



Full wwPDB X-ray Structure Validation Report ⓘ

Oct 10, 2023 – 10:01 PM EDT

PDB ID : 7KJA
Title : Crystal structure of the EphA2 intracellular KD-SAM domains
Authors : Lechtenberg, B.C.; Pasquale, E.B.
Deposited on : 2020-10-26
Resolution : 1.75 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 : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.35.1
buster-report : 1.1.7 (2018)
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.35.1

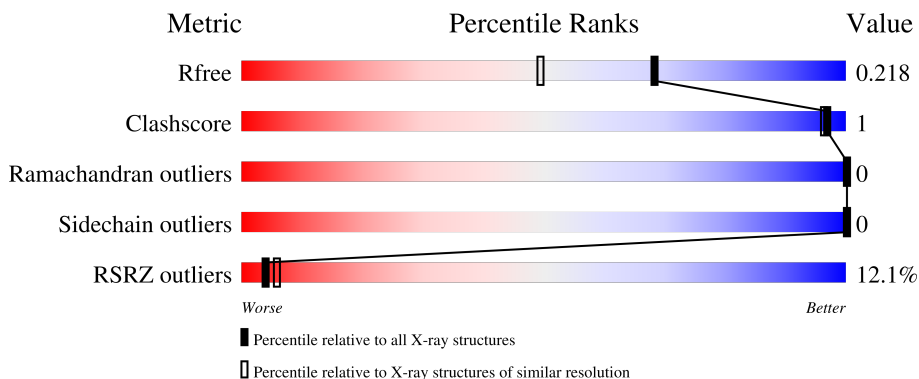
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.75 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}	130704	2340 (1.76-1.76)
Clashscore	141614	2466 (1.76-1.76)
Ramachandran outliers	138981	2437 (1.76-1.76)
Sidechain outliers	138945	2437 (1.76-1.76)
RSRZ outliers	127900	2298 (1.76-1.76)

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 $\leq 5\%$. 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	390	 13% 91% 7%
1	B	390	 9% 88% 11%

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 12395 atoms, of which 5923 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 Ephrin type-A receptor 2.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
1	A	364	5932	1882	2991	506	531	22	0	8	0
1	B	349	5683	1807	2860	484	510	22	0	8	0

There are 6 discrepancies between the modelled and reference sequences:

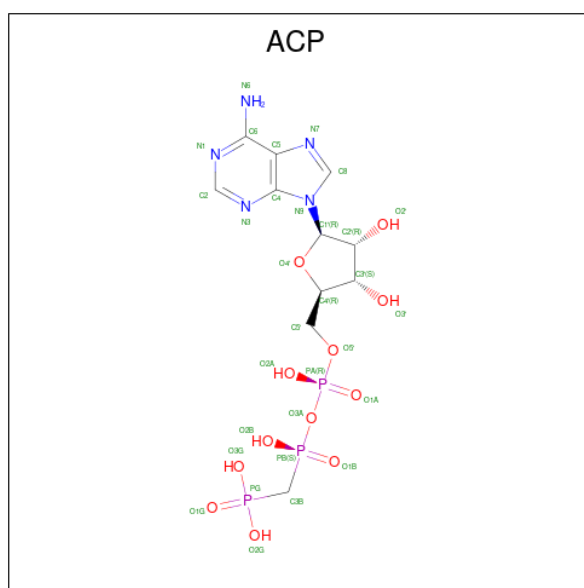
Chain	Residue	Modelled	Actual	Comment	Reference
A	587	GLY	-	expression tag	UNP P29317
A	588	PRO	-	expression tag	UNP P29317
A	589	GLY	-	expression tag	UNP P29317
B	587	GLY	-	expression tag	UNP P29317
B	588	PRO	-	expression tag	UNP P29317
B	589	GLY	-	expression tag	UNP P29317

- Molecule 2 is GLYCEROL (three-letter code: GOL) (formula: C₃H₈O₃).



