



# Full wwPDB X-ray Structure Validation Report ⓘ

May 14, 2020 – 08:39 am BST

PDB ID : 1XDW  
Title : NAD<sup>+</sup>-dependent (R)-2-Hydroxyglutarate Dehydrogenase from *Acidaminococcus fermentans*  
Authors : Martins, B.M.; Macedo-Ribeiro, S.; Bresser, J.; Buckel, W.; Messerschmidt, A.  
Deposited on : 2004-09-08  
Resolution : 1.98 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  
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

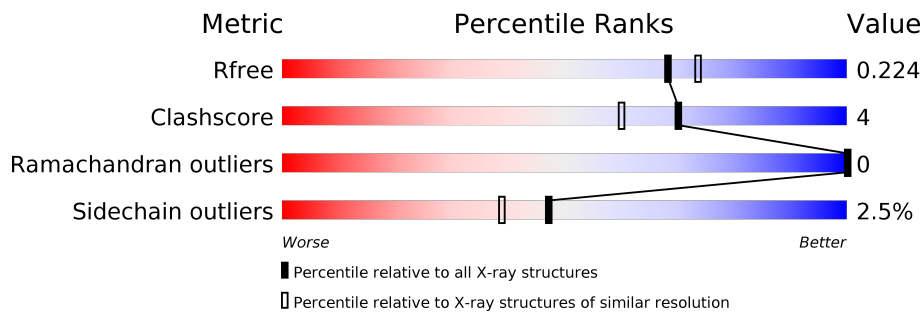
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*


The reported resolution of this entry is 1.98 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	11647 (2.00-1.96)
Clashscore	141614	1014 (1.98-1.98)
Ramachandran outliers	138981	1006 (1.98-1.98)
Sidechain outliers	138945	1006 (1.98-1.98)

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  $\leq 5\%$ .

Mol	Chain	Length	Quality of chain
1	A	331	 85% 12% ..

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 2967 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 NAD<sup>+</sup>-dependent (R)-2-Hydroxyglutarate Dehydrogenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	331	2564	1632	426	488	18	63	0	0

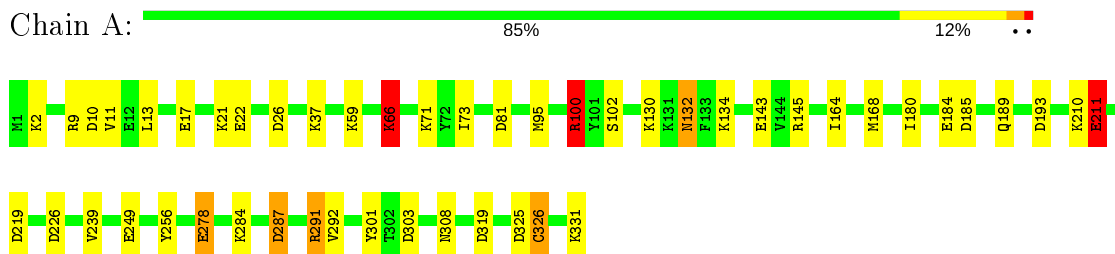
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	403	Total 403	O 403	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 the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. 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. 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: NAD<sup>+</sup>-dependent (R)-2-Hydroxyglutarate Dehydrogenase



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 61 2 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	67.49Å 67.49Å 312.79Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	19.46 – 1.98 19.45 – 1.98	Depositor EDS
% Data completeness (in resolution range)	100.0 (19.46-1.98) 98.2 (19.45-1.98)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.05	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.66 (at 1.97Å)	Xtrriage
Refinement program	REFMAC 5.1.24	Depositor
R, $R_{free}$	0.177 , 0.225 0.188 , 0.224	Depositor DCC
$R_{free}$ test set	1492 reflections (4.96%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	22.9	Xtrriage
Anisotropy	0.477	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.31 , 45.7	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.51$ , $\langle L^2 \rangle = 0.34$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.73	EDS
Total number of atoms	2967	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	26.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.92% 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 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	1.32	15/2606 (0.6%)	1.18	29/3517 (0.8%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	2

All (15) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	66	LYS	CG-CD	-21.99	0.77	1.52
1	A	130	LYS	CD-CE	-19.05	1.03	1.51
1	A	278	GLU	CB-CG	-12.82	1.27	1.52
1	A	21	LYS	CB-CG	-12.82	1.18	1.52
1	A	331	LYS	CA-CB	-10.84	1.30	1.53
1	A	22	GLU	CB-CG	10.21	1.71	1.52
1	A	37	LYS	CA-CB	8.14	1.71	1.53
1	A	13	LEU	CB-CG	-7.41	1.31	1.52
1	A	17	GLU	CB-CG	-6.66	1.39	1.52
1	A	100	ARG	NE-CZ	6.25	1.41	1.33
1	A	239	VAL	CB-CG2	-5.79	1.40	1.52
1	A	301	TYR	CE1-CZ	5.77	1.46	1.38
1	A	210	LYS	CB-CG	-5.71	1.37	1.52
1	A	59	LYS	CD-CE	-5.36	1.37	1.51
1	A	326	CYS	CB-SG	-5.36	1.73	1.81

All (29) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	66	LYS	CB-CG-CD	20.39	164.61	111.60

