



# wwPDB X-ray Structure Validation Summary Report ⓘ

Jan 31, 2016 – 06:51 PM GMT

PDB ID : 1COM  
Title : THE MONOFUNCTIONAL CHORISMATE MUTASE FROM BACILLUS SUBTILIS: STRUCTURE DETERMINATION OF CHORISMATE MUTASE AND ITS COMPLEXES WITH A TRANSITION STATE ANALOG AND PREPHENATE, AND IMPLICATIONS ON THE MECHANISM OF ENZY-MATIC REACTION  
Authors : Chook, Y.M.; Ke, H.; Lipscomb, W.N.  
Deposited on : 1994-04-08  
Resolution : 2.20 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](mailto:validation@mail.wwpdb.org)  
A user guide is available at  
<http://wwpdb.org/validation/2016/XrayValidationReportHelp>  
with specific help available everywhere you see the ⓘ symbol.

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

MolProbity : 4.02b-467  
Mogul : 1.7 (RC4), CSD as536be (2015)  
Xtriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : trunk26865

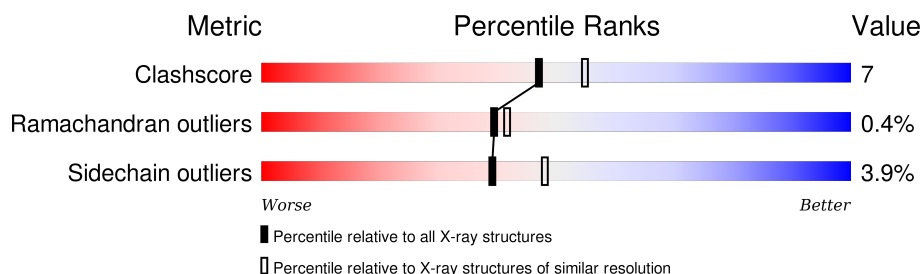
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.20 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))
Clashscore	102246	4477 (2.20-2.20)
Ramachandran outliers	100387	4404 (2.20-2.20)
Sidechain outliers	100360	4405 (2.20-2.20)

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  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. 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.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	127	
1	B	127	
1	C	127	
1	D	127	
1	E	127	
1	F	127	
1	G	127	

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Mol	Chain	Length	Quality of chain
1	H	127	<div><div></div><div>66%20%••10%</div></div>
1	I	127	<div><div></div><div>68%20%•10%</div></div>
1	J	127	<div><div></div><div>72%16%•10%</div></div>
1	K	127	<div><div></div><div>65%23%•9%</div></div>
1	L	127	<div><div></div><div>65%23%•10%</div></div>

## 2 Entry composition

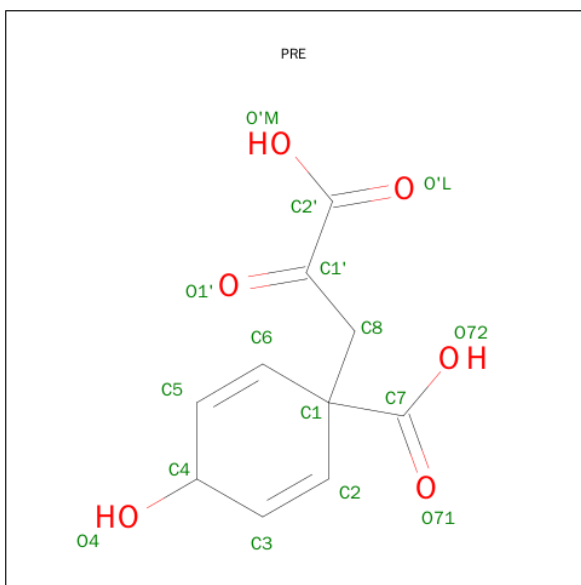
There are 3 unique types of molecules in this entry. The entry contains 15125 atoms, of which 3466 are hydrogens and 0 are deuteriums.

