



Full wwPDB X-ray Structure Validation Report ⓘ

May 21, 2020 – 11:36 pm BST

PDB ID : 3PBE
Title : Crystal structure of the mutant W207F of human secretory glutaminyl cyclase
Authors : Huang, K.F.; Liaw, S.S.; Huang, W.L.; Chia, C.Y.; Lo, Y.C.; Chen, Y.L.; Wang, A.H.J.
Deposited on : 2010-10-20
Resolution : 1.95 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
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.11
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) : 2.11

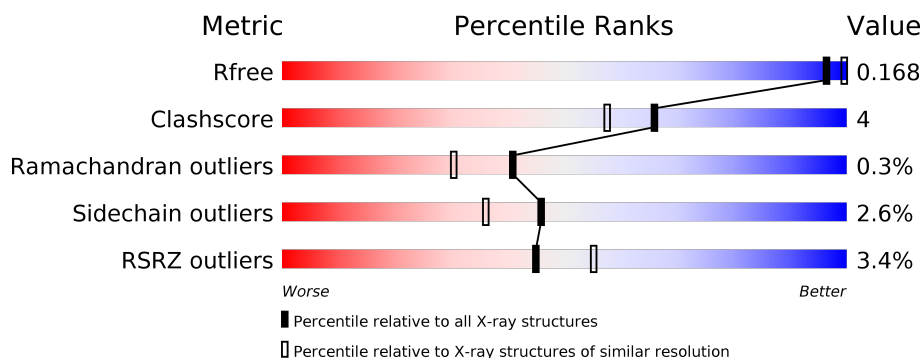
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.95 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	2580 (1.96-1.96)
Clashscore	141614	2705 (1.96-1.96)
Ramachandran outliers	138981	2678 (1.96-1.96)
Sidechain outliers	138945	2678 (1.96-1.96)
RSRZ outliers	127900	2539 (1.96-1.96)

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	329	<div> <div>2%</div> <div> <div></div> <div>87%</div> <div>9%</div> <div>• •</div> </div> </div>
1	B	329	<div> <div>5%</div> <div> <div></div> <div>87%</div> <div>9%</div> <div>• • •</div> </div> </div>

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 5733 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 Glutaminyl-peptide cyclotransferase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	323	Total	C	N	O	S	5	0	0
			2607	1671	449	478	9			
1	B	323	Total	C	N	O	S	5	0	0
			2607	1671	449	478	9			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	207	PHE	TRP	ENGINEERED MUTATION	UNP Q16769
B	207	PHE	TRP	ENGINEERED MUTATION	UNP Q16769

- Molecule 2 is ZINC ION (three-letter code: ZN) (formula: Zn).

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

- Molecule 3 is SULFATE ION (three-letter code: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	O	S	0	0
			5	4	1		
3	B	1	Total	O	S	0	0
			5	4	1		

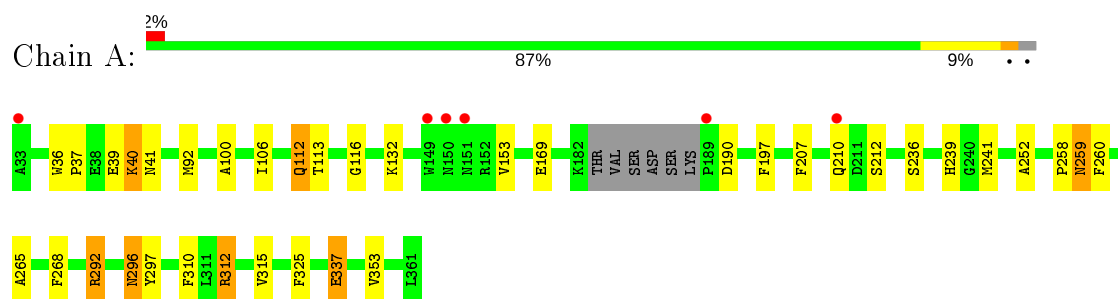
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	289	Total	O	0	0
			289	289		
4	B	218	Total	O	0	0
			218	218		