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

- Molecule 3 is PHOSPHOMETHYLPHOSPHONIC ACID ADENYLATE ESTER (three-letter code: ACP) (formula: $C_{11}H_{18}N_5O_{12}P_3$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	
			Total	C	H	N	O			P
3	A	1	47	11	16	5	12	3	0	0
3	B	1	47	11	16	5	12	3	0	0

- Molecule 4 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Mg		
4	A	1	1	1	0	0

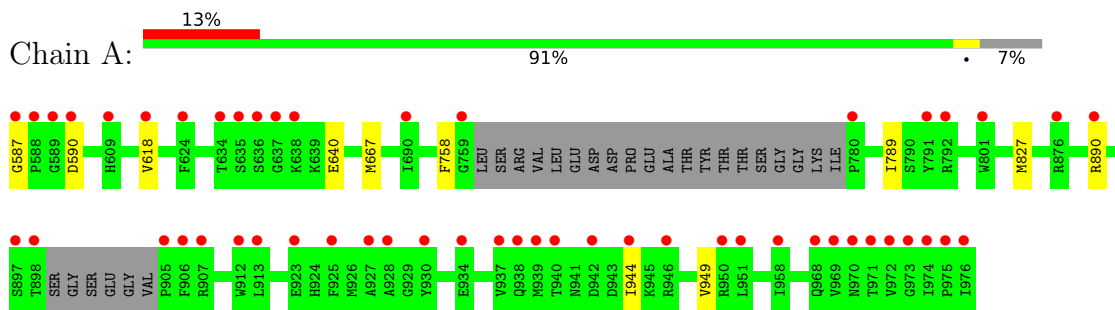
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	308	Total 308	O 308	0	0
5	B	307	Total 307	O 307	0	0

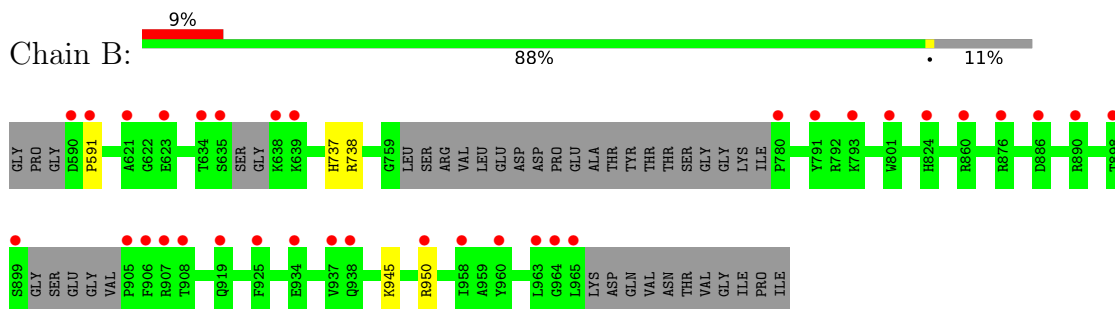
3 Residue-property plots [i](#)

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: Ephrin type-A receptor 2



- Molecule 1: Ephrin type-A receptor 2



4 Data and refinement statistics

Property	Value	Source
Space group	I 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	123.06Å 55.03Å 135.64Å 90.00° 94.86° 90.00°	Depositor
Resolution (Å)	20.49 – 1.75 20.49 – 1.75	Depositor EDS
% Data completeness (in resolution range)	99.3 (20.49-1.75) 99.4 (20.49-1.75)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.92 (at 1.75Å)	Xtrriage
Refinement program	PHENIX 1.18.2_3874	Depositor
R, R_{free}	0.188 , 0.217 0.189 , 0.218	Depositor DCC
R_{free} test set	4494 reflections (4.94%)	wwPDB-VP
Wilson B-factor (Å ²)	22.9	Xtrriage
Anisotropy	0.356	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.42 , 49.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	12395	wwPDB-VP
Average B, all atoms (Å ²)	36.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.97% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ 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: ACP, MG, 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	0.28	0/3026	0.49	0/4080
1	B	0.28	0/2914	0.49	0/3928
All	All	0.28	0/5940	0.49	0/8008

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	2941	2991	2991	7	0
1	B	2823	2860	2844	4	0
2	A	12	16	16	0	0
2	B	18	24	24	0	0
3	A	31	16	14	0	0
3	B	31	16	14	0	0
4	A	1	0	0	0	0
5	A	308	0	0	3	0
5	B	307	0	0	3	0
All	All	6472	5923	5903	11	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 1.

