WORLDWIDE wwPDB PROTEIN DATA BANK

Full wwPDB X-ray Structure Validation Report ⓘ

Nov 21, 2023 – 12:40 AM JST

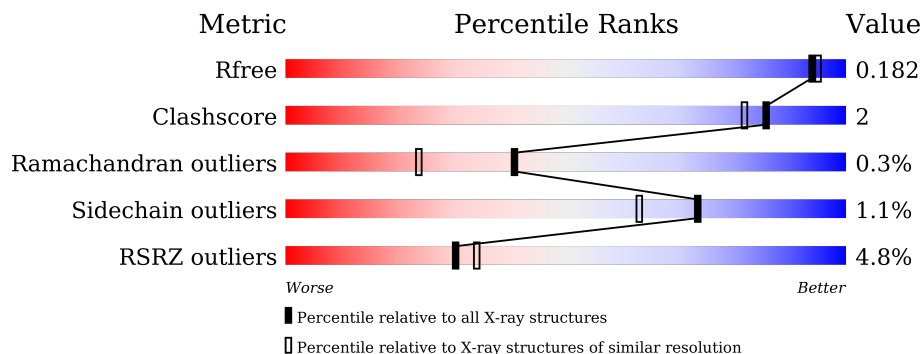|		
PDB ID	:	7E2P
Title	:	The Crystal Structure of Mycoplasma bovis enolase
Authors	:	Chen, R.; Zhang, S.; Gan, R.; Wang, W.; Ran, T.; Shao, G.; Xiong, Q.; Feng, Z.
Deposited on	:	2021-02-07
Resolution	:	1.70 Å(reported)

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1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:
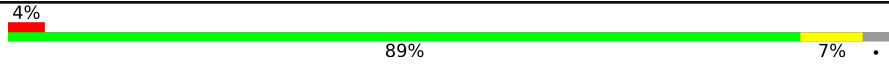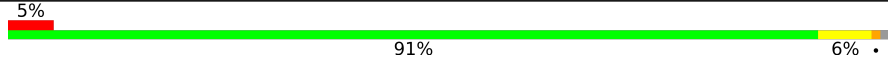*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.70 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	Percentile Ranks	Value
Rfree		0.182
Clashscore		2
Ramachandran outliers		0.3%
Sidechain outliers		1.1%
RSRZ outliers		4.8%

Worse   *Better*

▌ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	4298 (1.70-1.70)
Clashscore	141614	4695 (1.70-1.70)
Ramachandran outliers	138981	4610 (1.70-1.70)
Sidechain outliers	138945	4610 (1.70-1.70)
RSRZ outliers	127900	4222 (1.70-1.70)

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 <=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	462	4% 89% 7% ·
1	B	462	5% 91% 6% · ·

2 Entity composition ⓘ

There are 2 unique types of molecules in this entry. The entry contains 7242 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 Enolase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	447	Total 3417	C 2154	N 574	O 673	S 16	0	0	0
1	B	449	Total 3434	C 2163	N 579	O 676	S 16	0	0	0

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	455	LEU	-	expression tag	UNP A0A7D5V839
A	456	GLU	-	expression tag	UNP A0A7D5V839
A	457	HIS	-	expression tag	UNP A0A7D5V839
A	458	HIS	-	expression tag	UNP A0A7D5V839
A	459	HIS	-	expression tag	UNP A0A7D5V839
A	460	HIS	-	expression tag	UNP A0A7D5V839
A	461	HIS	-	expression tag	UNP A0A7D5V839
A	462	HIS	-	expression tag	UNP A0A7D5V839
B	455	LEU	-	expression tag	UNP A0A7D5V839
B	456	GLU	-	expression tag	UNP A0A7D5V839
B	457	HIS	-	expression tag	UNP A0A7D5V839
B	458	HIS	-	expression tag	UNP A0A7D5V839
B	459	HIS	-	expression tag	UNP A0A7D5V839
B	460	HIS	-	expression tag	UNP A0A7D5V839
B	461	HIS	-	expression tag	UNP A0A7D5V839
B	462	HIS	-	expression tag	UNP A0A7D5V839

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	211	Total 211	O 211	0	0
2	B	180	Total 180	O 180	0	0

3 Residue-property plots ⓘ

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: Enolase

Chain A:

• Molecule 1: Enolase

Chain B:
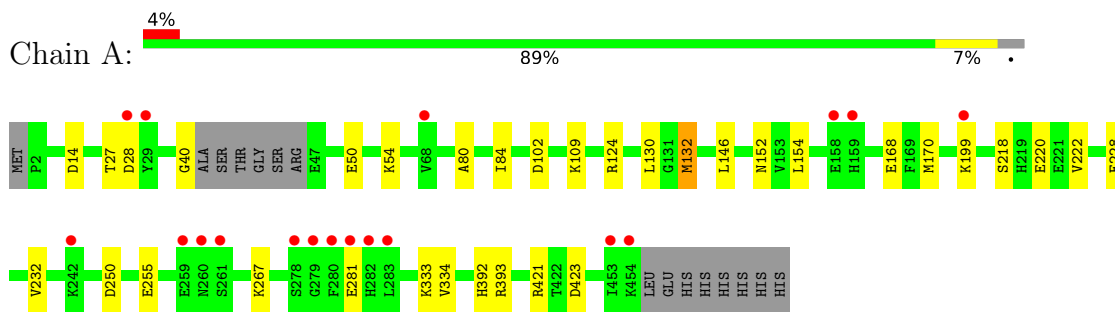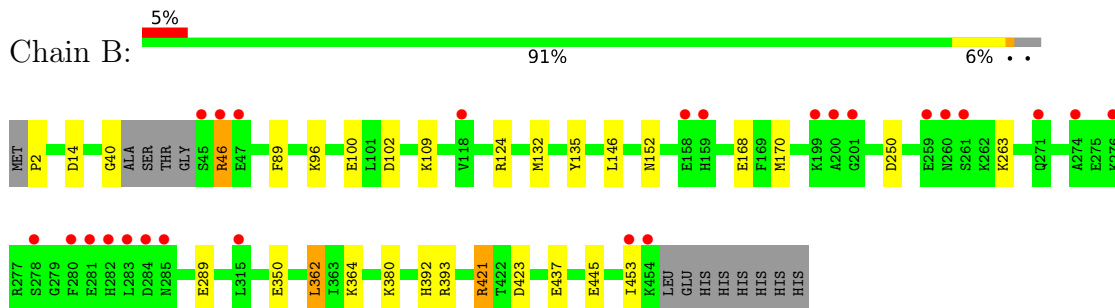
4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	I 4	Depositor
Cell constants a, b, c, α, β, γ	142.22Å 142.22Å 107.42Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	19.72 – 1.70 19.72 – 1.70	Depositor EDS
% Data completeness (in resolution range)	98.1 (19.72-1.70) 98.1 (19.72-1.70)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.15 (at 1.70Å)	Xtriage
Refinement program	PHENIX 1.16_3549	Depositor
R, R_{free}	0.158 , 0.182 0.158 , 0.182	Depositor DCC
R_{free} test set	5819 reflections (5.07%)	wwPDB-VP
Wilson B-factor (Å^2)	28.5	Xtriage
Anisotropy	0.042	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 41.8	EDS
L-test for twinning[2]	$< \|L\| > = 0.49, < L^2 > = 0.32$	Xtriage
Estimated twinning fraction	0.021 for -k,-h,-l	Xtriage
F_o,F_c correlation	0.97	EDS
Total number of atoms	7242	wwPDB-VP
Average B, all atoms (Å^2)	34.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.80% of the height of the origin peak. No significant pseudotranslation is detected.*

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[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< \|L\| >$, $< L^2 >$ 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	0.68	0/3465	0.76	4/4671 (0.1%)
1	B	0.66	0/3482	0.78	6/4693 (0.1%)
All	All	0.67	0/6947	0.77	10/9364 (0.1%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand.A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	1

There are no bond length outliers.

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	146	LEU	CA-CB-CG	-7.88	97.18	115.30
1	A	146	LEU	CA-CB-CG	-7.75	97.47	115.30
1	B	14	ASP	CB-CG-OD1	7.08	124.67	118.30
1	B	124	ARG	NE-CZ-NH2	-6.99	116.81	120.30
1	B	421	ARG	NE-CZ-NH1	6.43	123.51	120.30
1	A	124	ARG	NE-CZ-NH2	-6.27	117.16	120.30
1	B	146	LEU	CB-CG-CD1	5.92	121.07	111.00
1	A	146	LEU	CB-CG-CD2	5.91	121.05	111.00
1	B	362	LEU	CA-CB-CG	5.73	128.48	115.30
1	A	14	ASP	CB-CG-OD1	5.66	123.39	118.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	27	THR	Peptide

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	3417	0	3443	16	0
1	B	3434	0	3461	14	0
2	A	211	0	0	1	0
2	B	180	0	0	1	0
All	All	7242	0	6904	30	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 2.

