



wwPDB EM Validation Summary Report ⓘ

Jul 15, 2025 – 12:36 PM JST

PDB ID : 9IYP / pdb_00009iyp
EMDB ID : EMD-61000
Title : Structure of the human GluN1-N2B NMDA receptors in the Mg²⁺ bound state
Authors : Huang, X.; Sun, X.; Zhu, S.
Deposited on : 2024-07-31
Resolution : 3.27 Å(reported)

This is a wwPDB EM Validation Summary 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/EMValidationReportHelp>
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:

EMDB validation analysis : **FAILED**
Mogul : 1.8.5 (274361), CSD as541be (2020)
MolProbity : 4-5-2 with Phenix2.0rc1
buster-report : 1.1.7 (2018)
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ : **FAILED**
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.44

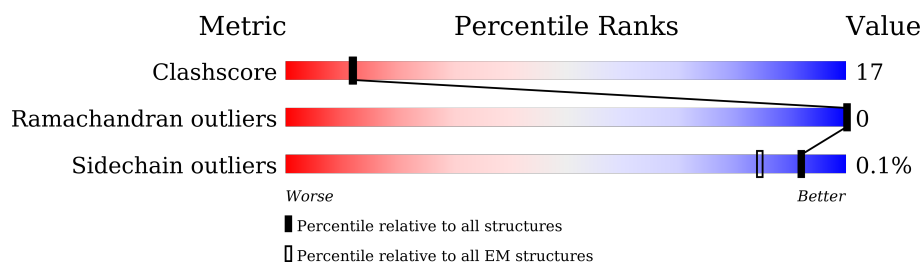
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.27 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)	EM structures (#Entries)
Clashscore	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the 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 $\leq 5\%$.

Mol	Chain	Length	Quality of chain
1	A	814	67% 30% .
1	C	814	68% 29% .
2	B	808	63% 32% .
2	D	808	72% 24% 5%

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
5	7RC	B	901	-	-	X	-

2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 23471 atoms, of which 28 are hydrogens and 0 are deuteriums.

In the tables below, 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.

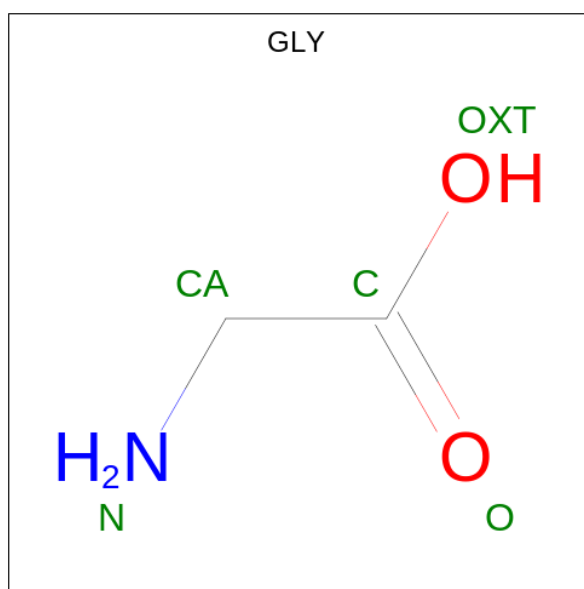
- Molecule 1 is a protein called Glutamate receptor ionotropic, NMDA 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	788	Total	C	N	O	S	0	0
			5951	3796	1037	1084	34		
1	C	796	Total	C	N	O	S	0	0
			5954	3805	1035	1083	31		

- Molecule 2 is a protein called Glutamate receptor ionotropic, NMDA 2B.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	772	Total	C	N	O	S	0	0
			5743	3698	935	1072	38		
2	D	770	Total	C	N	O	S	0	0
			5704	3699	932	1038	35		

- Molecule 3 is GLYCINE (CCD ID: GLY) (formula: C₂H₅NO₂).



