



Full wwPDB EM Validation Report ⓘ

Jun 23, 2025 – 06:59 PM JST

PDB ID : 9IQY / pdb_00009iqy
EMDB ID : EMD-60798
Title : Cryo-EM structure of human TRPV4 intracellular domain in complex with GTPase RhoA
Authors : Yuan, Z.; Ruan, S.S.; Li, S.L.
Deposited on : 2024-07-13
Resolution : 3.16 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 : 4-5-2 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

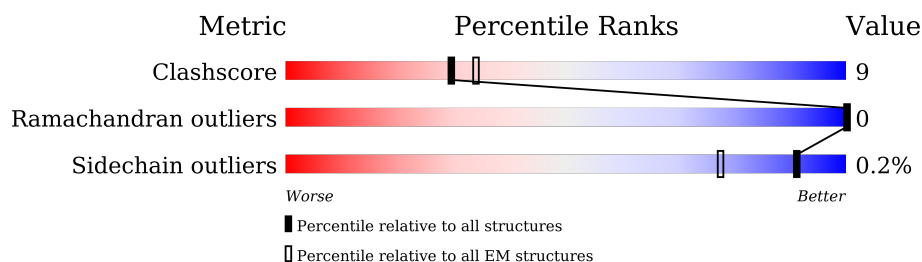
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.16 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	B	640	
1	C	640	
2	J	193	

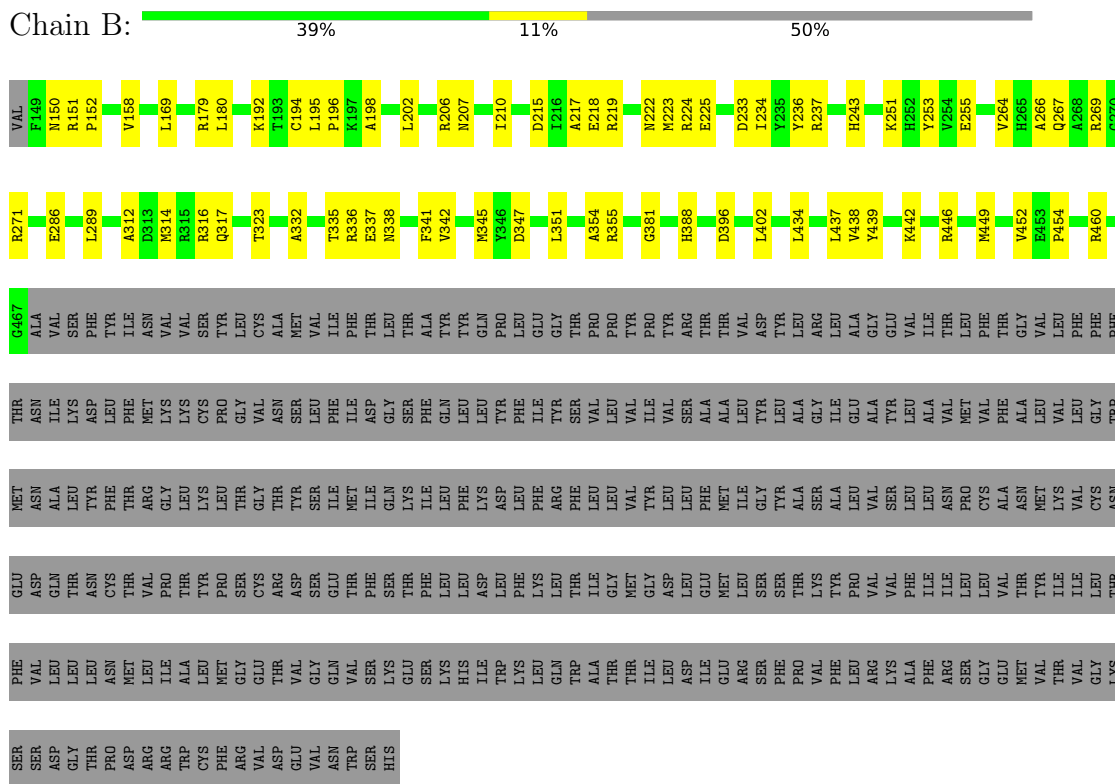
- Molecule 4 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		AltConf
4	J	1	Total	Mg	0
			1	1	

