wwPDB X-ray Structure Validation Summary Report (i)

Jun 25, 2024 – 03:25 PM EDT

PDB ID	:	6OP5
Title	:	Crystal Structure of Piper methysticum Styrylpyrone Synthase 1 in complex with p-coumaroyl-CoA
Authors	:	Pluskal, T.; Weng, J.K.
Deposited on	:	2019-04-24
Resolution	:	2.70 Å(reported)

This is a wwPDB X-ray Structure 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/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:

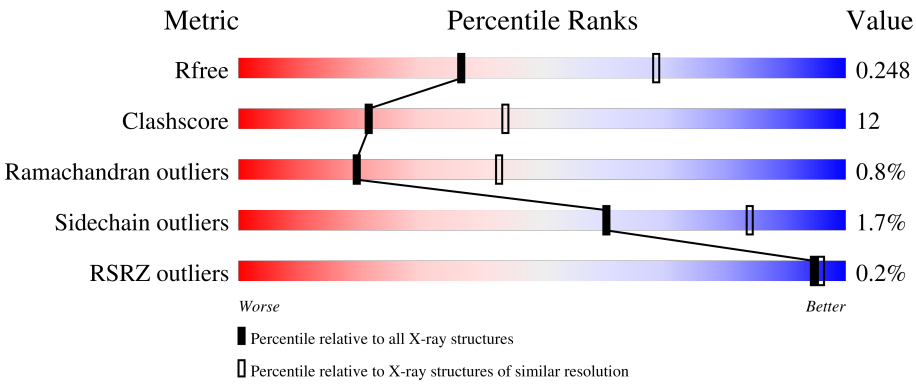
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.37.1
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.37.1

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 2.70 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	2808 (2.70-2.70)
Clashscore	141614	3122 (2.70-2.70)
Ramachandran outliers	138981	3069 (2.70-2.70)
Sidechain outliers	138945	3069 (2.70-2.70)
RSRZ outliers	127900	2737 (2.70-2.70)

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	397	74% 21% • •
1	B	397	68% 28% •
1	D	397	72% 23% • •
1	E	397	67% 27% • •
1	F	397	67% 27% • •

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Mol	Chain	Length	Quality of chain
2	C	397	73% 22%

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 17920 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.

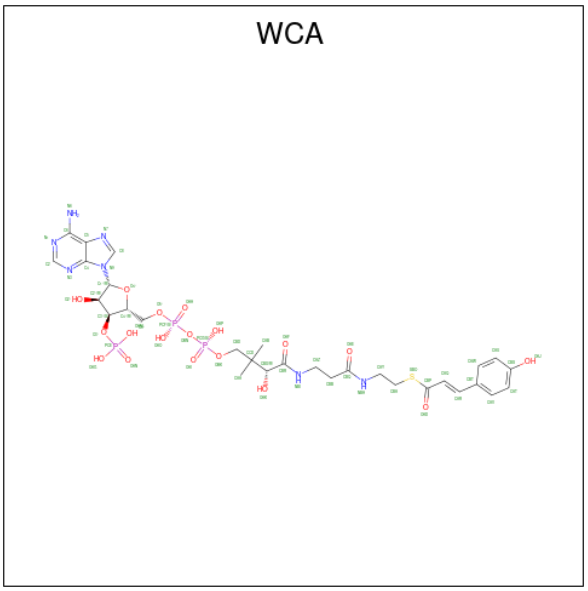
- Molecule 1 is a protein called Styrylpyrone synthase 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	383	2939	1867	502	550	20	0	0	0
1	B	382	2934	1864	501	549	20	0	0	0
1	D	382	2934	1864	501	549	20	0	0	0
1	E	382	2934	1864	501	549	20	0	0	0
1	F	382	2934	1864	501	549	20	0	0	0

- Molecule 2 is a protein called Styrylpyrone synthase 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	C	382	2945	1873	501	551	20	0	0	0

- Molecule 3 is p-coumaroyl-CoA (three-letter code: WCA) (formula: $C_{30}H_{42}N_7O_{18}P_3S$).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
			Total	C	N	O	P	S		
3	A	1	59	30	7	18	3	1	0	0
3	B	1	59	30	7	18	3	1	0	0

- Molecule 4 is water.

