Full wwPDB X-ray Structure Validation Report (i)

Aug 15, 2023 – 06:13 PM EDT

PDB ID	:	1XVU
Title	:	Crystal Structure of CaiB mutant D169A in complex with Coenzyme A
Authors	:	Rangarajan, E.S.; Li, Y.; Iannuzzi, P.; Cygler, M.; Matte, A.
Deposited on	:	2004-10-28
Resolution	:	2.40 Å(reported)

This is a Full wwPDB X-ray Structure Validation 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 (i) symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

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

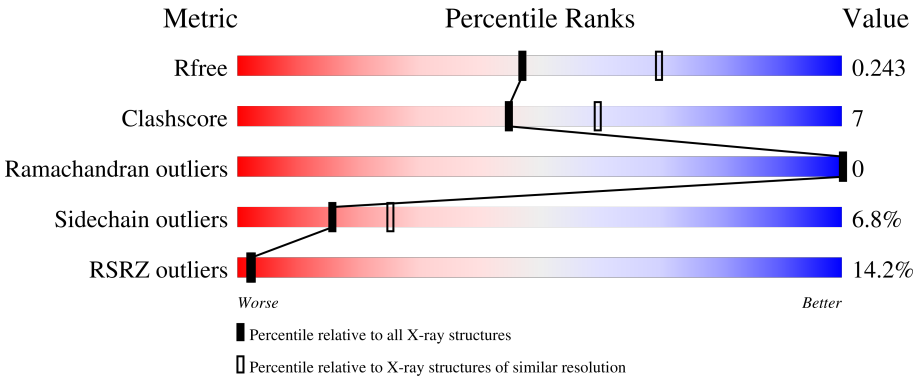
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.35
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.35

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.40 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	3907 (2.40-2.40)
Clashscore	141614	4398 (2.40-2.40)
Ramachandran outliers	138981	4318 (2.40-2.40)
Sidechain outliers	138945	4319 (2.40-2.40)
RSRZ outliers	127900	3811 (2.40-2.40)

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 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	408	14% 83% 14% ..

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 3160 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.

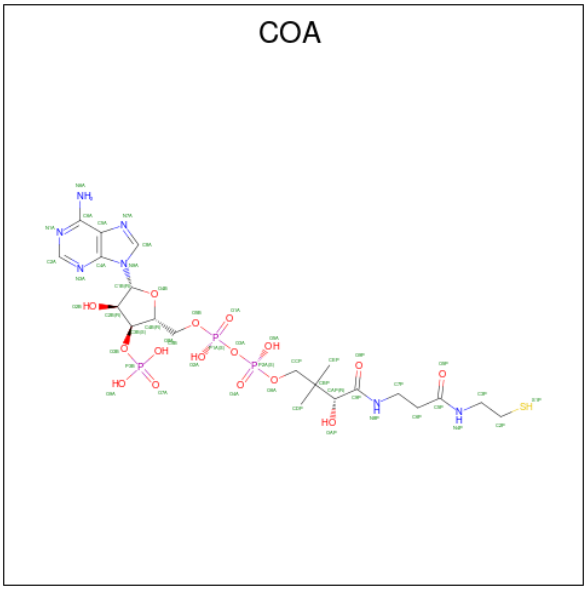
- Molecule 1 is a protein called Crotonobetainyl-CoA:carnitine CoA-transferase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	402	3024	1938	507	556	23	0	0	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	GLY	-	cloning artifact	UNP P31572
A	-1	SER	-	cloning artifact	UNP P31572
A	0	HIS	-	cloning artifact	UNP P31572
A	169	ALA	ASP	engineered mutation	UNP P31572

- Molecule 2 is COENZYME A (three-letter code: COA) (formula: $C_{21}H_{36}N_7O_{16}P_3S$).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
			Total	C	N	O	P	S		
2	A	1	48	21	7	16	3	1	0	0

