



# Full wwPDB X-ray Structure Validation Report ⓘ

Sep 30, 2021 – 03:15 PM EDT

PDB ID : 3M44  
Title : Crystal structure of the mutant V201A of orotidine 5'-monophosphate decarboxylase from Methanobacterium thermoautotrophicum  
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Deposited on : 2010-03-10  
Resolution : 1.40 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](mailto: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.

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

MolProbity : 4.02b-467  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.23.2  
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) : 2.23.2

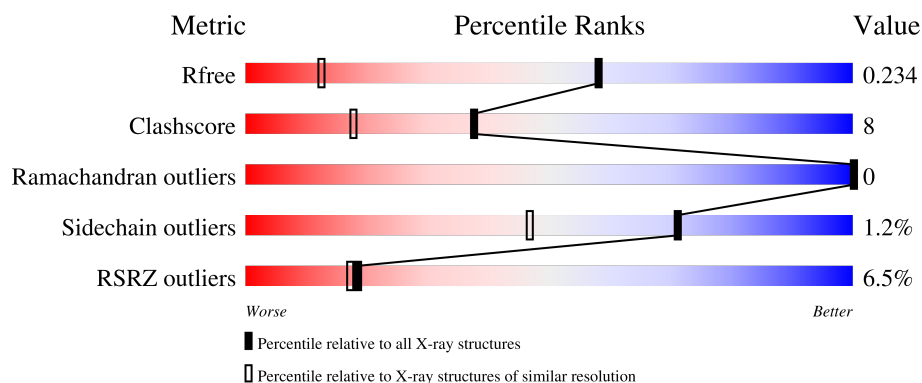
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.40 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	1714 (1.40-1.40)
Clashscore	141614	1812 (1.40-1.40)
Ramachandran outliers	138981	1763 (1.40-1.40)
Sidechain outliers	138945	1762 (1.40-1.40)
RSRZ outliers	127900	1674 (1.40-1.40)

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  $\geq 3$ , 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	228	<div> <div>6%</div> <div> <div></div> <div>77%</div> <div>14%</div> <div>9%</div> </div> </div>
1	B	228	<div> <div>6%</div> <div> <div></div> <div>78%</div> <div>13%</div> <div>9%</div> </div> </div>

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	GOL	B	229	-	-	X	-

## 2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 3478 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.

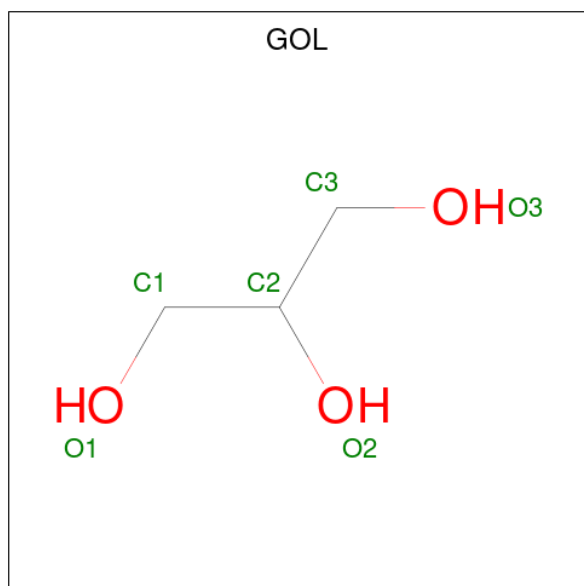
- Molecule 1 is a protein called Orotidine 5'-phosphate decarboxylase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	207	Total	C	N	O	S	0	3	0
			1607	1015	280	300	12			
1	B	208	Total	C	N	O	S	0	4	0
			1625	1025	284	304	12			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	101	PRO	ARG	engineered mutation	UNP O26232
A	201	ALA	VAL	engineered mutation	UNP O26232
B	101	PRO	ARG	engineered mutation	UNP O26232
B	201	ALA	VAL	engineered mutation	UNP O26232

