Full wwPDB X-ray Structure Validation Report (i)

Sep 10, 2023 – 05:39 AM EDT

PDB ID	:	4HQB
Title	:	Crystal structure of DdrB from Deinococcus radiodurans bound to ssDNA
Authors	:	Sugiman-Marangos, S.N.; Junop, M.S.
Deposited on	:	2012-10-25
Resolution	:	2.30 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 (i) 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 (1)) were used in the production of this report:

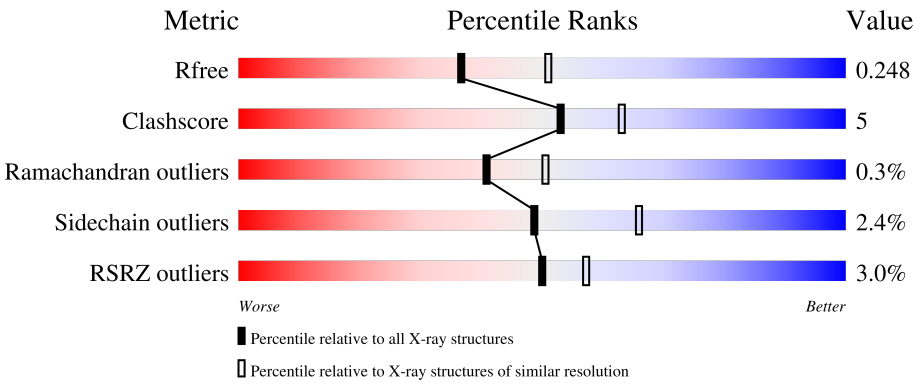
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.35.1
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.35.1

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 2.30 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	5042 (2.30-2.30)
Clashscore	141614	5643 (2.30-2.30)
Ramachandran outliers	138981	5575 (2.30-2.30)
Sidechain outliers	138945	5575 (2.30-2.30)
RSRZ outliers	127900	4938 (2.30-2.30)

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 <=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	148	85% 10% • •
1	B	148	2% 80% 8% 11%
1	C	148	8% 68% 11% • 20%
1	D	148	2% 64% 9% 26%
1	E	148	% 74% 12% • 14%

Continued on next page...

Continued from previous page...

Mol	Chain	Length	Quality of chain
2	M	4	25% 50% 25%
3	N	5	40% 40% 20%

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 5062 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 Single-stranded DNA-binding protein DdrB.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
1	A	143	1103	701	202	200	0	0	0
1	B	131	991	630	189	172	0	0	0
1	C	118	819	521	148	150	0	0	0
1	D	109	807	516	147	144	0	0	0
1	E	128	983	627	181	175	0	0	0

There are 20 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-3	ASP	-	expression tag	UNP Q9RY80
A	-2	PRO	-	expression tag	UNP Q9RY80
A	-1	PHE	-	expression tag	UNP Q9RY80
A	0	THR	-	expression tag	UNP Q9RY80
B	-3	ASP	-	expression tag	UNP Q9RY80
B	-2	PRO	-	expression tag	UNP Q9RY80
B	-1	PHE	-	expression tag	UNP Q9RY80
B	0	THR	-	expression tag	UNP Q9RY80
C	-3	ASP	-	expression tag	UNP Q9RY80
C	-2	PRO	-	expression tag	UNP Q9RY80
C	-1	PHE	-	expression tag	UNP Q9RY80
C	0	THR	-	expression tag	UNP Q9RY80
D	-3	ASP	-	expression tag	UNP Q9RY80
D	-2	PRO	-	expression tag	UNP Q9RY80
D	-1	PHE	-	expression tag	UNP Q9RY80
D	0	THR	-	expression tag	UNP Q9RY80
E	-3	ASP	-	expression tag	UNP Q9RY80
E	-2	PRO	-	expression tag	UNP Q9RY80
E	-1	PHE	-	expression tag	UNP Q9RY80

Continued on next page...

Continued from previous page...

