



wwPDB X-ray Structure Validation Summary Report

Feb 28, 2014 – 12:34 AM GMT

PDB ID : 1NS2
Title : Crystal structure of galactose mutarotase from *Lactococcus lactis* mutant E304A complexed with galactose
Authors : Holden, H.M.; Thoden, J.B.
Deposited on : 2003-01-27
Resolution : 1.95 Å(reported)

This is a wwPDB validation summary report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at <http://wwpdb.org/ValidationPDFNotes.html>

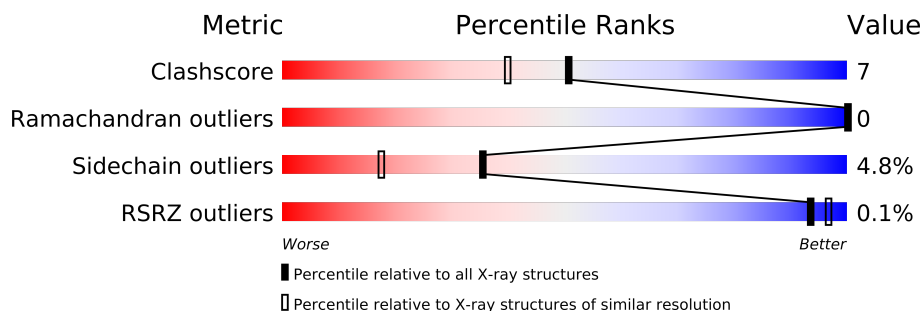
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity	:	4.02b-467
Mogul	:	1.15 2013
Xtriage (Phenix)	:	dev-1323
EDS	:	stable22639
Percentile statistics	:	21963
Refmac	:	5.8.0049
CCP4	:	6.3.0 (Settle)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et. al. (1996)
Validation Pipeline (wwPDB-VP)	:	stable22683

1 Overall quality at a glance

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))
Clashscore	79885	1488 (1.96-1.96)
Ramachandran outliers	78287	1475 (1.96-1.96)
Sidechain outliers	78261	1475 (1.96-1.96)
RSRZ outliers	66119	1321 (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 on the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Mol	Chain	Length	Quality of chain
1	A	347	
1	B	347	

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 5787 atoms, of which 0 are hydrogen and 0 are deuterium.

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.

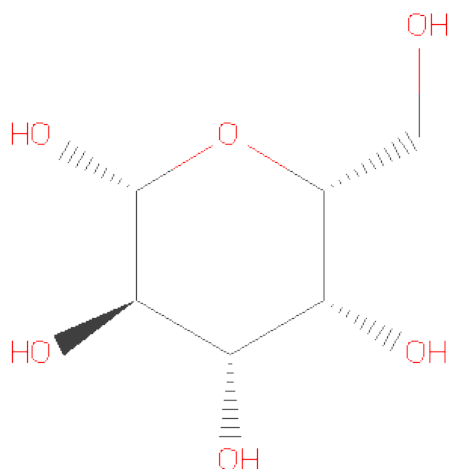
- Molecule 1 is a protein called GALACTOSE MUTAROTASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	339	Total	C	N	O	S	0	1	0
			2645	1669	447	526	3			
1	B	346	Total	C	N	O	S	0	0	0
			2713	1709	466	535	3			

There are 20 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	2	SER	GLU	CLONING ARTIFACT	UNP Q9ZB17
A	304	ALA	GLU	ENGINEERED	UNP Q9ZB17
A	340	LEU	-	EXPRESSION TAG	UNP Q9ZB17
A	341	GLU	-	EXPRESSION TAG	UNP Q9ZB17
A	342	HIS	-	EXPRESSION TAG	UNP Q9ZB17
A	343	HIS	-	EXPRESSION TAG	UNP Q9ZB17
A	344	HIS	-	EXPRESSION TAG	UNP Q9ZB17
A	345	HIS	-	EXPRESSION TAG	UNP Q9ZB17
A	346	HIS	-	EXPRESSION TAG	UNP Q9ZB17
A	347	HIS	-	EXPRESSION TAG	UNP Q9ZB17
B	2	SER	GLU	CLONING ARTIFACT	UNP Q9ZB17
B	304	ALA	GLU	ENGINEERED	UNP Q9ZB17
B	340	LEU	-	EXPRESSION TAG	UNP Q9ZB17
B	341	GLU	-	EXPRESSION TAG	UNP Q9ZB17
B	342	HIS	-	EXPRESSION TAG	UNP Q9ZB17
B	343	HIS	-	EXPRESSION TAG	UNP Q9ZB17
B	344	HIS	-	EXPRESSION TAG	UNP Q9ZB17
B	345	HIS	-	EXPRESSION TAG	UNP Q9ZB17
B	346	HIS	-	EXPRESSION TAG	UNP Q9ZB17
B	347	HIS	-	EXPRESSION TAG	UNP Q9ZB17

