



Full wwPDB X-ray Structure Validation Report ⓘ

Aug 31, 2020 – 08:24 AM BST

PDB ID : 1AMY
Title : CRYSTAL AND MOLECULAR STRUCTURE OF BARLEY ALPHA-AMYLASE
Authors : Kadziola, A.; Haser, R.
Deposited on : 1994-03-10
Resolution : 2.80 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 following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Xtriage (Phenix) : 1.13
EDS : 2.13
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) : 2.13

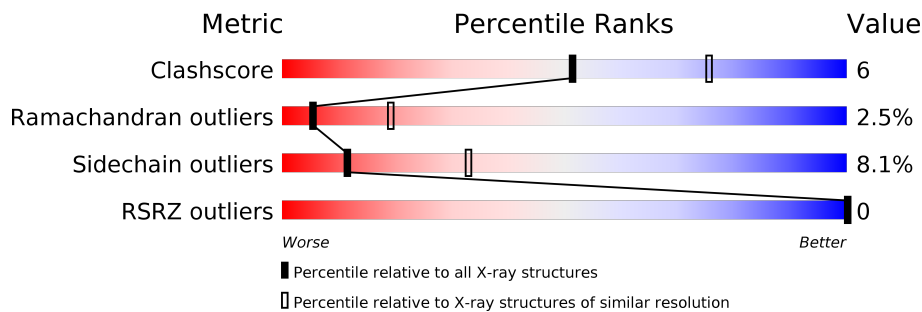
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION


The reported resolution of this entry is 2.80 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	3569 (2.80-2.80)
Ramachandran outliers	138981	3498 (2.80-2.80)
Sidechain outliers	138945	3500 (2.80-2.80)
RSRZ outliers	127900	3078 (2.80-2.80)

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 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 $\leq 5\%$. 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	403	

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 3339 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 1,4-ALPHA-D-GLUCAN GLUCANOHYDROLASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	403	3184	2040	552	583	9	0	0	0

- Molecule 2 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	3	Total	Ca	0	0
			3	3		

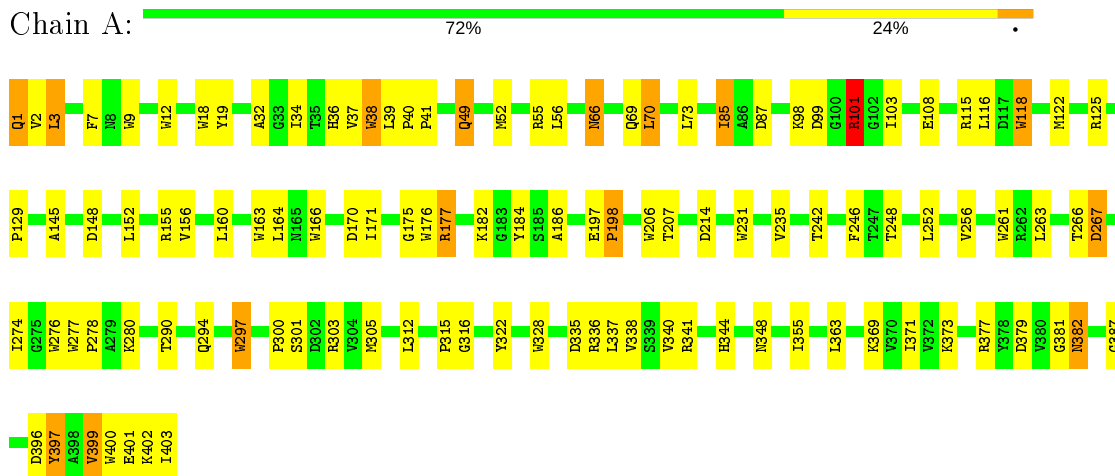
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	152	Total	O	0	0
			152	152		

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: 1,4-ALPHA-D-GLUCAN GLUCANOHYDROLASE



