WORLDWIDE PDB
PROTEIN DATA BANK

wwPDB X-ray Structure Validation Summary Report ⓘ

Jun 11, 2024 – 05:36 PM EDT

PDB ID	:	1VGW
Title	:	Crystal structure of 4-diphosphocytidyl-2C-methyl-D-erythritol synthase
Authors	:	Structural GenomiX
Deposited on	:	2003-11-03
Resolution	:	2.35 Å(reported)

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

|		
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.20.1
EDS	:	2.36.2
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36.2

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 2.35 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.
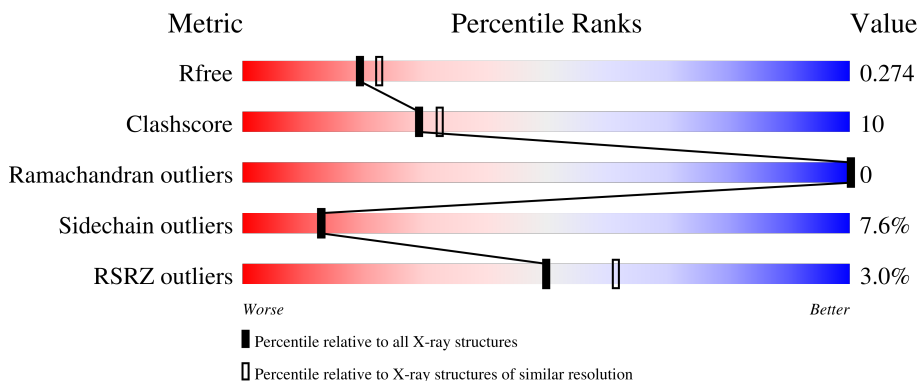
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	1164 (2.36-2.36)
Clashscore	141614	1232 (2.36-2.36)
Ramachandran outliers	138981	1211 (2.36-2.36)
Sidechain outliers	138945	1212 (2.36-2.36)
RSRZ outliers	127900	1150 (2.36-2.36)

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	231	
1	B	231	
1	C	231	
1	D	231	
1	E	231	

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Mol	Chain	Length	Quality of chain
1	F	231	

2 Entry composition ⓘ

There are 2 unique types of molecules in this entry. The entry contains 9804 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 4-diphosphocytidyl-2C-methyl-D-erythritol synthase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	212	Total 1584	C 994	N 289	O 299	S 2	0	0	0
1	B	214	Total 1609	C 1010	N 292	O 305	S 2	0	0	0
1	C	214	Total 1603	C 1007	N 290	O 304	S 2	0	0	0
1	D	211	Total 1587	C 996	N 287	O 302	S 2	0	0	0
1	E	213	Total 1595	C 1002	N 286	O 305	S 2	0	0	0
1	F	209	Total 1569	C 985	N 282	O 300	S 2	0	0	0

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	39	Total 39	O 39	0	0
2	B	59	Total 59	O 59	0	0
2	C	30	Total 30	O 30	0	0
2	D	38	Total 38	O 38	0	0
2	E	52	Total 52	O 52	0	0
2	F	39	Total 39	O 39	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.

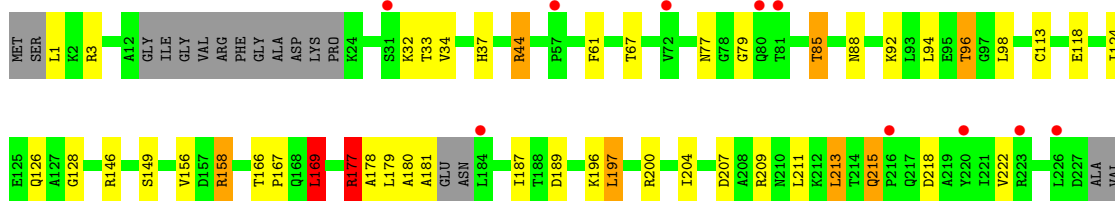- Molecule 1: 4-diphosphocytidyl-2C-methyl-D-erythritol synthase

Chain A:

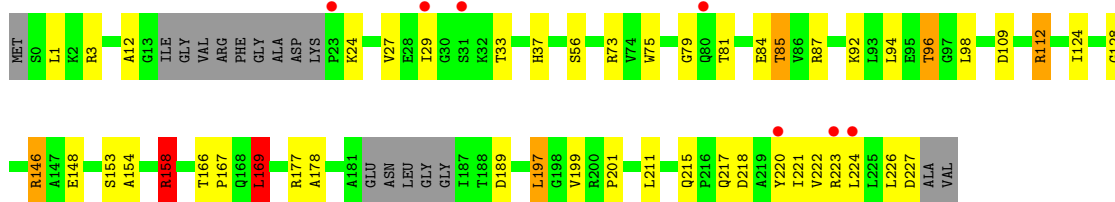- Molecule 1: 4-diphosphocytidyl-2C-methyl-D-erythritol synthase

Chain B:

- Molecule 1: 4-diphosphocytidyl-2C-methyl-D-erythritol synthase

Chain C:

- Molecule 1: 4-diphosphocytidyl-2C-methyl-D-erythritol synthase

Chain D:

MET SER LEU LYS R3 A12 GLY ILE GLY VAL ARG PHE GLY ALA ASP LYS P23 K24 V27 S31 V34 V38 F61 A62 D63 N77 G78 G79 Q80 T81 R82 T85 L94 E95 T96 G97 L98 T102 D103 N104 D109 R112 C113 R122 E132

V140 R146 A147 E148 S153 V156 D157 R158 S159 Q163 T166 P167 Q168 L169 A180 A181 GLU ASN LEU GLY G186 I187 S192 A193 K196 L197 G198 V199 R200 P201 R209 N210 L211 Y220 R223 L224 D227 ALA VAL

• Molecule 1: 4-diphosphocytidyl-2C-methyl-D-erythritol synthase

Chain E:

MET S0 L1 K4 G13 ILE GLY VAL ARG PHE GLY ALA ASP LYS P23 K24 Q25 Y26 S31 K32 T33 V34 H37 V38 R44 S56 D59 T60 F61 R73 G78 G79 Q80 T81 T85 K92 L93 L94 E95 T96 G97 L98 E101 L106 A110

S117 E118 R146 Q151 V156 D157 R158 L161 T166 P167 Q168 L169 A180 ALA GLU ASN LEU GLY GLY I187 L197 R200 R209 N210 L211 L226 D227 ALA VAL

• Molecule 1: 4-diphosphocytidyl-2C-methyl-D-erythritol synthase

Chain F:

MET SER LEU K2 A11 A12 GLY ILE GLY VAL ARG PHE GLY ALA ASP LYS PRO LYS Q25 E28 I29 G30 S31 K32 T33 H37 L50 T51 V55 S56 P57 E58 D59 T60 K64 T67 K76 G79 Q80 T81 E84 T85 K92 L93 L94 E95 T96 G97 L98

E101 L106 A111 R122 L123 I124 G128 T143 L144 K145 R146 A147 E148 Q151 I152 V156 D157 R158 T166 P167 Q168 L169 A180 ALA GLU ASN LEU GLY G186 L197 K212 Q215 I221 V222 R223 L226 D227 ALA VAL

4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	50.17Å 95.11Å 173.86Å 90.00° 93.65° 90.00°	Depositor
Resolution (Å)	39.47 – 2.35 39.47 – 2.35	Depositor EDS
% Data completeness (in resolution range)	(Not available) (39.47-2.35) 99.9 (39.47-2.35)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$<I/\sigma(I)>$ [1]	2.98 (at 2.34Å)	Xtriage
Refinement program	REFMAC 4.0	Depositor
R, R_{free}	0.260 , 0.317 0.225 , 0.274	Depositor DCC
R_{free} test set	3449 reflections (5.07%)	wwPDB-VP
Wilson B-factor (Å^2)	45.9	Xtriage
Anisotropy	0.534	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.33 , 56.1	EDS
L-test for twinning[2]	$<|L|> = 0.50, <L^2> = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	9804	wwPDB-VP
Average B, all atoms (Å^2)	44.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.08% 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 ⓘ

5.1　Standard geometry ⓘ

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	0.66	0/1603	1.10	5/2176 (0.2%)
1	B	0.68	0/1628	1.15	7/2209 (0.3%)
1	C	0.64	0/1622	1.15	9/2204 (0.4%)
1	D	0.62	0/1607	1.05	7/2183 (0.3%)
1	E	0.67	0/1615	1.18	5/2194 (0.2%)
1	F	0.67	0/1588	1.06	4/2158 (0.2%)
All	All	0.66	0/9663	1.12	37/13124 (0.3%)

There are no bond length outliers.

