Full wwPDB X-ray Structure Validation Report ⓘ

Oct 23, 2025 – 12:32 PM EDT

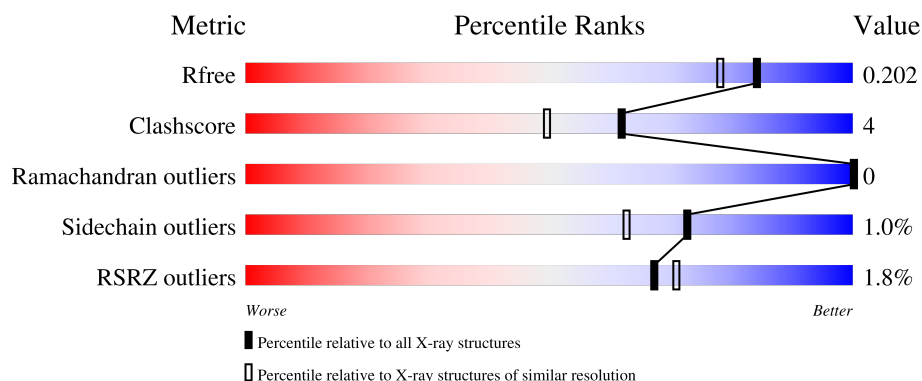|		
PDB ID	:	9NYZ / pdb_00009nyz
Title	:	Crystal structure of DCKA/glutamate-bound GluN1/GluN2A agonist binding domains with UCM-101
Authors	:	Lotti, J.S.; Syrenne, J.T.; Yates-Hansen, C.K.; McClelland, L.J.; Hansen, K.B.
Deposited on	:	2025-03-30
Resolution	:	1.71 Å(reported)

1 Overall quality at a glance ⓘ

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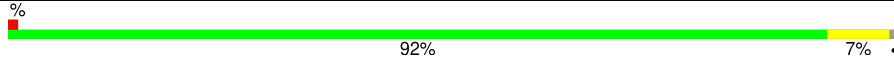*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.71 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		0.202
Clashscore		4
Ramachandran outliers		0
Sidechain outliers		1.0%
RSRZ outliers		1.8%

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	7106 (1.74-1.70)
Clashscore	180529	7746 (1.74-1.70)
Ramachandran outliers	177936	7654 (1.74-1.70)
Sidechain outliers	177891	7654 (1.74-1.70)
RSRZ outliers	164620	7104 (1.74-1.70)

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	292	2% / 89% / 8% ·
2	B	283	% / 92% / 7% ·

2 Entity composition ⓘ

There are 6 unique types of molecules in this entry. The entry contains 9741 atoms, of which 4594 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 ionotropic, NMDA 1.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	285	Total	C	H	N	O	S	0	8	0
			4650	1480	2311	403	437	19			

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	GLY	-	expression tag	UNP P35439
A	153	GLY	-	linker	UNP P35439
A	154	THR	-	linker	UNP P35439

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

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
2	B	281	Total	C	H	N	O	S	0	7	0
			4503	1431	2245	387	422	18			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	4	SER	-	expression tag	UNP Q00959
B	143	GLY	-	linker	UNP Q00959
B	144	THR	-	linker	UNP Q00959
B	242	THR	SER	conflict	UNP Q00959

- Molecule 3 is 5,7-DICHLORO-4-HYDROXYQUINOLINE-2-CARBOXYLIC ACID (CCD ID: DK1) (formula: $C_{10}H_5Cl_2NO_3$) (labeled as "Ligand of Interest" by depositor).