4 Data and refinement statistics

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, α , β , γ	135.20 Å 135.20 Å 79.60 Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	10.00 – 2.80 26.53 – 2.80	Depositor EDS
% Data completeness (in resolution range)	(Not available) (10.00-2.80) 89.7 (26.53-2.80)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.74 (at 2.80 Å)	Xtrriage
Refinement program	X-PLOR	Depositor
R, R_{free}	0.153 , (Not available) 0.144 , (Not available)	Depositor DCC
R_{free} test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å ²)	31.4	Xtrriage
Anisotropy	0.110	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.28 , 79.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.43$, $\langle L^2 \rangle = 0.25$	Xtrriage
Estimated twinning fraction	0.063 for -h,-k,l	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	3339	wwPDB-VP
Average B, all atoms (Å ²)	19.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.02% of the height of the origin peak. No significant pseudotranslation is detected.*

¹ Intensities estimated from amplitudes.

² Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ 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

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

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	0.99	0/3281	1.72	79/4459 (1.8%)

There are no bond length outliers.

All (79) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	176	TRP	CD1-CG-CD2	10.48	114.68	106.30
1	A	328	TRP	CD1-CG-CD2	10.15	114.42	106.30
1	A	18	TRP	CD1-CG-CD2	9.56	113.94	106.30
1	A	12	TRP	CD1-CG-CD2	9.19	113.65	106.30
1	A	176	TRP	CE2-CD2-CG	-9.06	100.06	107.30
1	A	163	TRP	CD1-CG-CD2	8.90	113.42	106.30
1	A	341	ARG	NE-CZ-NH1	8.86	124.73	120.30
1	A	400	TRP	CD1-CG-CD2	8.69	113.25	106.30
1	A	166	TRP	CD1-CG-CD2	8.55	113.14	106.30
1	A	303	ARG	NE-CZ-NH2	-8.33	116.13	120.30
1	A	336	ARG	NE-CZ-NH2	-8.28	116.16	120.30
1	A	118	TRP	CD1-CG-CD2	8.19	112.86	106.30
1	A	402	LYS	O-C-N	7.94	135.40	122.70
1	A	261	TRP	CD1-CG-CD2	7.89	112.62	106.30
1	A	38	TRP	CD1-CG-CD2	7.88	112.61	106.30
1	A	277	TRP	CD1-CG-CD2	7.86	112.58	106.30
1	A	176	TRP	CG-CD2-CE3	7.84	140.96	133.90
1	A	231	TRP	CD1-CG-CD2	7.63	112.40	106.30
1	A	400	TRP	CE2-CD2-CG	-7.61	101.21	107.30
1	A	18	TRP	CE2-CD2-CG	-7.60	101.22	107.30
1	A	12	TRP	CE2-CD2-CG	-7.44	101.35	107.30
1	A	38	TRP	CE2-CD2-CG	-7.38	101.40	107.30
1	A	261	TRP	CG-CD2-CE3	7.37	140.53	133.90
