



wwPDB X-ray Structure Validation Summary Report ⓘ

Jun 13, 2024 – 01:06 AM EDT

PDB ID : 3CB3
Title : Crystal structure of L-Talarate dehydratase from Polaromonas sp. JS666 complexed with Mg and L-glucarate
Authors : Fedorov, A.A.; Fedorov, E.V.; Yew, W.S.; Burley, S.K.; Gerlt, J.A.; Almo, S.C.; New York SGX Research Center for Structural Genomics (NYSGXRC)
Deposited on : 2008-02-21
Resolution : 2.00 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 ⓘ 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	:	4.02b-467
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	1.20.1
EDS	:	2.36.2
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)	:	2.36.2

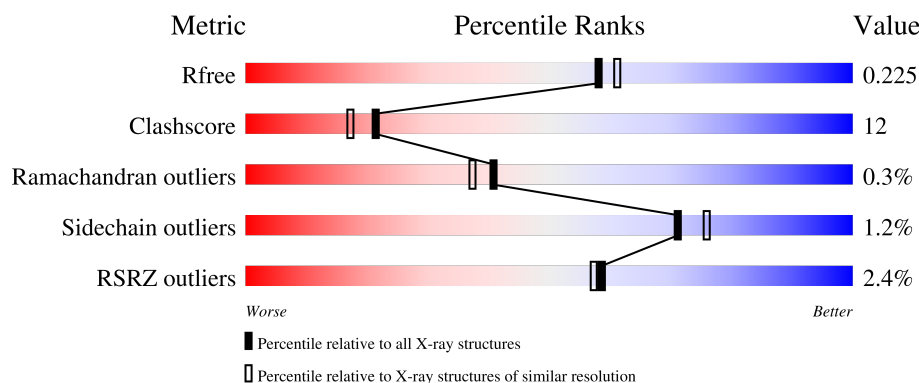
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.00 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}	130704	8085 (2.00-2.00)
Clashscore	141614	9178 (2.00-2.00)
Ramachandran outliers	138981	9054 (2.00-2.00)
Sidechain outliers	138945	9053 (2.00-2.00)
RSRZ outliers	127900	7900 (2.00-2.00)

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	393	
1	B	393	
1	C	393	
1	D	393	

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 11715 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 Mandelate racemase/muconate lactonizing enzyme.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	373	Total	C	N	O	S	0	0	0
			2867	1821	513	520	13			
1	B	361	Total	C	N	O	S	0	0	0
			2777	1766	495	503	13			
1	C	357	Total	C	N	O	S	0	0	0
			2750	1748	491	498	13			
1	D	358	Total	C	N	O	S	0	0	0
			2757	1753	492	499	13			

There are 44 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-1	MET	-	expression tag	UNP Q12GE3
A	0	SER	-	expression tag	UNP Q12GE3
A	1	LEU	-	expression tag	UNP Q12GE3
A	384	GLU	-	expression tag	UNP Q12GE3
A	385	GLY	-	expression tag	UNP Q12GE3
A	386	HIS	-	expression tag	UNP Q12GE3
A	387	HIS	-	expression tag	UNP Q12GE3
A	388	HIS	-	expression tag	UNP Q12GE3
A	389	HIS	-	expression tag	UNP Q12GE3
A	390	HIS	-	expression tag	UNP Q12GE3
A	391	HIS	-	expression tag	UNP Q12GE3
B	-1	MET	-	expression tag	UNP Q12GE3
B	0	SER	-	expression tag	UNP Q12GE3
B	1	LEU	-	expression tag	UNP Q12GE3
B	384	GLU	-	expression tag	UNP Q12GE3
B	385	GLY	-	expression tag	UNP Q12GE3
B	386	HIS	-	expression tag	UNP Q12GE3
B	387	HIS	-	expression tag	UNP Q12GE3
B	388	HIS	-	expression tag	UNP Q12GE3
B	389	HIS	-	expression tag	UNP Q12GE3
B	390	HIS	-	expression tag	UNP Q12GE3