- Molecule 2 is SUGAR (D-GALACTOSE) (three-letter code: GAL) (formula: C₆H₁₂O₆).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	C	O	0	1
			13	6	7		
2	B	1	Total	C	O	0	1
			13	6	7		

- Molecule 3 is NICKEL (II) ION (three-letter code: NI) (formula: Ni).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Ni	0	0
			1	1		

- Molecule 4 is water.

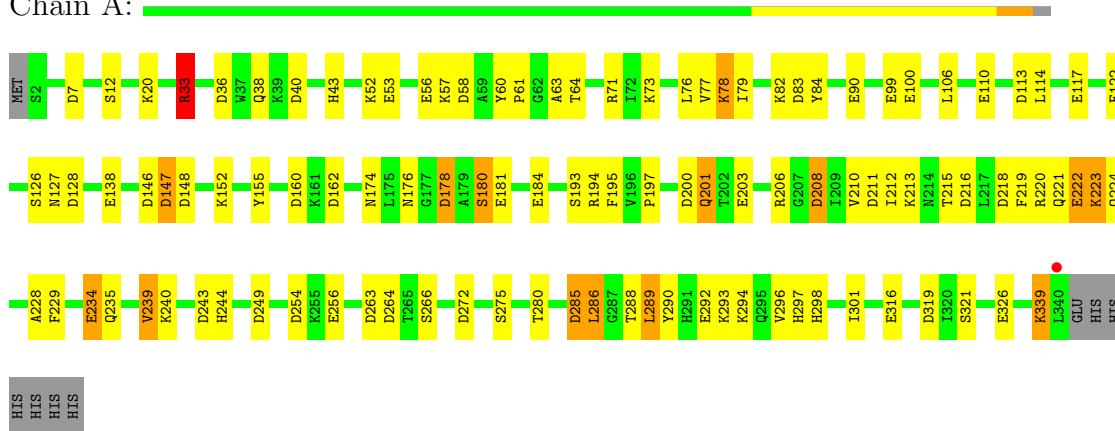
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	178	Total	O	0	0
			178	178		
4	B	224	Total	O	0	0
			224	224		

3 Residue-property plots

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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.

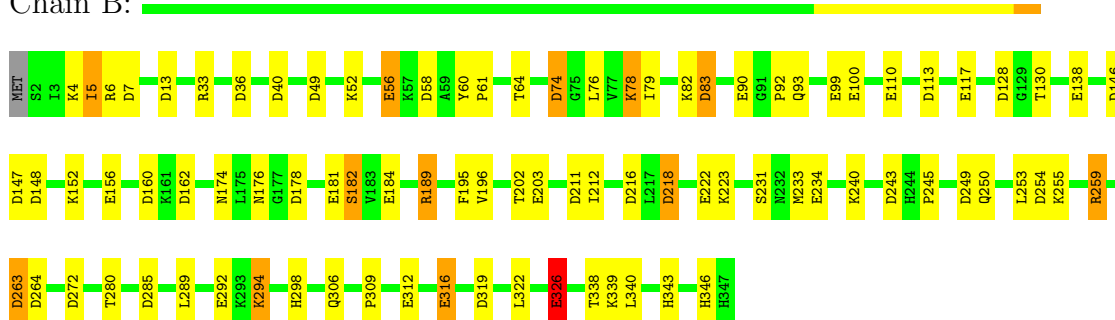
• Molecule 1: GALACTOSE MUTAROTASE

Chain A:



• Molecule 1: GALACTOSE MUTAROTASE

Chain B:



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	44.80Å 76.40Å 211.40Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	30.00 – 1.95 61.92 – 1.91	Depositor EDS
% Data completeness (in resolution range)	94.1 (30.00-1.95) 92.5 (61.92-1.91)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.07	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.68 (at 1.91Å)	Xtriage
Refinement program	TNT	Depositor
R, R_{free}	0.163 , 0.229 0.164 , (Not available)	Depositor DCC
R_{free} test set	No test flags present.	DCC
Wilson B-factor (Å ²)	20.8	Xtriage
Anisotropy	0.180	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 84.0	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Outliers	0 of 52812 reflections	Xtriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	5787	wwPDB-VP
Average B, all atoms (Å ²)	29.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.56% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

