



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 22, 2016 – 08:03 PM EDT

PDB ID : 5EMF
Title : Crystal structure of RNA r(GCUGCUGC) with antisense PNA p(GCAGCAGC)
Authors : Kiliszek, A.; Banaszak, K.; Dauter, Z.; Rypniewski, W.
Deposited on : 2015-11-06
Resolution : 1.14 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
<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 : 1.7.1 (RC1), CSD as537be (2016)
Xtriage (Phenix) : 1.9-1692
EDS : rb-20027107
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac : 5.8.0122
CCP4 : 6.5.0
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : rb-20027107

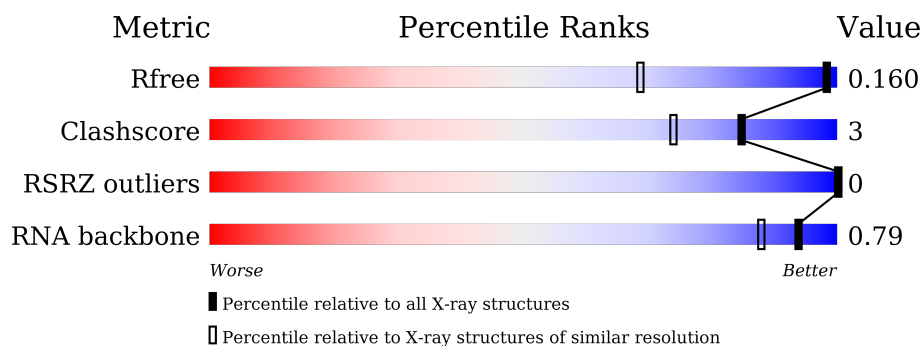
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION



The reported resolution of this entry is 1.14 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	1495 (1.20-1.08)
Clashscore	102246	1593 (1.20-1.08)
RSRZ outliers	91569	1498 (1.20-1.08)
RNA backbone	2183	1046 (2.70-0.62)

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	A	8	
2	B	8	

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 540 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 RNA (5'-R(*GP*CP*UP*GP*CP*UP*GP*C)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	8	Total	C	N	O	P	0	4	0
			196	87	31	69	9			

- Molecule 2 is a protein called antisense PNA p(GCAGCAGC).

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	B	8	Total	C	N	O	0	4	0
			220	119	70	31			

- Molecule 3 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	B	1	Total	Cl	0	0
			1	1		
3	A	1	Total	Cl	0	1
			2	2		


- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	70	Total	O	0	4
			73	73		
4	B	44	Total	O	0	6
			48	48		

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: RNA (5'-R(*GP*CP*UP*GP*CP*UP*GP*C)-3')

Chain A:  88% 13%



- Molecule 2: antisense PNA p(GCAGCAGC)

Chain B:  75% 25%



4 Data and refinement statistics

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, α , β , γ	35.11Å 35.11Å 69.11Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	30.41 – 1.14 30.41 – 1.14	Depositor EDS
% Data completeness (in resolution range)	99.1 (30.41-1.14) 98.4 (30.41-1.14)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.05	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.46 (at 1.14Å)	Xtriage
Refinement program	REFMAC 5.8.0124	Depositor
R, R_{free}	0.122 , 0.153 0.131 , 0.160	Depositor DCC
R_{free} test set	1111 reflections (6.39%)	DCC
Wilson B-factor (Å ²)	12.1	Xtriage
Anisotropy	0.452	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 53.0	EDS
Estimated twinning fraction	0.040 for -h,-k,l	Xtriage
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Outliers	0 of 18511 reflections	Xtriage
F_o, F_c correlation	0.98	EDS
Total number of atoms	540	wwPDB-VP
Average B, all atoms (Å ²)	15.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 12.48% 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 [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: GPN, APN, CPN, CL

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	1.66	0/277	1.43	0/431

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

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	1[A]	G	Sidechain

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	196	0	86	0	0
2	B	220	0	146	2	0

Continued on next page...