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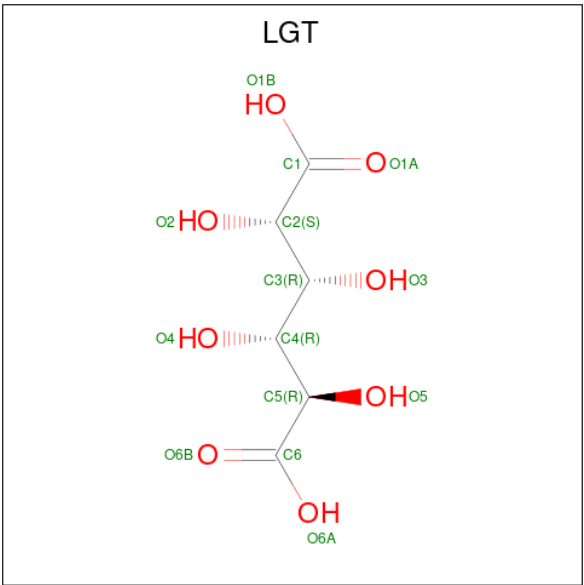
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Chain	Residue	Modelled	Actual	Comment	Reference
B	391	HIS	-	expression tag	UNP Q12GE3
C	-1	MET	-	expression tag	UNP Q12GE3
C	0	SER	-	expression tag	UNP Q12GE3
C	1	LEU	-	expression tag	UNP Q12GE3
C	384	GLU	-	expression tag	UNP Q12GE3
C	385	GLY	-	expression tag	UNP Q12GE3
C	386	HIS	-	expression tag	UNP Q12GE3
C	387	HIS	-	expression tag	UNP Q12GE3
C	388	HIS	-	expression tag	UNP Q12GE3
C	389	HIS	-	expression tag	UNP Q12GE3
C	390	HIS	-	expression tag	UNP Q12GE3
C	391	HIS	-	expression tag	UNP Q12GE3
D	-1	MET	-	expression tag	UNP Q12GE3
D	0	SER	-	expression tag	UNP Q12GE3
D	1	LEU	-	expression tag	UNP Q12GE3
D	384	GLU	-	expression tag	UNP Q12GE3
D	385	GLY	-	expression tag	UNP Q12GE3
D	386	HIS	-	expression tag	UNP Q12GE3
D	387	HIS	-	expression tag	UNP Q12GE3
D	388	HIS	-	expression tag	UNP Q12GE3
D	389	HIS	-	expression tag	UNP Q12GE3
D	390	HIS	-	expression tag	UNP Q12GE3
D	391	HIS	-	expression tag	UNP Q12GE3

- Molecule 2 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	2	Total Mg 2 2	0	0
2	B	2	Total Mg 2 2	0	0
2	C	2	Total Mg 2 2	0	0
2	D	2	Total Mg 2 2	0	0

- Molecule 3 is L-GLUCARIC ACID (three-letter code: LGT) (formula: C₆H₁₀O₈).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			14	6	8		
3	B	1	Total	C	O	0	0
			14	6	8		
3	C	1	Total	C	O	0	0
			14	6	8		
3	D	1	Total	C	O	0	0
			14	6	8		

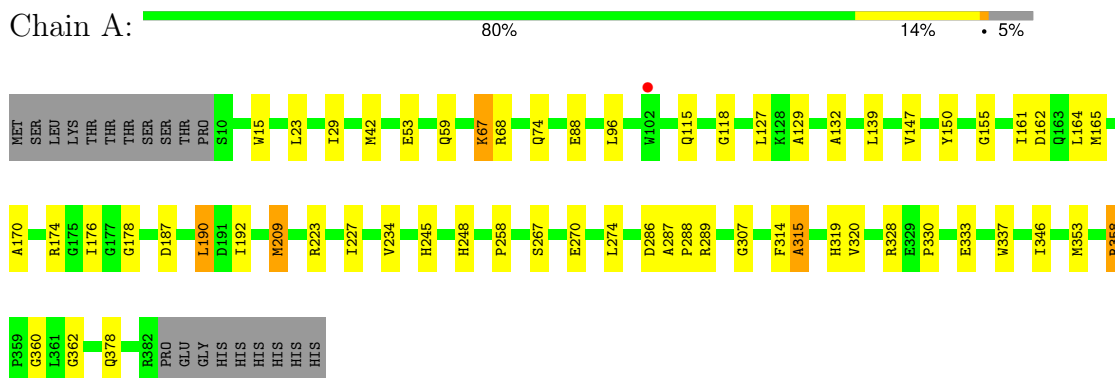
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	141	Total	O	0	0
			141	141		
4	B	123	Total	O	0	0
			123	123		
4	C	107	Total	O	0	0
			107	107		
4	D	129	Total	O	0	0
			129	129		

