wwPDB EM Validation Summary Report

Jul 15, 2025 – 11:06 AM JST

PDB ID	:	8ZYT / pdb_00008zyt
EMDB ID	:	EMD-60578
Title	:	Cryo-EM structure of neurotensin receptor 1 in complex with beta-arrestin1 and SBI-553 (complex 3)
Authors	:	Sun, D.; Li, X.; Yuan, Q.; Yin, W.; Xu, H.E.; Tian, C.
Deposited on	:	2024-06-18
Resolution	:	2.65 Å(reported)

This is a wwPDB EM 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/EMValidationReportHelp
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:

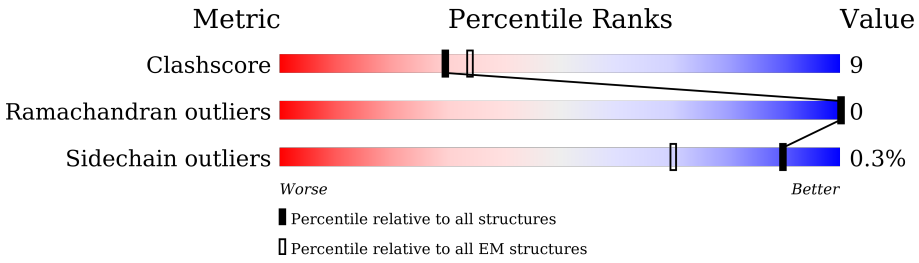
EMDB validation analysis	:	FAILED
Mogul	:	1.8.5 (274361), CSD as541be (2020)
MolProbity	:	4-5-2 with Phenix2.0rc1
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ	:	FAILED
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.44

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
ELECTRON MICROSCOPY

The reported resolution of this entry is 2.65 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)	EM structures (#Entries)
Clashscore	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the 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%

Mol	Chain	Length	Quality of chain
1	B	402	69% 20% 10%
2	D	260	72% 13% 15%
3	Q	235	74% 18% 8%
4	R	557	45% 9% 46%
5	L	6	67% 33%

2 Entry composition (i)

There are 7 unique types of molecules in this entry. The entry contains 7930 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, 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 Beta-arrestin-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	B	361	2648	1703	465	471	9	0	0

There are 21 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	-20	MET	-	initiating methionine	UNP P49407
B	-19	GLY	-	expression tag	UNP P49407
B	-18	SER	-	expression tag	UNP P49407
B	-17	HIS	-	expression tag	UNP P49407
B	-16	HIS	-	expression tag	UNP P49407
B	-15	HIS	-	expression tag	UNP P49407
B	-14	HIS	-	expression tag	UNP P49407
B	-13	HIS	-	expression tag	UNP P49407
B	-12	HIS	-	expression tag	UNP P49407
B	-11	HIS	-	expression tag	UNP P49407
B	-10	HIS	-	expression tag	UNP P49407
B	-9	GLY	-	expression tag	UNP P49407
B	-8	SER	-	expression tag	UNP P49407
B	-7	LEU	-	expression tag	UNP P49407
B	-6	GLU	-	expression tag	UNP P49407
B	-5	VAL	-	expression tag	UNP P49407
B	-4	LEU	-	expression tag	UNP P49407
B	-3	PHE	-	expression tag	UNP P49407
B	-2	GLN	-	expression tag	UNP P49407
B	-1	GLY	-	expression tag	UNP P49407
B	0	PRO	-	expression tag	UNP P49407

- Molecule 2 is a protein called Fab30 heavy chain.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
2	D	221	1629	1036	270	320	3	0	0

- Molecule 3 is a protein called Fab30 light chain.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	Q	216	Total	C	N	O	S	0	0
			1598	1000	265	327	6		

- Molecule 4 is a protein called Soluble cytochrome b562,Neurotensin receptor type 1.

