



wwPDB X-ray Structure Validation Summary Report ⓘ

Jan 31, 2016 – 08:54 PM GMT

PDB ID : 1MMS
Title : Crystal structure of the ribosomal PROTEIN L11-RNA complex
Authors : Wimberly, B.T.; Guymon, R.; Mccutcheon, J.P.; White, S.W.; Ramakrishnan, V.
Deposited on : 1999-04-14
Resolution : 2.57 Å(reported)

This is a wwPDB X-ray Structure Validation Summary Report for a publicly released PDB entry.
We welcome your comments at validation@mail.wwpdb.org
A user guide is available at
<http://wwpdb.org/validation/2016/XrayValidationReportHelp>
with specific help available everywhere you see the ⓘ symbol.

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

MolProbity : 4.02b-467
Mogul : 1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix) : 1.9-1692
EDS : rb-20026688
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac : 5.8.0135
CCP4 : 6.5.0
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : trunk26865

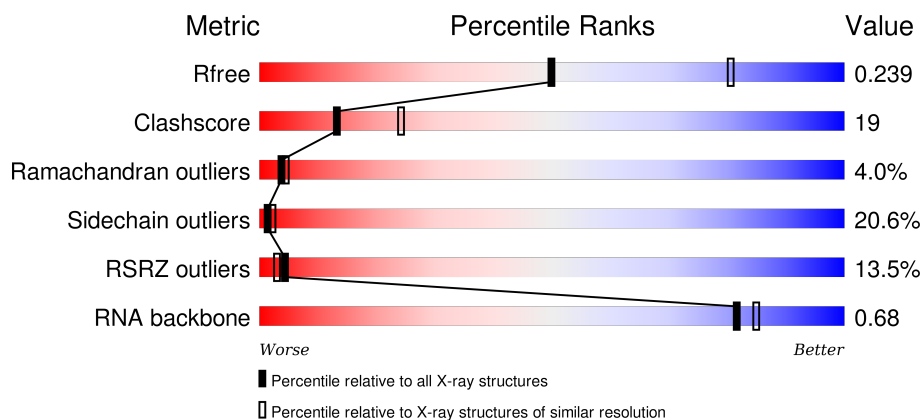
1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.57 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}	91344	2636 (2.60-2.56)
Clashscore	102246	3003 (2.60-2.56)
Ramachandran outliers	100387	2956 (2.60-2.56)
Sidechain outliers	100360	2956 (2.60-2.56)
RSRZ outliers	91569	2642 (2.60-2.56)
RNA backbone	2183	1042 (3.00-2.16)

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 ≥ 3 , 2, 1 and 0 types of geometric quality criteria. 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 $\leq 5\%$. 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	C	58	<div> <div style="width: 43%; background-color: green;"></div> <div style="width: 57%; background-color: yellow;"></div> </div>
1	D	58	<div> <div style="width: 2%; background-color: red;"></div> <div style="width: 62%; background-color: green;"></div> <div style="width: 38%; background-color: yellow;"></div> </div>
2	A	140	<div> <div style="width: 29%; background-color: red;"></div> <div style="width: 32%; background-color: green;"></div> <div style="width: 48%; background-color: yellow;"></div> <div style="width: 14%; background-color: orange;"></div> <div style="width: 5%; background-color: grey;"></div> </div>
2	B	140	<div> <div style="width: 30%; background-color: green;"></div> <div style="width: 16%; background-color: yellow;"></div> <div style="width: 50%; background-color: grey;"></div> </div>

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
3	CD	A	413	-	-	-	X
3	CD	A	414	-	-	-	X
4	MG	C	210	-	-	-	X
4	MG	C	226	-	-	-	X
4	MG	C	257	-	-	-	X
4	MG	D	326	-	-	-	X
4	MG	D	380	-	-	-	X
4	MG	D	385	-	-	-	X

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 4173 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 RNA chain called 23S RIBOSOMAL RNA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	C	58	Total	C	N	O	P	0	0	0
			1237	554	225	401	57			
1	D	58	Total	C	N	O	P	0	0	0
			1237	554	225	401	57			

- Molecule 2 is a protein called PROTEIN (RIBOSOMAL PROTEIN L11).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	A	133	Total	C	N	O	S	0	0	0
			999	642	169	182	6			
2	B	70	Total	C	N	O	S	0	0	0
			523	331	91	98	3			

