



# wwPDB X-ray Structure Validation Summary Report ⓘ

May 12, 2020 – 11:33 pm BST

PDB ID : 2Q2W  
Title : Structure of D-3-Hydroxybutyrate Dehydrogenase from *Pseudomonas putida*  
Authors : Paithankar, K.S.; Feller, C.; Kuettner, E.B.; Keim, A.; Grunow, M.; Strater, N.  
Deposited on : 2007-05-29  
Resolution : 2.12 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](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
Xtriage (Phenix)	:	1.13
EDS	:	2.11
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)	:	2.11

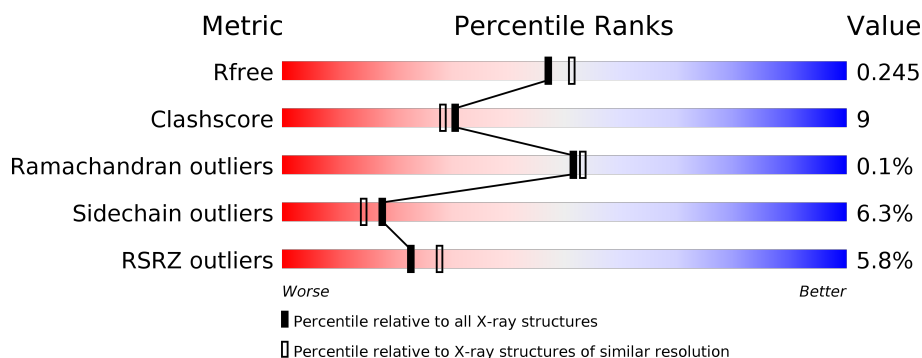
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.12 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	6241 (2.14-2.10)
Clashscore	141614	6778 (2.14-2.10)
Ramachandran outliers	138981	6705 (2.14-2.10)
Sidechain outliers	138945	6706 (2.14-2.10)
RSRZ outliers	127900	6112 (2.14-2.10)

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  $\geq 3$ , 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	255	<div> <div>6%</div> <div> <div></div> <div>77%</div> <div>17%</div> <div>• •</div> </div> </div>
1	B	255	<div> <div>4%</div> <div> <div></div> <div>80%</div> <div>19%</div> <div></div> </div> </div>
1	C	255	<div> <div>7%</div> <div> <div></div> <div>75%</div> <div>22%</div> <div>• • •</div> </div> </div>
1	D	255	<div> <div>5%</div> <div> <div></div> <div>76%</div> <div>19%</div> <div>• •</div> </div> </div>

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 7712 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 Beta-D-hydroxybutyrate dehydrogenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	253	Total	C	N	O	S	0	0	0
			1859	1179	334	342	4			
1	B	255	Total	C	N	O	S	0	0	0
			1869	1185	336	344	4			
1	C	251	Total	C	N	O	S	0	0	0
			1840	1169	328	339	4			
1	D	248	Total	C	N	O	S	0	0	0
			1824	1161	325	334	4			

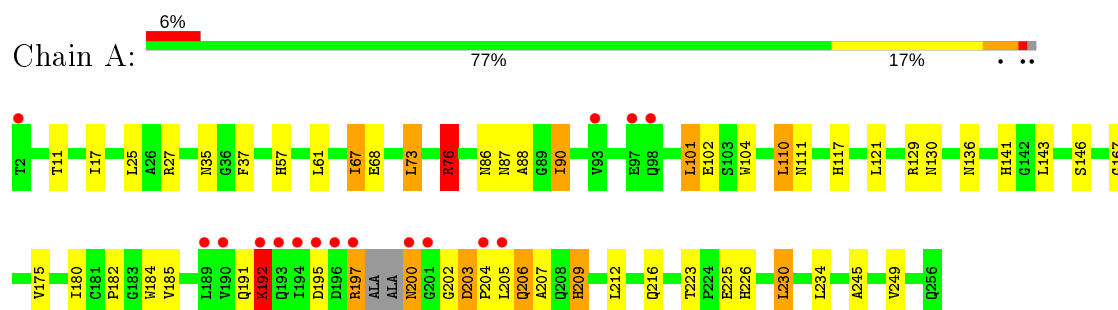
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	84	Total	O	0	0
			84	84		
2	B	99	Total	O	0	0
			99	99		
2	C	75	Total	O	0	0
			75	75		
2	D	62	Total	O	0	0
			62	62		

