W O R L D W I D E

wwPDB

P R O T E I N   D A T A   B A N K

wwPDB X-ray Structure Validation Summary Report (i)

Oct 11, 2021 – 07:29 PM EDT

PDB ID	:	2O8R
Title	:	Crystal Structure of Polyphosphate Kinase from Porphyromonas Gingivalis
Authors	:	Patskovsky, Y.; Toro, R.; Sauder, J.M.; Dickey, M.; Adams, J.M.; Ozyurt, S.; Wasserman, S.R.; Burley, S.K.; Almo, S.C.; New York SGX Research Center for Structural Genomics (NYSGXRC)
Deposited on	:	2006-12-12
Resolution	:	2.70 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 (i) symbol.

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

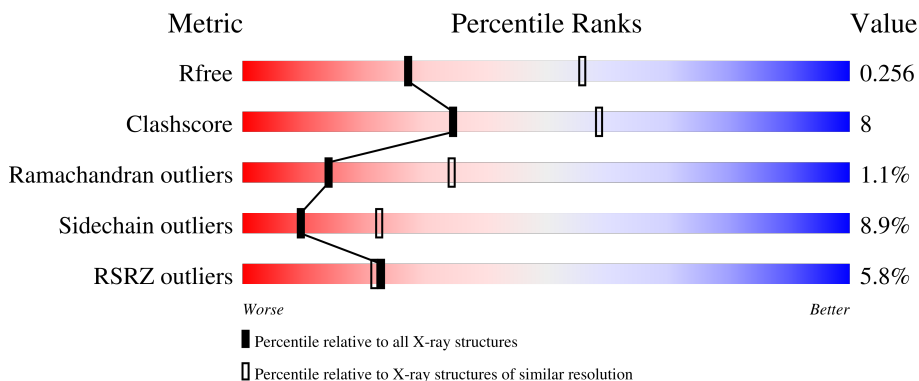|		
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.23.2
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.23.2

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 2.70 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	Percentile Ranks	Value
Rfree		0.256
Clashscore		8
Ramachandran outliers		1.1%
Sidechain outliers		8.9%
RSRZ outliers		5.8%

Worse   *Better*

▌ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	2808 (2.70-2.70)
Clashscore	141614	3122 (2.70-2.70)
Ramachandran outliers	138981	3069 (2.70-2.70)
Sidechain outliers	138945	3069 (2.70-2.70)
RSRZ outliers	127900	2737 (2.70-2.70)

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 <=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	705	2% / 70% / 20% / • / 8%
1	B	705	9% / 62% / 22% / • / 14%

2 Entry composition ⓘ

There are 3 unique types of molecules in this entry. The entry contains 10452 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 Polyphosphate kinase.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	648	Total 5344	C 3412	N 935	O 972	S 7	Se 18	0	4	0
1	B	605	Total 4987	C 3189	N 867	O 907	S 5	Se 19	0	3	0

There are 62 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-1	MSE	-	cloning artifact	UNP Q7MTR1
A	0	SER	-	cloning artifact	UNP Q7MTR1
A	1	LEU	MET	engineered mutation	UNP Q7MTR1
A	13	MSE	MET	engineered mutation	UNP Q7MTR1
A	24	MSE	MET	engineered mutation	UNP Q7MTR1
A	144	MSE	MET	engineered mutation	UNP Q7MTR1
A	225	MSE	MET	engineered mutation	UNP Q7MTR1
A	268	MSE	MET	engineered mutation	UNP Q7MTR1
A	273	MSE	MET	engineered mutation	UNP Q7MTR1
A	306	MSE	MET	engineered mutation	UNP Q7MTR1
A	335	MSE	MET	engineered mutation	UNP Q7MTR1
A	360	MSE	MET	engineered mutation	UNP Q7MTR1
A	420	MSE	MET	engineered mutation	UNP Q7MTR1
A	431	MSE	MET	engineered mutation	UNP Q7MTR1
A	478	MSE	MET	engineered mutation	UNP Q7MTR1
A	514	MSE	MET	engineered mutation	UNP Q7MTR1
A	537	MSE	MET	engineered mutation	UNP Q7MTR1
A	541	MSE	MET	engineered mutation	UNP Q7MTR1
A	577	MSE	MET	engineered mutation	UNP Q7MTR1
A	591	MSE	MET	engineered mutation	UNP Q7MTR1
A	617	MSE	MET	engineered mutation	UNP Q7MTR1
A	635	THR	ALA	engineered mutation	UNP Q7MTR1
A	690	THR	ALA	engineered mutation	UNP Q7MTR1
A	696	GLU	-	cloning artifact	UNP Q7MTR1
A	697	GLY	-	cloning artifact	UNP Q7MTR1

