



# Full wwPDB X-ray Structure Validation Report ⓘ

Oct 10, 2023 – 06:35 PM EDT

PDB ID : 7KJC  
Title : Crystal structure of the EphA2 S901E mutant intracellular KD-SAM domains  
Authors : Lechtenberg, B.C.; Pasquale, E.B.  
Deposited on : 2020-10-26  
Resolution : 2.30 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](mailto: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>.

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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



## 2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 12260 atoms, of which 5983 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	376	6069	1931	3051	516	548	23	0	4	0
1	B	350	5697	1814	2868	486	506	23	0	7	0

There are 8 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
A	901	GLU	SER	engineered mutation	UNP P29317
B	587	GLY	-	expression tag	UNP P29317
B	588	PRO	-	expression tag	UNP P29317
B	589	GLY	-	expression tag	UNP P29317
B	901	GLU	SER	engineered mutation	UNP P29317

- Molecule 2 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
4	A	1	Total	C	H	O	0	0
			14	3	8	3		
4	A	1	Total	C	H	O	0	0
			14	3	8	3		
4	B	1	Total	C	H	O	0	0
			14	3	8	3		
4	B	1	Total	C	H	O	0	0
			14	3	8	3		

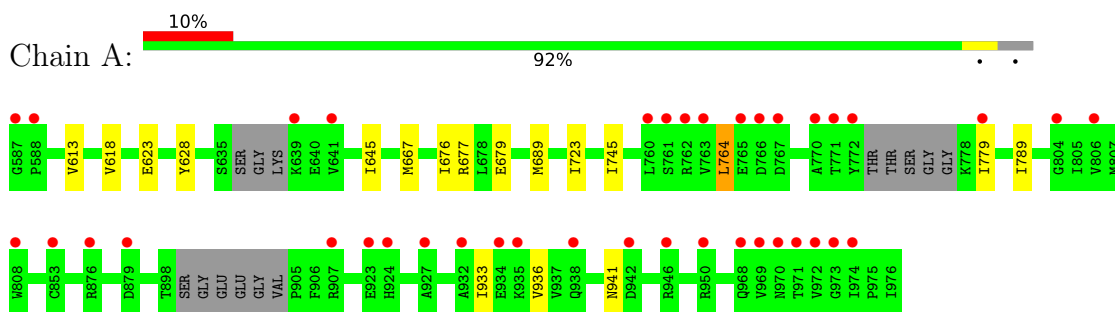
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	171	Total	O	0	0
			171	171		
5	B	172	Total	O	0	0
			172	172		

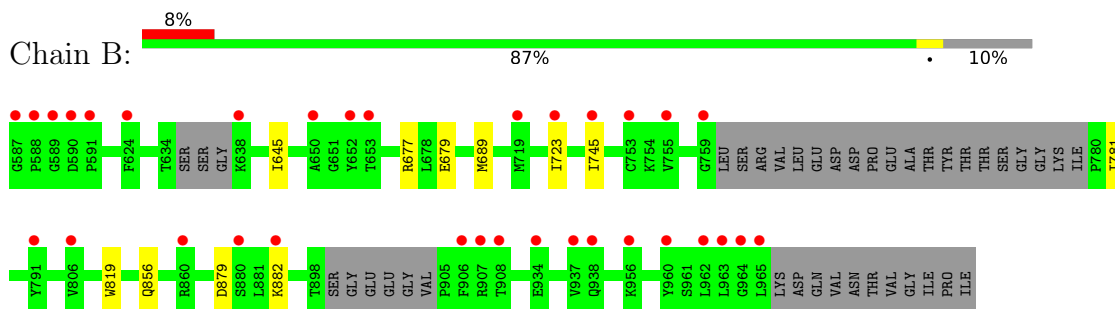
### 3 Residue-property plots [i](#)

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, $\alpha$ , $\beta$ , $\gamma$	121.64Å 54.59Å 135.54Å 90.00° 95.22° 90.00°	Depositor
Resolution (Å)	29.25 – 2.30 29.25 – 2.30	Depositor EDS
% Data completeness (in resolution range)	99.8 (29.25-2.30) 99.8 (29.25-2.30)	Depositor EDS
$R_{merge}$	0.09	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.06 (at 2.31Å)	Xtrriage
Refinement program	PHENIX 1.18.2_3874	Depositor
R, $R_{free}$	0.188 , 0.226 0.188 , 0.226	Depositor DCC
$R_{free}$ test set	2026 reflections (5.10%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	31.5	Xtrriage
Anisotropy	0.560	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.40 , 52.6	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	12260	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	47.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.02% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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: GOL, MG, ACP