1	A	163	TRP	CE2-CD2-CG	-7.36	101.42	107.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	261	TRP	CE2-CD2-CG	-7.33	101.44	107.30
1	A	328	TRP	CE2-CD2-CG	-7.21	101.53	107.30
1	A	9	TRP	CD1-CG-CD2	7.20	112.06	106.30
1	A	305	MET	CG-SD-CE	-7.16	88.74	100.20
1	A	9	TRP	CE2-CD2-CG	-7.15	101.58	107.30
1	A	177	ARG	CA-CB-CG	-7.10	97.78	113.40
1	A	328	TRP	CG-CD1-NE1	-7.00	103.09	110.10
1	A	166	TRP	CE2-CD2-CG	-6.90	101.78	107.30
1	A	397	TYR	CB-CG-CD2	-6.85	116.89	121.00
1	A	336	ARG	NE-CZ-NH1	6.79	123.70	120.30
1	A	277	TRP	CE2-CD2-CG	-6.76	101.89	107.30
1	A	297	TRP	CG-CD2-CE3	6.73	139.96	133.90
1	A	231	TRP	CE2-CD2-CG	-6.72	101.92	107.30
1	A	176	TRP	CG-CD1-NE1	-6.70	103.40	110.10
1	A	297	TRP	CE2-CD2-CG	-6.68	101.96	107.30
1	A	402	LYS	CA-C-N	-6.67	102.53	117.20
1	A	261	TRP	CB-CG-CD1	-6.66	118.34	127.00
1	A	101	ARG	NE-CZ-NH1	6.55	123.57	120.30
1	A	297	TRP	CD1-CG-CD2	6.53	111.52	106.30
1	A	118	TRP	CE2-CD2-CG	-6.50	102.10	107.30
1	A	18	TRP	CG-CD1-NE1	-6.44	103.66	110.10
1	A	176	TRP	CB-CG-CD1	-6.42	118.65	127.00
1	A	163	TRP	CG-CD1-NE1	-6.29	103.81	110.10
1	A	206	TRP	CD1-CG-CD2	6.23	111.28	106.30
1	A	1	GLN	N-CA-C	-6.21	94.24	111.00
1	A	52	MET	CG-SD-CE	-6.18	90.30	100.20
1	A	3	LEU	CA-CB-CG	6.17	129.48	115.30
1	A	38	TRP	CG-CD2-CE3	6.11	139.40	133.90
1	A	12	TRP	CG-CD1-NE1	-6.11	103.99	110.10
1	A	155	ARG	NE-CZ-NH2	-6.05	117.28	120.30
1	A	206	TRP	CE2-CD2-CG	-6.05	102.46	107.30
1	A	377	ARG	NE-CZ-NH2	-6.01	117.30	120.30
1	A	177	ARG	CB-CG-CD	5.98	127.14	111.60
1	A	303	ARG	NE-CZ-NH1	5.93	123.27	120.30
1	A	115	ARG	NE-CZ-NH1	5.91	123.25	120.30
1	A	338	VAL	CG1-CB-CG2	-5.90	101.47	110.90
1	A	101	ARG	NE-CZ-NH2	-5.74	117.43	120.30
1	A	341	ARG	NE-CZ-NH2	-5.69	117.45	120.30
1	A	267	ASP	CA-CB-CG	5.64	125.81	113.40
1	A	400	TRP	CG-CD1-NE1	-5.52	104.58	110.10
1	A	118	TRP	CG-CD1-NE1	-5.46	104.64	110.10
1	A	276	TRP	CE2-CD2-CG	-5.46	102.93	107.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	197	GLU	CA-CB-CG	5.42	125.32	113.40
1	A	400	TRP	CB-CG-CD1	-5.41	119.97	127.00
1	A	206	TRP	CG-CD2-CE3	5.40	138.76	133.90
1	A	166	TRP	CG-CD1-NE1	-5.34	104.76	110.10
1	A	184	TYR	CB-CG-CD1	-5.33	117.80	121.00
1	A	277	TRP	CG-CD1-NE1	-5.25	104.85	110.10
1	A	19	TYR	CB-CG-CD2	-5.25	117.85	121.00
1	A	379	ASP	CA-CB-CG	5.23	124.92	113.40
1	A	261	TRP	CG-CD1-NE1	-5.22	104.88	110.10
1	A	177	ARG	CG-CD-NE	5.21	122.75	111.80
1	A	276	TRP	CD1-CG-CD2	5.17	110.43	106.30
1	A	322	TYR	CB-CG-CD2	-5.13	117.92	121.00
1	A	294	GLN	CA-CB-CG	-5.06	102.27	113.40