Mol	Chain	Residues	Atoms						AltConf	Trace
4	R	302	Total	C	N	O	P	S	0	0
			1931	1231	344	346	3	7		

There are 39 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
R	-135	MET	-	initiating methionine	UNP P0ABE7
R	-134	LYS	-	expression tag	UNP P0ABE7
R	-133	THR	-	expression tag	UNP P0ABE7
R	-132	ILE	-	expression tag	UNP P0ABE7
R	-131	ILE	-	expression tag	UNP P0ABE7
R	-130	ALA	-	expression tag	UNP P0ABE7
R	-129	LEU	-	expression tag	UNP P0ABE7
R	-128	SER	-	expression tag	UNP P0ABE7
R	-127	TYR	-	expression tag	UNP P0ABE7
R	-126	ILE	-	expression tag	UNP P0ABE7
R	-125	PHE	-	expression tag	UNP P0ABE7
R	-124	CYS	-	expression tag	UNP P0ABE7
R	-123	LEU	-	expression tag	UNP P0ABE7
R	-122	VAL	-	expression tag	UNP P0ABE7
R	-121	PHE	-	expression tag	UNP P0ABE7
R	-120	ALA	-	expression tag	UNP P0ABE7
R	-119	GLY	-	expression tag	UNP P0ABE7
R	-118	SER	-	expression tag	UNP P0ABE7
R	-111	TRP	MET	conflict	UNP P0ABE7
R	-16	ILE	HIS	conflict	UNP P0ABE7
R	-12	LEU	-	linker	UNP P0ABE7
R	-11	ALA	-	linker	UNP P0ABE7
R	-10	SER	-	linker	UNP P0ABE7
R	-9	GLY	-	linker	UNP P0ABE7
R	-8	SER	-	linker	UNP P0ABE7
R	-7	LEU	-	linker	UNP P0ABE7
R	-6	GLU	-	linker	UNP P0ABE7
R	-5	VAL	-	linker	UNP P0ABE7
R	-4	LEU	-	linker	UNP P0ABE7

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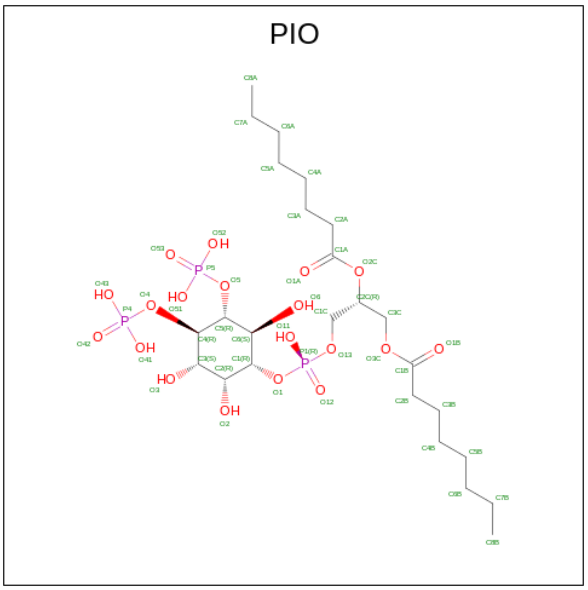
Chain	Residue	Modelled	Actual	Comment	Reference
R	-3	PHE	-	linker	UNP P0ABE7
R	-2	GLN	-	linker	UNP P0ABE7
R	-1	GLY	-	linker	UNP P0ABE7
R	0	PRO	-	linker	UNP P0ABE7
R	170	LEU	ILE	conflict	UNP P30989
R	376	ILE	LEU	conflict	UNP P30989
R	380N	CYS	-	insertion	UNP P30989
R	380O	PHE	-	insertion	UNP P30989
R	380P	ASN	-	insertion	UNP P30989
R	380V	CYS	ALA	conflict	UNP P30989

- Molecule 5 is a protein called neurotensin peptide 8-13.

Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
5	L	6	51	32	12	7	0	0

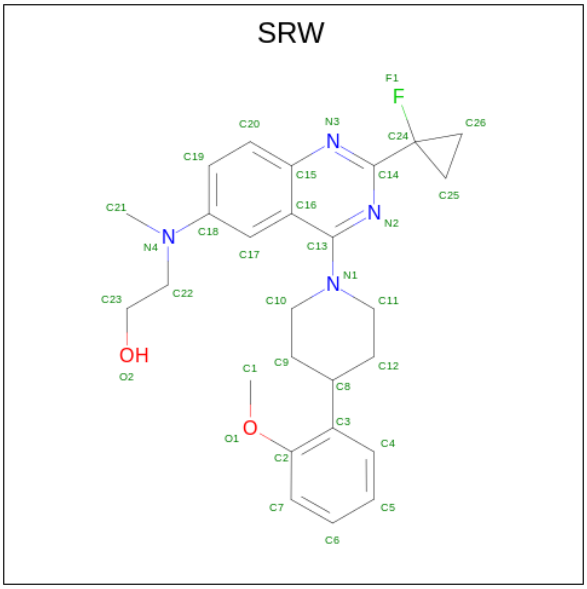
- Molecule 6 is [(2R)-2-octanoyloxy-3-[oxidanyl-[(1R,2R,3S,4R,5R,6S)-2,3,6-tris(oxidanyl)-4,5-diphosphonooxy-cyclohexyl]oxy-phosphoryl]oxy-propyl] octanoate (CCD ID: PIO) (formula: $C_{25}H_{49}O_{19}P_3$).



Mol	Chain	Residues	Atoms				AltConf
			Total	C	O	P	
6	R	1	40	18	19	3	0

- Molecule 7 is 2-[{2-(1-fluorocyclopropyl)-4-[4-(2-methoxyphenyl)piperidin-1-yl]quinazolin-6-

yl}(methyl)amino]ethan-1-ol (CCD ID: SRW) (formula: $C_{26}H_{31}FN_4O_2$) (labeled as "Ligand of Interest" by depositor).



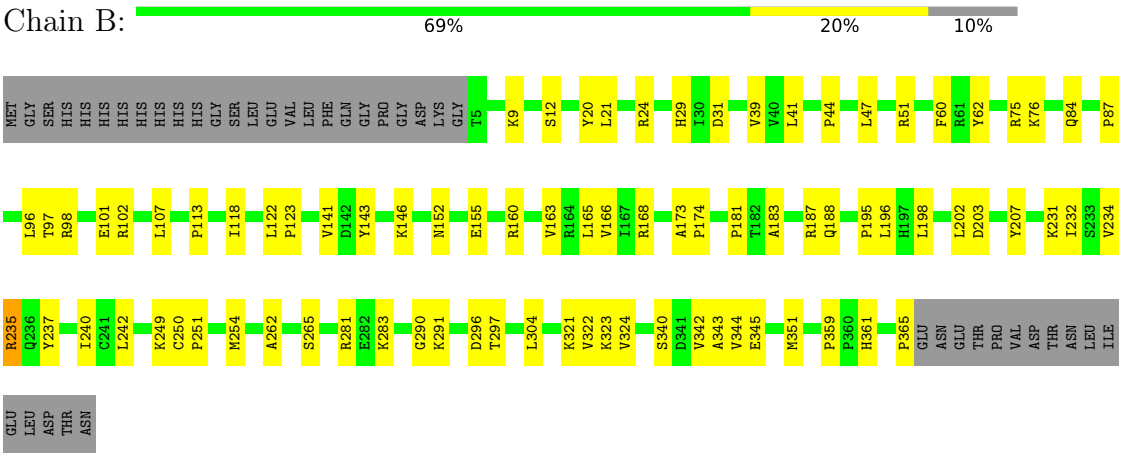
Mol	Chain	Residues	Atoms					AltConf
7	R	1	Total	C	F	N	O	0
			33	26	1	4	2	

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. 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. 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.

