



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 03:35 PM UTC

PDB ID : 5IKO / pdb_00005iko
Title : Crystal structure of human brain glycogen phosphorylase
Authors : Mathieu, C.; Li de la Sierra-Gallay, I.; Xu, X.; Haouz, A.; Rodrigues-Lima, F.
Deposited on : 2016-03-03
Resolution : 2.50 Å(reported)

This is a Full wwPDB X-ray Structure 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/XrayValidationReportHelp>

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:

MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

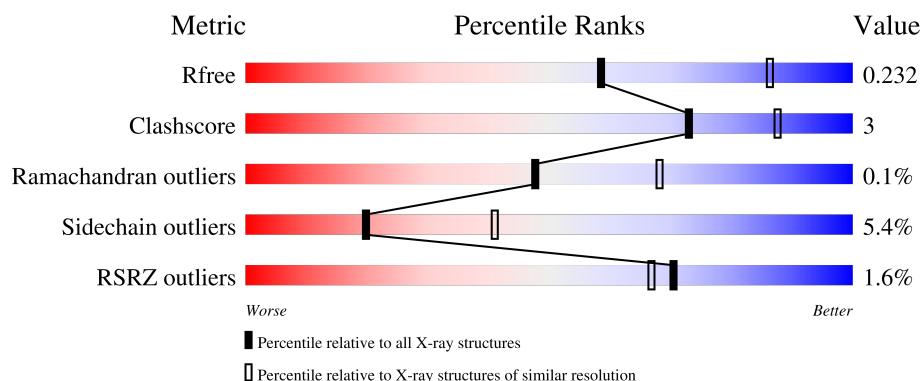
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

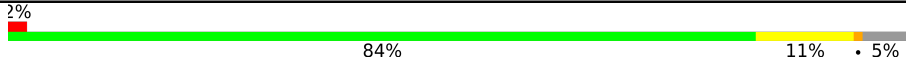
The reported resolution of this entry is 2.50 Å.

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)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	5829 (2.50-2.50)
Clashscore	190562	6492 (2.50-2.50)
Ramachandran outliers	187476	6378 (2.50-2.50)
Sidechain outliers	187428	6380 (2.50-2.50)
RSRZ outliers	180081	5833 (2.50-2.50)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower 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 $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	846	

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 6678 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, 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.

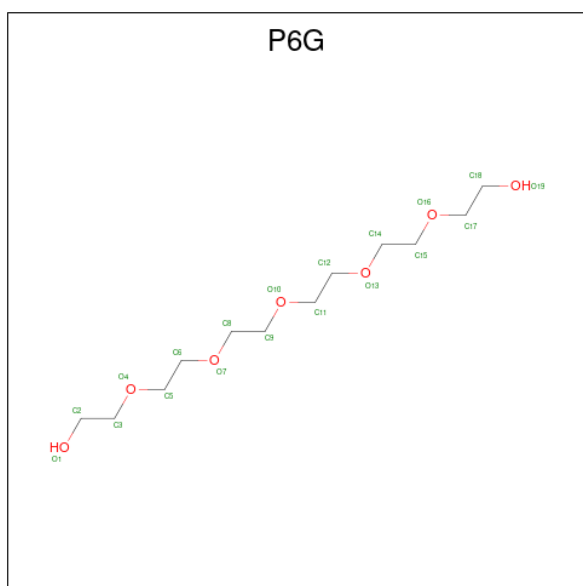
- Molecule 1 is a protein called Glycogen phosphorylase, brain form.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	807	6531	4176	1129	1195	31	0	1	0

There are 3 discrepancies between the modelled and reference sequences:

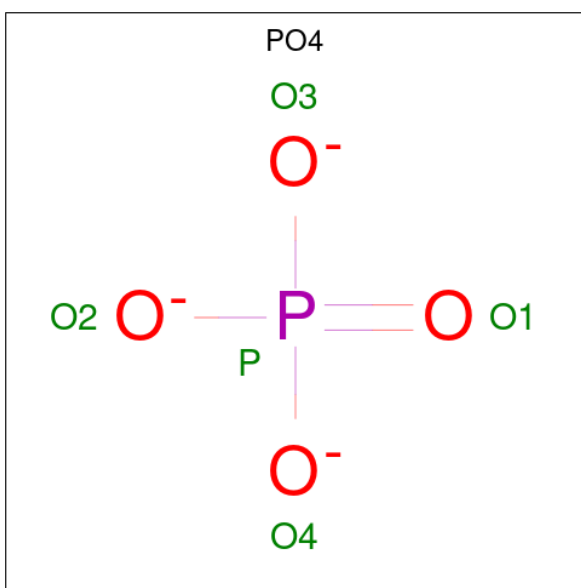
Chain	Residue	Modelled	Actual	Comment	Reference
A	-3	GLY	-	expression tag	UNP P11216
A	-2	SER	-	expression tag	UNP P11216
A	-1	HIS	-	expression tag	UNP P11216

- Molecule 2 is HEXAETHYLENE GLYCOL (CCD ID: P6G) (formula: $C_{12}H_{26}O_7$).



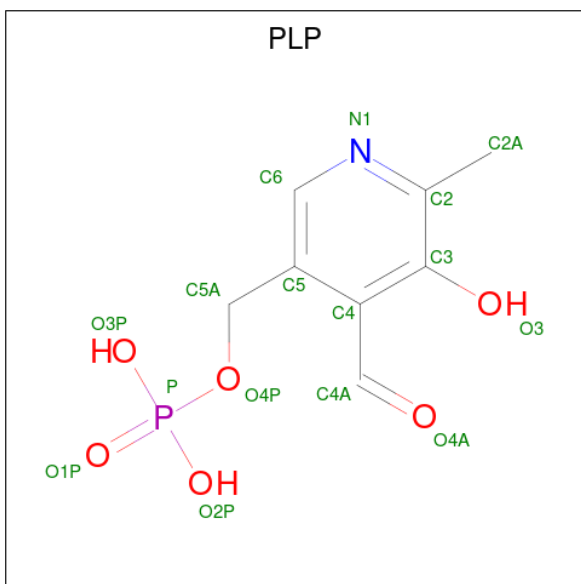
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	C	O	0	0
			19	12	7		
2	A	1	Total	C	O	0	0
			19	12	7		

- Molecule 3 is PHOSPHATE ION (CCD ID: PO4) (formula: O_4P).



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

- Molecule 4 is PYRIDOXAL-5'-PHOSPHATE (CCD ID: PLP) (formula: $\text{C}_8\text{H}_{10}\text{NO}_6\text{P}$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total	C	N	O	P	0	0
			15	8	1	5	1		

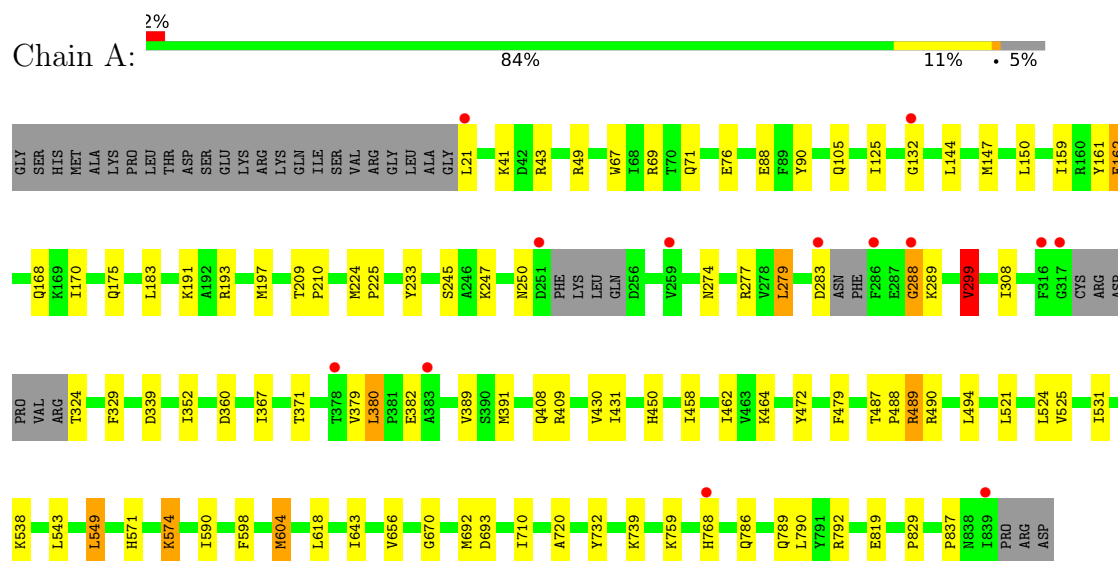
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	84	Total 84	O 84	0	0

