Full wwPDB X-ray Structure Validation Report ⓘ

Jan 20, 2026 – 06:22 pm GMT

PDB ID	:	9TME / pdb_00009tme
Title	:	Structure of Plasmodium falciparum Transketolase in complex with Oxythiamine
Authors	:	Raimi, O.G.; Akintola, I.A.; Orogun, Y.; Babalola, K.I.; Soriyan, O.O.; Ogunlana, O.O.; Ogunjimi, A.A.; Vanderpuye, O.A.; Fadare, O.A.
Deposited on	:	2025-12-12
Resolution	:	1.81 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 ⓘ 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 ⓘ) were used in the production of this report:

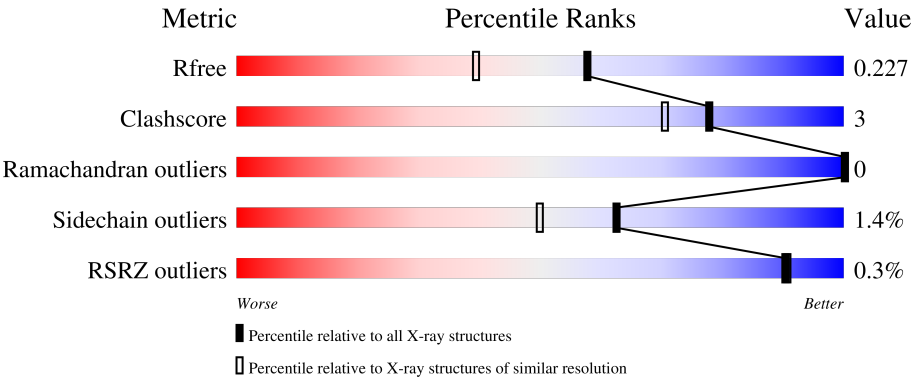
MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.47

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 1.81 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}	164625	9242 (1.84-1.80)
Clashscore	180529	1080 (1.82-1.82)
Ramachandran outliers	177936	1073 (1.82-1.82)
Sidechain outliers	177891	1073 (1.82-1.82)
RSRZ outliers	164620	9241 (1.84-1.80)

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	672	93% 6% •
1	B	672	91% 8% •
1	C	672	92% 7% •
1	D	672	92% 7% •

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
2	GOL	B	703	-	-	X	-
2	GOL	C	701	-	-	X	-

2 Entry composition (i)

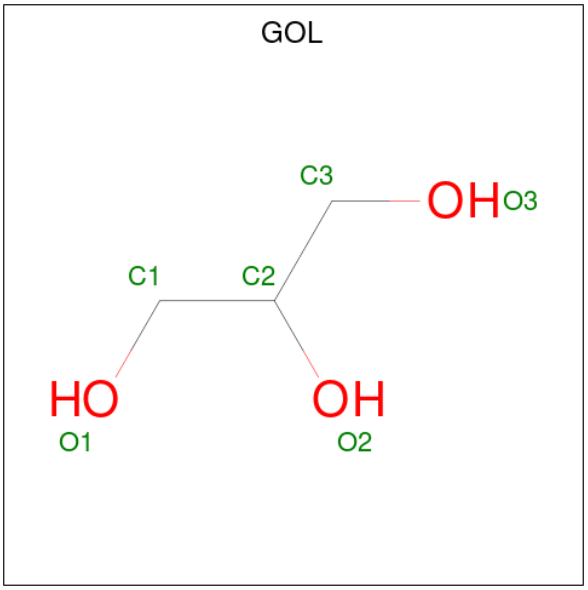
There are 5 unique types of molecules in this entry. The entry contains 23239 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 transketolase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	664	Total	C	N	O	S	0	0	0
			5277	3363	901	990	23			
1	B	667	Total	C	N	O	S	0	0	0
			5302	3378	905	995	24			
1	C	665	Total	C	N	O	S	0	1	0
			5292	3374	904	991	23			
1	D	663	Total	C	N	O	S	0	1	0
			5275	3362	901	989	23			

- Molecule 2 is GLYCEROL (CCD ID: GOL) (formula: $C_3H_8O_3$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	O		0	0
			6	3	3			
2	A	1	Total	C	O		0	0
			6	3	3			

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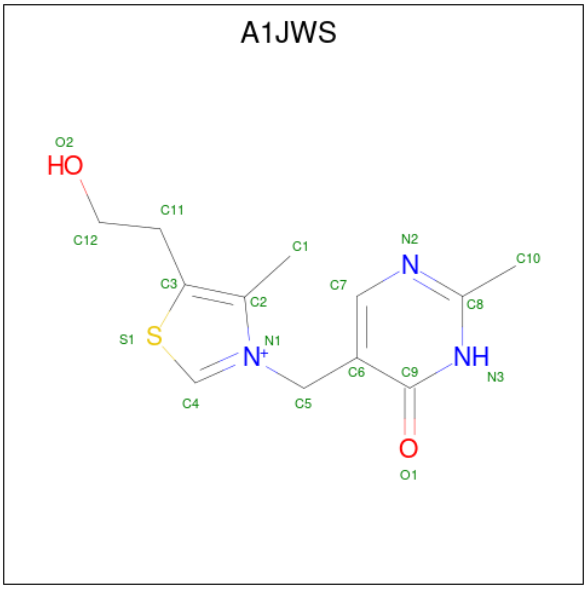
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	B	1	Total C O 6 3 3	0	0
2	B	1	Total C O 6 3 3	0	0
2	C	1	Total C O 6 3 3	0	0
2	C	1	Total C O 6 3 3	0	0

- Molecule 3 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total Cl 1 1	0	0
3	B	1	Total Cl 1 1	0	0
3	C	1	Total Cl 1 1	0	0
3	D	1	Total Cl 1 1	0	0

- Molecule 4 is Oxythiamine (CCD ID: A1JWS) (formula: $C_{12}H_{16}N_3O_2S$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C N O S 18 12 3 2 1	0	0

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	B	1	Total	C	N	O	S	0	0
			18	12	3	2	1		
4	B	1	Total	C	N	O	S	0	0
			18	12	3	2	1		
4	C	1	Total	C	N	O	S	0	0
			18	12	3	2	1		

- Molecule 5 is water.

