



# Full wwPDB X-ray Structure Validation Report ⓘ

Mar 7, 2026 – 11:34 PM UTC

PDB ID : 4D99 / pdb\_00004d99  
Title : Salmonella typhimurium D-Cysteine desulfhydrase with L-ser bound non-covalently at the active site  
Authors : Bharath, S.R.; Shveta, B.; Rajesh, K.H.; Savithri, H.S.; Murthy, M.R.N.  
Deposited on : 2012-01-11  
Resolution : 2.01 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](mailto: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>.

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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
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

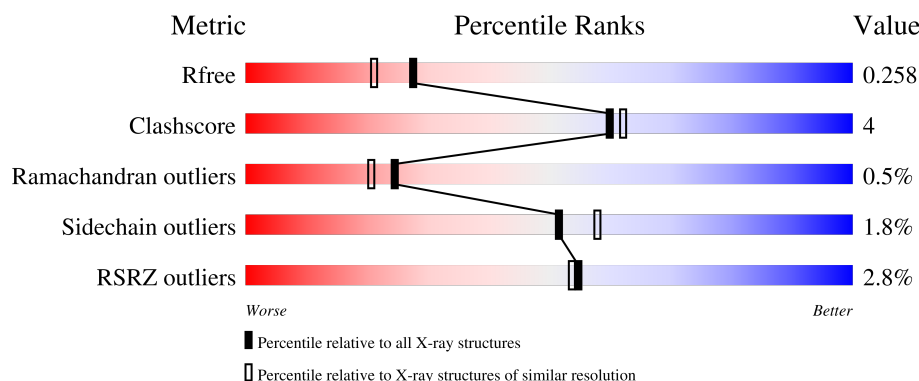
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.01 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	10052 (2.00-2.00)
Clashscore	190562	11152 (2.00-2.00)
Ramachandran outliers	187476	11031 (2.00-2.00)
Sidechain outliers	187428	11029 (2.00-2.00)
RSRZ outliers	180081	10067 (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  $\geq 3$ , 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	342	
1	B	342	
1	C	342	
1	D	342	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard

residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	SER	B	402	-	X	-	-

## 2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 10364 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 D-cysteine desulfhydrase.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	328	Total	C	N	O	P	S	0	1	0
			2463	1568	414	471	1	9			
1	B	324	Total	C	N	O	P	S	0	1	0
			2393	1523	402	458	1	9			
1	C	323	Total	C	N	O	P	S	0	3	0
			2412	1534	406	462	1	9			
1	D	328	Total	C	N	O	P	S	0	0	0
			2446	1561	411	464	1	9			

There are 56 discrepancies between the modelled and reference sequences:

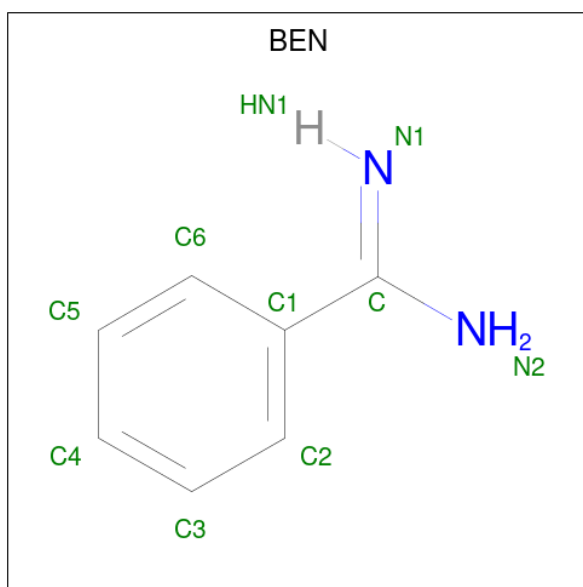
Chain	Residue	Modelled	Actual	Comment	Reference
A	-13	MET	-	expression tag	UNP Q8ZNT7
A	-12	ARG	-	expression tag	UNP Q8ZNT7
A	-11	GLY	-	expression tag	UNP Q8ZNT7
A	-10	SER	-	expression tag	UNP Q8ZNT7
A	-9	HIS	-	expression tag	UNP Q8ZNT7
A	-8	HIS	-	expression tag	UNP Q8ZNT7
A	-7	HIS	-	expression tag	UNP Q8ZNT7
A	-6	HIS	-	expression tag	UNP Q8ZNT7
A	-5	HIS	-	expression tag	UNP Q8ZNT7
A	-4	HIS	-	expression tag	UNP Q8ZNT7
A	-3	GLY	-	expression tag	UNP Q8ZNT7
A	-2	MET	-	expression tag	UNP Q8ZNT7
A	-1	ALA	-	expression tag	UNP Q8ZNT7
A	0	SER	-	expression tag	UNP Q8ZNT7
B	-13	MET	-	expression tag	UNP Q8ZNT7
B	-12	ARG	-	expression tag	UNP Q8ZNT7
B	-11	GLY	-	expression tag	UNP Q8ZNT7
B	-10	SER	-	expression tag	UNP Q8ZNT7
B	-9	HIS	-	expression tag	UNP Q8ZNT7
B	-8	HIS	-	expression tag	UNP Q8ZNT7
B	-7	HIS	-	expression tag	UNP Q8ZNT7

