



Full wwPDB/EMDatabank EM Map/Model Validation Report ⓘ

Nov 14, 2019 – 01:39 AM EST

PDB ID : 6NQ0
EMDB ID: : EMD-0477
Title : Cryo-EM structure of human TPC2 channel in the ligand-bound open state
Authors : She, J.; Zeng, W.; Guo, J.; Chen, Q.; Bai, X.; Jiang, Y.
Deposited on : 2019-01-18
Resolution : 3.70 Å(reported)

This is a Full wwPDB/EMDatabank EM Map/Model Validation Report
for a publicly released PDB/EMDB 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.

MolProbity : 4.02b-467
Mogul : 1.8.0 (224370), CSD as540be (2019)
Percentile statistics : 20171227.v01 (using entries in the PDB archive December 27th 2017)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)
Validation Pipeline (wwPDB-VP) : 2.4

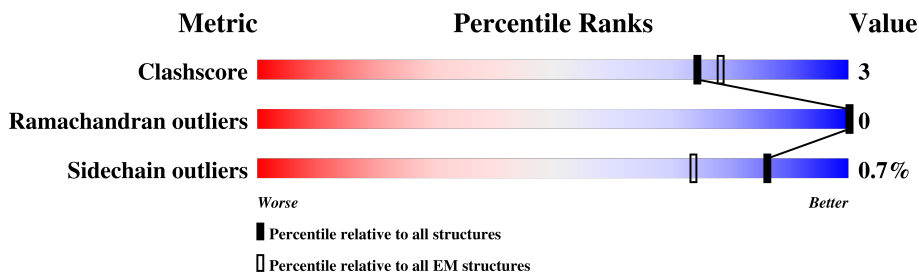
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.70 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	136327	1886
Ramachandran outliers	132723	1663
Sidechain outliers	132532	1531

The table below summarises the geometric issues observed across the polymeric chains. The red, orange, yellow and green segments on the bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria. 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	A	756	
1	B	756	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 10140 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.

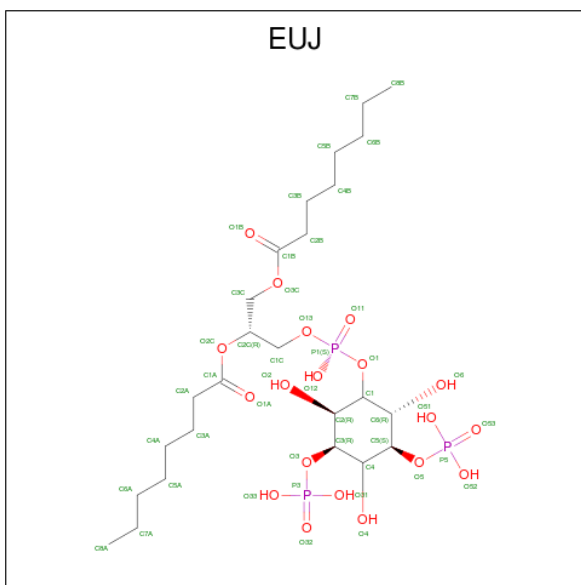
- Molecule 1 is a protein called Two pore calcium channel protein 2.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	621	Total	C	N	O	S	0	0
			5023	3337	811	845	30		
1	B	621	Total	C	N	O	S	0	0
			5023	3337	811	845	30		

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-3	GLY	-	expression tag	UNP Q8NHX9
A	-2	SER	-	expression tag	UNP Q8NHX9
A	-1	LEU	-	expression tag	UNP Q8NHX9
A	0	GLU	-	expression tag	UNP Q8NHX9
A	11	ALA	LEU	conflict	UNP Q8NHX9
A	12	ALA	LEU	conflict	UNP Q8NHX9
A	564	PRO	LEU	conflict	UNP Q8NHX9
A	734	GLU	GLY	conflict	UNP Q8NHX9
B	-3	GLY	-	expression tag	UNP Q8NHX9
B	-2	SER	-	expression tag	UNP Q8NHX9
B	-1	LEU	-	expression tag	UNP Q8NHX9
B	0	GLU	-	expression tag	UNP Q8NHX9
B	11	ALA	LEU	conflict	UNP Q8NHX9
B	12	ALA	LEU	conflict	UNP Q8NHX9
B	564	PRO	LEU	conflict	UNP Q8NHX9
B	734	GLU	GLY	conflict	UNP Q8NHX9