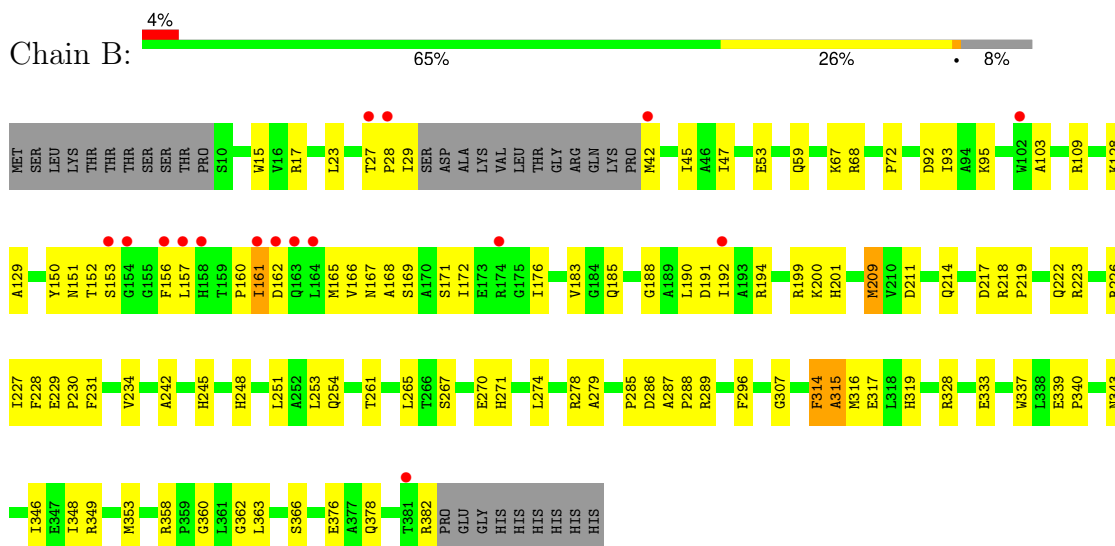
3 Residue-property plots [i](#)

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.

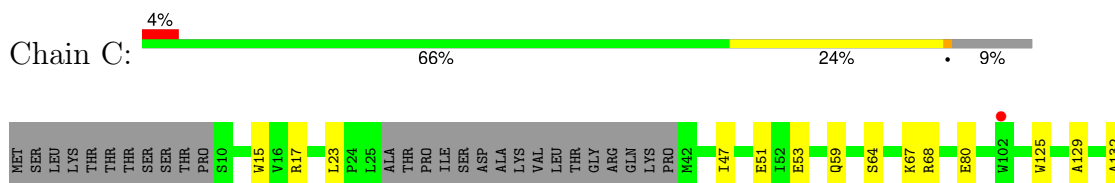
- Molecule 1: Mandelate racemase/muconate lactonizing enzyme

