



wwPDB EM Validation Summary Report ⓘ

Jul 9, 2025 – 01:33 PM JST

PDB ID : 9J51 / pdb_00009j51
EMDB ID : EMD-61139
Title : CryoEM structure of human XPR1 in complex with phosphate in state A
Authors : Zhang, W.H.; Chen, Y.K.; Guan, Z.Y.; Liu, Z.
Deposited on : 2024-08-11
Resolution : 3.10 Å(reported)

This is a wwPDB EM Validation Summary Report for a publicly released PDB entry.

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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

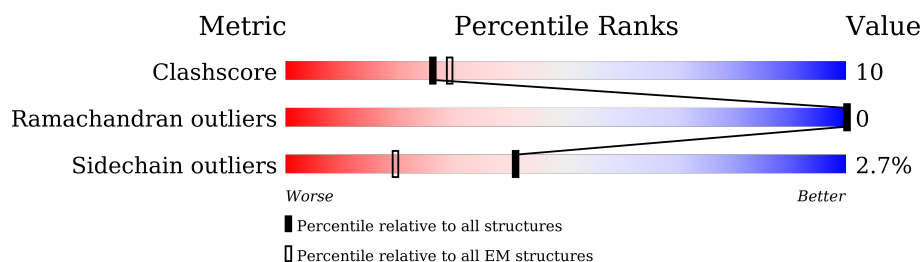
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.10 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	A	720	
1	B	720	

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 6581 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 Solute carrier family 53 member 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	380	Total	C	N	O	S	0	0
			3174	2135	508	516	15		
1	B	382	Total	C	N	O	S	0	0
			3186	2143	510	518	15		

There are 48 discrepancies between the modelled and reference sequences:

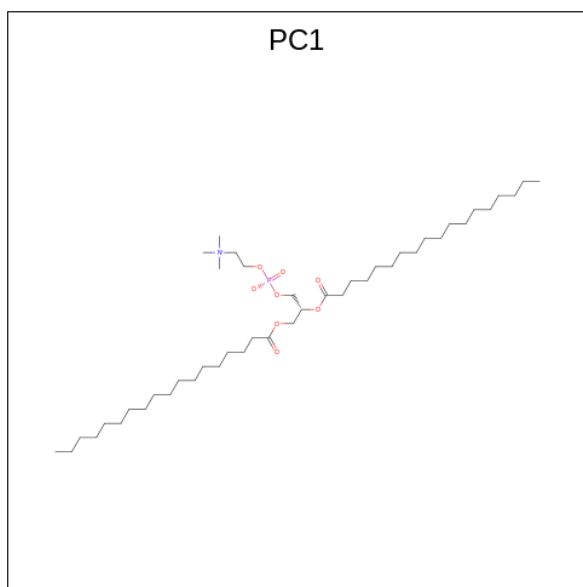
Chain	Residue	Modelled	Actual	Comment	Reference
A	697	LEU	-	expression tag	UNP Q9UBH6
A	698	GLU	-	expression tag	UNP Q9UBH6
A	699	ASP	-	expression tag	UNP Q9UBH6
A	700	TYR	-	expression tag	UNP Q9UBH6
A	701	LYS	-	expression tag	UNP Q9UBH6
A	702	ASP	-	expression tag	UNP Q9UBH6
A	703	HIS	-	expression tag	UNP Q9UBH6
A	704	ASP	-	expression tag	UNP Q9UBH6
A	705	GLY	-	expression tag	UNP Q9UBH6
A	706	ASP	-	expression tag	UNP Q9UBH6
A	707	TYR	-	expression tag	UNP Q9UBH6
A	708	LYS	-	expression tag	UNP Q9UBH6
A	709	ASP	-	expression tag	UNP Q9UBH6
A	710	HIS	-	expression tag	UNP Q9UBH6
A	711	ASP	-	expression tag	UNP Q9UBH6
A	712	ILE	-	expression tag	UNP Q9UBH6
A	713	ASP	-	expression tag	UNP Q9UBH6
A	714	TYR	-	expression tag	UNP Q9UBH6
A	715	LYS	-	expression tag	UNP Q9UBH6
A	716	ASP	-	expression tag	UNP Q9UBH6
A	717	ASP	-	expression tag	UNP Q9UBH6
A	718	ASP	-	expression tag	UNP Q9UBH6
A	719	ASP	-	expression tag	UNP Q9UBH6
A	720	LYS	-	expression tag	UNP Q9UBH6
B	697	LEU	-	expression tag	UNP Q9UBH6
B	698	GLU	-	expression tag	UNP Q9UBH6