- Molecule 2 is (2R)-3-[[[(S)-hydroxy{[(1S,2R,3R,4S,5S,6R)-2,4,6-trihydroxy-3,5-bis(phosphonooxy)cyclohexyl]oxy}phosphoryl]oxy}propane-1,2-diyl dioctanoate (three-letter code: EUJ) (formula: C₂₅H₄₉O₁₉P₃).

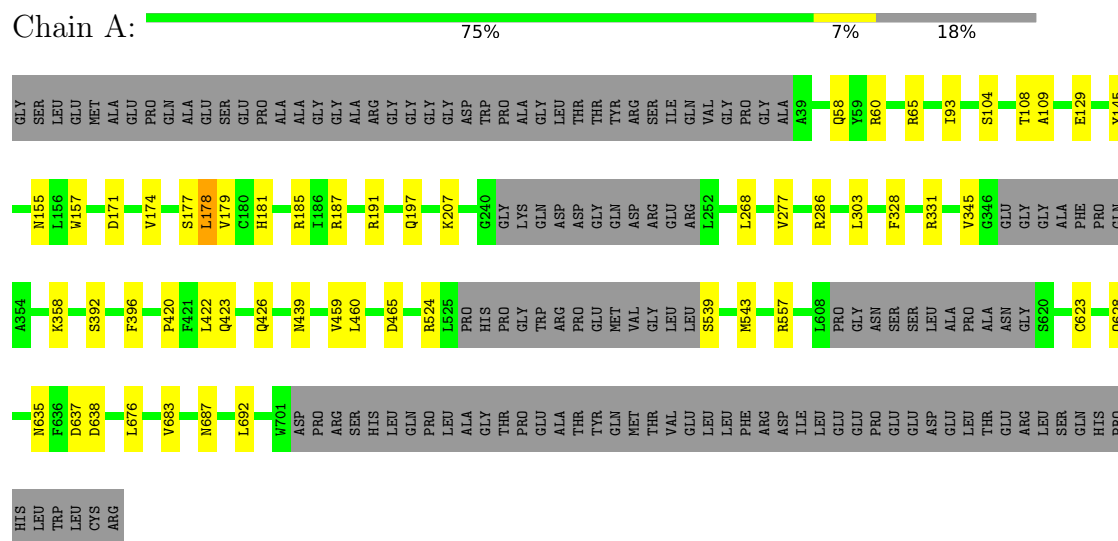


Mol	Chain	Residues	Atoms				AltConf
2	A	1	Total 47	C 25	O 19	P 3	0
2	B	1	Total 47	C 25	O 19	P 3	0