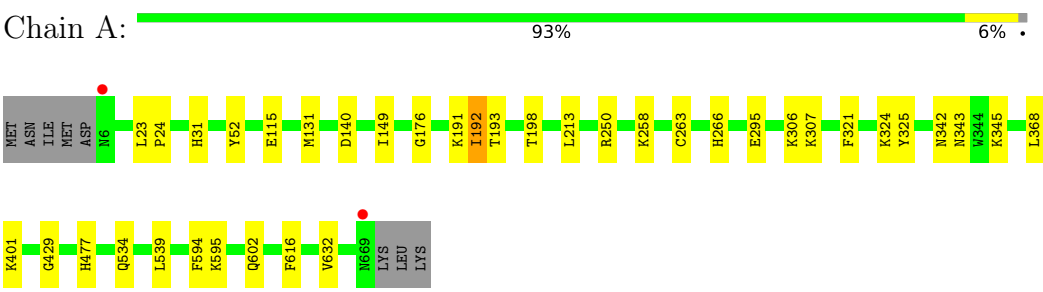
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	537	Total	O	0	0
			537	537		
5	B	478	Total	O	0	0
			478	478		
5	C	502	Total	O	0	0
			502	502		
5	D	464	Total	O	0	0
			464	464		

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.

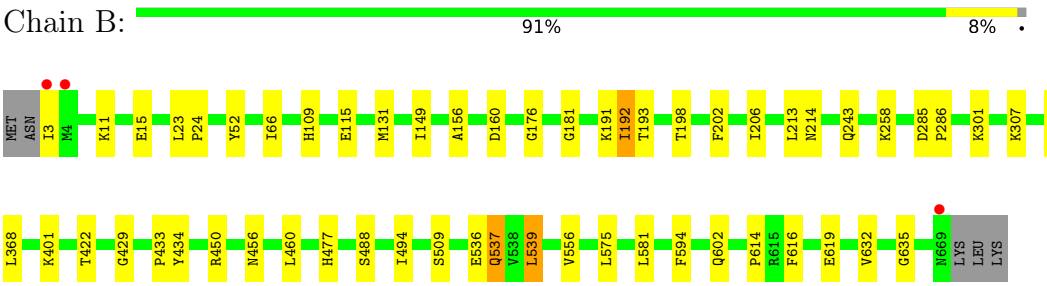
• Molecule 1: transketolase

Chain A:



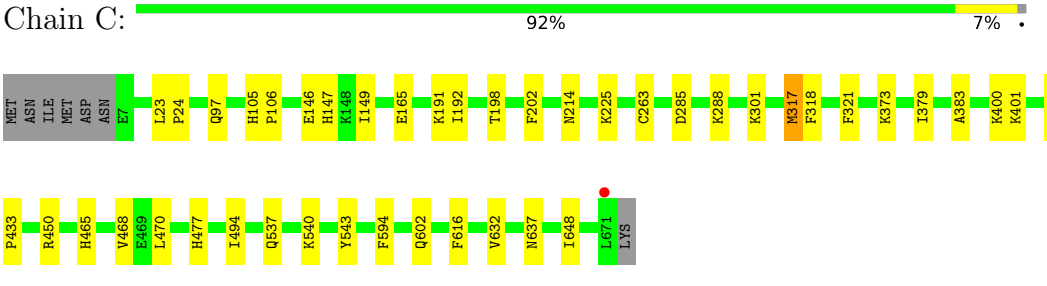
• Molecule 1: transketolase

Chain B:



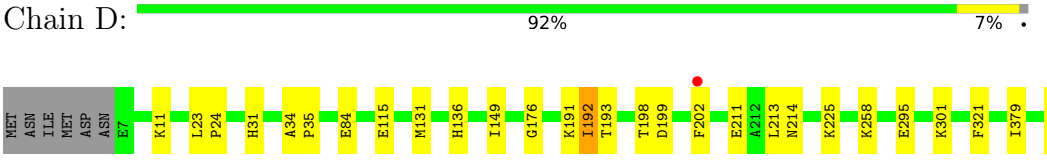
• Molecule 1: transketolase

Chain C:



• Molecule 1: transketolase

Chain D:




N402
S403
Y404
P433
R450
L470
H477
Q478
M493
S509
L539
F594
Q602
F616
V632
N637
N669
LYS
LEU
LYS

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	114.39Å 142.81Å 176.19Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	110.94 – 1.81 110.94 – 1.81	Depositor EDS
% Data completeness (in resolution range)	99.2 (110.94-1.81) 99.2 (110.94-1.81)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.45 (at 1.81Å)	Xtriage
Refinement program	REFMAC 5.8.0258	Depositor
R, R_{free}	0.181 , 0.217 0.193 , 0.227	Depositor DCC
R_{free} test set	12987 reflections (4.99%)	wwPDB-VP
Wilson B-factor (Å^2)	21.6	Xtriage
Anisotropy	0.134	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.33 , 29.3	EDS
L-test for twinning[2]	$< \|L\| > = 0.54$, $< L^2 > = 0.38$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	23239	wwPDB-VP
Average B, all atoms (Å^2)	23.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 24.57 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 3.7409e-03. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

[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: A1JWS, CL, GOL

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	1.05	0/5407	1.24	1/7322 (0.0%)
1	B	1.05	1/5432 (0.0%)	1.27	1/7356 (0.0%)
1	C	1.03	0/5425	1.26	5/7346 (0.1%)
1	D	1.04	2/5408 (0.0%)	1.28	3/7324 (0.0%)
All	All	1.04	3/21672 (0.0%)	1.26	10/29348 (0.0%)

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	31	HIS	CE1-NE2	5.73	1.38	1.32
1	B	352	THR	N-CA	5.52	1.49	1.46
1	D	403	SER	CA-CB	-5.20	1.47	1.53

