WORLDWIDE wwPDB PROTEIN DATA BANK

Full wwPDB X-ray Structure Validation Report (i)

Nov 20, 2024 – 02:38 pm GMT

PDB ID	:	9GIB
Title	:	NMDA bound to compound 380
Authors	:	Carr, K.H.; Ascic, E.; Leonard, P.M.
Deposited on	:	2024-08-19
Resolution	:	1.95 Å(reported)

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

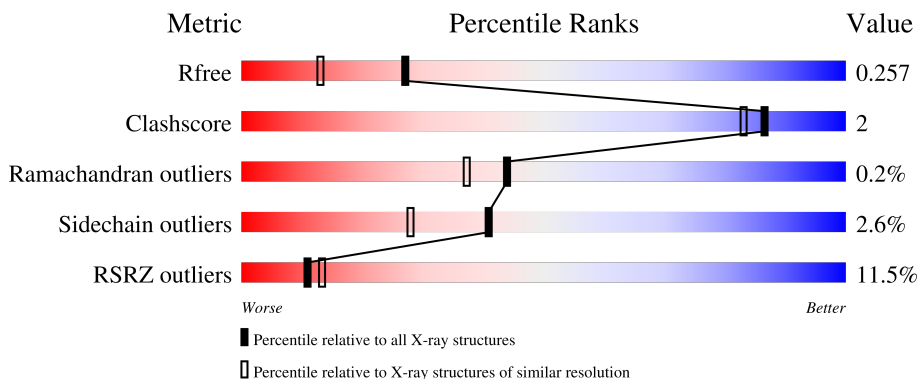|		
MolProbity	:	4.02b-467
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	3.0
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.003 (Gargrove)
Density-Fitness	:	1.0.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.39

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 1.95 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		0.257
Clashscore		2
Ramachandran outliers		0.2%
Sidechain outliers		2.6%
RSRZ outliers		11.5%

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	1306 (1.94-1.94)
Clashscore	180529	1400 (1.94-1.94)
Ramachandran outliers	177936	1387 (1.94-1.94)
Sidechain outliers	177891	1387 (1.94-1.94)
RSRZ outliers	164620	1306 (1.94-1.94)

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	285	6% / 92% / 5% ••
2	B	291	16% / 89% / 5% 5%

2 Entry composition ⓘ

There are 7 unique types of molecules in this entry. The entry contains 9019 atoms, of which 4275 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 Glutamate receptor.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	281	Total 4359	C 1391	H 2173	N 370	O 411	S 14	67	0	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	399	GLY	-	expression tag	UNP G3V9C5
A	400	SER	-	expression tag	UNP G3V9C5
A	540	GLY	-	linker	UNP G3V9C5
A	541	THR	-	linker	UNP G3V9C5

- Molecule 2 is a protein called Isoform 1 of Glutamate receptor ionotropic, NMDA 1.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
2	B	275	Total 4186	C 1352	H 2070	N 351	O 399	S 14	100	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	545	GLY	-	linker	UNP Q05586
B	546	THR	-	linker	UNP Q05586

- Molecule 3 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$).

GOL
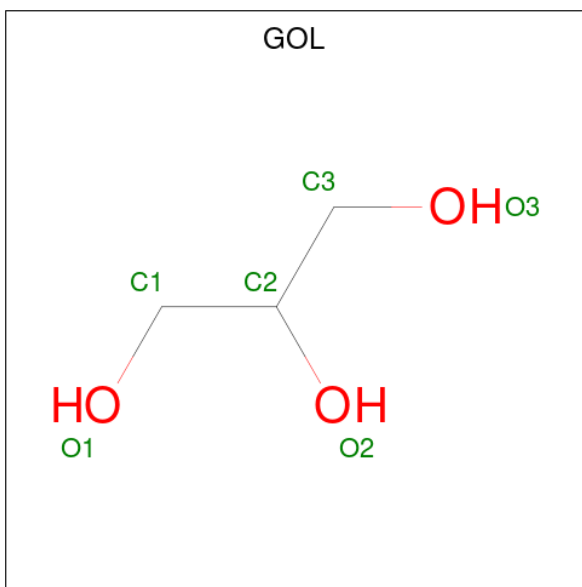
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	H	O	3	0
			14	3	8	3		

- Molecule 4 is GLUTAMIC ACID (three-letter code: GLU) (formula: $C_5H_9NO_4$).