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 CHORISMATE MUTASE.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	114	Total	C	H	N	O	S	0	0	0
			1106	570	201	156	171	8			
1	B	118	Total	C	H	N	O	S	0	0	0
			1148	591	209	163	177	8			
1	C	119	Total	C	H	N	O	S	0	0	0
			1156	594	211	164	179	8			
1	D	114	Total	C	H	N	O	S	0	0	0
			1106	570	201	156	171	8			
1	E	118	Total	C	H	N	O	S	0	0	0
			1148	591	209	163	177	8			
1	F	117	Total	C	H	N	O	S	0	0	0
			1139	585	208	162	176	8			
1	G	114	Total	C	H	N	O	S	0	0	0
			1106	570	201	156	171	8			
1	H	114	Total	C	H	N	O	S	0	0	0
			1106	570	201	156	171	8			
1	I	114	Total	C	H	N	O	S	0	0	0
			1106	570	201	156	171	8			
1	J	114	Total	C	H	N	O	S	0	0	0
			1106	570	201	156	171	8			
1	K	116	Total	C	H	N	O	S	0	0	0
			1130	581	207	161	173	8			
1	L	114	Total	C	H	N	O	S	0	0	0
			1106	570	201	156	171	8			

- Molecule 2 is PREPHENIC ACID (three-letter code: PRE) (formula: C<sub>10</sub>H<sub>10</sub>O<sub>6</sub>).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	B	1	Total	C	H	O	0	0
			17	10	1	6		
2	C	1	Total	C	H	O	0	0
			17	10	1	6		
2	A	1	Total	C	H	O	0	0
			17	10	1	6		
2	E	1	Total	C	H	O	0	0
			17	10	1	6		
2	F	1	Total	C	H	O	0	0
			17	10	1	6		
2	D	1	Total	C	H	O	0	0
			17	10	1	6		
2	H	1	Total	C	H	O	0	0
			17	10	1	6		
2	G	1	Total	C	H	O	0	0
			17	10	1	6		
2	K	1	Total	C	H	O	0	0
			17	10	1	6		

- Molecule 3 is water.

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	36	Total	H	O	0	0
			108	72	36		
3	B	42	Total	H	O	0	0
			126	84	42		
3	C	44	Total	H	O	0	0
			132	88	44		

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	D	37	Total	H	O	0	0
			111	74	37		
3	E	45	Total	H	O	0	0
			135	90	45		
3	F	57	Total	H	O	0	0
			171	114	57		
3	G	33	Total	H	O	0	0
			99	66	33		
3	H	16	Total	H	O	0	0
			48	32	16		
3	I	49	Total	H	O	0	0
			147	98	49		
3	J	36	Total	H	O	0	0
			108	72	36		
3	K	38	Total	H	O	0	0
			114	76	38		
3	L	70	Total	H	O	0	0
			210	140	70		

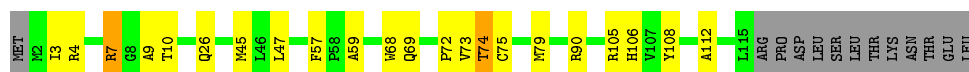
### 3 Residue-property plots

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.

Note EDS was not executed.

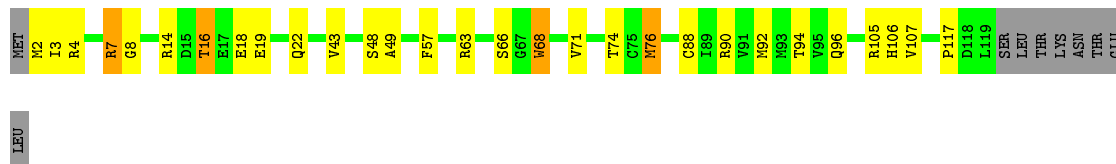
#### • Molecule 1: CHORISMATE MUTASE

Chain A: 



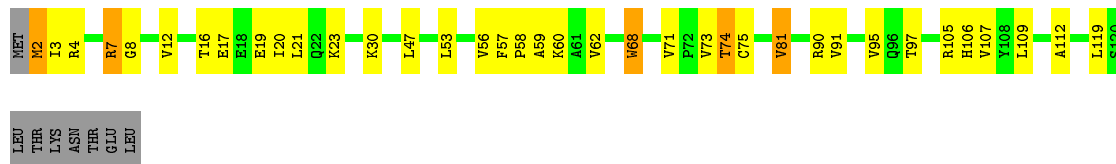
#### • Molecule 1: CHORISMATE MUTASE

Chain B: 



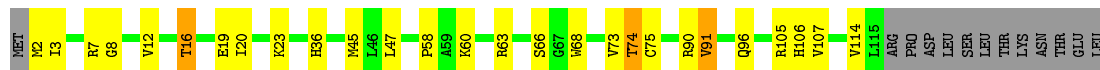
#### • Molecule 1: CHORISMATE MUTASE

Chain C: 



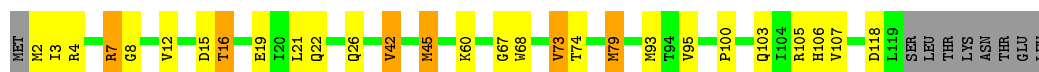
#### • Molecule 1: CHORISMATE MUTASE

Chain D: 