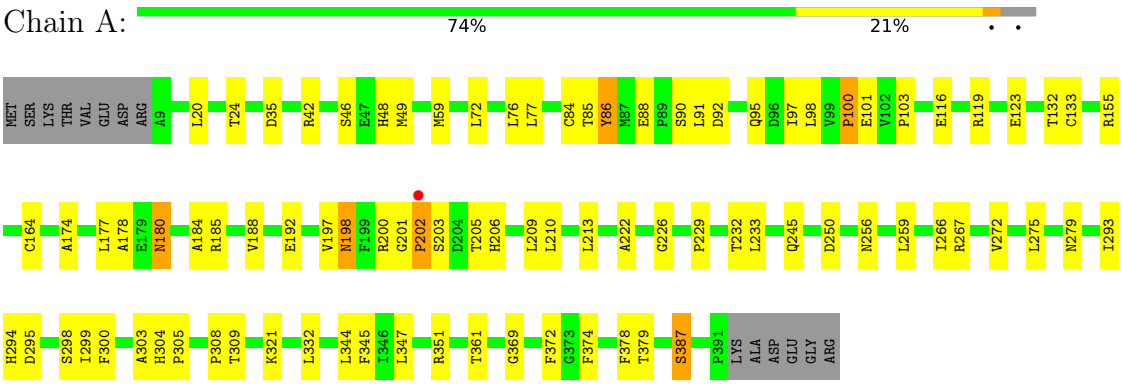
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
4	A	39	39	39	0	0
4	B	36	36	36	0	0
4	C	33	33	33	0	0
4	D	32	32	32	0	0
4	E	21	21	21	0	0
4	F	21	21	21	0	0

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.

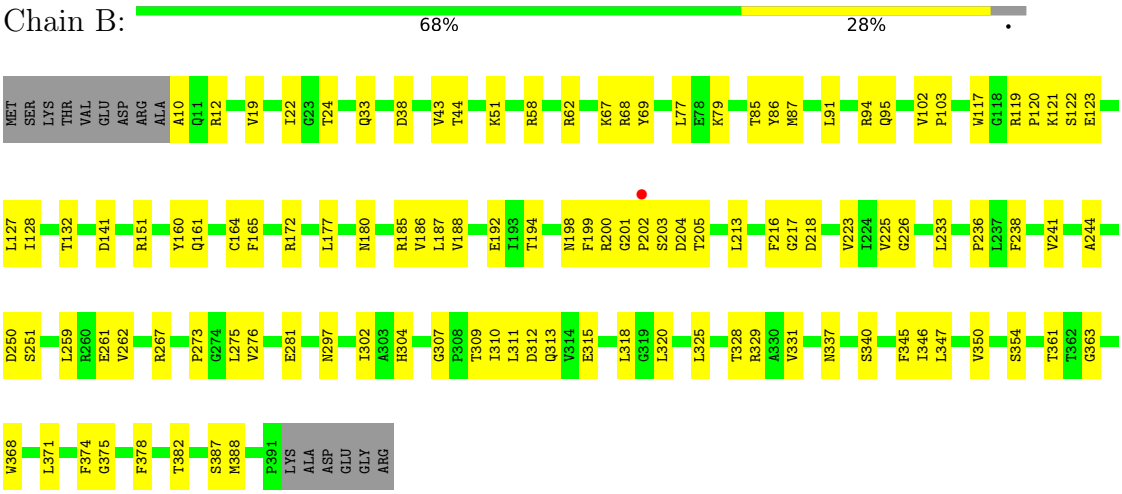
• Molecule 1: Styrylpyrone synthase 1

Chain A:



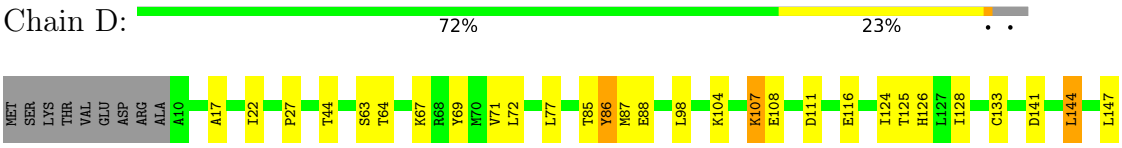
• Molecule 1: Styrylpyrone synthase 1

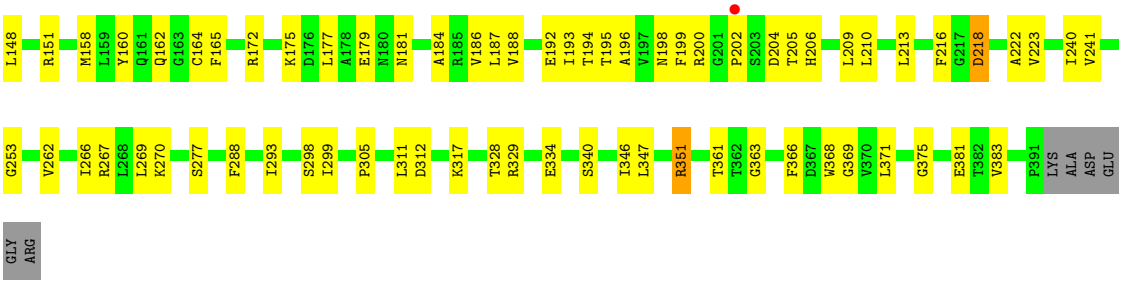
Chain B:



• Molecule 1: Styrylpyrone synthase 1

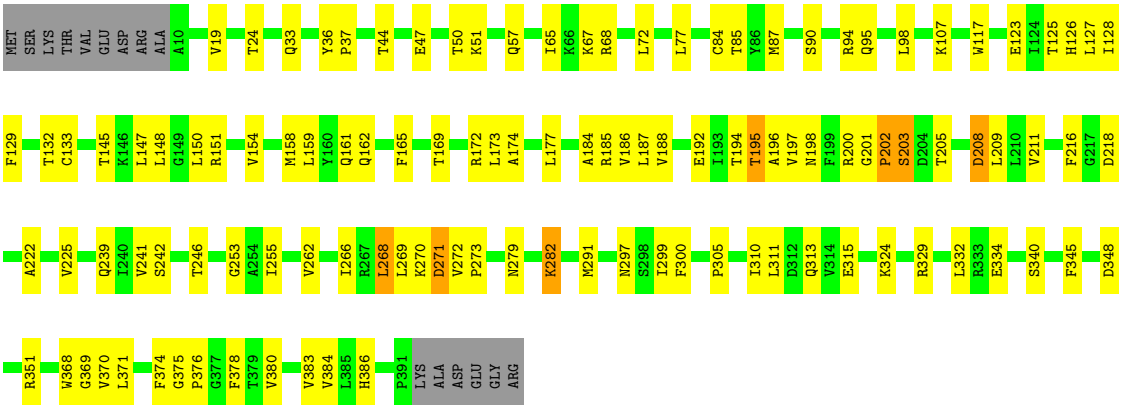
Chain D:





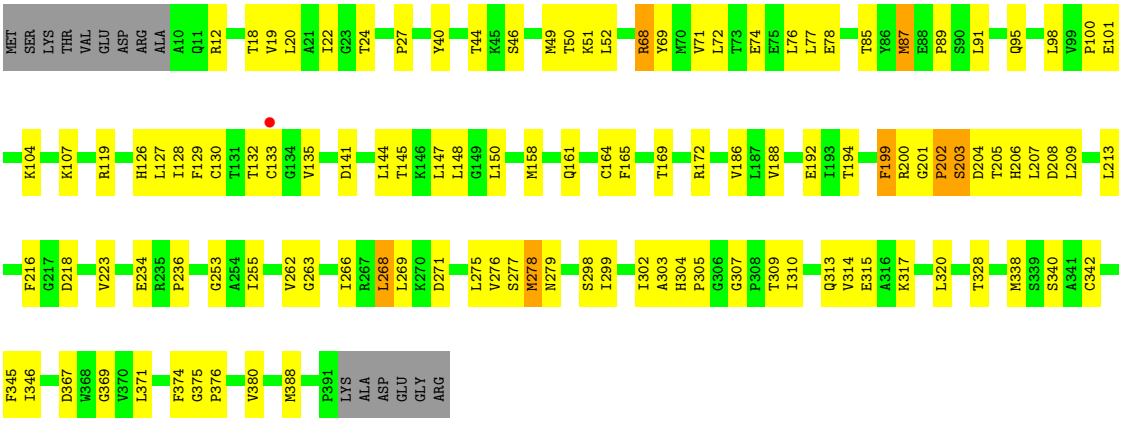
- Molecule 1: Styrylpyrone synthase 1

Chain E:



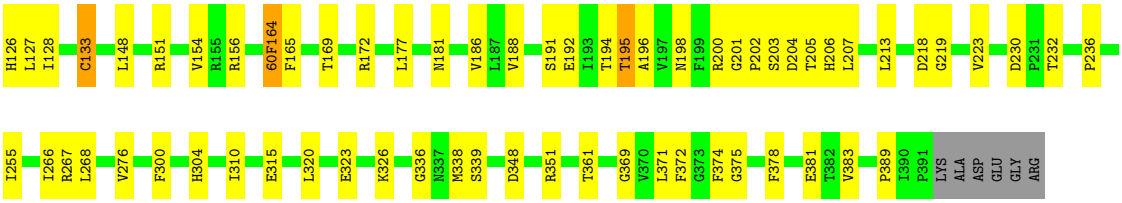
- Molecule 1: Styrylpyrone synthase 1

Chain F:



- Molecule 2: Styrylpyrone synthase 1

Chain C:


H126
L127
I128
C133
L148
R151
V154
R155
R156
6OF164
F165
T169
R172
L177
N181
V186
L187
V188
S191
E192
I193
T194
T195
A196
V197
N198
F199
R200
G201
P202
S203
D204
T205
H206
L207
L213
D218
G219
V223
D230
P231
T232
P236
I255
I266
R267
L268
V276
F300
H304
I310
E315
L320
E323
K326
G336
N337
M338
S339
D348
R351
T361
G369
V370
L371
F372
G373
F374
G375
F378
E381
T382
V383
P389
I390
P391
LYS
ALA
ASP
GLU
GLY
ARG

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 31	Depositor
Cell constants a, b, c, α, β, γ	164.40Å 164.40Å 87.12Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	82.20 – 2.70 82.20 – 2.70	Depositor EDS
% Data completeness (in resolution range)	98.8 (82.20-2.70) 98.7 (82.20-2.70)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.27 (at 2.69Å)	Xtriage
Refinement program	PHENIX 1.14_3260	Depositor
R, R_{free}	0.204 , 0.261 0.192 , 0.248	Depositor DCC
R_{free} test set	1967 reflections (2.75%)	wwPDB-VP
Wilson B-factor (Å^2)	44.0	Xtriage
Anisotropy	0.170	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.28 , 13.8	EDS
L-test for twinning[2]	$< \|L\| > = 0.47$, $< L^2 > = 0.30$	Xtriage
Estimated twinning fraction	0.439 for -h,-k,l 0.039 for h,-h-k,-l 0.039 for -k,-h,-l	Xtriage
F_o,F_c correlation	0.92	EDS
Total number of atoms	17920	wwPDB-VP
Average B, all atoms (Å^2)	37.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.51% 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: 60F, WCA

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	0.27	0/2996	0.46	0/4060
1	B	0.28	0/2991	0.48	0/4053
1	D	0.27	0/2991	0.46	0/4053
1	E	0.28	0/2991	0.47	0/4053
1	F	0.28	0/2991	0.48	0/4053
2	C	0.27	0/2984	0.45	0/4042
All	All	0.28	0/17944	0.47	0/24314