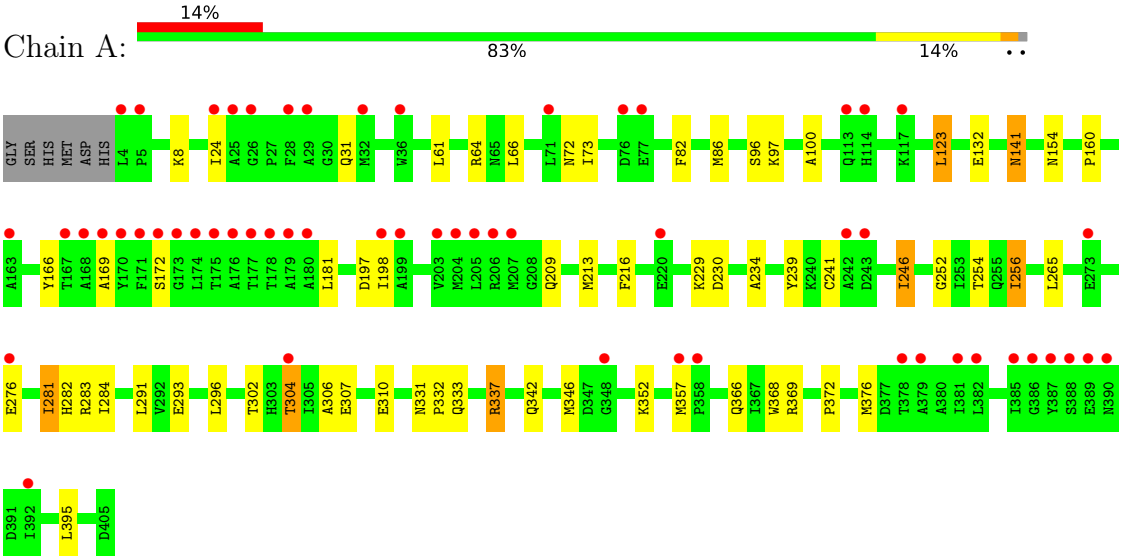
- Molecule 3 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	88	Total O 88 88	0	0

3 Residue-property plots (i)

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: Crotonobetainyl-CoA:carnitine CoA-transferase



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, α, β, γ	86.84Å 86.84Å 164.06Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	43.44 – 2.40 43.42 – 2.40	Depositor EDS
% Data completeness (in resolution range)	97.9 (43.44-2.40) 97.9 (43.42-2.40)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.06	Depositor
$< I/\sigma(I) >$ [1]	5.86 (at 2.39Å)	Xtriage
Refinement program	REFMAC 5.2.0005	Depositor
R, R_{free}	0.198 , 0.244 0.197 , 0.243	Depositor DCC
R_{free} test set	1265 reflections (5.10%)	wwPDB-VP
Wilson B-factor (Å^2)	46.0	Xtriage
Anisotropy	0.027	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 51.7	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	0.94	EDS
Total number of atoms	3160	wwPDB-VP
Average B, all atoms (Å^2)	52.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.12% of the height of the origin peak. No significant pseudotranslation is detected.*

[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: COA

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	0.59	1/3100 (0.0%)	0.67	2/4217 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	395	LEU	C-N	11.64	1.60	1.34

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	337	ARG	NE-CZ-NH1	-8.97	115.82	120.30
1	A	197	ASP	CB-CG-OD1	5.04	122.83	118.30

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	3024	0	2880	39	0
2	A	48	0	32	3	0
3	A	88	0	0	1	0
All	All	3160	0	2912	39	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 7.