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 and electron density. 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. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). 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: Glycogen phosphorylase, brain form



4 Data and refinement statistics

Property	Value	Source
Space group	P 6 2 2	Depositor
Cell constants a, b, c, α , β , γ	171.66Å 171.66Å 122.92Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	47.37 – 2.50 47.37 – 2.50	Depositor EDS
% Data completeness (in resolution range)	99.2 (47.37-2.50) 99.4 (47.37-2.50)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.14 (at 2.48Å)	Xtriage
Refinement program	REFMAC 5.8.0135	Depositor
R, R_{free}	0.187 , 0.239 0.187 , 0.232	Depositor DCC
R_{free} test set	1866 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	64.2	Xtriage
Anisotropy	0.166	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 38.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	6678	wwPDB-VP
Average B, all atoms (Å ²)	69.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.14% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

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: PLP, PO4, P6G

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	0.95	0/6684	1.18	3/9048 (0.0%)

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	656	VAL	N-CA-C	5.76	116.53	110.72
1	A	288	GLY	N-CA-C	-5.16	108.56	115.32
1	A	299	VAL	CB-CA-C	-5.15	105.11	112.22

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	6531	0	6478	40	0
2	A	38	0	52	6	0
3	A	10	0	0	0	0
4	A	15	0	7	0	0
5	A	84	0	0	2	0
All	All	6678	0	6537	42	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 (42) 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:367:ILE:O	1:A:371:THR:HG23	1.81	0.81
1:A:549:LEU:HD21	1:A:604:MET:HE1	1.74	0.69
2:A:901:P6G:H32	2:A:901:P6G:H81	1.80	0.63
2:A:901:P6G:H171	2:A:901:P6G:H31	1.81	0.61
1:A:168:GLN:HG3	1:A:175:GLN:HG3	1.84	0.58
1:A:274:ASN:HA	1:A:277:ARG:HB2	1.89	0.55
1:A:692:MET:HG2	1:A:710:ILE:HG21	1.89	0.54
1:A:521:LEU:HA	1:A:524:LEU:HD12	1.90	0.54
1:A:67:TRP:CE2	2:A:902:P6G:H32	2.46	0.51
1:A:69:ARG:HD3	1:A:837:PRO:HA	1.92	0.50
1:A:233:TYR:HB2	1:A:489:ARG:HD3	1.94	0.49
1:A:71:GLN:HG3	2:A:902:P6G:H31	1.95	0.49
1:A:464:LYS:HG2	1:A:479:PHE:HB3	1.97	0.47
1:A:490:ARG:HA	1:A:494:LEU:HD12	1.97	0.46
1:A:670:GLY:H	1:A:693:ASP:CG	2.24	0.46
1:A:308:ILE:HD13	1:A:352:ILE:HG21	1.98	0.46
1:A:289:LYS:HG3	1:A:391:MET:HE1	1.98	0.46
1:A:193:ARG:HB2	1:A:225:PRO:HG2	1.97	0.46
1:A:720:ALA:HB3	2:A:901:P6G:H111	1.98	0.45
1:A:732:TYR:CE1	1:A:739:LYS:HG3	2.51	0.45