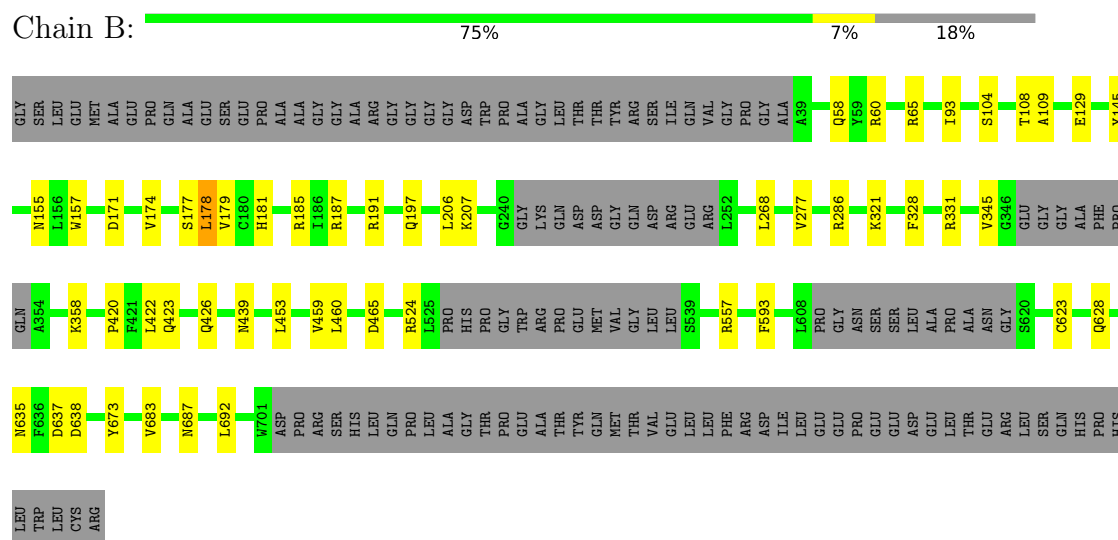
3 Residue-property plots

These plots are drawn for all protein, RNA and DNA 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: Two pore calcium channel protein 2



- Molecule 1: Two pore calcium channel protein 2



4 Experimental information

Property	Value	Source
Reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	Depositor
Number of particles used	33441	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 ($e^-/\text{\AA}^2$)	1.6	Depositor
Minimum defocus (nm)	Not provided	Depositor
Maximum defocus (nm)	Not provided	Depositor
Magnification	Not provided	Depositor
Image detector	GATAN K2 SUMMIT (4k 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: EUJ

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	$\# Z > 2$	RMSZ	$\# Z > 2$
1	A	0.32	0/5151	0.50	0/7007
1	B	0.32	0/5151	0.50	0/7007
All	All	0.32	0/10302	0.50	0/14014

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	A	5023	0	5149	36	0
1	B	5023	0	5149	36	0
2	A	47	0	0	2	0
2	B	47	0	0	2	0
All	All	10140	0	10298	71	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 3.