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Chain	Residue	Modelled	Actual	Comment	Reference
A	698	HIS	-	expression tag	UNP Q7MTR1
A	699	HIS	-	expression tag	UNP Q7MTR1
A	700	HIS	-	expression tag	UNP Q7MTR1
A	701	HIS	-	expression tag	UNP Q7MTR1
A	702	HIS	-	expression tag	UNP Q7MTR1
A	703	HIS	-	expression tag	UNP Q7MTR1
B	-1	MSE	-	cloning artifact	UNP Q7MTR1
B	0	SER	-	cloning artifact	UNP Q7MTR1
B	1	LEU	MET	engineered mutation	UNP Q7MTR1
B	13	MSE	MET	engineered mutation	UNP Q7MTR1
B	24	MSE	MET	engineered mutation	UNP Q7MTR1
B	144	MSE	MET	engineered mutation	UNP Q7MTR1
B	225	MSE	MET	engineered mutation	UNP Q7MTR1
B	268	MSE	MET	engineered mutation	UNP Q7MTR1
B	273	MSE	MET	engineered mutation	UNP Q7MTR1
B	306	MSE	MET	engineered mutation	UNP Q7MTR1
B	335	MSE	MET	engineered mutation	UNP Q7MTR1
B	360	MSE	MET	engineered mutation	UNP Q7MTR1
B	420	MSE	MET	engineered mutation	UNP Q7MTR1
B	431	MSE	MET	engineered mutation	UNP Q7MTR1
B	478	MSE	MET	engineered mutation	UNP Q7MTR1
B	514	MSE	MET	engineered mutation	UNP Q7MTR1
B	537	MSE	MET	engineered mutation	UNP Q7MTR1
B	541	MSE	MET	engineered mutation	UNP Q7MTR1
B	577	MSE	MET	engineered mutation	UNP Q7MTR1
B	591	MSE	MET	engineered mutation	UNP Q7MTR1
B	617	MSE	MET	engineered mutation	UNP Q7MTR1
B	635	THR	ALA	engineered mutation	UNP Q7MTR1
B	690	THR	ALA	engineered mutation	UNP Q7MTR1
B	696	GLU	-	cloning artifact	UNP Q7MTR1
B	697	GLY	-	cloning artifact	UNP Q7MTR1
B	698	HIS	-	expression tag	UNP Q7MTR1
B	699	HIS	-	expression tag	UNP Q7MTR1
B	700	HIS	-	expression tag	UNP Q7MTR1
B	701	HIS	-	expression tag	UNP Q7MTR1
B	702	HIS	-	expression tag	UNP Q7MTR1
B	703	HIS	-	expression tag	UNP Q7MTR1

- Molecule 2 is SULFATE ION (three-letter code: SO4) (formula: O_4S).

SO4

O1

O

O3 O⁻ — S — O⁻ O4

S

O

O2

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total 5	O 4	S 1	0	0
2	A	1	Total 5	O 4	S 1	0	0
2	A	1	Total 5	O 4	S 1	0	0
2	A	1	Total 5	O 4	S 1	0	0
2	A	1	Total 5	O 4	S 1	0	0
2	A	1	Total 5	O 4	S 1	0	0
2	A	1	Total 5	O 4	S 1	0	0
2	A	1	Total 5	O 4	S 1	0	0
2	B	1	Total 5	O 4	S 1	0	0
2	B	1	Total 5	O 4	S 1	0	0
2	B	1	Total 5	O 4	S 1	0	0
2	B	1	Total 5	O 4	S 1	0	0
2	B	1	Total 5	O 4	S 1	0	0

- Molecule 3 is water.

