



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 02:43 PM UTC

PDB ID : 3OH8 / pdb_00003oh8
Title : Crystal structure of the nucleoside-diphosphate sugar epimerase from *Corynebacterium glutamicum*. Northeast Structural Genomics Consortium Target CgR91
Authors : Vorobiev, S.; Lew, S.; Kuzin, A.; Mao, M.; Xiao, R.; Ciccocanti, C.; Wang, H.; Everett, J.K.; Nair, R.; Acton, T.B.; Rost, B.; Montelione, G.T.; Tong, L.; Hunt, J.F.; Northeast Structural Genomics Consortium (NESG)
Deposited on : 2010-08-17
Resolution : 2.00 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)

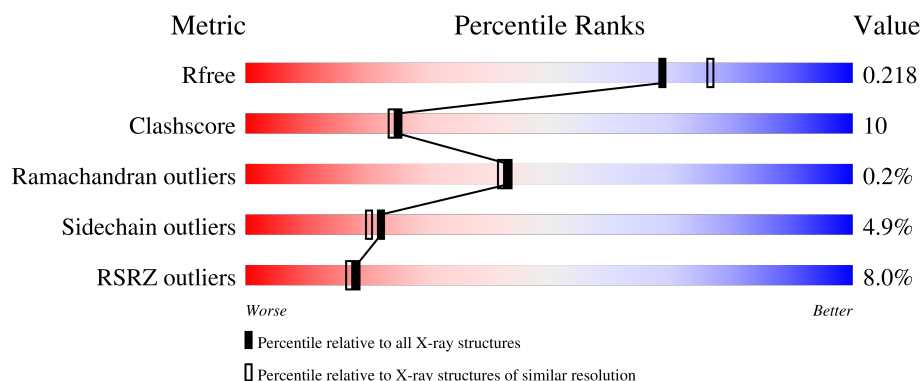
1 Overall quality at a glance

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}	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 ≥ 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	516	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 3793 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 Nucleoside-diphosphate sugar epimerase (SulA family).

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	N	O	S	Se			
1	A	456	3488	2198	615	667	3	5	0	0	0

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	509	LEU	-	expression tag	UNP Q6M4Z6
A	510	GLU	-	expression tag	UNP Q6M4Z6
A	511	HIS	-	expression tag	UNP Q6M4Z6
A	512	HIS	-	expression tag	UNP Q6M4Z6
A	513	HIS	-	expression tag	UNP Q6M4Z6
A	514	HIS	-	expression tag	UNP Q6M4Z6
A	515	HIS	-	expression tag	UNP Q6M4Z6
A	516	HIS	-	expression tag	UNP Q6M4Z6

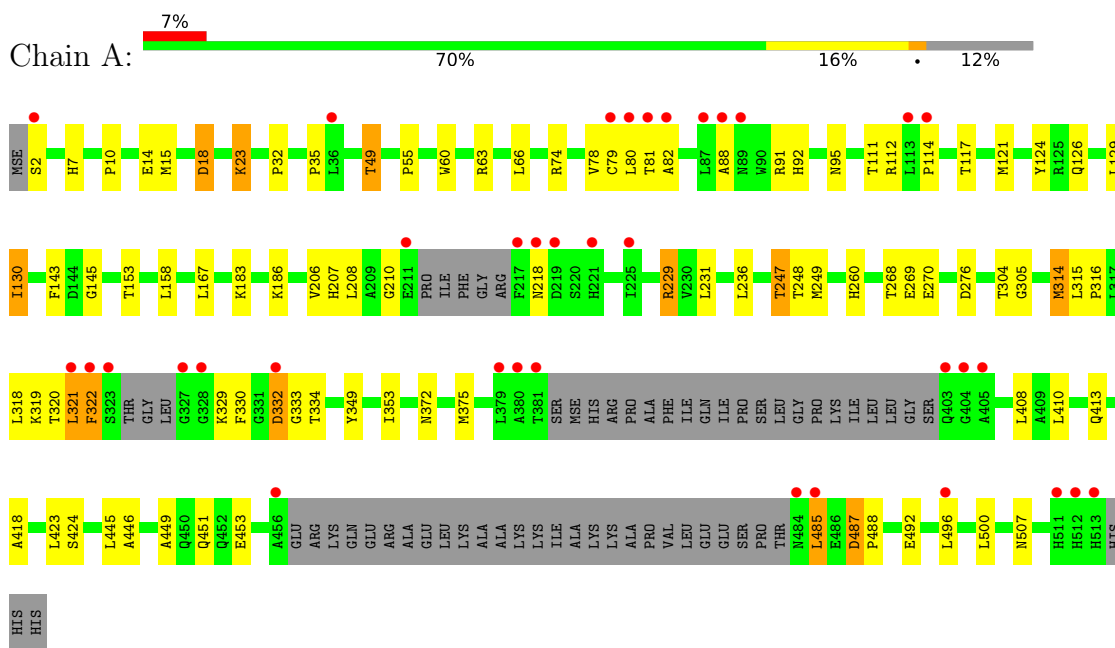
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	305	Total	O	0	0
			305	305		