All (39) 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:A:281:ILE:HD12	1:A:281:ILE:H	1.09	1.10
1:A:281:ILE:HD12	1:A:281:ILE:N	1.86	0.91
1:A:213:MET:HA	1:A:213:MET:HE2	1.53	0.91
1:A:281:ILE:H	1:A:281:ILE:CD1	1.84	0.90
1:A:304:THR:HG22	1:A:307:GLU:H	1.49	0.75
1:A:230:ASP:O	1:A:283:ARG:NH2	2.24	0.69
1:A:342:GLN:HE21	1:A:352:LYS:HE3	1.57	0.69
1:A:283:ARG:NH1	1:A:293:GLU:OE2	2.27	0.68
1:A:281:ILE:N	1:A:281:ILE:CD1	2.52	0.66
1:A:213:MET:CE	1:A:216:PHE:HD2	2.10	0.64
1:A:213:MET:HA	1:A:213:MET:CE	2.29	0.61
1:A:132:GLU:HG3	3:A:557:HOH:O	2.02	0.60
1:A:252:GLY:O	1:A:256:ILE:HG13	2.02	0.59
1:A:234:ALA:HA	1:A:283:ARG:NH1	2.21	0.56
1:A:24:ILE:HB	1:A:169:ALA:HB1	1.88	0.54
1:A:276:GLU:HA	1:A:276:GLU:OE1	2.07	0.54
1:A:141:ASN:ND2	1:A:166:TYR:HA	2.25	0.52
1:A:72:ASN:OD1	2:A:501:COA:H2A	2.10	0.52
1:A:213:MET:HE2	1:A:216:PHE:HD2	1.77	0.49
1:A:241:CYS:SG	1:A:246:ILE:HD12	2.52	0.49
1:A:66:LEU:O	1:A:372:PRO:HG3	2.14	0.48
1:A:234:ALA:HA	1:A:283:ARG:HH12	1.79	0.47
1:A:256:ILE:HD13	1:A:281:ILE:HG13	1.95	0.47
1:A:209:GLN:HE21	1:A:213:MET:HG2	1.80	0.46
1:A:82:PHE:O	1:A:86:MET:HG2	2.16	0.46
1:A:304:THR:HG23	1:A:306:ALA:H	1.81	0.46
1:A:96:SER:HB3	1:A:100:ALA:HB3	1.98	0.45
1:A:368:TRP:CE3	1:A:369:ARG:HB2	2.53	0.43
1:A:229:LYS:HE2	1:A:239:TYR:CE2	2.53	0.43
1:A:61:LEU:O	1:A:64:ARG:HG2	2.19	0.42
1:A:282:HIS:HE1	1:A:284:ILE:HB	1.84	0.42
1:A:154:ASN:O	1:A:160:PRO:HA	2.20	0.41
1:A:333:GLN:O	1:A:337:ARG:HG3	2.21	0.41
1:A:97:LYS:HB2	1:A:97:LYS:HE2	1.82	0.41
1:A:73:ILE:HG12	2:A:501:COA:N1A	2.36	0.41
1:A:123:LEU:HD21	1:A:172:SER:HB3	2.03	0.41
1:A:73:ILE:HG12	2:A:501:COA:C6A	2.51	0.40

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:331:ASN:HA	1:A:332:PRO:HD3	1.97	0.40
1:A:282:HIS:CE1	1:A:284:ILE:HB	2.56	0.40

There are no symmetry-related clashes.

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	400/408 (98%)	383 (96%)	17 (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	296/333 (89%)	276 (93%)	20 (7%)	16 25

All (20) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	8	LYS
1	A	31	GLN
1	A	123	LEU
1	A	141	ASN

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	A	181	LEU
1	A	198	ILE
1	A	246	ILE
1	A	254	THR
1	A	256	ILE
1	A	265	LEU
1	A	281	ILE
1	A	291	LEU
1	A	296	LEU
1	A	302	THR
1	A	304	THR
1	A	310	GLU
1	A	346	MET
1	A	357	MET
1	A	366	GLN
1	A	376	MET

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	31	GLN
1	A	60	GLN
1	A	113	GLN
1	A	209	GLN
1	A	267	HIS
1	A	342	GLN
1	A	374	HIS

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 monosaccharides in this entry.

5.6 Ligand geometry (i)

1 ligand is 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	$\#\|Z\| > 2$
2	COA	A	501	-	41,50,50	1.60	3 (7%)	52,75,75	1.35	4 (7%)

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
2	COA	A	501	-	-	11/44/64/64	0/3/3/3

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	501	COA	O9P-C9P	8.10	1.39	1.23
2	A	501	COA	C2A-N3A	3.72	1.38	1.32
2	A	501	COA	C2A-N1A	2.54	1.38	1.33

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	501	COA	N3A-C2A-N1A	-5.33	120.35	128.68
2	A	501	COA	CEP-CBP-CAP	3.40	114.71	108.82
2	A	501	COA	O3B-C3B-C2B	-2.43	102.89	111.68
2	A	501	COA	C1B-N9A-C4A	-2.27	122.65	126.64

There are no chirality outliers.

All (11) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	501	COA	C5B-O5B-P1A-O1A

Continued on next page...

Continued from previous page...

