WORLDWIDE wwPDB PROTEIN DATA BANK

Full wwPDB X-ray Structure Validation Report (i)

Jun 9, 2025 – 02:14 PM JST

PDB ID	:	8ZVR / pdb_00008zvr
Title	:	Human citrate synthase intermediate 2
Authors	:	Yang, L.Y.; Fang, Y.J.
Deposited on	:	2024-06-12
Resolution	:	1.80 Å(reported)

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

|		
MolProbity	:	4-5-2 with Phenix2.0rc1
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	2.0rc1
EDS	:	3.0
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.006 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.43.1

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 1.80 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		0.275
Clashscore		9
Ramachandran outliers		0.8%
Sidechain outliers		5.1%
RSRZ outliers		20.6%

Worse   *Better*

▌ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution
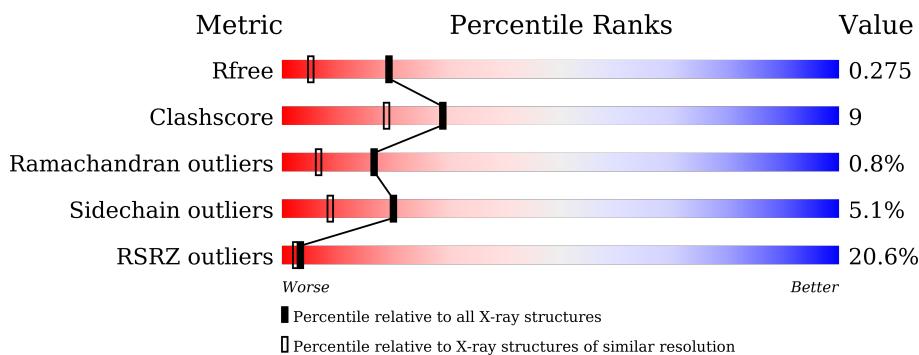
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R$_{free}$	164625	7108 (1.80-1.80)
Clashscore	180529	8162 (1.80-1.80)
Ramachandran outliers	177936	8077 (1.80-1.80)
Sidechain outliers	177891	8076 (1.80-1.80)
RSRZ outliers	164620	7108 (1.80-1.80)

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	434	20% / 83% / 14% / •
1	B	434	22% / 77% / 17% / 6%
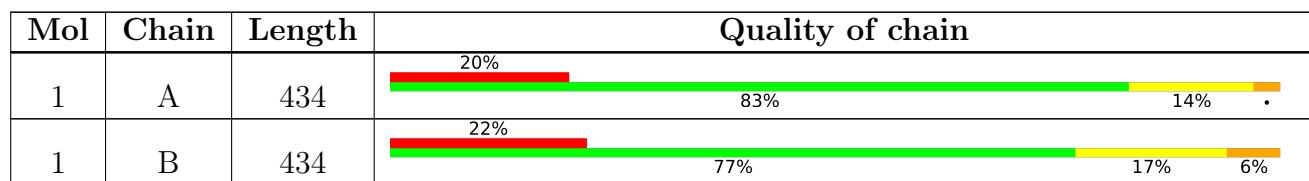
The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

| Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	ACE	A	502	-	-	X	-
4	OAA	A	503	-	-	X	-

2 Entry composition ⓘ

There are 5 unique types of molecules in this entry. The entry contains 7234 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 Citrate synthase, mitochondrial.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	434	Total	C	N	O	S	0	1	0
			3424	2190	587	630	17			
1	B	434	Total	C	N	O	S	0	1	0
			3393	2170	579	627	17			

- Molecule 2 is COENZYME A (CCD ID: COA) (formula: $C_{21}H_{36}N_7O_{16}P_3S$).
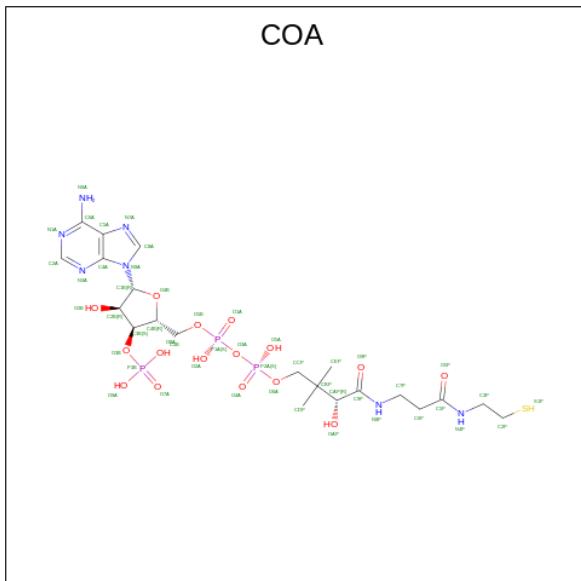
Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	S	0	0
			48	21	7	16	3	1		

- Molecule 3 is ACETYL GROUP (CCD ID: ACE) (formula: C_2H_4O).