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	2939	0	2978	62	0
1	B	2934	0	2973	90	0
1	D	2934	0	2973	68	0
1	E	2934	0	2973	77	0
1	F	2934	0	2973	84	0
2	C	2945	0	2968	58	0
3	A	59	0	38	5	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	59	0	38	3	0
4	A	39	0	0	3	0
4	B	36	0	0	5	0
4	C	33	0	0	2	0
4	D	32	0	0	2	0
4	E	21	0	0	3	0
4	F	21	0	0	1	0
All	All	17920	0	17914	428	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 12.

The worst 5 of 428 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:F:255:ILE:HD13	1:F:268:LEU:HG	1.25	1.10
1:B:86:TYR:H	1:B:200:ARG:NE	1.53	1.04
1:B:86:TYR:HB3	1:B:200:ARG:CZ	1.89	1.02
1:B:86:TYR:H	1:B:200:ARG:HE	1.02	0.99
1:A:86:TYR:H	1:A:200:ARG:HE	1.03	0.98

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	381/397 (96%)	357 (94%)	19 (5%)	5 (1%)	12	30
1	B	380/397 (96%)	360 (95%)	19 (5%)	1 (0%)	41	66
1	D	380/397 (96%)	355 (93%)	23 (6%)	2 (0%)	29	54
1	E	380/397 (96%)	351 (92%)	25 (7%)	4 (1%)	14	34

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	F	380/397 (96%)	350 (92%)	26 (7%)	4 (1%)	14	34
2	C	379/397 (96%)	351 (93%)	26 (7%)	2 (0%)	29	54
All	All	2280/2382 (96%)	2124 (93%)	138 (6%)	18 (1%)	19	43

5 of 18 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	202	PRO
2	C	195	THR
1	D	195	THR
1	E	202	PRO
1	A	198	ASN

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	318/330 (96%)	314 (99%)	4 (1%)	69	87
1	B	318/330 (96%)	312 (98%)	6 (2%)	57	82
1	D	318/330 (96%)	314 (99%)	4 (1%)	69	87
1	E	318/330 (96%)	312 (98%)	6 (2%)	57	82
1	F	318/330 (96%)	309 (97%)	9 (3%)	43	73
2	C	317/329 (96%)	313 (99%)	4 (1%)	69	87
All	All	1907/1979 (96%)	1874 (98%)	33 (2%)	60	84

5 of 33 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	F	203	SER
1	F	213	LEU
1	F	371	LEU
2	C	107	LYS
2	C	29	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	95	GLN
2	C	57	GLN
2	C	245	GLN
1	E	162	GLN

5.3.3 RNA (i)

There are no RNA molecules in this entry.

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

1 non-standard protein/DNA/RNA residue is 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	60F	C	164	2	14,17,18	0.90	1 (7%)	13,21,23	4.13	2 (15%)

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	60F	C	164	2	-	4/10/12/14	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	164	60F	C1'-C3	2.01	1.53	1.47

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	C	164	60F	CB-SG-C1	13.48	119.07	100.42
2	C	164	60F	C1'-C3-C2	-5.87	113.47	126.91

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	C	164	60F	SG-C1-C2-C3
2	C	164	60F	C2'-C1'-C3-C2
2	C	164	60F	C6'-C1'-C3-C2
2	C	164	60F	O1-C1-C2-C3

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	C	164	60F	1	0

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	$\#\|Z\| > 2$
3	WCA	A	801	-	52,62,62	3.28	12 (23%)	65,91,91	2.27	11 (16%)
3	WCA	B	801	-	52,62,62	3.29	14 (26%)	65,91,91	2.12	11 (16%)

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	WCA	A	801	-	-	19/52/72/72	0/4/4/4
3	WCA	B	801	-	-	27/52/72/72	0/4/4/4