All (71) 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:B:174:VAL:HA	1:B:177:SER:OG	1.95	0.66
1:A:174:VAL:HA	1:A:177:SER:OG	1.95	0.65
2:A:1000:EUI:O2	2:A:1000:EUI:O11	2.20	0.59
2:B:1000:EUI:O11	2:B:1000:EUI:O2	2.20	0.59
1:B:93:ILE:HG22	1:B:191:ARG:HD3	1.87	0.57
1:A:93:ILE:HG22	1:A:191:ARG:HD3	1.87	0.56
1:A:65:ARG:NH1	1:A:145:TYR:O	2.39	0.56
1:A:58:GLN:OE1	1:A:60:ARG:NH2	2.40	0.55
1:A:638:ASP:OD1	1:A:638:ASP:N	2.39	0.54
1:B:58:GLN:OE1	1:B:60:ARG:NH2	2.40	0.54
1:B:459:VAL:HG12	1:B:460:LEU:HD23	1.91	0.53
1:A:157:TRP:HB3	1:A:197:GLN:HE22	1.74	0.53
1:B:65:ARG:NH1	1:B:145:TYR:O	2.39	0.53
1:B:638:ASP:OD1	1:B:638:ASP:N	2.40	0.53
1:A:459:VAL:HG12	1:A:460:LEU:HD23	1.91	0.53
1:B:439:ASN:OD1	1:B:557:ARG:NH1	2.42	0.53
1:A:129:GLU:OE2	1:A:191:ARG:NH1	2.43	0.52
1:A:439:ASN:OD1	1:A:557:ARG:NH1	2.42	0.52
1:B:157:TRP:HB3	1:B:197:GLN:HE22	1.74	0.52
1:A:174:VAL:HA	1:A:177:SER:HG	1.74	0.51
1:B:129:GLU:OE2	1:B:191:ARG:NH1	2.43	0.51
1:B:207:LYS:HD2	2:B:1000:EUI:O6	2.11	0.51
1:A:207:LYS:HD2	2:A:1000:EUI:O6	2.11	0.50
1:B:174:VAL:HA	1:B:177:SER:HG	1.76	0.49
1:A:345:VAL:HG22	1:A:358:LYS:HE3	1.94	0.49
1:B:179:VAL:CG1	1:B:181:HIS:HB2	2.42	0.49
1:A:179:VAL:CG1	1:A:181:HIS:HB2	2.42	0.48
1:B:345:VAL:HG22	1:B:358:LYS:HE3	1.94	0.48
1:A:683:VAL:O	1:A:687:ASN:ND2	2.46	0.48
1:B:683:VAL:O	1:B:687:ASN:ND2	2.46	0.47
1:A:420:PRO:O	1:A:423:GLN:NE2	2.47	0.47
1:B:171:ASP:OD1	1:B:187:ARG:NH1	2.43	0.47
1:B:420:PRO:O	1:B:423:GLN:NE2	2.47	0.47
1:A:109:ALA:HB2	1:B:286:ARG:HE	1.80	0.47
1:B:108:THR:OG1	1:B:109:ALA:N	2.48	0.47
1:A:108:THR:OG1	1:A:109:ALA:N	2.49	0.46
1:A:623:CYS:HB3	1:B:623:CYS:HB3	1.69	0.46
1:A:635:ASN:ND2	1:A:637:ASP:OD2	2.49	0.46
1:B:104:SER:HB3	1:B:638:ASP:HB2	1.98	0.46
1:B:178:LEU:HG	1:B:178:LEU:H	1.57	0.45
1:B:179:VAL:HG13	1:B:181:HIS:N	2.32	0.45
1:B:635:ASN:ND2	1:B:637:ASP:OD2	2.49	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:104:SER:HB3	1:A:638:ASP:HB2	1.98	0.45
1:B:422:LEU:O	1:B:426:GLN:NE2	2.49	0.45
1:A:179:VAL:HG13	1:A:181:HIS:N	2.32	0.45
1:A:422:LEU:O	1:A:426:GLN:NE2	2.49	0.45
1:A:286:ARG:HE	1:B:109:ALA:HB2	1.81	0.45
1:A:178:LEU:HD12	1:A:179:VAL:H	1.83	0.45
1:B:178:LEU:HD12	1:B:179:VAL:H	1.83	0.44
1:A:171:ASP:OD1	1:A:187:ARG:NH1	2.43	0.44
1:B:171:ASP:HA	1:B:174:VAL:HG12	2.00	0.43
1:A:171:ASP:HA	1:A:174:VAL:HG12	2.00	0.43
1:A:268:LEU:HD22	1:A:277:VAL:HG11	2.00	0.43
1:A:303:LEU:HA	1:A:303:LEU:HD23	1.91	0.43
1:B:268:LEU:HD22	1:B:277:VAL:HG11	2.00	0.42
1:A:692:LEU:HA	1:A:692:LEU:HD12	1.89	0.42
1:A:328:PHE:HD1	1:A:331:ARG:HH21	1.68	0.42
1:A:392:SER:O	1:A:396:PHE:N	2.53	0.42
1:B:206:LEU:HA	1:B:206:LEU:HD23	1.87	0.41
1:A:539:SER:O	1:A:543:MET:N	2.53	0.41
1:B:623:CYS:HA	1:B:628:GLN:HG3	2.01	0.41
1:B:453:LEU:HD12	1:B:453:LEU:HA	1.93	0.41
1:B:593:PHE:O	1:B:673:TYR:OH	2.35	0.41
1:A:465:ASP:OD1	1:A:465:ASP:N	2.53	0.41
1:A:676:LEU:HA	1:A:676:LEU:HD23	1.92	0.41
1:B:328:PHE:HD1	1:B:331:ARG:HH21	1.68	0.41
1:A:623:CYS:HA	1:A:628:GLN:HG3	2.01	0.41
1:B:465:ASP:N	1:B:465:ASP:OD1	2.53	0.41
1:B:321:LYS:HD3	1:B:321:LYS:HA	1.88	0.41
1:A:423:GLN:HG3	1:A:423:GLN:H	1.71	0.40
1:B:692:LEU:HD12	1:B:692:LEU:HA	1.88	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	A	611/756 (81%)	584 (96%)	27 (4%)	0	100	100
1	B	611/756 (81%)	584 (96%)	27 (4%)	0	100	100
All	All	1222/1512 (81%)	1168 (96%)	54 (4%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains ⓘ