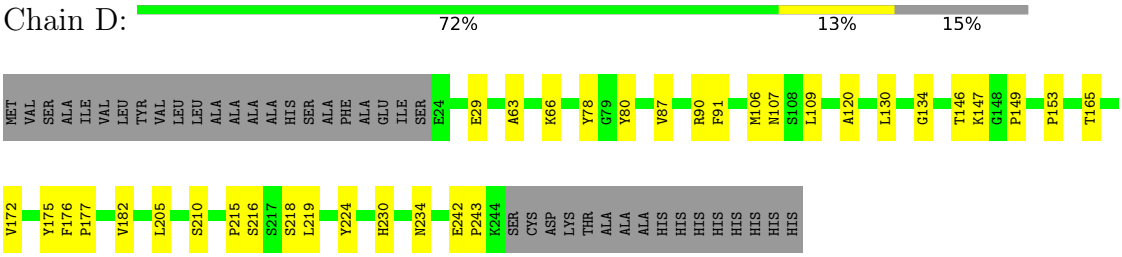
• Molecule 1: Beta-arrestin-1

Chain B:



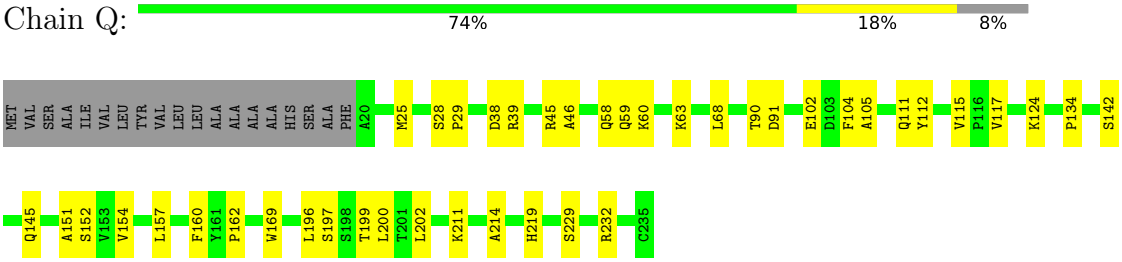
• Molecule 2: Fab30 heavy chain

Chain D:



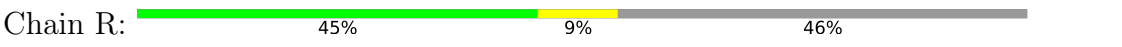
• Molecule 3: Fab30 light chain

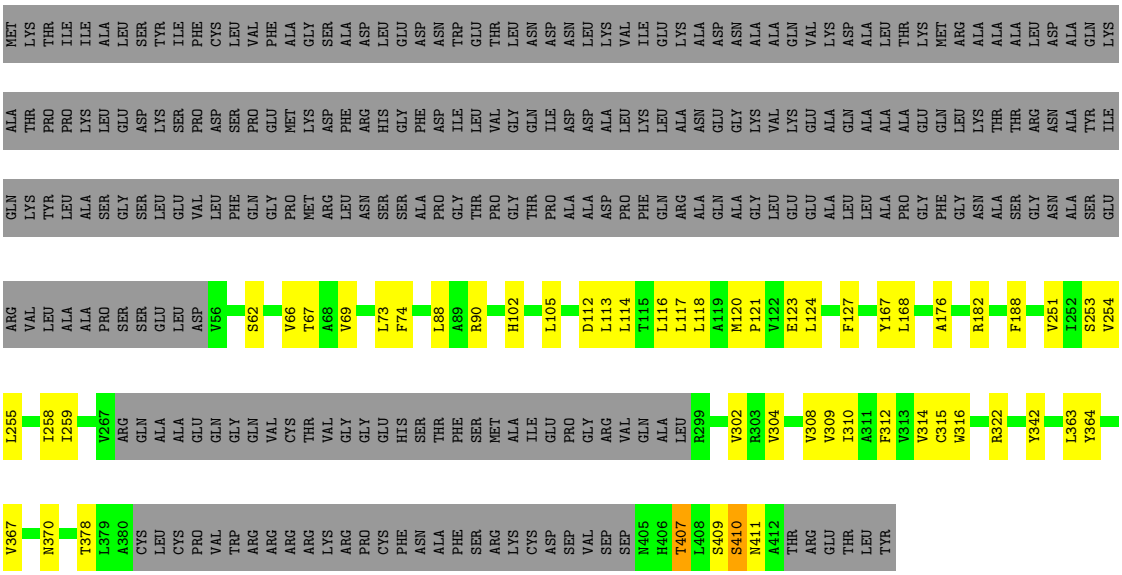
Chain Q:



• Molecule 4: Soluble cytochrome b562,Neurotensin receptor type 1

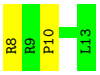
Chain R:





• Molecule 5: neurotensin peptide 8-13

Chain L:



4 Experimental information (i)

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	5006335	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/Å^2$)	50	Depositor
Minimum defocus (nm)	800	Depositor
Maximum defocus (nm)	2000	Depositor
Magnification	Not provided	
Image detector	GATAN K3 BIOQUANTUM (6k x 4k)	Depositor

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: SEP, TPO, SRW, PIO

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	B	0.16	0/2710	0.30	0/3702
2	D	0.17	0/1672	0.32	0/2286
3	Q	0.14	0/1632	0.31	0/2224
4	R	0.12	0/1935	0.30	0/2670
5	L	0.14	0/52	0.42	0/69
All	All	0.15	0/8001	0.31	0/10951

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

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	B	2648	0	2565	56	0
2	D	1629	0	1555	25	0
3	Q	1598	0	1513	27	0
4	R	1931	0	1501	34	0
5	L	51	0	45	1	0
6	R	40	0	24	1	0
7	R	33	0	0	0	0
All	All	7930	0	7203	136	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 9.

The worst 5 of 136 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)
3:Q:25:MET:HE3	3:Q:111:GLN:HB3	1.60	0.81
4:R:120:MET:HG3	4:R:121:PRO:HD3	1.62	0.80
1:B:237:TYR:HE2	1:B:321:LYS:HB2	1.56	0.69
3:Q:134:PRO:HB3	3:Q:160:PHE:HB3	1.76	0.68
2:D:153:PRO:O	3:Q:142:SER:OG	2.13	0.66

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 PDB entries followed by that with respect to all EM entries.

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	B	359/402 (89%)	335 (93%)	24 (7%)	0	100	100
2	D	219/260 (84%)	208 (95%)	11 (5%)	0	100	100
3	Q	214/235 (91%)	204 (95%)	10 (5%)	0	100	100
4	R	293/557 (53%)	284 (97%)	9 (3%)	0	100	100
5	L	4/6 (67%)	2 (50%)	2 (50%)	0	100	100
All	All	1089/1460 (75%)	1033 (95%)	56 (5%)	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 PDB entries followed by that with respect to all EM entries.

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	B	263/357 (74%)	262 (100%)	1 (0%)	89 95
2	D	174/213 (82%)	174 (100%)	0	100 100
3	Q	176/203 (87%)	176 (100%)	0	100 100
4	R	117/459 (26%)	116 (99%)	1 (1%)	75 87
5	L	4/6 (67%)	4 (100%)	0	100 100
All	All	734/1238 (59%)	732 (100%)	2 (0%)	90 96

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	235	ARG
4	R	370	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 9 such sidechains are listed below:

Mol	Chain	Res	Type
4	R	102	HIS
4	R	240	ASN
2	D	222	GLN
3	Q	27	GLN
3	Q	159	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)

3 non-standard protein/DNA/RNA residues 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	$\#\|Z\|>2$
4	SEP	R	410	4	8,9,10	1.53	1 (12%)	8,12,14	1.58	2 (25%)
4	TPO	R	407	4	8,10,11	1.05	0	10,14,16	1.84	2 (20%)
4	SEP	R	409	4	8,9,10	1.49	1 (12%)	8,12,14	1.41	2 (25%)