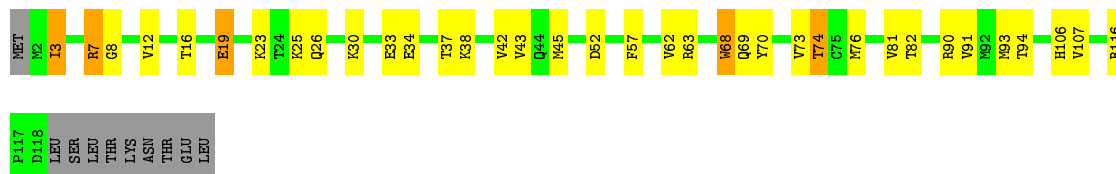
#### • Molecule 1: CHORISMATE MUTASE

Chain E: 



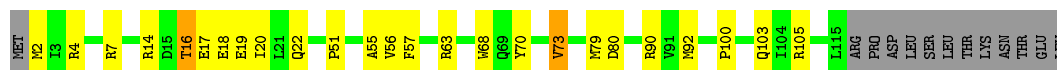
- Molecule 1: CHORISMATE MUTASE

Chain F: 64% 24% 8%



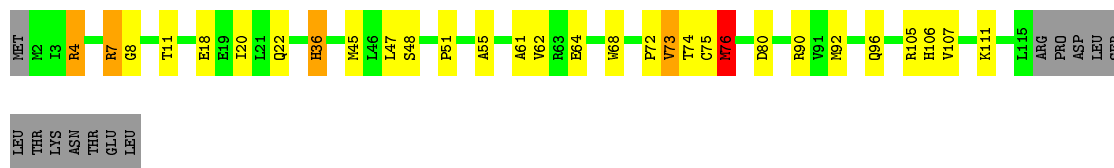
- Molecule 1: CHORISMATE MUTASE

Chain G: 70% 18% 10%



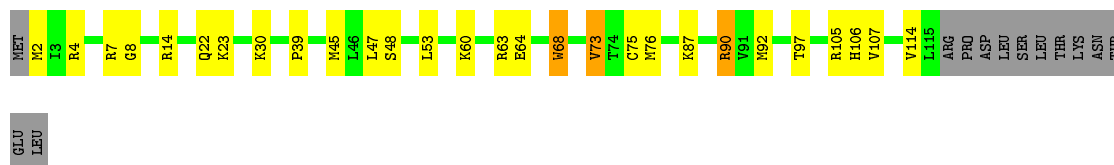
- Molecule 1: CHORISMATE MUTASE

Chain H: 66% 20% 10%



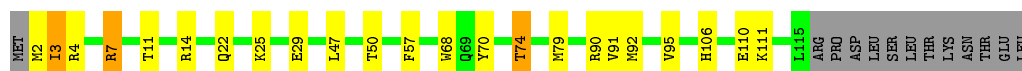
- Molecule 1: CHORISMATE MUTASE

Chain I: 68% 20% 10%



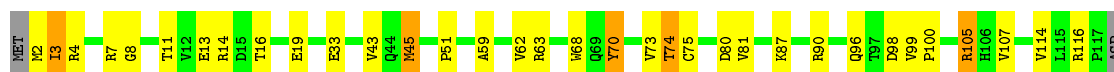
- Molecule 1: CHORISMATE MUTASE

Chain J: 72% 16% 10%



- Molecule 1: CHORISMATE MUTASE

Chain K: 65% 23% 9%





LEU  
SER  
LEU  
THR  
LYS  
ASN  
THR  
GLU  
LEU

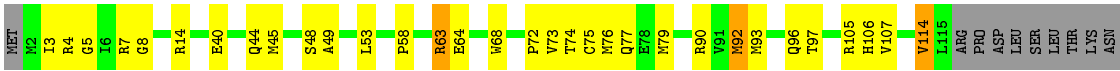
● Molecule 1: CHORISMATE MUTASE

Chain L: 

65%

23%

• 10%



THR  
GLU  
LEU

## 4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section will therefore be incomplete.

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	102.40 Å 68.30 Å 102.80 Å 90.00° 105.60° 90.00°	Depositor
Resolution (Å)	(Not available) – 2.20	Depositor
% Data completeness (in resolution range)	(Not available) ((Not available)-2.20)	Depositor
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	X-PLOR	Depositor
R, $R_{free}$	0.179 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	15125	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	13.0	wwPDB-VP