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: Nucleoside-diphosphate sugar epimerase (SulA family)



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	64.50Å 74.08Å 128.44Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	38.78 – 2.00 38.78 – 2.00	Depositor EDS
% Data completeness (in resolution range)	88.1 (38.78-2.00) 88.3 (38.78-2.00)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.84 (at 2.00Å)	Xtriage
Refinement program	PHENIX 1.6_289	Depositor
R, R_{free}	0.188 , 0.220 0.185 , 0.218	Depositor DCC
R_{free} test set	1874 reflections (4.41%)	wwPDB-VP
Wilson B-factor (Å ²)	23.5	Xtriage
Anisotropy	0.566	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 45.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	3793	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 5.35% 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	0.53	5/3557 (0.1%)	0.77	3/4829 (0.1%)

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	314	MSE	SE-CE	-6.01	1.77	1.95
1	A	249	MSE	SE-CE	-5.64	1.78	1.95
1	A	121	MSE	SE-CE	-5.48	1.79	1.95
1	A	375	MSE	SE-CE	-5.15	1.79	1.95
1	A	15	MSE	SE-CE	-5.03	1.80	1.95

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	322	PHE	N-CA-C	-8.32	101.13	112.03
1	A	487	ASP	CA-C-N	5.48	124.94	119.24
1	A	487	ASP	C-N-CA	5.48	124.94	119.24

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	3488	0	3390	67	0
2	A	305	0	0	6	0
All	All	3793	0	3390	67	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 10.

All (67) 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:229:ARG:HH11	1:A:229:ARG:HG3	1.10	1.08
1:A:330:PHE:H	1:A:372:ASN:HD21	1.27	0.82
1:A:126:GLN:HE22	1:A:446:ALA:H	1.25	0.82
1:A:80:LEU:HD12	1:A:81:THR:HG23	1.61	0.81
1:A:229:ARG:HH11	1:A:229:ARG:CG	1.94	0.76
1:A:78:VAL:HG12	1:A:91:ARG:HG3	1.69	0.74
1:A:229:ARG:HG3	1:A:229:ARG:NH1	1.91	0.73
1:A:333:GLY:HA2	1:A:372:ASN:HD22	1.54	0.72
1:A:318:LEU:O	1:A:322:PHE:CD2	2.45	0.69
1:A:74:ARG:HE	1:A:95:ASN:HD22	1.37	0.69
1:A:23:LYS:HD3	2:A:859:HOH:O	1.94	0.67
1:A:247:THR:HG22	1:A:248:THR:OG1	1.98	0.64
1:A:268:THR:HG22	1:A:270:GLU:H	1.61	0.64
1:A:208:LEU:HD21	1:A:349:TYR:CZ	2.33	0.62
1:A:318:LEU:O	1:A:322:PHE:HD2	1.83	0.61
1:A:2:SER:CB	1:A:111:THR:HG22	2.31	0.60
1:A:10:PRO:HD2	1:A:130:ILE:CD1	2.32	0.59
1:A:321:LEU:C	1:A:322:PHE:CD2	2.81	0.59
1:A:445:LEU:H	1:A:451:GLN:NE2	1.99	0.59
1:A:80:LEU:CD1	1:A:81:THR:HG23	2.30	0.59
1:A:268:THR:HG22	1:A:269:GLU:N	2.18	0.58
1:A:112:ARG:HG2	1:A:485:LEU:HD13	1.88	0.56
1:A:268:THR:HG23	1:A:418:ALA:HB3	1.88	0.55
1:A:330:PHE:H	1:A:372:ASN:ND2	1.99	0.54
1:A:304:THR:HG22	1:A:305:GLY:O	2.07	0.54
1:A:153:THR:OG1	1:A:207:HIS:HD2	1.90	0.54
1:A:320:THR:C	1:A:322:PHE:H	2.18	0.52
1:A:60:TRP:NE1	1:A:79:CYS:SG	2.83	0.51
1:A:507:ASN:HB2	2:A:883:HOH:O	2.09	0.51
1:A:49:THR:HG22	1:A:63:ARG:HG3	1.92	0.51
1:A:260:HIS:HD2	1:A:276:ASP:OD2	1.93	0.51
1:A:183:LYS:H	1:A:186:LYS:HD2	1.75	0.51
1:A:268:THR:CG2	1:A:269:GLU:N	2.74	0.51
1:A:318:LEU:O	1:A:322:PHE:CE2	2.63	0.51
1:A:314:MSE:HG3	1:A:408:LEU:HD11	1.92	0.51
1:A:10:PRO:HD2	1:A:130:ILE:HD11	1.94	0.50
1:A:7:HIS:HD2	2:A:737:HOH:O	1.94	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:318:LEU:O	1:A:319:LYS:C	2.55	0.50
1:A:10:PRO:HD2	1:A:130:ILE:HD13	1.93	0.49
1:A:487:ASP:C	1:A:487:ASP:OD2	2.56	0.48
1:A:206:VAL:HG21	1:A:353:ILE:HD11	1.96	0.48
1:A:79:CYS:SG	1:A:81:THR:O	2.73	0.47
1:A:319:LYS:HD3	2:A:946:HOH:O	2.13	0.47
1:A:332:ASP:HB3	1:A:334:THR:H	1.80	0.47
1:A:35:PRO:HB2	1:A:55:PRO:HG3	1.97	0.47
1:A:2:SER:CB	1:A:111:THR:CG2	2.93	0.46
1:A:14:GLU:O	1:A:18:ASP:HB2	2.15	0.46
1:A:268:THR:HG21	2:A:852:HOH:O	2.14	0.46
1:A:32:PRO:HD3	1:A:124:TYR:CZ	2.50	0.46
1:A:153:THR:O	1:A:208:LEU:HB2	2.15	0.46
1:A:330:PHE:N	1:A:372:ASN:HD21	2.05	0.46
1:A:315:LEU:HB3	1:A:316:PRO:HD3	1.99	0.45
1:A:74:ARG:HE	1:A:95:ASN:ND2	2.12	0.45
1:A:449:ALA:O	1:A:453:GLU:HG3	2.18	0.44
1:A:487:ASP:HB2	1:A:488:PRO:HD2	2.00	0.44
1:A:492:GLU:O	1:A:496:LEU:HD13	2.17	0.44
1:A:92:HIS:HD2	2:A:738:HOH:O	2.00	0.43
1:A:114:PRO:HG2	1:A:117:THR:OG1	2.18	0.43
1:A:210:GLY:HA3	1:A:229:ARG:HH12	1.83	0.43
1:A:7:HIS:CD2	1:A:126:GLN:HG2	2.54	0.42
1:A:126:GLN:NE2	1:A:446:ALA:H	2.02	0.42
1:A:423:LEU:O	1:A:424:SER:HB2	2.20	0.42
1:A:130:ILE:HD12	1:A:130:ILE:O	2.19	0.42
1:A:82:ALA:HA	1:A:88:ALA:HB2	2.00	0.42
1:A:321:LEU:C	1:A:322:PHE:CG	2.98	0.41
1:A:143:PHE:CZ	1:A:145:GLY:HA2	2.56	0.40
1:A:410:LEU:HD23	1:A:410:LEU:HA	1.95	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	446/516 (86%)	436 (98%)	9 (2%)	1 (0%)	43	42

