wwPDB X-ray Structure Validation Summary Report ⓘ

Nov 5, 2023 – 01:52 PM EST

PDB ID	:	5I1S
Title	:	Villin headpiece subdomain with a Lys30 to APC substitution
Authors	:	Kreitler, D.F.; Mortenson, D.E.; Gellman, S.H.; Forest, K.T.
Deposited on	:	2016-02-05
Resolution	:	1.12 Å(reported)

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

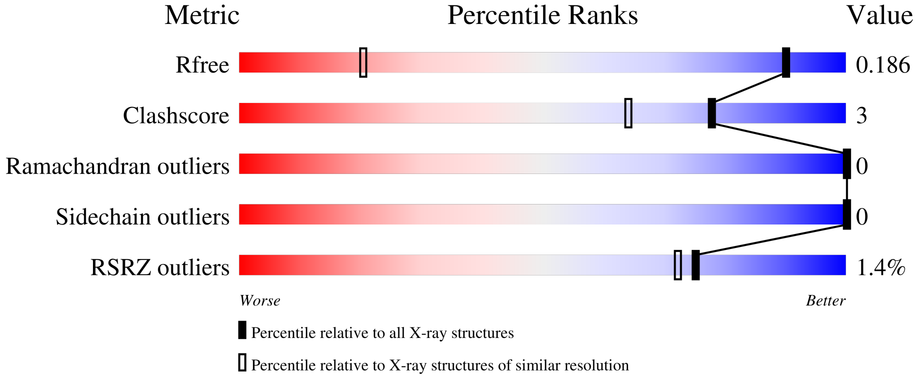
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

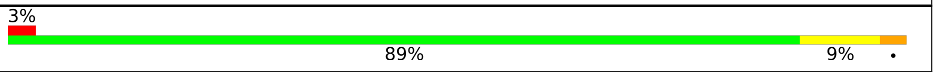
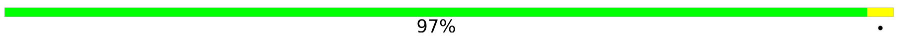
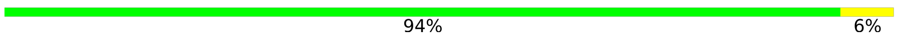
The reported resolution of this entry is 1.12 Å.

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	1168 (1.14-1.10)
Clashscore	141614	1205 (1.14-1.10)
Ramachandran outliers	138981	1168 (1.14-1.10)
Sidechain outliers	138945	1165 (1.14-1.10)
RSRZ outliers	127900	1146 (1.14-1.10)

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 <=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	35	
1	B	35	
2	C	35	
2	D	35	

2 Entry composition ⓘ

There are 3 unique types of molecules in this entry. The entry contains 2771 atoms, of which 1261 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 Villin-1.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	35	Total 592	C 193	H 299	N 49	O 50	S 1	0	1	0
1	B	35	Total 641	C 207	H 330	N 52	O 51	S 1	0	4	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	27	HIS	ASN	engineered mutation	UNP P02640
A	30	XPC	LYS	engineered mutation	UNP P02640
B	27	HIS	ASN	engineered mutation	UNP P02640
B	30	XPC	LYS	engineered mutation	UNP P02640

- Molecule 2 is a protein (with D amino acids) called D-Villin headpiece subdomain.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
2	C	35	Total 622	C 201	H 315	N 51	O 54	S 1	0	2	0
2	D	35	Total 617	C 199	H 317	N 50	O 50	S 1	0	2	0

- Molecule 3 is water.

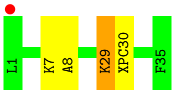
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	63	Total 63	O 63	0	0
3	B	81	Total 81	O 81	0	0
3	C	87	Total 87	O 87	0	0
3	D	68	Total 68	O 68	0	0

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 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.