1:A:88:GLU:HG2	1:A:132:GLY:HA2	1.99	0.44
1:A:571:HIS:HB3	1:A:574:LYS:HG3	1.99	0.44
1:A:786:GLN:HA	1:A:789:GLN:HE21	1.83	0.43
1:A:379:VAL:HG23	1:A:462:ILE:HG21	2.00	0.43
1:A:162:GLU:HA	1:A:183:LEU:HD12	2.01	0.43
1:A:224:MET:HB3	5:A:1064:HOH:O	2.19	0.42
1:A:150:LEU:HB3	1:A:829:PRO:HB3	2.02	0.42
1:A:144:LEU:HA	1:A:147:MET:HE3	2.01	0.42
1:A:161:TYR:CE2	1:A:279:LEU:HG	2.55	0.42
1:A:49:ARG:HA	1:A:125:ILE:HG21	2.01	0.42
1:A:209:THR:HB	1:A:210:PRO:HD2	2.02	0.41
1:A:450:HIS:HE1	5:A:1079:HOH:O	2.02	0.41
1:A:159:ILE:HG12	1:A:299:VAL:HG13	2.02	0.41
1:A:720:ALA:CB	2:A:901:P6G:H111	2.51	0.41
1:A:283:ASP:HB2	1:A:288:GLY:HA3	2.02	0.41
1:A:464:LYS:HD2	1:A:472:TYR:CE1	2.56	0.41
1:A:525:VAL:O	1:A:531:ILE:HD11	2.21	0.41
1:A:487:THR:HA	1:A:488:PRO:HD3	1.92	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:329:PHE:CD2	1:A:371:THR:HG21	2.56	0.40
1:A:590:ILE:HD11	1:A:598:PHE:CE2	2.56	0.40
1:A:159:ILE:CG1	1:A:299:VAL:HG13	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 X-ray entries followed by that with respect to entries of similar resolution.

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	800/846 (95%)	772 (96%)	27 (3%)	1 (0%)	48 68

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	380	LEU

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 X-ray entries followed by that with respect to entries of similar resolution.

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	704/737 (96%)	666 (95%)	38 (5%)	20 41

All (38) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	21	LEU
1	A	41	LYS
1	A	43	ARG
1	A	76	GLU
1	A	90	TYR
1	A	105	GLN
1	A	162	GLU
1	A	170	ILE
1	A	191	LYS
1	A	197	MET
1	A	245	SER
1	A	247	LYS
1	A	250	ASN
1	A	279	LEU
1	A	299	VAL
1	A	324	THR
1	A	339	ASP
1	A	360	ASP
1	A	380	LEU
1	A	382	GLU
1	A	389	VAL
1	A	408	GLN
1	A	409	ARG
1	A	430	VAL
1	A	431	ILE
1	A	458	ILE
1	A	489	ARG
1	A	538	LYS
1	A	543	LEU
1	A	549	LEU
1	A	574	LYS
1	A	604	MET
1	A	618	LEU
1	A	643	ILE
1	A	759	LYS
1	A	790	LEU
1	A	792	ARG
1	A	819	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (15) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	71	GLN

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Mol	Chain	Res	Type
1	A	101	ASN
1	A	106	ASN
1	A	114	GLN
1	A	305	GLN
1	A	413	HIS
1	A	450	HIS
1	A	453	ASN
1	A	465	GLN
1	A	484	ASN
1	A	496	ASN
1	A	517	GLN
1	A	541	ASN
1	A	614	HIS
1	A	789	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	P6G	A	901	-	18,18,18	0.47	0	17,17,17	0.74	0
3	PO4	A	904	-	4,4,4	0.84	0	6,6,6	0.51	0
2	P6G	A	902	-	18,18,18	0.52	0	17,17,17	0.62	0
3	PO4	A	903	-	4,4,4	0.98	0	6,6,6	0.84	0
4	PLP	A	905	1	15,15,16	3.53	3 (20%)	21,22,23	1.55	6 (28%)