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	D	478	GLN	CA-C-O	5.85	123.09	119.29
1	D	202	PHE	CA-CB-CG	5.83	119.63	113.80
1	C	165	GLU	CA-C-N	5.79	126.51	120.03
1	C	165	GLU	C-N-CA	5.79	126.51	120.03
1	D	199	ASP	CA-CB-CG	5.73	118.33	112.60
1	C	263	CYS	CA-C-N	5.34	127.70	120.38
1	C	263	CYS	C-N-CA	5.34	127.70	120.38
1	A	429	GLY	CA-C-O	-5.25	118.61	122.23
1	C	465	HIS	CB-CA-C	5.12	118.73	111.86
1	B	429	GLY	CA-C-O	-5.08	118.72	122.23

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	A	5277	0	5169	29	0
1	B	5302	0	5194	30	0
1	C	5292	0	5194	25	0
1	D	5275	0	5170	22	0
2	A	12	0	16	1	0
2	B	12	0	16	5	0
2	C	12	0	16	5	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
3	C	1	0	0	0	0
3	D	1	0	0	0	0
4	A	18	0	0	0	0
4	B	36	0	0	0	0
4	C	18	0	0	1	0
5	A	537	0	0	13	1
5	B	478	0	0	8	1
5	C	502	0	0	6	1
5	D	464	0	0	2	1
All	All	23239	0	20775	114	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 3.

All (114) 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:202:PHE:HZ	1:B:206:ILE:HD11	1.25	0.96
1:A:250:ARG:NH1	5:A:802:HOH:O	1.94	0.94
1:A:266:HIS:HD2	5:A:1227:HOH:O	1.52	0.91
1:A:140:ASP:OD2	5:A:801:HOH:O	1.90	0.88
1:B:202:PHE:CZ	1:B:206:ILE:HD11	2.14	0.80
1:A:345:LYS:CE	5:A:818:HOH:O	2.30	0.80
1:C:317:MET:HE2	1:C:317:MET:C	2.14	0.72
1:A:193:THR:HG23	1:A:198:THR:HG22	1.73	0.70
1:A:342:ASN:HD21	1:A:343:ASN:ND2	1.91	0.69

