



wwPDB X-ray Structure Validation Summary Report

Feb 28, 2014 – 10:58 PM GMT

PDB ID : 2ECP
Title : THE CRYSTAL STRUCTURE OF THE E. COLI MALTODEXTRIN PHOSPHORYLASE COMPLEX
Authors : O'Reilly, M.; Watson, K.A.; Johnson, L.N.
Deposited on : 1998-10-27
Resolution : 2.95 Å(reported)

This is a wwPDB validation summary report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at <http://wwpdb.org/ValidationPDFNotes.html>

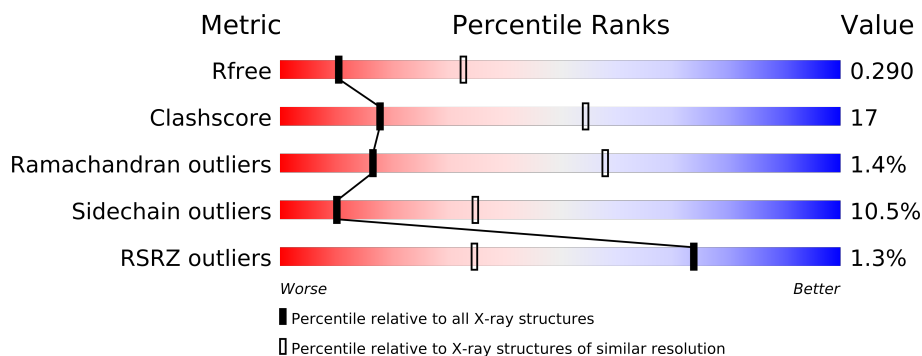
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity	:	4.02b-467
Mogul	:	1.15 2013
Xtriage (Phenix)	:	dev-1323
EDS	:	stable22639
Percentile statistics	:	21963
Refmac	:	5.8.0049
CCP4	:	6.3.0 (Settle)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et. al. (1996)
Validation Pipeline (wwPDB-VP)	:	stable22683

1 Overall quality at a glance

The reported resolution of this entry is 2.95 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}	66092	1587 (3.00-2.92)
Clashscore	79885	2029 (3.00-2.92)
Ramachandran outliers	78287	1955 (3.00-2.92)
Sidechain outliers	78261	1958 (3.00-2.92)
RSRZ outliers	66119	1588 (3.00-2.92)

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 on the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Mol	Chain	Length	Quality of chain
1	A	796	
1	B	796	

The following table lists non-polymeric compounds that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Geometry	Electron density
4	GOL	A	998	-	X
4	GOL	B	998	-	X

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 12961 atoms, of which 0 are hydrogen and 0 are deuterium.

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.

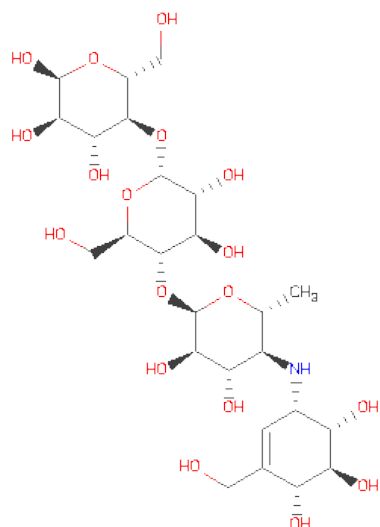
- Molecule 1 is a protein called MALTODEXTRIN PHOSPHORYLASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	796	Total	C	N	O	S	0	0	0
			6369	4065	1127	1157	20			
1	B	796	Total	C	N	O	S	0	0	0
			6369	4065	1127	1157	20			

There are 10 discrepancies between the modelled and reference sequences:

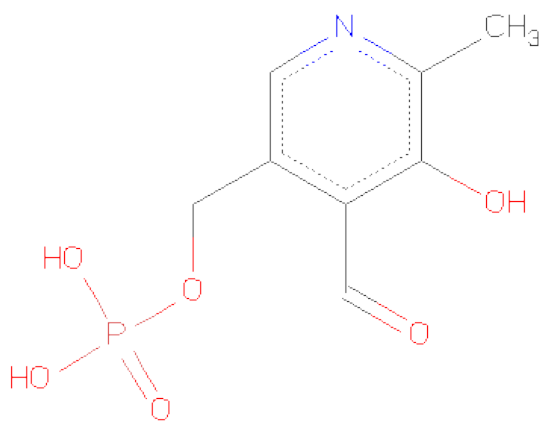
Chain	Residue	Modelled	Actual	Comment	Reference
A	205	ALA	LYS	CONFLICT	UNP P00490
A	532	ASP	GLN	CONFLICT	UNP P00490
A	582	ARG	HIS	CONFLICT	UNP P00490
A	716	LYS	GLU	CONFLICT	UNP P00490
A	828	ALA	LYS	CONFLICT	UNP P00490
B	205	ALA	LYS	CONFLICT	UNP P00490
B	532	ASP	GLN	CONFLICT	UNP P00490
B	582	ARG	HIS	CONFLICT	UNP P00490
B	716	LYS	GLU	CONFLICT	UNP P00490
B	828	ALA	LYS	CONFLICT	UNP P00490

- Molecule 2 is SUGAR (ACARBOSE) (three-letter code: ACR) (formula: C₂₅H₄₃NO₁₈).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	N	O	0	0
			44	25	1	18		
2	B	1	Total	C	N	O	0	0
			44	25	1	18		

- Molecule 3 is PYRIDOXAL-5'-PHOSPHATE (three-letter code: PLP) (formula: $C_8H_{10}NO_6P$).



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

- Molecule 4 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	C	O	0	0
			6	3	3		
4	B	1	Total	C	O	0	0
			6	3	3		

- Molecule 5 is water.

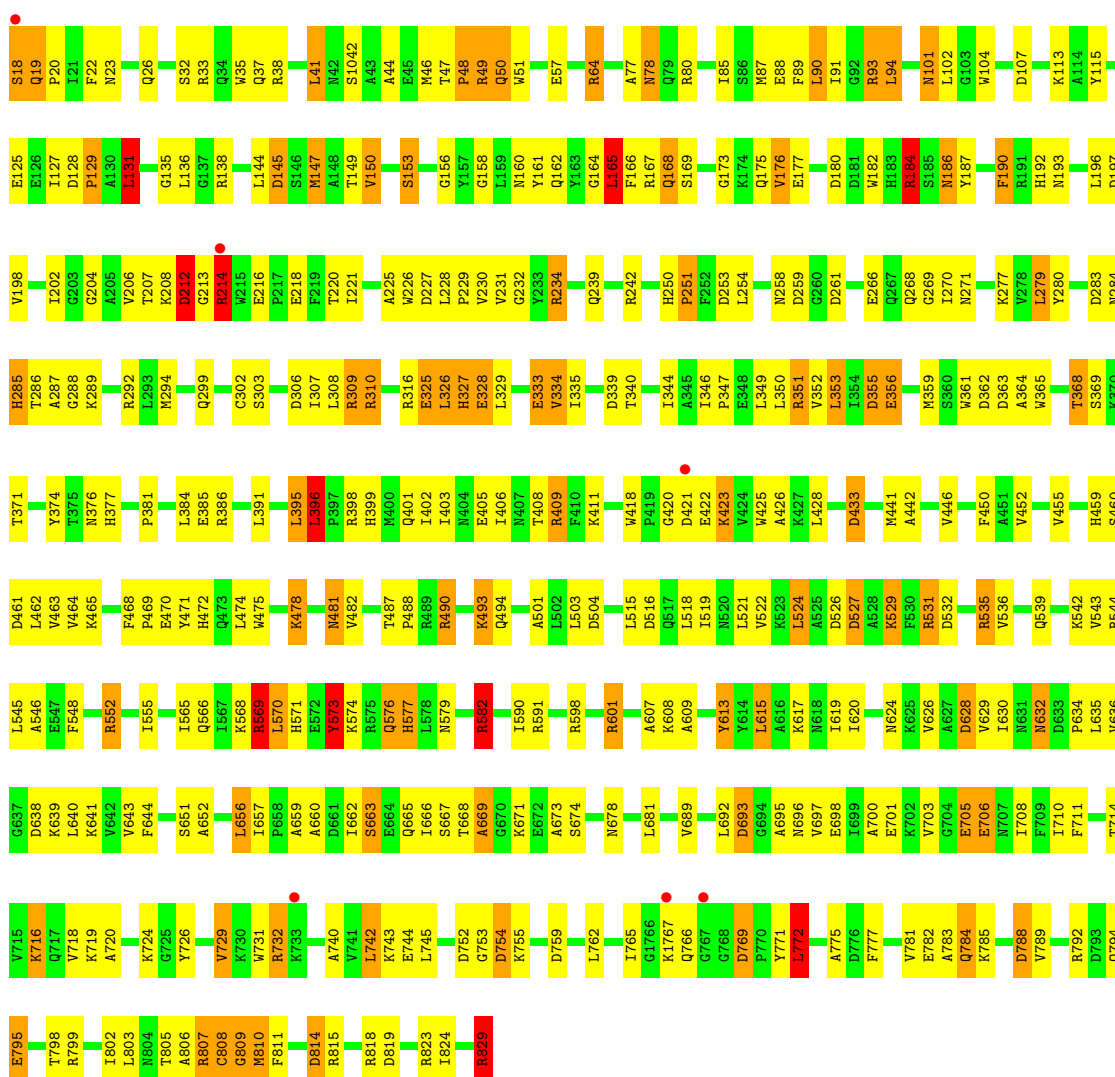
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	54	Total	O	0	0
			54	54		
5	B	39	Total	O	0	0
			39	39		