Continued from previous page...

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	A	2	0	0	0	0
3	B	1	0	0	0	0
4	A	73	0	0	0	0
4	B	48	0	0	0	0
All	All	540	0	232	2	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 3.

All (2) 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:B:104[B]:GPN:H8'2	2:B:104[B]:GPN:H3'2	1.88	0.42

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

There are no protein backbone outliers to report in this entry.

5.3.2 Protein sidechains [i](#)

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

5.3.3 RNA [i](#)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
1	A	4/8 (50%)	0	0

There are no RNA backbone outliers to report.

There are no RNA pucker outliers to report.

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

12 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$
2	GPN	B	101	2	19,22,23	1.28	2 (10%)	16,30,32	3.95	3 (18%)
2	CPN	B	102	2	16,18,19	1.53	4 (25%)	17,23,25	2.10	7 (41%)
2	APN	B	103	2	19,21,22	1.56	5 (26%)	13,28,30	1.26	2 (15%)
2	GPN	B	104[A]	2	19,22,23	1.56	4 (21%)	16,30,32	3.90	8 (50%)
2	GPN	B	104[B]	2	19,22,23	1.14	1 (5%)	16,30,32	3.41	4 (25%)
2	CPN	B	105[A]	2	16,18,19	1.45	3 (18%)	17,23,25	1.88	4 (23%)
2	CPN	B	105[B]	2	16,18,19	1.01	1 (6%)	17,23,25	1.92	4 (23%)
2	APN	B	106[A]	2	19,21,22	1.27	2 (10%)	13,28,30	1.62	3 (23%)
2	APN	B	106[B]	2	19,21,22	1.04	1 (5%)	13,28,30	1.90	4 (30%)
2	GPN	B	107[A]	2	19,22,23	1.71	2 (10%)	16,30,32	3.02	5 (31%)
2	GPN	B	107[B]	2	19,22,23	1.70	2 (10%)	16,30,32	3.03	5 (31%)
2	CPN	B	108	2	14,19,19	1.15	1 (7%)	17,25,25	1.15	2 (11%)

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	GPN	B	101	2	-	0/13/14/15	0/2/2/2
2	CPN	B	102	2	-	0/13/14/15	0/1/1/1
2	APN	B	103	2	-	0/13/14/15	0/2/2/2
2	GPN	B	104[A]	2	-	0/13/14/15	0/2/2/2
2	GPN	B	104[B]	2	-	0/13/14/15	0/2/2/2
2	CPN	B	105[A]	2	-	0/13/14/15	0/1/1/1
2	CPN	B	105[B]	2	-	0/13/14/15	0/1/1/1
2	APN	B	106[A]	2	-	0/13/14/15	0/2/2/2
2	APN	B	106[B]	2	-	0/13/14/15	0/2/2/2
2	GPN	B	107[A]	2	-	0/13/14/15	0/2/2/2
2	GPN	B	107[B]	2	-	0/13/14/15	0/2/2/2
2	CPN	B	108	2	-	0/13/15/15	0/1/1/1