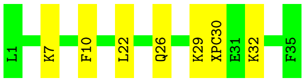
- Molecule 1: Villin-1

Chain A:



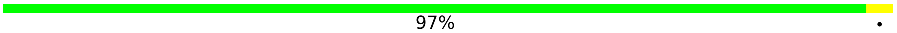
- Molecule 1: Villin-1

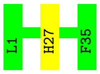
Chain B:



- Molecule 2: D-Villin headpiece subdomain

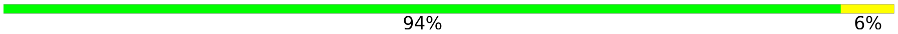
Chain C:

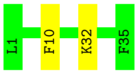




- Molecule 2: D-Villin headpiece subdomain

Chain D:





4 Data and refinement statistics ⓘ

Property	**Value**	**Source**
Space group	P 1	Depositor
Cell constants a, b, c, α, β, γ	24.03Å 34.32Å 42.87Å 106.22° 108.61° 98.46°	Depositor
Resolution (Å)	30.12 – 1.12 38.09 – 1.12	Depositor EDS
% Data completeness (in resolution range)	90.6 (30.12-1.12) 90.8 (38.09-1.12)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.04	Depositor
$< I/\sigma(I) >$ [1]	1.65 (at 1.12Å)	Xtriage
Refinement program	PHENIX 1.9_1692	Depositor
R, R_{free}	0.155 , 0.185 0.156 , 0.186	Depositor DCC
R_{free} test set	2109 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å^2)	9.6	Xtriage
Anisotropy	0.385	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.40 , 58.5	EDS
L-test for twinning[2]	$< \|L\| > = 0.57$, $< L^2 > = 0.42$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.98	EDS
Total number of atoms	2771	wwPDB-VP
Average B, all atoms (Å^2)	15.0	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 60.85 % 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 1.4309e-05. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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[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 ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: MED, DPR, DHI, DPN, DSN, DGL, DAS, XPC, DLY, DSG, DTH, DLE, DAR, DGN, DVA, DTR, DAL

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	0.52	0/294	0.80	1/390 (0.3%)
1	B	0.66	0/321	0.77	0/424
2	C	0.42	0/6	0.60	0/4
2	D	0.53	0/6	0.33	0/4
All	All	0.60	0/627	0.78	1/822 (0.1%)

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	1
1	B	0	1
All	All	0	2

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	29	LYS	CB-CA-C	-5.80	98.80	110.40

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	29	LYS	Peptide
1	B	29	LYS	Peptide

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	293	299	298	3	0
1	B	311	330	332	4	1
2	C	307	315	289	1	0
2	D	300	317	291	2	0
3	A	63	0	0	0	5
3	B	81	0	0	0	1
3	C	87	0	0	1	3
3	D	68	0	0	0	3
All	All	1510	1261	1210	7	7

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 3.

The worst 5 of 7 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:8:ALA:O	1:B:26[A]:GLN:NE2	2.16	0.79
1:A:7:LYS:HG2	1:B:22[A]:LEU:HD21	1.89	0.54
1:B:10:PHE:HA	1:B:32[B]:LYS:HE2	1.91	0.52
1:A:8:ALA:HA	1:B:26[B]:GLN:OE1	2.19	0.43
2:D:10:DPN:HD1	2:D:32:DLY:HE3	2.01	0.42

The worst 5 of 7 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)
3:A:122:HOH:O	3:D:102:HOH:O[1_665]	1.96	0.24
3:A:148:HOH:O	3:C:139:HOH:O[1_454]	1.98	0.22
3:D:141:HOH:O	3:D:159:HOH:O[1_455]	1.98	0.22
3:B:177:HOH:O	3:C:163:HOH:O[1_444]	2.06	0.14
3:A:163:HOH:O	3:D:147:HOH:O[1_655]	2.07	0.13

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	33/35 (94%)	33 (100%)	0	0	100	100
1	B	36/35 (103%)	36 (100%)	0	0	100	100
2	C	2/35 (6%)	2 (100%)	0	0	100	100
2	D	2/35 (6%)	2 (100%)	0	0	100	100
All	All	73/140 (52%)	73 (100%)	0	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	30/29 (103%)	30 (100%)	0	100	100
1	B	33/29 (114%)	33 (100%)	0	100	100
All	All	63/58 (109%)	63 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