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 errors 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.

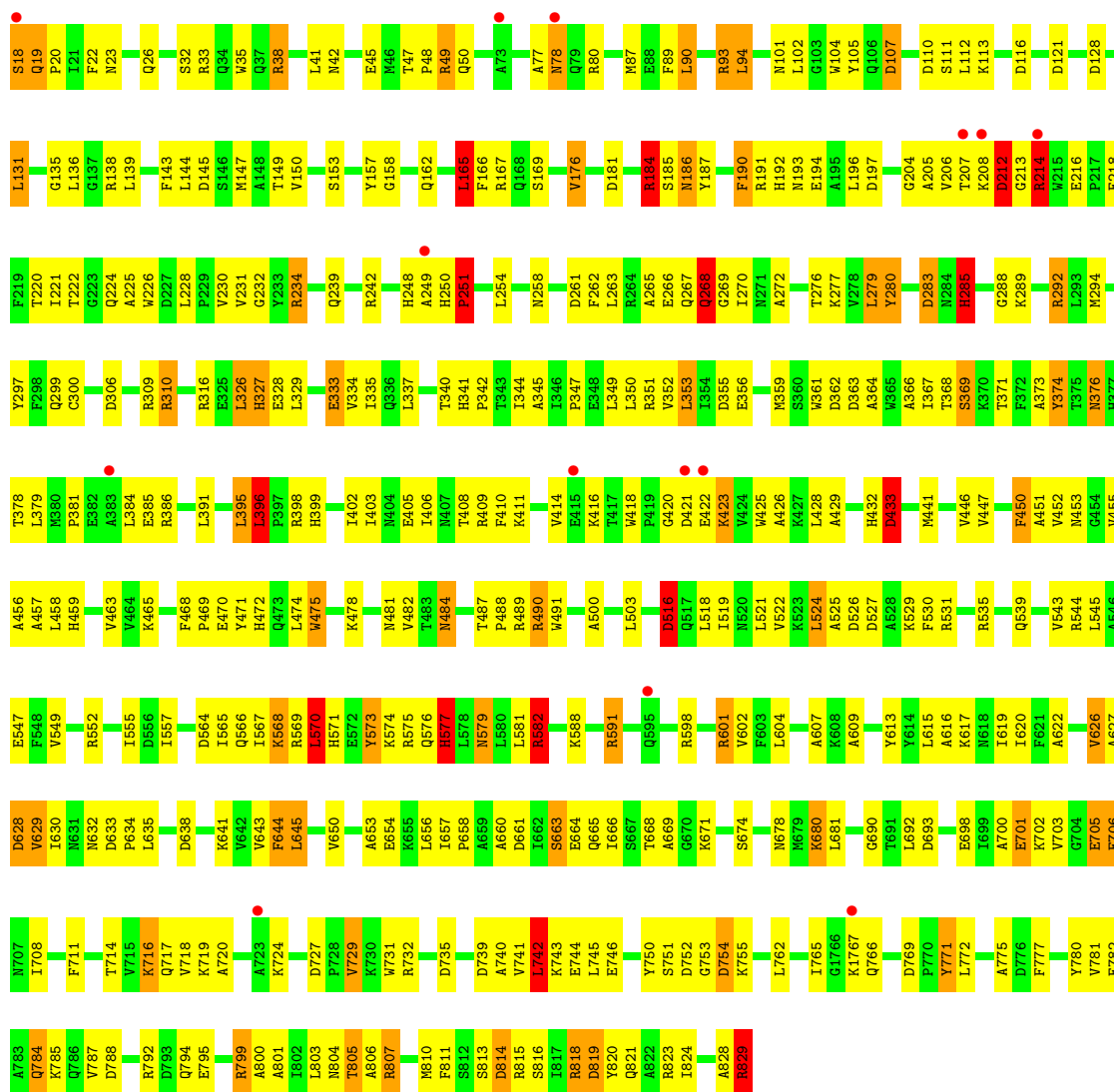
• Molecule 1: MALTODEXTRIN PHOSPHORYLASE

