



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 08:40 AM UTC

PDB ID : 7TL8 / pdb_00007tl8
Title : 1.95Å resolution structure of independent phosphoglycerate mutase from *S. aureus* in complex with a macrocyclic peptide inhibitor (Sa-D3)
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Deposited on : 2022-01-18
Resolution : 1.95 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 ⓘ 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	:	4-5-2 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

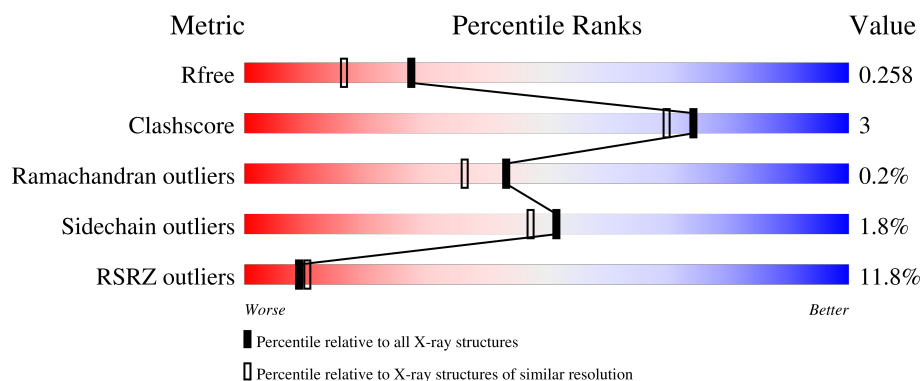
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.95 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	3494 (1.96-1.96)
Clashscore	190562	3612 (1.96-1.96)
Ramachandran outliers	187476	3587 (1.96-1.96)
Sidechain outliers	187428	3587 (1.96-1.96)
RSRZ outliers	180081	3495 (1.96-1.96)

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	511	12% 88% 8% 5%
2	B	15	67% 33%

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 4095 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 2,3-bisphosphoglycerate-independent phosphoglycerate mutase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	488	Total	C	N	O	S	0	1	0
			3733	2359	631	731	12			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	506	HIS	-	expression tag	UNP W8U5L7
A	507	HIS	-	expression tag	UNP W8U5L7
A	508	HIS	-	expression tag	UNP W8U5L7
A	509	HIS	-	expression tag	UNP W8U5L7
A	510	HIS	-	expression tag	UNP W8U5L7
A	511	HIS	-	expression tag	UNP W8U5L7

- Molecule 2 is a protein called Peptide Sa-D3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	15	Total	C	N	O	S	0	0	0
			129	87	18	23	1			

- Molecule 3 is MANGANESE (II) ION (CCD ID: MN) (formula: Mn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	2	Total	Mn	0	0
			2	2		

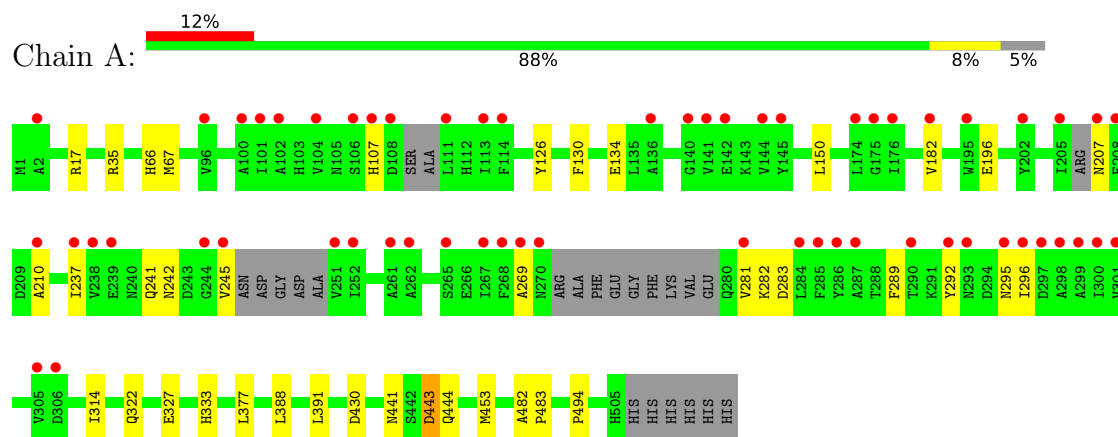
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	220	Total	O	0	0
			220	220		
4	B	11	Total	O	0	0
			11	11		