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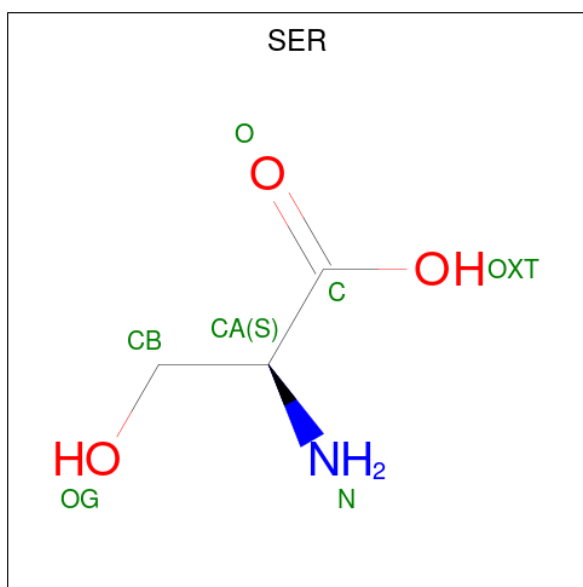
Chain	Residue	Modelled	Actual	Comment	Reference
B	-6	HIS	-	expression tag	UNP Q8ZNT7
B	-5	HIS	-	expression tag	UNP Q8ZNT7
B	-4	HIS	-	expression tag	UNP Q8ZNT7
B	-3	GLY	-	expression tag	UNP Q8ZNT7
B	-2	MET	-	expression tag	UNP Q8ZNT7
B	-1	ALA	-	expression tag	UNP Q8ZNT7
B	0	SER	-	expression tag	UNP Q8ZNT7
C	-13	MET	-	expression tag	UNP Q8ZNT7
C	-12	ARG	-	expression tag	UNP Q8ZNT7
C	-11	GLY	-	expression tag	UNP Q8ZNT7
C	-10	SER	-	expression tag	UNP Q8ZNT7
C	-9	HIS	-	expression tag	UNP Q8ZNT7
C	-8	HIS	-	expression tag	UNP Q8ZNT7
C	-7	HIS	-	expression tag	UNP Q8ZNT7
C	-6	HIS	-	expression tag	UNP Q8ZNT7
C	-5	HIS	-	expression tag	UNP Q8ZNT7
C	-4	HIS	-	expression tag	UNP Q8ZNT7
C	-3	GLY	-	expression tag	UNP Q8ZNT7
C	-2	MET	-	expression tag	UNP Q8ZNT7
C	-1	ALA	-	expression tag	UNP Q8ZNT7
C	0	SER	-	expression tag	UNP Q8ZNT7
D	-13	MET	-	expression tag	UNP Q8ZNT7
D	-12	ARG	-	expression tag	UNP Q8ZNT7
D	-11	GLY	-	expression tag	UNP Q8ZNT7
D	-10	SER	-	expression tag	UNP Q8ZNT7
D	-9	HIS	-	expression tag	UNP Q8ZNT7
D	-8	HIS	-	expression tag	UNP Q8ZNT7
D	-7	HIS	-	expression tag	UNP Q8ZNT7
D	-6	HIS	-	expression tag	UNP Q8ZNT7
D	-5	HIS	-	expression tag	UNP Q8ZNT7
D	-4	HIS	-	expression tag	UNP Q8ZNT7
D	-3	GLY	-	expression tag	UNP Q8ZNT7
D	-2	MET	-	expression tag	UNP Q8ZNT7
D	-1	ALA	-	expression tag	UNP Q8ZNT7
D	0	SER	-	expression tag	UNP Q8ZNT7