GLU
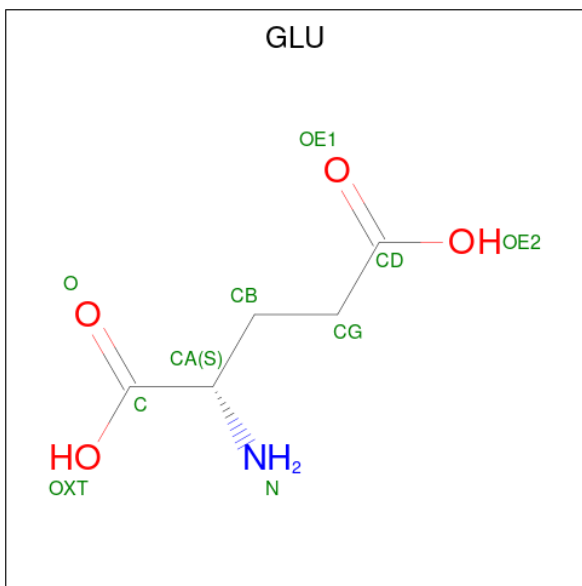
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total	C	H	N	O	0	0
			18	5	8	1	4		

- Molecule 5 is (2 {R})-2-azanyl-3-[[3-(5-ethyl-1,2-oxazol-4-yl)-5-fluoranyl-phenyl]carbonylam ino]propanoic acid (three-letter code: A1ILP) (formula: $C_{15}H_{16}FN_3O_4$) (labeled as "Ligand of Interest" by depositor).
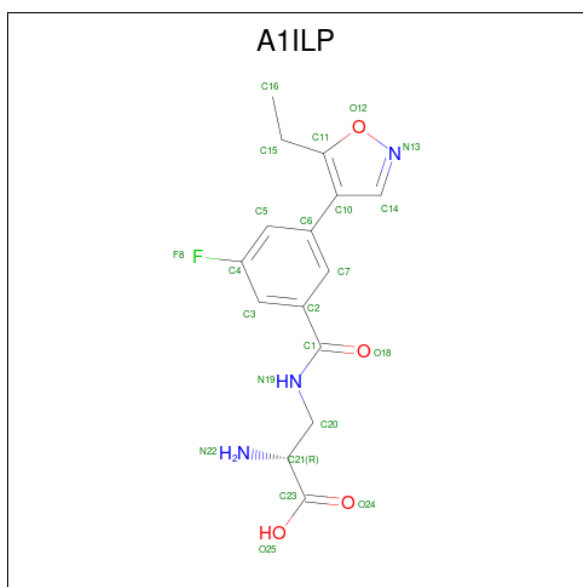
Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
			Total	C	F	H	N	O		
5	B	1	39	15	1	16	3	4	0	0

- Molecule 6 is SULFATE ION (three-letter code: SO4) (formula: O_4S).

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	O	S		
6	B	1	5	4	1	0	0

- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	236	Total 236	O 236	0	0
7	B	162	Total 162	O 162	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: Glutamate receptor

Chain A:
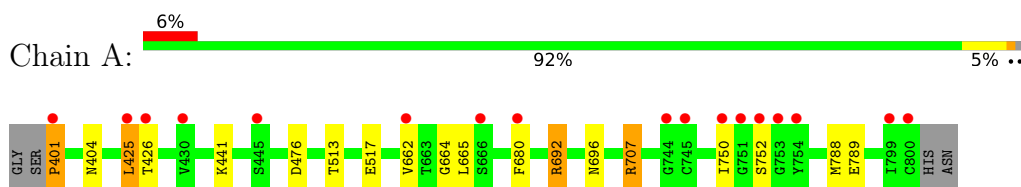
• Molecule 2: Isoform 1 of Glutamate receptor ionotropic, NMDA 1

