wwPDB X-ray Structure Validation Summary Report (i)

Feb 1, 2016 – 09:56 AM GMT

PDB ID	:	3K8E
Title	:	Crystal structure of E. coli lipopolysaccharide specific CMP-KDO synthetase
Authors	:	Heyes, D.J.; Levy, C.W.; Lafite, P.; Scrutton, N.S.; Leys, D.
Deposited on	:	2009-10-14
Resolution	:	2.51 Å(reported)

This is a wwPDB X-ray Structure 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/validation/2016/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The following versions of software and data (see references (1)) were used in the production of this report:

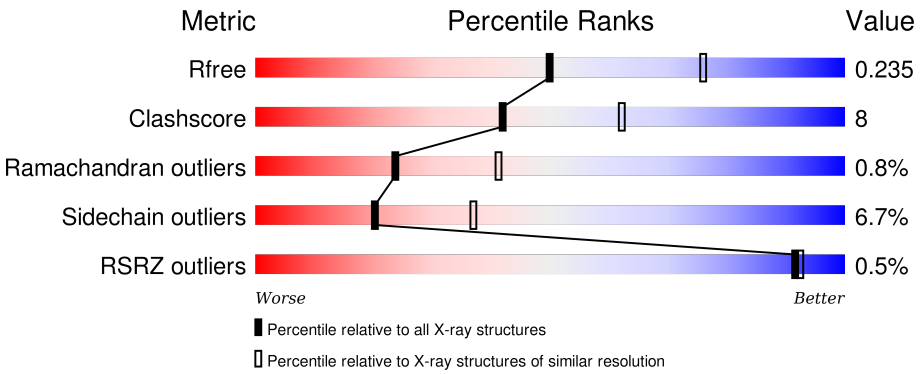
MolProbity	:	4.02b-467
Mogul	:	1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20026688
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	trunk26865

1 Overall quality at a glance (i)

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

The reported resolution of this entry is 2.51 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}	91344	3553 (2.50-2.50)
Clashscore	102246	4242 (2.50-2.50)
Ramachandran outliers	100387	4156 (2.50-2.50)
Sidechain outliers	100360	4158 (2.50-2.50)
RSRZ outliers	91569	3562 (2.50-2.50)

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. 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	264	% 73% 16% • 8%
1	B	264	% 80% 11% • 7%
1	C	264	77% 13% • 8%
1	D	264	71% 17% • 10%

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 7657 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 3-deoxy-manno-octulosonate cytidylyltransferase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	C	244	1895	1192	342	355	6	0	0	0
			Total	C	N	O	S			
1	D	238	1832	1161	324	339	8	0	0	0
			Total	C	N	O	S			
1	A	242	1882	1185	340	350	7	0	0	0
			Total	C	N	O	S			
1	B	246	1906	1200	344	355	7	0	0	0

There are 64 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	-15	HIS	-	EXPRESSION TAG	UNP P04951
C	-14	HIS	-	EXPRESSION TAG	UNP P04951
C	-13	HIS	-	EXPRESSION TAG	UNP P04951
C	-12	HIS	-	EXPRESSION TAG	UNP P04951
C	-11	HIS	-	EXPRESSION TAG	UNP P04951
C	-10	HIS	-	EXPRESSION TAG	UNP P04951
C	-9	SER	-	EXPRESSION TAG	UNP P04951
C	-8	SER	-	EXPRESSION TAG	UNP P04951
C	-7	GLY	-	EXPRESSION TAG	UNP P04951
C	-6	LEU	-	EXPRESSION TAG	UNP P04951
C	-5	VAL	-	EXPRESSION TAG	UNP P04951
C	-4	PRO	-	EXPRESSION TAG	UNP P04951
C	-3	ARG	-	EXPRESSION TAG	UNP P04951
C	-2	GLY	-	EXPRESSION TAG	UNP P04951
C	-1	SER	-	EXPRESSION TAG	UNP P04951
C	0	HIS	-	EXPRESSION TAG	UNP P04951
D	-15	HIS	-	EXPRESSION TAG	UNP P04951
D	-14	HIS	-	EXPRESSION TAG	UNP P04951
D	-13	HIS	-	EXPRESSION TAG	UNP P04951
D	-12	HIS	-	EXPRESSION TAG	UNP P04951
D	-11	HIS	-	EXPRESSION TAG	UNP P04951

Continued on next page...

