



Full wwPDB X-ray Structure Validation Report ⓘ

Dec 3, 2023 – 03:57 pm GMT

PDB ID : 1EB8
Title : Structure Determinants of Substrate Specificity of Hydroxynitrile Lyase from *Manihot esculenta*
Authors : Lauble, H.; Miehlich, B.; Foerster, S.; Kobler, C.; Wajant, H.; Effenberger, F.
Deposited on : 2001-07-24
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 : 4.02b-467
Mogul : 1.8.4, CSD as541be (2020)
Xtrriage (Phenix) : **NOT EXECUTED**
EDS : **NOT EXECUTED**
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.36

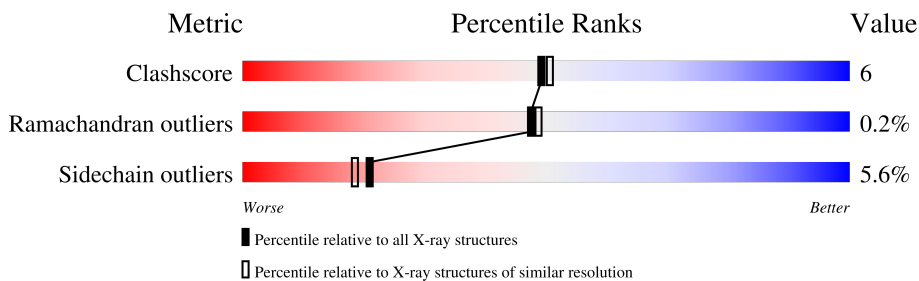
1 Overall quality at a glance i

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	141614	5710 (2.10-2.10)
Ramachandran outliers	138981	5647 (2.10-2.10)
Sidechain outliers	138945	5648 (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	262	 75% 21% ..
1	B	262	 79% 16% ..

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 4426 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.

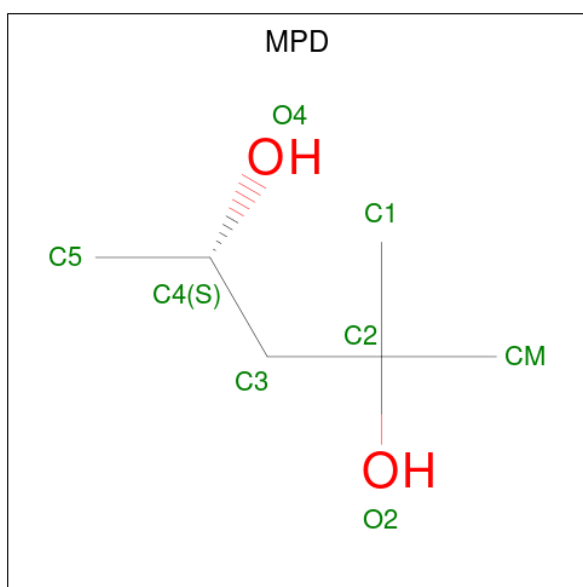
- Molecule 1 is a protein called (S)-ACETONE-CYANOHYDRIN LYASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	262	Total 2095	C 1351	N 348	O 388	S 8	0	0	0
1	B	258	Total 2065	C 1331	N 343	O 383	S 8	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	128	ALA	TRP	engineered mutation	UNP P52705
B	128	ALA	TRP	engineered mutation	UNP P52705

- Molecule 2 is (4S)-2-METHYL-2,4-PENTANEDIOL (three-letter code: MPD) (formula: C₆H₁₄O₂).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
2	A	1	Total 8	C 6	O 2	0	0

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	B	1	Total	C	O	0	0
			8	6	2		

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	116	Total	O	0	0
			116	116		
3	B	134	Total	O	0	0
			134	134		

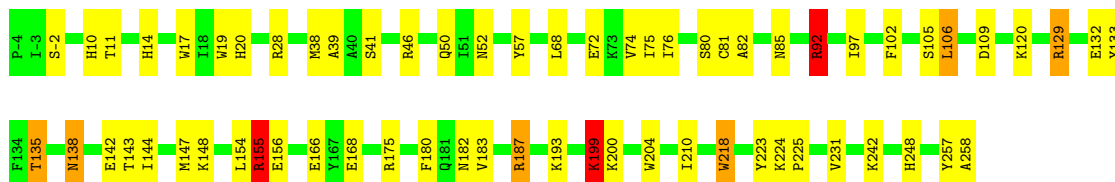
3 Residue-property plots

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.