## 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: PRE

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	0.80	0/917	1.46	12/1240 (1.0%)
1	B	0.79	0/952	1.46	14/1288 (1.1%)
1	C	0.76	0/958	1.47	13/1296 (1.0%)
1	D	0.82	0/917	1.47	7/1240 (0.6%)
1	E	0.81	0/952	1.53	14/1288 (1.1%)
1	F	0.79	0/944	1.44	16/1277 (1.3%)
1	G	0.79	0/917	1.47	16/1240 (1.3%)
1	H	0.76	0/917	1.43	12/1240 (1.0%)
1	I	0.81	0/917	1.48	12/1240 (1.0%)
1	J	0.80	0/917	1.51	13/1240 (1.0%)
1	K	0.78	0/936	1.47	17/1266 (1.3%)
1	L	0.82	0/917	1.54	19/1240 (1.5%)
All	All	0.79	0/11161	1.48	165/15095 (1.1%)

There are no bond length outliers.

The worst 5 of 165 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	7	ARG	NE-CZ-NH2	-11.68	114.46	120.30
1	D	105	ARG	NE-CZ-NH2	-11.21	114.69	120.30
1	H	4	ARG	NE-CZ-NH1	10.41	125.50	120.30
1	B	4	ARG	NE-CZ-NH1	10.40	125.50	120.30
1	E	4	ARG	NE-CZ-NH1	10.19	125.40	120.30

There are no chirality outliers.

There are no planarity outliers.

## 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	905	201	936	13	0
1	B	939	209	971	18	0
1	C	945	211	976	27	0
1	D	905	201	936	18	2
1	E	939	209	971	19	1
1	F	931	208	960	19	1
1	G	905	201	936	6	0
1	H	905	201	936	15	1
1	I	905	201	936	12	0
1	J	905	201	936	9	0
1	K	923	207	956	15	1
1	L	905	201	936	12	1
2	A	16	1	8	4	0
2	B	16	1	8	2	0
2	C	16	1	8	1	0
2	D	16	1	8	3	0
2	E	16	1	8	1	0
2	F	16	1	8	1	0
2	G	16	1	8	0	0
2	H	16	1	8	1	0
2	K	16	1	8	2	0
3	A	36	72	0	0	0
3	B	42	84	0	0	0
3	C	44	88	0	0	0
3	D	37	74	0	0	1
3	E	45	90	0	0	1
3	F	57	114	0	0	0
3	G	33	66	0	0	0
3	H	16	32	0	0	0
3	I	49	98	0	0	0
3	J	36	72	0	0	0
3	K	38	76	0	1	0
3	L	70	140	0	0	3
All	All	11659	3466	11458	169	6

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 7.

The worst 5 of 169 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:H:45:MET:HB3	1:H:73:VAL:HG12	1.58	0.84
1:G:100:PRO:HG2	1:G:103:GLN:HG3	1.61	0.82
1:B:7:ARG:H	1:B:106:HIS:HD2	1.34	0.76
1:F:7:ARG:H	1:F:106:HIS:HD2	1.31	0.74
1:D:7:ARG:H	1:D:106:HIS:HD2	1.33	0.74

The worst 5 of 6 symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:F:38:LYS:HZ2	1:H:36:HIS:HD1[2_656]	1.29	0.31
1:E:67:GLY:O	3:E:734:HOH:H2[2_756]	1.56	0.04
1:D:96:GLN:O	3:L:797:HOH:H2[2_756]	1.56	0.04
1:L:96:GLN:O	3:D:326:HOH:H1[2_746]	1.57	0.03
1:K:70:TYR:OH	3:L:501:HOH:H2[2_747]	1.60	0.00

## 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	112/127 (88%)	110 (98%)	2 (2%)	0	100	100
1	B	116/127 (91%)	111 (96%)	4 (3%)	1 (1%)	21	19
1	C	117/127 (92%)	110 (94%)	7 (6%)	0	100	100
1	D	112/127 (88%)	105 (94%)	5 (4%)	2 (2%)	11	7
1	E	116/127 (91%)	112 (97%)	3 (3%)	1 (1%)	21	19
1	F	115/127 (91%)	111 (96%)	4 (4%)	0	100	100
1	G	112/127 (88%)	107 (96%)	5 (4%)	0	100	100
1	H	112/127 (88%)	108 (96%)	4 (4%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	I	112/127 (88%)	107 (96%)	5 (4%)	0	100	100
1	J	112/127 (88%)	110 (98%)	2 (2%)	0	100	100
1	K	114/127 (90%)	112 (98%)	2 (2%)	0	100	100
1	L	112/127 (88%)	108 (96%)	3 (3%)	1 (1%)	21	19
All	All	1362/1524 (89%)	1311 (96%)	46 (3%)	5 (0%)	39	42