Chain A: 



• Molecule 1: MALTODEXTRIN PHOSPHORYLASE

Chain B: 



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	76.49Å 105.84Å 217.72Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	15.00 – 2.95 15.00 – 2.95	Depositor EDS
% Data completeness (in resolution range)	88.9 (15.00-2.95) 88.5 (15.00-2.95)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.81 (at 2.96Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.241 , 0.293 0.243 , 0.290	Depositor DCC
R_{free} test set	852 reflections (2.62%)	DCC
Wilson B-factor (Å ²)	52.5	Xtriage
Anisotropy	0.065	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.28 , 57.1	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning	$\langle L \rangle = 0.40$, $\langle L^2 \rangle = 0.23$	Xtriage
Outliers	0 of 33376 reflections	Xtriage
F_o, F_c correlation	0.88	EDS
Total number of atoms	12961	wwPDB-VP
Average B, all atoms (Å ²)	53.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.34% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: GOL, PLP, ACR

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	0.77	1/6517 (0.0%)	1.99	165/8841 (1.9%)
1	B	0.75	1/6517 (0.0%)	2.12	163/8841 (1.8%)
All	All	0.76	2/13034 (0.0%)	2.05	328/17682 (1.9%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	B	0	1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	569	ARG	NE-CZ	-5.76	1.25	1.33
1	B	292	ARG	CD-NE	-5.03	1.38	1.46

The worst 5 of 328 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	292	ARG	NE-CZ-NH2	65.00	152.80	120.30
1	A	292	ARG	NE-CZ-NH2	46.98	143.79	120.30
1	B	569	ARG	NE-CZ-NH2	44.11	142.35	120.30
1	A	569	ARG	NE-CZ-NH1	32.74	136.67	120.30
1	B	292	ARG	NE-CZ-NH1	-32.15	104.22	120.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	516	ASP	Mainchain

5.2 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 hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	6369	0	6324	223	0
1	B	6369	0	6324	220	0
2	A	44	0	43	3	0
2	B	44	0	43	5	0
3	A	15	0	6	1	0
3	B	15	0	6	3	0
4	A	6	0	8	2	0
4	B	6	0	8	0	0
5	A	54	0	0	11	0
5	B	39	0	0	9	0
All	All	12961	0	12762	440	0

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 17.

The worst 5 of 440 close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:A:716:LYS:HE2	1:A:719:LYS:HD2	1.42	0.99
1:A:522:VAL:HG11	5:A:1777:HOH:O	1.61	0.97
1:B:310:ARG:HD2	5:B:1804:HOH:O	1.71	0.88
1:A:266:GLU:HG3	1:B:270:ILE:HD13	1.55	0.87
1:B:292:ARG:NH2	2:B:992:ACR:O2B	2.09	0.85

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 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	794/796 (100%)	729 (92%)	54 (7%)	11 (1%)	16	58
1	B	794/796 (100%)	725 (91%)	58 (7%)	11 (1%)	16	58
All	All	1588/1592 (100%)	1454 (92%)	112 (7%)	22 (1%)	16	58