- Molecule 2 is BENZAMIDINE (CCD ID: BEN) (formula: C<sub>7</sub>H<sub>8</sub>N<sub>2</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	C	N	0	0
			9	7	2		
2	B	1	Total	C	N	0	0
			9	7	2		
2	D	1	Total	C	N	0	0
			9	7	2		

- Molecule 3 is SERINE (CCD ID: SER) (formula:  $C_3H_7NO_3$ ).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			7	3	1	3		

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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	B	1	Total	C	N	O	0	0
			7	3	1	3		
3	C	1	Total	C	N	O	0	0
			7	3	1	3		
3	D	1	Total	C	N	O	0	0
			7	3	1	3		

- Molecule 4 is SODIUM ION (CCD ID: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	C	1	Total	Na	0	0
			1	1		

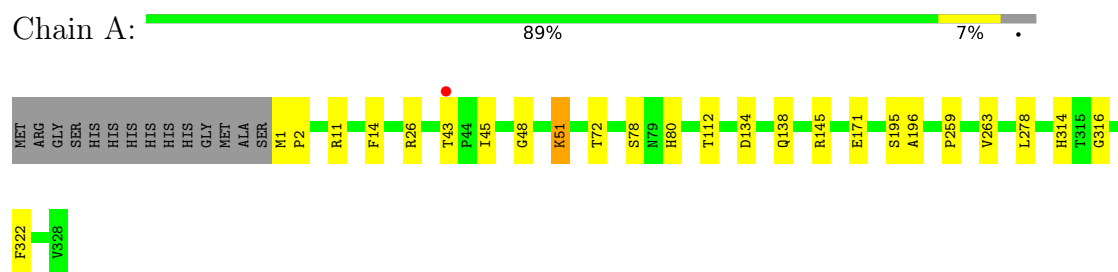
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	187	Total	O	0	0
			187	187		
5	B	120	Total	O	0	0
			120	120		
5	C	104	Total	O	0	0
			104	104		
5	D	183	Total	O	0	0
			183	183		

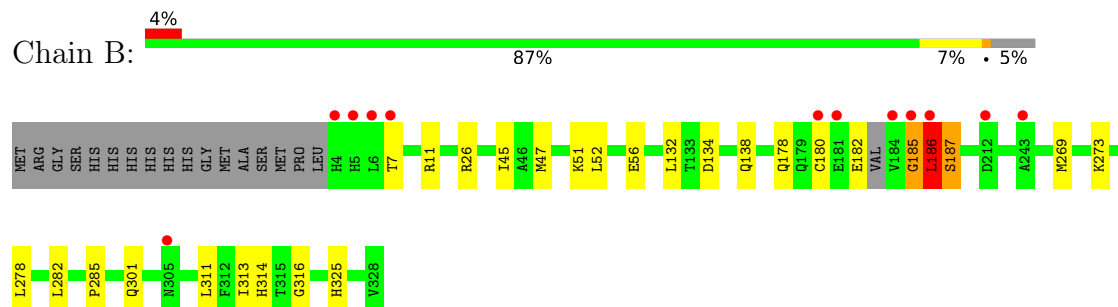
### 3 Residue-property plots [i](#)

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.