ACE
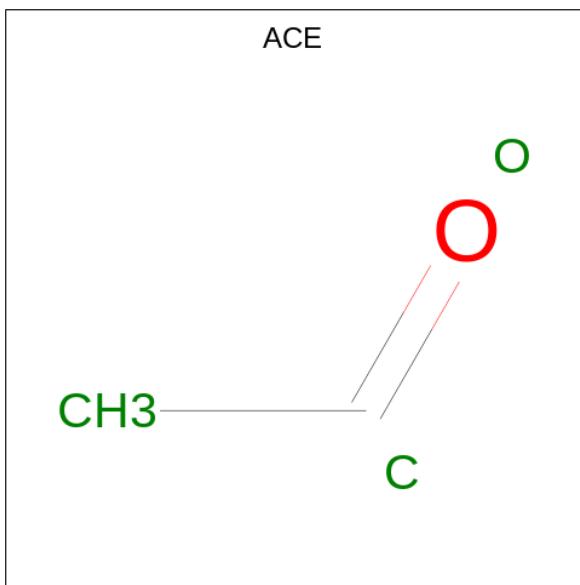
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total C O 3　　2　1	0	0

- Molecule 4 is OXALOACETATE ION (CCD ID: OAA) (formula: $C_4H_3O_5$).

OAA
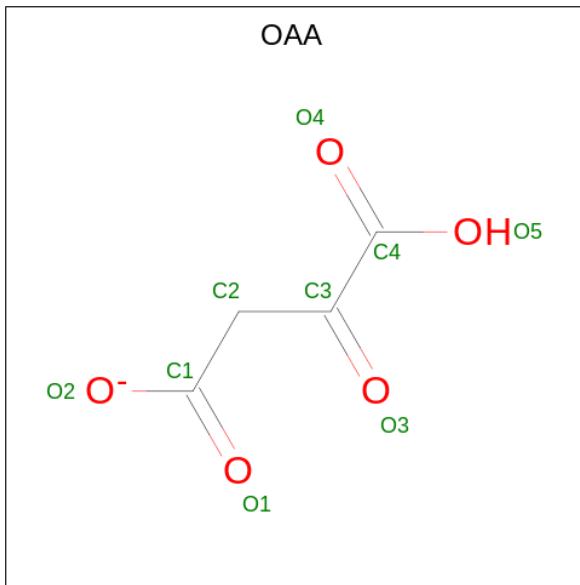
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C O 9　　4　5	0	0

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	183	Total 183	O 183	0	0
5	B	174	Total 174	O 174	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 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: Citrate synthase, mitochondrial

Chain A:

- Molecule 1: Citrate synthase, mitochondrial

Chain B:
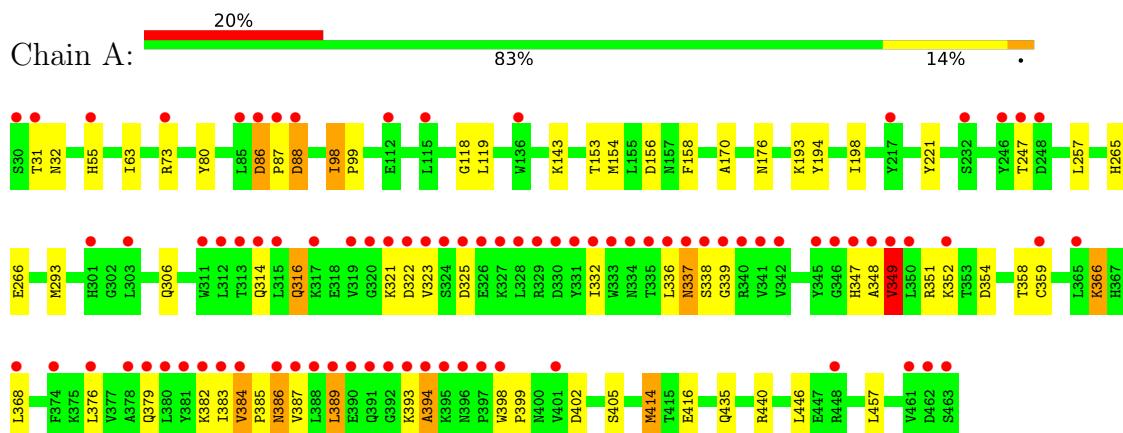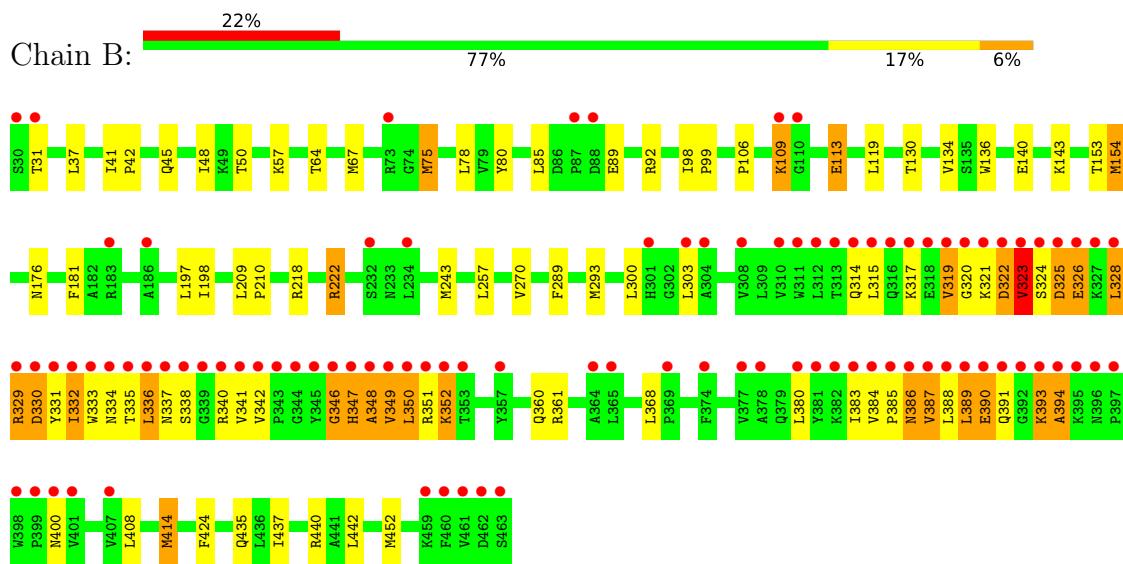
4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α, β, γ	57.92Å 59.73Å 73.28Å 101.58° 98.87° 116.40°	Depositor
Resolution (Å)	68.97 – 1.80 68.97 – 1.80	Depositor EDS
% Data completeness (in resolution range)	83.6 (68.97-1.80) 83.6 (68.97-1.80)	Depositor EDS
R_{merge}	0.14	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.73 (at 1.80Å)	Xtriage
Refinement program	REFMAC 5.8.0419	Depositor
R, R_{free}	0.220 , 0.274 0.226 , 0.275	Depositor DCC
R_{free} test set	3844 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å^2)	21.1	Xtriage
Anisotropy	0.154	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.36 , 36.4	EDS
L-test for twinning[2]	$< |L| > = 0.49, < L^2 > = 0.33$	Xtriage
Estimated twinning fraction	0.016 for -k,-h,-l	Xtriage
F_o,F_c correlation	0.92	EDS
Total number of atoms	7234	wwPDB-VP
Average B, all atoms (Å^2)	41.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.01% 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: ACE, COA, OAA