5 of 22 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	423	LYS
1	B	423	LYS
1	A	285	HIS
1	A	421	ASP
1	B	207	THR

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 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	665/665 (100%)	594 (89%)	71 (11%)	10	33
1	B	665/665 (100%)	596 (90%)	69 (10%)	10	35
All	All	1330/1330 (100%)	1190 (90%)	140 (10%)	10	35

5 of 140 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	742	LEU
1	B	165	LEU
1	B	716	LYS
1	A	766	GLN

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Mol	Chain	Res	Type
1	B	18	SER

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 41 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	784	GLN
1	B	183	HIS
1	B	579	ASN
1	B	26	GLN
1	B	109	GLN

5.3.3 RNA ⓘ

There are no RNA chains 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 carbohydrates in this entry.

5.6 Ligand geometry ⓘ

6 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	ACR	A	992	-	47,47,47	1.04	2 (4%)	70,70,70	2.51	22 (31%)
4	GOL	A	998	-	5,5,5	0.65	0	5,5,5	0.78	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
3	PLP	A	999	1	14,15,16	2.08	2 (14%)	20,22,23	1.93	5 (25%)
2	ACR	B	992	-	47,47,47	1.26	5 (10%)	70,70,70	2.40	22 (31%)
4	GOL	B	998	-	5,5,5	0.39	0	5,5,5	0.62	0
3	PLP	B	999	1	14,15,16	3.42	2 (14%)	20,22,23	1.85	4 (20%)

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	ACR	A	992	-	1/1/20/22	0/18/98/98	0/4/4/4
4	GOL	A	998	-	-	0/4/4/4	0/0/0/0
3	PLP	A	999	1	-	0/6/6/8	0/1/1/1
2	ACR	B	992	-	1/1/20/22	0/18/98/98	0/4/4/4
4	GOL	B	998	-	-	0/4/4/4	0/0/0/0
3	PLP	B	999	1	-	0/6/6/8	0/1/1/1

The worst 5 of 11 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	999	PLP	C3-C2	-11.73	1.32	1.40
3	A	999	PLP	C3-C2	-6.05	1.36	1.40
2	B	992	ACR	C7A-C5A	3.56	1.38	1.32
3	B	999	PLP	P-O3P	-3.37	1.42	1.54
3	A	999	PLP	P-O3P	-3.27	1.42	1.54

The worst 5 of 53 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	992	ACR	C6A-C5A-C4A	10.25	129.15	114.53
2	A	992	ACR	C6A-C5A-C4A	7.57	125.33	114.53
2	A	992	ACR	C7A-C1A-N4B	6.82	121.05	111.19
2	A	992	ACR	O3A-C3A-C4A	6.27	118.85	109.36
2	B	992	ACR	C2A-C1A-N4B	-6.03	101.27	111.95

All (2) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
2	A	992	ACR	C1D
2	B	992	ACR	C1D

There are no torsion outliers.

There are no ring outliers.

5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

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	796/796 (100%)	-0.18	6 (0%) 83 42	41, 50, 76, 114	0
1	B	796/796 (100%)	-0.27	14 (1%) 65 29	41, 50, 76, 114	0
All	All	1592/1592 (100%)	-0.22	20 (1%) 74 35	41, 50, 76, 114	0

The worst 5 of 20 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	18	SER	4.4
1	B	207	THR	4.1
1	B	723	ALA	3.8
1	B	421	ASP	3.6
1	B	208	LYS	3.2

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

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

6.3 Carbohydrates ⓘ

There are no carbohydrates in this entry.

6.4 Ligands ⓘ

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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	RSR	LLDF	B-factors(\AA^2)	Q<0.9
4	GOL	A	998	6/6	0.26	3.36	58,58,59,59	0
4	GOL	B	998	6/6	0.23	2.18	58,58,59,59	0
2	ACR	B	992	44/44	0.20	1.94	58,58,59,60	0
2	ACR	A	992	44/44	0.21	1.62	58,58,59,60	0
3	PLP	A	999	15/16	0.17	-0.07	37,42,47,51	0
3	PLP	B	999	15/16	0.11	-1.16	41,43,48,48	0

6.5 Other polymers ⓘ

There are no such residues in this entry.