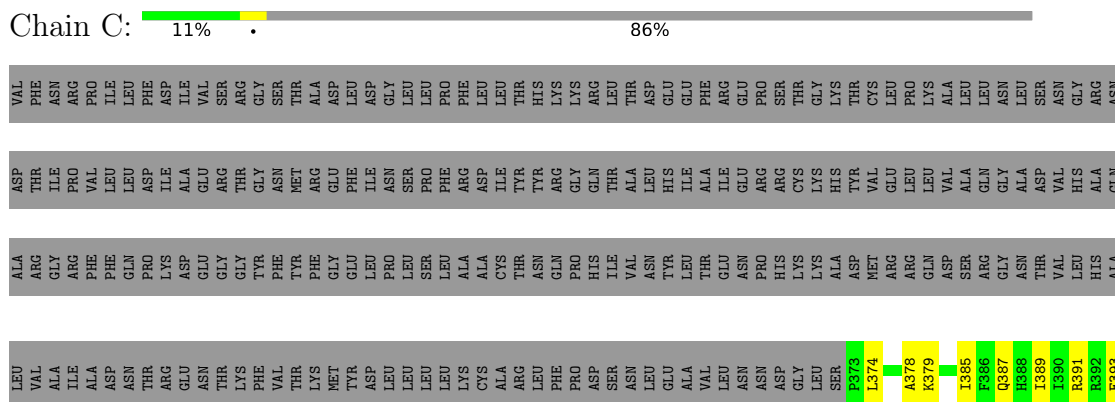
3 Residue-property plots

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: Transient receptor potential cation channel subfamily V member 4



- Molecule 1: Transient receptor potential cation channel subfamily V member 4



V394	T399	K405	D420	L421	S422	E430	A431	M440	S441	K442	M449	E453	K462	TRP	ARG	LYS	PHE	GLY	ALA	VAL	SER	PHE	TYR	ILE	ASN	VAL	VAL	VAL	SER	TYR	LEU	ALA	MET	VAL	ILE	PHE	THR	THR	ALA	TYR	TYR	GLN	PRO	LEU	GLY	THR	PRO	TYR
PRO	TYR	ARG	THR	VAL	ASP	TYR	LEU	ARG	GLY	ALA	GLY	THR	GLY	VAL	LEU	PHE	PHE	THR	ASN	ILE	LYS	ASP	LEU	PHE	THR	ASN	GLY	LEU	LYS	PRO	GLY	VAL	ASN	SER	LEU	ILE	PHE	ILE	ASP	GLY	THR	SER	THR	ALA	TYR	VAL		
ILE	VAL	SER	ALA	LEU	TYR	LEU	ALA	TYR	GLY	ALA	GLY	THR	GLY	VAL	LEU	PHE	TRP	MET	ASN	ALA	ILE	TYR	PHE	ASN	THR	ARG	GLY	LEU	LYS	LEU	LEU	THR	GLY	VAL	THR	SER	ILE	ILE	MET	ILE	GLN	GLY	SER	PHE	THR	VAL		
TYR	LEU	PHE	MET	ILE	GLY	TYR	ALA	SER	TYR	VAL	PRO	CYS	ALA	VAL	THR	ASN	CYS	ASN	GLU	ASP	GLN	THR	ASN	CYS	THR	THR	PRO	VAL	THR	PRO	SER	CYS	THR	ARG	ASP	THR	SER	ILE	ILE	MET	THR	PHE	LEU	ASP	THR	VAL		
GLY	ASP	LEU	GLU	MET	SER	SER	THR	LYS	PRO	VAL	VAL	VAL	THR	THR	THR	THR	THR	PHE	VAL	LEU	LEU	ASN	LEU	MET	ILE	ALA	LEU	ALA	LEU	MET	GLY	THR	VAL	GLN	GLY	VAL	ASN	GLY	VAL	THR	LYS	THR	GLN	THR	ALA	THR		
ILE	LEU	ASP	ILE	GLU	ARG	SER	PHE	PRO	PHE	LEU	ARG	LYS	ALA	ARG	SER	GLY	GLU	MET	VAL	THR	VAL	GLY	LYS	SER	GLU	ASP	GLY	THR	PRO	ASP	ARG	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR	THR		

● Molecule 2: Transforming protein RhoA

Chain J:

72%

21%

7%

M1	A2	A3	K7	L8	V9	I10	L21	L22	I23	S26	F30	P31	P36	T37	V38	Y42	L57	W58	P71	L72	S73	Y74	L81	M82	C83	F84	D87	S88	P89	D90	S91	L92	I96	F106	I113	L121	T127	G144	M147	I151		
F154	G155	Y156	M157	E158	C159	V167	R168	E169	Q180	ALA	ARG	ARG	GLY	LYS	LYS	SER	GLY	CYS	LEU	VAL	LEU																					

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	132000	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	NONE	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	50	Depositor
Minimum defocus (nm)	1000	Depositor
Maximum defocus (nm)	2000	Depositor
Magnification	64000	Depositor
Image detector	GATAN K3 BIOCONTINUUM (6k 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: GDP, MG

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	0.14	0/2620	0.40	0/3541
1	C	0.13	0/742	0.34	0/999
2	J	0.35	0/1388	0.56	0/1887
All	All	0.22	0/4750	0.44	0/6427

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	B	2567	0	2565	44	0
1	C	729	0	730	12	0
2	J	1360	0	1325	29	0
3	J	28	0	12	0	0
4	J	1	0	0	0	0
All	All	4685	0	4632	84	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.

All (84) 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)
2:J:159:CYS:SG	2:J:167:VAL:HG12	2.16	0.86
1:B:452:VAL:HG12	1:B:454:PRO:HD2	1.64	0.79
2:J:21:LEU:HD13	2:J:159:CYS:SG	2.23	0.78
2:J:84:PHE:HB3	2:J:95:ILE:HD11	1.74	0.69
2:J:21:LEU:CD1	2:J:159:CYS:SG	2.85	0.64
1:B:207:ASN:N	1:B:253:TYR:OH	2.30	0.64
1:C:378:ALA:HA	1:C:449:MET:HE1	1.77	0.64
1:B:317:GLN:HG2	1:B:323:THR:HG22	1.79	0.64
1:B:206:ARG:HA	1:B:253:TYR:OH	1.96	0.64
2:J:91:SER:O	2:J:95:ILE:HG13	1.99	0.62
1:B:316:ARG:NH2	2:J:3:ALA:O	2.37	0.57
1:B:218:GLU:HB2	1:B:223:MET:HE2	1.87	0.56
1:B:224:ARG:NH2	1:B:225:GLU:OE2	2.39	0.56
1:B:217:ALA:HB1	1:B:222:ASN:O	2.07	0.55
2:J:7:LYS:NZ	2:J:73:SER:O	2.36	0.54
2:J:71:PRO:HB3	2:J:106:PHE:CE2	2.42	0.54
2:J:81:LEU:HD23	2:J:113:ILE:HB	1.90	0.54
2:J:89:PRO:O	2:J:92:LEU:N	2.41	0.53
1:C:420:ASP:OD1	1:C:421:LEU:N	2.41	0.53
1:B:233:ASP:OD1	1:B:236:TYR:N	2.42	0.53
1:B:439:TYR:O	1:B:442:LYS:NZ	2.37	0.52
2:J:159:CYS:SG	2:J:167:VAL:CG1	2.93	0.52
1:C:394:VAL:HG11	1:C:399:THR:HG23	1.91	0.52
2:J:8:LEU:HD21	2:J:81:LEU:HD12	1.92	0.51
1:B:207:ASN:HB3	1:B:210:ILE:HG13	1.93	0.51
1:C:387:GLN:CD	1:C:391:ARG:HE	2.18	0.51
1:B:202:LEU:HD23	1:B:207:ASN:HB2	1.92	0.50
1:B:215:ASP:O	1:B:219:ARG:HG2	2.12	0.50
2:J:22:LEU:HD22	2:J:57:LEU:HD13	1.94	0.49
1:B:179:ARG:NE	1:B:222:ASN:OD1	2.46	0.49
1:B:338:ASN:HA	1:B:341:PHE:CE1	2.48	0.48
1:B:335:THR:OG1	1:B:338:ASN:ND2	2.41	0.48
2:J:121:LEU:HD22	2:J:127:THR:HG21	1.94	0.48
1:B:169:LEU:HD21	1:B:180:LEU:HD21	1.94	0.48
1:B:289:LEU:HD21	1:B:314:MET:HG2	1.94	0.48