The worst 5 of 26 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	801	WCA	O4'-C1'	14.06	1.60	1.41
3	B	801	WCA	O4'-C1'	13.70	1.60	1.41
3	A	801	WCA	C2'-C1'	-12.10	1.35	1.53
3	B	801	WCA	C2'-C1'	-12.01	1.35	1.53
3	B	801	WCA	O4'-C4'	-6.82	1.29	1.45

The worst 5 of 22 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	A	801	WCA	C5-C6-N6	9.42	134.67	120.35
3	B	801	WCA	C5-C6-N6	8.71	133.59	120.35
3	A	801	WCA	N6-C6-N1	-7.25	103.53	118.57
3	A	801	WCA	CBA-SBO-CBP	6.97	108.55	99.80
3	B	801	WCA	CBA-SBO-CBP	6.89	108.45	99.80

There are no chirality outliers.

5 of 46 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	801	WCA	CAR-CAQ-CBP-OAD
3	A	801	WCA	CAR-CAQ-CBP-SBO
3	A	801	WCA	CAQ-CBP-SBO-CBA
3	A	801	WCA	OAD-CBP-SBO-CBA
3	A	801	WCA	CAY-CBA-SBO-CBP

There are no ring outliers.

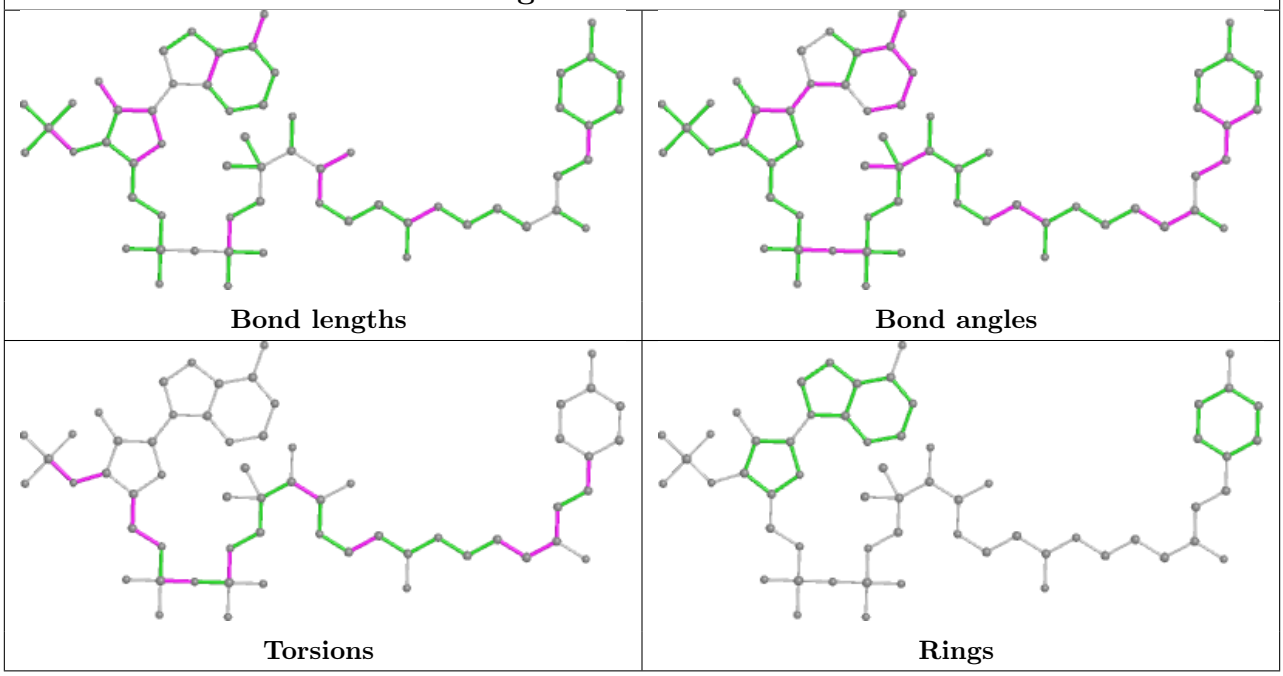
2 monomers are involved in 8 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	801	WCA	5	0
3	B	801	WCA	3	0