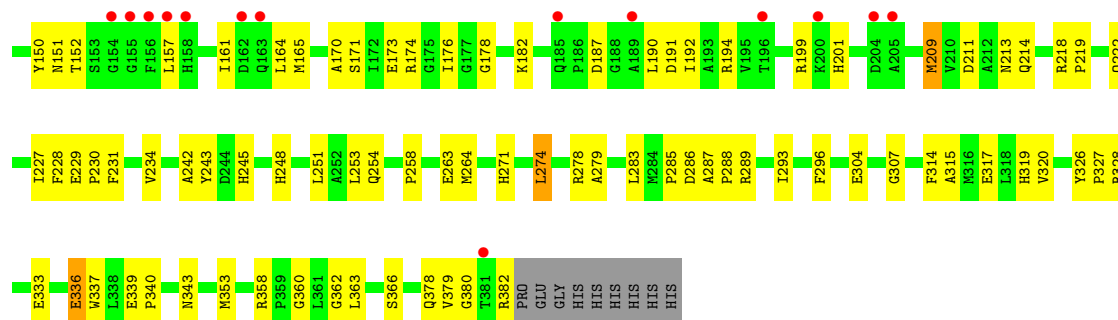


- Molecule 1: Mandelate racemase/muconate lactonizing enzyme

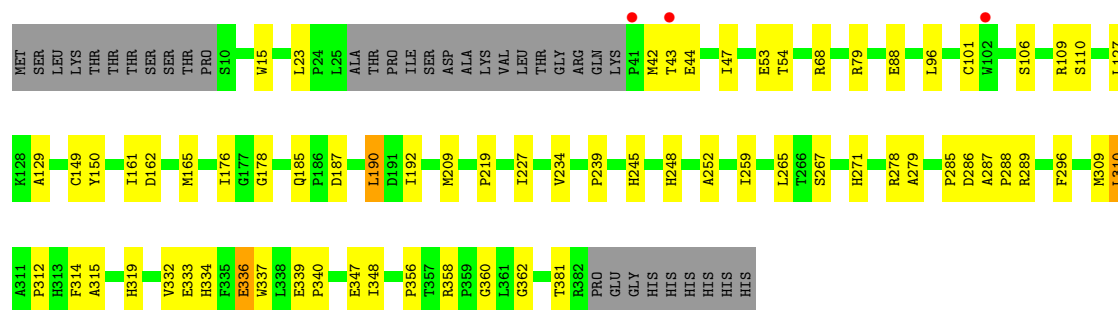
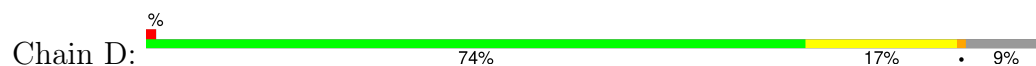


- Molecule 1: Mandelate racemase/muconate lactonizing enzyme





- Molecule 1: Mandelate racemase/muconate lactonizing enzyme



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	195.47Å 84.74Å 118.25Å 90.00° 126.04° 90.00°	Depositor
Resolution (Å)	24.91 – 2.00 39.51 – 2.00	Depositor EDS
% Data completeness (in resolution range)	94.7 (24.91-2.00) 94.6 (39.51-2.00)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.69 (at 2.00Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.210 , 0.239 0.200 , 0.225	Depositor DCC
R_{free} test set	5205 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å ²)	25.6	Xtriage
Anisotropy	0.219	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 46.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	0.022 for -h-2*k,l	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	11715	wwPDB-VP
Average B, all atoms (Å ²)	28.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 9.96% 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: MG, LGT

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	0.33	0/2938	0.57	0/3991
1	B	0.33	0/2846	0.57	0/3866
1	C	0.32	0/2818	0.58	0/3826
1	D	0.33	0/2826	0.58	0/3837
All	All	0.33	0/11428	0.57	0/15520

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	2867	0	2851	52	0
1	B	2777	0	2752	89	0
1	C	2750	0	2722	77	0
1	D	2757	0	2730	57	0
2	A	2	0	0	0	0
2	B	2	0	0	0	0
2	C	2	0	0	0	0
2	D	2	0	0	0	0
3	A	14	0	7	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	14	0	7	0	0
3	C	14	0	7	2	0
3	D	14	0	7	0	0
4	A	141	0	0	4	0
4	B	123	0	0	8	0
4	C	107	0	0	5	0
4	D	129	0	0	7	0
All	All	11715	0	11083	267	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 12.

The worst 5 of 267 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:358:ARG:HH11	1:A:358:ARG:HB2	1.24	1.03
1:C:214:GLN:HE21	1:C:242:ALA:H	1.10	0.98
1:B:214:GLN:HE21	1:B:242:ALA:H	1.21	0.89
1:B:192:ILE:HD13	1:B:227:ILE:HG21	1.60	0.83
1:A:53:GLU:HG2	1:A:59:GLN:HG2	1.60	0.82

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	371/393 (94%)	364 (98%)	6 (2%)	1 (0%)	41	37
1	B	357/393 (91%)	346 (97%)	9 (2%)	2 (1%)	25	19
1	C	353/393 (90%)	341 (97%)	11 (3%)	1 (0%)	41	37
1	D	354/393 (90%)	347 (98%)	7 (2%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
All	All	1435/1572 (91%)	1398 (97%)	33 (2%)	4 (0%)	41 37