1:B:437:LEU:O	1:B:446:ARG:NH1	2.37	0.48
2:J:10:ILE:HG13	2:J:83:CYS:SG	2.54	0.48
2:J:71:PRO:HB3	2:J:106:PHE:HE2	1.79	0.48
2:J:144:GLY:HA3	2:J:156:TYR:CE2	2.49	0.48
2:J:147:MET:HE2	2:J:147:MET:HA	1.96	0.47
1:B:150:ASN:CG	1:B:152:PRO:HD2	2.40	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:351:LEU:O	1:B:355:ARG:HG3	2.15	0.47
1:B:438:VAL:HG23	1:B:439:TYR:CD1	2.50	0.47
1:C:374:LEU:HD12	1:C:389:ILE:HG22	1.96	0.47
1:B:347:ASP:CG	1:B:388:HIS:HE2	2.21	0.46
1:C:391:ARG:HH22	1:C:453:GLU:HG2	1.81	0.46
1:B:243:HIS:HE1	1:B:266:ALA:HB3	1.81	0.46
2:J:26:SER:HB3	2:J:42:TYR:CE2	2.51	0.46
2:J:157:MET:HE1	2:J:169:GLU:HB2	1.98	0.46
2:J:82:MET:HE1	2:J:151:ILE:HD13	1.98	0.45
1:B:206:ARG:CA	1:B:253:TYR:OH	2.64	0.45
1:B:192:LYS:HG3	1:B:196:PRO:HB2	1.99	0.45
1:C:379:LYS:HE2	1:C:440:ASN:HB3	1.98	0.45
1:B:264:VAL:HG12	1:B:312:ALA:HB2	1.99	0.44
1:B:347:ASP:OD2	1:B:388:HIS:NE2	2.41	0.44
1:C:393:GLU:OE2	1:C:405:LYS:HD3	2.18	0.44
1:B:198:ALA:HB1	1:B:210:ILE:HG12	1.99	0.44
1:B:336:ARG:NH2	1:B:337:GLU:OE2	2.51	0.43
1:B:158:VAL:HG21	1:B:194:CYS:HB3	1.99	0.43
1:B:355:ARG:NH2	1:B:396:ASP:OD2	2.51	0.43
1:C:430:GLU:HG2	1:C:431:ALA:H	1.84	0.43
2:J:10:ILE:HG22	2:J:58:TRP:O	2.18	0.43
2:J:30:PHE:CD1	2:J:31:PRO:HD2	2.54	0.43
2:J:23:ILE:HD11	2:J:36:PRO:HD2	2.01	0.42
1:C:442:LYS:HD3	1:C:442:LYS:HA	1.75	0.42
1:B:251:LYS:O	1:B:255:GLU:HG3	2.20	0.42
1:B:434:LEU:O	1:B:438:VAL:HG22	2.19	0.42
1:B:195:LEU:HB3	1:B:196:PRO:HD3	2.02	0.42
1:B:267:GLN:HA	1:B:286:GLU:O	2.20	0.42
2:J:71:PRO:HA	2:J:74:TYR:CD2	2.55	0.42
1:B:234:ILE:HG22	1:B:271:ARG:HD3	2.01	0.41
1:B:381:GLY:HA2	1:B:449:MET:HE1	2.01	0.41
1:C:420:ASP:OD1	1:C:422:SER:N	2.44	0.41
1:B:354:ALA:HB2	1:B:402:LEU:HD11	2.02	0.41
2:J:87:ASP:OD1	2:J:127:THR:HB	2.20	0.41
2:J:8:LEU:HD22	2:J:57:LEU:HD22	2.01	0.41
1:B:332:ALA:HB2	1:B:342:VAL:HG11	2.02	0.41
1:B:150:ASN:OD1	1:B:151:ARG:N	2.54	0.41
1:B:237:ARG:O	1:B:269:ARG:N	2.49	0.41
1:B:345:MET:HE2	1:B:345:MET:HB2	1.95	0.41
2:J:113:ILE:HG12	2:J:154:PHE:HB3	2.02	0.41
1:C:385:ILE:HD12	1:C:385:ILE:HA	1.91	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:J:37:THR:HG23	2:J:38:VAL:HG22	2.02	0.40
1:B:460:ARG:CZ	1:B:460:ARG:HB2	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 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	317/640 (50%)	304 (96%)	13 (4%)	0	100	100
1	C	88/640 (14%)	84 (96%)	4 (4%)	0	100	100
2	J	178/193 (92%)	174 (98%)	4 (2%)	0	100	100
All	All	583/1473 (40%)	562 (96%)	21 (4%)	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	279/566 (49%)	279 (100%)	0	100	100
1	C	81/566 (14%)	81 (100%)	0	100	100
2	J	140/167 (84%)	139 (99%)	1 (1%)	81	90
All	All	500/1299 (38%)	499 (100%)	1 (0%)	91	96