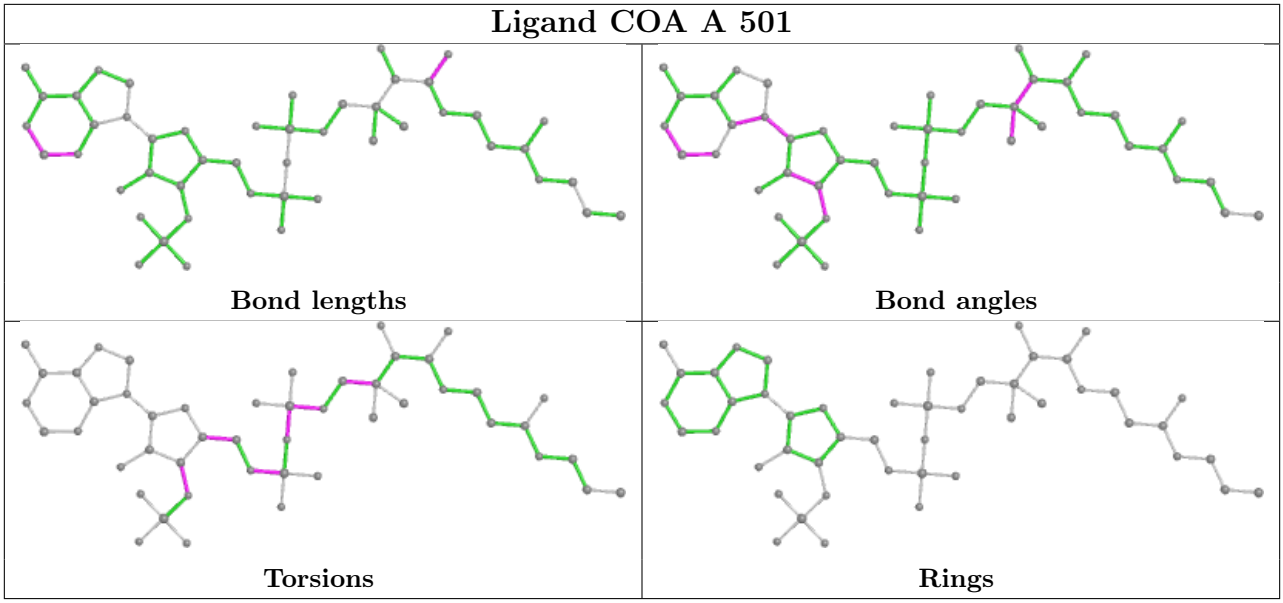
Mol	Chain	Res	Type	Atoms
2	A	501	COA	C5B-O5B-P1A-O2A
2	A	501	COA	C5B-O5B-P1A-O3A
2	A	501	COA	CCP-O6A-P2A-O4A
2	A	501	COA	CCP-O6A-P2A-O5A
2	A	501	COA	P1A-O3A-P2A-O6A
2	A	501	COA	CEP-CBP-CCP-O6A
2	A	501	COA	C2B-C3B-O3B-P3B
2	A	501	COA	C4B-C3B-O3B-P3B
2	A	501	COA	O4B-C4B-C5B-O5B
2	A	501	COA	CCP-O6A-P2A-O3A

There are no ring outliers.

1 monomer is involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	501	COA	3	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



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	A	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	A	395:LEU	C	396:VAL	N	1.60

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, 95^{th} 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	402/408 (98%)	0.57	57 (14%)	2 2	44, 52, 60, 68	0

All (57) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	390	ASN	6.4
1	A	174	LEU	6.0
1	A	175	THR	5.1
1	A	171	PHE	4.6
1	A	387	TYR	4.1
1	A	386	GLY	4.0
1	A	178	THR	3.8
1	A	176	ALA	3.6
1	A	170	TYR	3.4
1	A	173	GLY	3.4
1	A	169	ALA	3.4
1	A	76	ASP	3.3
1	A	28	PHE	3.3
1	A	177	THR	3.3
1	A	172	SER	3.3
1	A	168	ALA	3.2
1	A	207	MET	3.2
1	A	243	ASP	3.1
1	A	242	ALA	3.0
1	A	5	PRO	2.9
1	A	381	ILE	2.9
1	A	198	ILE	2.8
1	A	167	THR	2.8
1	A	203	VAL	2.8
1	A	114	HIS	2.7
1	A	113	GLN	2.7
1	A	25	ALA	2.7

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	A	179	ALA	2.7
1	A	24	ILE	2.7
1	A	392	ILE	2.7
1	A	32	MET	2.6
1	A	379	ALA	2.6
1	A	385	ILE	2.6
1	A	276	GLU	2.6
1	A	204	MET	2.5
1	A	388	SER	2.5
1	A	273	GLU	2.5
1	A	36	TRP	2.4
1	A	304	THR	2.3
1	A	26	GLY	2.3
1	A	180	ALA	2.3
1	A	71	LEU	2.3
1	A	358	PRO	2.3
1	A	205	LEU	2.3
1	A	348	GLY	2.2
1	A	199	ALA	2.2
1	A	29	ALA	2.2
1	A	4	LEU	2.1
1	A	382	LEU	2.1
1	A	117	LYS	2.1
1	A	77	GLU	2.1
1	A	357	MET	2.1
1	A	163	ALA	2.1
1	A	378	THR	2.1
1	A	389	GLU	2.1
1	A	206	ARG	2.0
1	A	220	GLU	2.0

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 monosaccharides in this entry.