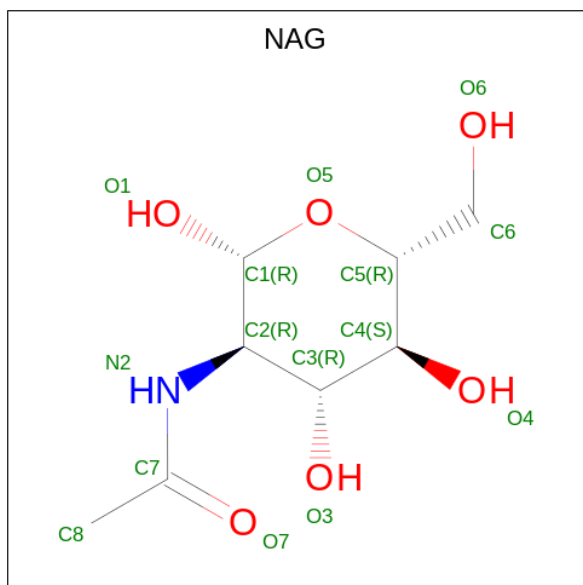
Mol	Chain	Residues	Atoms				AltConf
3	A	1	Total	C	N	O	0
			5	2	1	2	

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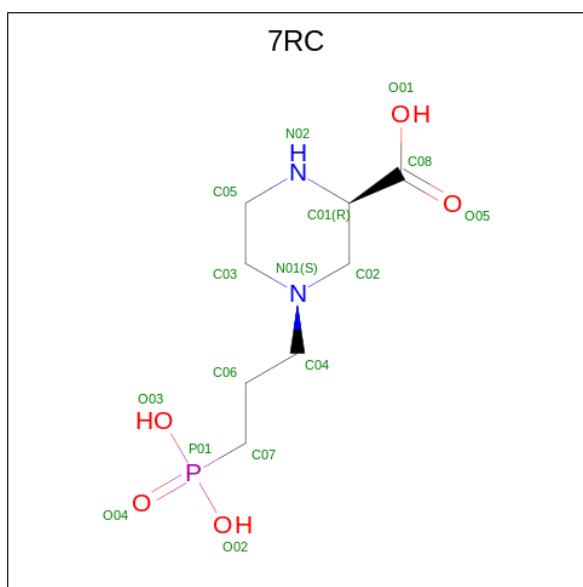
Mol	Chain	Residues	Atoms				AltConf
3	C	1	Total	C	N	O	0
			5	2	1	2	

- Molecule 4 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: $C_8H_{15}NO_6$).



Mol	Chain	Residues	Atoms				AltConf
4	A	1	Total	C	N	O	0
			14	8	1	5	
4	C	1	Total	C	N	O	0
			14	8	1	5	
4	C	1	Total	C	N	O	0
			14	8	1	5	

- Molecule 5 is (2R)-4-(3-phosphonopropyl)piperazine-2-carboxylic acid (CCD ID: 7RC) (formula: $C_8H_{17}N_2O_5P$).



Mol	Chain	Residues	Atoms						AltConf
5	B	1	Total	C	H	N	O	P	0
			30	8	14	2	5	1	
5	D	1	Total	C	H	N	O	P	0
			30	8	14	2	5	1	