All (11) 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:A:890:ARG:NH1	5:A:1101:HOH:O	2.00	0.94
1:B:945:LYS:O	5:B:1101:HOH:O	2.04	0.75
1:A:587:GLY:N	1:A:590:ASP:OD2	2.34	0.61
1:B:591:PRO:O	5:B:1102:HOH:O	2.20	0.48
1:A:944:ILE:HG22	1:A:949:VAL:HB	1.96	0.47
1:A:789:ILE:HG21	1:A:827:MET:HE1	1.97	0.47
1:B:950:ARG:HD3	5:B:1101:HOH:O	2.17	0.45
1:A:640:GLU:HG3	5:A:1345:HOH:O	2.16	0.45
1:A:667[B]:MET:HG2	1:A:758:PHE:CD2	2.54	0.41
1:B:737:HIS:O	1:B:738:ARG:HB2	2.20	0.41
1:A:618:VAL:HG12	5:A:1309:HOH:O	2.21	0.40

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 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	366/390 (94%)	361 (99%)	5 (1%)	0	100	100
1	B	349/390 (90%)	346 (99%)	3 (1%)	0	100	100
All	All	715/780 (92%)	707 (99%)	8 (1%)	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	322/335 (96%)	322 (100%)	0	100	100
1	B	310/335 (92%)	310 (100%)	0	100	100
All	All	632/670 (94%)	632 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

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

5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 8 ligands modelled in this entry, 1 is 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	$\# Z > 2$
3	ACP	B	1003	-	27,33,33	1.99	6 (22%)	32,52,52	1.53	4 (12%)
2	GOL	A	1001	-	5,5,5	0.82	0	5,5,5	0.82	0
2	GOL	A	1003	-	5,5,5	0.86	0	5,5,5	1.09	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
2	GOL	B	1002	-	5,5,5	0.75	0	5,5,5	0.91	0
3	ACP	A	1002	4	27,33,33	1.92	6 (22%)	32,52,52	1.74	6 (18%)
2	GOL	B	1001	-	5,5,5	0.75	0	5,5,5	0.87	0
2	GOL	B	1004	-	5,5,5	0.72	0	5,5,5	0.92	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
3	ACP	B	1003	-	-	0/15/38/38	0/3/3/3
2	GOL	A	1001	-	-	0/4/4/4	-
2	GOL	A	1003	-	-	0/4/4/4	-
2	GOL	B	1002	-	-	2/4/4/4	-
3	ACP	A	1002	4	-	1/15/38/38	0/3/3/3
2	GOL	B	1001	-	-	0/4/4/4	-
2	GOL	B	1004	-	-	2/4/4/4	-

All (12) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	1002	ACP	C2'-C1'	-5.45	1.45	1.53
3	B	1003	ACP	C2'-C1'	-5.35	1.45	1.53
3	B	1003	ACP	O4'-C1'	4.80	1.47	1.41
3	A	1002	ACP	O4'-C1'	4.44	1.47	1.41
3	A	1002	ACP	C2'-C3'	-3.93	1.42	1.53
3	B	1003	ACP	C2'-C3'	-3.80	1.42	1.53
3	A	1002	ACP	C3'-C4'	-3.10	1.45	1.53
3	B	1003	ACP	C3'-C4'	-3.06	1.45	1.53
3	B	1003	ACP	C6-N6	2.97	1.44	1.34
3	A	1002	ACP	C6-N6	2.76	1.44	1.34
3	B	1003	ACP	C2-N3	2.56	1.36	1.32
3	A	1002	ACP	C2-N3	2.09	1.35	1.32

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	1002	ACP	N3-C2-N1	-5.98	119.33	128.68
3	B	1003	ACP	N3-C2-N1	-5.47	120.13	128.68
3	A	1002	ACP	PB-O3A-PA	-4.01	119.84	132.56