WORLDWIDE PDB
PROTEIN DATA BANK

| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	38	Total 38	O 38	0	0
3	B	18	Total 18	O 18	0	0

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 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: Polyphosphate kinase

Chain A:

• Molecule 1: Polyphosphate kinase

Chain B:
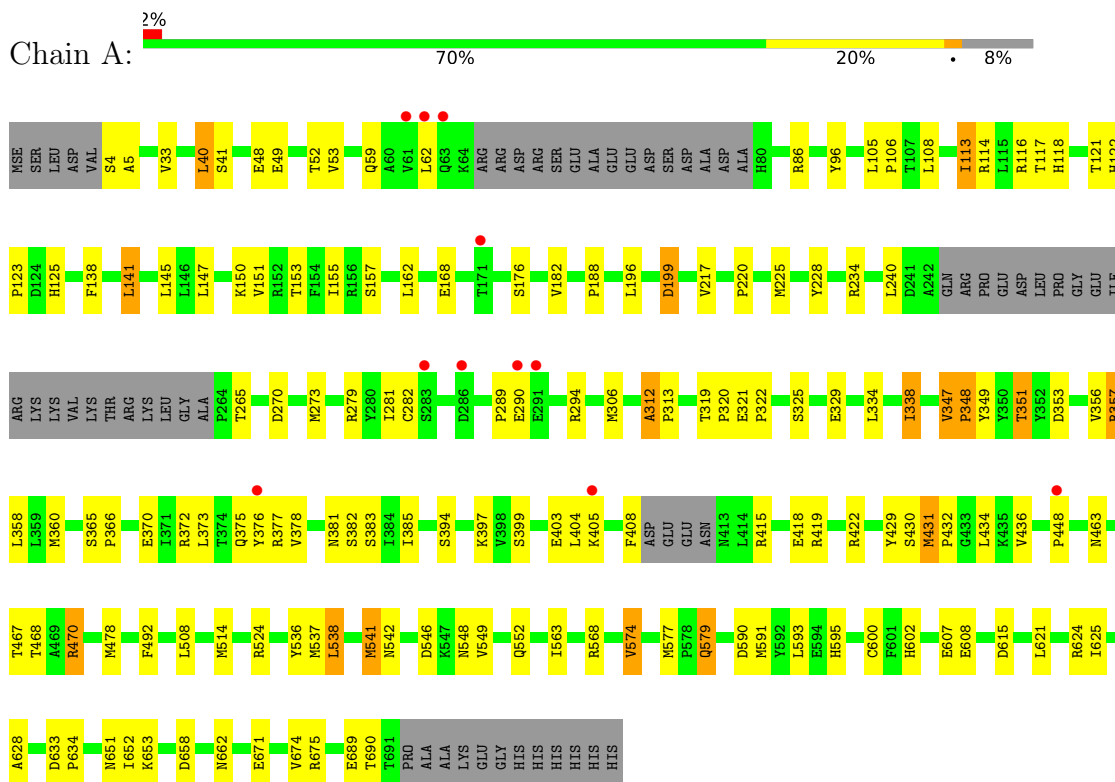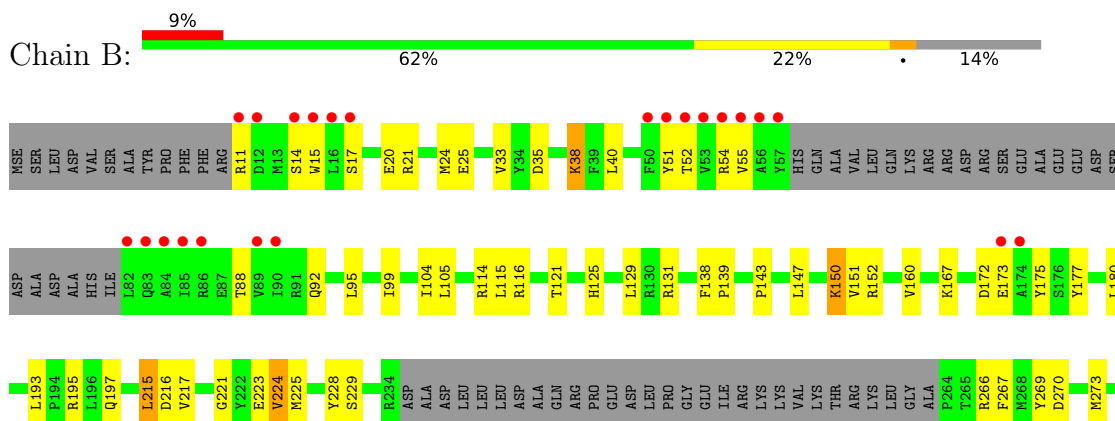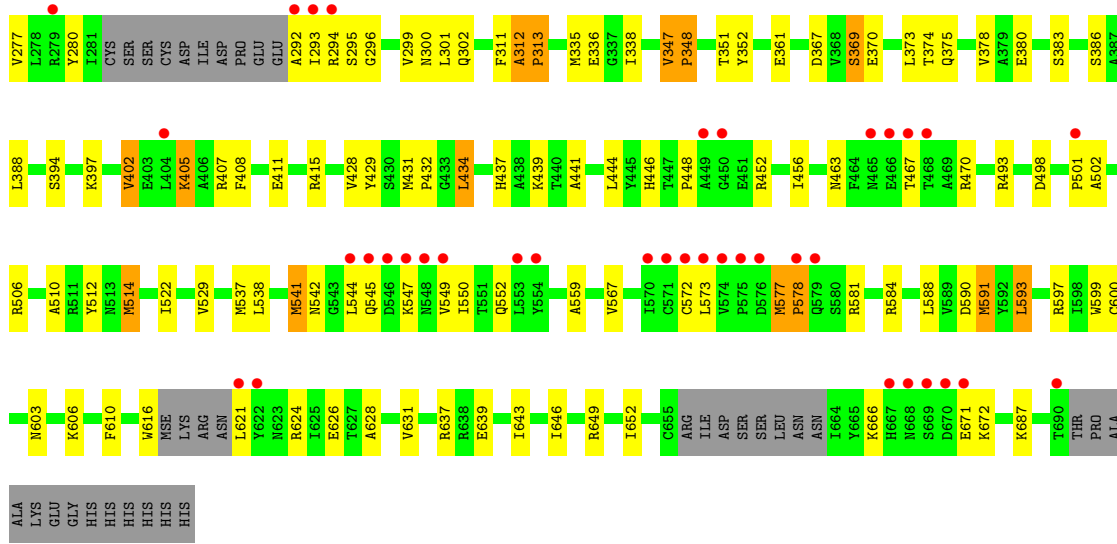
4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 65	Depositor
Cell constants a, b, c, α, β, γ	99.33Å 99.33Å 335.06Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	20.00 – 2.70 37.11 – 2.70	Depositor EDS
% Data completeness (in resolution range)	99.4 (20.00-2.70) 99.4 (37.11-2.70)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	0.09	Depositor
$< I/\sigma(I) >$ [1]	2.04 (at 2.68Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.188 , 0.255 0.188 , 0.256	Depositor DCC
R_{free} test set	1583 reflections (3.11%)	wwPDB-VP
Wilson B-factor (Å^2)	62.2	Xtriage
Anisotropy	0.053	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.31 , 69.1	EDS
L-test for twinning [2]	$< |L| > = 0.47, < L^2 > = 0.30$	Xtriage
Estimated twinning fraction	0.067 for h,-h-k,-l	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	10452	wwPDB-VP
Average B, all atoms (Å^2)	72.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.16% of the height of the origin peak. No significant pseudotranslation is detected.*