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:211:GLU:OE1	5:D:802:HOH:O	2.12	0.68
1:A:342:ASN:ND2	1:A:343:ASN:ND2	2.42	0.67
1:D:192:ILE:O	5:D:801:HOH:O	2.11	0.67
2:B:702:GOL:H32	5:B:1218:HOH:O	1.96	0.64
1:C:147:HIS:HB3	1:C:317:MET:HE3	1.82	0.62
1:C:191:LYS:C	1:C:198:THR:HG23	2.24	0.62
1:A:345:LYS:HE2	5:A:818:HOH:O	1.99	0.61
1:C:637:ASN:OD1	2:C:701:GOL:O3	2.18	0.60
1:D:149:ILE:HD11	1:D:321:PHE:CE1	2.36	0.60
1:A:191:LYS:C	1:A:198:THR:HG23	2.28	0.59
1:B:191:LYS:C	1:B:198:THR:HG23	2.29	0.58
1:C:214:ASN:HD21	1:C:401:LYS:NZ	2.01	0.58
1:D:191:LYS:C	1:D:198:THR:HG23	2.29	0.58
1:A:263:CYS:HB3	5:A:1233:HOH:O	2.02	0.58
1:A:477:HIS:HE1	5:C:819:HOH:O	1.88	0.56
1:B:11:LYS:HE2	1:B:15:GLU:OE2	2.06	0.56
1:B:509:SER:OG	1:B:539:LEU:HD12	2.06	0.55
1:B:149:ILE:HD11	1:B:321:PHE:CD1	2.41	0.55
1:B:193:THR:HG23	1:B:198:THR:HG22	1.87	0.55
1:C:214:ASN:HD21	1:C:401:LYS:HZ2	1.54	0.54
1:B:477:HIS:HE1	5:B:896:HOH:O	1.90	0.54
1:A:394:LYS:HE3	1:A:394:LYS:HA	1.90	0.53
1:C:317:MET:HE2	1:C:317:MET:O	2.08	0.52
1:C:317:MET:HE2	1:C:318:PHE:HA	1.91	0.52
1:A:295:GLU:HB2	5:A:1025:HOH:O	2.09	0.52
1:B:23:LEU:HB2	1:B:24:PRO:HD3	1.93	0.51
1:D:214:ASN:HD21	1:D:401:LYS:NZ	2.08	0.51
1:B:616:PHE:HA	1:B:632:VAL:O	2.11	0.51
2:C:701:GOL:C1	5:C:1235:HOH:O	2.58	0.51
1:D:84:GLU:OE2	1:D:301:LYS:HE2	2.09	0.51
2:B:703:GOL:C3	5:B:1164:HOH:O	2.59	0.51
1:D:616:PHE:HA	1:D:632:VAL:O	2.11	0.50
5:B:843:HOH:O	1:D:477:HIS:HE1	1.93	0.50
1:C:97:GLN:HG3	5:C:1231:HOH:O	2.11	0.50
1:B:149:ILE:HD11	1:B:321:PHE:CE1	2.47	0.49
1:B:594:PHE:CZ	1:B:602:GLN:HA	2.48	0.49
1:A:595:LYS:HD2	5:A:1125:HOH:O	2.13	0.49
2:C:701:GOL:H12	5:C:1235:HOH:O	2.12	0.48
2:B:703:GOL:O1	1:D:637:ASN:OD1	2.30	0.48
1:B:556:VAL:HG22	1:B:614:PRO:HG2	1.96	0.48
1:C:23:LEU:HB2	1:C:24:PRO:HD3	1.96	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:422:THR:HG23	1:C:433:PRO:HB2	1.97	0.47
1:A:149:ILE:HD11	1:A:321:PHE:CE1	2.49	0.47
1:C:616:PHE:HA	1:C:632:VAL:O	2.13	0.47
2:B:703:GOL:H31	5:B:1164:HOH:O	2.14	0.47
1:D:115:GLU:HB3	1:D:131:MET:HE1	1.95	0.47
1:B:176:GLY:HA3	1:B:213:LEU:O	2.14	0.47
1:A:23:LEU:HB2	1:A:24:PRO:HD3	1.96	0.47
1:D:23:LEU:HB2	1:D:24:PRO:HD3	1.97	0.47
1:A:192:ILE:N	1:A:198:THR:HG23	2.31	0.46
1:B:160:ASP:OD2	5:B:801:HOH:O	2.21	0.46
1:A:149:ILE:HD11	1:A:321:PHE:CD1	2.51	0.46
1:B:422:THR:HG23	1:B:433:PRO:HB2	1.96	0.46
1:A:594:PHE:CZ	1:A:602:GLN:HA	2.51	0.46
1:A:176:GLY:HA3	1:A:213:LEU:O	2.16	0.46
1:A:401:LYS:CE	5:A:875:HOH:O	2.63	0.45
1:B:537:GLN:HE21	1:B:537:GLN:HA	1.82	0.45
1:B:109:HIS:CE1	1:B:456:ASN:ND2	2.85	0.45
1:B:575:LEU:HD22	1:B:581:LEU:HD12	1.99	0.45
1:C:470:LEU:C	1:C:470:LEU:HD12	2.42	0.45
1:C:537:GLN:HB3	1:C:543:TYR:CG	2.52	0.44
2:C:701:GOL:H11	5:C:1053:HOH:O	2.17	0.44
1:B:115:GLU:HB3	1:B:131:MET:HE1	2.00	0.44
1:C:317:MET:HE2	1:C:318:PHE:N	2.31	0.44
1:D:594:PHE:CZ	1:D:602:GLN:HA	2.53	0.44
5:A:849:HOH:O	1:C:477:HIS:HE1	2.00	0.44
1:C:202:PHE:C	1:C:202:PHE:CD1	2.96	0.44
1:D:193:THR:HG23	1:D:198:THR:HG22	1.98	0.44
1:D:379:ILE:O	1:D:433:PRO:HA	2.18	0.44
1:B:477:HIS:HD2	5:B:1242:HOH:O	2.00	0.44
1:A:31:HIS:HD2	5:A:1146:HOH:O	2.01	0.43
1:A:140:ASP:CG	5:A:1150:HOH:O	2.60	0.43
1:B:619:GLU:O	1:B:635:GLY:HA2	2.18	0.43
1:C:149:ILE:HD11	1:C:321:PHE:CE1	2.53	0.43
1:A:345:LYS:NZ	5:A:818:HOH:O	2.49	0.43
1:B:214:ASN:HD21	1:B:401:LYS:NZ	2.16	0.43
1:A:52:TYR:O	1:A:307:LYS:HB3	2.18	0.43
1:C:149:ILE:HD11	1:C:321:PHE:CD1	2.54	0.43
1:A:616:PHE:HA	1:A:632:VAL:O	2.19	0.42
1:B:66:ILE:O	1:B:156:ALA:HA	2.19	0.42
1:D:509:SER:OG	1:D:539:LEU:HD12	2.18	0.42
1:C:105:HIS:HA	1:C:106:PRO:HD3	1.95	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:306:LYS:HD2	2:A:701:GOL:H31	2.02	0.42
2:C:701:GOL:H11	5:C:1235:HOH:O	2.18	0.42
1:C:594:PHE:CZ	1:C:602:GLN:HA	2.55	0.42
1:D:176:GLY:HA3	1:D:213:LEU:O	2.20	0.42
1:C:379:ILE:O	1:C:433:PRO:HA	2.20	0.42
1:D:470:LEU:C	1:D:470:LEU:HD12	2.45	0.42
1:D:136:HIS:HB3	1:D:404:TYR:CG	2.55	0.41
1:D:149:ILE:HD11	1:D:321:PHE:CZ	2.55	0.41
1:D:34:ALA:N	1:D:35:PRO:CD	2.82	0.41
1:B:285:ASP:HA	1:B:286:PRO:HD2	1.98	0.41
1:B:434:TYR:HA	1:B:460:LEU:O	2.20	0.41
1:B:488:SER:HA	2:B:703:GOL:H12	2.02	0.41
1:D:11:LYS:NZ	1:D:295:GLU:OE1	2.54	0.41
1:B:181:GLY:HA2	1:B:243:GLN:O	2.21	0.41
1:B:192:ILE:O	5:B:801:HOH:O	2.21	0.41
1:C:383:ALA:HA	1:C:412:GLY:O	2.21	0.41
1:C:468:VAL:HB	1:C:648:ILE:HG21	2.03	0.41
1:A:115:GLU:HB3	1:A:131:MET:HE1	2.03	0.41
1:C:285:ASP:OD2	1:C:288:LYS:HE2	2.21	0.41
1:D:493:ASN:HD22	1:D:493:ASN:HA	1.76	0.40
1:A:324:LYS:HG3	1:A:325:TYR:CE2	2.57	0.40
1:B:52:TYR:O	1:B:307:LYS:HB3	2.20	0.40
4:C:704:A1JWS:O2	4:C:704:A1JWS:S1	2.79	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)
5:A:1282:HOH:O	5:D:1196:HOH:O[3_544]	2.08	0.12
5:B:1232:HOH:O	5:C:1243:HOH:O[3_454]	2.18	0.02

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	662/672 (98%)	649 (98%)	13 (2%)	0	100	100
1	B	665/672 (99%)	653 (98%)	12 (2%)	0	100	100
1	C	664/672 (99%)	654 (98%)	10 (2%)	0	100	100
1	D	662/672 (98%)	650 (98%)	12 (2%)	0	100	100
All	All	2653/2688 (99%)	2606 (98%)	47 (2%)	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	574/583 (98%)	567 (99%)	7 (1%)	67	56
1	B	578/583 (99%)	568 (98%)	10 (2%)	56	42
1	C	577/583 (99%)	567 (98%)	10 (2%)	56	42
1	D	575/583 (99%)	569 (99%)	6 (1%)	73	62
All	All	2304/2332 (99%)	2271 (99%)	33 (1%)	62	50