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	0.71	3/3512 (0.1%)	1.17	11/4767 (0.2%)
1	B	0.87	8/3480 (0.2%)	1.25	24/4729 (0.5%)
All	All	0.80	11/6992 (0.2%)	1.21	35/9496 (0.4%)

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	A	0	1
1	B	0	5
All	All	0	6

All (11) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	348	ALA	C-N	19.21	1.59	1.33
1	B	347	HIS	C-N	14.86	1.55	1.33
1	A	349	VAL	C-N	14.69	1.53	1.33
1	B	330	ASP	C-N	12.44	1.49	1.33
1	B	346	GLY	C-N	8.42	1.44	1.33
1	A	337	ASN	C-N	8.34	1.45	1.33
1	B	329	ARG	C-N	8.29	1.45	1.33
1	B	386	ASN	C-N	-8.19	1.22	1.33
1	B	323	VAL	C-N	7.96	1.43	1.33
1	A	348	ALA	C-N	7.67	1.44	1.33
1	B	341	VAL	C-N	-5.49	1.27	1.33

All (35) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	109	LYS	CB-CA-C	10.08	126.02	109.89
1	A	337	ASN	CA-C-N	-9.20	105.82	120.63
1	A	337	ASN	C-N-CA	-9.20	105.82	120.63
1	B	348	ALA	CA-C-N	-9.01	105.75	121.97
1	B	348	ALA	C-N-CA	-9.01	105.75	121.97
1	B	346	GLY	CA-C-N	-8.13	109.18	122.11
1	B	346	GLY	C-N-CA	-8.13	109.18	122.11
1	B	414	MET	CG-SD-CE	7.58	117.57	100.90
1	B	424	PHE	CA-CB-CG	7.17	120.97	113.80
1	B	452	MET	CG-SD-CE	-7.10	85.28	100.90
1	B	352	LYS	N-CA-CB	6.53	121.52	110.49
1	B	75	MET	CG-SD-CE	-6.33	86.97	100.90
1	B	153	THR	CA-CB-OG1	-6.29	100.16	109.60
1	B	319	VAL	N-CA-CB	-6.23	100.96	111.23
1	A	354	ASP	CA-CB-CG	6.20	118.80	112.60
1	B	50	THR	CA-CB-OG1	-6.12	100.42	109.60
1	B	346	GLY	O-C-N	-6.09	117.90	123.56
1	A	86	ASP	CB-CA-C	6.09	119.72	109.67
1	A	153	THR	CA-CB-OG1	-6.09	100.47	109.60
1	B	386	ASN	CA-C-N	6.00	132.76	121.97
1	B	386	ASN	C-N-CA	6.00	132.76	121.97
1	A	384	VAL	N-CA-CB	5.95	114.25	110.50
1	B	154	MET	CG-SD-CE	-5.84	88.06	100.90
1	A	414	MET	CG-SD-CE	5.76	113.56	100.90
1	A	383	ILE	CA-C-N	5.72	123.84	120.24
1	A	383	ILE	C-N-CA	5.72	123.84	120.24
1	B	386	ASN	N-CA-C	-5.69	104.98	112.72
1	B	113	GLU	CB-CA-C	5.68	116.55	108.76
1	B	143	LYS	CB-CA-C	-5.66	100.15	110.63
1	B	130	THR	CA-CB-OG1	-5.63	101.15	109.60
1	B	325	ASP	CA-CB-CG	5.34	117.94	112.60
1	A	156	ASP	CA-CB-CG	5.30	117.90	112.60
1	A	32	ASN	N-CA-CB	5.12	118.12	109.94
1	B	352	LYS	CB-CA-C	-5.11	100.26	110.42
1	B	181	PHE	CA-CB-CG	-5.07	108.73	113.80