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	A	551/655 (84%)	547 (99%)	4 (1%)	85	93
1	B	551/655 (84%)	547 (99%)	4 (1%)	85	93
All	All	1102/1310 (84%)	1094 (99%)	8 (1%)	86	93

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	155	ASN
1	A	178	LEU
1	A	185	ARG
1	A	524	ARG
1	B	155	ASN
1	B	178	LEU
1	B	185	ARG
1	B	524	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (14) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	197	GLN
1	A	305	ASN
1	A	397	GLN
1	A	401	ASN
1	A	426	GLN

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Mol	Chain	Res	Type
1	A	431	HIS
1	A	687	ASN
1	B	197	GLN
1	B	305	ASN
1	B	397	GLN
1	B	401	ASN
1	B	426	GLN
1	B	431	HIS
1	B	687	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 carbohydrates 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	EUJ	A	1000	-	47,47,47	1.16	6 (12%)	61,65,65	1.60	4 (6%)
2	EUJ	B	1000	-	47,47,47	1.16	6 (12%)	61,65,65	1.60	4 (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
2	EUJ	A	1000	-	-	20/44/68/68	0/1/1/1
2	EUJ	B	1000	-	-	20/44/68/68	0/1/1/1

All (12) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	1000	EUJ	P3-O3	3.06	1.65	1.59
2	A	1000	EUJ	P3-O3	3.05	1.65	1.59
2	B	1000	EUJ	P5-O5	2.96	1.64	1.59
2	A	1000	EUJ	P5-O5	2.95	1.64	1.59
2	B	1000	EUJ	O2C-C2C	-2.41	1.40	1.46
2	A	1000	EUJ	O2C-C2C	-2.41	1.40	1.46
2	B	1000	EUJ	O3C-C1B	2.38	1.40	1.33
2	A	1000	EUJ	O3C-C1B	2.37	1.40	1.33
2	A	1000	EUJ	O2C-C1A	2.15	1.40	1.34
2	B	1000	EUJ	O2C-C1A	2.14	1.40	1.34
2	B	1000	EUJ	O3C-C3C	-2.06	1.40	1.45
2	A	1000	EUJ	O3C-C3C	-2.06	1.40	1.45

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	1000	EUJ	O2-C2-C1	7.68	130.65	109.94
2	A	1000	EUJ	O2-C2-C1	7.67	130.62	109.94
2	A	1000	EUJ	O2-C2-C3	-6.64	92.02	109.94
2	B	1000	EUJ	O2-C2-C3	-6.64	92.03	109.94
2	A	1000	EUJ	O2C-C1A-C2A	3.88	119.99	111.51
2	B	1000	EUJ	O2C-C1A-C2A	3.87	119.95	111.51
2	A	1000	EUJ	O3C-C1B-C2B	2.51	119.98	111.93
2	B	1000	EUJ	O3C-C1B-C2B	2.50	119.95	111.93

There are no chirality outliers.

All (40) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	1000	EUJ	C2-C1-O1-P1
2	B	1000	EUJ	C6-C1-O1-P1
2	B	1000	EUJ	C2A-C1A-O2C-C2C

