



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 11:15 AM UTC

PDB ID : 1QFE / pdb_00001qfe
Title : THE STRUCTURE OF TYPE I 3-DEHYDROQUINATE DEHYDRATASE
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Deposited on : 1999-04-05
Resolution : 2.10 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

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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

MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

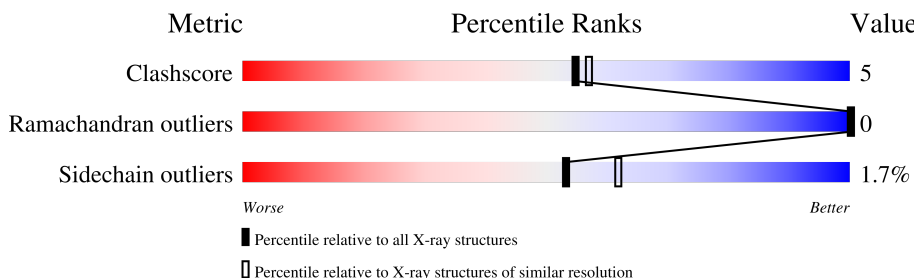
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.10 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))
Clashscore	190562	7164 (2.10-2.10)
Ramachandran outliers	187476	7099 (2.10-2.10)
Sidechain outliers	187428	7100 (2.10-2.10)

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 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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	252	
1	B	252	

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	DHS	A	301	X	-	-	-
2	DHS	B	301	X	-	-	-

2 Entry composition [i](#)

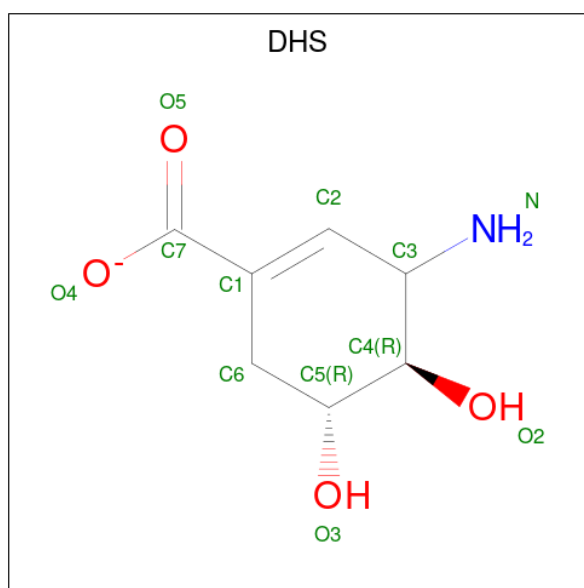
There are 3 unique types of molecules in this entry. The entry contains 4036 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 PROTEIN (3-DEHYDROQUINATE DEHYDRATASE).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	252	Total	C	N	O	S	0	1	0
			1938	1221	336	367	14			
1	B	252	Total	C	N	O	S	0	1	0
			1939	1222	335	368	14			

- Molecule 2 is 3-AMINO-4,5-DIHYDROXY-CYCLOHEX-1-ENECARBOXYLATE (CCD ID: DHS) (formula: $C_7H_{10}NO_4$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	C	O	0	0
			11	7	4		
2	B	1	Total	C	O	0	0
			11	7	4		

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	60	Total 60	O 60	0	0
3	B	77	Total 77	O 77	0	0

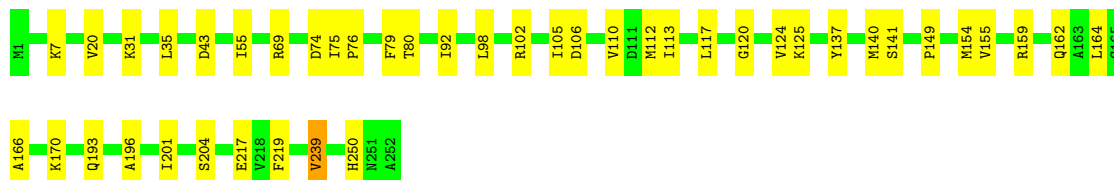
3 Residue-property plots

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. 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.

Note EDS was not executed.

