



Full wwPDB EM Validation Report ⓘ

Oct 7, 2024 – 02:32 PM JST

PDB ID : 8XZI
EMDB ID : EMD-38797
Title : Cryo-EM structure of the CMF-019-bound human APLNR-Gi complex
Authors : Wang, W.; Ji, S.; Zhang, Y.
Deposited on : 2024-01-21
Resolution : 2.70 Å(reported)

This is a Full wwPDB EM 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/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	: 4.02b-467
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)	: 2.39

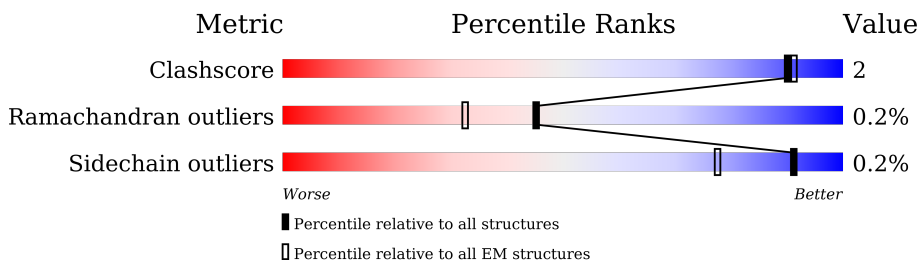
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

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)	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 $\leq 5\%$.

Mol	Chain	Length	Quality of chain
1	R	380	
2	A	354	
3	B	339	
4	G	71	
5	S	250	

2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 9073 atoms, of which 32 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 Apelin receptor.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	R	309	Total	C	N	O	S	0	0
			2473	1634	398	417	24		

- Molecule 2 is a protein called Guanine nucleotide-binding protein G(i) subunit alpha-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	A	218	Total	C	N	O	S	0	0
			1756	1117	294	331	14		

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	47	ASN	SER	conflict	UNP P63096
A	203	ALA	GLY	conflict	UNP P63096
A	245	ALA	GLU	conflict	UNP P63096
A	326	SER	ALA	conflict	UNP P63096

- Molecule 3 is a protein called Guanine nucleotide-binding protein G(I)/G(S)/G(T) subunit beta-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	B	332	Total	C	N	O	S	0	0
			2553	1574	459	499	21		

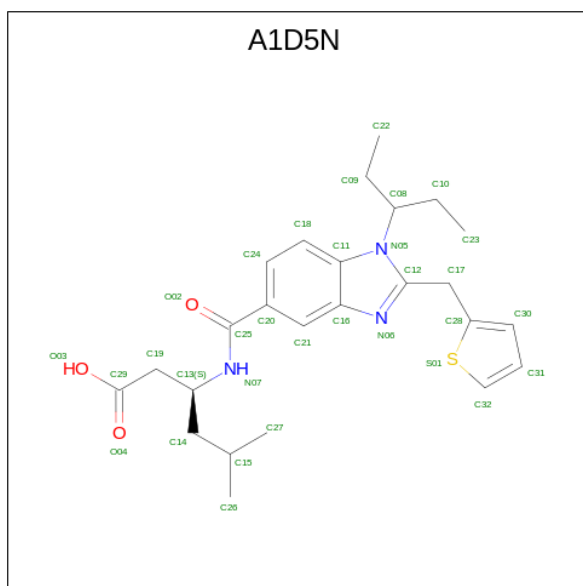
- Molecule 4 is a protein called Guanine nucleotide-binding protein G(I)/G(S)/G(O) subunit gamma-2.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	G	58	Total	C	N	O	S	0	0
			444	277	79	85	3		

- Molecule 5 is a protein called scFv16.

Mol	Chain	Residues	Atoms					AltConf	Trace
5	S	232	Total	C	N	O	S	0	0
			1783	1131	295	347	10		

- Molecule 6 is (3 {S})-5-methyl-3-[[1-pentan-3-yl-2-(thiophen-2-ylmethyl)benzimidazol-5-yl]carbonylamino]hexanoic acid (three-letter code: A1D5N) (formula: C₂₅H₃₃N₃O₃S).