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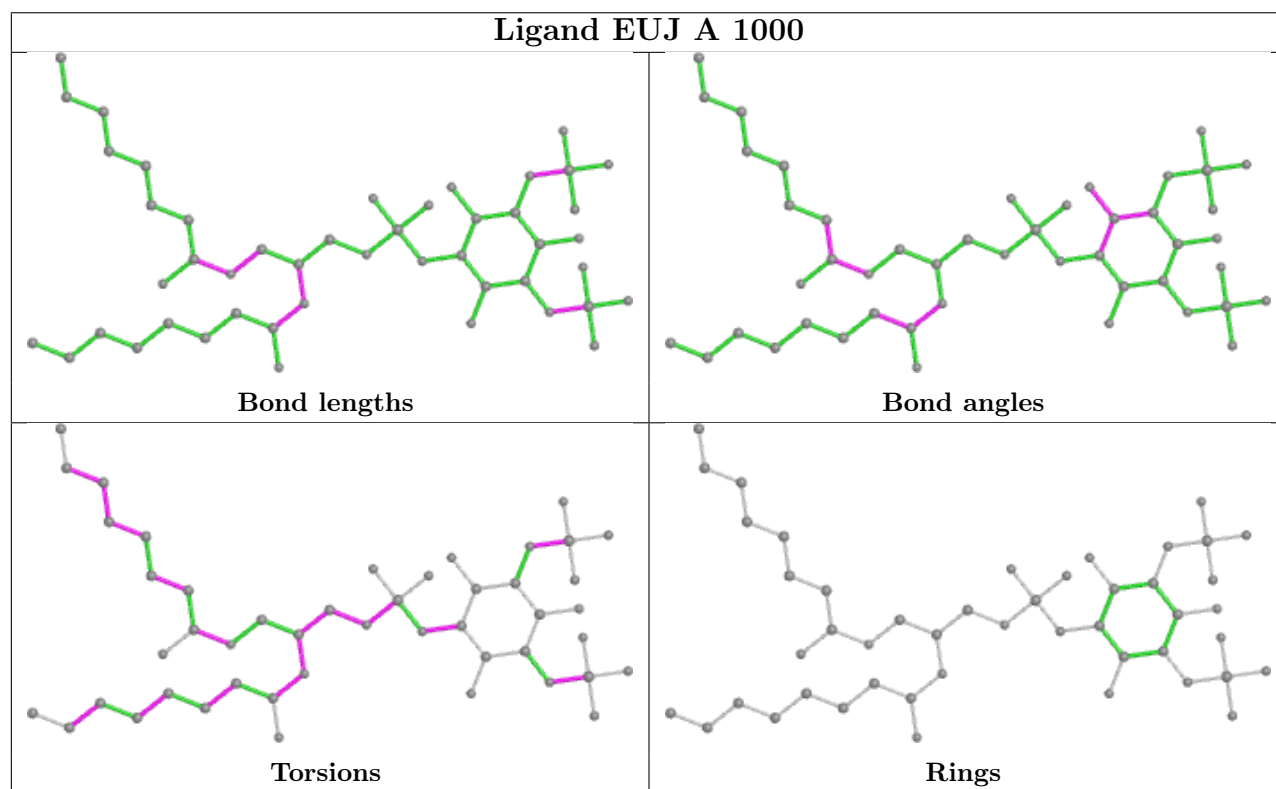
Mol	Chain	Res	Type	Atoms
2	A	1000	EUJ	C2-C1-O1-P1
2	A	1000	EUJ	C6-C1-O1-P1
2	A	1000	EUJ	C2A-C1A-O2C-C2C
2	B	1000	EUJ	O1A-C1A-O2C-C2C
2	A	1000	EUJ	O1A-C1A-O2C-C2C
2	B	1000	EUJ	C4B-C5B-C6B-C7B
2	A	1000	EUJ	C4B-C5B-C6B-C7B
2	B	1000	EUJ	C2B-C1B-O3C-C3C
2	A	1000	EUJ	C2B-C1B-O3C-C3C
2	B	1000	EUJ	O1B-C1B-O3C-C3C
2	A	1000	EUJ	O1B-C1B-O3C-C3C
2	A	1000	EUJ	C5B-C6B-C7B-C8B
2	B	1000	EUJ	C5B-C6B-C7B-C8B
2	B	1000	EUJ	C1A-C2A-C3A-C4A
2	A	1000	EUJ	C1A-C2A-C3A-C4A
2	B	1000	EUJ	C1B-C2B-C3B-C4B
2	A	1000	EUJ	C1B-C2B-C3B-C4B
2	B	1000	EUJ	O13-C1C-C2C-C3C
2	A	1000	EUJ	O13-C1C-C2C-C3C
2	B	1000	EUJ	C2C-C1C-O13-P1
2	A	1000	EUJ	C2C-C1C-O13-P1
2	B	1000	EUJ	C3A-C4A-C5A-C6A
2	A	1000	EUJ	C3A-C4A-C5A-C6A
2	B	1000	EUJ	O13-C1C-C2C-O2C
2	A	1000	EUJ	O13-C1C-C2C-O2C
2	B	1000	EUJ	C3-O3-P3-O31
2	A	1000	EUJ	C3-O3-P3-O31
2	B	1000	EUJ	C3B-C4B-C5B-C6B
2	A	1000	EUJ	C3B-C4B-C5B-C6B
2	B	1000	EUJ	C3C-C2C-O2C-C1A
2	A	1000	EUJ	C3C-C2C-O2C-C1A
2	B	1000	EUJ	C1C-O13-P1-O1
2	A	1000	EUJ	C1C-O13-P1-O1
2	B	1000	EUJ	C5-O5-P5-O52
2	A	1000	EUJ	C5-O5-P5-O52
2	B	1000	EUJ	C5A-C6A-C7A-C8A
2	A	1000	EUJ	C5A-C6A-C7A-C8A