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	3184	0	3044	35	0
2	A	3	0	0	0	0
3	A	152	0	0	1	0
All	All	3339	0	3044	35	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 (35) 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:186:ALA:HB1	1:A:235:VAL:HG23	1.79	0.64
1:A:38:TRP:CZ2	1:A:177:ARG:HD3	2.39	0.58
1:A:373:LYS:O	1:A:397:TYR:HA	2.05	0.56
1:A:49:GLN:NE2	1:A:49:GLN:H	2.04	0.55

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:66:ASN:ND2	1:A:69:GLN:H	2.03	0.55
1:A:66:ASN:HD22	1:A:69:GLN:H	1.56	0.54
1:A:118:TRP:HB3	1:A:122:MET:SD	2.48	0.54
1:A:355:ILE:HG21	1:A:363:LEU:HD23	1.91	0.51
1:A:38:TRP:HA	1:A:85:ILE:HG13	1.91	0.51
1:A:175:GLY:HA2	1:A:198:PRO:HB2	1.93	0.51
1:A:156:VAL:O	1:A:160:LEU:HB2	2.12	0.50
1:A:242:THR:HG22	1:A:280:LYS:HA	1.95	0.49
1:A:55:ARG:HA	1:A:108:GLU:O	2.14	0.48
1:A:3:LEU:HD22	1:A:36:HIS:HB2	1.95	0.48
1:A:355:ILE:CG2	1:A:363:LEU:HD23	2.44	0.48
1:A:274:ILE:HA	1:A:278:PRO:HA	1.97	0.47
1:A:344:HIS:CE1	1:A:401:GLU:HB2	2.51	0.46
1:A:387:GLY:O	1:A:403:ILE:HG12	2.15	0.46
1:A:160:LEU:HA	1:A:160:LEU:HD12	1.84	0.46
1:A:248:THR:O	1:A:252:LEU:HB2	2.16	0.45
1:A:340:VAL:O	1:A:344:HIS:HD2	1.98	0.45
1:A:41:PRO:HG3	1:A:87:ASP:HB3	1.97	0.45
1:A:246:PHE:HD2	1:A:297:TRP:HZ3	1.65	0.45
1:A:32:ALA:HB3	1:A:34:ILE:HD12	2.00	0.44
1:A:98:LYS:HA	1:A:103:ILE:O	2.17	0.44
1:A:70:LEU:HD13	1:A:171:ILE:HG21	2.00	0.43
1:A:7:PHE:CD2	1:A:40:PRO:HB3	2.54	0.43
1:A:182:LYS:HD3	1:A:207:THR:HG22	2.00	0.42
1:A:371:ILE:O	1:A:399:VAL:HA	2.19	0.42
1:A:99:ASP:OD1	1:A:101:ARG:HB2	2.20	0.42
1:A:170:ASP:HB2	3:A:686:HOH:O	2.20	0.41
1:A:290:THR:HB	1:A:297:TRP:O	2.21	0.41
1:A:278:PRO:O	1:A:316:GLY:HA2	2.21	0.41
1:A:49:GLN:H	1:A:49:GLN:CD	2.24	0.41
1:A:344:HIS:HB3	1:A:369:LYS:HD2	2.04	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	401/403 (100%)	364 (91%)	27 (7%)	10 (2%)	5 19

All (10) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	101	ARG
1	A	348	ASN
1	A	125	ARG
1	A	214	ASP
1	A	381	GLY
1	A	382	ASN
1	A	396	ASP
1	A	145	ALA
1	A	315	PRO
1	A	300	PRO

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	322/322 (100%)	296 (92%)	26 (8%)	11 33

All (26) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1	GLN
1	A	2	VAL
1	A	37	VAL
1	A	39	LEU
1	A	49	GLN
1	A	56	LEU
1	A	66	ASN
1	A	70	LEU
1	A	73	LEU

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Mol	Chain	Res	Type
1	A	85	ILE
1	A	116	LEU
1	A	129	PRO
1	A	148	ASP
1	A	152	LEU
1	A	164	LEU
1	A	198	PRO
1	A	256	VAL
1	A	263	LEU
1	A	266	THR
1	A	267	ASP
1	A	301	SER
1	A	312	LEU
1	A	335	ASP
1	A	337	LEU
1	A	382	ASN
1	A	399	VAL

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	49	GLN
1	A	66	ASN
1	A	226	GLN
1	A	230	ASN
1	A	306	GLN
1	A	344	HIS
1	A	382	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

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

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 [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	403/403 (100%)	-1.19	0 100 100	3, 15, 44, 78	0

There are no RSRZ outliers to report.

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](#)

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
2	CA	A	502	1/1	0.97	0.06	14,14,14,14	0
2	CA	A	501	1/1	0.98	0.05	5,5,5,5	0
2	CA	A	500	1/1	0.99	0.02	17,17,17,17	0

6.5 Other polymers [i](#)

There are no such residues in this entry.