Chain	Residue	Modelled	Actual	Comment	Reference
E	0	THR	-	expression tag	UNP Q9RY80

- Molecule 2 is a DNA chain called 5'-D(*TP*TP*TP*T)-3'.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
2	M	4	76	40	8	25	3	0	0	0

- Molecule 3 is a DNA chain called 5'-D(P*TP*TP*TP*TP*T)-3'.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
3	N	5	84	40	8	31	5	0	0	0

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
4	A	69	69	69	0	0
4	B	31	31	31	0	0
4	C	18	18	18	0	0
4	D	23	23	23	0	0
4	E	49	49	49	0	0
4	M	3	3	3	0	0
4	N	6	6	6	0	0

3 Residue-property plots (i)

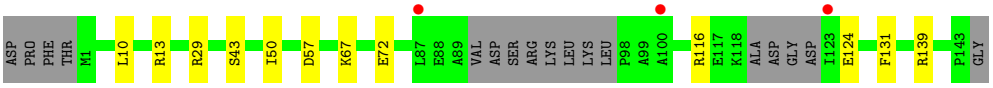
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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: Single-stranded DNA-binding protein DdrB

Chain A:

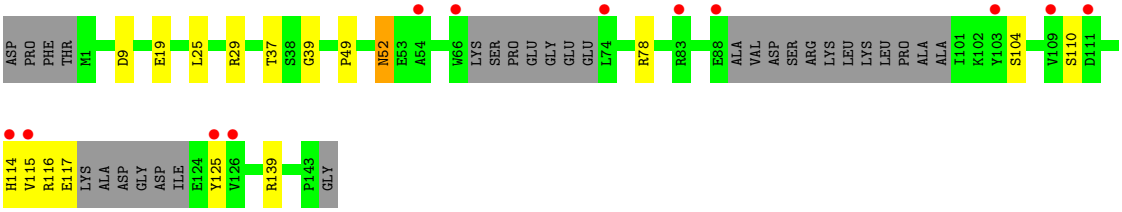
• Molecule 1: Single-stranded DNA-binding protein DdrB

Chain B:



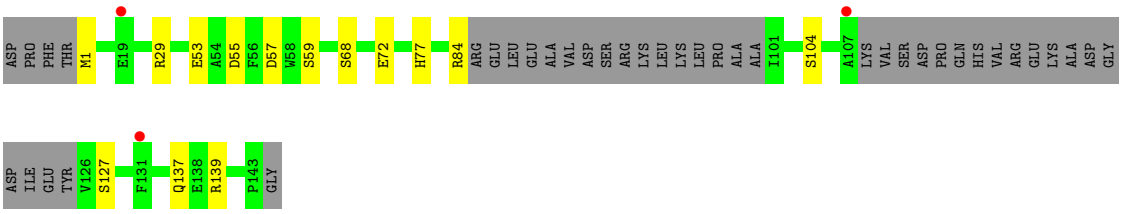
• Molecule 1: Single-stranded DNA-binding protein DdrB

Chain C:



• Molecule 1: Single-stranded DNA-binding protein DdrB

Chain D:

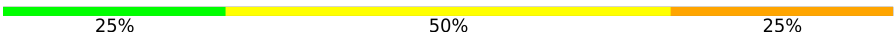


• Molecule 1: Single-stranded DNA-binding protein DdrB

Chain E:

- Molecule 2: 5'-D(*TP*TP*TP*T)-3'

Chain M:



- Molecule 3: 5'-D(P*TP*TP*TP*TP*T)-3'

Chain N:

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 32	Depositor
Cell constants a, b, c, α, β, γ	110.70Å 110.70Å 58.78Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	40.30 – 2.30 40.30 – 2.30	Depositor EDS
% Data completeness (in resolution range)	99.8 (40.30-2.30) 94.4 (40.30-2.30)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.70 (at 2.29Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.8.1_1168)	Depositor
R, R_{free}	0.190 , 0.246 0.192 , 0.248	Depositor DCC
R_{free} test set	1798 reflections (5.03%)	wwPDB-VP
Wilson B-factor (Å^2)	48.9	Xtriage
Anisotropy	0.358	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 51.3	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	0.016 for -h,-k,l 0.028 for h,-h-k,-l 0.017 for -k,-h,-l	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	5062	wwPDB-VP
Average B, all atoms (Å^2)	61.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.36% of the height of the origin peak. No significant pseudotranslation is detected.*

[1]Intensities estimated from amplitudes.

[2]Theoretical values of $< |L| >$, $< L^2 >$ 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	0.47	0/1128	0.57	0/1528
1	B	0.38	0/1013	0.49	0/1369
1	C	0.31	0/835	0.46	0/1138
1	D	0.32	0/826	0.48	0/1123
1	E	0.42	0/1006	0.54	0/1363
2	M	0.76	0/83	1.64	2/127 (1.6%)
3	N	1.12	0/91	2.08	5/139 (3.6%)
All	All	0.42	0/4982	0.63	7/6787 (0.1%)

There are no bond length outliers.