- Molecule 2 is GLYCEROL (three-letter code: GOL) (formula:  $C_3H_8O_3$ ).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	B	1	Total	C	O	0	0
			6	3	3		

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	125	Total	O	0	0
			125	125		
3	B	115	Total	O	0	0
			115	115		



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	56.81Å 56.79Å 125.94Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	33.76 – 1.40 33.86 – 1.40	Depositor EDS
% Data completeness (in resolution range)	90.3 (33.76-1.40) 90.3 (33.86-1.40)	Depositor EDS
$R_{merge}$	0.07	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.13 (at 1.40Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.5_2)	Depositor
R, $R_{free}$	0.213 , 0.238 0.208 , 0.234	Depositor DCC
$R_{free}$ test set	3692 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	19.8	Xtriage
Anisotropy	0.073	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.40 , 34.8	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	0.488 for k,h,-l	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	3478	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	24.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.63% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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

### 5.1 Standard geometry

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

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	0.33	0/1635	0.52	0/2206
1	B	0.34	0/1650	0.50	0/2225
All	All	0.33	0/3285	0.51	0/4431

There are no bond length outliers.

There are no bond angle outliers.

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	1607	0	1629	26	0
1	B	1625	0	1645	26	0
2	B	6	0	8	6	0
3	A	125	0	0	5	0
3	B	115	0	0	4	0
All	All	3478	0	3282	50	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.

All (50) 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:61:LYS:HG3	3:A:301:HOH:O	1.70	0.90
2:B:229:GOL:H31	3:B:334:HOH:O	1.94	0.66
1:B:72:LYS:NZ	2:B:229:GOL:H32	2.11	0.66
1:B:125:GLU:OE1	1:B:157:PRO:HG3	1.97	0.64
1:A:33:GLU:HG2	3:A:291:HOH:O	1.98	0.64
1:B:72:LYS:CE	2:B:229:GOL:H32	2.28	0.64
1:A:203:ARG:HH22	1:B:78:GLU:CD	2.01	0.63
1:A:125:GLU:OE2	1:A:157:PRO:HG3	1.99	0.61
1:A:194:ARG:HG2	1:A:194:ARG:HH21	1.65	0.61
1:B:72:LYS:HZ1	2:B:229:GOL:H32	1.67	0.58
1:A:216:ALA:O	1:A:220:GLU:HG2	2.05	0.56
1:A:157:PRO:HG2	1:A:163:ARG:HB3	1.88	0.55
1:A:43:ILE:HD12	1:A:43:ILE:O	2.07	0.54
1:A:78:GLU:CD	1:B:203:ARG:HH22	2.11	0.54
1:B:70:ASP:OD2	2:B:229:GOL:H11	2.09	0.53
1:B:45:TYR:HA	1:B:48:VAL:HG22	1.91	0.53
1:A:5:ARG:HB2	1:A:8:VAL:HG22	1.90	0.53
1:A:43:ILE:HD12	1:A:43:ILE:C	2.29	0.53
1:B:23:ASN:ND2	1:B:26:ASP:H	2.07	0.52
1:A:35:ARG:NE	1:A:63:PHE:O	2.37	0.52
1:B:35:ARG:NE	1:B:63:PHE:O	2.41	0.52
1:B:193:LEU:HD21	1:B:199:ILE:HG23	1.92	0.52
1:A:45:TYR:HA	1:A:48:VAL:HG22	1.91	0.52
1:B:157:PRO:HG2	1:B:163:ARG:HB3	1.92	0.51
1:B:127[A]:SER:OG	1:B:158:SER:HB3	2.10	0.51
1:A:85:ARG:HG2	1:A:89:LYS:HE3	1.93	0.50
1:B:216:ALA:O	1:B:220:GLU:HG2	2.11	0.50
1:B:23:ASN:HD21	1:B:26:ASP:H	1.59	0.50
1:A:23:ASN:HD21	1:A:26:ASP:CG	2.15	0.50
1:B:89:LYS:HD2	3:B:306:HOH:O	2.11	0.49
1:A:29:ARG:O	1:A:33:GLU:HG3	2.13	0.48
1:B:60:ARG:NH2	3:B:302:HOH:O	2.45	0.48
1:A:127:SER:OG	1:A:158:SER:HB3	2.15	0.47
1:A:107:ARG:HD2	3:A:285:HOH:O	2.13	0.47
1:A:61:LYS:HD2	3:A:245:HOH:O	2.15	0.47
1:B:72:LYS:HZ1	2:B:229:GOL:C3	2.28	0.46
1:B:222:ILE:O	1:B:223:LYS:HB2	2.14	0.46
1:A:89:LYS:HD2	3:A:235:HOH:O	2.15	0.46
1:B:85:ARG:HG2	1:B:89:LYS:HE3	1.98	0.45
1:B:160:ARG:O	1:B:163:ARG:HB2	2.17	0.45
1:B:222:ILE:O	1:B:222:ILE:HG22	2.18	0.44
1:A:168:ARG:HA	1:A:168:ARG:HD3	1.85	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:78:GLU:CD	1:B:203:ARG:NH2	2.71	0.43
1:A:194:ARG:HH21	1:A:194:ARG:CG	2.30	0.43
1:B:149:LEU:HD23	3:B:293:HOH:O	2.19	0.42
1:A:160:ARG:O	1:A:163:ARG:HB2	2.21	0.41
1:A:218:ILE:O	1:A:222:ILE:HG13	2.21	0.41
1:B:37:TYR:HB3	1:B:219:ILE:CD1	2.51	0.41
1:A:163:ARG:HD2	1:A:163:ARG:HA	1.95	0.40
1:B:168:ARG:HA	1:B:168:ARG:HD3	1.94	0.40