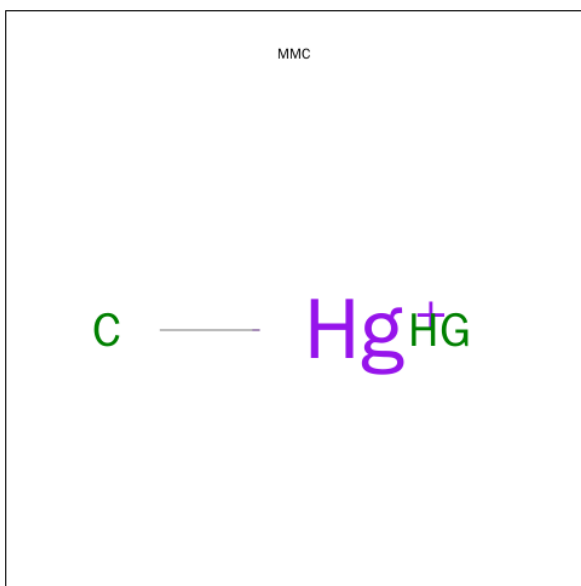
- Molecule 3 is CADMIUM ION (three-letter code: CD) (formula: Cd).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	2	Total	Cd	0	0
			2	2		
3	D	3	Total	Cd	0	0
			3	3		
3	C	3	Total	Cd	0	0
			3	3		

- Molecule 4 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total	Mg	0	0
			1	1		
4	D	9	Total	Mg	0	0
			9	9		
4	C	9	Total	Mg	0	0
			9	9		

- Molecule 5 is METHYL MERCURY ION (three-letter code: MMC) (formula: CH₃Hg).



Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	C	1	Total 1	Hg 1	0	0
5	C	1	Total 1	Hg 1	0	0
5	D	1	Total 1	Hg 1	0	0
5	D	1	Total 1	Hg 1	0	0
5	A	1	Total 1	Hg 1	0	0
5	A	1	Total 1	Hg 1	0	0
5	A	1	Total 1	Hg 1	0	0
5	D	1	Total 1	Hg 1	0	0

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	5	Total 5	O 5	0	0
6	B	12	Total 12	O 12	0	0
6	C	58	Total 58	O 58	0	0

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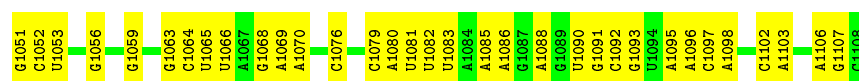
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	D	67	Total	O	0	0
			67	67		

3 Residue-property plots

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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.

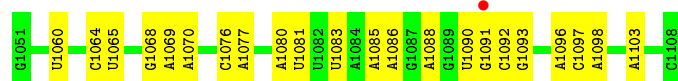
- Molecule 1: 23S RIBOSOMAL RNA

Chain C: 



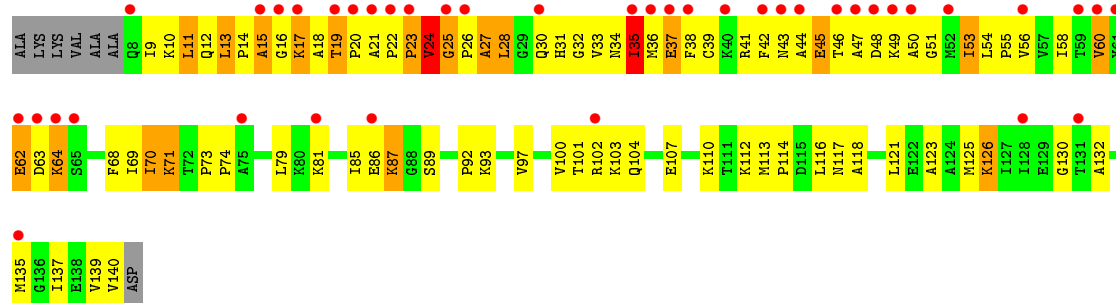
- Molecule 1: 23S RIBOSOMAL RNA

Chain D: 