All (30) 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:333:LYS:HG3	1:A:334:VAL:HG23	1.60	0.81
1:A:80:ALA:O	1:A:84:ILE:HG12	2.08	0.54
1:B:96:LYS:HE2	1:B:100:GLU:OE2	2.10	0.52
1:B:152:ASN:HA	1:B:170:MET:HG2	1.94	0.49
1:A:152:ASN:HA	1:A:170:MET:HG2	1.97	0.47
1:B:46:ARG:NH1	2:B:503:HOH:O	2.48	0.47
1:A:168:GLU:HB2	1:A:250:ASP:HB3	1.98	0.46
1:A:154:LEU:HD13	1:A:222:VAL:HG13	1.97	0.46
1:B:168:GLU:HB2	1:B:250:ASP:HB3	1.98	0.45
1:A:220:GLU:H	1:A:220:GLU:CD	2.21	0.45
1:A:40:GLY:HA3	1:A:393:ARG:NH2	2.32	0.44
1:B:2:PRO:HB3	1:B:89:PHE:CE2	2.52	0.44
1:B:135:TYR:OH	1:B:437:GLU:OE2	2.30	0.44
1:A:199:LYS:HE2	1:A:199:LYS:HB3	1.76	0.43
1:A:218:SER:HB2	1:A:220:GLU:OE1	2.19	0.43
1:A:54:LYS:HB2	2:A:683:HOH:O	2.19	0.43
1:A:228:GLU:O	1:A:232:VAL:HG23	2.19	0.42
1:A:281:GLU:H	1:A:281:GLU:CD	2.23	0.42
1:B:453:ILE:HD12	1:B:453:ILE:HG23	1.81	0.42
1:B:350:GLU:OE2	1:B:380:LYS:NZ	2.48	0.42
1:B:132:MET:HE2	1:B:132:MET:HB2	1.81	0.41
1:B:362:LEU:HD13	1:B:364:LYS:HE3	2.01	0.41
1:B:453:ILE:HD13	1:B:453:ILE:HA	1.75	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:263:LYS:HD2	1:B:289:GLU:HG2	2.01	0.41
1:B:40:GLY:HA3	1:B:393:ARG:NH2	2.36	0.41
1:A:132:MET:HE2	1:A:132:MET:HB2	1.85	0.40
1:A:255:GLU:OE2	1:A:267:LYS:NZ	2.31	0.40
1:A:102:ASP:O	1:A:109:LYS:HE3	2.21	0.40
1:A:130:LEU:HD13	1:A:132:MET:CE	2.51	0.40
1:B:102:ASP:O	1:B:109:LYS:HE3	2.22	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	443/462 (96%)	433 (98%)	8 (2%)	2 (0%)	29	13
1	B	445/462 (96%)	434 (98%)	10 (2%)	1 (0%)	47	30
All	All	888/924 (96%)	867 (98%)	18 (2%)	3 (0%)	41	24

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	28	ASP
1	A	421	ARG
1	B	421	ARG

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	363/376 (96%)	359 (99%)	4 (1%)	73	63
1	B	365/376 (97%)	361 (99%)	4 (1%)	73	63
All	All	728/752 (97%)	720 (99%)	8 (1%)	73	63

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	50	GLU
1	A	132	MET
1	A	392	HIS
1	A	423	ASP
1	B	46	ARG
1	B	392	HIS
1	B	423	ASP
1	B	445	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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 monosaccharides in this entry.

5.6 Ligand geometry ⓘ

There are no ligands in this entry.

5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

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	447/462 (96%)	0.09	18 (4%)	38	42	21, 31, 52, 82	0
1	B	449/462 (97%)	0.16	25 (5%)	24	27	22, 31, 59, 101	0
All	All	896/924 (96%)	0.13	43 (4%)	30	34	21, 31, 57, 101	0

All (43) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	274	ALA	5.9
1	A	454	LYS	5.2
1	B	159	HIS	4.9
1	B	283	LEU	4.9
1	A	283	LEU	4.3
1	A	159	HIS	4.2
1	B	280	PHE	4.0
1	B	278	SER	3.9
1	B	282	HIS	3.9
1	B	158	GLU	3.7
1	B	45	SER	3.6
1	B	46	ARG	3.5
1	B	276	LYS	3.4
1	A	278	SER	3.2
1	B	284	ASP	3.2
1	B	201	GLY	3.0
1	B	259	GLU	3.0
1	A	260	ASN	2.9
1	A	279	GLY	2.9
1	B	454	LYS	2.9
1	B	453	ILE	2.9
1	A	158	GLU	2.8
1	A	242	LYS	2.8
1	A	29	TYR	2.7

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Mol	Chain	Res	Type	RSRZ
1	A	282	HIS	2.7
1	B	199	LYS	2.6
1	B	200	ALA	2.6
1	B	285	ASN	2.6
1	A	280	PHE	2.5
1	B	315	LEU	2.5
1	B	261	SER	2.4
1	B	271	GLN	2.4
1	A	259	GLU	2.4
1	B	281	GLU	2.4
1	B	260	ASN	2.3
1	B	47	GLU	2.3
1	A	281	GLU	2.3
1	A	453	ILE	2.3
1	B	118	VAL	2.2
1	A	199	LYS	2.1
1	A	261	SER	2.1
1	A	28	ASP	2.1
1	A	68	VAL	2.1

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

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates ⓘ

There are no monosaccharides in this entry.

6.4 Ligands ⓘ

There are no ligands in this entry.

6.5 Other polymers ⓘ

There are no such residues in this entry.