Continued from previous page...

Chain	Residue	Modelled	Actual	Comment	Reference
D	-10	HIS	-	EXPRESSION TAG	UNP P04951
D	-9	SER	-	EXPRESSION TAG	UNP P04951
D	-8	SER	-	EXPRESSION TAG	UNP P04951
D	-7	GLY	-	EXPRESSION TAG	UNP P04951
D	-6	LEU	-	EXPRESSION TAG	UNP P04951
D	-5	VAL	-	EXPRESSION TAG	UNP P04951
D	-4	PRO	-	EXPRESSION TAG	UNP P04951
D	-3	ARG	-	EXPRESSION TAG	UNP P04951
D	-2	GLY	-	EXPRESSION TAG	UNP P04951
D	-1	SER	-	EXPRESSION TAG	UNP P04951
D	0	HIS	-	EXPRESSION TAG	UNP P04951
A	-15	HIS	-	EXPRESSION TAG	UNP P04951
A	-14	HIS	-	EXPRESSION TAG	UNP P04951
A	-13	HIS	-	EXPRESSION TAG	UNP P04951
A	-12	HIS	-	EXPRESSION TAG	UNP P04951
A	-11	HIS	-	EXPRESSION TAG	UNP P04951
A	-10	HIS	-	EXPRESSION TAG	UNP P04951
A	-9	SER	-	EXPRESSION TAG	UNP P04951
A	-8	SER	-	EXPRESSION TAG	UNP P04951
A	-7	GLY	-	EXPRESSION TAG	UNP P04951
A	-6	LEU	-	EXPRESSION TAG	UNP P04951
A	-5	VAL	-	EXPRESSION TAG	UNP P04951
A	-4	PRO	-	EXPRESSION TAG	UNP P04951
A	-3	ARG	-	EXPRESSION TAG	UNP P04951
A	-2	GLY	-	EXPRESSION TAG	UNP P04951
A	-1	SER	-	EXPRESSION TAG	UNP P04951
A	0	HIS	-	EXPRESSION TAG	UNP P04951
B	-15	HIS	-	EXPRESSION TAG	UNP P04951
B	-14	HIS	-	EXPRESSION TAG	UNP P04951
B	-13	HIS	-	EXPRESSION TAG	UNP P04951
B	-12	HIS	-	EXPRESSION TAG	UNP P04951
B	-11	HIS	-	EXPRESSION TAG	UNP P04951
B	-10	HIS	-	EXPRESSION TAG	UNP P04951
B	-9	SER	-	EXPRESSION TAG	UNP P04951
B	-8	SER	-	EXPRESSION TAG	UNP P04951
B	-7	GLY	-	EXPRESSION TAG	UNP P04951
B	-6	LEU	-	EXPRESSION TAG	UNP P04951
B	-5	VAL	-	EXPRESSION TAG	UNP P04951
B	-4	PRO	-	EXPRESSION TAG	UNP P04951
B	-3	ARG	-	EXPRESSION TAG	UNP P04951
B	-2	GLY	-	EXPRESSION TAG	UNP P04951
B	-1	SER	-	EXPRESSION TAG	UNP P04951

Continued on next page...

Continued from previous page...

Chain	Residue	Modelled	Actual	Comment	Reference
B	0	HIS	-	EXPRESSION TAG	UNP P04951

- Molecule 2 is water.