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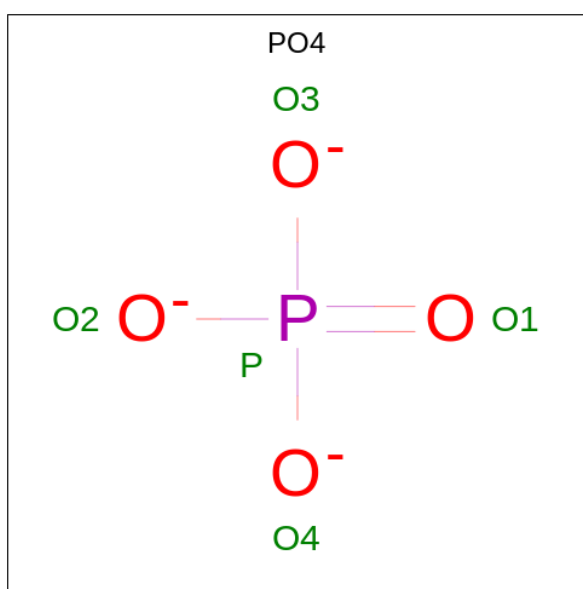
Chain	Residue	Modelled	Actual	Comment	Reference
B	699	ASP	-	expression tag	UNP Q9UBH6
B	700	TYR	-	expression tag	UNP Q9UBH6
B	701	LYS	-	expression tag	UNP Q9UBH6
B	702	ASP	-	expression tag	UNP Q9UBH6
B	703	HIS	-	expression tag	UNP Q9UBH6
B	704	ASP	-	expression tag	UNP Q9UBH6
B	705	GLY	-	expression tag	UNP Q9UBH6
B	706	ASP	-	expression tag	UNP Q9UBH6
B	707	TYR	-	expression tag	UNP Q9UBH6
B	708	LYS	-	expression tag	UNP Q9UBH6
B	709	ASP	-	expression tag	UNP Q9UBH6
B	710	HIS	-	expression tag	UNP Q9UBH6
B	711	ASP	-	expression tag	UNP Q9UBH6
B	712	ILE	-	expression tag	UNP Q9UBH6
B	713	ASP	-	expression tag	UNP Q9UBH6
B	714	TYR	-	expression tag	UNP Q9UBH6
B	715	LYS	-	expression tag	UNP Q9UBH6
B	716	ASP	-	expression tag	UNP Q9UBH6
B	717	ASP	-	expression tag	UNP Q9UBH6
B	718	ASP	-	expression tag	UNP Q9UBH6
B	719	ASP	-	expression tag	UNP Q9UBH6
B	720	LYS	-	expression tag	UNP Q9UBH6

- Molecule 2 is 1,2-DIACYL-SN-GLYCERO-3-PHOSPHOCHOLINE (CCD ID: PC1) (formula: $C_{44}H_{88}NO_8P$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					AltConf
2	A	1	Total	C	N	O	P	0
			54	44	1	8	1	
2	A	1	Total	C	N	O	P	0
			54	44	1	8	1	
2	B	1	Total	C	N	O	P	0
			54	44	1	8	1	
2	B	1	Total	C	N	O	P	0
			54	44	1	8	1	

- Molecule 3 is PHOSPHATE ION (CCD ID: PO4) (formula: O_4P) (labeled as "Ligand of Interest" by depositor).

