Full wwPDB X-ray Structure Validation Report (i)

Sep 14, 2023 – 05:48 AM EDT

PDB ID	:	4RWL
Title	:	Crystal structure of FGFR1 (C488A, C584C) in complex with 6-(7-((1-amino cyclopropyl) methoxy)-6-methoxyquinolin-4-yloxy)-N-methyl-1-naphthamide (E3810)
Authors	:	Sohl, C.D.; Anderson, K.S.
Deposited on	:	2014-12-04
Resolution	:	2.19 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 (i) 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 (i)) were used in the production of this report:

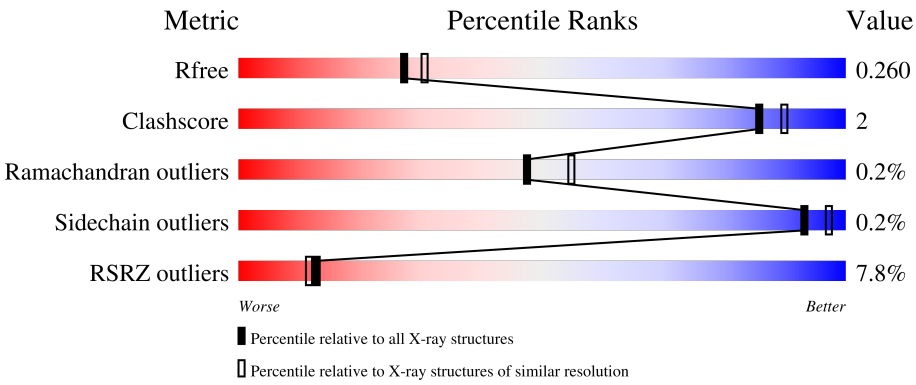
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.35.1
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.35.1

1 Overall quality at a glance (i)

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

The reported resolution of this entry is 2.19 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	4898 (2.20-2.20)
Clashscore	141614	5594 (2.20-2.20)
Ramachandran outliers	138981	5503 (2.20-2.20)
Sidechain outliers	138945	5504 (2.20-2.20)
RSRZ outliers	127900	4800 (2.20-2.20)

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	317	4% 86% • 11%
1	B	317	9% 84% 6% 10%

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
3	SO4	B	802	-	-	X	-

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 4451 atoms, of which 0 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.

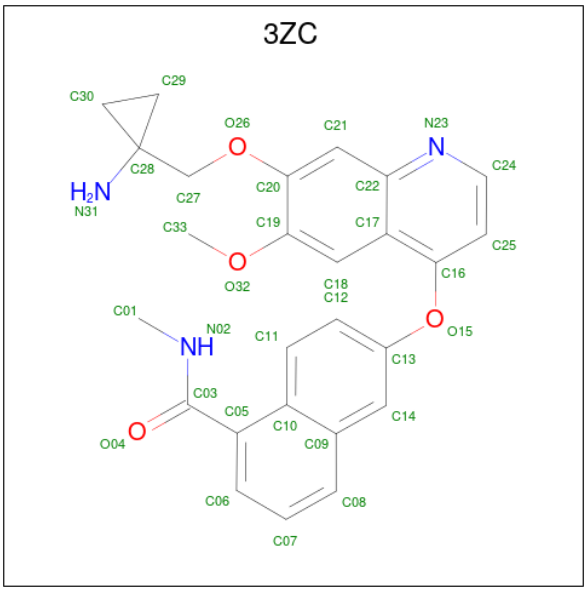
- Molecule 1 is a protein called Fibroblast growth factor receptor 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	282	2166	1378	370	401	17	0	0	0
1	B	285	2197	1397	374	410	16	0	0	0

There are 22 discrepancies between the modelled and reference sequences:

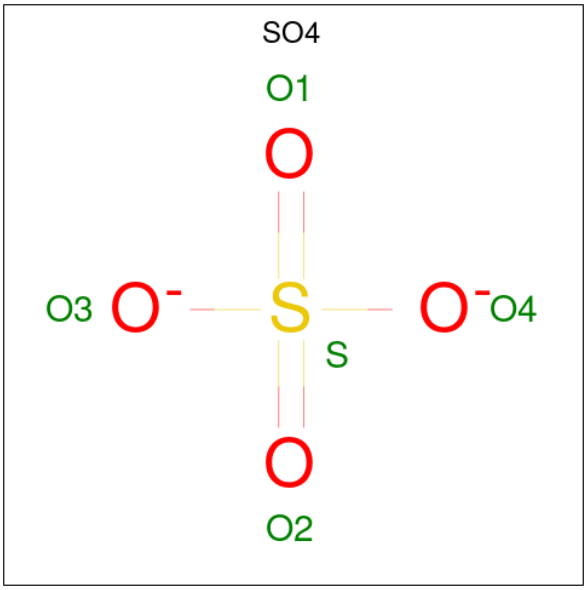
Chain	Residue	Modelled	Actual	Comment	Reference
A	449	MET	-	expression tag	UNP P11362
A	450	GLY	-	expression tag	UNP P11362
A	451	HIS	-	expression tag	UNP P11362
A	452	HIS	-	expression tag	UNP P11362
A	453	HIS	-	expression tag	UNP P11362
A	454	HIS	-	expression tag	UNP P11362
A	455	HIS	-	expression tag	UNP P11362
A	456	HIS	-	expression tag	UNP P11362
A	457	MET	-	expression tag	UNP P11362
A	488	ALA	CYS	engineered mutation	UNP P11362
A	584	SER	CYS	engineered mutation	UNP P11362
B	449	MET	-	expression tag	UNP P11362
B	450	GLY	-	expression tag	UNP P11362
B	451	HIS	-	expression tag	UNP P11362
B	452	HIS	-	expression tag	UNP P11362
B	453	HIS	-	expression tag	UNP P11362
B	454	HIS	-	expression tag	UNP P11362
B	455	HIS	-	expression tag	UNP P11362
B	456	HIS	-	expression tag	UNP P11362
B	457	MET	-	expression tag	UNP P11362
B	488	ALA	CYS	engineered mutation	UNP P11362
B	584	SER	CYS	engineered mutation	UNP P11362

- Molecule 2 is 6-({7-[(1-aminocyclopropyl)methoxy]-6-methoxyquinolin-4-yl}oxy)-N-methyln aphthalene-1-carboxamide (three-letter code: 3ZC) (formula: $C_{26}H_{25}N_3O_4$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
2	B	1	33	26	3	4	0	0

- Molecule 3 is SULFATE ION (three-letter code: SO4) (formula: O_4S).



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

- Molecule 4 is water.

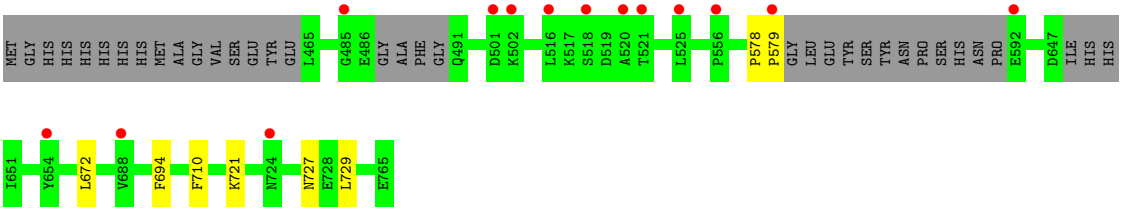
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
4	A	25	25	25	0	0
			Total	O		
4	B	25	25	25	0	0

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.

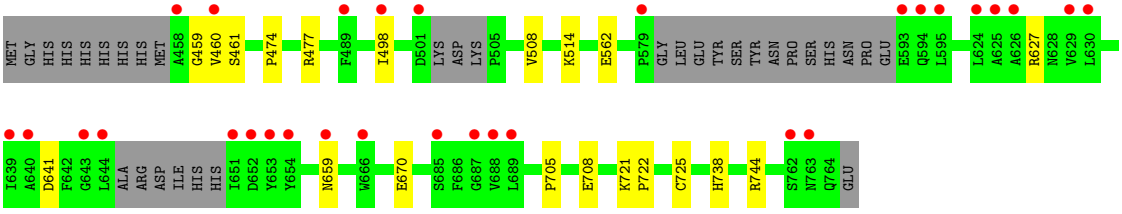
• Molecule 1: Fibroblast growth factor receptor 1

Chain A:



• Molecule 1: Fibroblast growth factor receptor 1

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	207.17Å 57.86Å 65.66Å 90.00° 107.19° 90.00°	Depositor
Resolution (Å)	32.99 – 2.19 32.99 – 2.19	Depositor EDS
% Data completeness (in resolution range)	99.5 (32.99-2.19) 95.7 (32.99-2.19)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.09	Depositor
$< I/\sigma(I) >$ [1]	3.47 (at 2.20Å)	Xtriage
Refinement program	PHENIX 1.9_1692	Depositor
R, R_{free}	0.207 , 0.256 0.212 , 0.260	Depositor DCC
R_{free} test set	1915 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å^2)	39.4	Xtriage
Anisotropy	0.574	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 38.2	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	0.022 for -h-2*l,-k,l	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	4451	wwPDB-VP
Average B, all atoms (Å^2)	47.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.22% of the height of the origin peak. No significant pseudotranslation is detected.*

[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: 3ZC, SO4

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	0.43	0/2209	0.56	0/2998
1	B	0.41	0/2241	0.54	0/3039
All	All	0.42	0/4450	0.55	0/6037

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	2166	0	2099	4	0
1	B	2197	0	2134	14	0
2	B	33	0	25	6	0
3	B	5	0	0	2	0
4	A	25	0	0	0	0
4	B	25	0	0	0	0
All	All	4451	0	4258	19	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 (19) 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:721:LYS:NZ	1:A:727:ASN:OD1	2.23	0.71
1:B:498:ILE:HG12	1:B:508:VAL:HG12	1.89	0.54
2:B:801:3ZC:H10	2:B:801:3ZC:O04	2.06	0.54
1:B:459:GLY:C	1:B:461:SER:H	2.12	0.54
1:B:562:GLU:O	2:B:801:3ZC:H2	2.09	0.52
1:B:670:GLU:OE2	1:B:744:ARG:NH1	2.33	0.50
1:B:514:LYS:HB2	2:B:801:3ZC:H9	1.95	0.48
1:B:514:LYS:HB2	2:B:801:3ZC:C08	2.45	0.47
1:B:474:PRO:HB2	1:B:477:ARG:HG3	1.98	0.46
1:B:627:ARG:HD3	3:B:802:SO4:O2	2.17	0.45
1:B:641:ASP:HA	2:B:801:3ZC:H5	1.98	0.45
1:A:694:PHE:CZ	1:A:729:LEU:HD13	2.51	0.45
1:B:721:LYS:HE3	1:B:725:CYS:O	2.18	0.44
1:A:672:LEU:HD21	1:A:710:PHE:CE1	2.53	0.43
1:A:578:PRO:HA	1:A:579:PRO:HD3	1.86	0.43
1:B:659:ASN:HB3	3:B:802:SO4:O4	2.19	0.42
1:B:705:PRO:HD2	1:B:708:GLU:HB2	2.02	0.41
1:B:721:LYS:HA	1:B:722:PRO:HD3	1.88	0.41
1:B:641:ASP:CA	2:B:801:3ZC:H5	2.51	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	274/317 (86%)	270 (98%)	4 (2%)	0	100	100
1	B	277/317 (87%)	274 (99%)	2 (1%)	1 (0%)	34	37
All	All	551/634 (87%)	544 (99%)	6 (1%)	1 (0%)	47	55

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	460	VAL

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	224/277 (81%)	224 (100%)	0	100	100
1	B	228/277 (82%)	227 (100%)	1 (0%)	91	96
All	All	452/554 (82%)	451 (100%)	1 (0%)	93	97

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

Mol	Chain	Res	Type
1	B	738	HIS

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

Mol	Chain	Res	Type
1	B	679	HIS
1	B	727	ASN

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)

2 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	$\#\|Z\| > 2$
2	3ZC	B	801	-	37,37,37	2.14	10 (27%)	48,54,54	1.57	13 (27%)
3	SO4	B	802	-	4,4,4	0.15	0	6,6,6	0.13	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
2	3ZC	B	801	-	-	1/17/22/22	0/5/5/5