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	SEP	R	410	4	-	1/5/8/10	-
4	TPO	R	407	4	-	2/9/11/13	-
4	SEP	R	409	4	-	2/5/8/10	-

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	R	410	SEP	P-O1P	3.32	1.61	1.50
4	R	409	SEP	P-O1P	3.28	1.61	1.50

The worst 5 of 6 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	R	407	TPO	P-OG1-CB	-5.05	107.97	123.21
4	R	410	SEP	P-OG-CB	-2.85	110.45	118.30
4	R	410	SEP	OG-CB-CA	2.82	110.89	108.14
4	R	409	SEP	P-OG-CB	-2.52	111.36	118.30
4	R	409	SEP	OG-CB-CA	2.37	110.46	108.14

There are no chirality outliers.

All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	R	409	SEP	CB-OG-P-O2P
4	R	409	SEP	CB-OG-P-O3P
4	R	410	SEP	N-CA-CB-OG
4	R	407	TPO	CB-OG1-P-O3P
4	R	407	TPO	O-C-CA-CB

There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	R	410	SEP	1	0
4	R	407	TPO	1	0

5.5 Carbohydrates (i)

There are no oligosaccharides 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	$\#\|Z\| > 2$
7	SRW	R	502	-	37,37,37	2.49	12 (32%)	48,54,54	1.91	14 (29%)
6	PIO	R	501	-	40,40,47	1.63	9 (22%)	54,58,65	1.01	3 (5%)

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
7	SRW	R	502	-	-	5/17/37/37	0/5/5/5
6	PIO	R	501	-	-	18/37/61/68	0/1/1/1

The worst 5 of 21 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
7	R	502	SRW	C3-C8	6.35	1.63	1.52
7	R	502	SRW	C10-N1	5.51	1.55	1.46
7	R	502	SRW	C11-N1	5.04	1.54	1.46
7	R	502	SRW	O2-C23	-4.42	1.19	1.42

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
7	R	502	SRW	C13-N1	4.07	1.49	1.37

The worst 5 of 17 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
7	R	502	SRW	N3-C14-N2	-5.47	121.47	129.29
7	R	502	SRW	C11-C12-C8	4.22	116.03	111.04
7	R	502	SRW	O1-C2-C3	4.17	119.82	115.83
7	R	502	SRW	C14-N3-C15	4.16	120.19	115.59
6	R	501	PIO	O2C-C1A-C2A	3.79	119.67	111.50

There are no chirality outliers.

5 of 23 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	R	501	PIO	C5-C4-O4-P4
6	R	501	PIO	C5-O5-P5-O52
7	R	502	SRW	C17-C18-N4-C21
7	R	502	SRW	C19-C18-N4-C21
6	R	501	PIO	C2B-C1B-O3C-C3C

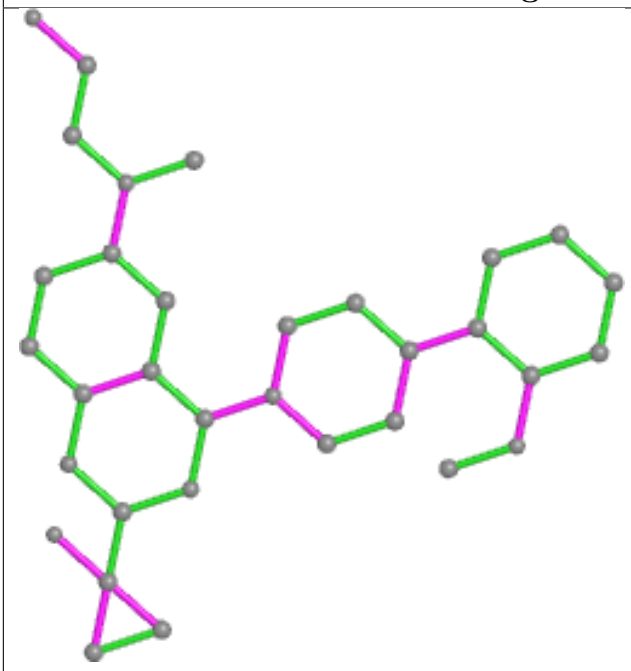
There are no ring outliers.