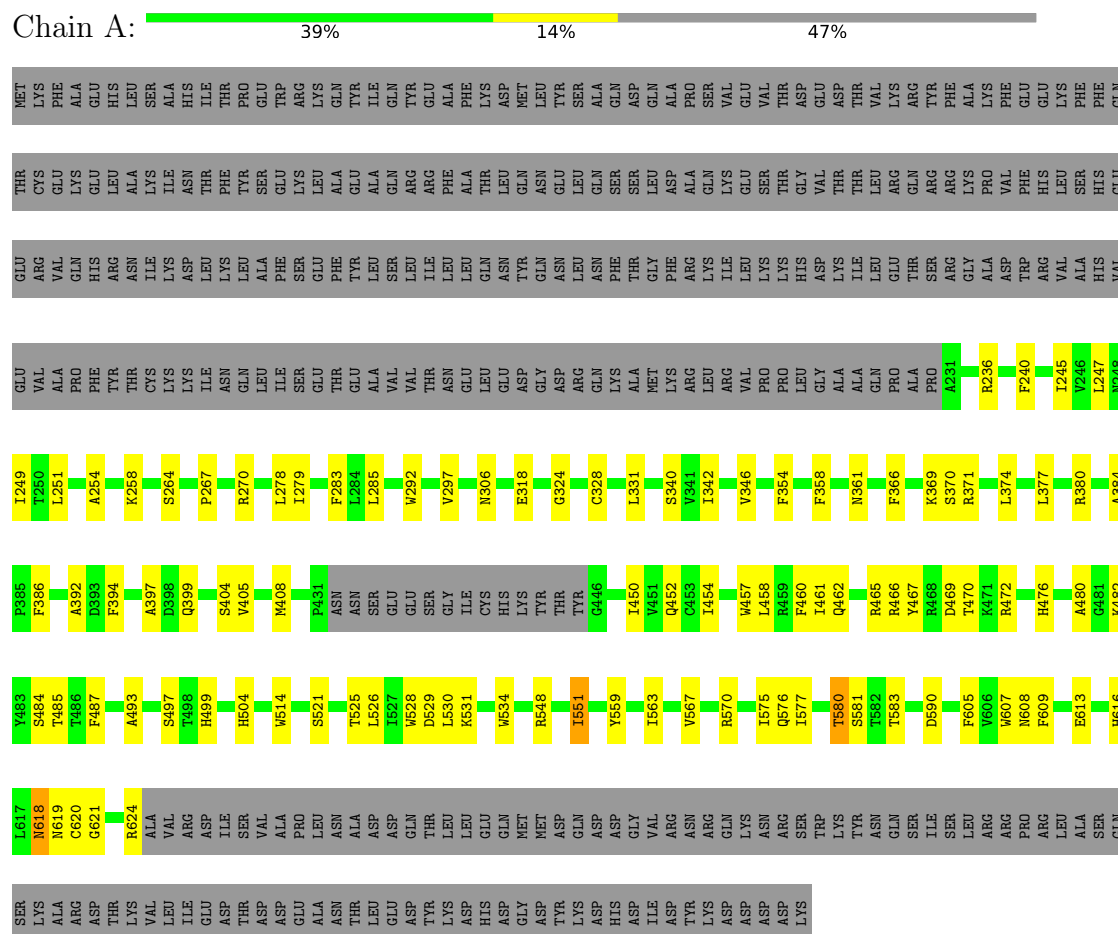


Mol	Chain	Residues	Atoms			AltConf
3	A	1	Total	O	P	0
			5	4	1	

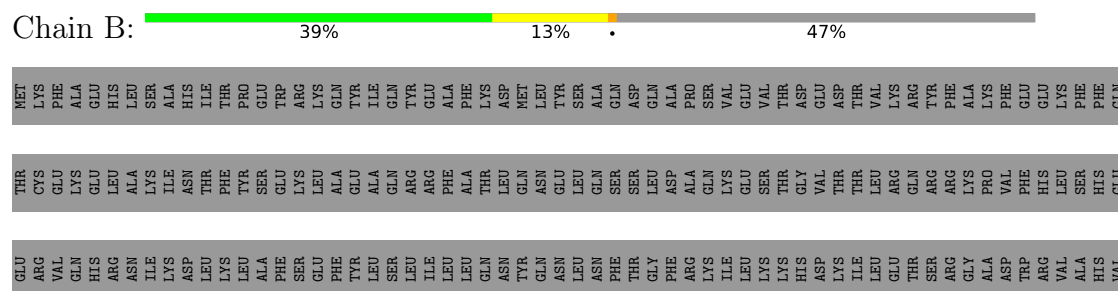
3 Residue-property plots

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: Solute carrier family 53 member 1