DK1
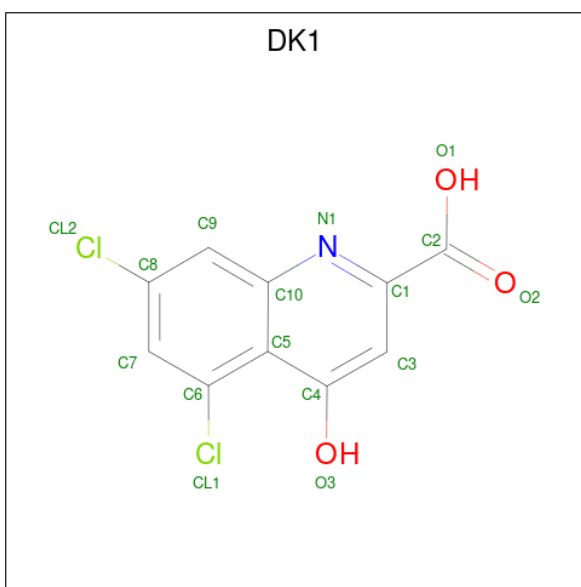
Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
			Total	C	Cl	H	N	O		
3	A	1	19	10	2	3	1	3	0	0

- Molecule 4 is N-(cyclohexylmethyl)-2-[(5-{[(1R)-1-phenylpropyl]amino}-1,3,4-thiadiazol-2-yl)sulfanyl]acetamide (CCD ID: A1B7E) (formula: $C_{20}H_{28}N_4OS_2$) (labeled as "Ligand of Interest" by depositor).

A1B7E
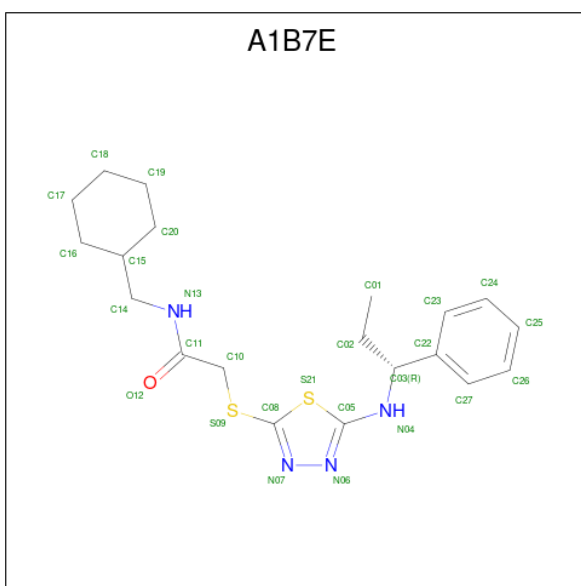
Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
			Total	C	H	N	O	S		
4	B	1	55	20	28	4	1	2	0	0

- Molecule 5 is GLUTAMIC ACID (CCD ID: GLU) (formula: $C_5H_9NO_4$) (labeled as "Ligand

of Interest" by depositor).
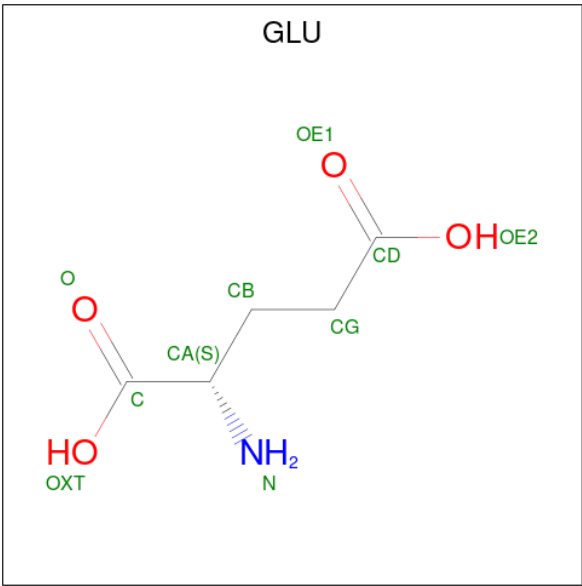
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
5	B	1	Total 17	C 5	H 7	N 1	O 4	0	0

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	222	Total 222	O 222	0	0
6	B	275	Total 275	O 275	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 ionotropic, NMDA 1