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	0.26	0/3097	0.43	0/4178
1	B	0.25	0/2915	0.42	0/3929
All	All	0.25	0/6012	0.43	0/8107

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	3018	3051	3041	13	0
1	B	2829	2868	2858	9	0
2	A	31	16	14	0	0
2	B	31	16	14	0	0
3	A	1	0	0	0	0
4	A	12	16	16	0	0
4	B	12	16	16	0	0
5	A	171	0	0	0	0
5	B	172	0	0	2	0
All	All	6277	5983	5959	21	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 (21) 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:723:ILE:HD13	1:A:745[B]:ILE:HD13	1.70	0.73
1:A:613:VAL:HG11	1:A:689:MET:HE1	1.74	0.69
1:B:856:GLN:O	5:B:1101:HOH:O	2.13	0.66
1:B:723:ILE:HD13	1:B:745[B]:ILE:HD13	1.78	0.64
1:B:781:ILE:O	5:B:1102:HOH:O	2.15	0.62
1:A:613:VAL:HG11	1:A:689:MET:CE	2.30	0.61
1:B:645:ILE:HG23	1:B:689:MET:HE2	1.82	0.61
1:A:623:GLU:OE2	1:A:764:LEU:HD22	2.03	0.59
1:A:723:ILE:CD1	1:A:745[B]:ILE:HD13	2.32	0.59
1:B:723:ILE:CD1	1:B:745[B]:ILE:HD13	2.35	0.56
1:A:941:ASN:ND2	1:B:819:TRP:O	2.38	0.56
1:A:645:ILE:HG23	1:A:689:MET:HE2	1.88	0.55
1:A:618:VAL:HG22	1:A:628:TYR:CE2	2.45	0.51
1:B:645:ILE:CG2	1:B:689:MET:HE2	2.43	0.48
1:B:677:ARG:NH1	1:B:679:GLU:OE2	2.48	0.47
1:A:623:GLU:CD	1:A:764:LEU:HB3	2.35	0.47
1:A:677:ARG:NH1	1:A:679:GLU:OE2	2.48	0.46
1:A:779:ILE:HD12	1:A:789:ILE:HG12	1.99	0.44
1:B:879:ASP:HA	1:B:882:LYS:HE2	2.01	0.42
1:A:667[B]:MET:HE2	1:A:676:ILE:HG23	2.01	0.41
1:A:933:ILE:HA	1:A:936:VAL:HG22	2.03	0.41

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	372/390 (95%)	360 (97%)	12 (3%)	0	100 100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	B	349/390 (90%)	340 (97%)	9 (3%)	0	100	100
All	All	721/780 (92%)	700 (97%)	21 (3%)	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	330/335 (98%)	329 (100%)	1 (0%)	92	97
1	B	309/335 (92%)	309 (100%)	0	100	100
All	All	639/670 (95%)	638 (100%)	1 (0%)	93	97

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	764	LEU

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

Of 7 ligands modelled in this entry, 1 is monoatomic - leaving 6 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	GOL	A	1003	-	5,5,5	0.84	0	5,5,5	1.04	0
4	GOL	B	1003	-	5,5,5	0.82	0	5,5,5	1.02	0
2	ACP	B	1002	-	27,33,33	2.06	6 (22%)	32,52,52	1.69	4 (12%)
4	GOL	A	1004	-	5,5,5	0.85	0	5,5,5	0.98	0
4	GOL	B	1001	-	5,5,5	0.87	0	5,5,5	0.98	0
2	ACP	A	1001	3	27,33,33	2.04	6 (22%)	32,52,52	1.70	4 (12%)

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	GOL	A	1003	-	-	1/4/4/4	-
4	GOL	B	1003	-	-	0/4/4/4	-
2	ACP	B	1002	-	-	0/15/38/38	0/3/3/3
4	GOL	A	1004	-	-	2/4/4/4	-
4	GOL	B	1001	-	-	0/4/4/4	-
2	ACP	A	1001	3	-	3/15/38/38	0/3/3/3