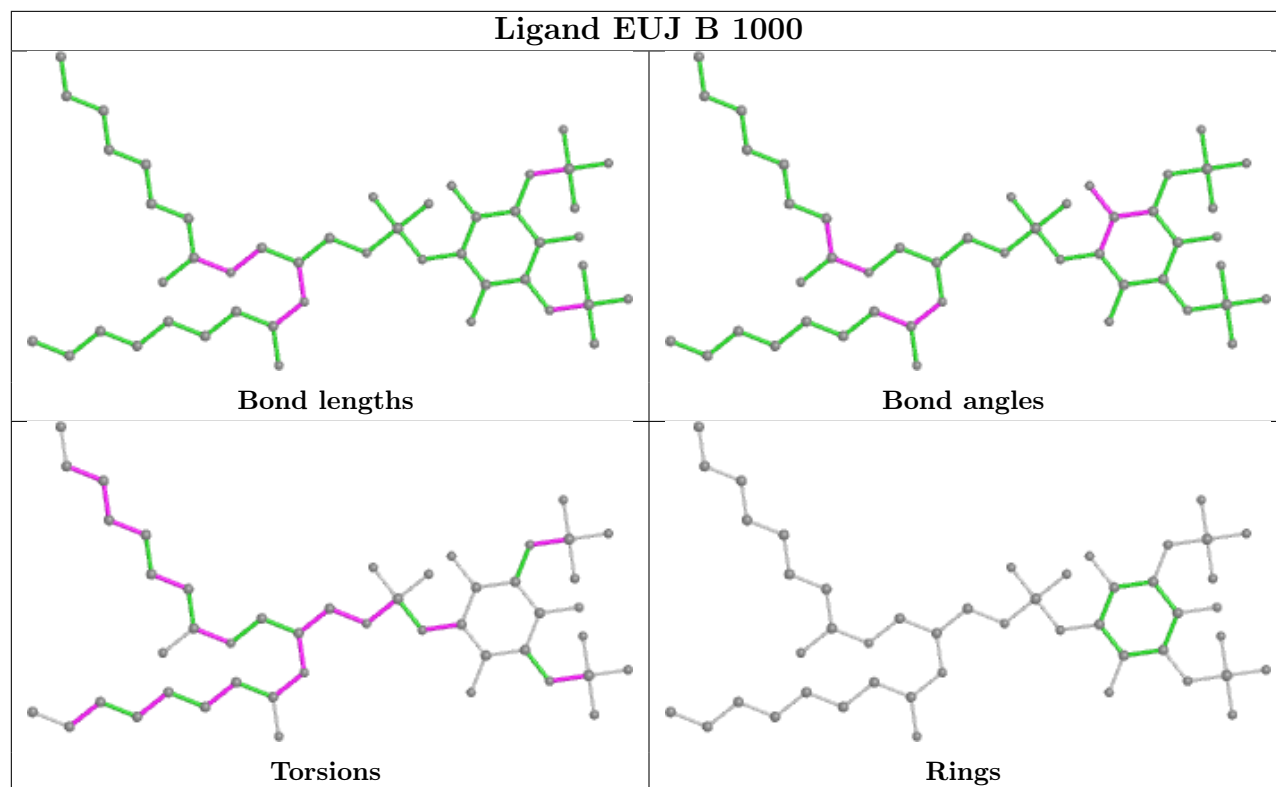
There are no ring outliers.

2 monomers are involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	1000	EUJ	2	0
2	B	1000	EUJ	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.