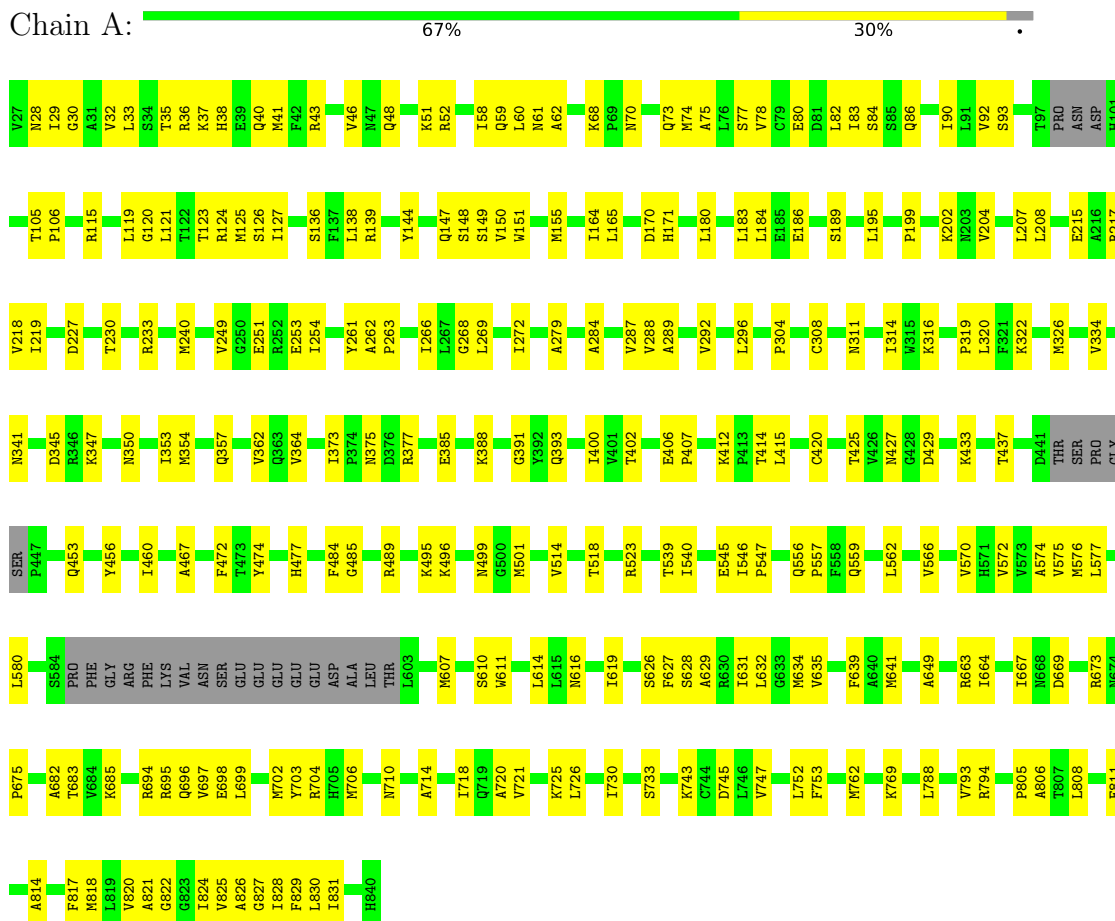
- Molecule 6 is MAGNESIUM ION (CCD ID: MG) (formula: Mg) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		AltConf
6	B	4	Total	Mg	0
			4	4	
6	C	1	Total	Mg	0
			1	1	
6	D	2	Total	Mg	0
			2	2	