Chain A:
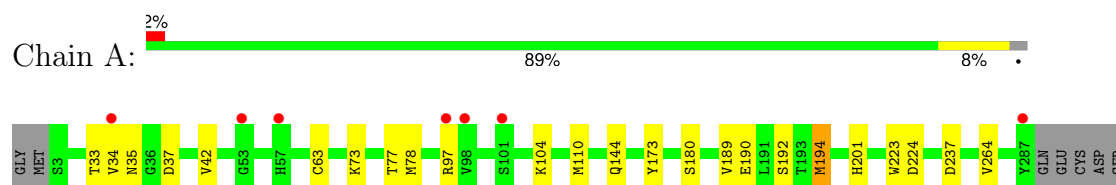
• Molecule 2: Glutamate receptor ionotropic, NMDA 2A

Chain B:
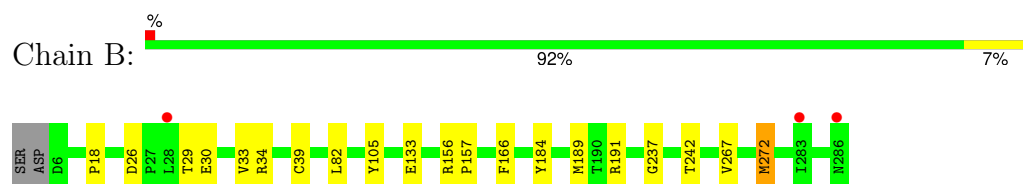
4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	54.47Å 88.33Å 137.27Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	33.28 – 1.71 33.28 – 1.71	Depositor EDS
% Data completeness (in resolution range)	99.4 (33.28-1.71) 91.5 (33.28-1.71)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	0.81 (at 1.72Å)	Xtriage
Refinement program	PHENIX 1.20.1_4487	Depositor
R, R_{free}	0.168 , 0.202 0.168 , 0.202	Depositor DCC
R_{free} test set	1999 reflections (2.78%)	wwPDB-VP
Wilson B-factor (Å^2)	25.4	Xtriage
Anisotropy	0.175	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 37.5	EDS
L-test for twinning[2]	$< |L| > = 0.49$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.97	EDS
Total number of atoms	9741	wwPDB-VP
Average B, all atoms (Å^2)	42.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.88% 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 (i)

5.1   Standard geometry (i)

Bond lengths and bond angles in the following residue types are not validated in this section: A1B7E, DK1

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	0.47	0/2396	0.65	0/3232
2	B	0.52	0/2312	0.66	0/3125
All	All	0.49	0/4708	0.66	0/6357

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
2	B	0	1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	B	156	ARG	Sidechain

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.

WORLDWIDE
wwPDB
PROTEIN DATA BANK

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2339	2311	2309	22	0
2	B	2258	2245	2247	15	0
3	A	16	3	3	1	0
4	B	27	28	0	0	0
5	B	10	7	5	0	0
6	A	222	0	0	8	0
6	B	275	0	0	5	1
All	All	5147	4594	4564	37	1

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 4.