There are no chirality outliers.

All (6) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	73	ARG	Sidechain
1	B	222	ARG	Sidechain
1	B	340	ARG	Sidechain

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Mol	Chain	Res	Type	Group
1	B	346	GLY	Mainchain
1	B	349	VAL	Mainchain
1	B	92	ARG	Sidechain

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	3424	0	3404	49	2
1	B	3393	0	3349	64	2
2	A	48	0	32	1	0
3	A	3	0	3	9	0
4	A	9	0	2	5	0
5	A	183	0	0	19	0
5	B	174	0	0	5	0
All	All	7234	0	6790	117	2

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 (117) 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)
3:A:502:ACE:H3	4:A:503:OAA:C3	1.70	1.20
3:A:502:ACE:CH3	5:A:602:HOH:O	1.94	1.15
3:A:502:ACE:H2	5:A:602:HOH:O	1.57	0.93
3:A:502:ACE:CH3	4:A:503:OAA:C3	2.51	0.89
5:A:638:HOH:O	1:B:300:LEU:HD12	1.75	0.86
1:B:328:LEU:HD21	1:B:380:LEU:HD23	1.59	0.84
1:B:222:ARG:NH2	5:B:501:HOH:O	2.14	0.80
1:B:329:ARG:HA	1:B:332:ILE:HB	1.67	0.77
1:A:322:ASP:O	5:A:601:HOH:O	2.03	0.76
3:A:502:ACE:C	5:A:602:HOH:O	2.22	0.76
1:A:402:ASP:OD2	5:A:602:HOH:O	2.04	0.76
1:A:257:LEU:HD11	1:A:359:CYS:SG	2.26	0.75
1:B:325:ASP:O	1:B:329:ARG:N	2.20	0.74