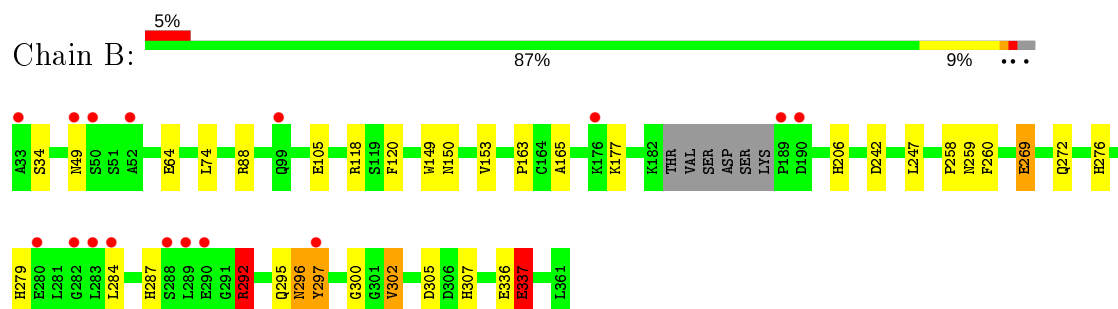
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA 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: Glutaminyl-peptidase cyclotransferase



- Molecule 1: Glutaminyl-peptidase cyclotransferase



4 Data and refinement statistics

Property	Value	Source
Space group	H 3 2	Depositor
Cell constants a, b, c, α , β , γ	118.75Å 118.75Å 332.09Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	30.00 – 1.95 40.49 – 1.95	Depositor EDS
% Data completeness (in resolution range)	99.8 (30.00-1.95) 96.0 (40.49-1.95)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.92 (at 1.95Å)	Xtriage
Refinement program	CNS, REFMAC 5.5.0102	Depositor
R, R_{free}	0.143 , 0.190 0.172 , 0.168	Depositor DCC
R_{free} test set	3340 reflections (5.07%)	wwPDB-VP
Wilson B-factor (Å ²)	31.4	Xtriage
Anisotropy	0.077	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.39 , 49.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	5733	wwPDB-VP
Average B, all atoms (Å ²)	36.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.64% 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, 0.333 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: ZN, SO4

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	1.40	13/2683 (0.5%)	0.93	1/3649 (0.0%)
1	B	1.29	10/2683 (0.4%)	0.92	4/3649 (0.1%)
All	All	1.35	23/5366 (0.4%)	0.93	5/7298 (0.1%)

All (23) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	337	GLU	CG-CD	10.17	1.67	1.51
1	A	337	GLU	CG-CD	9.10	1.65	1.51
1	B	337	GLU	CB-CG	8.43	1.68	1.52
1	A	40	LYS	CE-NZ	7.69	1.68	1.49
1	A	337	GLU	CB-CG	7.42	1.66	1.52
1	B	153	VAL	CB-CG2	6.87	1.67	1.52
1	B	269	GLU	CG-CD	6.71	1.62	1.51
1	A	100	ALA	CA-CB	6.37	1.65	1.52
1	A	153	VAL	CB-CG2	6.17	1.65	1.52
1	A	268	PHE	CD1-CE1	5.85	1.50	1.39
1	B	337	GLU	CD-OE1	5.82	1.32	1.25
1	B	64	GLU	CB-CG	5.69	1.62	1.52
1	A	39	GLU	CB-CG	5.67	1.62	1.52
1	A	353	VAL	CB-CG1	5.61	1.64	1.52
1	A	197	PHE	CD2-CE2	5.41	1.50	1.39
1	B	337	GLU	CD-OE2	5.38	1.31	1.25
1	A	310	PHE	CE2-CZ	5.35	1.47	1.37
1	B	105	GLU	CD-OE2	5.26	1.31	1.25
1	A	325	PHE	CE2-CZ	5.17	1.47	1.37
1	B	120	PHE	CE1-CZ	5.17	1.47	1.37
1	A	252	ALA	CA-CB	5.10	1.63	1.52
1	A	169	GLU	CG-CD	5.09	1.59	1.51
1	B	165	ALA	CA-CB	5.04	1.63	1.52