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

Mol	Chain	Res	Type
2	J	10	ILE

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

Mol	Chain	Res	Type
1	B	322	ASN
1	B	338	ASN
1	B	445	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 2 ligands modelled in this entry, 1 is monoatomic - leaving 1 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	$\# Z > 2$
3	GDP	J	201	4	24,30,30	1.03	1 (4%)	30,47,47	1.30	5 (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	GDP	J	201	4	-	0/12/32/32	0/3/3/3

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	J	201	GDP	C6-N1	-2.95	1.33	1.37

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	J	201	GDP	C3'-C2'-C1'	3.04	105.56	100.98
3	J	201	GDP	PA-O3A-PB	-2.98	122.59	132.83
3	J	201	GDP	C5-C6-N1	2.46	118.30	113.95
3	J	201	GDP	O6-C6-C5	-2.09	120.30	124.37
3	J	201	GDP	C8-N7-C5	2.07	106.94	102.99

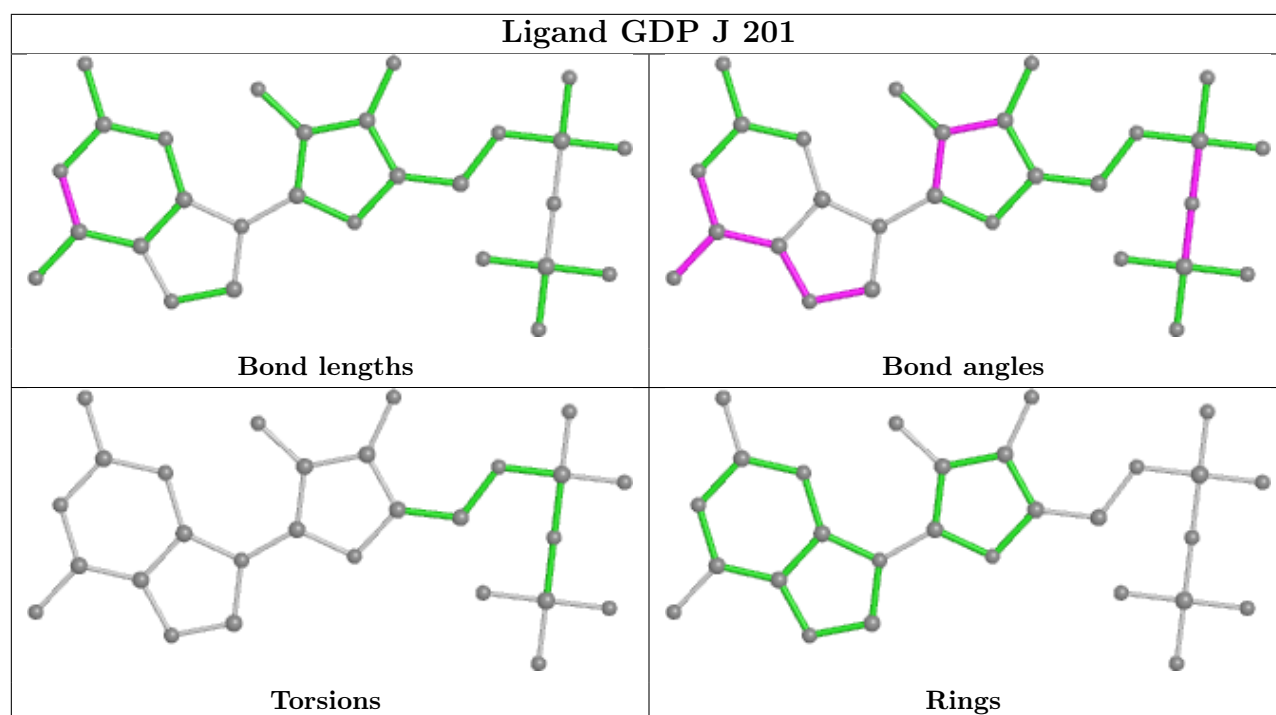
There are no chirality outliers.

There are no torsion outliers.

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.