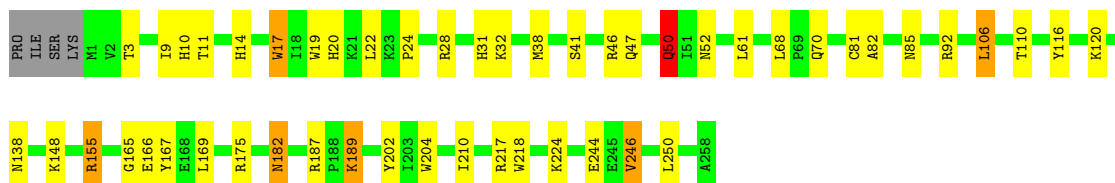
- Molecule 1: (S)-ACETONE-CYANOHYDRIN LYASE

Chain A:  75% 21%



- Molecule 1: (S)-ACETONE-CYANOHYDRIN LYASE

Chain B:  79% 16%



4 Data and refinement statistics

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

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, α , β , γ	106.40Å 106.40Å 188.43Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	8.00 – 2.10	Depositor
% Data completeness (in resolution range)	86.6 (8.00-2.10)	Depositor
R_{merge}	0.04	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	X-PLOR 3.851	Depositor
R, R_{free}	0.192 , 0.234	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	4426	wwPDB-VP
Average B, all atoms (Å ²)	26.0	wwPDB-VP

5 Model quality i

5.1 Standard geometry i

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

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	0.85	0/2145	1.47	25/2905 (0.9%)
1	B	0.86	0/2114	1.49	33/2864 (1.2%)
All	All	0.86	0/4259	1.48	58/5769 (1.0%)

There are no bond length outliers.

All (58) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	155	ARG	NE-CZ-NH2	-13.51	113.54	120.30
1	A	92	ARG	NE-CZ-NH2	-11.35	114.62	120.30
1	A	155	ARG	NE-CZ-NH2	-10.83	114.89	120.30
1	A	129	ARG	NE-CZ-NH2	-10.03	115.29	120.30
1	B	175	ARG	NE-CZ-NH1	9.70	125.15	120.30
1	A	155	ARG	NE-CZ-NH1	9.20	124.90	120.30
1	A	129	ARG	NE-CZ-NH1	9.04	124.82	120.30
1	B	92	ARG	NE-CZ-NH1	8.82	124.71	120.30
1	B	19	TRP	CD1-CG-CD2	8.66	113.23	106.30
1	B	204	TRP	CD1-CG-CD2	8.47	113.08	106.30
1	A	19	TRP	CD1-CG-CD2	8.14	112.81	106.30
1	B	217	ARG	NE-CZ-NH2	-8.07	116.27	120.30
1	A	19	TRP	CE2-CD2-CG	-7.95	100.94	107.30
1	A	204	TRP	CD1-CG-CD2	7.77	112.51	106.30
1	B	19	TRP	CE2-CD2-CG	-7.76	101.09	107.30
1	A	187	ARG	NE-CZ-NH1	7.50	124.05	120.30