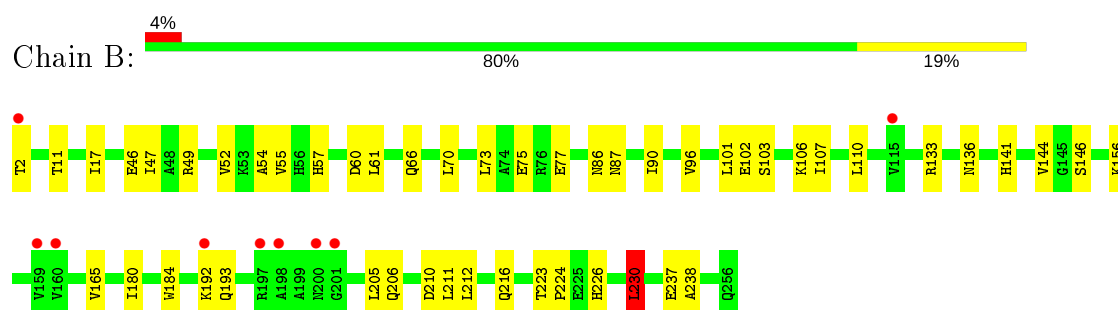
### 3 Residue-property plots [i](#)

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

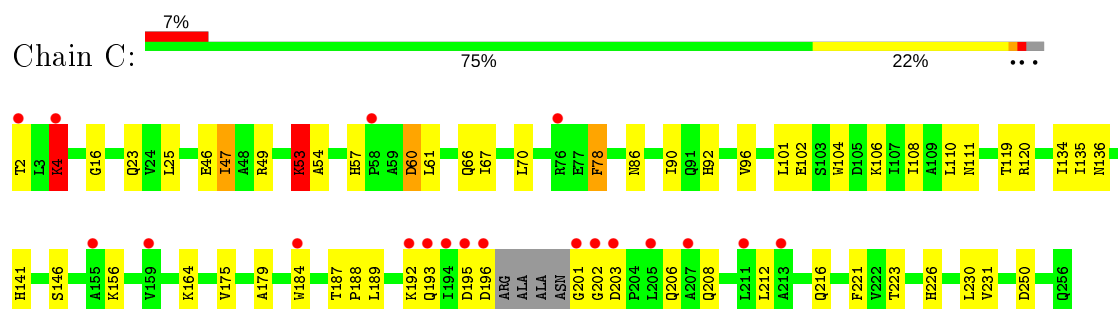
- Molecule 1: Beta-D-hydroxybutyrate dehydrogenase



- Molecule 1: Beta-D-hydroxybutyrate dehydrogenase

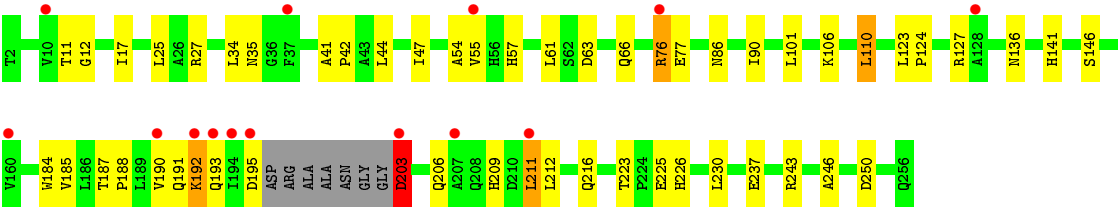


- Molecule 1: Beta-D-hydroxybutyrate dehydrogenase



- Molecule 1: Beta-D-hydroxybutyrate dehydrogenase





## 4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	117.68Å 58.81Å 119.46Å 90.00° 93.72° 90.00°	Depositor
Resolution (Å)	30.00 – 2.12 29.80 – 2.12	Depositor EDS
% Data completeness (in resolution range)	99.0 (30.00-2.12) 99.0 (29.80-2.12)	Depositor EDS
$R_{merge}$	0.07	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.82 (at 2.12Å)	Xtriage
Refinement program	REFMAC 5.2.0005	Depositor
R, $R_{free}$	0.181 , 0.247 0.180 , 0.245	Depositor DCC
$R_{free}$ test set	2340 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	31.7	Xtriage
Anisotropy	0.418	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 54.2	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.51$ , $\langle L^2 \rangle = 0.35$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	7712	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	32.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 34.11 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 7.1842e-04. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