All (37) 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:242[B]:THR:HG21	6:B:589:HOH:O	1.90	0.71
6:A:792:HOH:O	2:B:242[B]:THR:HG22	1.91	0.71
1:A:180[B]:SER:OG	6:A:701:HOH:O	2.15	0.65
2:B:105:TYR:OH	6:B:401:HOH:O	2.06	0.65
1:A:33:THR:OG1	6:A:702:HOH:O	2.15	0.64
2:B:133:GLU:OE2	6:B:402:HOH:O	2.15	0.64
2:B:267:VAL:HG22	2:B:272[B]:MET:HG3	1.82	0.61
1:A:78:MET:HE1	1:A:264:VAL:HG23	1.84	0.59
2:B:30:GLU:O	2:B:30:GLU:CG	2.51	0.57
2:B:39[B]:CYS:SG	2:B:82:LEU:HG	2.44	0.57
1:A:190:GLU:H	1:A:190:GLU:CD	2.16	0.54
2:B:237:GLY:N	6:B:408:HOH:O	2.36	0.53
2:B:26:ASP:OD1	2:B:29:THR:HG23	2.11	0.50
1:A:73:LYS:HE2	6:A:732:HOH:O	2.10	0.50
1:A:33:THR:CG2	6:A:702:HOH:O	2.60	0.49
1:A:42:VAL:CG2	1:A:63[B]:CYS:SG	3.00	0.49
1:A:223:TRP:CZ2	3:A:301:DK1:CL1	3.02	0.48
2:B:30:GLU:O	2:B:30:GLU:HG3	2.13	0.48
2:B:166:PHE:CE2	2:B:189:MET:HG2	2.48	0.48
1:A:144:GLN:OE1	1:A:224[B]:ASP:OD2	2.33	0.47
1:A:189:VAL:O	1:A:192:SER:HB2	2.15	0.47
1:A:37:ASP:HB2	6:A:702:HOH:O	2.14	0.46
1:A:78:MET:HE1	1:A:264:VAL:CG2	2.46	0.45
6:A:849:HOH:O	2:B:267:VAL:HG11	2.16	0.45
1:A:237:ASP:OD1	1:A:237:ASP:N	2.44	0.44
1:A:201:HIS:HD2	6:A:905:HOH:O	2.00	0.44
1:A:97:ARG:HG3	1:A:104:LYS:HD2	1.99	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:173:TYR:OH	1:A:194[B]:MET:HG2	2.19	0.43
1:A:110:MET:HE3	1:A:110:MET:HB3	1.84	0.43
2:B:33:VAL:HG23	2:B:34:ARG:HG3	2.01	0.43
1:A:33:THR:HG1	1:A:35:ASN:CG	2.26	0.43
1:A:144:GLN:OE1	1:A:224[B]:ASP:CG	2.61	0.42
1:A:144:GLN:CD	1:A:224[B]:ASP:OD2	2.62	0.42
2:B:157:PRO:HD2	2:B:184:TYR:CE2	2.54	0.42
1:A:42:VAL:HG22	1:A:63[B]:CYS:SG	2.61	0.41
1:A:144:GLN:NE2	1:A:224[B]:ASP:OD2	2.54	0.41
2:B:191:ARG:CD	6:B:539:HOH:O	2.70	0.40

All (1) 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)
6:B:518:HOH:O	6:B:616:HOH:O[4_545]	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	291/292 (100%)	285 (98%)	6 (2%)	0	100	100
2	B	286/283 (101%)	277 (97%)	9 (3%)	0	100	100
All	All	577/575 (100%)	562 (97%)	15 (3%)	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 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	262/260 (101%)	258 (98%)	4 (2%)	60	45
2	B	253/248 (102%)	250 (99%)	3 (1%)	67	55
All	All	515/508 (101%)	508 (99%)	7 (1%)	73	48

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	34	VAL
1	A	77	THR
1	A	194[A]	MET
1	A	194[B]	MET
2	B	18	PRO
2	B	272[A]	MET
2	B	272[B]	MET

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	117	GLN
2	B	85	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 ⓘ

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	#$|Z| > 2$
5	GLU	B	302	-	8,9,9	1.69	2 (25%)	8,11,11	1.01	0
4	A1B7E	B	301	-	26,29,29	1.77	10 (38%)	25,37,37	1.84	5 (20%)
3	DK1	A	301	-	17,17,17	1.87	5 (29%)	24,25,25	1.93	7 (29%)

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
5	GLU	B	302	-	-	2/9/9/9	-
4	A1B7E	B	301	-	-	0/16/28/28	0/3/3/3
3	DK1	A	301	-	-	0/4/4/4	0/2/2/2

All (17) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	301	DK1	O3-C4	-4.43	1.23	1.36
4	B	301	A1B7E	C22-C03	4.00	1.57	1.52
3	A	301	DK1	C3-C4	3.34	1.45	1.37
5	B	302	GLU	CG-CD	2.86	1.57	1.50
3	A	301	DK1	C4-C5	2.74	1.47	1.43
4	B	301	A1B7E	C08-N07	2.64	1.42	1.34
4	B	301	A1B7E	C02-C03	2.61	1.56	1.53
4	B	301	A1B7E	C08-S21	-2.51	1.67	1.72
4	B	301	A1B7E	C25-C24	2.47	1.43	1.38
4	B	301	A1B7E	C03-N04	-2.42	1.42	1.45
3	A	301	DK1	C6-C5	-2.31	1.39	1.43
4	B	301	A1B7E	C24-C23	2.29	1.42	1.38
4	B	301	A1B7E	C11-N13	2.28	1.38	1.33