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	1003	ACP	PB-O3A-PA	-3.93	120.10	132.56
3	A	1002	ACP	C3'-C2'-C1'	3.52	106.27	100.98
3	B	1003	ACP	C3'-C2'-C1'	2.85	105.27	100.98
3	A	1002	ACP	C1'-N9-C4	-2.40	122.42	126.64
3	A	1002	ACP	C4-C5-N7	-2.33	106.97	109.40
3	B	1003	ACP	C4-C5-N7	-2.22	107.08	109.40
3	A	1002	ACP	C2-N1-C6	2.16	122.45	118.75

There are no chirality outliers.

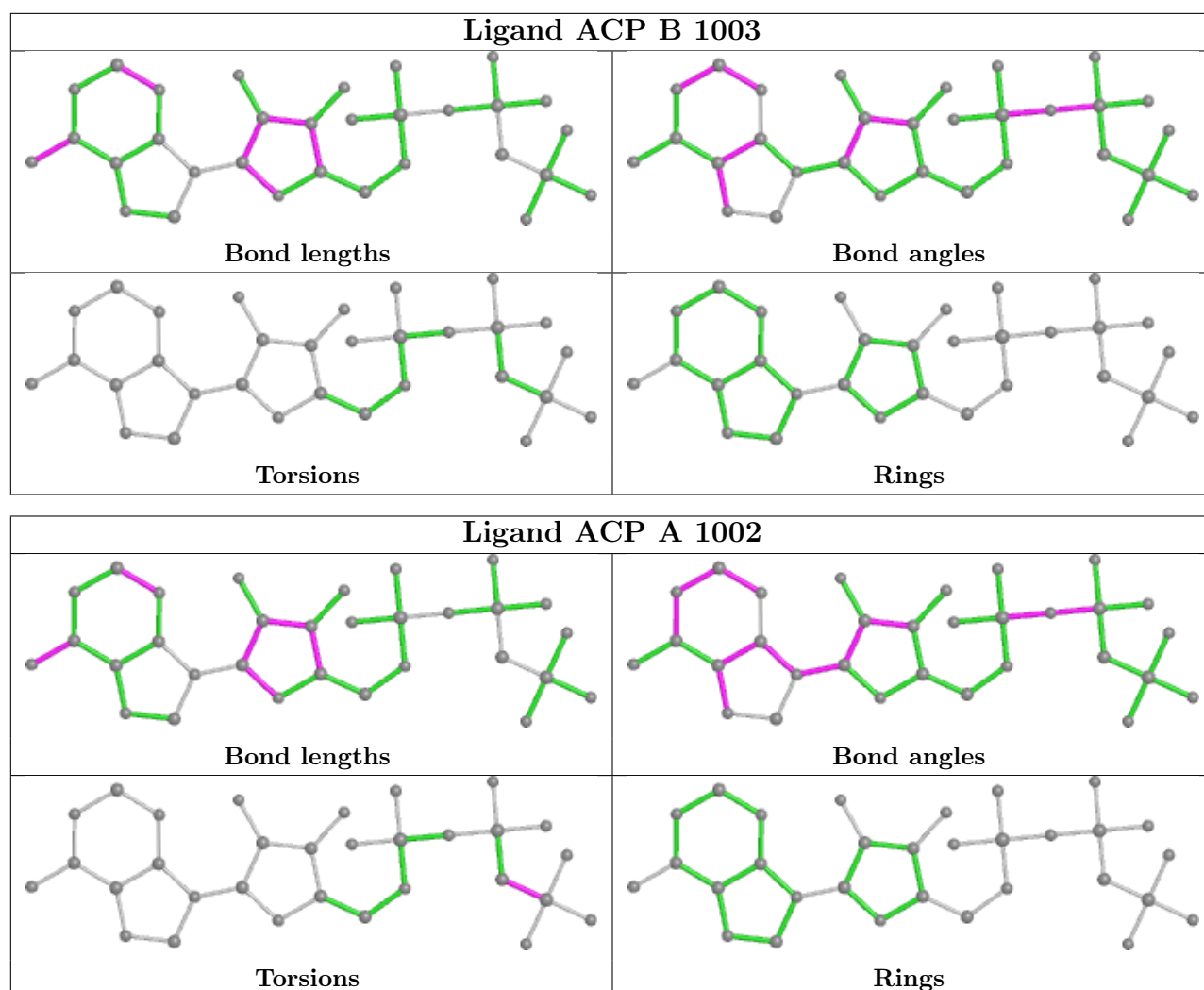
All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	1002	GOL	C1-C2-C3-O3
2	B	1002	GOL	O2-C2-C3-O3
2	B	1004	GOL	O2-C2-C3-O3
2	B	1004	GOL	C1-C2-C3-O3
3	A	1002	ACP	PB-C3B-PG-O1G