73 non-standard protein/DNA/RNA residues 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
1	XPC	B	30	1	6,8,9	3.88	4 (66%)	4,10,12	2.13	1 (25%)
1	XPC	A	30	1	6,8,9	4.28	3 (50%)	4,10,12	2.08	2 (50%)

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
1	XPC	B	30	1	-	1/1/12/14	0/1/1/1
1	XPC	A	30	1	-	1/1/12/14	0/1/1/1

The worst 5 of 7 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	30	XPC	CA-C	9.45	1.65	1.50
1	B	30	XPC	CA-C	8.33	1.63	1.50
1	A	30	XPC	CE-ND	3.18	1.56	1.46
1	B	30	XPC	CE-ND	3.00	1.56	1.46
1	B	30	XPC	CG-ND	2.34	1.54	1.46

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	30	XPC	O-C-CA	-3.78	116.33	125.16
1	A	30	XPC	O-C-CA	-3.56	116.86	125.16
1	A	30	XPC	CE-CA-C	2.04	116.54	113.17

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	B	30	XPC	O-C-CA-CB
1	A	30	XPC	O-C-CA-CB

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates ⓘ

There are no monosaccharides in this entry.

5.6 Ligand geometry ⓘ

There are no ligands in this entry.

5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

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	34/35 (97%)	-0.47	1 (2%)	51	50	8, 11, 17, 20	0
1	B	34/35 (97%)	-0.41	0	100	100	9, 11, 15, 24	0
2	C	2/35 (5%)	-0.60	0	100	100	11, 11, 11, 12	0
2	D	2/35 (5%)	-0.34	0	100	100	9, 9, 9, 15	0
All	All	72/140 (51%)	-0.44	1 (1%)	75	72	8, 11, 17, 24	0