Chain B:
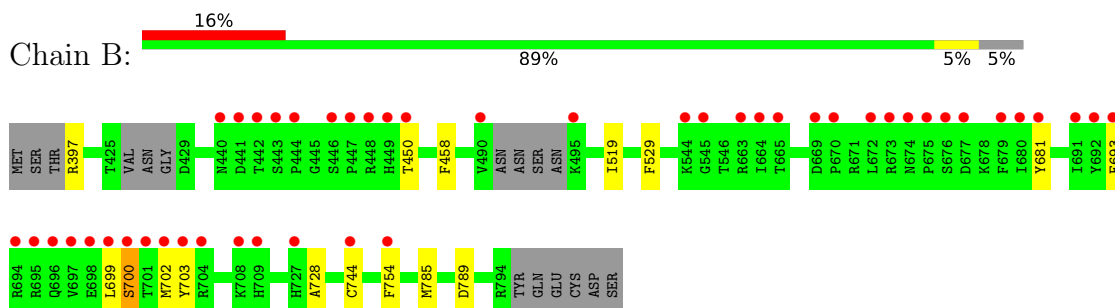
4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	53.97Å 90.04Å 123.17Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	72.70 – 1.95 72.69 – 1.95	Depositor EDS
% Data completeness (in resolution range)	99.5 (72.70-1.95) 99.4 (72.69-1.95)	Depositor EDS
R_{merge}	0.14	Depositor
R_{sym}	(Not available)	Depositor
$<I/\sigma(I)>$ [1]	2.49 (at 1.95Å)	Xtriage
Refinement program	REFMAC 5.8.0425	Depositor
R, R_{free}	0.203 , 0.256 0.204 , 0.257	Depositor DCC
R_{free} test set	2318 reflections (5.20%)	wwPDB-VP
Wilson B-factor (Å^2)	22.1	Xtriage
Anisotropy	0.063	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.39 , 35.4	EDS
L-test for twinning [2]	$<|L|> = 0.49, <L^2> = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	9019	wwPDB-VP
Average B, all atoms (Å^2)	30.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.13% 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: A1ILP, SO4, 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	0.40	0/2230	0.81	4/3022 (0.1%)
2	B	0.39	0/2163	0.69	0/2933
All	All	0.40	0/4393	0.75	4/5955 (0.1%)

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

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	707	ARG	NE-CZ-NH2	-7.98	116.31	120.30
1	A	788	MET	CG-SD-CE	-6.05	90.52	100.20
1	A	401	PRO	CA-N-CD	-5.48	103.83	111.50
1	A	707	ARG	CG-CD-NE	-5.09	101.11	111.80

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	707	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	2186	2173	2154	7	0
2	B	2116	2070	2020	9	0
3	A	6	8	8	0	0
4	A	10	8	5	1	0
5	B	23	16	0	1	0
6	B	5	0	0	0	0
7	A	236	0	0	4	0
7	B	162	0	0	2	0
All	All	4744	4275	4187	17	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 2.

All (17) 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)
2:B:744:CYS:SG	7:B:1121:HOH:O	2.38	0.81
7:A:1186:HOH:O	5:B:901:A1ILP:C16	2.36	0.74
2:B:693:PHE:O	2:B:703:TYR:CB	2.44	0.65
1:A:513:THR:HG1	4:A:902:GLU:N	2.08	0.52
2:B:458:PHE:CZ	2:B:785:MET:CE	2.94	0.51
2:B:397:ARG:N	7:B:1008:HOH:O	2.46	0.49
2:B:681:TYR:HB3	2:B:728:ALA:HB3	1.94	0.49
1:A:476:ASP:HB2	7:A:1146:HOH:O	2.17	0.45
2:B:519:ILE:HG12	2:B:529:PHE:CD1	2.52	0.45
2:B:458:PHE:CZ	2:B:785:MET:HE3	2.52	0.44
2:B:699:LEU:O	2:B:702:MET:N	2.50	0.43
1:A:696:ASN:ND2	7:A:1017:HOH:O	2.52	0.42
1:A:425:LEU:HD12	1:A:426:THR:HG23	2.02	0.41
1:A:517:GLU:OE2	1:A:692:ARG:HD2	2.20	0.41
1:A:752:SER:HA	7:A:1023:HOH:O	2.20	0.41
1:A:664:GLY:HA2	1:A:750:ILE:HD11	2.02	0.41
2:B:699:LEU:O	2:B:700:SER:C	2.59	0.41

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	279/285 (98%)	271 (97%)	8 (3%)	0	100	100
2	B	269/291 (92%)	260 (97%)	8 (3%)	1 (0%)	30	22
All	All	548/576 (95%)	531 (97%)	16 (3%)	1 (0%)	44	37

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	700	SER

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	239/249 (96%)	230 (96%)	9 (4%)	28	14
2	B	225/260 (86%)	222 (99%)	3 (1%)	65	58
All	All	464/509 (91%)	452 (97%)	12 (3%)	41	28