• Molecule 1: Solute carrier family 53 member 1



ILE	ARG	L495	L463	R263	GLU
GLU	ASP	D506	S404	S264	VAL
ASP	ILE	Y512	V405	W265	ALA
ASP	VAL	Y516	M408	P267	PHE
ASP	ALA	V517	E411	L268	TYR
GLU	PRO	F518	I425	W269	THR
ALA	LEU	Y519	S426	R270	CYS
ASN	ASN	I520	K427	L271	LYS
THR	ALA	I525	G428	L277	ILE
LEU	ASP	T526	L429	L278	ILE
ASP	GLN	L529	L430	L279	ASN
GLN	THR	D529	P431	L285	GLN
THR	LEU	D533	ASN	L290	LEU
LYS	LEU	R548	ASN	Y290	GLU
LYS	GLU	V552	GLU	G291	THR
HIS	GLN	I563	GLU	W292	GLU
ASP	MET	F564	GLU	R293	ALA
GLY	MET	D566	GLY	Q294	ALA
ASP	ASP	I568	GLY	H299	VAL
LYS	GLN	L569	ILE	F303	THR
ASP	ASP	R570	CYS	N306	ASN
ASP	GLY	W573	HIS	P307	GLU
ASP	VAL	T574	LYS	R308	LEU
ASP	ARG	D590	G446	S309	ASP
ASP	ARG	F596	W447	N310	ASP
ASP	ASN	A597	R448	G324	ARG
ASP	ASN	P598	C453	I325	GLN
LYS	TRP	L599	I454	L331	LYS
LYS	LYS	E600	P455	L332	MET
LYS	TYR	R603	A456	F336	ARG
LYS	ASN	N608	W457	I339	LEU
LYS	GLN	L612	I461	I342	ARG
LYS	ILE	E613	Q462	Y352	ARG
LYS	ILE	N614	C463	M355	ARG
LYS	LEU	L617	L464	V356	VAL
LYS	ARG	N618	R465	I359	PRO
LYS	ARG	F623	D469	I360	PRO
LYS	ARG	R624	A473	K369	PRO
LYS	PRO	ALA	L477	D353	LEU
LYS	LEU	LEU	G481	D388	ALA
LYS	ALA	SER	K482	Q399	ALA
LYS	GLN	GLN	Y483	S402	ALA
LYS	GLN	GLN	S484		
LYS	LYS	LYS	T485		
LYS	ALA	ALA	T486		
LYS	ASP	ASP	F487		
LYS	THR	THR	M489		
LYS	LYS	LYS			
LYS	VAL	VAL			
LYS	LEU	LEU			

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, C1	Depositor
Number of particles used	143463	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)	1200	Depositor
Maximum defocus (nm)	2200	Depositor
Magnification	Not provided	
Image detector	GATAN K3 BIOQUANTUM (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: PO4, PC1

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	0.16	0/3279	0.36	0/4460
1	B	0.15	0/3292	0.32	0/4479
All	All	0.16	0/6571	0.34	0/8939

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	3174	0	3174	65	0
1	B	3186	0	3186	63	0
2	A	108	0	176	10	0
2	B	108	0	176	5	0
3	A	5	0	0	0	0
All	All	6581	0	6712	131	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 10.