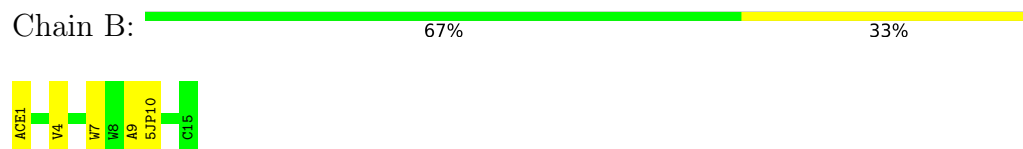
3 Residue-property plots [i](#)

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: 2,3-bisphosphoglycerate-independent phosphoglycerate mutase



- Molecule 2: Peptide Sa-D3



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	46.90Å 74.17Å 75.02Å 90.00° 100.54° 90.00°	Depositor
Resolution (Å)	46.11 – 1.95 46.11 – 1.95	Depositor EDS
% Data completeness (in resolution range)	98.7 (46.11-1.95) 98.8 (46.11-1.95)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.73 (at 1.95Å)	Xtriage
Refinement program	PHENIX 1.20_4438	Depositor
R, R_{free}	0.194 , 0.255 0.201 , 0.258	Depositor DCC
R_{free} test set	1729 reflections (4.68%)	wwPDB-VP
Wilson B-factor (Å ²)	27.8	Xtriage
Anisotropy	0.129	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 54.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	4095	wwPDB-VP
Average B, all atoms (Å ²)	36.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.00% 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: DTY, MN, ACE, 5JP

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	0.39	0/3803	0.54	0/5161
2	B	0.40	0/112	0.48	0/154
All	All	0.39	0/3915	0.54	0/5315

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

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	3733	0	3545	21	0
2	B	129	0	107	3	0
3	A	2	0	0	0	0
4	A	220	0	0	2	0
4	B	11	0	0	0	0
All	All	4095	0	3652	23	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 3.

All (23) 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:295:ASN:O	1:A:296:ILE:HG23	1.89	0.71
1:A:210:ALA:HB3	1:A:237:ILE:HD11	1.73	0.70
1:A:207:ASN:ND2	1:A:242:ASN:O	2.27	0.67
1:A:269:ALA:HB1	1:A:296:ILE:HG21	1.78	0.66
2:B:1:ACE:O	2:B:4:VAL:HG22	1.99	0.63
1:A:269:ALA:CB	1:A:296:ILE:HG21	2.38	0.54
1:A:314:ILE:HD11	1:A:494:PRO:HG3	1.90	0.53
1:A:210:ALA:HB3	1:A:237:ILE:CD1	2.39	0.53
1:A:377:LEU:CD2	1:A:391:LEU:HD22	2.39	0.52
1:A:17:ARG:HD3	1:A:443:ASP:O	2.09	0.52
1:A:444:GLN:O	1:A:453:MET:HE3	2.12	0.49
1:A:107:HIS:NE2	1:A:283:ASP:OD2	2.46	0.49
1:A:130:PHE:O	1:A:134:GLU:HG3	2.16	0.46
1:A:150:LEU:HD11	1:A:182:VAL:CG1	2.46	0.46
1:A:35:ARG:NH1	4:A:715:HOH:O	2.47	0.45
1:A:322:GLN:HA	1:A:388:LEU:O	2.18	0.44
1:A:482:ALA:HB3	1:A:483:PRO:HD3	2.00	0.43
2:B:9:ALA:HA	2:B:10:5JP:H7	1.86	0.41
1:A:66:HIS:CG	1:A:333:HIS:HB3	2.55	0.41
1:A:67:MET:HE1	2:B:7:TRP:CD2	2.55	0.40
1:A:281:VAL:HG12	1:A:282:LYS:N	2.36	0.40
1:A:196:GLU:CB	4:A:817:HOH:O	2.70	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	479/511 (94%)	458 (96%)	20 (4%)	1 (0%)	43	36
2	B	11/15 (73%)	8 (73%)	3 (27%)	0	100	100
All	All	490/526 (93%)	466 (95%)	23 (5%)	1 (0%)	43	36