5 Model quality ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: NI, GAL

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	0.94	14/2701 (0.5%)	1.44	54/3656 (1.5%)
1	B	0.97	14/2771 (0.5%)	1.42	51/3750 (1.4%)
All	All	0.95	28/5472 (0.5%)	1.43	105/7406 (1.4%)

The worst 5 of 28 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	316	GLU	CD-OE2	7.89	1.34	1.25
1	B	326	GLU	CD-OE2	7.82	1.34	1.25
1	A	326	GLU	CD-OE2	7.28	1.33	1.25
1	A	184	GLU	CD-OE2	7.21	1.33	1.25
1	B	292	GLU	CD-OE2	7.15	1.33	1.25

The worst 5 of 105 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	6	ARG	NE-CZ-NH1	9.71	125.16	120.30
1	B	128	ASP	CB-CG-OD2	-9.66	109.60	118.30
1	A	146	ASP	CB-CG-OD1	8.97	126.38	118.30
1	A	147	ASP	CB-CG-OD2	-8.88	110.31	118.30
1	B	272	ASP	CB-CG-OD2	-8.82	110.36	118.30

There are no chirality outliers.

There are no planarity outliers.

5.2 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 hydrogens

added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2645	0	2586	49	0
1	B	2713	0	2633	31	0
2	A	13	0	4	0	0
2	B	13	0	4	0	0
3	A	1	0	0	0	0
4	A	178	0	0	3	0
4	B	224	0	0	2	0
All	All	5787	0	5227	79	0

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 7.

The worst 5 of 79 close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:B:338:THR:HG22	1:B:339:LYS:HG3	1.60	0.80
1:A:289:LEU:HD23	1:A:294:LYS:HA	1.68	0.75
1:B:338:THR:CG2	1:B:339:LYS:HG3	2.18	0.73
1:A:20:LYS:HD2	1:A:147:ASP:OD2	1.88	0.73
1:A:78:LYS:HB2	1:A:78:LYS:NZ	2.05	0.72

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	338/347 (97%)	314 (93%)	24 (7%)	0	100	100
1	B	344/347 (99%)	324 (94%)	20 (6%)	0	100	100
All	All	682/694 (98%)	638 (94%)	44 (6%)	0	100	100

There are no Ramachandran outliers to report.

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	292/299 (98%)	276 (94%)	16 (6%)	30	14
1	B	298/299 (100%)	286 (96%)	12 (4%)	42	26
All	All	590/598 (99%)	562 (95%)	28 (5%)	35	18

5 of 28 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	275	SER
1	A	339	LYS
1	B	294	LYS
1	A	286	LEU
1	A	289	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	201	GLN
1	A	227	ASN
1	A	237	GLN
1	B	38	GLN
1	B	224	GLN

5.3.3 RNA ⓘ

There are no RNA chains 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 carbohydrates in this entry.

5.6 Ligand geometry ⓘ

Of 5 ligands modelled in this entry, 1 is monoatomic and 4 are modelled with single atom - 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.

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	339/347 (97%)	-0.52	1 (0%) 91 95	15, 26, 58, 91	0
1	B	346/347 (99%)	-0.62	0 100 100	15, 23, 50, 60	0
All	All	685/694 (98%)	-0.57	1 (0%) 93 97	15, 24, 54, 91	0

All (1) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	340	LEU	3.2

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 carbohydrates in this entry.

6.4 Ligands ⓘ

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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	RSR	LLDF	B-factors(Å ²)	Q<0.9
2	GAL	A	1400[A]	1/12	0.08	0.78	16,16,16,16	1
2	GAL	A	1400[B]	1/12	0.08	0.48	27,27,27,27	1

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Mol	Type	Chain	Res	Atoms	RSR	LLDF	B-factors(\AA^2)	Q<0.9
2	GAL	B	2400[A]	1/12	0.08	0.27	39,39,39,39	1
2	GAL	B	2400[B]	1/12	0.08	0.13	21,21,21,21	1
3	NI	A	1401	1/1	0.05	-2.34	28,28,28,28	0

6.5 Other polymers

There are no such residues in this entry.