HD12	1:B:77:GLU:HG2	2.01	0.42
1:B:209:PHE:C	1:B:209:PHE:CD1	2.92	0.42
1:A:28:GLU:HG2	1:A:30:GLY:N	2.30	0.42
1:B:211:ARG:HA	1:B:215:PHE:HD1	1.84	0.42
1:D:49:GLU:O	1:D:61:ILE:HG12	2.19	0.42
1:A:215:PHE:HA	1:B:215:PHE:HA	2.01	0.42
1:D:47:ASP:HB3	1:D:196:ALA:HB1	2.00	0.42
1:E:45:TRP:CD1	1:E:68:THR:HG23	2.55	0.42
1:A:42:ARG:HD3	1:A:75:LEU:HD12	2.02	0.42
1:B:139:LEU:HD23	1:B:139:LEU:HA	1.88	0.42
1:E:51:THR:HG22	1:E:61:ILE:HG13	2.00	0.42
1:E:84:LYS:HG2	1:E:110:VAL:O	2.21	0.41
1:E:49:GLU:O	1:E:61:ILE:HB	2.20	0.41
1:B:94:SER:O	1:B:98:LYS:N	2.45	0.41
1:B:72:LEU:HD22	1:B:204:ILE:HG23	2.03	0.41
1:E:43:MET:HB2	1:E:45:TRP:HE1	1.84	0.41
1:D:124:PHE:HB3	1:D:158:PHE:CE2	2.55	0.41
1:B:122:TYR:O	1:B:126:SER:OG	2.33	0.41
1:A:220:ASP:OD1	1:A:221:GLU:N	2.53	0.41
1:B:93:MET:HE3	1:B:97:CYS:HB3	2.04	0.41
1:D:213:ASN:O	1:E:216:LYS:NZ	2.34	0.40
1:A:117:LEU:O	1:A:121:GLU:N	2.39	0.40
1:D:41:GLN:CG	1:D:70:SER:HB2	2.52	0.40
1:D:88:GLU:OE1	1:D:88:GLU:N	2.31	0.40
1:D:47:ASP:HB2	1:D:200:ILE:CG1	2.50	0.40
1:A:124:PHE:O	1:A:128:VAL:HG13	2.22	0.40

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)
1:A:37:GLU:OE2	1:A:94:SER:OG[2_554]	2.16	0.04

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	A	193/237 (81%)	189 (98%)	4 (2%)	0	100	100
1	B	188/237 (79%)	182 (97%)	6 (3%)	0	100	100
1	D	193/237 (81%)	186 (96%)	7 (4%)	0	100	100
1	E	177/237 (75%)	167 (94%)	10 (6%)	0	100	100
All	All	751/948 (79%)	724 (96%)	27 (4%)	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	A	163/203 (80%)	160 (98%)	3 (2%)	59	81
1	B	148/203 (73%)	144 (97%)	4 (3%)	44	73
1	D	153/203 (75%)	148 (97%)	5 (3%)	38	69
1	E	134/203 (66%)	130 (97%)	4 (3%)	41	71
All	All	598/812 (74%)	582 (97%)	16 (3%)	44	73

All (16) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	94	SER
1	A	195	ARG

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Mol	Chain	Res	Type
1	A	225	LYS
1	B	95	ASP
1	B	163	HIS
1	B	209	PHE
1	B	213	ASN
1	D	38	SER
1	D	50	MET
1	D	92	SER
1	D	142	ASN
1	D	176	CYS
1	E	81	LEU
1	E	87	ASP
1	E	158	PHE
1	E	189	LYS

Sometimes 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
2	C	2/11 (18%)	0	0
2	F	1/11 (9%)	0	0
All	All	3/22 (13%)	0	0

There are no RNA backbone outliers to report.

There are no RNA pucker outliers to report.

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 1 ligands modelled in this entry, 1 is 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 ⓘ

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(Å²)	Q<0.9
1	A	198/237 (83%)	-0.18	0	100	100	47, 71, 104, 129	1 (0%)
1	B	190/237 (80%)	-0.03	1 (0%)	91	86	47, 80, 130, 146	0
1	D	197/237 (83%)	-0.21	0	100	100	47, 79, 119, 144	0
1	E	181/237 (76%)	0.09	4 (2%)	62	47	52, 87, 147, 187	0
2	C	3/11 (27%)	0.07	0	100	100	103, 103, 105, 148	0
2	F	2/11 (18%)	2.43	1 (50%)	0	0	172, 172, 172, 216	0
All	All	771/970 (79%)	-0.08	6 (0%)	86	78	47, 79, 133, 216	1 (0%)