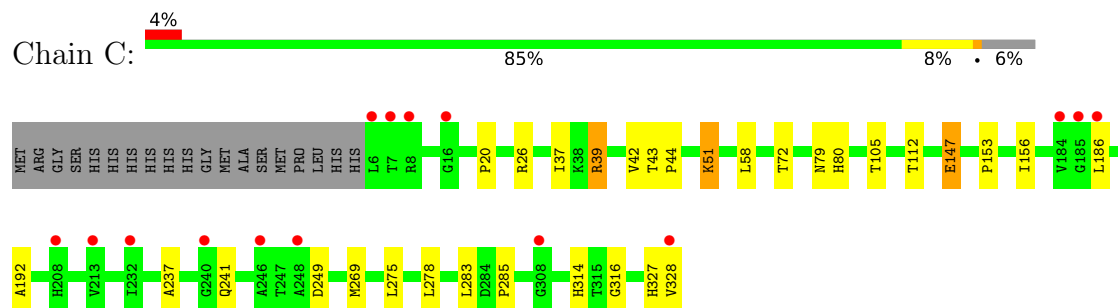
- Molecule 1: D-cysteine desulfhydrase



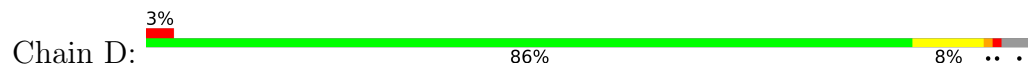
- Molecule 1: D-cysteine desulfhydrase



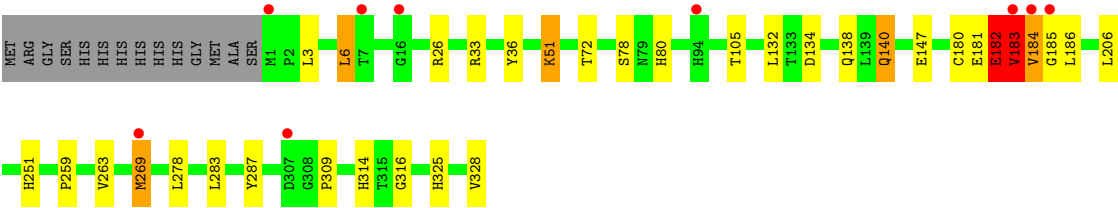
- Molecule 1: D-cysteine desulfhydrase



- Molecule 1: D-cysteine desulfhydrase







## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	66.56Å 165.49Å 68.88Å 90.00° 119.34° 90.00°	Depositor
Resolution (Å)	32.63 – 2.01 32.63 – 2.01	Depositor EDS
% Data completeness (in resolution range)	90.5 (32.63-2.01) 90.8 (32.63-2.01)	Depositor EDS
$R_{merge}$	0.06	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	7.13 (at 2.01Å)	Xtriage
Refinement program	REFMAC 5.6.0117	Depositor
R, $R_{free}$	0.212 , 0.259 0.211 , 0.258	Depositor DCC
$R_{free}$ test set	4333 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	26.7	Xtriage
Anisotropy	0.171	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 33.8	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.000 for l,k,-h-l 0.000 for -h-l,k,h 0.020 for h,-k,-h-l 0.022 for l,-k,h 0.026 for -h-l,-k,l	Xtriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	10364	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	32.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.03% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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: BEN, NA, LLP

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	0.63	0/2489	0.82	0/3394
1	B	0.59	0/2415	0.82	1/3295 (0.0%)
1	C	0.57	0/2436	0.83	0/3321
1	D	0.64	0/2469	0.82	0/3367
All	All	0.61	0/9809	0.82	1/13377 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	187	SER	N-CA-C	5.13	121.73	110.80

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	2463	0	2459	21	0
1	B	2393	0	2359	16	0
1	C	2412	0	2394	22	0
1	D	2446	0	2441	30	0
2	A	9	0	7	0	0
2	B	9	0	7	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	D	9	0	7	0	0
3	A	7	0	4	2	0
3	B	7	0	4	0	0
3	C	7	0	4	1	0
3	D	7	0	4	3	0
4	C	1	0	0	0	0
5	A	187	0	0	1	0
5	B	120	0	0	0	0
5	C	104	0	0	0	0
5	D	183	0	0	4	0
All	All	10364	0	9690	84	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 4.