6.4 Ligands

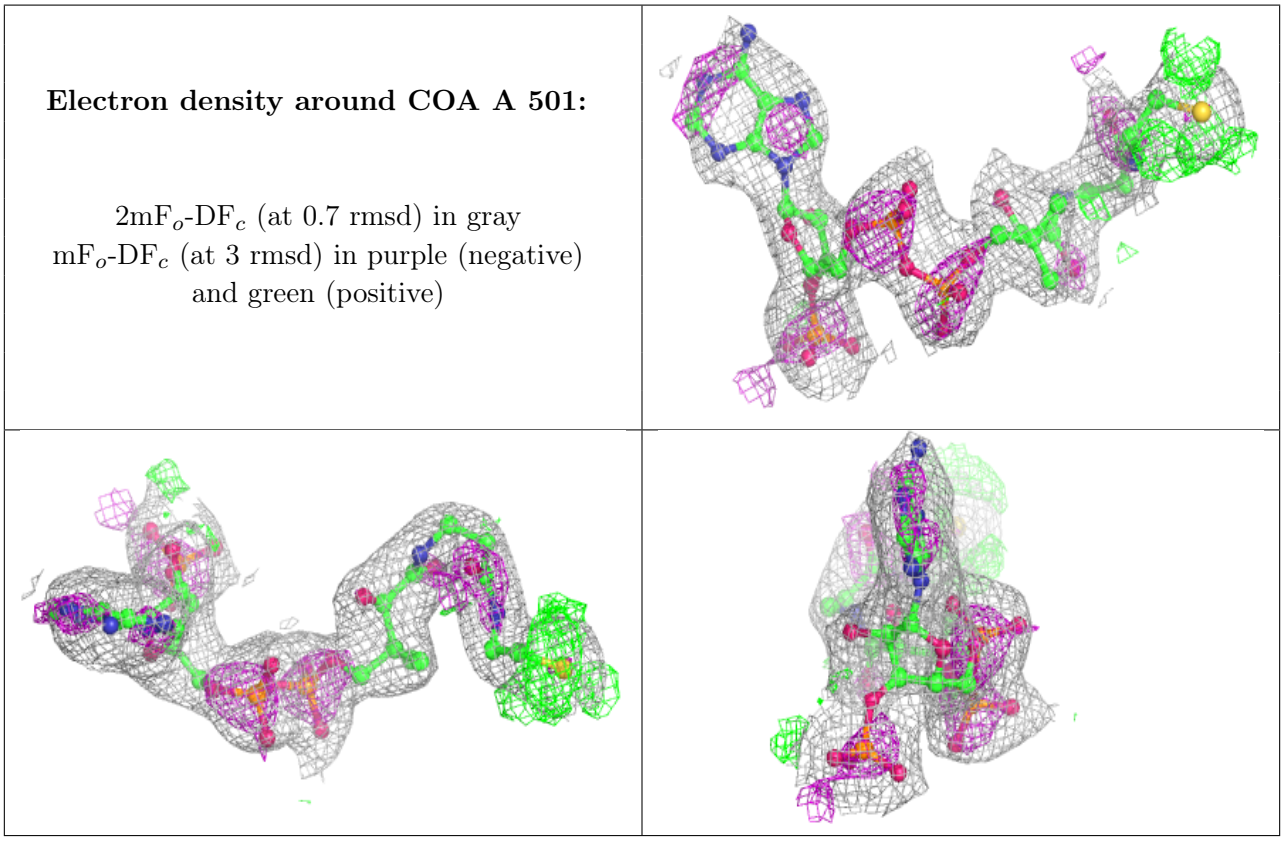
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' 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
2	COA	A	501	48/48	0.91	0.13	37,64,74,74	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 COA A 501:

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



6.5 Other polymers

There are no such residues in this entry.