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	292	ARG	NE-CZ-NH1	6.20	123.40	120.30
1	A	292	ARG	NE-CZ-NH1	5.64	123.12	120.30
1	B	247	LEU	CB-CG-CD2	-5.58	101.52	111.00
1	B	118	ARG	NE-CZ-NH1	5.42	123.01	120.30
1	B	88	ARG	NE-CZ-NH1	5.22	122.91	120.30

There are no chirality outliers.

There are no planarity outliers.

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	2607	0	2528	20	0
1	B	2607	0	2528	21	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	5	0	0	0	0
3	B	5	0	0	0	0
4	A	289	0	0	4	0
4	B	218	0	0	6	0
All	All	5733	0	5056	41	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 4.

All (41) 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:40:LYS:CE	1:A:40:LYS:NZ	1.68	1.54
1:A:236:SER:H	1:A:239:HIS:CD2	2.00	0.80
1:A:236:SER:H	1:A:239:HIS:HD2	1.33	0.75
1:A:312:ARG:HH11	1:A:312:ARG:HG2	1.51	0.75
1:A:337:GLU:HG2	4:A:557:HOH:O	1.93	0.68
1:B:292:ARG:HD2	4:B:884:HOH:O	1.96	0.65

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:177:LYS:NZ	4:B:855:HOH:O	2.18	0.65
1:B:337:GLU:HG2	4:B:720:HOH:O	1.96	0.64
1:A:312:ARG:HH11	1:A:312:ARG:CG	2.13	0.61
1:B:258:PRO:HG2	1:B:260:PHE:CZ	2.39	0.57
1:A:241:MET:HE2	1:A:315:VAL:HG11	1.87	0.57
1:A:112:GLN:HE21	1:A:113:THR:H	1.54	0.55
1:B:296:ASN:ND2	4:B:884:HOH:O	2.40	0.54
1:B:302:VAL:CG1	1:B:307:HIS:HE1	2.22	0.52
1:A:292:ARG:NE	4:A:877:HOH:O	2.32	0.52
1:A:296:ASN:O	1:A:297:TYR:HB3	2.10	0.52
1:A:40:LYS:NZ	1:A:40:LYS:CD	2.66	0.52
1:B:269:GLU:HA	1:B:272:GLN:HE21	1.75	0.51
1:B:305:ASP:HB3	1:B:307:HIS:CD2	2.47	0.50
1:A:41:ASN:ND2	4:A:409:HOH:O	2.44	0.50
1:A:258:PRO:HG2	1:A:260:PHE:CZ	2.47	0.50
1:A:112:GLN:HE21	1:A:112:GLN:HA	1.77	0.49
1:B:307:HIS:H	1:B:307:HIS:CD2	2.30	0.49
1:B:279:HIS:HD2	1:B:287:HIS:ND1	2.10	0.49
1:B:300:GLY:CA	4:B:896:HOH:O	2.61	0.48
1:B:296:ASN:H	1:B:296:ASN:ND2	2.12	0.47
1:B:74:LEU:HD13	1:B:336:GLU:HB2	1.97	0.47
1:B:276:HIS:HB2	1:B:292:ARG:HH22	1.80	0.46
1:B:295:GLN:O	1:B:297:TYR:N	2.48	0.46
1:A:210:GLN:HB2	4:A:874:HOH:O	2.16	0.46
1:A:132:LYS:HG3	1:A:190:ASP:OD2	2.16	0.45
1:B:305:ASP:HB3	1:B:307:HIS:HD2	1.82	0.44
1:B:300:GLY:HA3	4:B:896:HOH:O	2.16	0.44
1:B:149:TRP:O	1:B:150:ASN:HB2	2.18	0.44
1:A:92:MET:SD	1:A:106:ILE:HD11	2.58	0.43
1:A:259:ASN:HD21	1:A:265:ALA:HA	1.84	0.43
1:A:36:TRP:N	1:A:37:PRO:CD	2.82	0.41
1:B:258:PRO:HG2	1:B:260:PHE:CE1	2.54	0.41
1:B:307:HIS:H	1:B:307:HIS:HD2	1.69	0.41
1:B:49:ASN:C	1:B:49:ASN:OD1	2.59	0.40
1:A:112:GLN:HE22	1:A:116:GLY:HA2	1.85	0.40