All (28) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	106[A]	APN	C8'-C7'	-3.43	1.49	1.52
2	B	103	APN	C8-N7	-3.12	1.28	1.34
2	B	103	APN	C8'-N9	-2.75	1.41	1.48
2	B	102	CPN	C4-N3	-2.75	1.30	1.35
2	B	101	GPN	C8-N7	-2.65	1.29	1.34
2	B	104[A]	GPN	C8-N7	-2.42	1.30	1.34
2	B	103	APN	C2'-N1'	-2.31	1.38	1.48
2	B	103	APN	C5-C4	-2.26	1.35	1.40
2	B	104[A]	GPN	C5'-N4'	-2.24	1.43	1.47
2	B	102	CPN	C6-C5	-2.18	1.33	1.38
2	B	102	CPN	C8'-N1	-2.17	1.45	1.47
2	B	104[A]	GPN	O7'-C7'	-2.13	1.18	1.23
2	B	105[B]	CPN	C8'-C7'	-2.10	1.50	1.52
2	B	106[A]	APN	C4-N3	-2.05	1.32	1.35
2	B	103	APN	C2-N3	2.04	1.35	1.32
2	B	101	GPN	C6-N1	2.05	1.36	1.33
2	B	108	CPN	O7'-C7'	2.14	1.28	1.23
2	B	106[B]	APN	C5-C4	2.40	1.45	1.40
2	B	102	CPN	C5-C4	2.49	1.46	1.41
2	B	105[A]	CPN	C8'-C7'	2.52	1.55	1.52
2	B	105[A]	CPN	C5'-C'	2.66	1.59	1.49
2	B	104[B]	GPN	C6-N1	2.93	1.38	1.33
2	B	104[A]	GPN	C6-N1	3.10	1.38	1.33
2	B	105[A]	CPN	C6-N1	3.28	1.41	1.36
2	B	107[A]	GPN	C2-N1	3.68	1.42	1.35
2	B	107[B]	GPN	C2-N1	3.68	1.42	1.35
2	B	107[A]	GPN	C6-N1	4.49	1.41	1.33
2	B	107[B]	GPN	C6-N1	4.49	1.41	1.33

All (51) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	101	GPN	C5-C6-N1	-10.26	110.11	123.52
2	B	104[A]	GPN	C5-C6-N1	-10.14	110.26	123.52
2	B	104[B]	GPN	C5-C6-N1	-9.06	111.67	123.52
2	B	107[A]	GPN	C5-C6-N1	-7.16	114.17	123.52
2	B	107[B]	GPN	C5-C6-N1	-7.16	114.17	123.52
2	B	102	CPN	C6-C5-C4	-5.52	115.27	117.44
2	B	107[A]	GPN	N3-C2-N1	-5.22	120.45	127.56
2	B	107[B]	GPN	N3-C2-N1	-5.22	120.45	127.56
2	B	101	GPN	N3-C2-N1	-4.38	121.60	127.56
2	B	105[A]	CPN	C5-C6-N1	-4.29	118.23	121.41