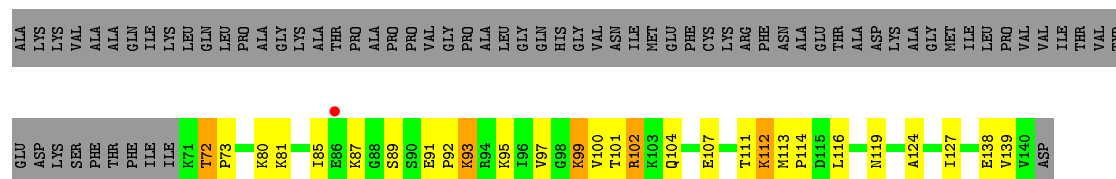
- Molecule 2: PROTEIN (RIBOSOMAL PROTEIN L11)

Chain A: 



- Molecule 2: PROTEIN (RIBOSOMAL PROTEIN L11)

Chain B: 



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	63.89Å 84.26Å 155.51Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	20.00 – 2.57 19.82 – 2.57	Depositor EDS
% Data completeness (in resolution range)	95.5 (20.00-2.57) 96.8 (19.82-2.57)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.04	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.36 (at 2.56Å)	Xtriage
Refinement program	X-PLOR 3.851	Depositor
R, R_{free}	0.219 , 0.254 0.213 , 0.239	Depositor DCC
R_{free} test set	1284 reflections (5.07%)	DCC
Wilson B-factor (Å ²)	42.9	Xtriage
Anisotropy	0.888	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 63.6	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Outliers	1 of 49336 reflections (0.002%)	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	4173	wwPDB-VP
Average B, all atoms (Å ²)	42.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.93% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.375 respectively for untwinned datasets, and 0.333, 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: MG, MMC, CD

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	C	0.36	0/1384	0.69	0/2156
1	D	0.35	0/1384	0.68	0/2156
2	A	0.31	0/1015	0.51	0/1366
2	B	0.32	0/527	0.50	0/702
All	All	0.34	0/4310	0.63	0/6380

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	C	0	1
1	D	0	1
All	All	0	2

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	C	1069	A	Sidechain
1	D	1069	A	Sidechain

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	C	1237	0	624	25	0
1	D	1237	0	624	16	0
2	A	999	0	1069	83	0
2	B	523	0	576	20	0
3	A	2	0	0	0	0
3	C	3	0	0	0	0
3	D	3	0	0	0	0
4	A	1	0	0	0	0
4	C	9	0	0	0	0
4	D	9	0	0	0	0
5	A	3	0	0	0	0
5	C	2	0	0	0	0
5	D	3	0	0	0	0
6	A	5	0	0	1	0
6	B	12	0	0	1	0
6	C	58	0	0	0	0
6	D	67	0	0	0	0
All	All	4173	0	2893	131	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 19.

The worst 5 of 131 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)
2:A:20:PRO:HB2	2:A:23:PRO:HD2	1.61	0.83
2:A:14:PRO:HG2	2:A:17:LYS:HG3	1.59	0.82
2:A:21:ALA:HB3	2:A:22:PRO:HD3	1.64	0.80
2:A:33:VAL:HG22	2:A:60:VAL:HG11	1.63	0.79
2:A:15:ALA:HB1	2:A:50:ALA:HA	1.65	0.78

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	
2	A	131/140 (94%)	112 (86%)	11 (8%)	8 (6%)	2	2
2	B	68/140 (49%)	67 (98%)	1 (2%)	0	100	100
All	All	199/280 (71%)	179 (90%)	12 (6%)	8 (4%)	4	4

5 of 8 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	A	15	ALA
2	A	19	THR
2	A	27	ALA
2	A	35	ILE
2	A	25	GLY

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	
2	A	108/112 (96%)	82 (76%)	26 (24%)	1	1
2	B	57/112 (51%)	49 (86%)	8 (14%)	4	7
All	All	165/224 (74%)	131 (79%)	34 (21%)	1	2

5 of 34 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	A	63	ASP

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Mol	Chain	Res	Type
2	A	81	LYS
2	B	102	ARG
2	A	70	ILE
2	A	35	ILE

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

Mol	Chain	Res	Type
2	A	34	ASN

5.3.3 RNA ⓘ

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
1	C	57/58 (98%)	3 (5%)	0
1	D	57/58 (98%)	3 (5%)	0
All	All	114/116 (98%)	6 (5%)	0

5 of 6 RNA backbone outliers are listed below:

Mol	Chain	Res	Type
1	C	1070	A
1	C	1088	A
1	C	1090	U
1	D	1070	A
1	D	1088	A

There are no RNA pucker outliers to report.