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	P6G	A	901	-	-	9/16/16/16	-
4	PLP	A	905	1	-	2/6/6/8	0/1/1/1
2	P6G	A	902	-	-	5/16/16/16	-

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	905	PLP	C5-C4	10.51	1.52	1.40
4	A	905	PLP	C3-C2	7.95	1.49	1.41
4	A	905	PLP	C3-C4	2.35	1.44	1.40

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	905	PLP	O2P-P-O4P	-2.53	100.07	106.67
4	A	905	PLP	C6-N1-C2	2.31	123.40	119.20
4	A	905	PLP	O3-C3-C2	2.14	122.03	117.58
4	A	905	PLP	C6-C5-C4	2.06	119.79	118.10
4	A	905	PLP	O3P-P-O2P	2.05	115.49	107.80
4	A	905	PLP	O3P-P-O4P	2.03	111.96	106.67

There are no chirality outliers.

All (16) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	905	PLP	C5A-O4P-P-O2P
4	A	905	PLP	C5A-O4P-P-O3P
2	A	901	P6G	O4-C5-C6-O7

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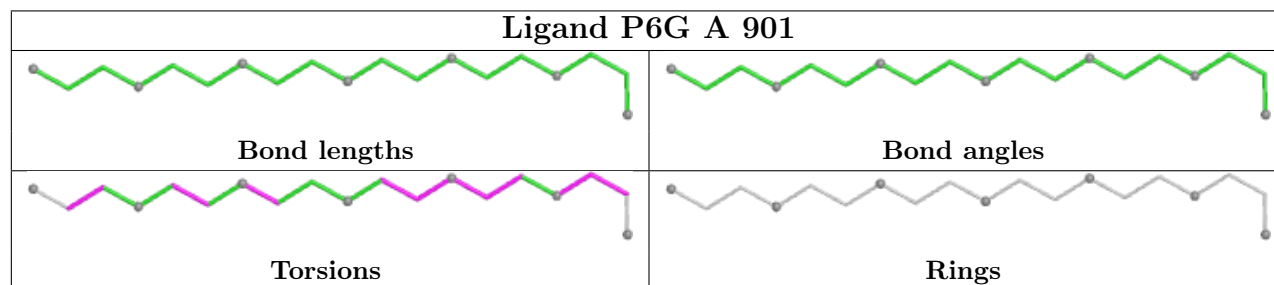
Mol	Chain	Res	Type	Atoms
2	A	901	P6G	O7-C8-C9-O10
2	A	902	P6G	O7-C8-C9-O10
2	A	901	P6G	O13-C14-C15-O16
2	A	901	P6G	O1-C2-C3-O4
2	A	901	P6G	O16-C17-C18-O19
2	A	901	P6G	C5-C6-O7-C8
2	A	901	P6G	C11-C12-O13-C14
2	A	901	P6G	C9-C8-O7-C6
2	A	901	P6G	C2-C3-O4-C5
2	A	902	P6G	O16-C17-C18-O19
2	A	902	P6G	C11-C12-O13-C14
2	A	902	P6G	O4-C5-C6-O7
2	A	902	P6G	C5-C6-O7-C8

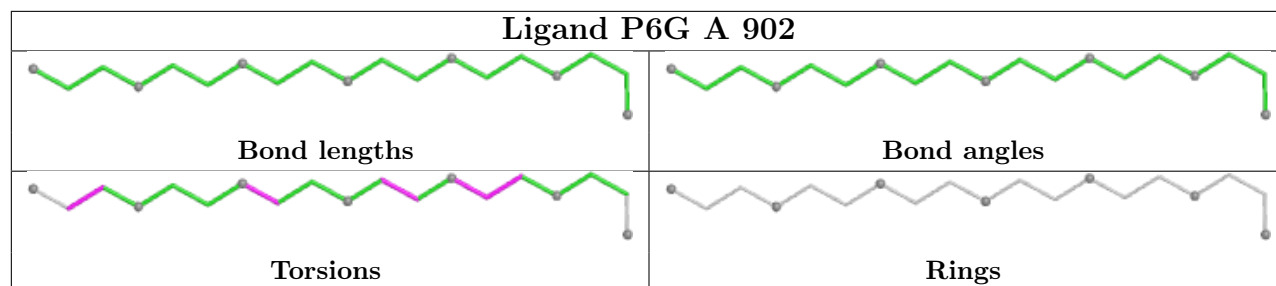
There are no ring outliers.