All (84) 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:D:184:VAL:CG1	1:D:185:GLY:HA2	1.68	1.23
1:D:184:VAL:HG13	1:D:185:GLY:HA2	1.03	1.00
1:D:184:VAL:HG13	1:D:185:GLY:CA	1.95	0.94
1:B:185:GLY:O	1:B:186:LEU:HB2	1.68	0.93
1:D:105:THR:OG1	1:D:328:VAL:HG12	1.71	0.91
1:C:105:THR:OG1	1:C:328[A]:VAL:HG12	1.75	0.86
1:D:251:HIS:HD2	5:D:665:HOH:O	1.60	0.84
1:D:181:GLU:O	1:D:182:GLU:HB2	1.80	0.80
1:D:182:GLU:O	1:D:183:VAL:HB	1.84	0.77
1:D:287:TYR:HH	3:D:402:SER:N	1.85	0.75
1:A:145:ARG:HH12	1:C:328[A]:VAL:HG11	1.54	0.71
1:D:269:MET:HG2	5:D:679:HOH:O	1.90	0.71
1:D:314:HIS:HD2	1:D:316:GLY:H	1.41	0.68
1:D:184:VAL:HG12	1:D:185:GLY:HA2	1.75	0.66
1:A:43:THR:OG1	1:A:48:GLY:HA2	1.98	0.64
1:D:184:VAL:CG1	1:D:185:GLY:CA	2.61	0.64
1:C:26:ARG:HD3	1:C:278:LEU:O	1.97	0.63
3:D:402:SER:HB3	5:D:683:HOH:O	1.98	0.62
1:C:79:ASN:N	3:C:402:SER:O	2.34	0.61
1:A:1:MET:N	1:A:2:PRO:HD2	2.18	0.59
1:D:183:VAL:HG13	1:D:183:VAL:O	2.03	0.59
1:C:37:ILE:HG23	1:C:39[A]:ARG:HD3	1.85	0.59
1:A:145:ARG:NH1	1:C:328[A]:VAL:HG11	2.18	0.59

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:78:SER:OG	3:D:402:SER:HB2	2.02	0.58
1:D:185:GLY:O	1:D:309:PRO:HD2	2.04	0.57
1:A:314:HIS:HD2	1:A:316:GLY:H	1.52	0.57
1:C:147:GLU:HG3	1:C:153:PRO:HD2	1.89	0.55
1:B:26:ARG:HD3	1:B:278:LEU:O	2.07	0.54
1:C:314:HIS:HD2	1:C:316:GLY:H	1.53	0.54
1:D:72:THR:OG1	1:D:80:HIS:HE1	1.91	0.53
1:D:140:GLN:HE21	1:D:140:GLN:HA	1.73	0.53
1:A:259:PRO:HG2	1:A:263:VAL:HG11	1.91	0.52
1:B:314:HIS:HD2	1:B:316:GLY:H	1.58	0.52
1:D:180:CYS:HA	1:D:183:VAL:HG12	1.93	0.51
1:A:78:SER:OG	3:A:402:SER:HA	2.11	0.50
1:A:145:ARG:HH22	1:C:328[A]:VAL:HG21	1.75	0.50
1:C:72:THR:OG1	1:C:80:HIS:HE1	1.95	0.49
1:A:1:MET:H2	1:A:2:PRO:HD2	1.78	0.49
1:C:42:VAL:O	1:C:42:VAL:HG12	2.11	0.49
1:D:26:ARG:HD3	1:D:278:LEU:O	2.12	0.49
1:A:78:SER:CB	3:A:402:SER:HA	2.42	0.48
1:B:134:ASP:C	1:B:138:GLN:HE21	2.21	0.48
1:A:26:ARG:HD3	1:A:278:LEU:O	2.13	0.48
1:B:45:ILE:HD12	1:B:52:LEU:HD11	1.95	0.48
1:B:180:CYS:HB3	1:B:186:LEU:HD21	1.96	0.48
5:A:629:HOH:O	1:C:327:HIS:HD2	1.95	0.47
1:A:134:ASP:H	1:A:138:GLN:NE2	2.12	0.47
1:C:269:MET:SD	1:C:285:PRO:HB3	2.54	0.47
1:D:251:HIS:HE1	5:D:666:HOH:O	1.96	0.47
1:A:72:THR:OG1	1:A:80:HIS:HE1	1.97	0.47
1:A:314:HIS:CD2	1:A:316:GLY:H	2.31	0.46
1:D:132:LEU:HA	1:D:138:GLN:HE22	1.80	0.46
1:A:1:MET:N	1:A:2:PRO:CD	2.79	0.45
1:A:112:THR:OG1	1:B:325:HIS:HE1	1.98	0.45
1:C:43:THR:HB	1:C:44:PRO:HD2	1.99	0.45
1:C:237:ALA:O	1:C:241:GLN:HG2	2.17	0.45
1:D:36:TYR:CE2	1:D:183:VAL:HG22	2.52	0.45
1:C:20:PRO:HD2	1:C:39[A]:ARG:HB2	1.99	0.45
1:C:51:LLP:H6	1:C:192:ALA:HB3	1.99	0.45
1:D:51:LLP:HE3	1:D:80:HIS:HB2	1.99	0.44
1:B:282:LEU:O	1:B:314:HIS:HE1	2.01	0.44
1:C:112:THR:OG1	1:D:325:HIS:HE1	2.01	0.44
1:A:195:SER:O	1:A:196:ALA:HB3	2.17	0.44
1:D:259:PRO:HG2	1:D:263:VAL:HG11	2.00	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:58:LEU:HD13	1:C:156:ILE:HG23	2.01	0.42
1:D:3:LEU:O	1:D:6:LEU:HB2	2.20	0.42
1:C:275:LEU:HG	1:C:283:LEU:HD11	2.02	0.42
1:C:37:ILE:HD11	1:C:314:HIS:HB2	2.00	0.42
1:A:322:PHE:HE1	1:B:47:MET:HE1	1.85	0.42
1:B:11:ARG:NH2	1:B:56:GLU:OE1	2.53	0.42
1:B:180:CYS:C	1:B:182:GLU:H	2.27	0.42
1:C:314:HIS:CD2	1:C:316:GLY:H	2.35	0.42
1:B:269:MET:SD	1:B:285:PRO:HB3	2.60	0.41
1:B:282:LEU:O	1:B:314:HIS:CE1	2.72	0.41
1:B:311:LEU:CD1	1:B:313:ILE:HD13	2.50	0.41
1:A:51:LLP:HE3	1:A:80:HIS:HB2	2.02	0.41
1:D:283:LEU:HD23	1:D:314:HIS:CE1	2.54	0.41
1:A:11:ARG:HH12	1:A:171:GLU:HG2	1.86	0.41
1:D:184:VAL:HG22	1:D:186:LEU:HB2	2.03	0.41
1:B:132:LEU:HA	1:B:138:GLN:HE22	1.86	0.40
1:D:314:HIS:CD2	1:D:316:GLY:H	2.29	0.40
1:B:273:LYS:HA	1:B:273:LYS:HD2	1.96	0.40
1:A:14:PHE:HB3	1:A:45:ILE:HD12	2.04	0.40
1:D:134:ASP:H	1:D:138:GLN:NE2	2.19	0.40