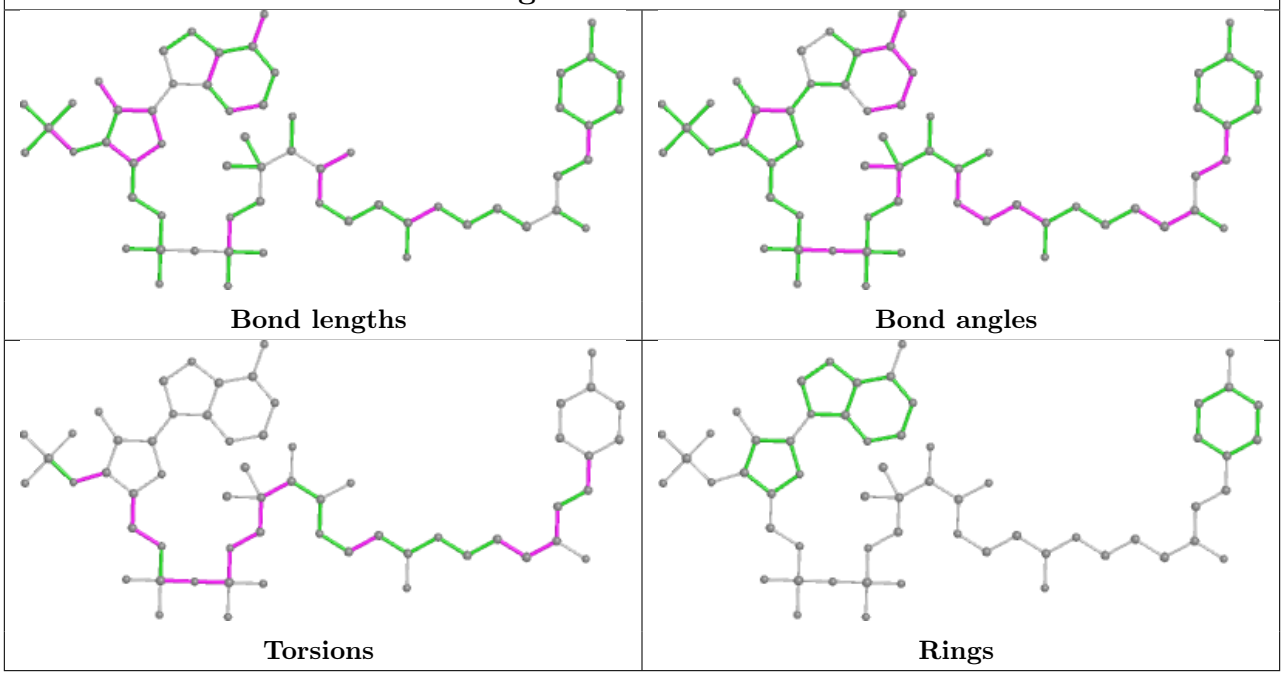
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths,

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 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 WCA A 801



Ligand WCA B 801



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	383/397 (96%)	-0.59	1 (0%)	94	95	23, 35, 54, 72	0
1	B	382/397 (96%)	-0.57	1 (0%)	94	95	23, 34, 47, 61	0
1	D	382/397 (96%)	-0.57	1 (0%)	94	95	23, 34, 47, 67	0
1	E	382/397 (96%)	-0.57	0	100	100	26, 38, 49, 66	0
1	F	382/397 (96%)	-0.60	1 (0%)	94	95	26, 36, 48, 61	0
2	C	381/397 (95%)	-0.53	1 (0%)	94	95	24, 37, 56, 68	0
All	All	2292/2382 (96%)	-0.57	5 (0%)	95	96	23, 36, 50, 72	0

All (5) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	202	PRO	3.5
1	B	202	PRO	3.5
2	C	10	ALA	3.1
1	D	202	PRO	2.3
1	F	133	CYS	2.0

6.2 Non-standard residues in protein, DNA, RNA chains (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	60F	C	164	17/18	0.93	0.16	32,39,55,60	0

6.3 Carbohydrates (i)

There are no monosaccharides in this entry.