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	301	A1B7E	O12-C11	2.16	1.27	1.23
5	B	302	GLU	OXT-C	-2.16	1.23	1.30
3	A	301	DK1	C1-N1	2.13	1.39	1.33
4	B	301	A1B7E	N07-N06	-2.03	1.33	1.37

All (12) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	B	301	A1B7E	C01-C02-C03	-4.55	108.35	113.64
3	A	301	DK1	C3-C4-C5	-4.20	116.00	120.55
4	B	301	A1B7E	C22-C03-N04	-3.80	108.52	113.50
3	A	301	DK1	C1-N1-C10	3.55	122.93	117.56
3	A	301	DK1	C7-C6-CL1	-3.52	112.36	118.72
4	B	301	A1B7E	C10-S09-C08	3.43	104.85	100.81
4	B	301	A1B7E	O12-C11-N13	-3.38	116.40	123.03
3	A	301	DK1	C7-C6-C5	3.20	124.70	121.68
3	A	301	DK1	C6-C7-C8	-3.17	115.10	118.72
4	B	301	A1B7E	C15-C14-N13	2.57	117.23	112.77
3	A	301	DK1	C3-C1-N1	-2.41	118.33	124.31
3	A	301	DK1	O1-C2-O2	2.22	128.13	123.35

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	B	302	GLU	OE2-CD-CG-CB
5	B	302	GLU	OE1-CD-CG-CB

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	301	DK1	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 GLU B 302

Bond lengths

Bond angles

Torsions

Rings

Ligand A1B7E B 301

Bond lengths

Bond angles

Torsions

Rings

Ligand DK1 A 301

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	285/292 (97%)	-0.02	7 (2%)	58	62	13, 41, 77, 118	8 (2%)
2	B	281/283 (99%)	-0.24	3 (1%)	77	81	16, 35, 66, 108	7 (2%)
All	All	566/575 (98%)	-0.13	10 (1%)	67	71	13, 37, 75, 118	15 (2%)

All (10) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	287	TYR	5.4
1	A	34	VAL	3.3
1	A	98	VAL	3.2
2	B	283	ILE	2.5
2	B	286	ASN	2.5
1	A	101	SER	2.4
1	A	97	ARG	2.2
1	A	57	HIS	2.2
1	A	53	GLY	2.1
2	B	28	LEU	2.1