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	326/342 (95%)	318 (98%)	8 (2%)	0	100	100
1	B	320/342 (94%)	308 (96%)	8 (2%)	4 (1%)	9	5
1	C	322/342 (94%)	312 (97%)	10 (3%)	0	100	100
1	D	325/342 (95%)	315 (97%)	8 (2%)	2 (1%)	21	17
All	All	1293/1368 (94%)	1253 (97%)	34 (3%)	6 (0%)	24	21

All (6) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	187	SER
1	D	182	GLU
1	D	183	VAL
1	B	186	LEU
1	B	7	THR
1	B	185	GLY

### 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	253/266 (95%)	253 (100%)	0	100	100
1	B	240/266 (90%)	237 (99%)	3 (1%)	61	68
1	C	244/266 (92%)	239 (98%)	5 (2%)	48	54
1	D	248/266 (93%)	239 (96%)	9 (4%)	31	31
All	All	985/1064 (93%)	968 (98%)	17 (2%)	51	60

All (17) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	178	GLN
1	B	186	LEU
1	B	301	GLN
1	C	39[A]	ARG
1	C	39[B]	ARG
1	C	147	GLU
1	C	186	LEU
1	C	249	ASP
1	D	6	LEU
1	D	33	ARG
1	D	140	GLN
1	D	147	GLU
1	D	182	GLU
1	D	183	VAL

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Mol	Chain	Res	Type
1	D	184	VAL
1	D	206	LEU
1	D	269	MET