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	210	LYS	CA-CB-CG	14.57	145.46	113.40
1	A	130	LYS	CG-CD-CE	12.82	150.36	111.90
1	A	100	ARG	NE-CZ-NH2	-9.84	115.38	120.30
1	A	193	ASP	CB-CG-OD1	9.73	127.05	118.30
1	A	303	ASP	CB-CG-OD1	8.87	126.28	118.30
1	A	331	LYS	N-CA-CB	8.30	125.54	110.60
1	A	10	ASP	CB-CG-OD1	8.29	125.76	118.30
1	A	66	LYS	CG-CD-CE	8.27	136.70	111.90
1	A	13	LEU	CA-CB-CG	8.03	133.77	115.30
1	A	219	ASP	CB-CG-OD1	7.38	124.94	118.30
1	A	100	ARG	CD-NE-CZ	-7.30	113.38	123.60
1	A	9	ARG	NE-CZ-NH1	7.21	123.90	120.30
1	A	81	ASP	CB-CG-OD1	6.99	124.59	118.30
1	A	319	ASP	CB-CG-OD1	6.64	124.28	118.30
1	A	100	ARG	NE-CZ-NH1	6.58	123.59	120.30
1	A	291	ARG	NE-CZ-NH1	6.41	123.50	120.30
1	A	130	LYS	CD-CE-NZ	6.39	126.40	111.70
1	A	37	LYS	N-CA-CB	-6.31	99.24	110.60
1	A	325	ASP	CB-CG-OD1	6.28	123.95	118.30
1	A	210	LYS	CB-CG-CD	6.23	127.79	111.60
1	A	278	GLU	CA-CB-CG	6.07	126.76	113.40
1	A	9	ARG	NE-CZ-NH2	-5.82	117.39	120.30
1	A	287	ASP	CB-CG-OD1	5.71	123.44	118.30
1	A	26	ASP	CB-CG-OD1	5.50	123.25	118.30
1	A	21	LYS	CA-CB-CG	5.48	125.46	113.40
1	A	226	ASP	CB-CG-OD1	5.29	123.06	118.30
1	A	211	GLU	CG-CD-OE1	-5.17	107.95	118.30
1	A	185	ASP	CB-CG-OD1	5.15	122.94	118.30

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	100	ARG	Sidechain
1	A	211	GLU	Sidechain

## 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	2564	0	2589	18	3
2	A	403	0	0	9	5
All	All	2967	0	2589	18	6

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 4.

All (18) 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:287:ASP:HB3	2:A:1398:HOH:O	1.63	0.97
1:A:100:ARG:HD2	2:A:1308:HOH:O	1.63	0.96
1:A:180:ILE:H	1:A:189:GLN:HE22	1.20	0.87
1:A:211:GLU:HG3	2:A:1381:HOH:O	1.76	0.84
1:A:2:LYS:HD2	2:A:1387:HOH:O	1.80	0.81
1:A:102:SER:H	1:A:308:ASN:HD22	1.33	0.75
1:A:211:GLU:CG	2:A:1381:HOH:O	2.32	0.74
1:A:66:LYS:CG	2:A:1402:HOH:O	2.46	0.64
1:A:284:LYS:HD3	2:A:1172:HOH:O	2.06	0.55
1:A:102:SER:H	1:A:308:ASN:ND2	2.05	0.51
1:A:256:TYR:O	1:A:292:VAL:HA	2.11	0.51
1:A:132:ASN:ND2	1:A:134:LYS:H	2.10	0.49
1:A:132:ASN:HD22	1:A:132:ASN:C	2.17	0.48
1:A:287:ASP:CB	2:A:1398:HOH:O	2.42	0.47
1:A:278:GLU:HB3	2:A:1397:HOH:O	2.15	0.47
1:A:132:ASN:HD21	1:A:134:LYS:HB2	1.82	0.45
1:A:73:ILE:O	1:A:95:MET:HA	2.18	0.43
1:A:164:ILE:O	1:A:168:MET:HG3	2.22	0.40

All (6) 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)
2:A:1229:HOH:O	2:A:1384:HOH:O[12_5111]	1.50	0.70
1:A:291:ARG:NH1	2:A:1372:HOH:O[6_895]	1.68	0.52
1:A:143:GLU:N	2:A:1023:HOH:O[12_5111]	2.06	0.14
2:A:1079:HOH:O	2:A:1161:HOH:O[6_895]	2.06	0.14
2:A:1092:HOH:O	2:A:1236:HOH:O[6_895]	2.07	0.13
1:A:71:LYS:NZ	1:A:249:GLU:OE2[5_144]	2.18	0.02



## 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	329/331 (99%)	321 (98%)	8 (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	276/276 (100%)	269 (98%)	7 (2%)	47 39

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	11	VAL
1	A	66	LYS
1	A	132	ASN
1	A	145	ARG
1	A	184	GLU
1	A	211	GLU
1	A	326	CYS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	113	GLN

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Mol	Chain	Res	Type
1	A	132	ASN
1	A	189	GLN
1	A	212	ASN
1	A	275	GLN
1	A	308	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

### 6.1 Protein, DNA and RNA chains

Unable to reproduce the depositors R factor - this section is therefore empty.

### 6.2 Non-standard residues in protein, DNA, RNA chains

Unable to reproduce the depositors R factor - this section is therefore empty.

### 6.3 Carbohydrates

Unable to reproduce the depositors R factor - this section is therefore empty.

### 6.4 Ligands

Unable to reproduce the depositors R factor - this section is therefore empty.

### 6.5 Other polymers

Unable to reproduce the depositors R factor - this section is therefore empty.