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:331:TYR:O	1:B:335:THR:N	2.20	0.74
1:B:222:ARG:CZ	5:B:501:HOH:O	2.36	0.73
1:A:63:ILE:HD11	1:B:75:MET:HG3	1.74	0.68
5:A:638:HOH:O	1:B:300:LEU:CD1	2.35	0.67
1:B:85:LEU:HD22	1:B:349:VAL:HG13	1.75	0.67
1:B:386:ASN:HA	5:B:517:HOH:O	1.93	0.67
2:A:501:COA:S1P	5:A:751:HOH:O	2.53	0.66
1:B:334:ASN:O	1:B:338:SER:OG	2.12	0.66
1:B:332:ILE:O	1:B:336:LEU:HB2	1.95	0.66
1:A:154:MET:HE3	1:B:154:MET:CE	2.28	0.64
1:B:319:VAL:HG12	1:B:320:GLY:O	1.97	0.64
1:A:306:GLN:HG2	5:A:695:HOH:O	1.98	0.63
1:A:446:LEU:HD11	1:B:270:VAL:HG21	1.82	0.62
1:A:347:HIS:HD2	1:A:349:VAL:H	1.47	0.61
1:A:337:ASN:O	1:A:338:SER:C	2.41	0.61
1:B:330:ASP:O	1:B:334:ASN:N	2.22	0.61
1:A:332:ILE:CG2	1:A:387:VAL:HG21	2.31	0.61
1:A:80:TYR:CE1	1:A:435:GLN:HG2	2.35	0.61
3:A:502:ACE:H3	4:A:503:OAA:C4	2.27	0.60
1:A:337:ASN:O	1:A:339:GLY:N	2.35	0.60
1:B:119:LEU:C	1:B:119:LEU:HD13	2.27	0.59
1:A:198:ILE:HG13	1:A:440:ARG:HG3	1.85	0.59
3:A:502:ACE:H3	4:A:503:OAA:C2	2.31	0.58
1:A:154:MET:HE1	1:A:170:ALA:C	2.28	0.58
1:A:446:LEU:HB2	5:A:638:HOH:O	2.05	0.57
1:B:342:VAL:HG11	1:B:384:VAL:HG21	1.88	0.56
1:B:333:TRP:O	1:B:337:ASN:HB2	2.06	0.56
1:B:98:ILE:HB	1:B:99:PRO:HD3	1.86	0.56
1:A:80:TYR:CD1	1:A:435:GLN:HG2	2.42	0.54
1:A:349:VAL:O	1:A:351:ARG:HG2	2.08	0.54
1:A:358:THR:HG23	5:A:749:HOH:O	2.08	0.53
1:A:154:MET:HE1	1:A:170:ALA:O	2.08	0.53
1:B:400:ASN:C	1:B:400:ASN:OD1	2.51	0.53
1:A:221:TYR:CD1	1:A:416:GLU:HG2	2.44	0.52
1:B:330:ASP:HB3	1:B:334:ASN:ND2	2.24	0.52
1:A:265:HIS:O	1:A:266:GLU:HB2	2.09	0.52
1:B:360:GLN:HB3	1:B:408:LEU:HD11	1.91	0.52
1:A:86:ASP:HB2	1:A:88:ASP:OD1	2.09	0.52
1:A:316:GLN:HG2	1:A:376:LEU:HD22	1.92	0.52
1:A:446:LEU:HD11	1:B:270:VAL:CG2	2.40	0.52
1:B:334:ASN:CG	5:B:568:HOH:O	2.53	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:337:ASN:C	1:A:339:GLY:N	2.67	0.51
1:B:315:LEU:O	1:B:319:VAL:HB	2.11	0.51
1:B:360:GLN:HB3	1:B:408:LEU:CD1	2.42	0.49
1:B:361:ARG:HG3	1:B:361:ARG:HH11	1.77	0.49
1:A:119:LEU:C	1:A:119:LEU:HD13	2.37	0.49
5:A:762:HOH:O	1:B:349:VAL:CG2	2.60	0.49
1:B:347:HIS:CD2	1:B:350:LEU:HD12	2.48	0.49
1:B:332:ILE:HD12	1:B:342:VAL:HG22	1.95	0.49
1:B:198:ILE:HG13	1:B:440:ARG:HG3	1.95	0.49
1:A:393:LYS:O	1:A:394:ALA:HB2	2.14	0.48
1:B:319:VAL:HG13	1:B:323:VAL:HG22	1.95	0.47
1:A:154:MET:HE2	1:A:158:PHE:HZ	1.80	0.47
1:B:64:THR:OG1	1:B:67:MET:HG3	2.15	0.47
1:A:118:GLY:HA3	5:A:703:HOH:O	2.14	0.47
1:B:197:LEU:HD22	1:B:197:LEU:N	2.30	0.47
1:A:154:MET:HE2	1:A:158:PHE:CZ	2.50	0.46
1:B:41:ILE:N	1:B:42:PRO:CD	2.78	0.46
1:A:366:LYS:NZ	5:A:616:HOH:O	2.47	0.46
1:B:78:LEU:N	1:B:78:LEU:HD23	2.31	0.45
1:B:331:TYR:O	1:B:332:ILE:C	2.60	0.45
1:A:154:MET:HE3	1:B:154:MET:HE3	1.98	0.45
1:B:41:ILE:O	1:B:45:GLN:HG3	2.16	0.45
1:B:387:VAL:HG12	1:B:389:LEU:HB2	1.98	0.45
1:B:384:VAL:N	1:B:385:PRO:CD	2.79	0.44
1:B:136:TRP:CH2	1:B:140:GLU:HG3	2.52	0.44
1:A:347:HIS:CD2	1:A:349:VAL:H	2.32	0.44
1:B:218:ARG:HD2	1:B:243:MET:O	2.18	0.44
1:B:210:PRO:HB2	1:B:243:MET:HE1	2.00	0.44
1:A:143:LYS:HG3	5:A:613:HOH:O	2.17	0.44
1:B:48:ILE:CD1	1:B:442:LEU:HD13	2.47	0.43
1:B:314:GLN:HA	1:B:317:LYS:HD3	1.99	0.43
1:B:335:THR:HA	1:B:338:SER:HB2	1.99	0.43
1:A:386:ASN:O	1:A:389:LEU:HB2	2.18	0.43
1:A:98:ILE:HB	1:A:99:PRO:HD3	2.00	0.43
1:B:289:PHE:CE1	1:B:293:MET:HE3	2.53	0.43
3:A:502:ACE:CH3	4:A:503:OAA:C2	2.93	0.43
1:B:390:GLU:H	1:B:390:GLU:HG3	1.43	0.43
1:B:330:ASP:O	1:B:331:TYR:C	2.61	0.43
1:B:393:LYS:O	1:B:394:ALA:HB2	2.18	0.43
1:A:293:MET:HE2	1:A:293:MET:HA	2.01	0.43
1:B:106:PRO:HG2	1:B:134:VAL:HG21	1.99	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:385:PRO:HG2	5:A:605:HOH:O	2.19	0.43
1:B:113:GLU:OE1	1:B:257:LEU:HD13	2.19	0.43
1:B:329:ARG:CA	1:B:332:ILE:HB	2.42	0.43
1:B:325:ASP:HB3	1:B:383:ILE:HD12	2.01	0.42
1:B:57:LYS:NZ	5:B:508:HOH:O	2.45	0.42
1:A:347:HIS:HE1	3:A:502:ACE:O	2.02	0.42
1:B:80:TYR:CE2	1:B:435:GLN:HG2	2.55	0.42
1:A:398:TRP:HB3	1:A:399:PRO:HD2	2.01	0.42
1:A:332:ILE:O	1:A:336:LEU:HG	2.19	0.42
1:A:332:ILE:HG12	1:A:384:VAL:HG22	2.01	0.42
1:B:330:ASP:O	1:B:333:TRP:N	2.53	0.42
1:A:323:VAL:N	5:A:621:HOH:O	2.52	0.41
1:B:209:LEU:N	1:B:210:PRO:HD2	2.35	0.41
1:A:446:LEU:HD13	5:A:638:HOH:O	2.20	0.41
1:A:384:VAL:N	1:A:385:PRO:CD	2.83	0.41
1:A:193:LYS:O	1:A:194:TYR:C	2.64	0.41
1:A:87:PRO:HG3	1:A:349:VAL:HG23	2.03	0.41
1:A:55:HIS:ND1	5:A:606:HOH:O	2.37	0.41
1:A:379:GLN:HA	1:A:382:LYS:HD3	2.02	0.40
1:B:347:HIS:CG	1:B:348:ALA:H	2.39	0.40
1:B:37:LEU:HD21	1:B:437:ILE:HG21	2.03	0.40
1:B:322:ASP:O	1:B:323:VAL:HG13	2.22	0.40