1 monomer is involved in 1 short contact:

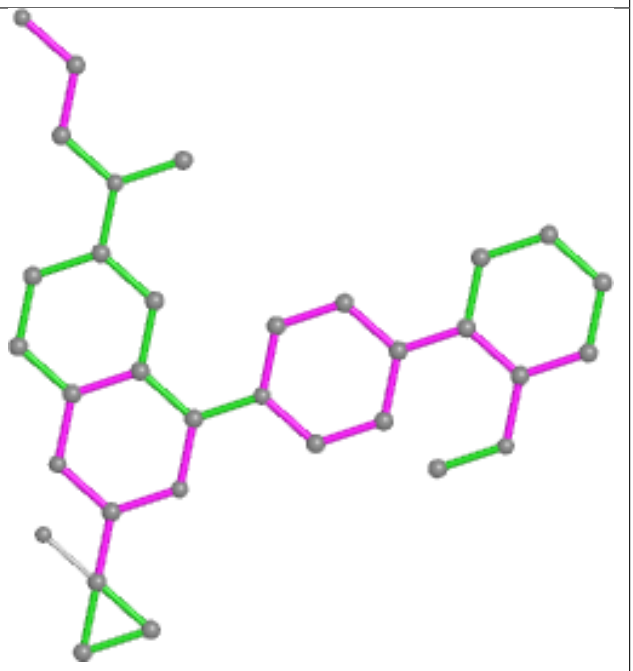
Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	R	501	PIO	1	0

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.