All (33) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	192	ILE
1	A	258	LYS
1	A	368	LEU
1	A	394	LYS
1	A	400	LYS
1	A	534	GLN
1	A	539	LEU
1	B	3	ILE
1	B	192	ILE
1	B	258	LYS
1	B	301	LYS

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Mol	Chain	Res	Type
1	B	368	LEU
1	B	450	ARG
1	B	494	ILE
1	B	536	GLU
1	B	537	GLN
1	B	539	LEU
1	C	146	GLU
1	C	192	ILE
1	C	225	LYS
1	C	301	LYS
1	C	317	MET
1	C	373	LYS
1	C	400	LYS
1	C	450	ARG
1	C	494	ILE
1	C	540	LYS
1	D	192	ILE
1	D	225	LYS
1	D	258	LYS
1	D	395	GLU
1	D	400	LYS
1	D	450	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (43) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	31	HIS
1	A	51	ASN
1	A	232	HIS
1	A	302	ASN
1	A	342	ASN
1	A	343	ASN
1	A	440	ASN
1	A	477	HIS
1	A	493	ASN
1	B	51	ASN
1	B	197	ASN
1	B	214	ASN
1	B	236	GLN
1	B	240	ASN
1	B	243	GLN
1	B	302	ASN

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Mol	Chain	Res	Type
1	B	477	HIS
1	B	493	ASN
1	B	537	GLN
1	B	578	GLN
1	B	580	GLN
1	C	51	ASN
1	C	97	GLN
1	C	152	ASN
1	C	214	ASN
1	C	240	ASN
1	C	242	GLN
1	C	243	GLN
1	C	302	ASN
1	C	477	HIS
1	C	493	ASN
1	C	651	HIS
1	D	51	ASN
1	D	97	GLN
1	D	214	ASN
1	D	236	GLN
1	D	240	ASN
1	D	243	GLN
1	D	302	ASN
1	D	440	ASN
1	D	456	ASN
1	D	477	HIS
1	D	578	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 (i)

Of 14 ligands modelled in this entry, 4 are monoatomic - leaving 10 for Mogul analysis.

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	GOL	A	703	-	5,5,5	0.22	0	5,5,5	0.27	0
2	GOL	C	703	-	5,5,5	0.20	0	5,5,5	0.50	0
2	GOL	A	701	-	5,5,5	0.19	0	5,5,5	0.54	0
4	A1JWS	B	705	-	15,19,19	0.80	1 (6%)	14,26,26	1.01	1 (7%)
2	GOL	B	703	-	5,5,5	0.15	0	5,5,5	0.29	0
4	A1JWS	A	704	-	15,19,19	0.69	0	14,26,26	1.00	1 (7%)
2	GOL	B	702	-	5,5,5	0.11	0	5,5,5	0.39	0
4	A1JWS	B	704	-	15,19,19	0.53	0	14,26,26	0.95	2 (14%)
4	A1JWS	C	704	-	15,19,19	0.53	0	14,26,26	1.06	2 (14%)
2	GOL	C	701	-	5,5,5	0.16	0	5,5,5	0.32	0

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	GOL	A	703	-	-	4/4/4/4	-
2	GOL	C	703	-	-	2/4/4/4	-
2	GOL	A	701	-	-	4/4/4/4	-
4	A1JWS	B	705	-	-	1/6/7/7	0/2/2/2
2	GOL	B	703	-	-	2/4/4/4	-
4	A1JWS	A	704	-	-	1/6/7/7	0/2/2/2
2	GOL	B	702	-	-	0/4/4/4	-
4	A1JWS	B	704	-	-	1/6/7/7	0/2/2/2
4	A1JWS	C	704	-	-	1/6/7/7	0/2/2/2
2	GOL	C	701	-	-	0/4/4/4	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	705	A1JWS	C5-C6	2.42	1.52	1.50

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	C	704	A1JWS	C5-N1-C4	-2.33	121.14	125.35
4	B	704	A1JWS	C5-N1-C4	-2.22	121.34	125.35
4	A	704	A1JWS	C3-C2-N1	2.18	111.93	107.57
4	C	704	A1JWS	C3-C2-N1	2.04	111.66	107.57
4	B	704	A1JWS	C3-C2-N1	2.02	111.62	107.57
4	B	705	A1JWS	C3-C2-N1	2.01	111.59	107.57

There are no chirality outliers.

All (16) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	701	GOL	O1-C1-C2-O2
2	A	701	GOL	O1-C1-C2-C3
2	A	703	GOL	C1-C2-C3-O3
2	B	703	GOL	C1-C2-C3-O3
2	C	703	GOL	C1-C2-C3-O3
4	A	704	A1JWS	C12-C11-C3-C2
4	B	704	A1JWS	C12-C11-C3-C2
4	B	705	A1JWS	C12-C11-C3-C2
4	C	704	A1JWS	C12-C11-C3-C2
2	B	703	GOL	O2-C2-C3-O3
2	A	703	GOL	O1-C1-C2-C3
2	A	703	GOL	O1-C1-C2-O2
2	A	703	GOL	O2-C2-C3-O3
2	C	703	GOL	O2-C2-C3-O3
2	A	701	GOL	C1-C2-C3-O3
2	A	701	GOL	O2-C2-C3-O3

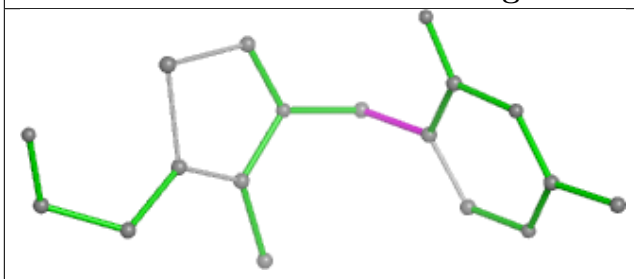
There are no ring outliers.