There are no ring outliers.

No monomer is involved in short contacts.

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.

6 Fit of model and data [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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	364/390 (93%)	0.79	52 (14%) 2 3	16, 27, 71, 91	0
1	B	349/390 (89%)	0.65	34 (9%) 7 10	16, 26, 62, 94	0
All	All	713/780 (91%)	0.72	86 (12%) 4 6	16, 27, 70, 94	0

All (86) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	969	VAL	9.6
1	A	972	VAL	8.8
1	A	973	GLY	8.6
1	B	963	LEU	8.1
1	B	591	PRO	6.9
1	B	960	TYR	6.4
1	B	590	ASP	6.4
1	A	636	SER	6.3
1	B	934	GLU	6.3
1	B	964	GLY	6.1
1	A	907	ARG	6.0
1	A	975	PRO	5.9
1	B	965	LEU	5.5
1	B	905	PRO	5.4
1	A	905	PRO	5.4
1	A	974	ILE	5.3
1	B	635	SER	5.2
1	B	899	SER	5.2
1	B	907	ARG	5.1
1	A	970	ASN	5.0
1	A	971	THR	4.9
1	B	638	LYS	4.8
1	A	946	ARG	4.6
1	A	780	PRO	4.6

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	B	950	ARG	4.4
1	A	590	ASP	4.3
1	A	940	THR	4.2
1	B	938	GLN	4.2
1	B	906	PHE	4.2
1	A	950	ARG	4.2
1	B	639	LYS	4.1
1	B	908	THR	3.8
1	B	791[A]	TYR	3.8
1	A	968	GLN	3.7
1	A	876	ARG	3.4
1	A	927	ALA	3.4
1	A	634	THR	3.4
1	A	938	GLN	3.3
1	A	898	THR	3.2
1	A	951	LEU	3.2
1	B	634	THR	3.1
1	A	791	TYR	3.1
1	A	587	GLY	3.1
1	A	930	TYR	3.0
1	A	589	GLY	3.0
1	A	638	LYS	3.0
1	A	588	PRO	3.0
1	A	944	ILE	2.9
1	A	976	ILE	2.9
1	A	937	VAL	2.9
1	A	912	TRP	2.9
1	A	792	ARG	2.8
1	A	923	GLU	2.8
1	A	906	PHE	2.8
1	B	780	PRO	2.8
1	A	942	ASP	2.7
1	A	624	PHE	2.7
1	B	860	ARG	2.6
1	A	939	MET	2.6
1	A	958	ILE	2.6
1	B	937	VAL	2.6
1	B	623	GLU	2.5
1	A	890	ARG	2.5
1	A	759	GLY	2.5
1	B	898	THR	2.4
1	A	801	TRP	2.4

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	B	801	TRP	2.4
1	A	690	ILE	2.3
1	A	928	ALA	2.3
1	B	886	ASP	2.3
1	A	913	LEU	2.3
1	B	958	ILE	2.3
1	B	621	ALA	2.3
1	A	635	SER	2.2
1	A	609	HIS	2.2
1	B	824	HIS	2.2
1	B	890	ARG	2.2
1	B	925	PHE	2.2
1	A	637	GLY	2.2
1	B	919	GLN	2.2
1	B	876	ARG	2.1
1	A	618	VAL	2.1
1	A	925	PHE	2.1
1	A	934	GLU	2.1
1	B	793	LYS	2.1
1	A	897	SER	2.1

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

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

6.3 Carbohydrates [i](#)

There are no monosaccharides 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, 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.