1	A	175	ARG	NE-CZ-NH2	-7.15	116.72	120.30
1	B	204	TRP	CE2-CD2-CG	-7.13	101.59	107.30
1	A	19	TRP	CG-CD2-CE3	7.07	140.26	133.90
1	A	204	TRP	CE2-CD2-CG	-6.97	101.72	107.30
1	A	17	TRP	CD1-CG-CD2	6.96	111.87	106.30
1	B	218	TRP	CE2-CD2-CG	-6.93	101.76	107.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	17	TRP	CE2-CD2-CG	-6.85	101.82	107.30
1	A	19	TRP	CB-CG-CD1	-6.85	118.10	127.00
1	B	218	TRP	CD1-CG-CD2	6.76	111.71	106.30
1	B	19	TRP	CG-CD2-CE3	6.60	139.84	133.90
1	B	92	ARG	NE-CZ-NH2	-6.57	117.01	120.30
1	A	133	TYR	CB-CG-CD2	-6.56	117.06	121.00
1	B	246	VAL	CG1-CB-CG2	-6.46	100.57	110.90
1	B	204	TRP	CG-CD1-NE1	-6.35	103.75	110.10
1	B	167	TYR	CB-CG-CD2	-6.31	117.21	121.00
1	B	155	ARG	NE-CZ-NH1	6.29	123.45	120.30
1	A	218	TRP	CD1-CG-CD2	6.28	111.33	106.30
1	A	218	TRP	CE2-CD2-CG	-6.26	102.29	107.30
1	A	175	ARG	NE-CZ-NH1	6.10	123.35	120.30
1	B	17	TRP	CE2-CD2-CG	-5.97	102.53	107.30
1	A	28	ARG	NE-CZ-NH1	5.93	123.26	120.30
1	A	92	ARG	NE-CZ-NH1	5.83	123.21	120.30
1	A	46	ARG	NE-CZ-NH1	5.80	123.20	120.30
1	B	187	ARG	NE-CZ-NH1	5.77	123.19	120.30
1	B	32	LYS	CA-CB-CG	-5.77	100.71	113.40
1	B	202	TYR	CB-CG-CD2	-5.67	117.60	121.00
1	B	50	GLN	CB-CG-CD	5.64	126.28	111.60
1	B	28	ARG	NE-CZ-NH1	5.60	123.10	120.30
1	B	19	TRP	CB-CG-CD1	-5.54	119.79	127.00
1	B	116	TYR	CB-CG-CD2	-5.50	117.70	121.00
1	B	17	TRP	CD1-CG-CD2	5.46	110.67	106.30
1	A	109	ASP	CB-CG-OD1	5.35	123.11	118.30
1	B	50	GLN	CG-CD-NE2	5.33	129.50	116.70
1	B	204	TRP	CG-CD2-CE3	5.21	138.59	133.90
1	A	199	LYS	CA-CB-CG	-5.18	101.99	113.40
1	B	19	TRP	CG-CD1-NE1	-5.18	104.92	110.10
1	B	46	ARG	NE-CZ-NH1	5.13	122.86	120.30
1	B	148	LYS	CA-CB-CG	5.12	124.67	113.40
1	B	189	LYS	CB-CG-CD	-5.12	98.28	111.60
1	B	218	TRP	CG-CD2-CE3	5.07	138.46	133.90
1	B	218	TRP	CB-CG-CD1	-5.06	120.43	127.00
1	A	17	TRP	CB-CG-CD1	-5.03	120.47	127.00