All (12) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	401	PRO
1	A	404	ASN
1	A	425	LEU
1	A	441	LYS
1	A	662	VAL

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Mol	Chain	Res	Type
1	A	665	LEU
1	A	680	PHE
1	A	692	ARG
1	A	789	GLU
2	B	450	THR
2	B	754	PHE
2	B	789	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	404	ASN
1	A	482	ASN
1	A	702	HIS

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 ⓘ

4 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
6	SO4	B	902	-	4,4,4	0.23	0	6,6,6	0.18	0
3	GOL	A	901	-	5,5,5	0.08	0	5,5,5	0.28	0
4	GLU	A	902	-	8,9,9	1.12	0	10,11,11	1.08	1 (10%)
5	A1ILP	B	901	-	17,24,24	0.80	0	23,33,33	1.77	7 (30%)

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
3	GOL	A	901	-	-	2/4/4/4	-
4	GLU	A	902	-	-	2/9/9/9	-
5	A1ILP	B	901	-	-	2/18/19/19	0/2/2/2

There are no bond length outliers.

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
5	B	901	A1ILP	C7-C6-C10	-3.19	115.33	120.61
5	B	901	A1ILP	C5-C4-C3	-2.92	119.83	123.52
5	B	901	A1ILP	C16-C15-C11	-2.70	108.22	114.88
5	B	901	A1ILP	F8-C4-C5	2.70	122.11	118.25
5	B	901	A1ILP	C15-C11-C10	-2.58	125.94	130.34
5	B	901	A1ILP	C20-C21-C23	2.57	114.10	108.94
5	B	901	A1ILP	C5-C6-C10	2.43	124.64	120.61
4	A	902	GLU	OE1-CD-CG	-2.00	116.65	123.08

There are no chirality outliers.

All (6) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	901	GOL	O1-C1-C2-C3
3	A	901	GOL	O1-C1-C2-O2
5	B	901	A1ILP	C10-C11-C15-C16
5	B	901	A1ILP	N19-C20-C21-C23
4	A	902	GLU	OE1-CD-CG-CB
4	A	902	GLU	OE2-CD-CG-CB

There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	902	GLU	1	0
5	B	901	A1ILP	1	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 A1ILP B 901