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	321	LEU

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	364/417 (87%)	346 (95%)	18 (5%)	22	20

All (18) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	18	ASP
1	A	23	LYS
1	A	49	THR
1	A	66	LEU
1	A	129	LEU
1	A	130	ILE
1	A	158	LEU
1	A	167	LEU
1	A	218	ASN
1	A	229	ARG
1	A	231	LEU
1	A	236	LEU
1	A	247	THR
1	A	329	LYS
1	A	332	ASP
1	A	413	GLN
1	A	485	LEU
1	A	500	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (13) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	7	HIS
1	A	41	GLN
1	A	71	ASN
1	A	95	ASN
1	A	126	GLN
1	A	207	HIS
1	A	218	ASN
1	A	260	HIS
1	A	357	GLN
1	A	372	ASN
1	A	413	GLN
1	A	451	GLN
1	A	511	HIS

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 ⓘ

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	451/516 (87%)	0.19	36 (7%) 18 17	13, 23, 61, 77	0

All (36) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	217	PHE	6.1
1	A	82	ALA	6.0
1	A	80	LEU	5.2
1	A	484	ASN	4.6
1	A	322	PHE	4.5
1	A	81	THR	4.3
1	A	456	ALA	4.1
1	A	513	HIS	4.0
1	A	323	SER	3.9
1	A	381	THR	3.6
1	A	219	ASP	3.4
1	A	380	ALA	3.4
1	A	403	GLN	3.4
1	A	87	LEU	3.4
1	A	321	LEU	3.3
1	A	88	ALA	3.2
1	A	485	LEU	3.0
1	A	225	ILE	3.0
1	A	36	LEU	2.9
1	A	2	SER	2.9
1	A	211	GLU	2.8
1	A	327	GLY	2.7
1	A	221	HIS	2.7
1	A	328	GLY	2.6
1	A	79	CYS	2.6
1	A	332	ASP	2.5
1	A	405	ALA	2.4

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Mol	Chain	Res	Type	RSRZ
1	A	379	LEU	2.3
1	A	511	HIS	2.3
1	A	218	ASN	2.2
1	A	512	HIS	2.2
1	A	114	PRO	2.1
1	A	113	LEU	2.1
1	A	496	LEU	2.1
1	A	89	ASN	2.0
1	A	404	GLY	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.