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

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates ⓘ

There are no carbohydrates in this entry.

5.6 Ligand geometry [i](#)

Of 35 ligands modelled in this entry, 8 are modelled with single atom and 27 are monoatomic - leaving 0 for Mogul analysis.

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 [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	C	58/58 (100%)	-0.16	0 100 100	22, 32, 53, 69	0
1	D	58/58 (100%)	-0.04	1 (1%) 73 69	22, 33, 55, 64	0
2	A	133/140 (95%)	1.51	41 (30%) 1 0	23, 57, 98, 100	0
2	B	70/140 (50%)	0.26	1 (1%) 78 75	22, 40, 57, 66	0
All	All	319/396 (80%)	0.65	43 (13%) 4 3	22, 41, 95, 100	0

The worst 5 of 43 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	A	48	ASP	7.0
2	A	61	TYR	6.7
2	A	36	MET	6.1
2	A	17	LYS	6.1
2	A	16	GLY	6.0

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 carbohydrates in this entry.

6.4 Ligands [i](#)

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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	LLDF	B-factors(Å ²)	Q<0.9
3	CD	A	413	1/1	0.74	0.71	22.77	33,33,33,33	1
4	MG	D	326	1/1	0.99	0.46	15.21	11,11,11,11	0
4	MG	C	210	1/1	0.98	0.34	12.87	31,31,31,31	0
4	MG	C	226	1/1	0.97	0.29	8.74	17,17,17,17	0
4	MG	D	385	1/1	0.98	0.23	5.44	26,26,26,26	0
4	MG	C	257	1/1	0.92	0.21	4.94	18,18,18,18	0
4	MG	D	380	1/1	0.99	0.27	4.74	15,15,15,15	0
3	CD	A	414	1/1	0.89	0.26	2.90	14,14,14,14	1
3	CD	C	202	1/1	1.00	0.12	-0.94	32,32,32,32	0
5	MMC	A	416	1/2	0.78	0.18	-1.17	45,45,45,45	1
3	CD	D	302	1/1	1.00	0.12	-1.29	31,31,31,31	0
5	MMC	A	415	1/2	0.80	0.12	-1.54	35,35,35,35	1
3	CD	C	211	1/1	0.99	0.07	-6.82	47,47,47,47	0
4	MG	C	225	1/1	0.80	0.33	-	41,41,41,41	0
3	CD	C	201	1/1	0.97	0.10	-	77,77,77,77	0
4	MG	C	215	1/1	0.93	0.28	-	23,23,23,23	0
3	CD	D	311	1/1	0.96	0.07	-	76,76,76,76	0
4	MG	D	318	1/1	0.97	0.40	-	17,17,17,17	0
5	MMC	D	451	1/2	0.83	0.20	-	26,26,26,26	1
5	MMC	C	227	1/2	0.88	0.21	-	21,21,21,21	1
4	MG	C	223	1/1	0.85	0.34	-	36,36,36,36	0
4	MG	C	228	1/1	0.87	0.24	-	49,49,49,49	0
5	MMC	D	347	1/2	0.95	0.06	-	54,54,54,54	1
4	MG	D	360	1/1	0.99	0.15	-	28,28,28,28	0
5	MMC	C	230	1/2	0.95	0.05	-	65,65,65,65	1
4	MG	C	437	1/1	0.61	0.12	-	47,47,47,47	0
4	MG	D	365	1/1	0.91	0.49	-	57,57,57,57	0
3	CD	D	390	1/1	0.99	0.12	-	66,66,66,66	0
4	MG	C	273	1/1	0.95	0.10	-	35,35,35,35	0
5	MMC	D	332	1/2	0.97	0.08	-	82,82,82,82	1
4	MG	A	214	1/1	0.85	0.19	-	36,36,36,36	0
4	MG	D	375	1/1	0.94	0.13	-	19,19,19,19	0
5	MMC	A	448	1/2	0.82	0.32	-	21,21,21,21	1
4	MG	D	354	1/1	0.96	0.09	-	29,29,29,29	0
4	MG	D	397	1/1	0.86	0.10	-	36,36,36,36	0

6.5 Other polymers ⓘ

There are no such residues in this entry.