All (12) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	1001	ACP	C2'-C1'	-5.81	1.44	1.53
2	B	1002	ACP	C2'-C1'	-5.80	1.45	1.53
2	B	1002	ACP	O4'-C1'	4.90	1.47	1.41
2	A	1001	ACP	O4'-C1'	4.82	1.47	1.41
2	B	1002	ACP	C2'-C3'	-4.10	1.42	1.53
2	A	1001	ACP	C2'-C3'	-4.05	1.42	1.53
2	A	1001	ACP	C3'-C4'	-3.15	1.44	1.53

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	1002	ACP	C3'-C4'	-3.13	1.45	1.53
2	B	1002	ACP	C6-N6	2.98	1.44	1.34
2	A	1001	ACP	C6-N6	2.94	1.44	1.34
2	B	1002	ACP	C2-N3	2.58	1.36	1.32
2	A	1001	ACP	C2-N3	2.51	1.36	1.32

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	1001	ACP	N3-C2-N1	-5.51	120.06	128.68
2	B	1002	ACP	N3-C2-N1	-5.33	120.35	128.68
2	B	1002	ACP	PB-O3A-PA	-4.56	118.09	132.56
2	A	1001	ACP	PB-O3A-PA	-4.53	118.20	132.56
2	B	1002	ACP	C3'-C2'-C1'	4.16	107.25	100.98
2	A	1001	ACP	C3'-C2'-C1'	3.92	106.88	100.98
2	A	1001	ACP	C4-C5-N7	-2.20	107.10	109.40
2	B	1002	ACP	C4-C5-N7	-2.18	107.13	109.40

There are no chirality outliers.

All (6) torsion outliers are listed below:

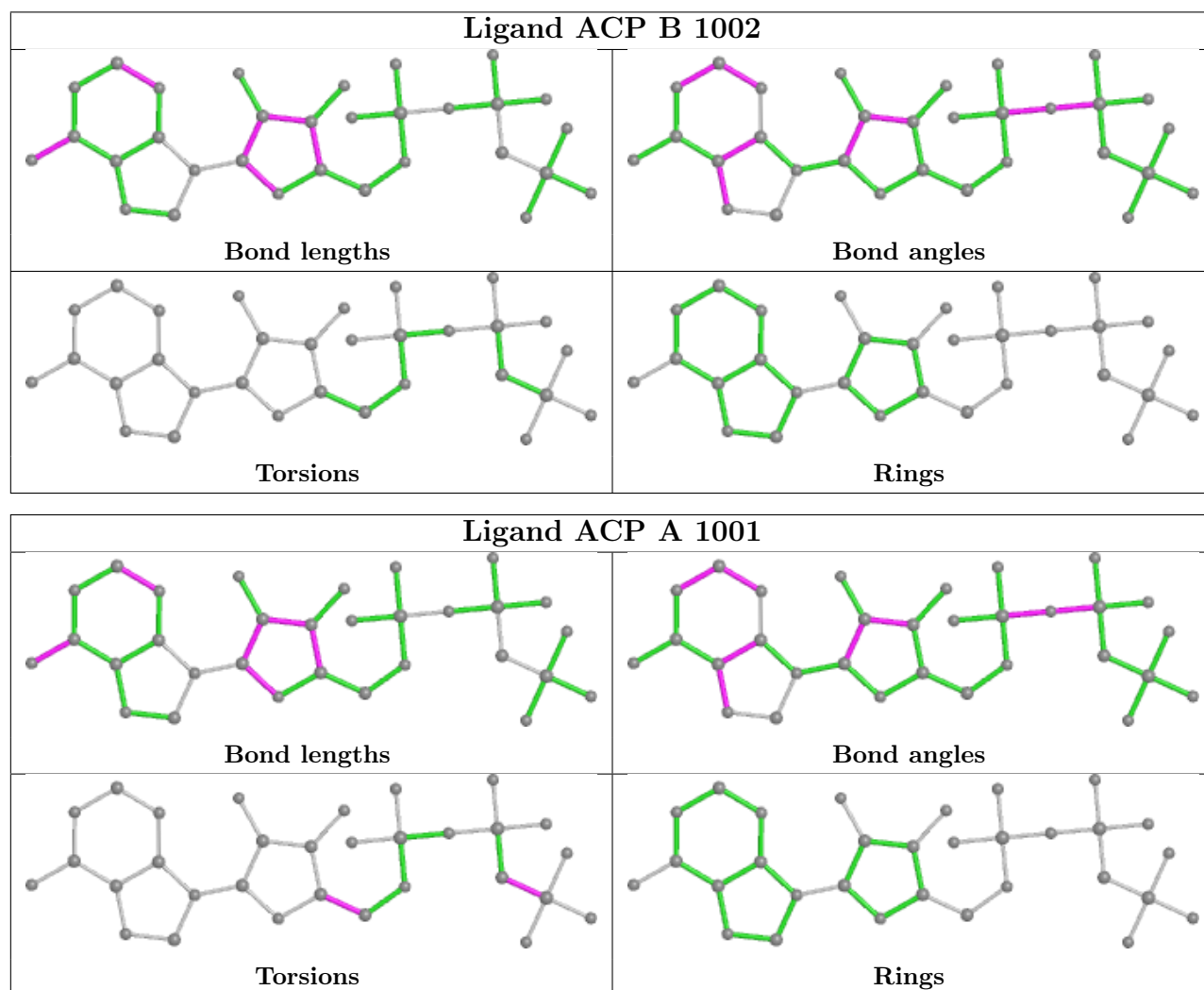
Mol	Chain	Res	Type	Atoms
4	A	1004	GOL	O1-C1-C2-C3
4	A	1004	GOL	O1-C1-C2-O2
4	A	1003	GOL	O1-C1-C2-C3
2	A	1001	ACP	O4'-C4'-C5'-O5'
2	A	1001	ACP	PB-C3B-PG-O1G
2	A	1001	ACP	C3'-C4'-C5'-O5'