There are no symmetry-related clashes.

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	319/329 (97%)	310 (97%)	8 (2%)	1 (0%)	41	30
1	B	319/329 (97%)	308 (97%)	10 (3%)	1 (0%)	41	30
All	All	638/658 (97%)	618 (97%)	18 (3%)	2 (0%)	41	30

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	296	ASN
1	A	212	SER

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	284/290 (98%)	279 (98%)	5 (2%)	59	53
1	B	284/290 (98%)	274 (96%)	10 (4%)	36	24
All	All	568/580 (98%)	553 (97%)	15 (3%)	46	36

All (15) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	112	GLN
1	A	207	PHE
1	A	259	ASN
1	A	296	ASN

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	A	312	ARG
1	B	34	SER
1	B	163	PRO
1	B	206	HIS
1	B	242	ASP
1	B	259	ASN
1	B	284	LEU
1	B	292	ARG
1	B	297	TYR
1	B	302	VAL
1	B	337	GLU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (12) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	41	ASN
1	A	93	GLN
1	A	112	GLN
1	A	150	ASN
1	A	239	HIS
1	A	259	ASN
1	B	112	GLN
1	B	259	ASN
1	B	272	GLN
1	B	279	HIS
1	B	296	ASN
1	B	307	HIS

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

Of 4 ligands modelled in this entry, 2 are monoatomic - leaving 2 for Mogul analysis.

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	$\# Z > 2$
3	SO4	A	395	-	4,4,4	0.33	0	6,6,6	0.72	0
3	SO4	B	396	-	4,4,4	0.72	0	6,6,6	0.46	0

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 ⓘ

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	322/329 (97%)	-0.30	6 (1%) 66 74	22, 30, 47, 63	0
1	B	322/329 (97%)	0.02	16 (4%) 28 39	25, 37, 58, 80	0
All	All	644/658 (97%)	-0.14	22 (3%) 45 55	22, 33, 54, 80	0

All (22) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	149	TRP	4.4
1	B	289	LEU	3.8
1	B	189	PRO	3.5
1	A	33	ALA	3.3
1	B	280	GLU	3.2
1	B	290	GLU	2.8
1	B	282	GLY	2.8
1	B	33	ALA	2.7
1	A	150	ASN	2.7
1	B	284	LEU	2.6
1	A	151	ASN	2.5
1	B	52	ALA	2.5
1	B	50	SER	2.5
1	B	288	SER	2.5
1	B	176	LYS	2.4
1	B	99	GLN	2.3
1	B	283	LEU	2.2
1	B	297	TYR	2.2
1	B	190	ASP	2.2
1	A	189	PRO	2.1
1	B	49	ASN	2.1
1	A	210	GLN	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 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. 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(\AA^2)	Q<0.9
3	SO4	B	396	5/5	0.97	0.07	38,42,43,44	0
2	ZN	B	392	1/1	0.99	0.10	29,29,29,29	0
3	SO4	A	395	5/5	0.99	0.09	47,47,51,51	0
2	ZN	A	391	1/1	1.00	0.08	27,27,27,27	0

6.5 Other polymers [i](#)

There are no such residues in this entry.