Bond lengths

Bond angles

Torsions

Rings
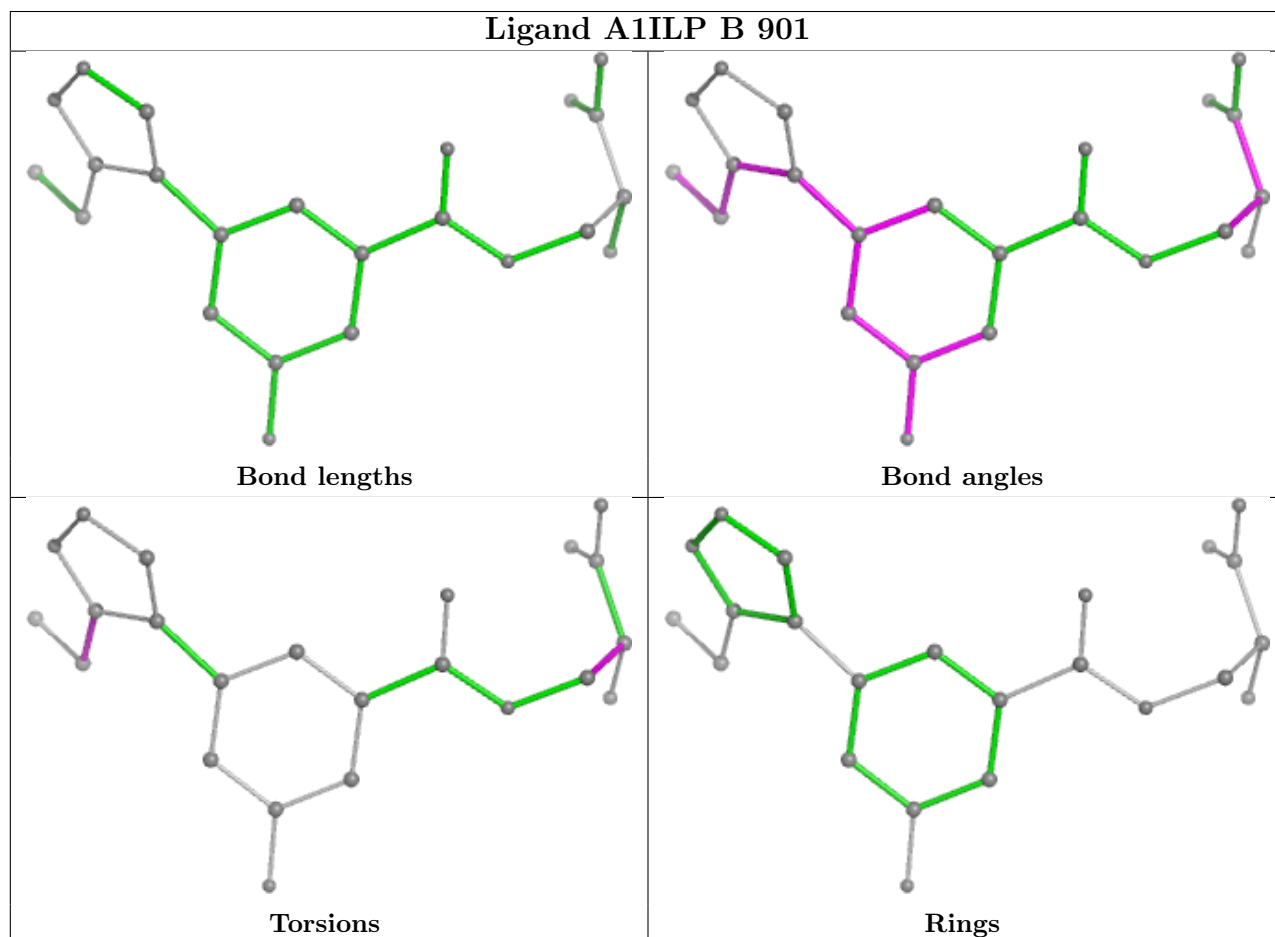
5.7 Other polymers ⓘ

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(Å^2)	Q<0.9
1	A	281/285 (98%)	0.02	17 (6%)	29	31	12, 22, 48, 88	0
2	B	275/291 (94%)	0.54	47 (17%)	5	5	13, 28, 65, 80	0
All	All	556/576 (96%)	0.28	64 (11%)	11	13	12, 25, 58, 88	0

All (64) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	693	PHE	6.7
1	A	752	SER	6.1
2	B	703	TYR	5.7
2	B	697	VAL	5.2
1	A	401	PRO	5.2
1	A	754	TYR	4.8
2	B	695	ARG	4.6
2	B	691	ILE	4.4
2	B	677	ASP	4.3
1	A	799	ILE	4.3
2	B	694	ARG	4.1
2	B	698	GLU	4.1
2	B	692	TYR	4.0
2	B	696	GLN	3.9
1	A	753	GLY	3.9
2	B	545	GLY	3.9
2	B	444	PRO	3.7
2	B	679	PHE	3.6
2	B	672	LEU	3.6
2	B	680	ILE	3.6
2	B	449	HIS	3.6
2	B	448	ARG	3.5
2	B	674	ASN	3.5
2	B	701	THR	3.5

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Mol	Chain	Res	Type	RSRZ
2	B	447	PRO	3.4
2	B	442	THR	3.4
2	B	664	ILE	3.4
2	B	443	SER	3.4
1	A	750	ILE	3.3
1	A	425	LEU	3.2
2	B	699	LEU	3.2
1	A	800	CYS	3.2
1	A	662	VAL	3.2
2	B	702	MET	3.2
2	B	544	LYS	3.1
2	B	700	SER	3.1
2	B	663	ARG	3.0
2	B	490	VAL	3.0
2	B	441	ASP	3.0
1	A	430	VAL	2.9
2	B	727	HIS	2.7
2	B	704	ARG	2.7
2	B	675	PRO	2.7
2	B	673	ARG	2.7
2	B	709	HIS	2.4
2	B	440	ASN	2.4
2	B	446	SER	2.4
2	B	495	LYS	2.4
1	A	744	GLY	2.4
2	B	744	CYS	2.4
2	B	708	LYS	2.3
1	A	680	PHE	2.3
2	B	676	SER	2.3
2	B	670	PRO	2.3
1	A	751	GLY	2.2
1	A	426	THR	2.2
2	B	754	PHE	2.2
1	A	445	SER	2.1
2	B	669	ASP	2.1
2	B	681	TYR	2.1
2	B	665	THR	2.1
1	A	745	CYS	2.0
1	A	666	SER	2.0
2	B	450	THR	2.0