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	E	118	ASP
1	L	44	GLN
1	B	117	PRO
1	D	66	SER
1	D	114	VAL

### 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	103/116 (89%)	100 (97%)	3 (3%)	50	62
1	B	107/116 (92%)	101 (94%)	6 (6%)	26	29
1	C	108/116 (93%)	105 (97%)	3 (3%)	51	63
1	D	103/116 (89%)	100 (97%)	3 (3%)	50	62
1	E	107/116 (92%)	105 (98%)	2 (2%)	65	77
1	F	106/116 (91%)	99 (93%)	7 (7%)	21	22
1	G	103/116 (89%)	98 (95%)	5 (5%)	31	36
1	H	103/116 (89%)	101 (98%)	2 (2%)	65	77
1	I	103/116 (89%)	100 (97%)	3 (3%)	50	62
1	J	103/116 (89%)	99 (96%)	4 (4%)	39	48
1	K	105/116 (90%)	98 (93%)	7 (7%)	20	21

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	L	103/116 (89%)	99 (96%)	4 (4%)	39 48
All	All	1254/1392 (90%)	1205 (96%)	49 (4%)	39 48

5 of 49 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	F	81	VAL
1	G	63	ARG
1	L	40	GLU
1	G	2	MET
1	G	73	VAL

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 33 such sidechains are listed below:

Mol	Chain	Res	Type
1	E	106	HIS
1	G	44	GLN
1	L	26	GLN
1	F	26	GLN
1	F	44	GLN

### 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 carbohydrates in this entry.

## 5.6 Ligand geometry ⓘ

9 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	PRE	A	223	-	9,16,16	1.61	2 (22%)	4,23,23	1.03	0
2	PRE	B	221	-	9,16,16	1.34	0	4,23,23	1.27	0
2	PRE	C	222	-	9,16,16	1.53	1 (11%)	4,23,23	1.25	1 (25%)
2	PRE	D	226	-	9,16,16	1.59	2 (22%)	4,23,23	0.87	0
2	PRE	E	224	-	9,16,16	1.47	1 (11%)	4,23,23	1.22	0
2	PRE	F	225	-	9,16,16	1.42	0	4,23,23	1.09	0
2	PRE	G	229	-	9,16,16	1.45	1 (11%)	4,23,23	1.42	0
2	PRE	H	227	-	9,16,16	1.53	2 (22%)	4,23,23	1.98	2 (50%)
2	PRE	K	230	-	9,16,16	1.48	1 (11%)	4,23,23	1.42	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
2	PRE	A	223	-	-	0/5/27/27	0/1/1/1
2	PRE	B	221	-	-	0/5/27/27	0/1/1/1
2	PRE	C	222	-	-	0/5/27/27	0/1/1/1
2	PRE	D	226	-	-	0/5/27/27	0/1/1/1
2	PRE	E	224	-	-	0/5/27/27	0/1/1/1
2	PRE	F	225	-	-	0/5/27/27	0/1/1/1
2	PRE	G	229	-	-	0/5/27/27	0/1/1/1
2	PRE	H	227	-	-	0/5/27/27	0/1/1/1
2	PRE	K	230	-	-	0/5/27/27	0/1/1/1

The worst 5 of 10 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	K	230	PRE	C5-C6	2.08	1.36	1.32
2	H	227	PRE	C5-C6	2.08	1.36	1.32
2	H	227	PRE	C3-C2	2.21	1.36	1.32
2	E	224	PRE	C5-C6	2.28	1.36	1.32
2	A	223	PRE	C5-C6	2.42	1.36	1.32



All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	H	227	PRE	O1'-C1'-C8	-3.11	116.26	120.44
2	H	227	PRE	O4-C4-C5	-2.08	105.90	117.56
2	C	222	PRE	O4-C4-C5	-2.06	106.02	117.56

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

8 monomers are involved in 15 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	223	PRE	4	0
2	B	221	PRE	2	0
2	C	222	PRE	1	0
2	D	226	PRE	3	0
2	E	224	PRE	1	0
2	F	225	PRE	1	0
2	H	227	PRE	1	0
2	K	230	PRE	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](#)

EDS was not executed - this section will therefore be empty.

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

EDS was not executed - this section will therefore be empty.

### 6.3 Carbohydrates [i](#)

EDS was not executed - this section will therefore be empty.

### 6.4 Ligands [i](#)

EDS was not executed - this section will therefore be empty.

### 6.5 Other polymers [i](#)

EDS was not executed - this section will therefore be empty.