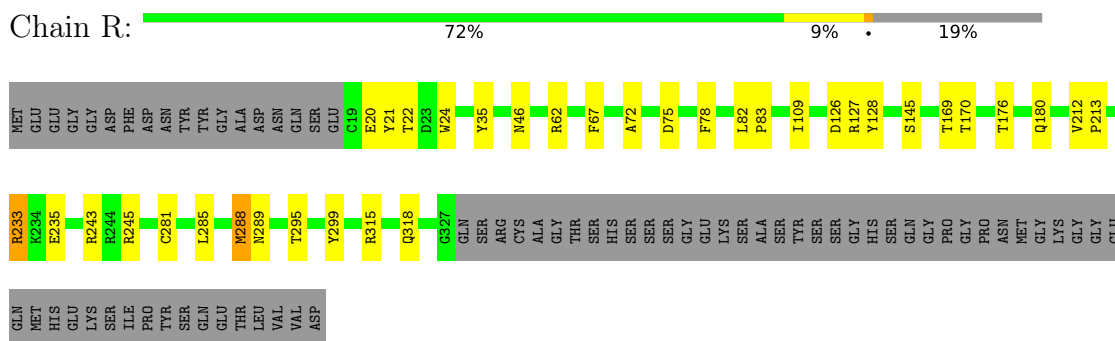


Mol	Chain	Residues	Atoms						AltConf
6	R	1	Total	C	H	N	O	S	0
			64	25	32	3	3	1	

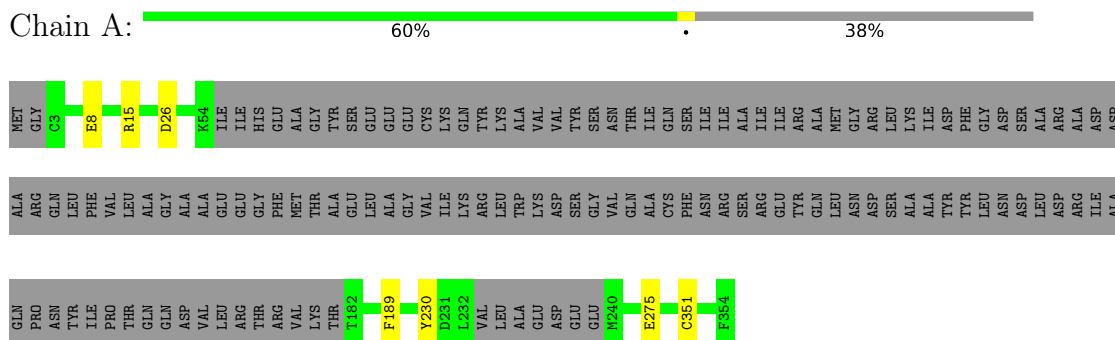
3 Residue-property plots

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.

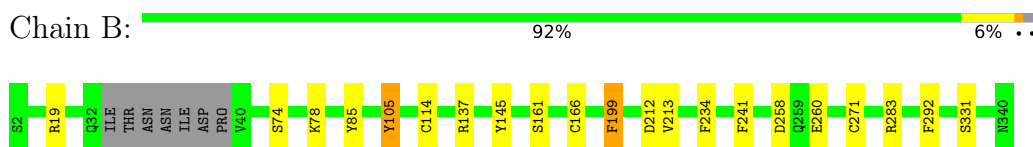
- Molecule 1: Apelin receptor



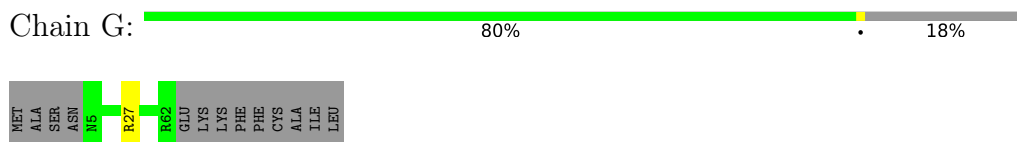
- Molecule 2: Guanine nucleotide-binding protein G(i) subunit alpha-1