<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 [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	1.52	14/1895 (0.7%)	1.11	8/2581 (0.3%)
1	B	1.21	6/1906 (0.3%)	0.98	2/2598 (0.1%)
1	C	1.24	12/1876 (0.6%)	0.92	4/2556 (0.2%)
1	D	1.20	9/1860 (0.5%)	1.00	6/2535 (0.2%)
All	All	1.30	41/7537 (0.5%)	1.01	20/10270 (0.2%)

The worst 5 of 41 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	203	ASP	CB-CG	18.28	1.90	1.51
1	A	192	LYS	CE-NZ	16.20	1.89	1.49
1	A	203	ASP	CG-OD2	11.80	1.52	1.25
1	A	195	ASP	CG-OD1	10.25	1.49	1.25
1	A	202	GLY	C-O	9.40	1.38	1.23

The worst 5 of 20 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	203	ASP	CB-CG-OD1	14.88	131.69	118.30
1	B	133	ARG	NE-CZ-NH1	-8.06	116.27	120.30
1	A	27	ARG	NE-CZ-NH2	-7.84	116.38	120.30
1	A	27	ARG	NE-CZ-NH1	7.01	123.81	120.30
1	A	76	ARG	NE-CZ-NH1	6.95	123.78	120.30

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	1859	0	1877	44	1
1	B	1869	0	1888	26	0
1	C	1840	0	1858	35	0
1	D	1824	0	1848	33	0
2	A	84	0	0	1	0
2	B	99	0	0	3	1
2	C	75	0	0	2	0
2	D	62	0	0	3	0
All	All	7712	0	7471	136	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 9.

The worst 5 of 136 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:4:LYS:NZ	1:C:4:LYS:CE	1.67	1.56
1:A:203:ASP:CG	1:A:203:ASP:CB	1.90	1.39
1:A:192:LYS:CE	1:A:192:LYS:NZ	1.89	1.34
1:C:184:TRP:H	1:C:216:GLN:HE22	1.07	0.97
1:D:184:TRP:H	1:D:216:GLN:HE22	1.16	0.94

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:A:205:LEU:CD2	2:B:307:HOH:O[1_565]	1.87	0.33

## 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	249/255 (98%)	241 (97%)	8 (3%)	0	100	100
1	B	253/255 (99%)	243 (96%)	9 (4%)	1 (0%)	34	32
1	C	247/255 (97%)	237 (96%)	10 (4%)	0	100	100
1	D	244/255 (96%)	230 (94%)	14 (6%)	0	100	100
All	All	993/1020 (97%)	951 (96%)	41 (4%)	1 (0%)	51	53

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	96	VAL

### 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	189/189 (100%)	175 (93%)	14 (7%)	13	10
1	B	189/189 (100%)	180 (95%)	9 (5%)	25	23
1	C	187/189 (99%)	175 (94%)	12 (6%)	17	14
1	D	186/189 (98%)	174 (94%)	12 (6%)	17	14
All	All	751/756 (99%)	704 (94%)	47 (6%)	18	14

5 of 47 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	211	LEU
1	C	47	ILE
1	D	211	LEU
1	C	2	THR
1	C	53	LYS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 37 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	216	GLN
1	C	35	ASN
1	D	216	GLN
1	B	226	HIS
1	B	256	GLN

### 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, 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	253/255 (99%)	0.28	16 (6%) 20 24	25, 31, 43, 52	0
1	B	255/255 (100%)	0.13	9 (3%) 44 50	26, 31, 39, 46	0
1	C	251/255 (98%)	0.24	19 (7%) 13 17	27, 31, 43, 52	0
1	D	248/255 (97%)	0.32	14 (5%) 24 29	26, 32, 41, 48	0
All	All	1007/1020 (98%)	0.24	58 (5%) 23 28	25, 31, 41, 52	0

The worst 5 of 58 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	194	ILE	5.1
1	D	203	ASP	4.9
1	A	195	ASP	4.8
1	A	192	LYS	4.7
1	A	194	ILE	4.7

### 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.