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[1]Intensities estimated from amplitudes.
[2]Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5   Model quality ⓘ

5.1   Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: SO4

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	0.42	0/5452	0.65	2/7348 (0.0%)
1	B	0.41	0/5083	0.61	2/6849 (0.0%)
All	All	0.42	0/10535	0.63	4/14197 (0.0%)

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	A	0	1
1	B	0	1
All	All	0	2

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	347	VAL	C-N-CD	-10.48	97.55	120.60
1	A	347	VAL	C-N-CD	-10.34	97.85	120.60
1	B	347	VAL	C-N-CA	6.35	148.68	122.00
1	A	347	VAL	C-N-CA	5.97	147.09	122.00

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	347	VAL	Peptide
1	B	347	VAL	Peptide

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	5344	0	5385	92	0
1	B	4987	0	5028	86	0
2	A	40	0	0	3	0
2	B	25	0	0	0	0
3	A	38	0	0	0	0
3	B	18	0	0	1	0
All	All	10452	0	10413	172	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 8.

The worst 5 of 172 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:357:ARG:HG2	1:A:357:ARG:HH21	1.26	0.97
1:A:312:ALA:HB3	1:A:313:PRO:HD3	1.49	0.92
1:B:312:ALA:HB1	1:B:313:PRO:HD3	1.51	0.92
1:A:312:ALA:CB	1:A:313:PRO:HD3	2.00	0.91
1:A:579:GLN:HE21	1:A:579:GLN:H	1.14	0.89

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	644/705 (91%)	612 (95%)	26 (4%)	6 (1%)	17	40

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	B	596/705 (84%)	553 (93%)	36 (6%)	7 (1%)	13	32
All	All	1240/1410 (88%)	1165 (94%)	62 (5%)	13 (1%)	14	37

5 of 13 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	312	ALA
1	A	348	PRO
1	A	448	PRO
1	B	312	ALA
1	B	348	PRO

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	587/612 (96%)	539 (92%)	48 (8%)	11	26
1	B	547/612 (89%)	493 (90%)	54 (10%)	8	18
All	All	1134/1224 (93%)	1032 (91%)	102 (9%)	9	22

5 of 102 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	114	ARG
1	B	336	GLU
1	B	666	LYS
1	B	150	LYS
1	B	224	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 16 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	651	ASN
1	B	545	GLN

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Mol	Chain	Res	Type
1	B	92	GLN
1	B	528	ASN
1	A	662	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 monosaccharides in this entry.

5.6   Ligand geometry ⓘ

13 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	SO4	A	704	-	4,4,4	0.17	0	6,6,6	0.18	0
2	SO4	A	711	-	4,4,4	0.14	0	6,6,6	0.17	0
2	SO4	B	707	-	4,4,4	0.15	0	6,6,6	0.06	0
2	SO4	B	708	-	4,4,4	0.13	0	6,6,6	0.10	0
2	SO4	A	705	-	4,4,4	0.10	0	6,6,6	0.22	0
2	SO4	A	706	-	4,4,4	0.17	0	6,6,6	0.14	0
2	SO4	A	710	-	4,4,4	0.18	0	6,6,6	0.10	0
2	SO4	A	708	-	4,4,4	0.15	0	6,6,6	0.12	0
2	SO4	A	709	-	4,4,4	0.14	0	6,6,6	0.13	0
2	SO4	B	704	-	4,4,4	0.14	0	6,6,6	0.11	0
2	SO4	A	707	-	4,4,4	0.19	0	6,6,6	0.33	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#|Z|>2$	Counts	RMSZ	$\#|Z|>2$
2	SO4	B	705	-	4,4,4	0.13	0	6,6,6	0.17	0
2	SO4	B	706	-	4,4,4	0.14	0	6,6,6	0.06	0

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

3 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	711	SO4	1	0
2	A	710	SO4	1	0
2	A	709	SO4	1	0

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(Å²)	Q<0.9
1	A	630/705 (89%)	-0.15	11 (1%)	70	72	39, 62, 107, 168	0
1	B	588/705 (83%)	0.22	60 (10%)	6	5	41, 72, 112, 163	0
All	All	1218/1410 (86%)	0.03	71 (5%)	23	22	39, 67, 109, 168	0

The worst 5 of 71 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	85	ILE	10.2
1	B	669	SER	8.4
1	B	571	CYS	7.5
1	B	573	LEU	7.2
1	B	578	PRO	6.8

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 monosaccharides 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. 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
2	SO4	B	707	5/5	0.84	0.19	138,140,146,150	0
2	SO4	B	708	5/5	0.84	0.15	123,145,145,147	0
2	SO4	A	705	5/5	0.91	0.16	89,114,127,132	0
2	SO4	B	705	5/5	0.91	0.14	108,109,122,138	0
2	SO4	A	710	5/5	0.93	0.17	103,116,127,134	0
2	SO4	A	706	5/5	0.93	0.21	101,117,123,127	0
2	SO4	B	706	5/5	0.95	0.15	116,122,128,133	0
2	SO4	A	707	5/5	0.96	0.20	68,68,92,102	0
2	SO4	A	711	5/5	0.97	0.17	131,132,134,135	0
2	SO4	B	704	5/5	0.97	0.09	88,96,109,111	0
2	SO4	A	704	5/5	0.97	0.09	79,84,104,105	0
2	SO4	A	708	5/5	0.98	0.13	114,123,127,134	0
2	SO4	A	709	5/5	0.99	0.09	66,77,96,99	0

6.5 Other polymers ⓘ

There are no such residues in this entry.