The worst 5 of 131 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:A:482:LYS:O	1:A:485:THR:OG1	2.09	0.71
1:A:452:GLN:NE2	1:A:577:ILE:O	2.28	0.67
1:A:548:ARG:NH1	1:A:613:GLU:OE2	2.25	0.65
1:A:285:LEU:HD21	2:A:801:PC1:H332	1.78	0.65
1:B:465:ARG:NH1	1:B:469:ASP:OD2	2.29	0.65

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	A	376/720 (52%)	356 (95%)	20 (5%)	0	100	100
1	B	378/720 (52%)	359 (95%)	19 (5%)	0	100	100
All	All	754/1440 (52%)	715 (95%)	39 (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	A	338/644 (52%)	327 (97%)	11 (3%)	33	62
1	B	339/644 (53%)	332 (98%)	7 (2%)	48	72
All	All	677/1288 (53%)	659 (97%)	18 (3%)	41	67

5 of 18 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	405	VAL
1	B	624	ARG
1	B	570	ARG
1	A	618	ASN
1	B	398	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 6 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	616	HIS
1	B	618	ASN
1	B	619	ASN
1	A	462	GLN
1	A	452	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](#)

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](#)

5 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	PC1	A	801	-	53,53,53	0.49	0	59,61,61	0.48	1 (1%)
3	PO4	A	803	-	4,4,4	1.34	1 (25%)	6,6,6	0.50	0
2	PC1	B	801	-	53,53,53	0.49	0	59,61,61	0.48	1 (1%)
2	PC1	A	802	-	53,53,53	0.50	0	59,61,61	0.48	1 (1%)
2	PC1	B	802	-	53,53,53	0.49	0	59,61,61	0.46	1 (1%)

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	PC1	B	801	-	-	16/57/57/57	-
2	PC1	B	802	-	-	22/57/57/57	-
2	PC1	A	801	-	-	16/57/57/57	-
2	PC1	A	802	-	-	14/57/57/57	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	803	PO4	P-O1	2.38	1.56	1.50

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	802	PC1	O12-P-O14	2.39	124.04	112.24
2	B	802	PC1	O12-P-O14	2.36	123.88	112.24
2	B	801	PC1	O12-P-O14	2.31	123.68	112.24
2	A	801	PC1	O12-P-O14	2.22	123.20	112.24

There are no chirality outliers.

5 of 68 torsion outliers are listed below:

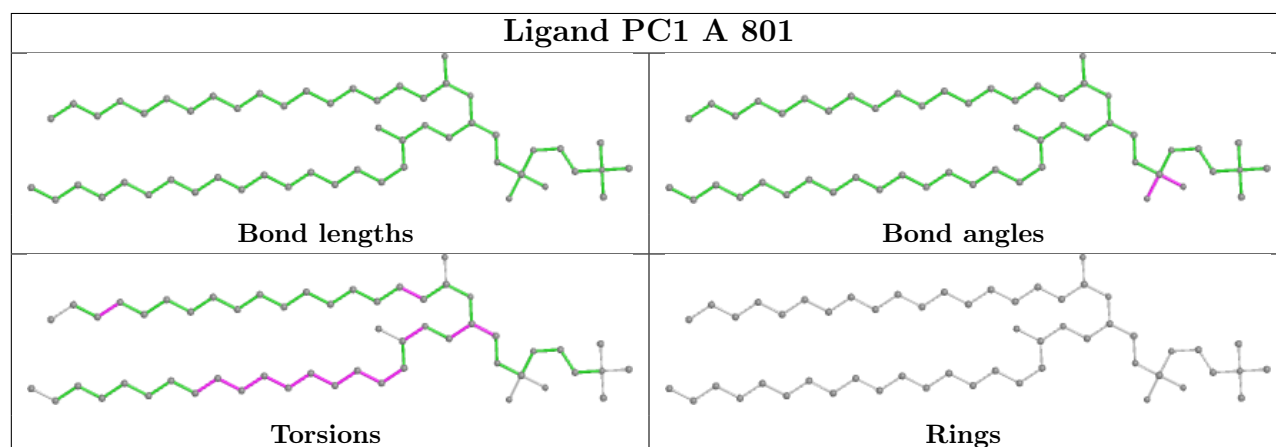
Mol	Chain	Res	Type	Atoms
2	A	802	PC1	C11-O13-P-O14
2	A	802	PC1	C11-O13-P-O11
2	A	802	PC1	O13-C11-C12-N
2	A	802	PC1	O22-C21-O21-C2
2	B	801	PC1	C11-O13-P-O12