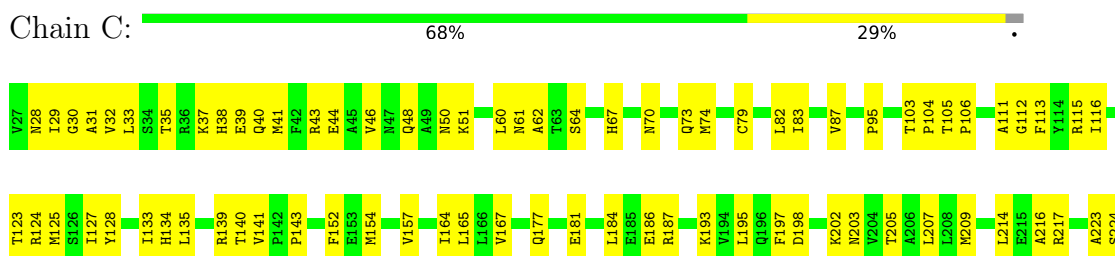
3 Residue-property plots

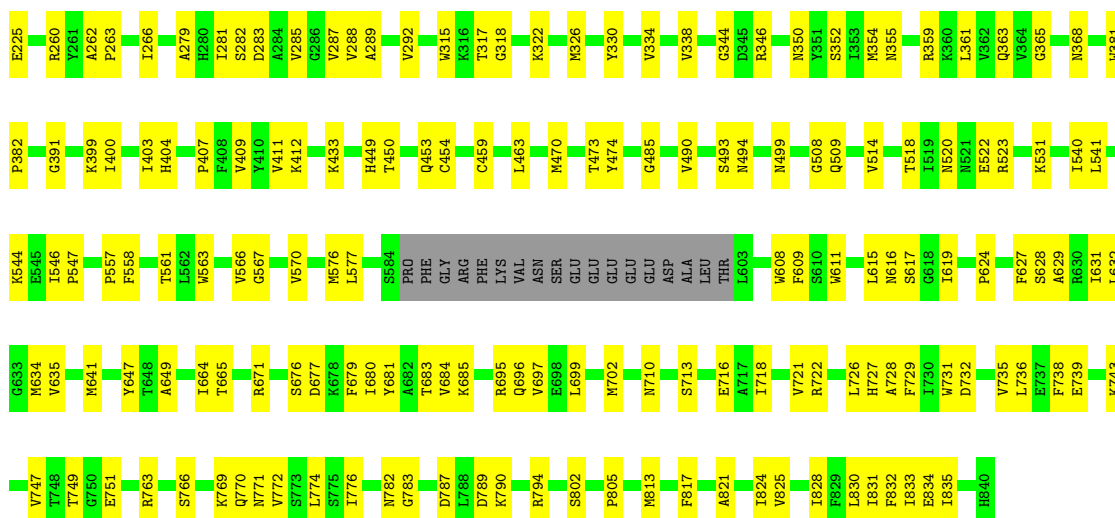
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded 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. 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 ionotropic, NMDA 1



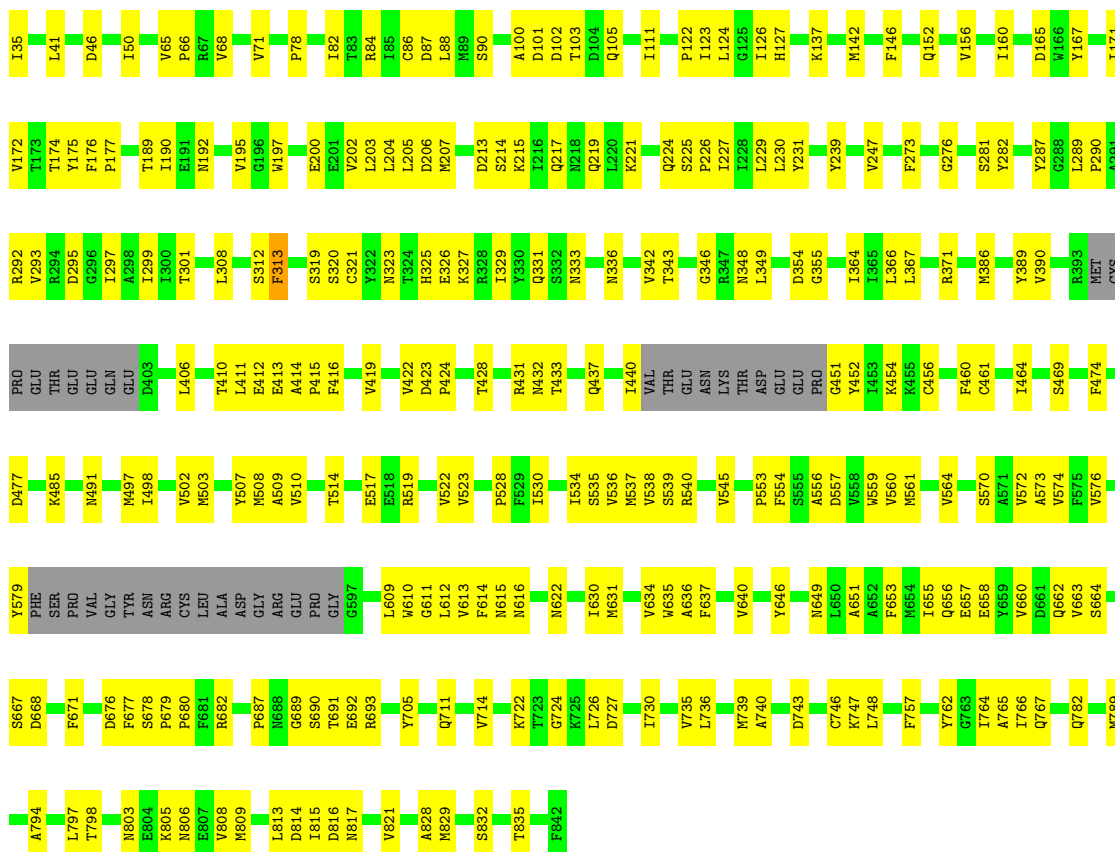
- Molecule 1: Glutamate receptor ionotropic, NMDA 1