6.4 Ligands (i)

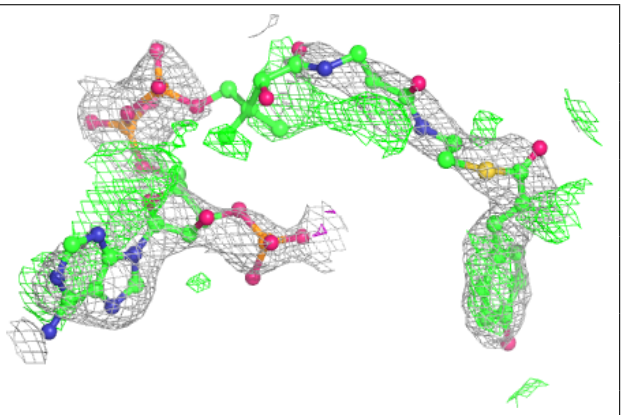
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

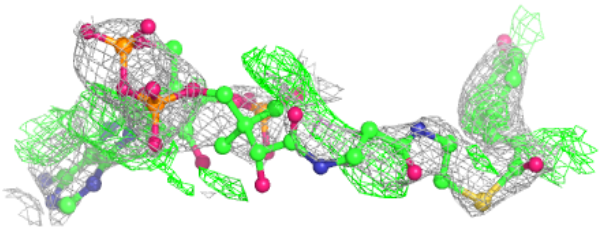
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
3	WCA	B	801	59/59	0.81	0.33	30,43,54,57	59
3	WCA	A	801	59/59	0.84	0.28	26,37,46,53	59

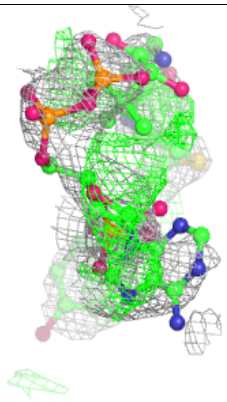
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

Electron density around WCA 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)

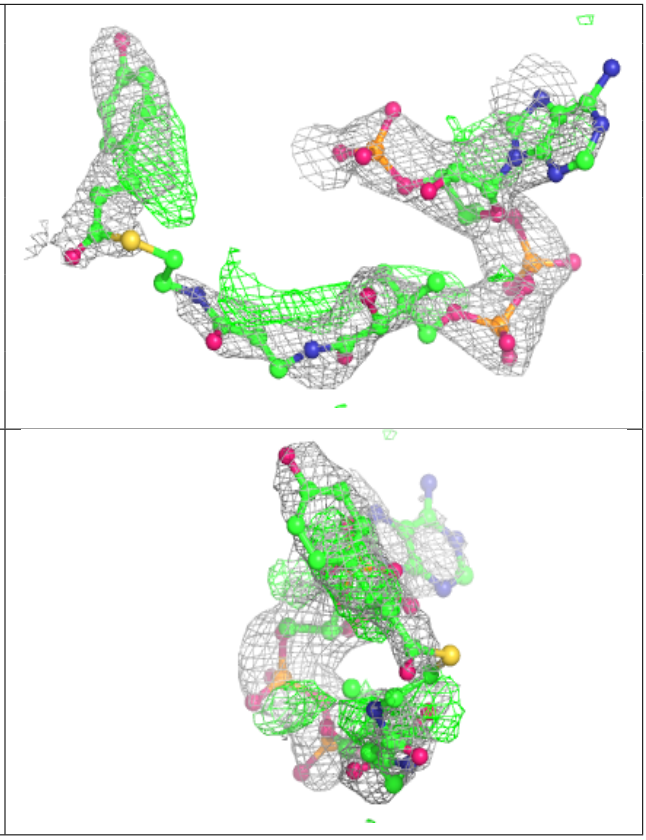






Electron density around WCA A 801:

$2mF_o$-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.