All (2) 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:247:THR:OG1	1:B:326:GLU:OE1[1_444]	1.85	0.35
1:A:247:THR:OG1	1:B:326:GLU:CD[1_444]	2.05	0.15

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	433/434 (100%)	419 (97%)	13 (3%)	1 (0%)	44	31
1	B	433/434 (100%)	394 (91%)	33 (8%)	6 (1%)	9	2
All	All	866/868 (100%)	813 (94%)	46 (5%)	7 (1%)	16	6

All (7) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	394	ALA
1	B	322	ASP
1	B	323	VAL
1	B	394	ALA
1	B	351	ARG
1	B	352	LYS
1	B	387	VAL

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	369/369 (100%)	352 (95%)	17 (5%)	23	11
1	B	363/369 (98%)	343 (94%)	20 (6%)	18	7
All	All	732/738 (99%)	695 (95%)	37 (5%)	20	9

All (37) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	31	THR
1	A	88	ASP
1	A	98	ILE
1	A	176	ASN
1	A	314	GLN
1	A	316	GLN
1	A	321	LYS
1	A	325	ASP
1	A	349	VAL

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Mol	Chain	Res	Type
1	A	352	LYS
1	A	366	LYS
1	A	368	LEU
1	A	386	ASN
1	A	389	LEU
1	A	405	SER
1	A	414	MET
1	A	457	LEU
1	B	31	THR
1	B	89	GLU
1	B	109	LYS
1	B	176	ASN
1	B	303	LEU
1	B	321	LYS
1	B	323	VAL
1	B	324	SER
1	B	326	GLU
1	B	328	LEU
1	B	332	ILE
1	B	336	LEU
1	B	350	LEU
1	B	368	LEU
1	B	388	LEU
1	B	389	LEU
1	B	390	GLU
1	B	391	GLN
1	B	393	LYS
1	B	414	MET

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (12) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	54	GLN
1	A	347	HIS
1	A	386	ASN
1	B	54	GLN
1	B	150	HIS
1	B	249	HIS
1	B	250	GLN
1	B	316	GLN
1	B	347	HIS
1	B	379	GLN

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Mol	Chain	Res	Type
1	B	386	ASN
1	B	391	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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 oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

3 ligands are 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	$\#|Z| > 2$
3	ACE	A	502	-	1,2,2	0.07	0	1,1,1	0.08	0
2	COA	A	501	-	41,50,50	0.63	0	52,75,75	0.82	2 (3%)
4	OAA	A	503	-	8,8,8	4.97	2 (25%)	9,10,10	1.51	1 (11%)

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	-	-	12/44/64/64	0/3/3/3

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	OAA	A	503	-	-	1/8/8/8	-

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	503	OAA	C3-C4	-13.58	1.35	1.53
4	A	503	OAA	O5-C4	-2.94	1.22	1.30

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	501	COA	C5A-C6A-N6A	2.38	123.97	120.35
4	A	503	OAA	O3-C3-C2	-2.37	117.15	120.58
2	A	501	COA	P2A-O3A-P1A	2.27	140.63	132.83

There are no chirality outliers.

All (13) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	501	COA	CCP-O6A-P2A-O3A
2	A	501	COA	CCP-O6A-P2A-O5A
2	A	501	COA	N8P-C9P-CAP-OAP
2	A	501	COA	O4B-C4B-C5B-O5B
2	A	501	COA	O9P-C9P-CAP-OAP
2	A	501	COA	O9P-C9P-CAP-CBP
2	A	501	COA	P1A-O3A-P2A-O6A
2	A	501	COA	C3B-C4B-C5B-O5B
2	A	501	COA	C5B-O5B-P1A-O2A
2	A	501	COA	P2A-O3A-P1A-O2A
2	A	501	COA	CEP-CBP-CCP-O6A
2	A	501	COA	C5B-O5B-P1A-O3A
4	A	503	OAA	O1-C1-C2-C3

There are no ring outliers.