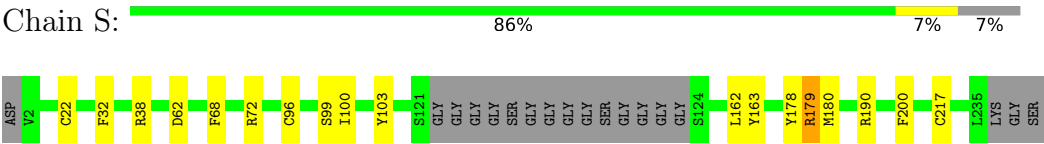
- Molecule 3: Guanine nucleotide-binding protein G(I)/G(S)/G(T) subunit beta-1



- Molecule 4: Guanine nucleotide-binding protein G(I)/G(S)/G(O) subunit gamma-2



● Molecule 5: scFv16



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	75660	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 ($e^-/\text{\AA}^2$)	50	Depositor
Minimum defocus (nm)	800	Depositor
Maximum defocus (nm)	1800	Depositor
Magnification	Not provided	
Image detector	FEI FALCON IV (4k x 4k)	Depositor

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: A1D5N

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	R	1.05	3/2543 (0.1%)	0.92	8/3467 (0.2%)
2	A	1.07	5/1785 (0.3%)	0.85	3/2393 (0.1%)
3	B	1.14	11/2598 (0.4%)	1.06	15/3517 (0.4%)
4	G	0.90	0/450	0.84	2/608 (0.3%)
5	S	1.14	5/1827 (0.3%)	0.99	6/2477 (0.2%)
All	All	1.09	24/9203 (0.3%)	0.96	34/12462 (0.3%)

All (24) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	S	96	CYS	CB-SG	-8.45	1.67	1.82
3	B	241	PHE	CB-CG	-7.67	1.38	1.51
3	B	271	CYS	CB-SG	-7.62	1.69	1.82
3	B	199	PHE	CB-CG	-7.56	1.38	1.51
3	B	114	CYS	CB-SG	-7.56	1.69	1.82
2	A	275	GLU	CD-OE1	-6.81	1.18	1.25
5	S	217	CYS	CB-SG	-6.70	1.70	1.82
1	R	67	PHE	CB-CG	-6.36	1.40	1.51
3	B	145	TYR	CE2-CZ	-6.16	1.30	1.38
3	B	260	GLU	CD-OE2	-6.03	1.19	1.25
5	S	99	SER	CB-OG	-5.86	1.34	1.42
2	A	8	GLU	CD-OE2	-5.72	1.19	1.25
3	B	331	SER	CB-OG	-5.69	1.34	1.42
3	B	74	SER	CB-OG	-5.54	1.35	1.42
2	A	8	GLU	CD-OE1	-5.47	1.19	1.25
3	B	161	SER	CB-OG	-5.41	1.35	1.42
3	B	166	CYS	CB-SG	-5.34	1.73	1.81
3	B	212	ASP	CB-CG	5.28	1.62	1.51
1	R	235	GLU	CD-OE1	-5.24	1.19	1.25
5	S	38	ARG	CB-CG	-5.20	1.38	1.52
2	A	230	TYR	CB-CG	-5.19	1.43	1.51

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	R	128	TYR	CB-CG	-5.11	1.44	1.51
2	A	351	CYS	CB-SG	-5.11	1.73	1.81
5	S	178	TYR	CB-CG	-5.02	1.44	1.51