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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	376/390 (96%)	0.45	39 (10%) <b>6</b>   <b>9</b>	23, 38, 83, 111	0
1	B	350/390 (89%)	0.42	33 (9%) <b>8</b>   <b>11</b>	22, 36, 81, 119	0
All	All	726/780 (93%)	0.44	72 (9%) <b>7</b>   <b>10</b>	22, 37, 83, 119	0

All (72) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	589	GLY	9.1
1	A	772	TYR	6.7
1	A	766	ASP	6.3
1	A	969	VAL	6.0
1	B	588	PRO	5.8
1	B	587	GLY	5.8
1	A	972	VAL	5.6
1	B	907	ARG	5.4
1	A	973	GLY	5.1
1	B	590	ASP	5.0
1	A	763	VAL	4.9
1	A	974	ILE	4.4
1	A	762	ARG	4.0
1	B	963	LEU	3.9
1	B	964	GLY	3.9
1	B	791	TYR	3.8
1	B	938	GLN	3.6
1	A	876	ARG	3.5
1	A	907	ARG	3.5
1	A	946	ARG	3.5
1	B	934	GLU	3.4
1	A	588	PRO	3.3
1	A	927	ALA	3.3
1	A	767	ASP	3.2

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<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>	<b>RSRZ</b>
1	A	770	ALA	3.2
1	B	937	VAL	3.2
1	B	906	PHE	3.1
1	A	932	ALA	3.1
1	A	970	ASN	2.9
1	B	960	TYR	2.9
1	A	587	GLY	2.8
1	B	638	LYS	2.8
1	B	652	TYR	2.8
1	A	771	THR	2.7
1	B	965	LEU	2.7
1	A	806	VAL	2.6
1	B	956	LYS	2.6
1	B	591	PRO	2.6
1	A	971	THR	2.5
1	A	935	LYS	2.5
1	A	639	LYS	2.5
1	A	879	ASP	2.5
1	B	753	CYS	2.4
1	B	962	LEU	2.4
1	A	968	GLN	2.4
1	B	806	VAL	2.4
1	A	923	GLU	2.4
1	A	765	GLU	2.4
1	B	908	THR	2.4
1	A	950	ARG	2.3
1	A	760	LEU	2.3
1	B	860	ARG	2.3
1	A	804	GLY	2.3
1	A	934	GLU	2.2
1	B	759	GLY	2.2
1	B	719	MET	2.2
1	A	761	SER	2.2
1	A	924	HIS	2.1
1	B	755	VAL	2.1
1	A	938	GLN	2.1
1	B	650	ALA	2.1
1	B	653	THR	2.1
1	B	880	SER	2.1
1	B	723	ILE	2.1
1	B	745[A]	ILE	2.1
1	A	808	TRP	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	641	VAL	2.1
1	B	882	LYS	2.1
1	A	853	CYS	2.0
1	B	624	PHE	2.0
1	A	779	ILE	2.0
1	A	942	ASP	2.0

## 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, 95<sup>th</sup> 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.