3 monomers are involved in 10 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	502	ACE	9	0
2	A	501	COA	1	0
4	A	503	OAA	5	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.

Ligand COA A 501
Bond lengths　　　　Bond angles

Torsions　　　　Rings
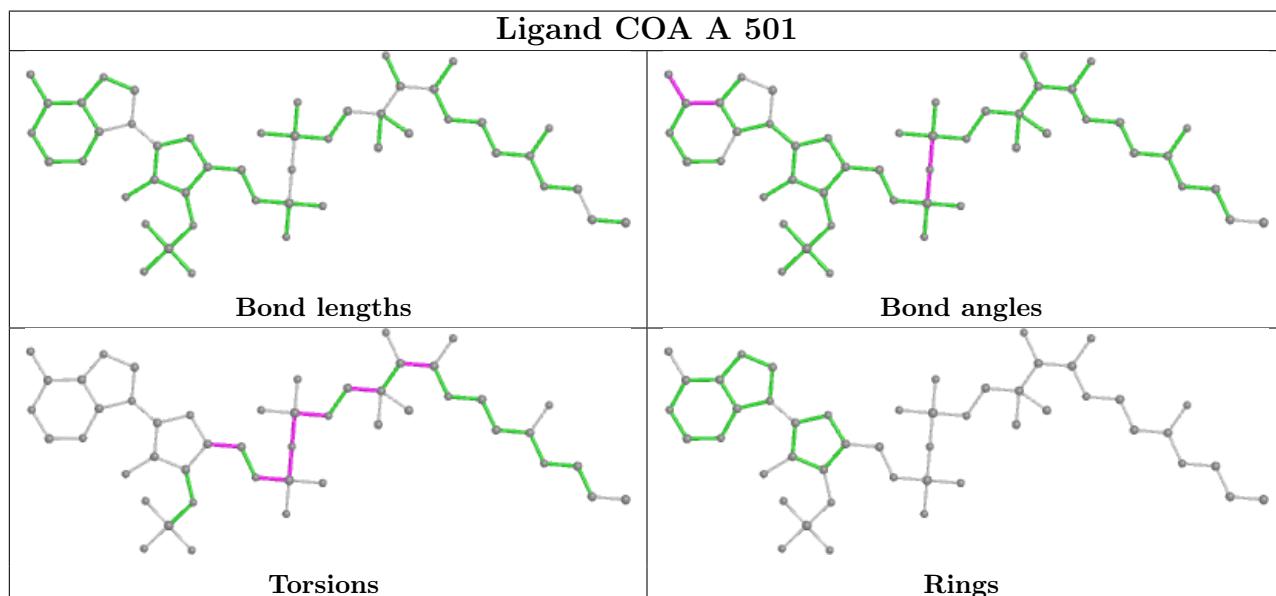
5.7 Other polymers ⓘ

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	434/434 (100%)	1.02	85 (19%)	4	3	15, 32, 82, 115	1 (0%)
1	B	434/434 (100%)	1.26	94 (21%)	3	2	16, 33, 114, 156	1 (0%)
All	All	868/868 (100%)	1.14	179 (20%)	3	2	15, 33, 97, 156	2 (0%)

All (179) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	388	LEU	8.4
1	B	332	ILE	8.0
1	B	333	TRP	7.6
1	B	389	LEU	7.0
1	B	336	LEU	6.9
1	A	389	LEU	6.8
1	B	323	VAL	6.8
1	B	387	VAL	6.4
1	B	346	GLY	6.4
1	B	341	VAL	5.8
1	B	328	LEU	5.6
1	B	383	ILE	5.6
1	B	350	LEU	5.6
1	B	348	ALA	5.5
1	A	387	VAL	5.5
1	A	383	ILE	5.2
1	B	345	TYR	5.2
1	A	388	LEU	5.1
1	B	315	LEU	5.1
1	B	349	VAL	5.0
1	B	319	VAL	5.0
1	B	331	TYR	5.0
1	A	31	THR	5.0
1	A	328	LEU	4.9

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Mol	Chain	Res	Type	RSRZ
1	A	323	VAL	4.8
1	B	311	TRP	4.7
1	B	384	VAL	4.7
1	B	352	LYS	4.6
1	B	394	ALA	4.6
1	B	396	ASN	4.6
1	B	325	ASP	4.6
1	A	349	VAL	4.5
1	B	398	TRP	4.4
1	B	329	ARG	4.4
1	B	393	LYS	4.4
1	B	397	PRO	4.4
1	A	341	VAL	4.4
1	B	324	SER	4.4
1	B	339	GLY	4.3
1	A	87	PRO	4.3
1	B	318	GLU	4.3
1	B	109	LYS	4.1
1	B	322	ASP	4.1
1	B	342	VAL	4.1
1	B	365	LEU	4.1
1	A	463	SER	4.0
1	B	347	HIS	4.0
1	B	303	LEU	4.0
1	B	340	ARG	3.9
1	B	327	LYS	3.9
1	A	332	ILE	3.9
1	B	335	THR	3.9
1	B	385	PRO	3.8
1	A	395	LYS	3.8
1	B	395	LYS	3.8
1	B	461	VAL	3.8
1	A	324	SER	3.7
1	B	30	SER	3.7
1	B	344	GLY	3.7
1	B	317	LYS	3.7
1	A	303	LEU	3.7
1	A	331	TYR	3.6
1	A	317	LYS	3.6
1	A	390	GLU	3.6
1	B	326	GLU	3.6
1	B	338	SER	3.6