All (34) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	R	62	ARG	NE-CZ-NH2	-9.74	115.43	120.30
5	S	72	ARG	NE-CZ-NH2	-9.45	115.58	120.30
4	G	27	ARG	NE-CZ-NH2	-9.07	115.76	120.30
3	B	137	ARG	NE-CZ-NH2	-8.89	115.86	120.30
1	R	233	ARG	NE-CZ-NH2	-8.53	116.03	120.30
3	B	105	TYR	CB-CG-CD1	-7.99	116.20	121.00
3	B	241	PHE	CB-CG-CD1	-7.84	115.31	120.80
2	A	15	ARG	NE-CZ-NH2	-7.55	116.53	120.30
3	B	258	ASP	CB-CG-OD1	7.49	125.04	118.30
3	B	241	PHE	CB-CA-C	-7.45	95.50	110.40
3	B	199	PHE	CB-CA-C	-7.13	96.14	110.40
5	S	190	ARG	NE-CZ-NH2	-6.92	116.84	120.30
1	R	62	ARG	NE-CZ-NH1	6.83	123.72	120.30
1	R	245	ARG	NE-CZ-NH2	-6.75	116.93	120.30
3	B	19	ARG	NE-CZ-NH2	-6.23	117.18	120.30
1	R	127	ARG	NE-CZ-NH2	-6.17	117.21	120.30
5	S	103	TYR	CB-CG-CD2	-6.09	117.34	121.00
1	R	35	TYR	CB-CG-CD1	-5.97	117.42	121.00
3	B	199	PHE	CB-CG-CD2	-5.96	116.62	120.80
5	S	163	TYR	CB-CG-CD2	-5.79	117.53	121.00
5	S	68	PHE	CB-CG-CD1	5.79	124.85	120.80
3	B	105	TYR	CB-CG-CD2	5.68	124.41	121.00
1	R	127	ARG	NE-CZ-NH1	5.56	123.08	120.30
3	B	137	ARG	NE-CZ-NH1	5.47	123.03	120.30
2	A	15	ARG	NE-CZ-NH1	5.46	123.03	120.30
3	B	234	PHE	CB-CG-CD1	5.41	124.59	120.80
3	B	283	ARG	NE-CZ-NH2	-5.40	117.60	120.30
3	B	85	TYR	CB-CG-CD1	-5.36	117.78	121.00
1	R	315	ARG	NE-CZ-NH2	-5.35	117.62	120.30
2	A	189	PHE	CB-CG-CD1	-5.28	117.11	120.80
5	S	179	ARG	N-CA-C	-5.25	96.83	111.00
3	B	241	PHE	CB-CG-CD2	5.18	124.43	120.80
3	B	292	PHE	CB-CG-CD1	5.10	124.37	120.80
4	G	27	ARG	NE-CZ-NH1	5.01	122.81	120.30