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	105[B]	CPN	C5-C6-N1	-3.75	118.63	121.41
2	B	105[B]	CPN	O7'-C7'-C8'	-3.38	115.13	120.63
2	B	104[B]	GPN	N3-C2-N1	-3.29	123.08	127.56
2	B	106[B]	APN	C7'-C8'-N9	-3.25	107.10	110.72
2	B	106[B]	APN	O7'-C7'-N4'	-3.14	115.29	122.03
2	B	106[A]	APN	N3-C2-N1	-2.94	126.56	128.87
2	B	104[A]	GPN	C6-C5-C4	-2.57	117.92	120.86
2	B	105[A]	CPN	O7'-C7'-N4'	-2.38	116.92	122.03
2	B	104[A]	GPN	N3-C2-N1	-2.32	124.40	127.56
2	B	102	CPN	C5-C4-N4	-2.31	117.49	121.19
2	B	102	CPN	C5'-N4'-C7'	-2.20	113.96	120.61
2	B	104[A]	GPN	C5'-N4'-C7'	-2.08	114.33	120.61
2	B	107[A]	GPN	C3'-C2'-N1'	-2.06	104.55	112.04
2	B	108	CPN	C7'-C8'-N1	-2.03	108.46	110.72
2	B	103	APN	O7'-C7'-C8'	-2.01	117.36	120.63
2	B	102	CPN	C3'-N4'-C7'	2.12	127.50	120.83
2	B	105[A]	CPN	C5'-N4'-C3'	2.20	120.19	116.63
2	B	108	CPN	C8'-C7'-N4'	2.24	120.57	117.13
2	B	106[B]	APN	C3'-N4'-C7'	2.30	128.04	120.83
2	B	103	APN	C8'-N9-C8	2.39	128.46	125.70
2	B	106[A]	APN	O7'-C7'-C8'	2.40	124.53	120.63
2	B	102	CPN	C8'-N1-C6	2.49	123.34	118.62
2	B	102	CPN	N4-C4-N3	2.54	120.94	116.50
2	B	105[B]	CPN	C8'-N1-C2	2.71	121.10	117.97
2	B	104[A]	GPN	C7'-C8'-N9	2.79	113.83	110.72
2	B	104[A]	GPN	C3'-N4'-C7'	2.80	129.62	120.83
2	B	107[B]	GPN	C5'-N4'-C3'	2.84	121.22	116.63
2	B	107[A]	GPN	N2-C2-N3	3.01	123.37	117.72
2	B	107[B]	GPN	N2-C2-N3	3.01	123.37	117.72
2	B	106[A]	APN	C8'-N9-C8	3.25	129.46	125.70
2	B	106[B]	APN	C8'-C7'-N4'	3.32	122.22	117.13
2	B	102	CPN	C5-C6-N1	3.45	123.97	121.41
2	B	104[B]	GPN	C8'-N9-C8	3.69	129.96	125.70
2	B	105[B]	CPN	C6-C5-C4	3.97	118.99	117.44
2	B	105[A]	CPN	C6-C5-C4	4.01	119.01	117.44
2	B	104[A]	GPN	C8'-N9-C8	4.37	130.75	125.70
2	B	107[A]	GPN	C6-N1-C2	6.03	122.95	115.88
2	B	107[B]	GPN	C6-N1-C2	6.03	122.95	115.88
2	B	104[B]	GPN	C6-N1-C2	8.28	125.58	115.88
2	B	104[A]	GPN	C6-N1-C2	9.26	126.73	115.88
2	B	101	GPN	C6-N1-C2	10.46	128.14	115.88

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	104[B]	GPN	1	0
2	B	107[B]	GPN	1	0

5.5 Carbohydrates [i](#)

There are no carbohydrates in this entry.

5.6 Ligand geometry [i](#)

Of 3 ligands modelled in this entry, 3 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 ⓘ

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	8/8 (100%)	-0.34	0 100 100	11, 13, 15, 16	0
2	B	0/8	-	-	-	-
All	All	8/16 (50%)	-0.34	0 100 100	11, 13, 15, 16	0

There are no RSRZ outliers to report.

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. 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
2	GPN	B	107[A]	21/22	0.99	0.05	-	9,10,11,12	4
2	CPN	B	108	19/19	0.99	0.06	-	8,9,11,16	0
2	APN	B	106[A]	20/21	0.98	0.06	-	11,13,17,18	20
2	APN	B	103	20/21	0.99	0.06	-	8,8,10,12	0
2	APN	B	106[B]	20/21	0.98	0.06	-	11,12,16,16	20
2	CPN	B	105[A]	18/19	0.99	0.06	-	10,11,15,19	18
2	GPN	B	104[A]	21/22	0.99	0.07	-	9,10,12,14	20
2	CPN	B	105[B]	18/19	0.99	0.06	-	11,13,16,18	18
2	GPN	B	104[B]	21/22	0.99	0.07	-	9,10,13,15	20
2	GPN	B	101	21/22	0.99	0.06	-	8,10,12,15	0
2	GPN	B	107[B]	21/22	0.99	0.05	-	9,10,11,14	4
2	CPN	B	102	18/19	0.99	0.06	-	8,8,10,10	0

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(\AA^2)	Q<0.9
3	CL	A	101[A]	1/1	1.00	0.08	-	21,21,21,21	1
3	CL	A	101[B]	1/1	1.00	0.08	-	18,18,18,18	1
3	CL	B	201	1/1	0.93	0.09	-	33,33,33,33	1

6.5 Other polymers [i](#)

There are no such residues in this entry.