All (6) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	E	60	ILE	3.6
1	E	110	VAL	3.5
2	F	2	C	3.4
1	E	93	MET	2.5
1	B	30	GLY	2.2
1	E	107	THR	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 ⓘ
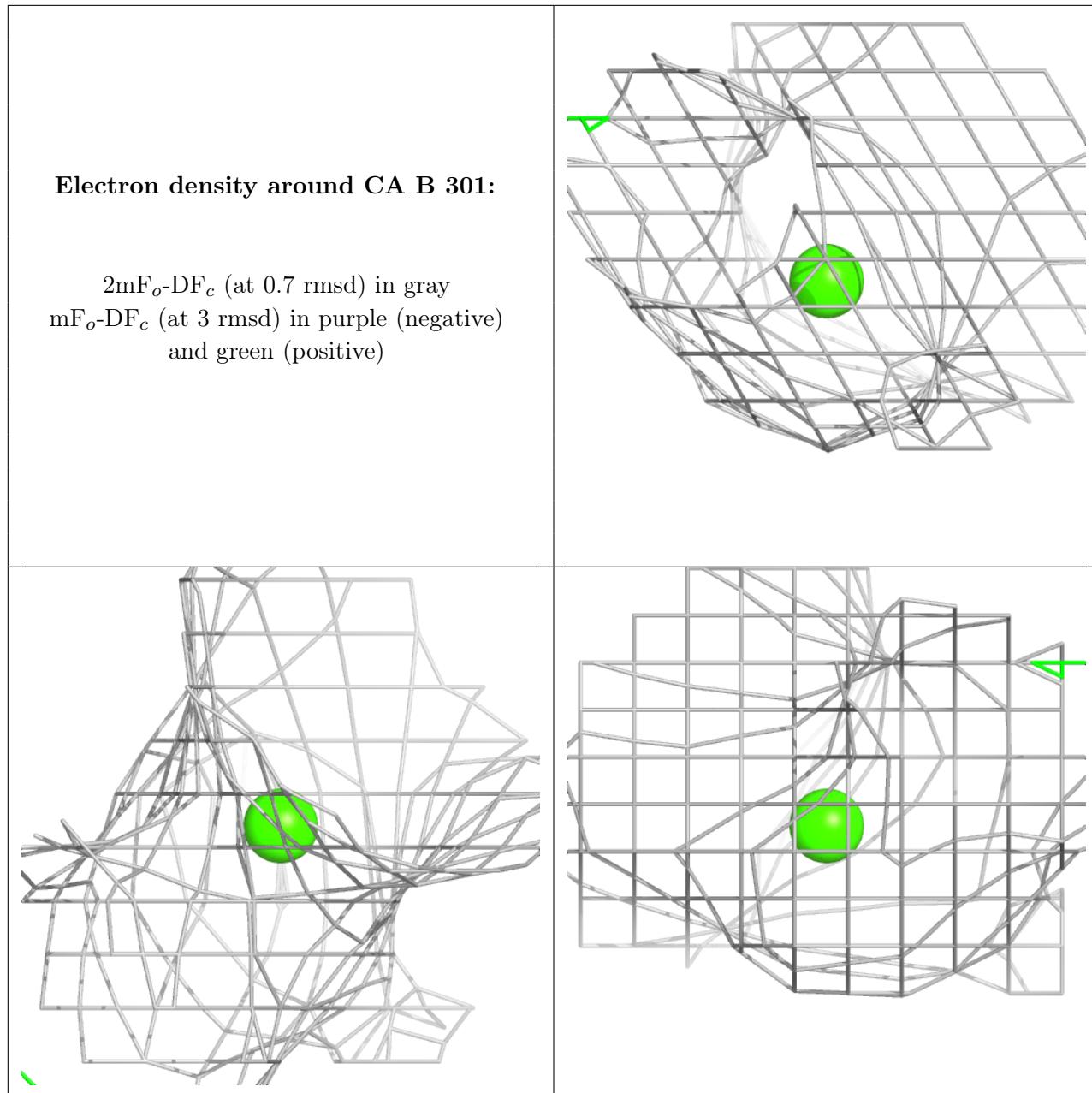
There are no monosaccharides in this entry.

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. 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
3	CA	B	301	1/1	0.92	0.09	140,140,140,140	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

Electron density around CA B 301:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)

6.5 Other polymers ⓘ

There are no such residues in this entry.