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	2095	0	2096	33	0
1	B	2065	0	2060	18	0
2	A	8	0	14	0	0
2	B	8	0	14	0	0
3	A	116	0	0	2	0
3	B	134	0	0	2	0
All	All	4426	0	4184	49	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 6.

All (49) 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:10:HIS:HE1	1:A:38:MET:H	1.18	0.89
1:B:10:HIS:HE1	1:B:38:MET:H	1.21	0.85
1:B:52:ASN:HD22	1:B:138:ASN:HB2	1.52	0.75
1:A:52:ASN:HD22	1:A:138:ASN:HB2	1.53	0.74
1:A:10:HIS:HD2	1:A:11:THR:O	1.73	0.71
1:B:81:CYS:HA	1:B:106:LEU:HD22	1.75	0.67
1:A:50:GLN:HG2	3:A:2027:HOH:O	1.97	0.65
1:B:10:HIS:HD2	1:B:11:THR:O	1.81	0.63
1:A:199:LYS:HG2	1:A:257:TYR:CE1	2.34	0.63
1:A:168:GLU:HG3	1:B:24:PRO:HD3	1.79	0.63
1:B:82:ALA:HA	1:B:85:ASN:HD22	1.69	0.58
1:A:68:LEU:HD11	1:A:74:VAL:HG13	1.86	0.58
1:A:155:ARG:HD3	1:A:155:ARG:O	2.05	0.57
1:A:81:CYS:HA	1:A:106:LEU:HD22	1.88	0.55
1:A:138:ASN:ND2	1:A:142:GLU:H	2.05	0.54
1:A:248:HIS:HB3	3:A:2113:HOH:O	2.07	0.53
1:A:129:ARG:NH2	1:A:156:GLU:HB2	2.23	0.53
1:B:50:GLN:HG3	3:B:2041:HOH:O	2.08	0.52
1:A:10:HIS:HE1	1:A:38:MET:N	1.99	0.51
1:A:120:LYS:HG3	1:A:218:TRP:CH2	2.46	0.51
1:A:82:ALA:HA	1:A:85:ASN:HD22	1.76	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:135:THR:HA	1:A:144:ILE:O	2.12	0.50
1:B:182:ASN:H	1:B:182:ASN:HD22	1.58	0.49
1:A:155:ARG:HD3	1:A:155:ARG:C	2.33	0.49
1:A:20:HIS:HE1	1:A:166:GLU:OE1	1.95	0.48
1:A:92:ARG:HH22	1:A:187:ARG:NH2	2.11	0.48
1:A:180:PHE:HB3	1:A:183:VAL:HG22	1.96	0.48
1:B:20:HIS:HE1	1:B:166:GLU:OE1	1.98	0.47
1:A:20:HIS:HD2	1:B:165:GLY:O	1.97	0.47
1:B:9:ILE:HD11	1:B:61:LEU:HD13	1.96	0.46
1:B:10:HIS:CE1	1:B:38:MET:H	2.13	0.45
1:A:224:LYS:HA	1:A:225:PRO:HD3	1.73	0.45
1:A:75:ILE:HD11	1:A:258:ALA:HB2	1.98	0.45
1:A:14:HIS:O	1:A:41:SER:HB3	2.17	0.45
1:B:22:LEU:HD13	1:B:246:VAL:HG23	2.00	0.44
1:A:231:VAL:HG11	1:A:242:LYS:HG3	1.99	0.43
1:B:47:GLN:O	1:B:50:GLN:HG2	2.18	0.43
1:B:3:THR:HA	1:B:31:HIS:ND1	2.34	0.43
1:B:50:GLN:HG3	3:B:2007:HOH:O	2.19	0.43
1:A:10:HIS:CE1	1:A:38:MET:H	2.11	0.42
1:A:11:THR:HB	1:A:80:SER:HB3	2.00	0.42
1:A:102:PHE:HB3	1:A:105:SER:HB3	2.01	0.42
1:A:39:ALA:HB3	1:A:57:TYR:HA	2.01	0.42
1:B:110:THR:O	1:B:189:LYS:HD3	2.21	0.41
1:A:200:LYS:HE2	1:A:223:TYR:HE2	1.85	0.41
1:B:14:HIS:O	1:B:41:SER:HB3	2.21	0.40
1:A:76:ILE:HD11	1:A:97:ILE:HD12	2.01	0.40
1:A:132:GLU:O	1:A:147:MET:HA	2.21	0.40
1:A:148:LYS:HD2	1:A:148:LYS:HA	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	260/262 (99%)	251 (96%)	9 (4%)	0	100	100
1	B	256/262 (98%)	244 (95%)	11 (4%)	1 (0%)	34	32
All	All	516/524 (98%)	495 (96%)	20 (4%)	1 (0%)	47	49

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	17	TRP

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	226/226 (100%)	213 (94%)	13 (6%)	20	17
1	B	222/226 (98%)	210 (95%)	12 (5%)	22	20
All	All	448/452 (99%)	423 (94%)	25 (6%)	21	18

All (25) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	-2	SER
1	A	72	GLU
1	A	92	ARG
1	A	106	LEU
1	A	135	THR
1	A	138	ASN
1	A	143	THR
1	A	154	LEU
1	A	155	ARG
1	A	182	ASN
1	A	193	LYS
1	A	199	LYS
1	A	210	ILE
1	B	50	GLN
1	B	68	LEU

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Mol	Chain	Res	Type
1	B	70	GLN
1	B	106	LEU
1	B	120	LYS
1	B	155	ARG
1	B	169	LEU
1	B	182	ASN
1	B	210	ILE
1	B	224	LYS
1	B	244	GLU
1	B	250	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (14) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	10	HIS
1	A	20	HIS
1	A	52	ASN
1	A	85	ASN
1	A	103	HIS
1	A	138	ASN
1	A	182	ASN
1	A	251	GLN
1	B	10	HIS
1	B	20	HIS
1	B	50	GLN
1	B	52	ASN
1	B	85	ASN
1	B	182	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 monosaccharides 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	MPD	B	1301	-	7,7,7	0.59	0	9,10,10	0.53	0
2	MPD	A	1301	-	7,7,7	0.55	0	9,10,10	0.54	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	MPD	B	1301	-	-	0/5/5/5	-
2	MPD	A	1301	-	-	0/5/5/5	-

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.

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.