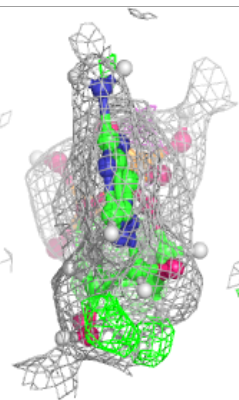
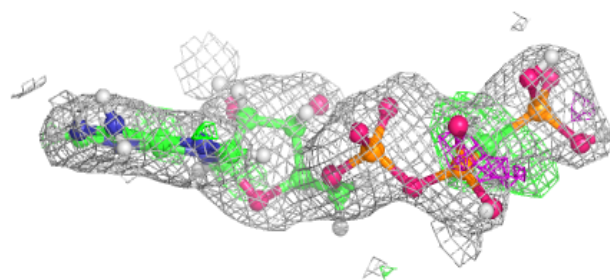
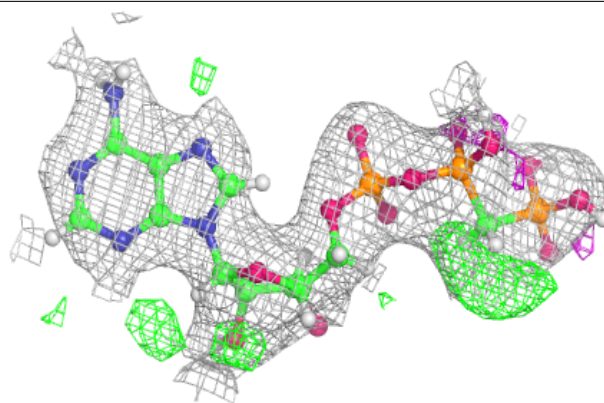
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
4	GOL	B	1003	6/6	0.69	0.22	49,66,72,80	0
4	GOL	A	1003	6/6	0.81	0.26	47,60,72,82	0
4	GOL	B	1001	6/6	0.86	0.20	48,57,70,70	0
4	GOL	A	1004	6/6	0.86	0.27	44,58,74,74	0
3	MG	A	1002	1/1	0.88	0.19	47,47,47,47	0
2	ACP	B	1002	31/31	0.89	0.15	28,53,71,76	0
2	ACP	A	1001	31/31	0.93	0.13	34,55,79,81	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.

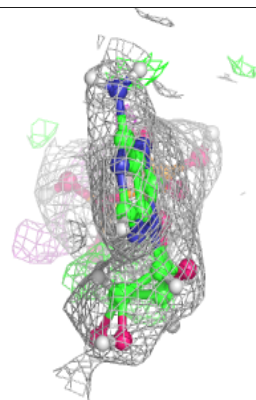
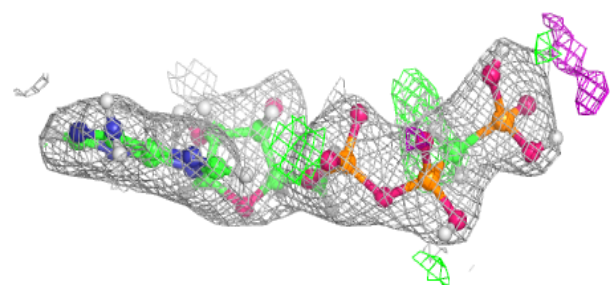
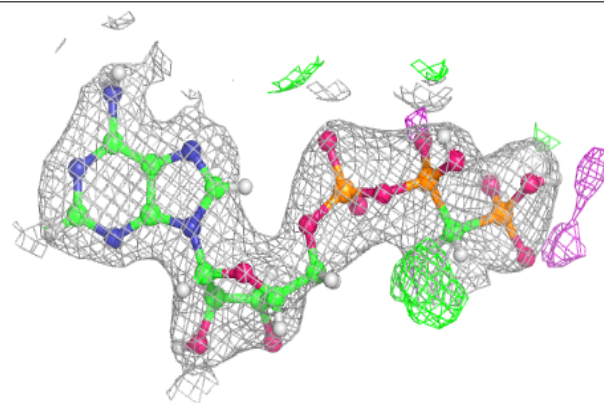


**Electron density around ACP B 1002:**

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

**Electron density around ACP A 1001:**

$2mF_o-DF_c$  (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.