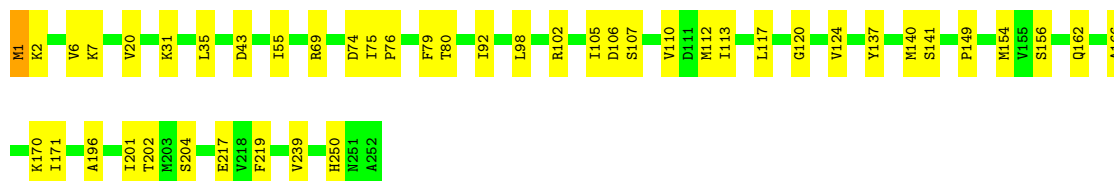
• Molecule 1: PROTEIN (3-DEHYDROQUINATE DEHYDRATASE)

Chain A:  83% 17%



• Molecule 1: PROTEIN (3-DEHYDROQUINATE DEHYDRATASE)

Chain B:  82% 17%



4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	60.49 Å 45.39 Å 85.47 Å 90.00° 95.48° 90.00°	Depositor
Resolution (Å)	12.00 – 2.10	Depositor
% Data completeness (in resolution range)	86.1 (12.00-2.10)	Depositor
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	X-PLOR 3.1	Depositor
R, R_{free}	0.199 , 0.247	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	4036	wwPDB-VP
Average B, all atoms (Å ²)	22.0	wwPDB-VP

5 Model quality

5.1 Standard geometry

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

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	0.62	0/1973	0.98	8/2672 (0.3%)
1	B	0.64	0/1974	0.96	7/2673 (0.3%)
All	All	0.63	0/3947	0.97	15/5345 (0.3%)

There are no bond length outliers.

All (15) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	141	SER	N-CA-C	7.04	120.12	109.41
1	A	204	SER	N-CA-C	-6.63	98.39	109.07
1	B	141	SER	N-CA-C	6.58	119.41	109.41
1	B	204	SER	N-CA-C	-6.50	98.61	109.07
1	B	219	PHE	N-CA-C	6.34	121.02	113.28
1	A	80	THR	N-CA-C	5.93	118.07	108.34
1	B	106	ASP	N-CA-C	5.81	117.29	111.07
1	B	80	THR	N-CA-C	5.79	118.32	108.02
1	A	219	PHE	N-CA-C	5.78	120.33	113.28
1	A	106	ASP	N-CA-C	5.69	117.49	111.28
1	A	239	VAL	N-CA-C	5.55	116.28	110.62
1	A	193	GLN	N-CA-C	5.18	118.06	111.69
1	B	107	SER	N-CA-C	5.17	118.69	112.38
1	B	75	ILE	N-CA-C	5.11	113.03	108.63
1	A	75	ILE	N-CA-C	5.01	112.94	108.63

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	1938	0	1964	18	0
1	B	1939	0	1964	20	0
2	A	11	0	7	0	0
2	B	11	0	7	0	0
3	A	60	0	0	1	0
3	B	77	0	0	0	0
All	All	4036	0	3942	38	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 5.