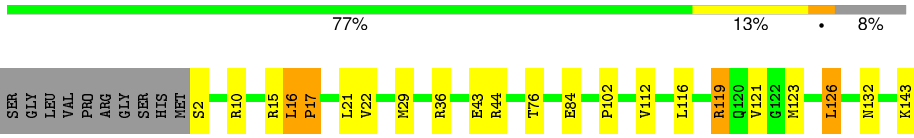
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	36	Total O 36 36	0	0
2	B	37	Total O 37 37	0	0
2	C	30	Total O 30 30	0	0
2	D	39	Total O 39 39	0	0

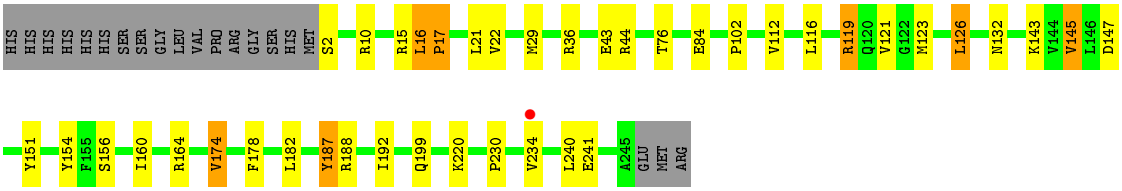
3 Residue-property plots (i)

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: 3-deoxy-manno-octulosonate cytidylyltransferase

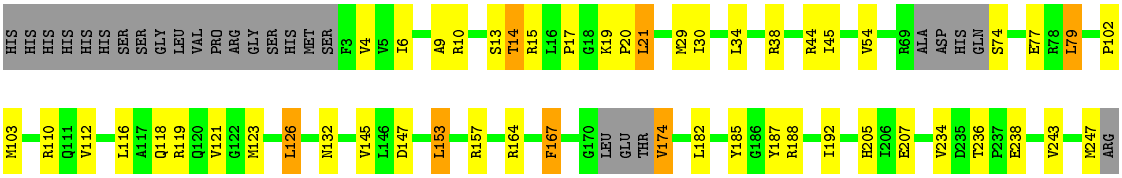
Chain C:





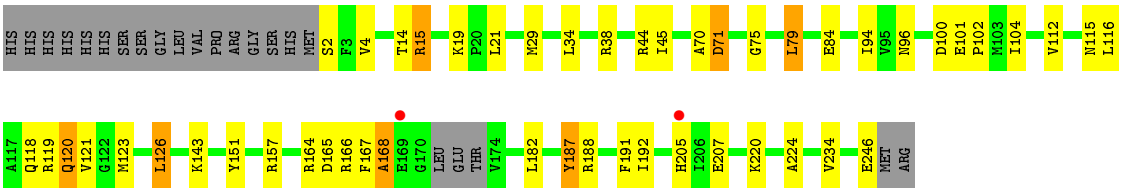
- Molecule 1: 3-deoxy-manno-octulosonate cytidylyltransferase

Chain D:



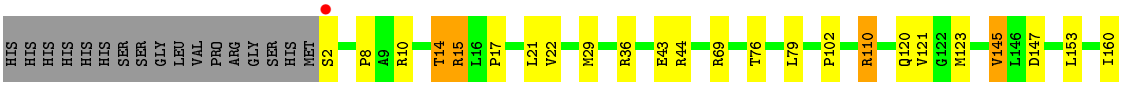
- Molecule 1: 3-deoxy-manno-octulosonate cytidylyltransferase

Chain A:



- Molecule 1: 3-deoxy-manno-octulosonate cytidylyltransferase

Chain B:



R164
V174
F178
Y187
I192
R193
S201
W216
K220
V234
L240
V243
M247
ARG

4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	124.47Å 77.18Å 143.63Å 90.00° 90.03° 90.00°	Depositor
Resolution (Å)	47.00 – 2.51 37.27 – 2.51	Depositor EDS
% Data completeness (in resolution range)	98.1 (47.00-2.51) 98.1 (37.27-2.51)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	4.82 (at 2.51Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.199 , 0.234 0.206 , 0.235	Depositor DCC
R_{free} test set	2350 reflections (5.38%)	DCC
Wilson B-factor (Å^2)	54.5	Xtriage
Anisotropy	0.072	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.33 , 45.4	EDS
Estimated twinning fraction	0.480 for -h,-k,l	Xtriage
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Outliers	0 of 46177 reflections	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	7657	wwPDB-VP
Average B, all atoms (Å^2)	54.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.08% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.375 respectively for untwinned datasets, and 0.333, 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	0.55	0/1919	0.64	0/2609
1	B	0.59	0/1945	0.71	1/2648 (0.0%)
1	C	0.60	0/1933	0.70	2/2631 (0.1%)
1	D	0.58	0/1868	0.70	0/2542
All	All	0.58	0/7665	0.69	3/10430 (0.0%)

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	C	2	SER	O-C-N	-6.51	112.28	122.70
1	B	110	ARG	NE-CZ-NH1	5.39	123.00	120.30
1	C	2	SER	CA-C-N	5.01	128.22	117.20

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	1882	0	1851	38	0
1	B	1906	0	1871	25	0
1	C	1895	0	1858	26	0
1	D	1832	0	1798	36	0
2	A	36	0	0	1	0
2	B	37	0	0	1	0

Continued on next page...

Continued from previous page...

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	C	30	0	0	0	0
2	D	39	0	0	1	0
All	All	7657	0	7378	125	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 8.

The worst 5 of 125 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:B:29:MET:HE2	1:B:102:PRO:HD3	1.28	1.11
1:B:193:ARG:HG3	1:B:193:ARG:HH11	0.96	1.07
1:A:29:MET:HE2	1:A:102:PRO:HD3	1.44	0.98
1:C:29:MET:HE2	1:C:102:PRO:HD3	1.47	0.96
1:B:193:ARG:CG	1:B:193:ARG:HH11	1.78	0.94

There are no symmetry-related clashes.

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	238/264 (90%)	227 (95%)	8 (3%)	3 (1%)	15	26
1	B	244/264 (92%)	235 (96%)	8 (3%)	1 (0%)	39	61
1	C	242/264 (92%)	232 (96%)	8 (3%)	2 (1%)	24	41
1	D	232/264 (88%)	220 (95%)	10 (4%)	2 (1%)	21	37
All	All	956/1056 (90%)	914 (96%)	34 (4%)	8 (1%)	24	41

5 of 8 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	16	LEU
1	C	17	PRO
1	A	168	ALA
1	D	17	PRO
1	A	71	ASP

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	194/217 (89%)	182 (94%)	12 (6%)	23	41
1	B	196/217 (90%)	184 (94%)	12 (6%)	23	42
1	C	195/217 (90%)	182 (93%)	13 (7%)	20	37
1	D	187/217 (86%)	172 (92%)	15 (8%)	15	28
All	All	772/868 (89%)	720 (93%)	52 (7%)	20	37

5 of 52 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	174	VAL
1	A	21	LEU
1	B	153	LEU
1	D	182	LEU
1	D	205	HIS

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

Mol	Chain	Res	Type
1	C	25	ASN
1	D	118	GLN
1	D	222	HIS
1	A	115	ASN
1	A	197	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 carbohydrates 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	242/264 (91%)	-0.10	2 (0%)	87	89	47, 54, 65, 70	0
1	B	246/264 (93%)	-0.06	2 (0%)	87	89	48, 54, 61, 68	0
1	C	244/264 (92%)	-0.11	1 (0%)	93	93	20, 54, 60, 66	0
1	D	238/264 (90%)	-0.13	0	100	100	48, 54, 63, 66	0
All	All	970/1056 (91%)	-0.10	5 (0%)	91	92	20, 54, 63, 70	0

All (5) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	169	GLU	2.6
1	C	234	VAL	2.5
1	B	243	VAL	2.4
1	B	2	SER	2.4
1	A	205	HIS	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 carbohydrates 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.