2 monomers are involved in 6 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	901	P6G	4	0
2	A	902	P6G	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.

6 Fit of model and data [i](#)

6.1 Protein, DNA and RNA chains [i](#)

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	807/846 (95%)	-0.15	13 (1%) 70 67	35, 66, 98, 143	1 (0%)

All (13) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	317	GLY	5.0
1	A	839	ILE	5.0
1	A	286	PHE	4.7
1	A	768[A]	HIS	4.5
1	A	378	THR	3.2
1	A	21	LEU	3.1
1	A	383	ALA	2.8
1	A	259	VAL	2.6
1	A	283	ASP	2.5
1	A	132	GLY	2.5
1	A	288	GLY	2.2
1	A	316	PHE	2.2
1	A	251	ASP	2.1

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

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

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

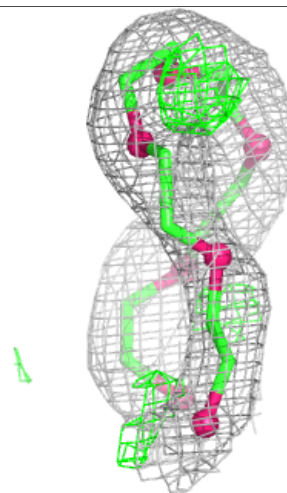
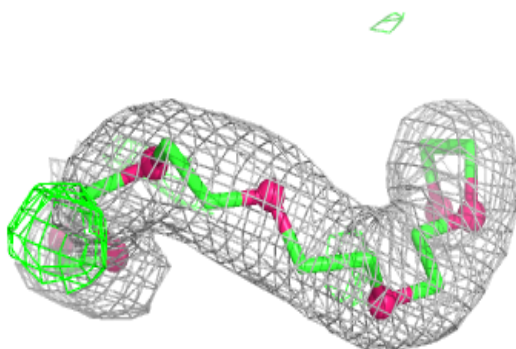
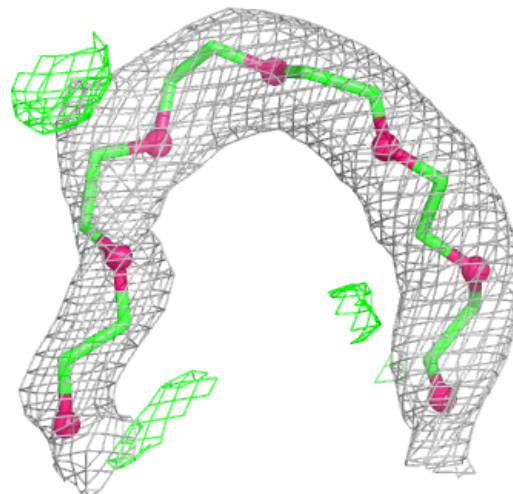
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q<0.9' lists the number of atoms with occupancy less than 0.9.