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	206/228 (90%)	202 (98%)	4 (2%)	0	100	100
1	B	208/228 (91%)	203 (98%)	5 (2%)	0	100	100
All	All	414/456 (91%)	405 (98%)	9 (2%)	0	100	100

There are no Ramachandran outliers to report.

### 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	169/181 (93%)	166 (98%)	3 (2%)	59	28

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	B	171/181 (94%)	170 (99%)	1 (1%)	86	70
All	All	340/362 (94%)	336 (99%)	4 (1%)	71	47

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	164	LEU
1	A	167	LEU
1	A	209	ASP
1	B	164	LEU

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 ⓘ

1 ligand is modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
2	GOL	B	229	-	5,5,5	0.40	0	5,5,5	0.36	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	GOL	B	229	-	-	0/4/4/4	-

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.

1 monomer is involved in 6 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	229	GOL	6	0

## 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	207/228 (90%)	0.06	14 (6%) 17 15	13, 22, 42, 56	0
1	B	208/228 (91%)	0.06	13 (6%) 20 18	13, 22, 41, 60	0
All	All	415/456 (91%)	0.06	27 (6%) 18 17	13, 22, 42, 60	0

All (27) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	159	THR	4.8
1	B	6	VAL	4.2
1	A	159	THR	4.0
1	B	212	ALA	3.9
1	A	160	ARG	3.9
1	B	158	SER	3.7
1	B	213	ALA	3.6
1	B	160	ARG	3.6
1	A	6	VAL	3.5
1	A	212	ALA	3.4
1	B	161	PRO	3.4
1	B	32	GLY	3.4
1	A	158	SER	3.2
1	A	209	ASP	3.2
1	B	208	ALA	3.2
1	A	161	PRO	3.1
1	A	222	ILE	3.0
1	B	5	ARG	3.0
1	A	32	GLY	2.9
1	A	5	ARG	2.6
1	A	220	GLU	2.5
1	A	208	ALA	2.5
1	B	220	GLU	2.4
1	B	222	ILE	2.4

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Mol	Chain	Res	Type	RSRZ
1	A	37	TYR	2.4
1	B	37	TYR	2.3
1	A	157	PRO	2.2

## 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 monosaccharides in this entry.

## 6.4 Ligands [i](#)

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. The B-factors column lists the minimum, median, 95<sup>th</sup> 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	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
2	GOL	B	229	6/6	0.83	0.16	24,27,37,40	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.