



Full wwPDB X-ray Structure Validation Report i

Jan 22, 2026 – 02:06 PM EST

PDB ID : 9OIJ / pdb_00009oj

Title : Structure of S. Typhimurium 14028 Gifsy-1 prophage HepS

Authors : Sargen, M.R.; Antine, S.P.; Grabe, G.J.; Antonellis, G.; Ragucci, A.E.; Kranzusch, P.J.; Helaine, S.A.

Deposited on : 2025-05-06

Resolution : 2.05 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

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the i 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](#) i) were used in the production of this report:

MolProbity : 4-5-2 with Phenix2.0

Xtriage (Phenix) : 2.0

EDS : 3.0

Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)

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) : 2.47

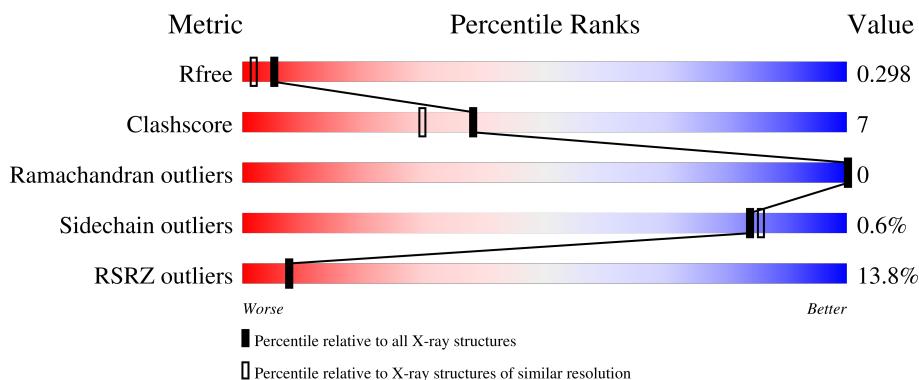
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

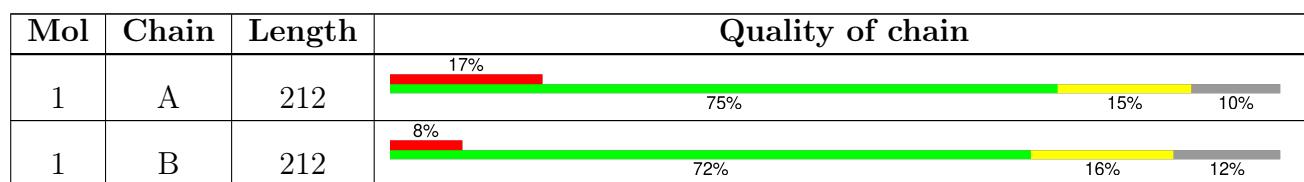
The reported resolution of this entry is 2.05 Å.

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}	164625	2096 (2.04-2.04)
Clashscore	180529	2229 (2.04-2.04)
Ramachandran outliers	177936	2217 (2.04-2.04)
Sidechain outliers	177891	2217 (2.04-2.04)
RSRZ outliers	164620	2096 (2.04-2.04)

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.



2 Entry composition [\(i\)](#)

There are 2 unique types of molecules in this entry. The entry contains 3074 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 HepS.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	191	Total	C	N	O	S	0	0	0
			1517	974	253	280	10			
1	B	186	Total	C	N	O	S	0	0	0
			1481	950	249	273	9			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-1	GLY	-	expression tag	UNP A0A0F6B549
A	0	SER	-	expression tag	UNP A0A0F6B549
B	-1	GLY	-	expression tag	UNP A0A0F6B549
B	0	SER	-	expression tag	UNP A0A0F6B549

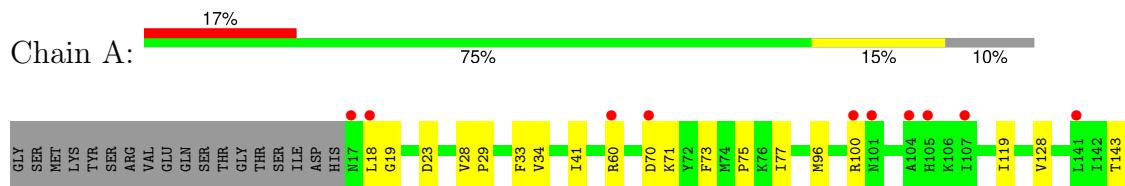
- Molecule 2 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	38	Total O 38 38	0	0
2	B	38	Total O 38 38	0	0