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	R	2473	0	2496	23	0
2	A	1756	0	1751	1	0
3	B	2553	0	2457	2	0
4	G	444	0	454	0	0
5	S	1783	0	1717	4	0
6	R	32	32	0	2	0
All	All	9041	32	8875	29	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 (29) 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:R:176:THR:HG21	1:R:180:GLN:HE21	1.20	1.06
1:R:176:THR:HG21	1:R:180:GLN:NE2	1.73	1.02
1:R:21:TYR:CE2	1:R:288:MET:HG2	2.07	0.89
1:R:20:GLU:O	1:R:285:LEU:HD21	1.75	0.86
1:R:21:TYR:HE2	1:R:288:MET:HG2	1.57	0.69
1:R:20:GLU:O	1:R:285:LEU:CD2	2.48	0.61
1:R:233:ARG:HG2	1:R:243:ARG:NH1	2.18	0.59
1:R:46:ASN:HD22	1:R:72:ALA:HA	1.68	0.57
1:R:46:ASN:ND2	1:R:75:ASP:HB2	2.21	0.55
1:R:295:THR:HG23	6:R:401:A1D5N:S01	2.50	0.52
2:A:26:ASP:OD2	3:B:78:LYS:NZ	2.36	0.51
1:R:78:PHE:CE1	1:R:109:ILE:HG23	2.47	0.50
3:B:199:PHE:CE1	3:B:213:VAL:HG22	2.47	0.50
1:R:233:ARG:CG	1:R:243:ARG:NH1	2.78	0.47
1:R:281:CYS:O	1:R:285:LEU:HG	2.15	0.46
1:R:233:ARG:HG2	1:R:243:ARG:HH12	1.80	0.46
5:S:62:ASP:N	5:S:62:ASP:OD1	2.43	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:R:22:THR:O	1:R:289:ASN:OD1	2.34	0.45
5:S:179:ARG:O	5:S:180:MET:C	2.54	0.45
1:R:169:THR:OG1	1:R:170:THR:N	2.51	0.44
5:S:162:LEU:HD22	5:S:200:PHE:CG	2.53	0.44
1:R:78:PHE:CE2	1:R:299:TYR:CE2	3.07	0.43
1:R:318:GLN:HA	1:R:318:GLN:OE1	2.19	0.43
1:R:295:THR:HG23	6:R:401:A1D5N:C32	2.49	0.42
1:R:233:ARG:CG	1:R:243:ARG:HH12	2.32	0.42
5:S:32:PHE:CD2	5:S:100:ILE:HB	2.55	0.41
1:R:126:ASP:OD2	1:R:145:SER:HB3	2.20	0.41
1:R:82:LEU:N	1:R:83:PRO:CD	2.85	0.40
1:R:212:VAL:HB	1:R:213:PRO:HD3	2.04	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 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	R	307/380 (81%)	296 (96%)	10 (3%)	1 (0%)	37	61
2	A	212/354 (60%)	206 (97%)	6 (3%)	0	100	100
3	B	328/339 (97%)	322 (98%)	6 (2%)	0	100	100
4	G	56/71 (79%)	56 (100%)	0	0	100	100
5	S	228/250 (91%)	224 (98%)	3 (1%)	1 (0%)	30	55
All	All	1131/1394 (81%)	1104 (98%)	25 (2%)	2 (0%)	45	68

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	R	24	TRP
5	S	22	CYS

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	R	270/327 (83%)	269 (100%)	1 (0%)	89	96
2	A	194/305 (64%)	194 (100%)	0	100	100
3	B	275/282 (98%)	274 (100%)	1 (0%)	89	96
4	G	47/58 (81%)	47 (100%)	0	100	100
5	S	197/202 (98%)	197 (100%)	0	100	100
All	All	983/1174 (84%)	981 (100%)	2 (0%)	91	98

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

Mol	Chain	Res	Type
1	R	288	MET
3	B	105	TYR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	R	46	ASN
1	R	180	GLN
1	R	289	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

1 ligand 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$
6	A1D5N	R	401	-	29,34,34	4.08	13 (44%)	30,47,47	1.56	2 (6%)

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
6	A1D5N	R	401	-	-	3/22/28/28	0/3/3/3

All (13) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	R	401	A1D5N	C21-C16	9.76	1.57	1.41
6	R	401	A1D5N	C28-S01	-9.06	1.54	1.73
6	R	401	A1D5N	C18-C11	7.94	1.56	1.41
6	R	401	A1D5N	C21-C20	7.64	1.50	1.37
6	R	401	A1D5N	C18-C24	6.51	1.50	1.36
6	R	401	A1D5N	C31-C30	6.26	1.59	1.39
6	R	401	A1D5N	C24-C20	5.18	1.48	1.39
6	R	401	A1D5N	C25-N07	5.12	1.45	1.34
6	R	401	A1D5N	C31-C32	3.47	1.45	1.34
6	R	401	A1D5N	C32-S01	-3.21	1.55	1.71
6	R	401	A1D5N	C30-C28	2.84	1.45	1.37
6	R	401	A1D5N	O02-C25	-2.35	1.18	1.23
6	R	401	A1D5N	C16-N06	-2.00	1.32	1.38

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	R	401	A1D5N	C31-C32-S01	-6.52	107.69	112.98
6	R	401	A1D5N	C12-C17-C28	-2.40	108.79	113.48

There are no chirality outliers.