5 monomers are involved in 12 short contacts:

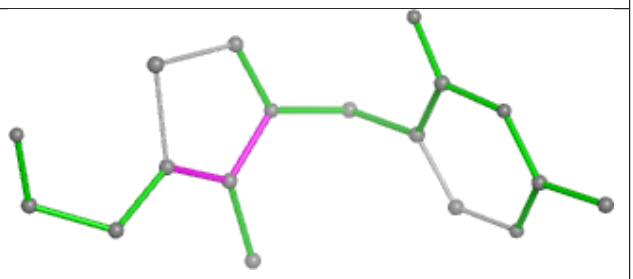
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	701	GOL	1	0
2	B	703	GOL	4	0
2	B	702	GOL	1	0
4	C	704	A1JWS	1	0
2	C	701	GOL	5	0

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.

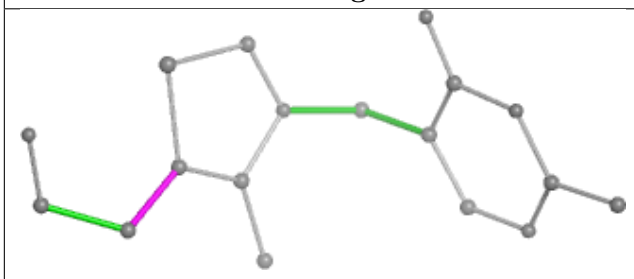
Ligand A1JWS B 705



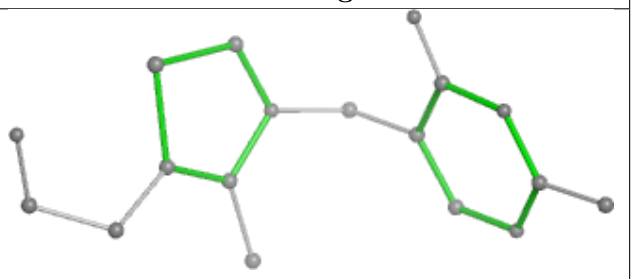
Bond lengths



Bond angles

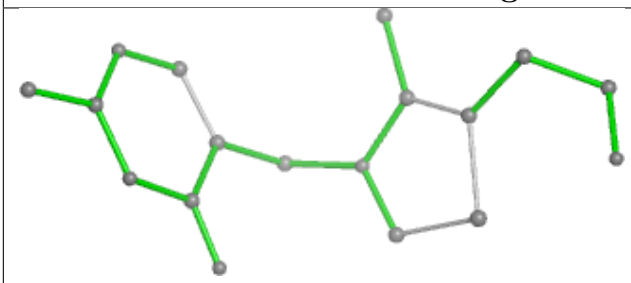


Torsions



Rings

Ligand A1JWS A 704



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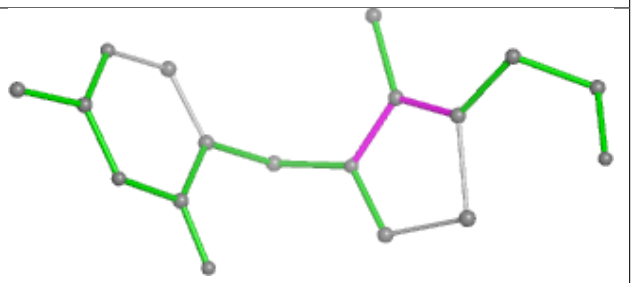

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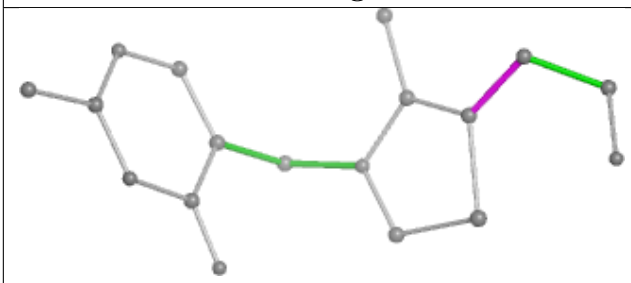

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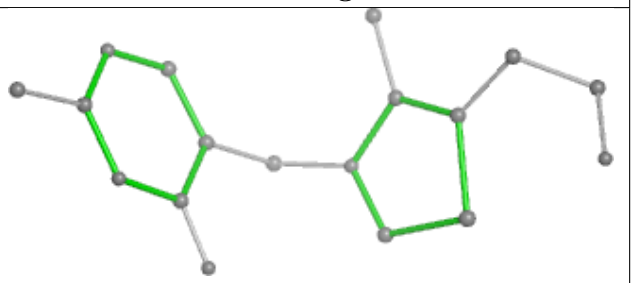
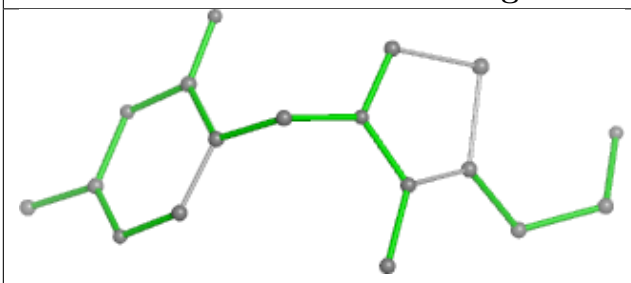
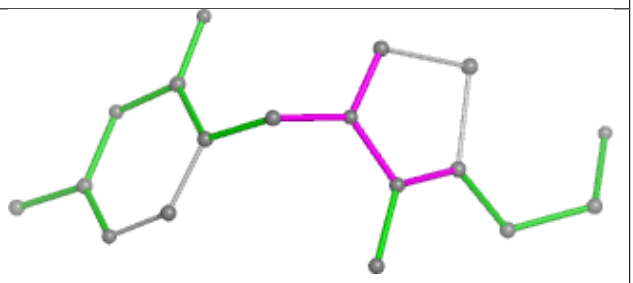