All (38) 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:162:GLN:HE22	1:B:196:ALA:HA	1.66	0.60
1:A:162:GLN:HE22	1:A:196:ALA:HA	1.67	0.60
1:A:112:MET:HG2	1:A:137:TYR:HB2	1.84	0.57
1:B:217:GLU:OE2	1:B:250:HIS:HD2	1.87	0.57
1:A:217:GLU:OE2	1:A:250:HIS:HD2	1.88	0.56
1:B:112:MET:HG2	1:B:137:TYR:HB2	1.88	0.55
1:B:120:GLY:O	1:B:124:VAL:HG13	2.09	0.51
1:B:7:LYS:HD2	1:B:74:ASP:O	2.11	0.51
1:A:120:GLY:O	1:A:124:VAL:HG13	2.10	0.50
1:A:7:LYS:HD2	1:A:74:ASP:O	2.12	0.50
1:B:1:MET:SD	1:B:2:LYS:O	2.70	0.49
1:B:170:LYS:HA	1:B:201:ILE:O	2.14	0.47
1:B:20:VAL:CG1	1:B:239:VAL:HG11	2.45	0.47
1:B:31:LYS:O	1:B:35:LEU:HG	2.15	0.47
1:A:43:ASP:O	1:A:76:PRO:HD2	2.15	0.46
1:B:43:ASP:O	1:B:76:PRO:HD2	2.15	0.46
1:B:55:ILE:HD12	1:B:92:ILE:HG21	1.98	0.46
1:A:170:LYS:HA	1:A:201:ILE:O	2.17	0.45
1:A:31:LYS:O	1:A:35:LEU:HG	2.16	0.45
1:A:20:VAL:CG1	1:A:239:VAL:HG11	2.46	0.45
1:A:105:ILE:HD11	1:A:113:ILE:HD13	1.99	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:124:VAL:HG21	1:A:164:LEU:HD13	1.98	0.44
1:B:171:ILE:HG22	1:B:202:THR:HG22	2.00	0.44
1:A:98:LEU:O	1:A:102:ARG:HG3	2.18	0.44
1:B:149:PRO:HG2	1:B:154:MET:CG	2.47	0.44
1:A:55:ILE:HD12	1:A:92:ILE:HG21	1.99	0.44
1:A:149:PRO:O	1:A:154:MET:HE2	2.18	0.44
1:B:105:ILE:HD11	1:B:113:ILE:HD13	2.00	0.43
1:B:98:LEU:O	1:B:102:ARG:HG3	2.17	0.43
1:B:79:PHE:HB2	1:B:110:VAL:HG11	2.01	0.42
1:B:149:PRO:O	1:B:154:MET:HE2	2.19	0.42
1:A:140:MET:HB2	1:A:166:ALA:HB2	2.00	0.42
1:A:102:ARG:NH1	3:A:404:HOH:O	2.52	0.42
1:A:79:PHE:HB2	1:A:110:VAL:HG11	2.03	0.41
1:A:155:VAL:O	1:A:159:ARG:HG3	2.20	0.41
1:B:6:VAL:HG11	1:B:112:MET:HE2	2.02	0.40
1:B:149:PRO:HG2	1:B:154:MET:HG3	2.02	0.40
1:B:140:MET:HB2	1:B:166:ALA:HB2	2.03	0.40

There are no symmetry-related clashes.

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	251/252 (100%)	247 (98%)	4 (2%)	0	100	100
1	B	251/252 (100%)	246 (98%)	5 (2%)	0	100	100
All	All	502/504 (100%)	493 (98%)	9 (2%)	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	210/209 (100%)	207 (99%)	3 (1%)	59	67
1	B	210/209 (100%)	206 (98%)	4 (2%)	50	58
All	All	420/418 (100%)	413 (98%)	7 (2%)	53	62

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

Mol	Chain	Res	Type
1	A	69	ARG
1	A	117	LEU
1	A	125	LYS
1	B	1	MET
1	B	69	ARG
1	B	117	LEU
1	B	156	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	90	GLN
1	A	101	ASN
1	A	134	HIS
1	A	146	HIS
1	A	162	GLN
1	A	192	GLN
1	A	250	HIS
1	B	90	GLN
1	B	162	GLN
1	B	192	GLN
1	B	250	HIS

5.3.3 RNA ⓘ

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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

2 ligands are 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	DHS	A	301	1	11,11,12	1.07	1 (9%)	13,15,17	1.75	3 (23%)
2	DHS	B	301	1	11,11,12	1.13	0	13,15,17	1.75	5 (38%)

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	DHS	A	301	1	1/1/4/6	2/4/17/20	0/1/1/1
2	DHS	B	301	1	1/1/4/6	2/4/17/20	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	301	DHS	O4-C7	-2.09	1.24	1.30

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	301	DHS	O2-C4-C3	3.73	115.92	109.53
2	B	301	DHS	O2-C4-C3	3.33	115.23	109.53
2	A	301	DHS	C3-C4-C5	3.32	114.92	110.69
2	B	301	DHS	C3-C4-C5	3.24	114.81	110.69
2	B	301	DHS	O2-C4-C5	2.34	115.33	110.20
2	A	301	DHS	O2-C4-C5	2.31	115.28	110.20
2	B	301	DHS	O5-C7-C1	-2.31	117.59	121.64
2	B	301	DHS	O4-C7-C1	2.06	119.78	115.43

All (2) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
2	A	301	DHS	C3
2	B	301	DHS	C3

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	301	DHS	C2-C1-C7-O4
2	A	301	DHS	C2-C1-C7-O5
2	B	301	DHS	C2-C1-C7-O4
2	B	301	DHS	C2-C1-C7-O5

There are no ring outliers.

No monomer is involved in short contacts.

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

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

6.4 Ligands

EDS was not executed - this section is therefore empty.

6.5 Other polymers

EDS was not executed - this section is therefore empty.