• Molecule 2: Glutamate receptor ionotropic, NMDA 2B

Chain B: 63% 32% .



• Molecule 2: Glutamate receptor ionotropic, NMDA 2B

Chain D: 72% 24% 5%

M818	G665	V564	I464	L362	I171	I35
A819	K670	I588	L465	V363	V172	G36
A828	F677	A571	K466	I364	I173	I37
S832	S678	V574	K467	N368	F176	A38
T836	P679		I468	R375	P177	T44
F842	P680		Y479	V376	I190	S45
	F681	F580	K485	L384	W197	D46
	T685	SER	H486	K387	E198	I50
	G689	PRO	G487	Y388	L199	P66
	S690	VAL	N495	R393	M207	P78
	T691	GLY	G496	MET	L223	I81
	M702	TYR	M497	CYS	Q224	I82
	H703	ASN	I498	PRO	S225	T83
		CYS		GLU	P226	R84
		LEU	M503	THR	I227	I85
		ALA	K504	GLU		C86
	M706	ASP		GLN	L230	D87
	Q711	GLY	Y507	GLU	Y231	L88
		ARG	M508	GLN		M89
	L719	PRO	A509	D403	Y239	
	K722	GLY	V510	L406	N245	I94
	T723	PRO	S512		T250	Q95
	L726	SER	L513	V409		G96
	I730		N516	T410		A117
	A740	T600		L411	W256	
	E744	I602	R519	E412	I257	T121
	G745	G603	V522	E413	V258	
	C746	T606	W607	A414	T275	G129
	K747	L608	S526	P415	G276	S130
		L609		V419	L277	S131
			I530	D423		M132
	K755	L612			W285	I133
	Y762	N616	M537	G427		M134
	A765	V618	R540	N432	L289	K137
	D777	P619	S541		P290	D138
	Q782	V620	N542	I440	V293	E139
		M631	G543	VAL	T301	S140
	E788	V632	T544	THR		S141
			P547	GLU	I314	M142
	L792	W635	F550	ASN	P315	Q145
	G799	A636	L551	LYS		P148
	H802	N649	E552	THR	R328	V156
		A651	P553	ASP	Q331	
	L813	L650	D557	GLU	N159	M159
	D814	A651		PRO	I160	I160
	I815	Q656	V560	G451	N336	M161
		E657	M561	C457	D354	I168
				F460	G355	F169
					Y356	S170

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	157704	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	NONE	Depositor
Microscope	TFS KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	51.00	Depositor
Minimum defocus (nm)	1200	Depositor
Maximum defocus (nm)	1800	Depositor
Magnification	Not provided	
Image detector	FEI FALCON IV (4k x 4k)	Depositor