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	441	ASN

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	383/432 (89%)	376 (98%)	7 (2%)	51	47
2	B	11/11 (100%)	11 (100%)	0	100	100
All	All	394/443 (89%)	387 (98%)	7 (2%)	51	47

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	126	TYR
1	A	241	GLN
1	A	245	VAL
1	A	289	PHE
1	A	292	TYR
1	A	430	ASP
1	A	443	ASP

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

Mol	Chain	Res	Type
1	A	123	HIS
1	A	343	ASN
2	B	3	GLN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

1 non-standard protein/DNA/RNA residue is modelled in this entry.

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.

No monomer is involved in short contacts.

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 2 ligands modelled in this entry, 2 are monoatomic - leaving 0 for Mogul analysis.

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.

No monomer is involved in short contacts.

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, 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	488/511 (95%)	0.58	59 (12%) 8 10	16, 33, 63, 77	1 (0%)
2	B	12/15 (80%)	0.69	0 100 100	24, 37, 44, 46	0
All	All	500/526 (95%)	0.58	59 (11%) 9 10	16, 33, 63, 77	1 (0%)

All (59) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	281	VAL	4.1
1	A	96	VAL	3.8
1	A	104	VAL	3.7
1	A	245	VAL	3.7
1	A	106	SER	3.5
1	A	205	ILE	3.5
1	A	287	ALA	3.5
1	A	144	VAL	3.4
1	A	251	VAL	3.4
1	A	174	LEU	3.4
1	A	296	ILE	3.3
1	A	286	TYR	3.3
1	A	101	ILE	3.2
1	A	141	VAL	3.2
1	A	208	PHE	3.2
1	A	305	VAL	3.1
1	A	111	LEU	3.1
1	A	298	ALA	3.0
1	A	270	ASN	2.9
1	A	267	ILE	2.9
1	A	285	PHE	2.9
1	A	269	ALA	2.8
1	A	102	ALA	2.8
1	A	210	ALA	2.7

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Mol	Chain	Res	Type	RSRZ
1	A	176	ILE	2.7
1	A	261	ALA	2.7
1	A	107	HIS	2.7
1	A	292	TYR	2.6
1	A	238	VAL	2.6
1	A	262	ALA	2.6
1	A	295	ASN	2.6
1	A	293	ASN	2.5
1	A	100	ALA	2.5
1	A	244	GLY	2.4
1	A	297	ASP	2.4
1	A	2	ALA	2.4
1	A	265	SER	2.3
1	A	145	TYR	2.3
1	A	301	VAL	2.3
1	A	239	GLU	2.3
1	A	195	TRP	2.2
1	A	114	PHE	2.2
1	A	268	PHE	2.2
1	A	299	ALA	2.2
1	A	175	GLY	2.2
1	A	108	ASP	2.2
1	A	202	TYR	2.2
1	A	113	ILE	2.2
1	A	252	ILE	2.2
1	A	300	ILE	2.2
1	A	136	ALA	2.2
1	A	237	ILE	2.1
1	A	290	THR	2.1
1	A	207	ASN	2.1
1	A	284	LEU	2.1
1	A	140	GLY	2.0
1	A	182	VAL	2.0
1	A	306	ASP	2.0
1	A	142	GLU	2.0

6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

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($\text{\AA}^2$)	Q<0.9
2	DTY	B	2	12/13	0.92	0.10	27,34,40,42	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, 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($\text{\AA}^2$)	Q<0.9
3	MN	A	601	1/1	1.00	0.02	19,19,19,19	0
3	MN	A	602	1/1	1.00	0.03	20,20,20,20	0

6.5 Other polymers [i](#)

There are no such residues in this entry.