All (10) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	801	3ZC	C03-N02	7.70	1.43	1.33
2	B	801	3ZC	O32-C19	3.69	1.43	1.37
2	B	801	3ZC	C10-C09	-3.21	1.37	1.43
2	B	801	3ZC	C17-C22	-3.08	1.37	1.42
2	B	801	3ZC	C21-C20	2.83	1.41	1.36
2	B	801	3ZC	O26-C20	2.65	1.42	1.37
2	B	801	3ZC	C27-C28	2.64	1.55	1.52
2	B	801	3ZC	C25-C16	2.55	1.44	1.38
2	B	801	3ZC	C18-C19	2.35	1.40	1.36
2	B	801	3ZC	C21-C22	2.09	1.45	1.41

All (13) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	B	801	3ZC	C16-O15-C13	-3.27	112.23	118.52
2	B	801	3ZC	C24-N23-C22	3.15	121.81	116.93
2	B	801	3ZC	O32-C19-C18	-3.07	121.26	125.24

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	B	801	3ZC	C21-C22-N23	2.94	121.32	117.97
2	B	801	3ZC	O32-C19-C20	2.81	119.33	115.41
2	B	801	3ZC	C17-C22-N23	-2.58	120.09	122.83
2	B	801	3ZC	C01-N02-C03	-2.55	119.00	121.89
2	B	801	3ZC	C33-O32-C19	-2.51	113.74	117.53
2	B	801	3ZC	C18-C17-C22	2.39	121.88	118.94
2	B	801	3ZC	C11-C10-C05	-2.10	120.07	123.31
2	B	801	3ZC	O15-C16-C25	2.07	126.61	120.76
2	B	801	3ZC	C11-C12-C13	-2.07	117.38	120.17
2	B	801	3ZC	C24-C25-C16	-2.03	115.72	118.06

There are no chirality outliers.

All (1) torsion outliers are listed below:

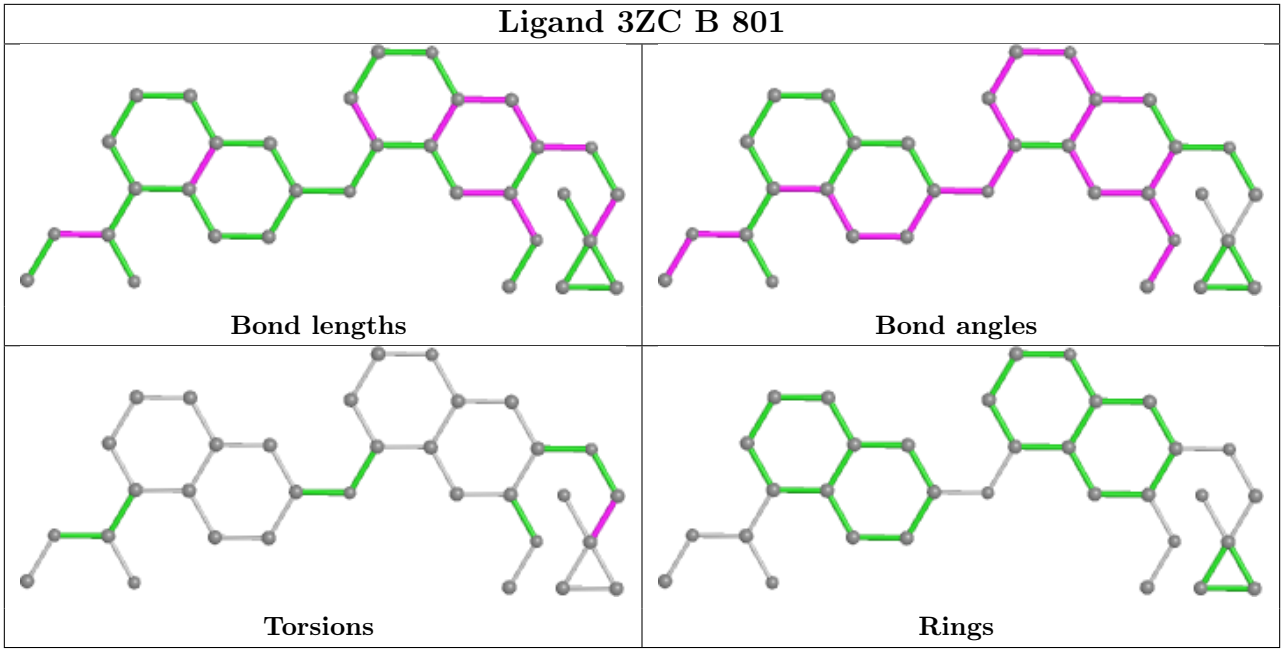
Mol	Chain	Res	Type	Atoms
2	B	801	3ZC	O26-C27-C28-C30

There are no ring outliers.