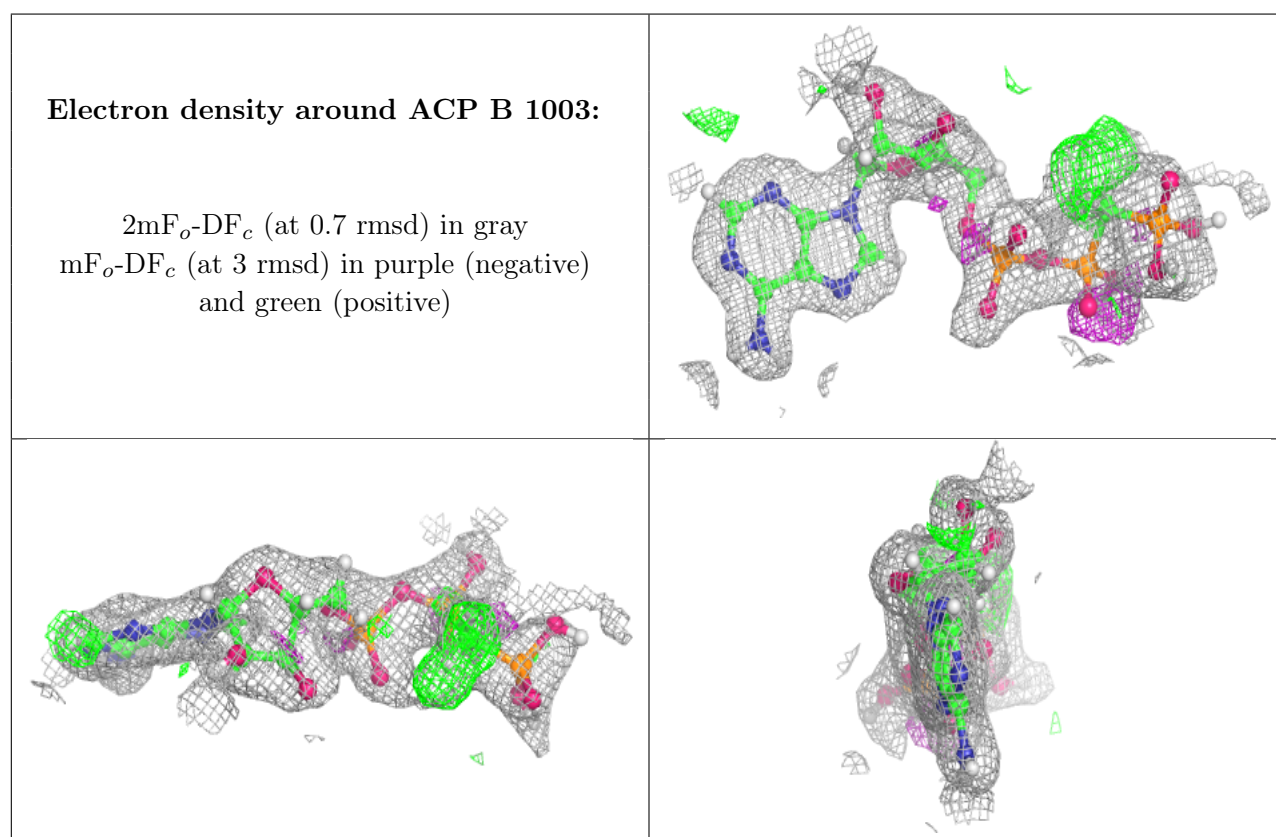
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
2	GOL	A	1003	6/6	0.71	0.35	38,51,61,70	0
4	MG	A	1004	1/1	0.71	0.28	49,49,49,49	0
2	GOL	B	1001	6/6	0.79	0.28	36,46,56,63	0