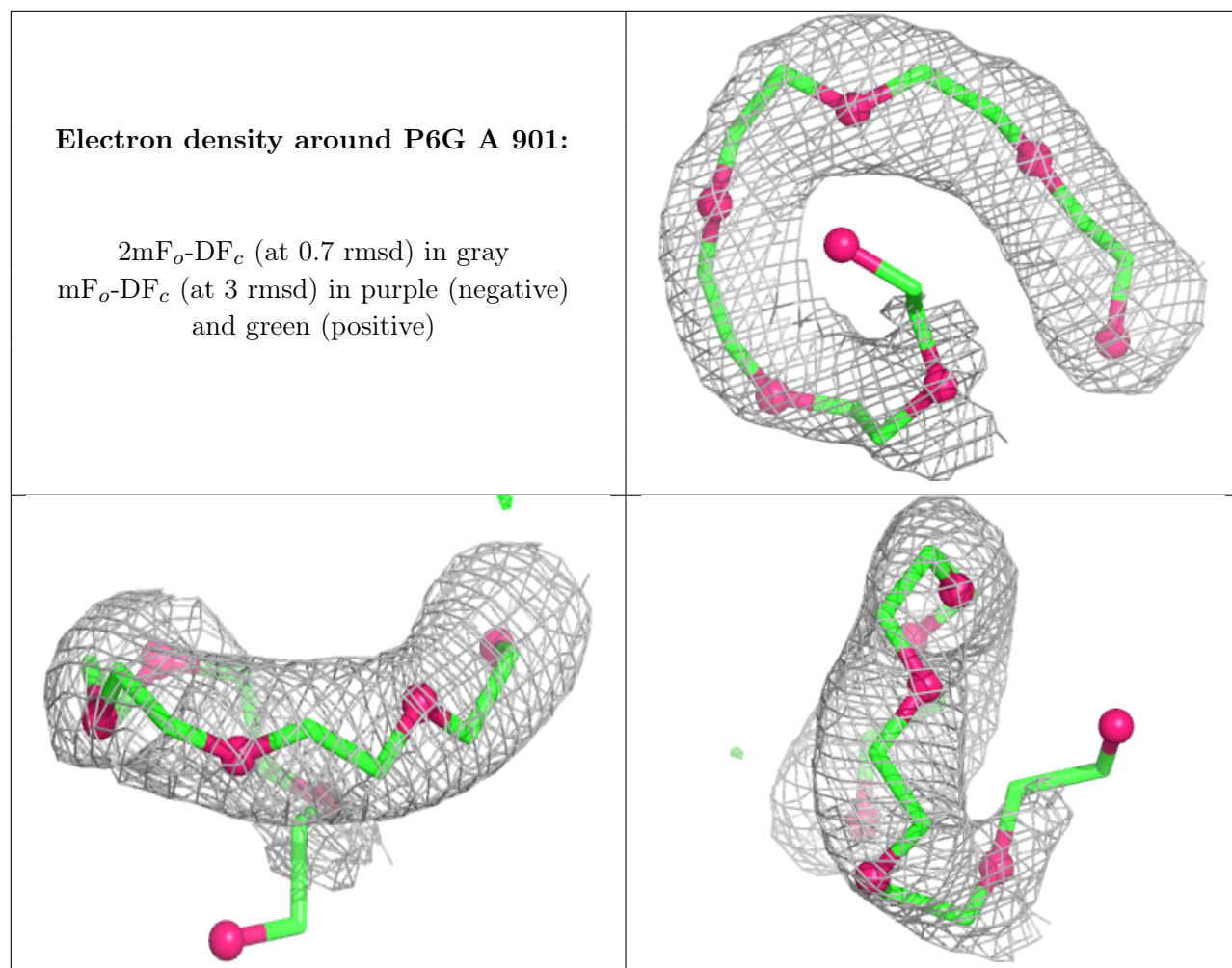
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	PO4	A	904	5/5	0.82	0.09	98,109,112,132	0
2	P6G	A	902	19/19	0.91	0.12	54,74,97,99	0
2	P6G	A	901	19/19	0.92	0.12	68,86,123,124	0
3	PO4	A	903	5/5	0.95	0.06	85,95,98,108	0
4	PLP	A	905	15/16	0.96	0.06	44,51,75,81	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

Electron density around P6G A 902:

2mF_o-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)





6.5 Other polymers [i](#)

There are no such residues in this entry.