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Mol	Chain	Res	Type	RSRZ
1	B	334	ASN	3.5
1	B	392	GLY	3.5
1	B	386	ASN	3.5
1	A	346	GLY	3.5
1	A	30	SER	3.4
1	A	342	VAL	3.4
1	B	353	THR	3.4
1	A	359	CYS	3.4
1	A	345	TYR	3.4
1	B	183	ARG	3.4
1	A	394	ALA	3.4
1	A	333	TRP	3.4
1	B	320	GLY	3.4
1	B	390	GLU	3.4
1	A	340	ARG	3.3
1	B	337	ASN	3.2
1	A	321	LYS	3.2
1	B	343	PRO	3.2
1	A	338	SER	3.2
1	B	381	TYR	3.2
1	B	73	ARG	3.2
1	A	336	LEU	3.1
1	A	461	VAL	3.1
1	B	380	LEU	3.1
1	A	88	ASP	3.1
1	B	401	VAL	3.1
1	A	327	LYS	3.1
1	A	386	ASN	3.1
1	B	110	GLY	3.1
1	B	351	ARG	3.0
1	B	321	LYS	3.0
1	B	364	ALA	3.0
1	A	368	LEU	3.0
1	A	348	ALA	3.0
1	A	378	ALA	3.0
1	A	396	ASN	3.0
1	A	398	TRP	3.0
1	A	376	LEU	2.9
1	A	319	VAL	2.9
1	A	329	ARG	2.9
1	B	330	ASP	2.9
1	A	350	LEU	2.8

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Mol	Chain	Res	Type	RSRZ
1	B	374	PHE	2.8
1	A	339	GLY	2.8
1	A	380	LEU	2.8
1	A	335	THR	2.8
1	B	316	GLN	2.7
1	A	247	THR	2.7
1	B	304	ALA	2.7
1	A	85	LEU	2.7
1	B	377	VAL	2.7
1	A	315	LEU	2.7
1	A	313	THR	2.6
1	A	337	ASN	2.6
1	A	314	GLN	2.6
1	B	357	TYR	2.6
1	A	393	LYS	2.6
1	B	31	THR	2.6
1	B	463	SER	2.6
1	B	382	LYS	2.6
1	A	448	ARG	2.6
1	B	186	ALA	2.6
1	A	352	LYS	2.5
1	A	381	TYR	2.5
1	A	86	ASP	2.5
1	B	314	GLN	2.5
1	B	407	VAL	2.5
1	A	322	ASP	2.5
1	A	347	HIS	2.5
1	A	462	ASP	2.5
1	B	88	ASP	2.5
1	B	378	ALA	2.5
1	B	310	VAL	2.4
1	B	399	PRO	2.4
1	B	232	SER	2.4
1	A	397	PRO	2.4
1	A	384	VAL	2.4
1	A	374	PHE	2.4
1	B	301	HIS	2.4
1	B	391	GLN	2.4
1	A	136	TRP	2.3
1	A	325	ASP	2.3
1	A	326	GLU	2.3
1	A	217	TYR	2.3

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Mol	Chain	Res	Type	RSRZ
1	B	234	LEU	2.3
1	A	379	GLN	2.3
1	A	334	ASN	2.3
1	B	400	ASN	2.3
1	B	313	THR	2.3
1	A	312	LEU	2.3
1	A	73	ARG	2.2
1	A	392	GLY	2.2
1	B	460	PHE	2.2
1	B	87	PRO	2.2
1	A	112	GLU	2.2
1	A	311	TRP	2.2
1	A	246	TYR	2.2
1	A	55	HIS	2.2
1	A	330	ASP	2.2
1	B	459	LYS	2.2
1	A	391	GLN	2.2
1	A	248	ASP	2.1
1	A	232	SER	2.1
1	A	401	VAL	2.1
1	B	308	VAL	2.1
1	A	320	GLY	2.1
1	B	462	ASP	2.1
1	A	301	HIS	2.1
1	A	115	LEU	2.1
1	B	369	PRO	2.1
1	A	382	LYS	2.0
1	A	365	LEU	2.0
1	B	312	LEU	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 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
2	COA	A	501	48/48	0.75	0.15	45,76,93,94	0
3	ACE	A	502	3/3	0.82	0.17	49,49,54,59	0
4	OAA	A	503	9/9	0.84	0.10	30,35,41,42	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.