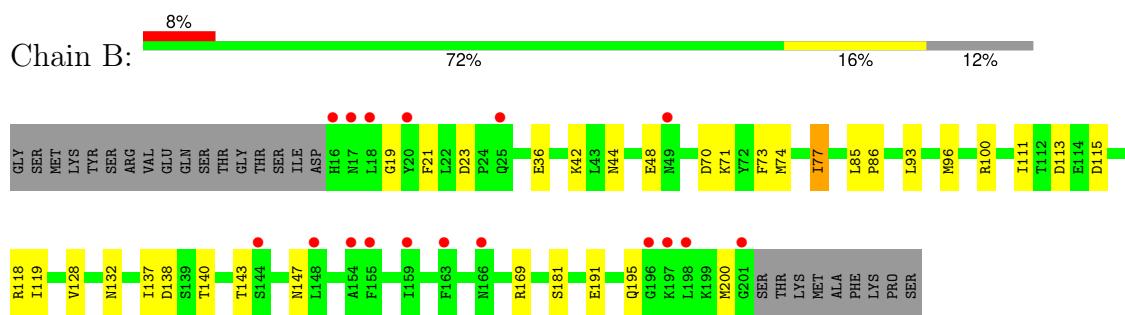
3 Residue-property plots [\(i\)](#)

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: HepS



- Molecule 1: HepS



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 32 2 1	Depositor
Cell constants a, b, c, α , β , γ	130.72Å 130.72Å 44.80Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	31.39 – 2.05 31.39 – 2.05	Depositor EDS
% Data completeness (in resolution range)	98.2 (31.39-2.05) 98.1 (31.39-2.05)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle^1$	0.77 (at 2.05Å)	Xtriage
Refinement program	PHENIX 1.21.1_5286	Depositor
R , R_{free}	0.246 , 0.297 0.247 , 0.298	Depositor DCC
R_{free} test set	1290 reflections (4.66%)	wwPDB-VP
Wilson B-factor (Å ²)	49.6	Xtriage
Anisotropy	0.353	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 45.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.35$	Xtriage
Estimated twinning fraction	0.028 for -h,-k,l	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	3074	wwPDB-VP
Average B, all atoms (Å ²)	63.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.40% 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 [\(i\)](#)

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	0.10	0/1544	0.28	0/2086
1	B	0.09	0/1508	0.24	0/2039
All	All	0.10	0/3052	0.26	0/4125

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	1517	0	1552	22	0
1	B	1481	0	1511	19	0
2	A	38	0	0	8	1
2	B	38	0	0	2	1
All	All	3074	0	3063	41	2

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.

All (41) 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:33:PHE:O	2:A:301:HOH:O	1.96	0.83

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:207:PHE:O	2:A:302:HOH:O	2.02	0.77
1:A:154:ALA:HB1	1:A:156:MET:HG3	1.71	0.71
1:A:165:ASP:OD1	2:A:303:HOH:O	2.10	0.69
1:B:48:GLU:HG2	1:B:73:PHE:HD2	1.65	0.62
1:B:191:GLU:OE2	1:B:195:GLN:NE2	2.36	0.59
1:A:70:ASP:OD1	1:A:71:LYS:N	2.35	0.57
1:A:60:ARG:NH1	2:A:309:HOH:O	2.38	0.56
1:B:147:ASN:OD1	2:B:301:HOH:O	2.17	0.56
1:A:200:MET:HG2	2:A:315:HOH:O	2.05	0.56
1:B:113:ASP:OD1	1:B:169:ARG:NH1	2.40	0.55
1:A:96:MET:HG2	1:A:119:ILE:HD13	1.88	0.55
1:B:42:LYS:NZ	2:B:304:HOH:O	2.41	0.53
1:B:85:LEU:HD12	1:B:86:PRO:HD2	1.90	0.53
1:B:138:ASP:OD2	1:B:140:THR:OG1	2.24	0.53
1:B:36:GLU:HG2	1:B:111:ILE:HD12	1.91	0.53
1:B:19:GLY:O	1:B:23:ASP:N	2.42	0.51
1:A:128:VAL:HG21	1:A:143:THR:HG22	1.92	0.50
1:B:21:PHE:HB3	1:B:181:SER:HB3	1.94	0.50
1:A:159:ILE:HB	1:A:160:PRO:HD3	1.93	0.50
1:A:73:PHE:HE1	1:A:77:ILE:HD11	1.76	0.49
1:A:23:ASP:OD2	2:A:304:HOH:O	2.20	0.48
1:B:132:ASN:ND2	1:B:137:ILE:O	2.39	0.48
1:B:44:ASN:CG	1:B:100:ARG:HD2	2.38	0.48
1:A:158:ASP:OD1	1:A:158:ASP:N	2.47	0.48
1:B:48:GLU:HG2	1:B:73:PHE:CD2	2.48	0.47
1:A:41:ILE:HG12	1:A:100:ARG:HD3	1.97	0.47
1:A:18:LEU:HB3	1:A:19:GLY:H	1.61	0.46
1:B:96:MET:HG2	1:B:119:ILE:HD13	1.97	0.46
1:A:19:GLY:N	2:A:312:HOH:O	2.48	0.45
1:A:165:ASP:O	1:A:167:ARG:N	2.49	0.45
1:A:70:ASP:HB3	1:A:75:PRO:HB2	1.99	0.44
1:A:34:VAL:O	1:A:167:ARG:NH1	2.50	0.44
1:A:192:LEU:HB3	1:A:197:LYS:HB2	2.00	0.44
1:A:168:ARG:N	2:A:311:HOH:O	2.43	0.44
1:B:128:VAL:HG21	1:B:143:THR:HG22	1.99	0.43
1:B:73:PHE:HZ	1:B:93:LEU:HB3	1.83	0.43
1:B:115:ASP:OD1	1:B:118:ARG:NH2	2.52	0.42
1:B:74:MET:O	1:B:77:ILE:HG22	2.20	0.42
1:B:70:ASP:OD1	1:B:71:LYS:N	2.54	0.41
1:A:28:VAL:HG23	1:A:29:PRO:HD3	2.02	0.40