Rings

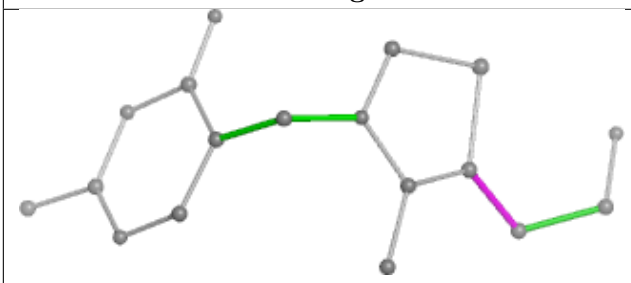
Ligand A1JWS B 704



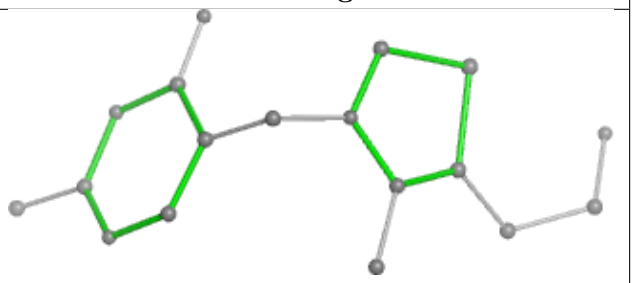
Bond lengths



Bond angles

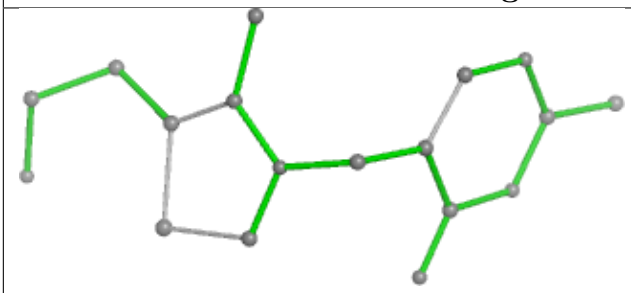


Torsions

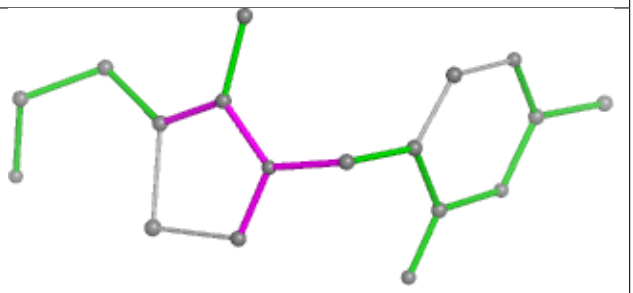


Rings

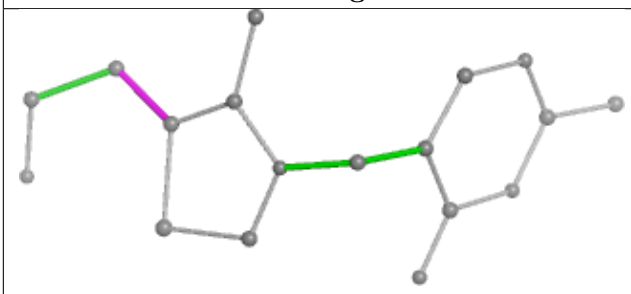
Ligand A1JWS C 704



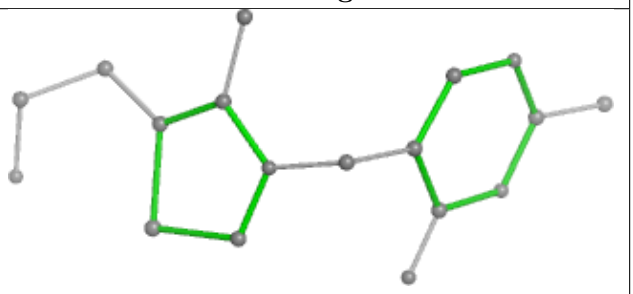
Bond lengths



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, 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	664/672 (98%)	-0.51	2 (0%)	90	91	13, 19, 33, 59	0
1	B	667/672 (99%)	-0.34	3 (0%)	89	89	15, 22, 36, 64	0
1	C	665/672 (98%)	-0.48	1 (0%)	92	92	12, 19, 34, 58	1 (0%)
1	D	663/672 (98%)	-0.35	1 (0%)	92	92	14, 22, 39, 52	1 (0%)
All	All	2659/2688 (98%)	-0.42	7 (0%)	90	91	12, 20, 36, 64	2 (0%)

All (7) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	3	ILE	7.2
1	B	4	MET	4.4
1	A	6	ASN	3.1
1	B	669	ASN	3.0
1	C	671	LEU	2.9
1	D	202	PHE	2.4
1	A	669	ASN	2.3

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 oligosaccharides in this entry.

6.4 Ligands (i)

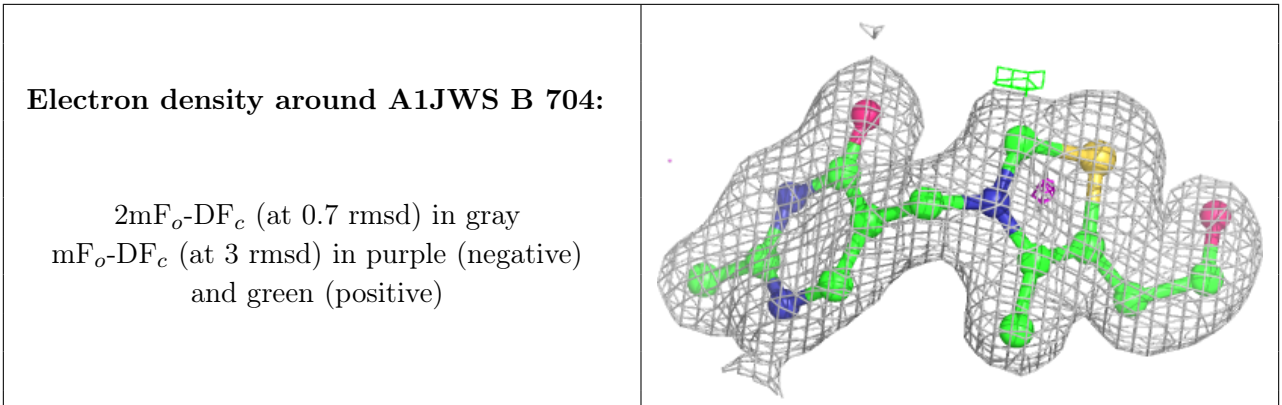
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' 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	GOL	A	701	6/6	0.83	0.18	39,41,45,57	0
2	GOL	A	703	6/6	0.84	0.20	45,48,52,62	0
2	GOL	C	703	6/6	0.84	0.14	37,42,45,50	0
2	GOL	B	703	6/6	0.88	0.16	38,44,51,58	0
2	GOL	C	701	6/6	0.89	0.12	40,40,42,44	0
2	GOL	B	702	6/6	0.92	0.12	30,42,44,46	0
4	A1JWS	B	704	18/18	0.96	0.07	19,22,36,41	0
4	A1JWS	A	704	18/18	0.97	0.06	16,18,29,33	0
4	A1JWS	B	705	18/18	0.97	0.07	18,22,33,35	0
4	A1JWS	C	704	18/18	0.97	0.06	18,21,27,33	0
3	CL	C	702	1/1	0.99	0.02	22,22,22,22	0
3	CL	D	701	1/1	0.99	0.04	27,27,27,27	0
3	CL	B	701	1/1	0.99	0.03	24,24,24,24	0
3	CL	A	702	1/1	1.00	0.04	21,21,21,21	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.