5 Model quality [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: 7RC, MG, NAG

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	0.10	0/6074	0.21	0/8252
1	C	0.08	0/6085	0.20	0/8281
2	B	0.10	0/5861	0.25	0/7973
2	D	0.07	0/5831	0.18	0/7944
All	All	0.09	0/23851	0.21	0/32450

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [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	5951	0	5774	222	0
1	C	5954	0	5693	217	0
2	B	5743	0	5467	224	0
2	D	5704	0	5403	166	0
3	A	5	0	2	3	0
3	C	5	0	2	1	0
4	A	14	0	13	0	0
4	C	28	0	26	1	0
5	B	16	14	0	7	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	D	16	14	0	2	0
6	B	4	0	0	0	0
6	C	1	0	0	0	0
6	D	2	0	0	0	0
All	All	23443	28	22380	782	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 17.

The worst 5 of 782 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:C:518:THR:HG23	3:C:903:GLY:HA3	1.29	1.14
1:C:283:ASP:O	1:C:287:VAL:HG23	1.76	0.85
1:A:518:THR:HG23	3:A:901:GLY:HA3	1.59	0.85
1:C:202:LYS:HE3	1:C:202:LYS:HA	1.59	0.84
1:C:696:GLN:HG3	1:C:699:LEU:HD12	1.59	0.84

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 PDB entries followed by that with respect to all EM entries.

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	780/814 (96%)	745 (96%)	35 (4%)	0	100	100
1	C	792/814 (97%)	754 (95%)	38 (5%)	0	100	100
2	B	764/808 (95%)	709 (93%)	55 (7%)	0	100	100
2	D	762/808 (94%)	732 (96%)	30 (4%)	0	100	100
All	All	3098/3244 (96%)	2940 (95%)	158 (5%)	0	100	100

There are no Ramachandran outliers to report.

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 PDB entries followed by that with respect to all EM entries.

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	607/702 (86%)	607 (100%)	0	100	100
1	C	592/702 (84%)	591 (100%)	1 (0%)	92	96
2	B	581/704 (82%)	579 (100%)	2 (0%)	91	94
2	D	566/704 (80%)	566 (100%)	0	100	100
All	All	2346/2812 (83%)	2343 (100%)	3 (0%)	92	96

All (3) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	B	312	SER
2	B	313	PHE
1	C	616	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 15 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	536	GLN
2	D	812	GLN
1	C	709	HIS
2	D	840	HIS
1	C	812	ASN

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 [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 14 ligands modelled in this entry, 7 are monoatomic - leaving 7 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
4	NAG	A	902	1	14,14,15	0.18	0	17,19,21	0.42	0
4	NAG	C	901	1	14,14,15	0.19	0	17,19,21	0.33	0
5	7RC	B	901	-	15,16,16	2.13	1 (6%)	17,22,22	1.50	2 (11%)
3	GLY	C	903	-	4,4,4	1.15	1 (25%)	3,4,4	1.66	1 (33%)
4	NAG	C	902	1	14,14,15	0.24	0	17,19,21	0.44	0
5	7RC	D	901	-	15,16,16	2.12	1 (6%)	17,22,22	1.50	1 (5%)
3	GLY	A	901	-	4,4,4	1.15	1 (25%)	3,4,4	1.65	1 (33%)

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
4	NAG	A	902	1	-	3/6/23/26	0/1/1/1
4	NAG	C	901	1	-	1/6/23/26	0/1/1/1
5	7RC	B	901	-	-	4/11/21/21	1/1/1/1
3	GLY	C	903	-	-	0/2/2/2	-
4	NAG	C	902	1	-	2/6/23/26	0/1/1/1
5	7RC	D	901	-	-	4/11/21/21	1/1/1/1
3	GLY	A	901	-	-	0/2/2/2	-