All (2) symmetry-related close contacts are listed below. The label for Atom-2 includes the sym-

metry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:327:HOH:O	2:B:330:HOH:O[6_554]	1.63	0.57
2:A:327:HOH:O	2:A:333:HOH:O[3_655]	2.03	0.17

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	189/212 (89%)	175 (93%)	14 (7%)	0	100 100
1	B	184/212 (87%)	181 (98%)	3 (2%)	0	100 100
All	All	373/424 (88%)	356 (95%)	17 (5%)	0	100 100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains [\(i\)](#)

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	170/189 (90%)	170 (100%)	0	100 100
1	B	166/189 (88%)	164 (99%)	2 (1%)	67 68
All	All	336/378 (89%)	334 (99%)	2 (1%)	84 86

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	77	ILE
1	B	200	MET

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	44	ASN
1	B	97	ASN
1	B	182	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 oligosaccharides in this entry.

5.6 Ligand geometry [\(i\)](#)

There are no ligands in this entry.

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	191/212 (90%)	0.98	35 (18%) 4 3	40, 57, 97, 113	0
1	B	186/212 (87%)	0.71	17 (9%) 16 18	46, 60, 100, 119	0
All	All	377/424 (88%)	0.85	52 (13%) 8 8	40, 59, 99, 119	0

All (52) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	155	PHE	6.5
1	A	159	ILE	5.5
1	A	141	LEU	5.4
1	A	162	ASP	5.2
1	A	161	LYS	5.1
1	A	195	GLN	4.6
1	A	165	ASP	4.5
1	A	160	PRO	4.3
1	A	167	ARG	4.1
1	A	206	ALA	4.0
1	A	207	PHE	4.0
1	B	163	PHE	4.0
1	A	163	PHE	3.9
1	A	197	LYS	3.9
1	A	156	MET	3.7
1	A	196	GLY	3.7
1	A	157	ASN	3.6
1	A	158	ASP	3.5
1	B	16	HIS	3.5
1	A	18	LEU	3.5
1	B	159	ILE	3.5
1	A	107	ILE	3.4
1	A	200	MET	3.3
1	A	155	PHE	3.3

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Mol	Chain	Res	Type	RSRZ
1	B	17	ASN	3.2
1	A	164	PRO	3.2
1	A	154	ALA	3.2
1	B	196	GLY	3.1
1	B	197	LYS	3.0
1	A	205	MET	2.9
1	B	18	LEU	2.9
1	A	198	LEU	2.7
1	B	166	ASN	2.7
1	A	203	THR	2.7
1	A	17	ASN	2.6
1	B	25	GLN	2.6
1	A	199	LYS	2.6
1	A	105	HIS	2.6
1	B	198	LEU	2.5
1	B	20	TYR	2.5
1	A	201	GLY	2.4
1	A	104	ALA	2.4
1	B	154	ALA	2.3
1	A	70	ASP	2.3
1	A	166	ASN	2.3
1	B	148	LEU	2.3
1	B	49	ASN	2.2
1	A	101	ASN	2.2
1	A	60	ARG	2.1
1	B	201	GLY	2.1
1	B	144	SER	2.1
1	A	100	ARG	2.0

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 oligosaccharides in this entry.

6.4 Ligands [\(i\)](#)

There are no ligands in this entry.

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

There are no such residues in this entry.