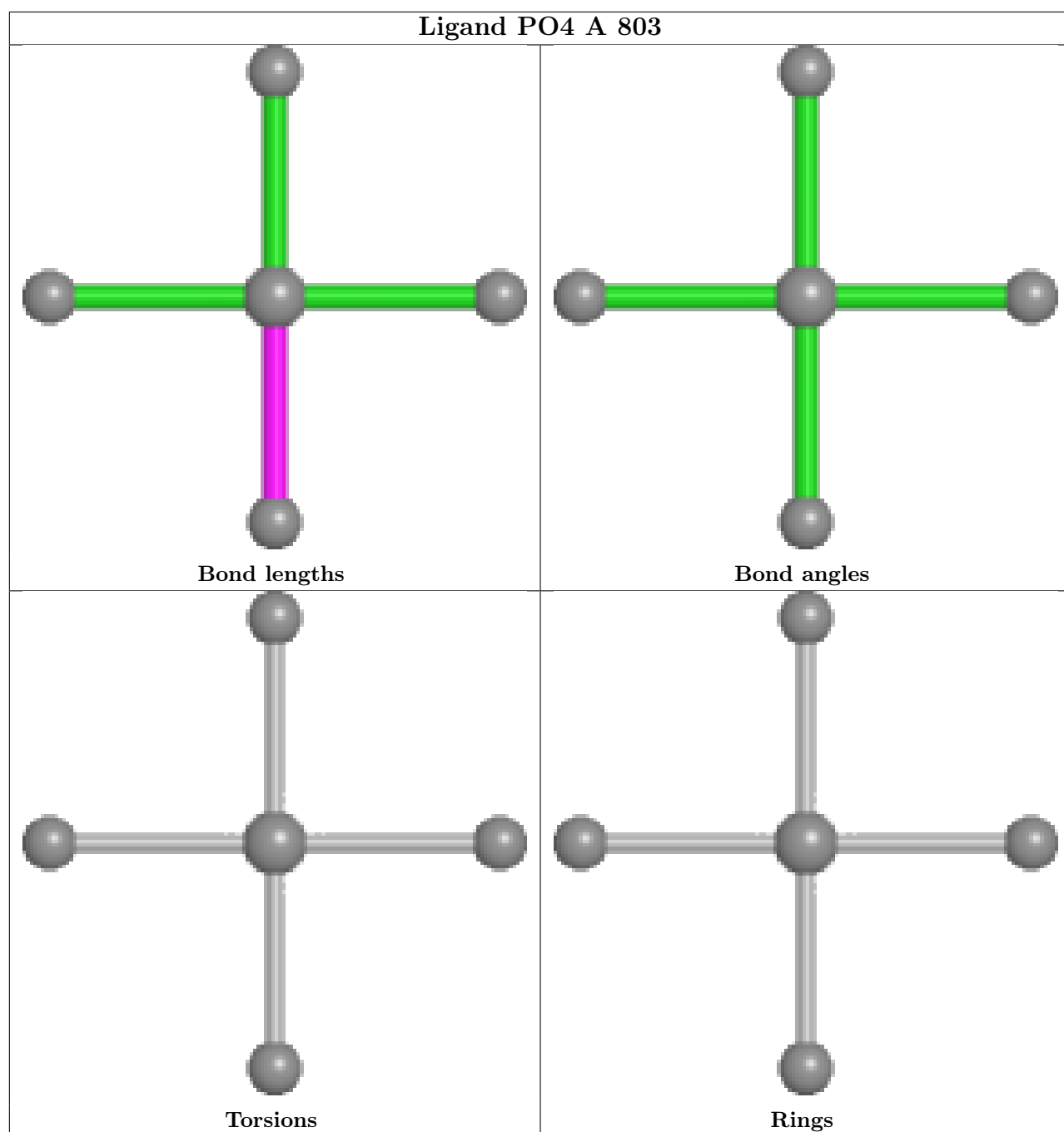
There are no ring outliers.