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	B	901	7RC	P01-C07	7.51	1.86	1.78
5	D	901	7RC	P01-C07	7.45	1.86	1.78
3	A	901	GLY	OXT-C	-2.17	1.23	1.30
3	C	903	GLY	OXT-C	-2.15	1.23	1.30

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	D	901	7RC	P01-C07-C06	-4.40	109.47	114.98
5	B	901	7RC	P01-C07-C06	-4.39	109.49	114.98
3	C	903	GLY	OXT-C-O	-2.12	118.01	123.30
3	A	901	GLY	OXT-C-O	-2.11	118.03	123.30
5	B	901	7RC	O01-C08-C01	2.00	120.06	113.40

There are no chirality outliers.

5 of 14 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	B	901	7RC	N02-C01-C08-O01
5	B	901	7RC	N02-C01-C08-O05
5	D	901	7RC	N02-C01-C08-O05
4	C	902	NAG	O5-C5-C6-O6
4	A	902	NAG	C4-C5-C6-O6

All (2) ring outliers are listed below:

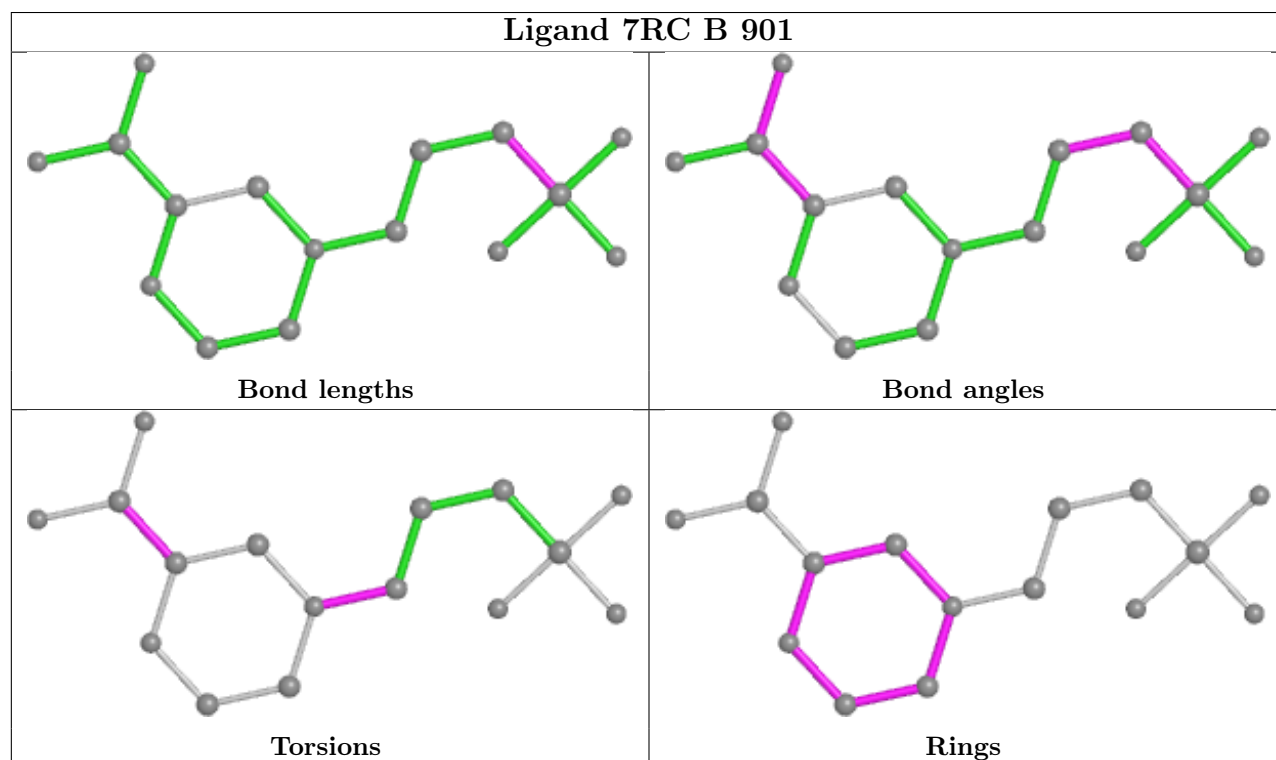
Mol	Chain	Res	Type	Atoms
5	B	901	7RC	C01-C02-C03-C05-N01-N02
5	D	901	7RC	C01-C02-C03-C05-N01-N02