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	N	5	DT	C4'-C3'-O3'	7.29	127.93	109.70
3	N	5	DT	P-O3'-C3'	6.53	127.54	119.70
3	N	8	DT	C6-C5-C7	-5.79	119.42	122.90
2	M	4	DT	C5-C4-O4	-5.76	120.87	124.90
2	M	4	DT	N3-C4-O4	5.53	123.22	119.90
3	N	5	DT	C4'-C3'-C2'	5.21	107.79	103.10
3	N	5	DT	OP1-P-O3'	5.02	116.24	105.20

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	1103	0	1057	12	0
1	B	991	0	931	6	0
1	C	819	0	685	10	0
1	D	807	0	725	9	0
1	E	983	0	932	14	0
2	M	76	0	47	1	1
3	N	84	0	48	1	1
4	A	69	0	0	3	0
4	B	31	0	0	0	0
4	C	18	0	0	2	0
4	D	23	0	0	2	0
4	E	49	0	0	3	0
4	M	3	0	0	0	0
4	N	6	0	0	0	0
All	All	5062	0	4425	50	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 5.

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:43:SER:HA	4:A:258:HOH:O	1.66	0.96
1:D:1:MET:N	4:D:216:HOH:O	2.00	0.89
1:E:20:HIS:HD2	1:E:22:SER:H	1.21	0.84
1:E:43:SER:O	4:E:232:HOH:O	2.00	0.80
1:A:124:GLU:OE2	4:A:257:HOH:O	2.04	0.76
1:C:9:ASP:O	4:C:211:HOH:O	2.08	0.71
1:E:20:HIS:CD2	1:E:22:SER:H	2.06	0.69
1:D:77:HIS:HD2	4:D:201:HOH:O	1.74	0.68
1:D:137:GLN:OE1	1:D:139:ARG:NH2	2.29	0.66
1:C:25:LEU:HD11	1:C:139:ARG:HH21	1.61	0.65
1:C:39:GLY:O	4:C:212:HOH:O	2.14	0.64
1:A:44:GLY:HA2	1:A:117:GLU:CD	2.21	0.61
1:E:19:GLU:H	1:E:23:ARG:NH1	2.01	0.58
1:E:100:ALA:HB2	1:E:132:ARG:HD3	1.86	0.57
1:A:5:GLU:OE2	1:B:13:ARG:NH1	2.38	0.56
1:A:134:GLY:N	3:N:6:DT:OP1	2.36	0.55
1:E:136:ARG:NH1	1:E:138:GLU:OE1	2.39	0.55
1:E:84:ARG:NH1	4:E:217:HOH:O	2.02	0.53
1:B:43:SER:HB3	1:C:110:SER:HB2	1.92	0.52
1:D:68:SER:HB3	1:D:72:GLU:H	1.75	0.51