2 monomers are involved in 8 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	801	3ZC	6	0
3	B	802	SO4	2	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.



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	282/317 (88%)	0.34	14 (4%)	28	27	32, 44, 72, 92	0
1	B	285/317 (89%)	0.61	30 (10%)	6	5	34, 46, 70, 81	0
All	All	567/634 (89%)	0.47	44 (7%)	13	11	32, 46, 72, 92	0

All (44) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	489	PHE	6.3
1	B	458	ALA	5.9
1	A	520	ALA	5.1
1	B	653	TYR	4.7
1	B	501	ASP	4.5
1	B	624	LEU	4.2
1	B	639	ILE	4.1
1	B	579	PRO	3.8
1	B	763	ASN	3.8
1	A	518	SER	3.7
1	B	689	LEU	3.7
1	A	521	THR	3.6
1	B	651	ILE	3.4
1	B	688	VAL	3.4
1	B	654	TYR	3.3
1	B	644	LEU	3.3
1	B	625	ALA	3.3
1	B	762	SER	3.2
1	B	498	ILE	3.2
1	A	654	TYR	3.1
1	B	594	GLN	3.1
1	A	516	LEU	2.9
1	A	485	GLY	2.9
1	B	652	ASP	2.8

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	A	556	PRO	2.7
1	B	687	GLY	2.7
1	B	685	SER	2.6
1	B	629	VAL	2.6
1	A	501	ASP	2.5
1	B	640	ALA	2.5
1	B	626	ALA	2.4
1	B	643	GLY	2.4
1	B	595	LEU	2.3
1	B	666	TRP	2.3
1	B	593	GLU	2.3
1	A	502	LYS	2.3
1	A	579	PRO	2.3
1	A	688	VAL	2.2
1	A	525	LEU	2.2
1	A	724	ASN	2.2
1	B	659	ASN	2.2
1	A	592	GLU	2.2
1	B	460	VAL	2.2
1	B	630	LEU	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)

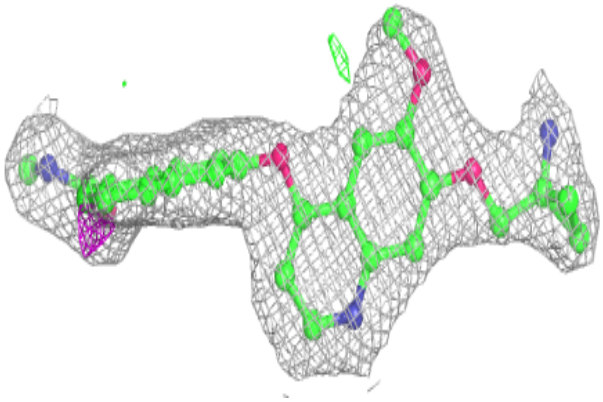
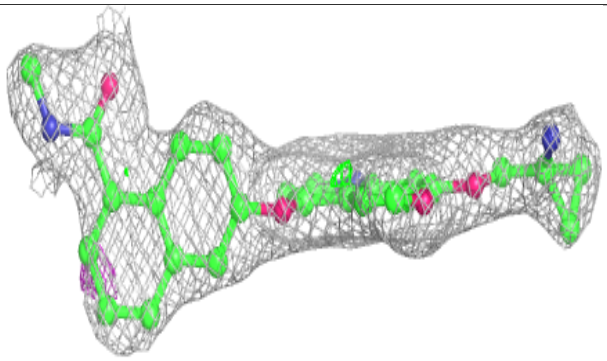
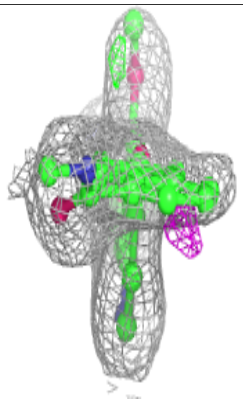
There are no monosaccharides in this entry.

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(Å^2)	Q<0.9
2	3ZC	B	801	33/33	0.88	0.18	40,45,52,54	0
3	SO4	B	802	5/5	0.99	0.09	52,54,59,62	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 3ZC B 801: 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.