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	315	ALA
1	C	315	ALA
1	A	315	ALA
1	B	161	ILE

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	291/310 (94%)	287 (99%)	4 (1%)	67 72
1	B	281/310 (91%)	279 (99%)	2 (1%)	84 88
1	C	278/310 (90%)	275 (99%)	3 (1%)	73 78
1	D	279/310 (90%)	275 (99%)	4 (1%)	67 72
All	All	1129/1240 (91%)	1116 (99%)	13 (1%)	71 76

5 of 13 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	274	LEU
1	C	336	GLU
1	D	336	GLU
1	D	190	LEU
1	D	310	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 43 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	248	HIS

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Mol	Chain	Res	Type
1	D	214	GLN
1	C	254	GLN
1	C	343	ASN
1	D	232	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 monosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 12 ligands modelled in this entry, 8 are monoatomic - leaving 4 for Mogul analysis.

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	$\# Z > 2$
3	LGT	D	601	2	13,13,13	1.32	1 (7%)	16,18,18	0.76	0
3	LGT	B	601	2	13,13,13	1.47	3 (23%)	16,18,18	0.69	0
3	LGT	A	601	2	13,13,13	1.41	2 (15%)	16,18,18	0.79	0
3	LGT	C	601	2	13,13,13	1.43	3 (23%)	16,18,18	0.71	0

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
3	LGT	D	601	2	-	6/20/20/20	-
3	LGT	B	601	2	-	4/20/20/20	-
3	LGT	A	601	2	-	7/20/20/20	-
3	LGT	C	601	2	-	9/20/20/20	-

The worst 5 of 9 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	601	LGT	C2-C1	2.74	1.56	1.52
3	C	601	LGT	C5-C6	2.52	1.56	1.52
3	B	601	LGT	C5-C6	2.39	1.56	1.52
3	B	601	LGT	C2-C1	2.34	1.56	1.52
3	C	601	LGT	C2-C1	2.20	1.55	1.52

There are no bond angle outliers.

There are no chirality outliers.

5 of 26 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	601	LGT	C2-C3-C4-O4
3	A	601	LGT	C2-C3-C4-C5
3	A	601	LGT	O3-C3-C4-O4
3	A	601	LGT	O3-C3-C4-C5
3	B	601	LGT	C2-C3-C4-O4

There are no ring outliers.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	C	601	LGT	2	0

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	373/393 (94%)	-0.29	1 (0%) 94 93	15, 25, 40, 51	0
1	B	361/393 (91%)	-0.00	16 (4%) 34 33	14, 26, 51, 62	0
1	C	357/393 (90%)	-0.00	15 (4%) 36 35	15, 27, 52, 61	0
1	D	358/393 (91%)	-0.32	3 (0%) 86 85	15, 25, 41, 56	0
All	All	1449/1572 (92%)	-0.15	35 (2%) 59 57	14, 26, 46, 62	0

The worst 5 of 35 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	158	HIS	6.7
1	B	102	TRP	4.6
1	C	157	LEU	4.6
1	B	158	HIS	4.5
1	B	157	LEU	4.4

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 monosaccharides 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(\AA^2)	Q<0.9
3	LGT	B	601	14/14	0.61	0.26	37,43,47,48	0
3	LGT	C	601	14/14	0.72	0.24	34,41,49,51	0
3	LGT	D	601	14/14	0.80	0.22	29,38,47,48	0
3	LGT	A	601	14/14	0.86	0.14	32,39,45,46	0
2	MG	B	502	1/1	0.86	0.07	31,31,31,31	0
2	MG	B	503	1/1	0.94	0.13	28,28,28,28	0
2	MG	C	502	1/1	0.96	0.10	32,32,32,32	0
2	MG	A	502	1/1	0.97	0.04	21,21,21,21	0
2	MG	D	502	1/1	0.97	0.05	29,29,29,29	0
2	MG	C	501	1/1	0.97	0.06	36,36,36,36	0
2	MG	D	503	1/1	0.98	0.04	21,21,21,21	0
2	MG	A	501	1/1	0.99	0.05	23,23,23,23	0

6.5 Other polymers [i](#)

There are no such residues in this entry.