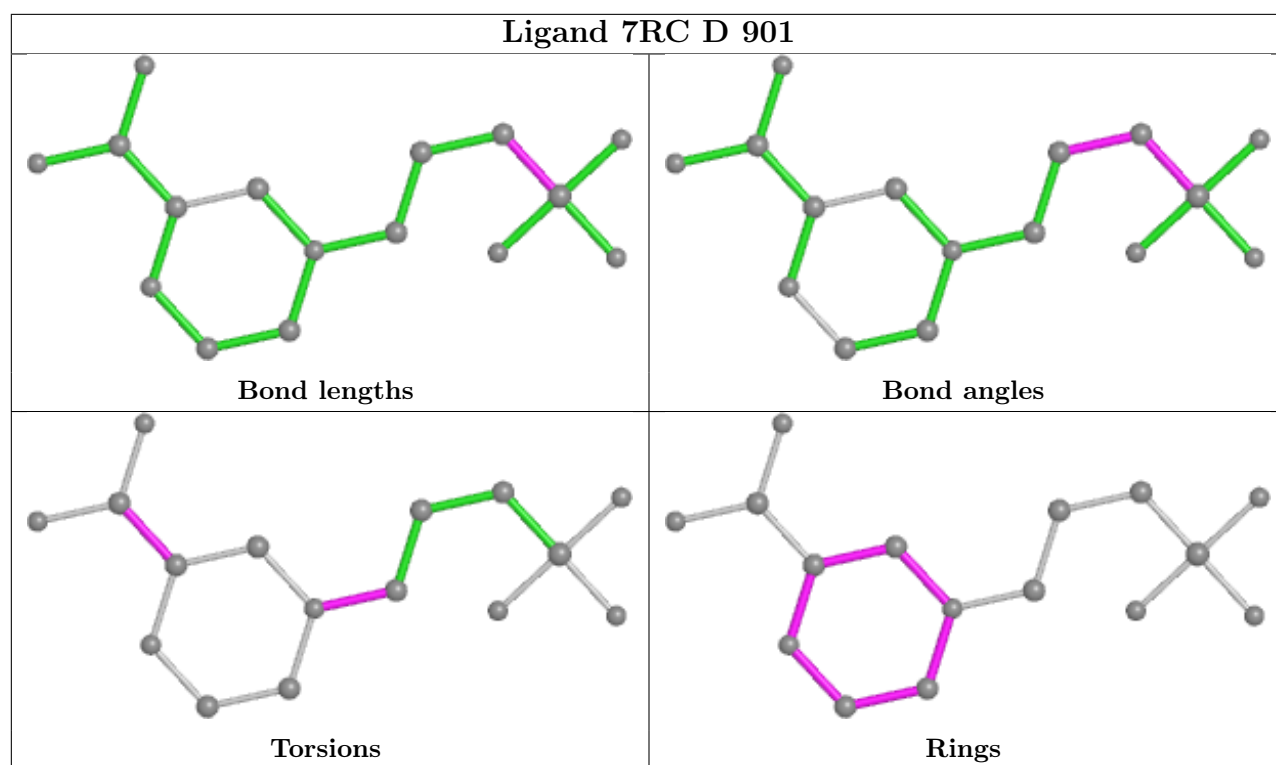
5 monomers are involved in 14 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	C	901	NAG	1	0
5	B	901	7RC	7	0
3	C	903	GLY	1	0
5	D	901	7RC	2	0
3	A	901	GLY	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 than 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 [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.