The worst 5 of 37 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	C	177	ARG	CD-NE-CZ	13.96	143.14	123.60
1	E	158	ARG	NE-CZ-NH2	-10.35	115.12	120.30
1	D	200	ARG	NE-CZ-NH1	8.87	124.74	120.30
1	E	169	LEU	CA-CB-CG	8.84	135.63	115.30
1	C	177	ARG	NE-CZ-NH1	8.21	124.40	120.30

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	1584	0	1622	34	0
1	B	1609	0	1650	31	1

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	C	1603	0	1637	34	0
1	D	1587	0	1617	28	0
1	E	1595	0	1619	30	1
1	F	1569	0	1593	32	0
2	A	39	0	0	0	0
2	B	59	0	0	2	0
2	C	30	0	0	2	0
2	D	38	0	0	1	0
2	E	52	0	0	2	0
2	F	39	0	0	4	0
All	All	9804	0	9738	185	1

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.

The worst 5 of 185 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:C:79:GLY:H	1:C:85:THR:HG22	1.24	0.97
1:F:79:GLY:H	1:F:85:THR:HG22	1.28	0.95
1:E:79:GLY:H	1:E:85:THR:HG22	1.32	0.94
1:C:84:GLU:HG3	1:C:87:ARG:NH2	1.87	0.89
1:A:79:GLY:H	1:A:85:THR:HG22	1.44	0.80

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:67:THR:O	1:E:4:LYS:NZ[2_756]	2.16	0.04

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	206/231 (89%)	191 (93%)	15 (7%)	0	100	100
1	B	208/231 (90%)	198 (95%)	10 (5%)	0	100	100
1	C	208/231 (90%)	201 (97%)	7 (3%)	0	100	100
1	D	205/231 (89%)	195 (95%)	10 (5%)	0	100	100
1	E	207/231 (90%)	194 (94%)	13 (6%)	0	100	100
1	F	203/231 (88%)	197 (97%)	6 (3%)	0	100	100
All	All	1237/1386 (89%)	1176 (95%)	61 (5%)	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	163/180 (91%)	152 (93%)	11 (7%)	16	17
1	B	166/180 (92%)	152 (92%)	14 (8%)	11	10
1	C	165/180 (92%)	155 (94%)	10 (6%)	18	20
1	D	164/180 (91%)	150 (92%)	14 (8%)	10	10
1	E	164/180 (91%)	149 (91%)	15 (9%)	9	8
1	F	162/180 (90%)	151 (93%)	11 (7%)	16	16
All	All	984/1080 (91%)	909 (92%)	75 (8%)	13	13

5 of 75 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	E	117	SER
1	F	156	VAL
1	E	151	GLN
1	F	32	LYS
1	B	215	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 18 such sidechains are listed below:

Mol	Chain	Res	Type
1	F	25	GLN
1	F	126	GLN
1	F	80	GLN
1	D	66	GLN
1	E	126	GLN

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	212/231 (91%)	0.07	6 (2%)	53	64	22, 39, 76, 88	0
1	B	214/231 (92%)	0.10	10 (4%)	31	44	22, 38, 73, 84	0
1	C	214/231 (92%)	-0.06	7 (3%)	46	59	25, 42, 71, 90	0
1	D	211/231 (91%)	0.04	7 (3%)	46	59	28, 43, 75, 84	0
1	E	213/231 (92%)	0.02	2 (0%)	84	90	23, 37, 70, 95	0
1	F	209/231 (90%)	-0.02	6 (2%)	51	62	21, 38, 68, 82	0
All	All	1273/1386 (91%)	0.02	38 (2%)	50	61	21, 39, 74, 95	0

The worst 5 of 38 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	E	23	PRO	4.5
1	B	220	TYR	4.2
1	B	31	SER	3.8
1	A	61	PHE	3.8
1	B	184	LEU	3.4

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.