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 ⓘ
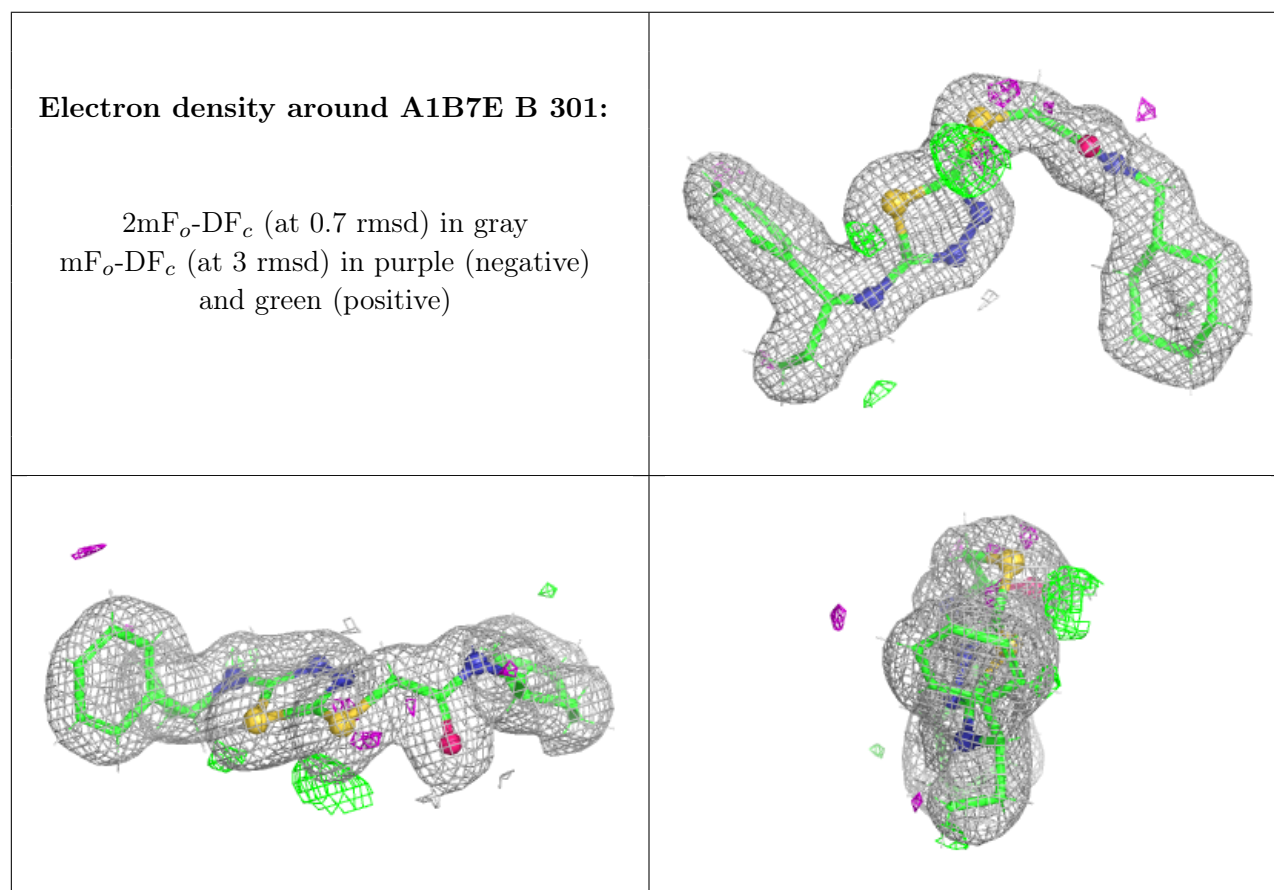
There are no oligosaccharides in this entry.