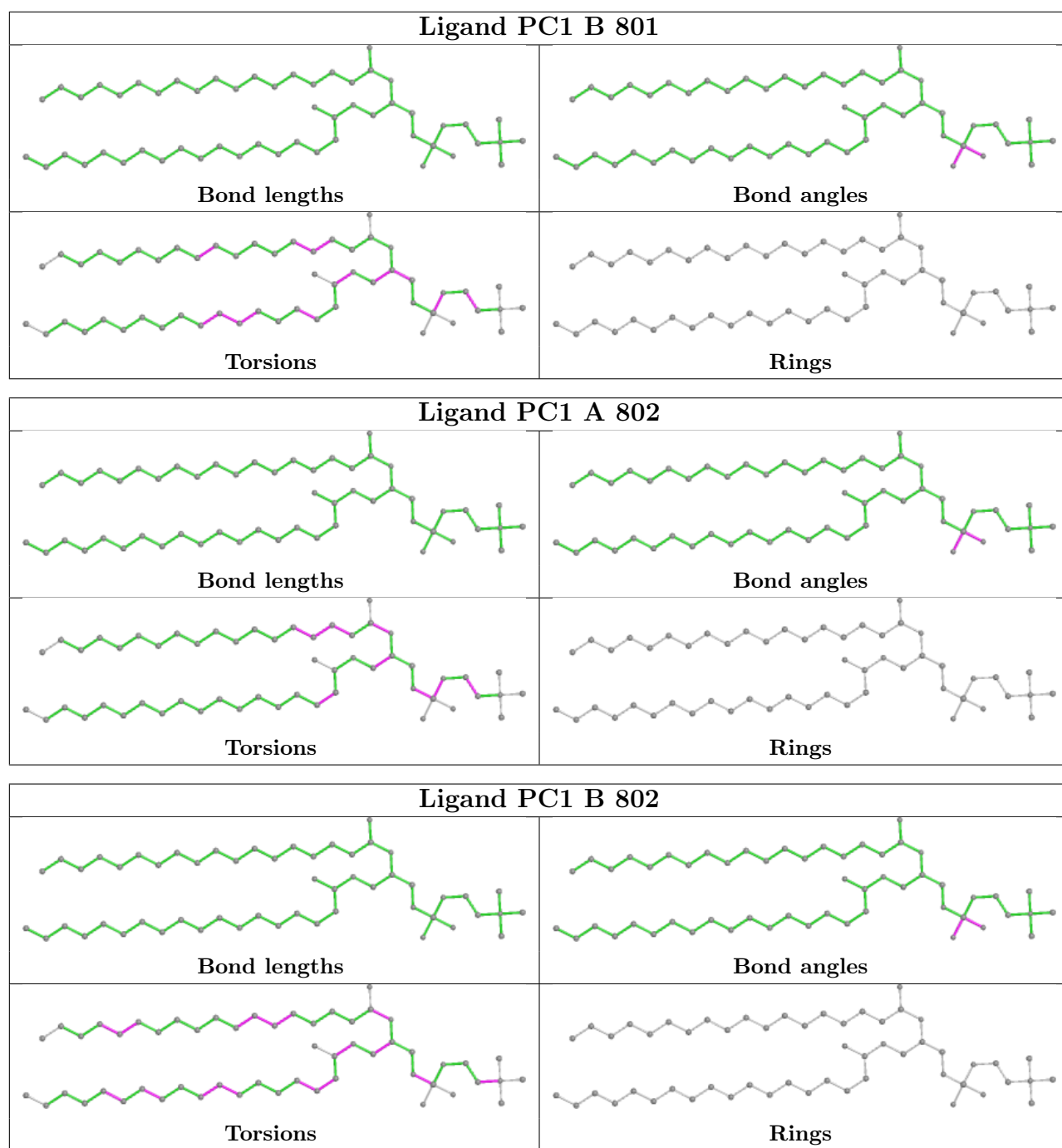
4 monomers are involved in 15 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	801	PC1	7	0
2	B	801	PC1	4	0
2	A	802	PC1	3	0
2	B	802	PC1	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 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.