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

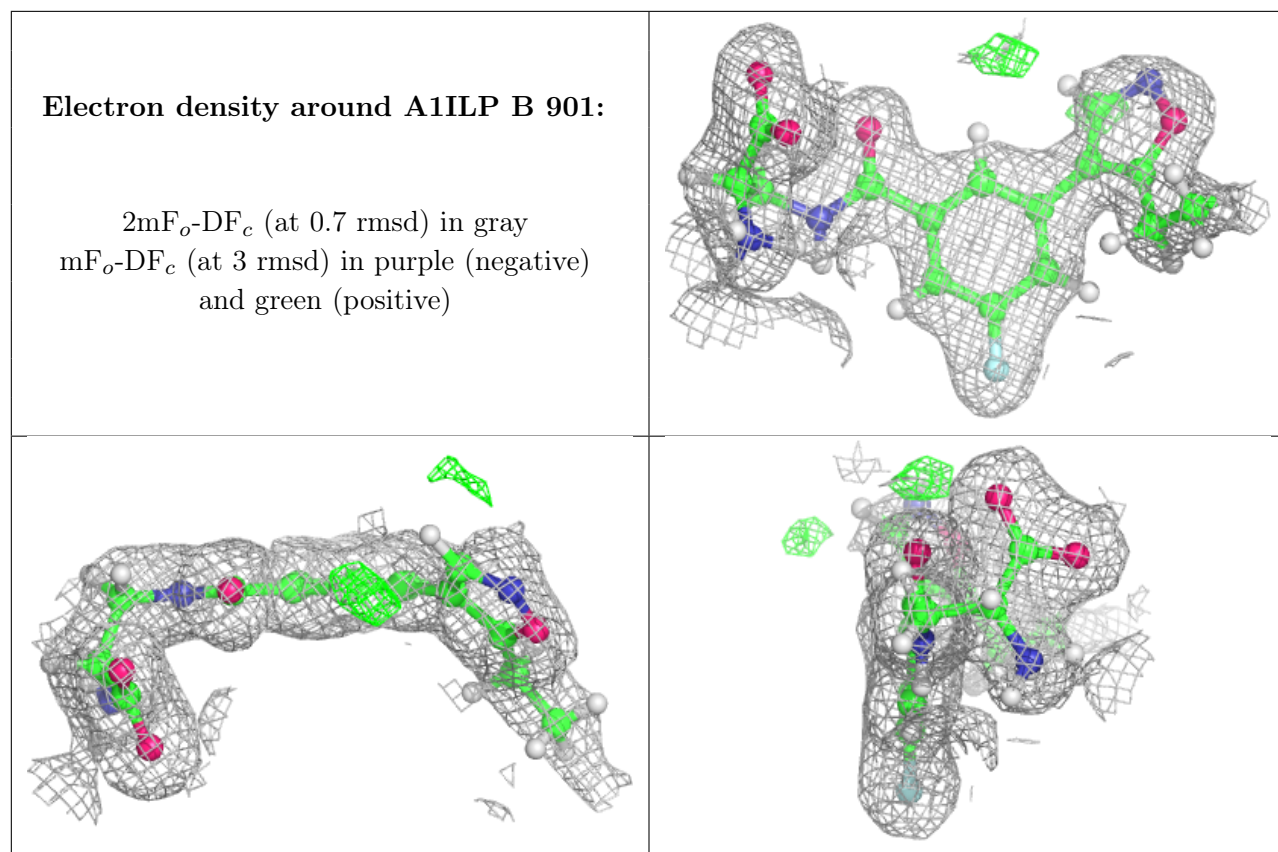There are no non-standard protein/DNA/RNA residues in this entry.

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
6	SO4	B	902	5/5	0.81	0.17	45,56,72,74	0
3	GOL	A	901	6/6	0.89	0.13	32,42,44,47	3
5	A1ILP	B	901	23/23	0.96	0.07	14,21,43,48	0
4	GLU	A	902	10/10	0.98	0.04	10,13,16,17	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 A1ILP B 901:

$2mF_o$-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.