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:E:20:HIS:HD2	1:E:22:SER:N	2.01	0.51
1:A:93:ARG:HA	1:A:94:LYS:HA	1.58	0.48
1:C:9:ASP:N	1:C:9:ASP:OD1	2.45	0.48
1:C:117:GLU:N	1:C:125:TYR:O	2.46	0.48
2:M:2:DT:H2"	2:M:3:DT:H5'	1.95	0.48
1:A:72:GLU:HG3	1:A:74:LEU:HD13	1.97	0.47
1:C:29:ARG:NH2	1:C:139:ARG:O	2.48	0.47
1:C:37:THR:OG1	1:C:78:ARG:NH1	2.46	0.47
1:C:114:HIS:C	1:C:116:ARG:H	2.18	0.47
1:A:44:GLY:N	4:A:258:HOH:O	2.38	0.46
1:B:116:ARG:HD3	1:B:124:GLU:OE1	2.15	0.46
1:B:29:ARG:NH2	1:B:139:ARG:O	2.40	0.44
1:B:29:ARG:NH1	1:B:57:ASP:OD2	2.49	0.44
1:E:55:ASP:OD1	1:E:136:ARG:NH2	2.51	0.44
1:D:29:ARG:HD3	1:D:57:ASP:OD2	2.17	0.43
1:D:53:GLU:OE2	1:D:84:ARG:NH1	2.48	0.43
1:E:25:LEU:O	1:E:29:ARG:HG3	2.18	0.43
1:A:10:LEU:HD23	1:A:10:LEU:HA	1.84	0.43
1:A:68:SER:OG	1:A:72:GLU:HB3	2.19	0.43
1:E:84:ARG:HG3	1:E:103:TYR:CZ	2.54	0.42
1:A:58:TRP:CD1	1:A:65:LYS:HG3	2.55	0.42
1:D:55:ASP:OD1	1:D:55:ASP:N	2.53	0.41
1:D:57:ASP:OD1	1:D:59:SER:OG	2.27	0.41
1:C:49:PRO:HG2	1:C:52:ASN:HB2	2.02	0.41
1:D:104:SER:HA	1:D:127:SER:HA	2.01	0.41
1:A:25:LEU:HD11	1:A:139:ARG:HD2	2.01	0.41
1:E:97:LEU:HD22	1:E:132:ARG:NH1	2.36	0.41
1:E:15:THR:OG1	4:E:233:HOH:O	2.22	0.41
1:E:58:TRP:CD1	1:E:65:LYS:HB2	2.56	0.40
1:B:50:ILE:HA	1:B:131:PHE:HB3	2.02	0.40

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)
2:M:4:DT:O3'	3:N:5:DT:P[2_554]	1.59	0.61

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	141/148 (95%)	138 (98%)	3 (2%)	0	100	100
1	B	125/148 (84%)	124 (99%)	1 (1%)	0	100	100
1	C	110/148 (74%)	104 (94%)	4 (4%)	2 (2%)	8	7
1	D	103/148 (70%)	102 (99%)	1 (1%)	0	100	100
1	E	124/148 (84%)	123 (99%)	1 (1%)	0	100	100
All	All	603/740 (82%)	591 (98%)	10 (2%)	2 (0%)	41	50

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	115	VAL
1	C	19	GLU

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	105/123 (85%)	102 (97%)	3 (3%)	42	58
1	B	88/123 (72%)	85 (97%)	3 (3%)	37	51
1	C	63/123 (51%)	61 (97%)	2 (3%)	39	54
1	D	70/123 (57%)	70 (100%)	0	100	100
1	E	92/123 (75%)	90 (98%)	2 (2%)	52	69
All	All	418/615 (68%)	408 (98%)	10 (2%)	49	66

All (10) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	43	SER
1	A	74	LEU
1	A	127	SER
1	B	10	LEU
1	B	67	LYS
1	B	72	GLU
1	C	52	ASN
1	C	104	SER
1	E	126	VAL
1	E	138	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	E	20	HIS

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)

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, 95th 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^2)	Q<0.9
1	A	143/148 (96%)	-0.18	0 100 100	31, 45, 81, 112	0
1	B	131/148 (88%)	-0.13	3 (2%) 60 67	34, 60, 89, 101	0
1	C	118/148 (79%)	0.32	12 (10%) 6 9	40, 81, 108, 127	0
1	D	109/148 (73%)	0.11	3 (2%) 53 60	44, 71, 107, 118	0
1	E	128/148 (86%)	-0.15	1 (0%) 86 89	35, 51, 86, 108	0
2	M	4/4 (100%)	-0.10	0 100 100	55, 82, 88, 104	0
3	N	5/5 (100%)	-0.68	0 100 100	41, 46, 50, 69	0
All	All	638/749 (85%)	-0.02	19 (2%) 50 57	31, 59, 101, 127	0

All (19) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	126	VAL	3.7
1	C	54	ALA	3.6
1	B	87	LEU	3.4
1	C	115	VAL	3.4
1	E	20	HIS	3.4
1	C	114	HIS	3.3
1	C	103	TYR	2.9
1	B	123	ILE	2.8
1	D	131	PHE	2.8
1	C	74	LEU	2.7
1	C	88	GLU	2.7
1	B	100	ALA	2.5
1	C	109	VAL	2.4
1	C	125	TYR	2.3
1	D	107	ALA	2.2
1	C	83	ARG	2.1
1	C	111	ASP	2.1

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	C	66	TRP	2.1
1	D	19	GLU	2.0

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)

There are no ligands in this entry.

6.5 Other polymers (i)

There are no such residues in this entry.