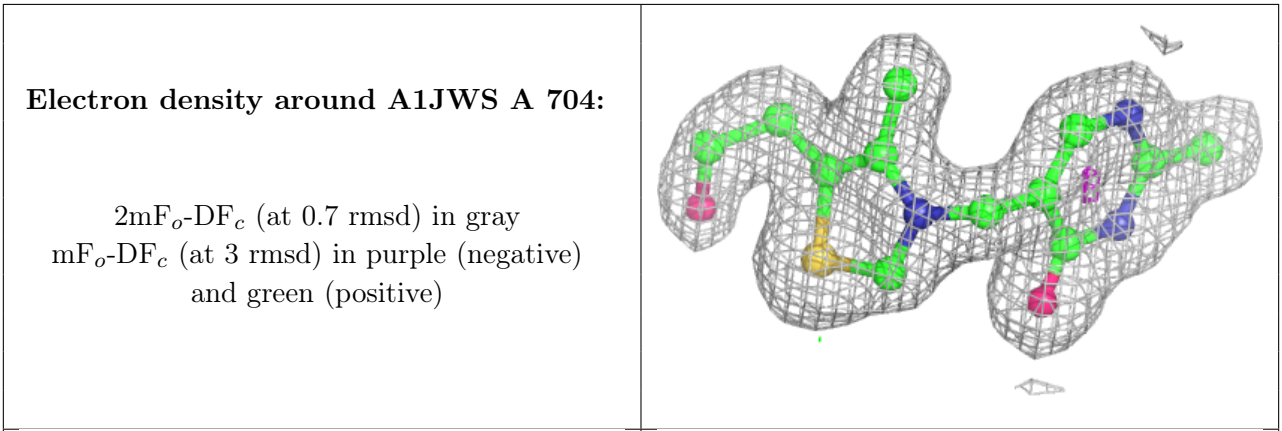
Electron density around A1JWS B 704:

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



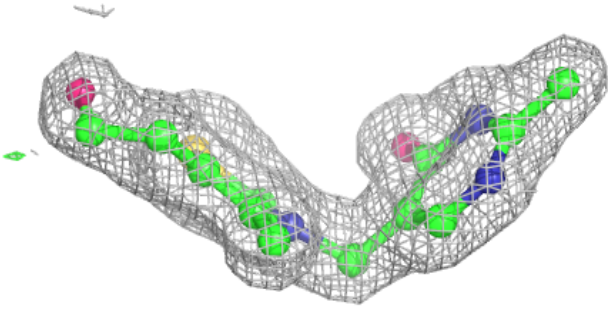
Electron density around A1JWS A 704:

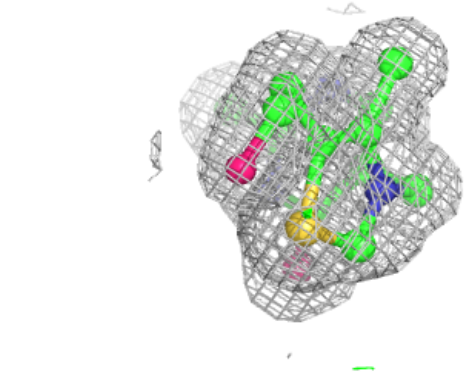
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)



Electron density around A1JWS B 705:

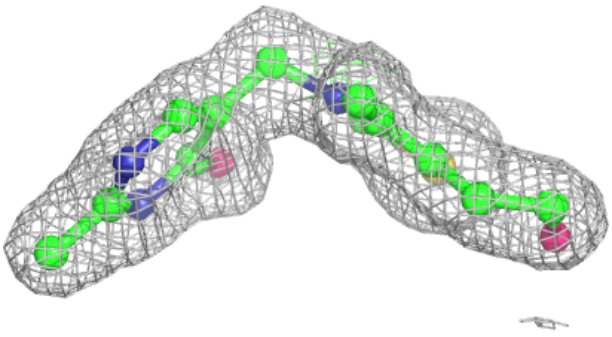
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

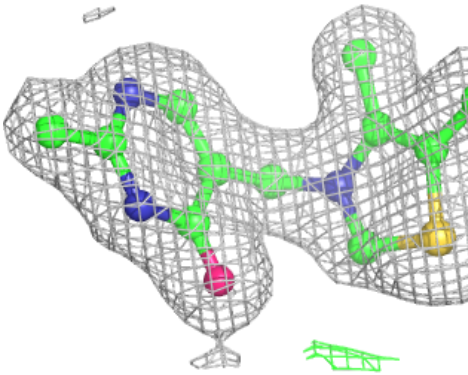




Electron density around A1JWS C 704:

$2mF_o$-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 (i)

There are no such residues in this entry.