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (24) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	80	HIS
1	A	83	GLN
1	A	125	GLN
1	A	138	GLN
1	A	149	GLN
1	A	314	HIS
1	B	94	HIS
1	B	138	GLN
1	B	178	GLN
1	B	208	HIS
1	B	314	HIS
1	B	325	HIS
1	C	80	HIS
1	C	138	GLN
1	C	314	HIS
1	D	80	HIS
1	D	83	GLN
1	D	125	GLN
1	D	138	GLN
1	D	140	GLN
1	D	208	HIS
1	D	251	HIS
1	D	314	HIS
1	D	325	HIS

### 5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

## 5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

4 non-standard protein/DNA/RNA residues 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
1	LLP	C	51	1	23,24,25	0.78	0	25,32,34	1.15	1 (4%)
1	LLP	D	51	1	23,24,25	0.76	1 (4%)	25,32,34	1.03	0
1	LLP	B	51	1	23,24,25	0.80	1 (4%)	25,32,34	1.15	1 (4%)
1	LLP	A	51	1	23,24,25	0.78	0	25,32,34	1.13	1 (4%)

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
1	LLP	C	51	1	-	2/16/17/19	0/1/1/1
1	LLP	D	51	1	-	3/16/17/19	0/1/1/1
1	LLP	B	51	1	-	4/16/17/19	0/1/1/1
1	LLP	A	51	1	-	4/16/17/19	0/1/1/1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	51	LLP	C3-C2	-2.06	1.38	1.41
1	B	51	LLP	C3-C2	-2.01	1.38	1.41

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	51	LLP	OP4-C5'-C5	2.39	113.84	109.36
1	A	51	LLP	C5-C6-N1	-2.16	120.32	123.83
1	C	51	LLP	C5-C6-N1	-2.04	120.51	123.83

There are no chirality outliers.

All (13) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	51	LLP	O-C-CA-CB
1	A	51	LLP	C4-C4'-NZ-CE
1	C	51	LLP	C4-C4'-NZ-CE
1	D	51	LLP	C4-C4'-NZ-CE
1	B	51	LLP	C4-C4'-NZ-CE
1	B	51	LLP	C3-C4-C4'-NZ
1	A	51	LLP	C3-C4-C4'-NZ
1	C	51	LLP	C3-C4-C4'-NZ
1	D	51	LLP	C3-C4-C4'-NZ
1	B	51	LLP	C5-C4-C4'-NZ
1	B	51	LLP	CE-CD-CG-CB
1	A	51	LLP	C5-C4-C4'-NZ
1	D	51	LLP	CE-CD-CG-CB

There are no ring outliers.

3 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	C	51	LLP	1	0
1	D	51	LLP	1	0
1	A	51	LLP	1	0

## 5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 8 ligands modelled in this entry, 1 is monoatomic - leaving 7 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	SER	C	402	-	4,6,6	1.22	1 (25%)	2,7,7	2.70	1 (50%)
2	BEN	A	401	-	9,9,9	0.98	1 (11%)	7,11,11	0.66	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
3	SER	B	402	-	4,6,6	1.16	1 (25%)	2,7,7	2.35	1 (50%)
2	BEN	B	401	-	9,9,9	1.44	2 (22%)	7,11,11	0.61	0
3	SER	A	402	-	4,6,6	1.03	0	2,7,7	1.98	1 (50%)
2	BEN	D	401	-	9,9,9	1.32	1 (11%)	7,11,11	0.68	0
3	SER	D	402	-	4,6,6	1.29	1 (25%)	2,7,7	2.48	1 (50%)

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	SER	C	402	-	-	3/6/6/6	-
2	BEN	A	401	-	-	0/4/4/4	0/1/1/1
3	SER	B	402	-	-	6/6/6/6	-
2	BEN	B	401	-	-	0/4/4/4	0/1/1/1
3	SER	A	402	-	-	4/6/6/6	-
2	BEN	D	401	-	-	0/4/4/4	0/1/1/1
3	SER	D	402	-	-	2/6/6/6	-

All (7) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	401	BEN	C-N2	-2.84	1.26	1.33
2	D	401	BEN	C-N2	-2.64	1.27	1.33
3	D	402	SER	OXT-C	-2.53	1.22	1.30
3	C	402	SER	OXT-C	-2.42	1.22	1.30
3	B	402	SER	OXT-C	-2.25	1.23	1.30
2	B	401	BEN	C1-C	2.23	1.51	1.47
2	A	401	BEN	C1-C	2.01	1.51	1.47

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	402	SER	OXT-C-O	-3.75	115.57	124.08
3	D	402	SER	OXT-C-O	-3.44	116.28	124.08
3	B	402	SER	OXT-C-O	-3.26	116.68	124.08
3	A	402	SER	OXT-C-O	-2.76	117.82	124.08

There are no chirality outliers.