6.4 Ligands ⓘ

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.
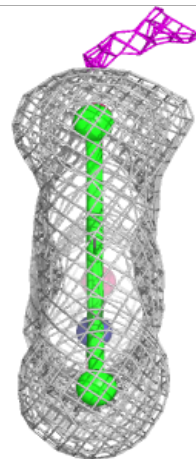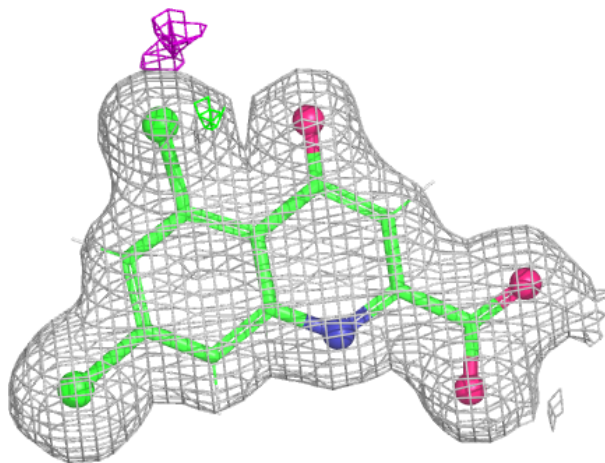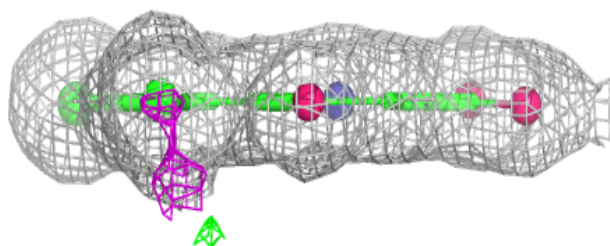
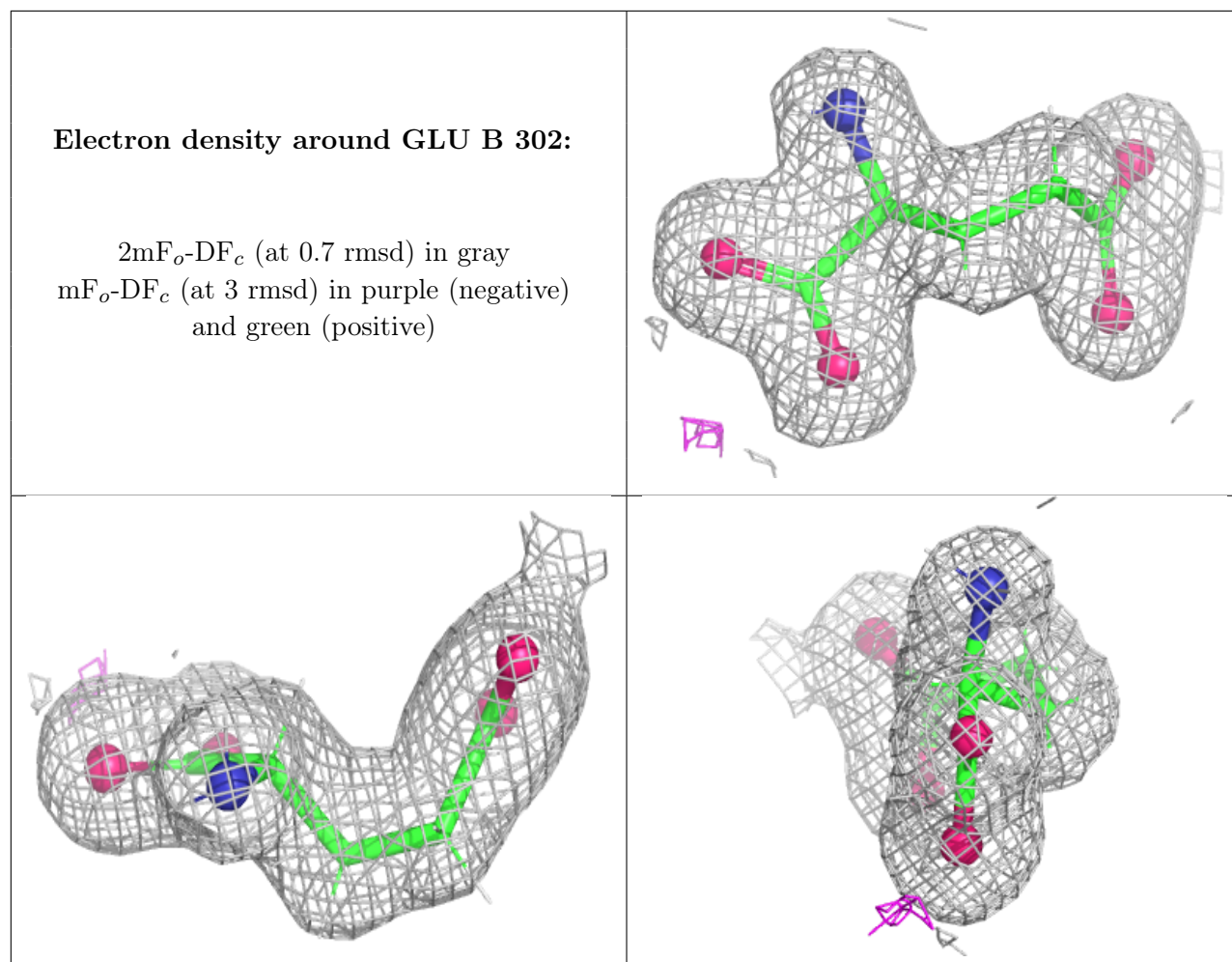| Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\mathring{A}^2$)	Q<0.9
4	A1B7E	B	301	27/27	0.97	0.07	22,31,41,48	0
3	DK1	A	301	16/16	0.98	0.05	23,27,36,45	0
5	GLU	B	302	10/10	0.99	0.04	20,25,33,33	0

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 A1B7E B 301:

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

Electron density around DK1 A 301:

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 GLU B 302:

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

6.5 Other polymers ⓘ

There are no such residues in this entry.