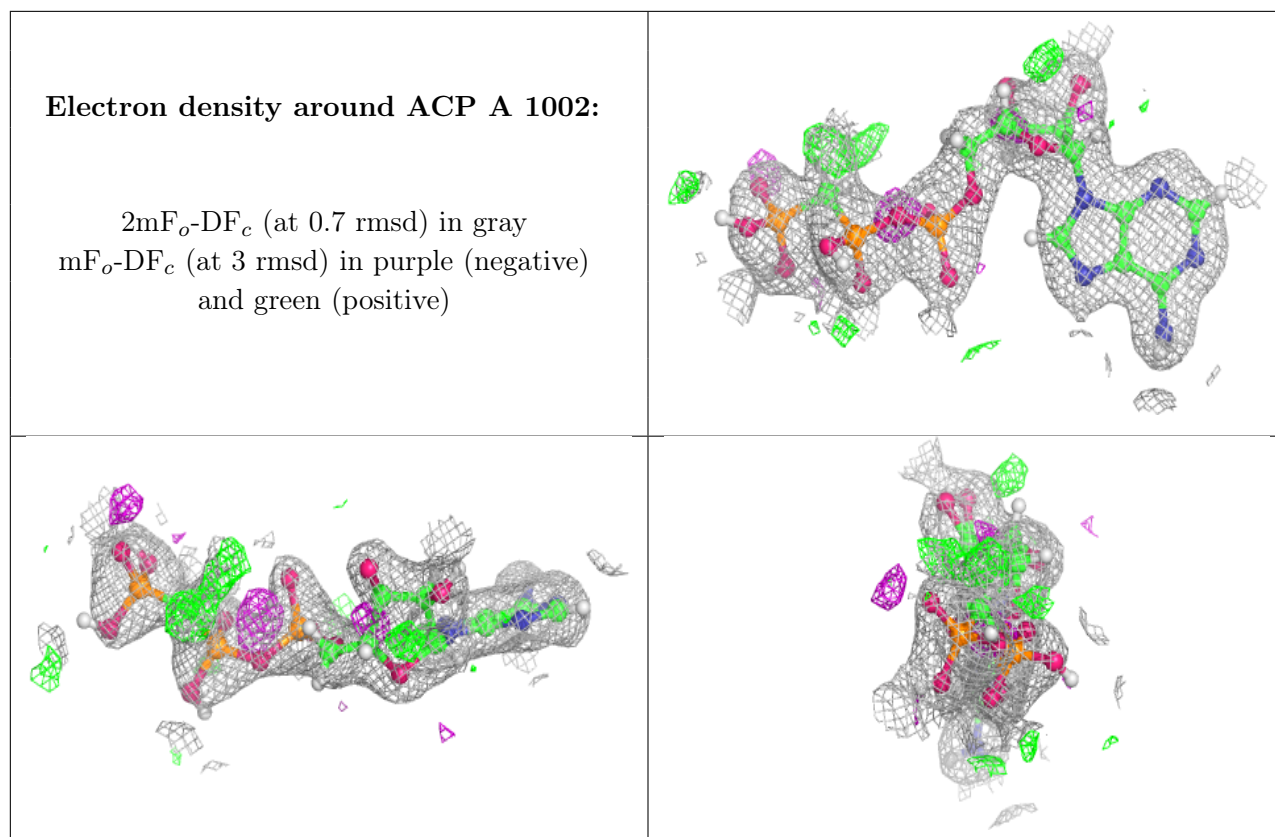
Continued on next page...

Continued from previous page...

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
2	GOL	B	1004	6/6	0.81	0.18	34,53,61,64	0
3	ACP	B	1003	31/31	0.83	0.17	20,46,73,83	0
2	GOL	A	1001	6/6	0.83	0.25	33,47,57,69	0
3	ACP	A	1002	31/31	0.86	0.16	21,43,58,69	0
2	GOL	B	1002	6/6	0.87	0.17	29,49,57,66	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.





6.5 Other polymers [i](#)

There are no such residues in this entry.