All (3) torsion outliers are listed below:

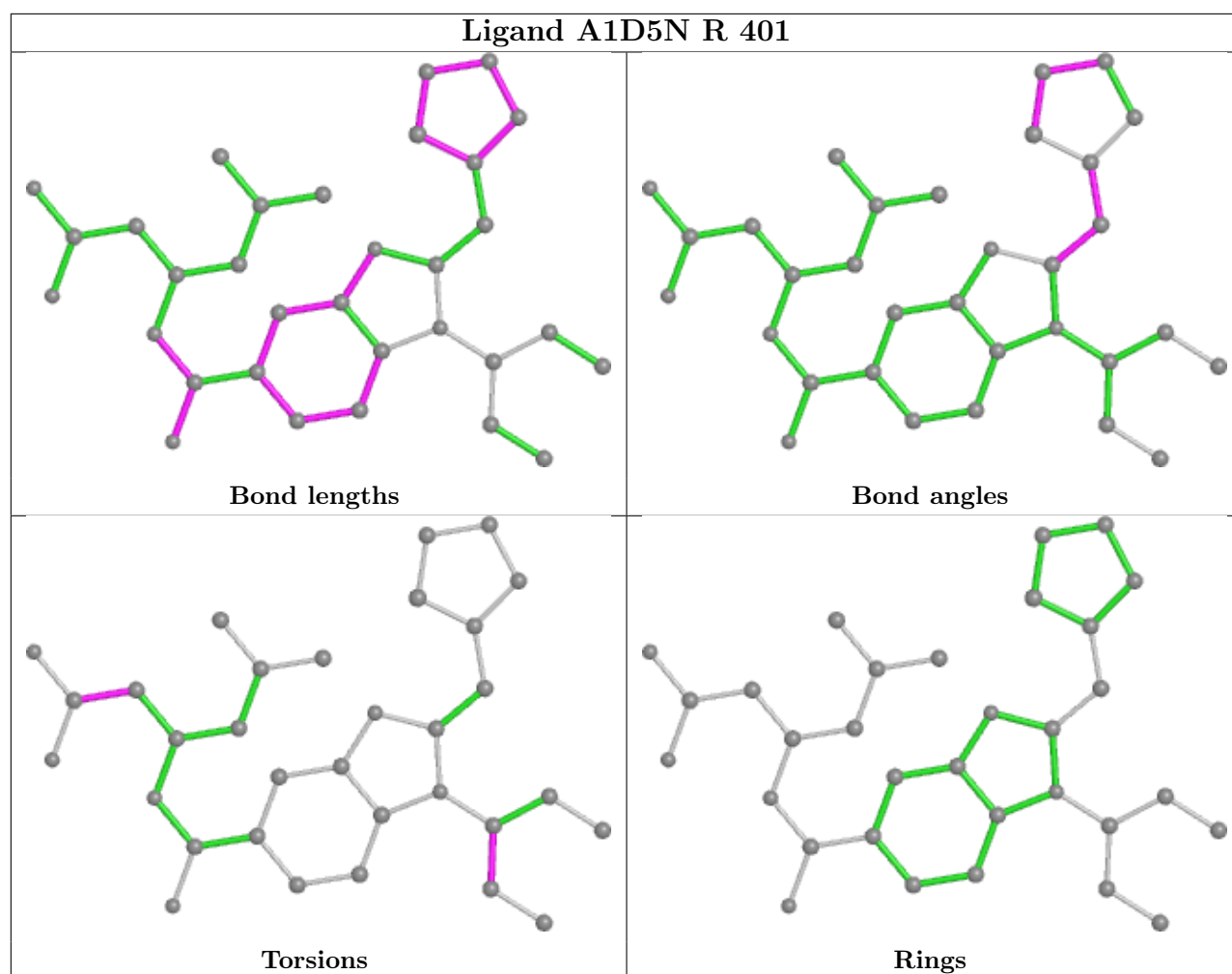
Mol	Chain	Res	Type	Atoms
6	R	401	A1D5N	C13-C19-C29-O04
6	R	401	A1D5N	C13-C19-C29-O03
6	R	401	A1D5N	C10-C08-C09-C22

There are no ring outliers.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	R	401	A1D5N	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 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.