All (15) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	402	SER	N-CA-CB-OG
3	A	402	SER	C-CA-CB-OG
3	B	402	SER	O-C-CA-N
3	B	402	SER	O-C-CA-CB
3	B	402	SER	OXT-C-CA-CB
3	B	402	SER	N-CA-CB-OG
3	B	402	SER	C-CA-CB-OG
3	C	402	SER	N-CA-CB-OG
3	A	402	SER	OXT-C-CA-N
3	B	402	SER	OXT-C-CA-N
3	D	402	SER	OXT-C-CA-N
3	C	402	SER	C-CA-CB-OG
3	A	402	SER	O-C-CA-N
3	D	402	SER	O-C-CA-N
3	C	402	SER	OXT-C-CA-N

There are no ring outliers.

3 monomers are involved in 6 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	C	402	SER	1	0
3	A	402	SER	2	0
3	D	402	SER	3	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

### 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	327/342 (95%)	-0.10	1 (0%) 90 89	15, 26, 42, 54	1 (0%)
1	B	323/342 (94%)	0.47	12 (3%) 45 44	15, 35, 54, 79	1 (0%)
1	C	322/342 (94%)	0.45	15 (4%) 36 35	15, 35, 51, 69	3 (0%)
1	D	327/342 (95%)	-0.09	9 (2%) 55 54	17, 25, 44, 62	0
All	All	1299/1368 (94%)	0.18	37 (2%) 55 54	15, 30, 50, 79	5 (0%)

All (37) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	186	LEU	7.7
1	D	183	VAL	4.9
1	C	7	THR	3.9
1	B	6	LEU	3.7
1	B	184	VAL	3.5
1	B	185	GLY	3.5
1	B	4	HIS	3.2
1	D	184	VAL	3.2
1	B	305	ASN	3.2
1	B	5	HIS	3.1
1	C	6	LEU	3.1
1	D	94	HIS	3.1
1	C	328[A]	VAL	3.0
1	D	16	GLY	2.9
1	D	269	MET	2.8
1	D	7	THR	2.7
1	D	1	MET	2.7
1	B	7	THR	2.7
1	C	213	VAL	2.7
1	C	186	LEU	2.6
1	B	180	CYS	2.6

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Mol	Chain	Res	Type	RSRZ
1	D	185	GLY	2.5
1	C	184	VAL	2.4
1	A	43	THR	2.4
1	B	181	GLU	2.4
1	D	307	ASP	2.4
1	C	232	ILE	2.4
1	C	16	GLY	2.3
1	C	8	ARG	2.2
1	C	246	ALA	2.1
1	B	243	ALA	2.1
1	C	248	ALA	2.1
1	B	212	ASP	2.0
1	C	208	HIS	2.0
1	C	185	GLY	2.0
1	C	240	GLY	2.0
1	C	308	GLY	2.0

## 6.2 Non-standard residues in protein, DNA, RNA chains [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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	LLP	B	51	24/25	0.92	0.09	30,34,36,37	0
1	LLP	C	51	24/25	0.92	0.09	30,32,35,37	0
1	LLP	D	51	24/25	0.95	0.07	24,25,26,27	0
1	LLP	A	51	24/25	0.96	0.07	23,24,26,27	0

## 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, 95<sup>th</sup> 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( $\text{\AA}^2$ )	Q<0.9
3	SER	B	402	7/7	0.72	0.17	47,48,50,54	0
3	SER	C	402	7/7	0.77	0.15	41,44,47,47	0
3	SER	D	402	7/7	0.78	0.14	40,42,43,43	0
3	SER	A	402	7/7	0.79	0.15	35,38,40,41	0
2	BEN	B	401	9/9	0.88	0.12	45,46,47,47	0
4	NA	C	401	1/1	0.94	0.07	38,38,38,38	0
2	BEN	D	401	9/9	0.95	0.06	19,19,19,19	0
2	BEN	A	401	9/9	0.95	0.07	20,21,21,21	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.