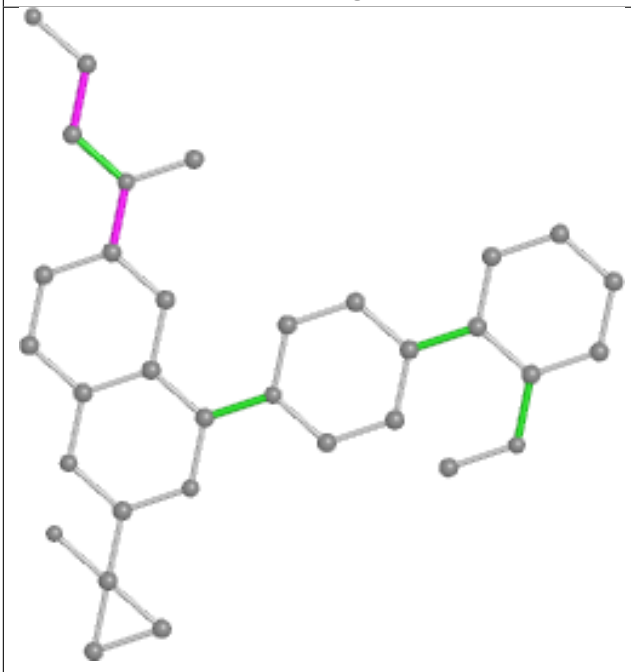
Ligand SRW R 502



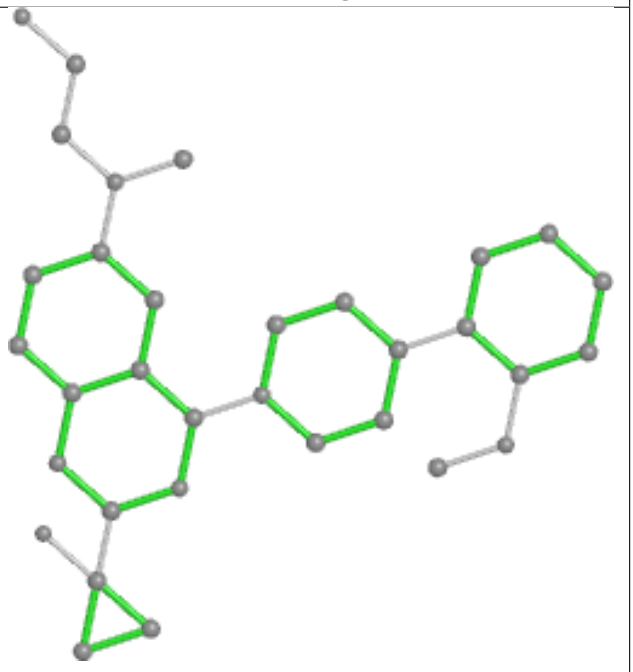
Bond lengths



Bond angles

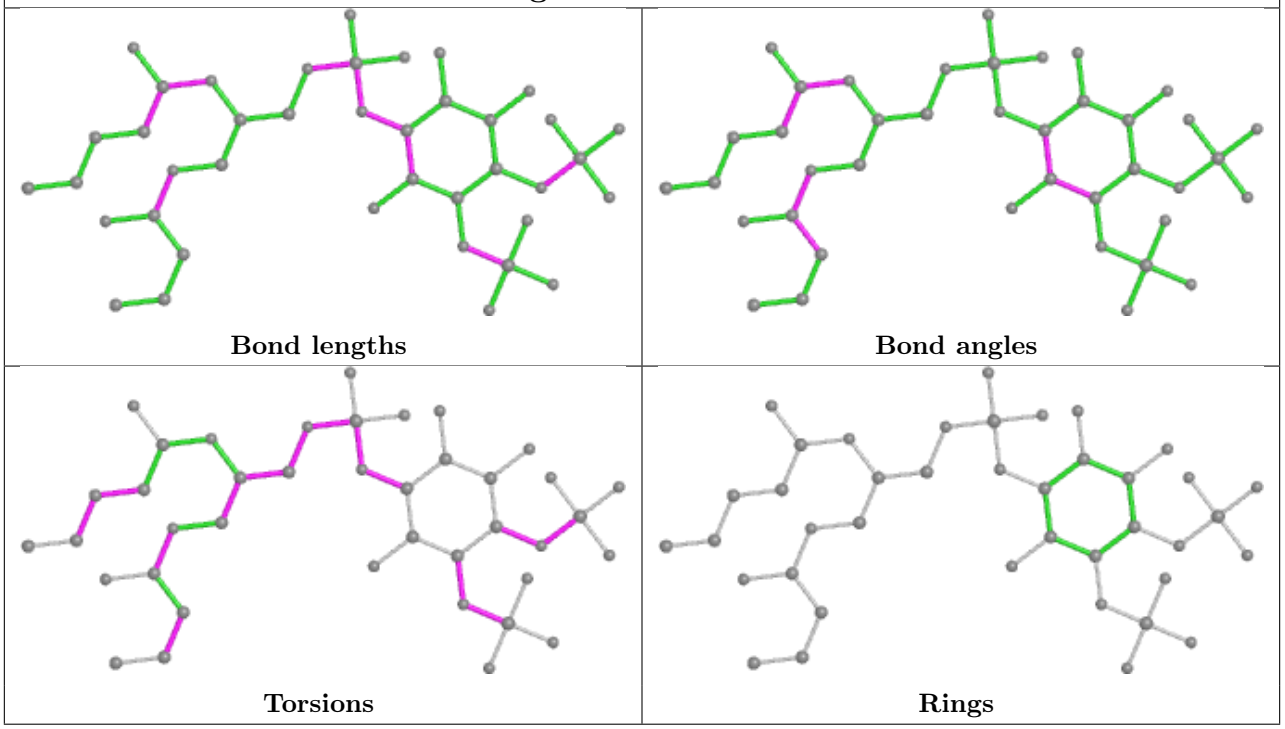


Torsions



Rings

Ligand PIO R 501



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.