All (1) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	1	LEU	2.2

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

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
1	XPC	A	30	8/9	0.92	0.08	15,20,24,24	0
2	DAS	C	5	8/9	0.93	0.10	10,14,17,18	0
2	DLY	D	30	9/10	0.93	0.13	11,24,30,31	0
2	DAR	D	14	11/12	0.94	0.11	8,17,23,24	0
2	DGL	C	31[A]	9/10	0.94	0.11	11,16,19,20	12
2	DGL	C	31[B]	9/10	0.94	0.11	11,17,21,21	12
2	DPN	C	35	12/12	0.94	0.07	12,16,19,19	0
2	DGN	C	26[B]	9/10	0.95	0.13	6,8,11,12	14
2	DGN	C	26[C]	9/10	0.95	0.13	8,9,11,12	14
2	DLE	D	1	8/9	0.95	0.07	15,20,27,27	0
1	XPC	B	30	8/9	0.95	0.06	14,17,20,20	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	DLE	C	1	8/9	0.95	0.09	14,19,26,26	0
2	DLY	C	32	9/10	0.95	0.10	12,20,28,28	0
2	DGN	C	26[A]	9/10	0.95	0.13	8,11,14,17	14
2	DLY	C	30	9/10	0.96	0.08	7,16,27,27	0
2	DLY	D	7	9/10	0.96	0.07	10,17,34,34	0
2	DLY	D	29	9/10	0.96	0.09	10,17,23,23	0
2	DPN	D	35	12/12	0.96	0.07	14,17,21,21	0
2	DVA	D	9	7/8	0.97	0.05	12,16,21,21	0
2	DPN	C	10	11/12	0.97	0.06	9,12,17,19	0
2	DGL	C	4	9/10	0.97	0.07	9,13,19,21	0
2	DSN	D	15	6/7	0.97	0.07	9,12,18,18	0
2	DSN	C	2	6/7	0.97	0.09	10,13,16,17	0
2	DGL	D	31	9/10	0.97	0.08	9,14,17,17	0
2	DLY	C	7	9/10	0.97	0.07	10,16,28,28	0
2	DLY	D	32	9/10	0.97	0.08	13,23,28,29	0
2	DAS	D	3	8/9	0.97	0.05	9,11,14,14	0
2	DGN	D	26	9/10	0.97	0.06	7,11,18,18	0
2	DLY	C	24	9/10	0.98	0.08	7,13,21,22	0
2	DLY	D	24[A]	9/10	0.98	0.09	8,14,22,24	19
2	DLY	D	24[B]	9/10	0.98	0.09	8,13,19,19	19
2	DGL	D	4	9/10	0.98	0.05	9,12,17,19	0
2	DAL	C	8	5/6	0.98	0.05	10,12,14,14	0
2	DVA	C	9	7/8	0.98	0.06	10,12,14,15	0
2	DSN	D	2	6/7	0.98	0.04	10,12,15,15	0
2	DLE	C	28	8/9	0.98	0.06	8,11,17,17	0
2	DLE	D	28	8/9	0.98	0.06	8,12,20,20	0
2	DLY	C	29	9/10	0.98	0.06	8,13,25,25	0
2	DAS	D	5	8/9	0.98	0.05	9,12,14,14	0
2	DPN	D	10	11/12	0.98	0.04	9,11,13,13	0
2	DAR	C	14	11/12	0.98	0.06	7,14,18,20	0
2	DPN	D	6	11/12	0.98	0.05	10,12,18,19	0
2	DSN	C	15	6/7	0.98	0.04	9,11,16,18	0
2	DAS	C	3	8/9	0.98	0.07	9,11,13,15	0
2	DSG	C	19	8/9	0.98	0.05	7,9,17,17	0
2	DLE	D	20	8/9	0.98	0.06	8,10,20,20	0
2	DLE	C	34	8/9	0.98	0.04	9,12,17,17	0
2	DLE	D	34	8/9	0.98	0.04	11,14,18,18	0
2	DLE	C	22	8/9	0.98	0.06	6,14,23,23	0
2	DTR	D	23	14/15	0.98	0.05	8,10,15,19	0
2	DGN	C	25	9/10	0.99	0.03	7,9,12,12	0
2	DGN	D	25	9/10	0.99	0.04	8,10,13,13	0
2	DAL	D	16	5/6	0.99	0.03	7,9,10,10	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($Å^2$)	Q<0.9
2	DPN	C	17	11/12	0.99	0.05	7,11,17,18	0
2	DPN	D	17	11/12	0.99	0.05	8,11,18,19	0
2	DAL	C	18	5/6	0.99	0.03	7,9,13,13	0
2	DHI	C	27	10/11	0.99	0.04	7,9,17,18	0
2	DHI	D	27	10/11	0.99	0.04	8,12,18,19	0
2	DAL	D	18	5/6	0.99	0.04	9,11,13,13	0
2	DTH	C	13	7/8	0.99	0.04	7,9,13,13	0
2	DSG	D	19	8/9	0.99	0.05	7,8,10,10	0
2	DLE	C	20	8/9	0.99	0.05	6,8,13,13	0
2	DTH	D	13	7/8	0.99	0.04	7,9,11,11	0
2	DPR	C	21	7/8	0.99	0.05	7,9,11,11	0
2	DPR	D	21	7/8	0.99	0.04	7,10,13,13	0
2	DPN	C	6	11/12	0.99	0.04	9,11,13,13	0
2	DLE	D	22[A]	8/9	0.99	0.06	6,8,10,10	16
2	DLE	D	22[B]	8/9	0.99	0.06	6,10,13,13	16
2	DTR	C	23	14/15	0.99	0.04	7,10,13,14	0
2	DAL	D	8	5/6	0.99	0.04	10,13,16,16	0
2	MED	C	12	8/9	0.99	0.04	8,11,14,14	0
2	MED	D	12	8/9	0.99	0.05	8,11,15,15	0
2	DAL	C	16	5/6	0.99	0.05	7,10,13,13	0

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.