



Full wwPDB X-ray Structure Validation Report ⓘ

Jul 10, 2023 – 10:31 pm BST

PDB ID : 8C66
Title : Structure of the Reconstructed Ancestor of Phenolic Acid Decarboxylase An-cPAD55
Authors : Schrufer, A.; Mokos, D.; Gruber, K.; Daniel, B.
Deposited on : 2023-01-11
Resolution : 1.60 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 types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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

MolProbity : 4.02b-467
Mogul : 1.8.4, CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.34
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) : 2.34

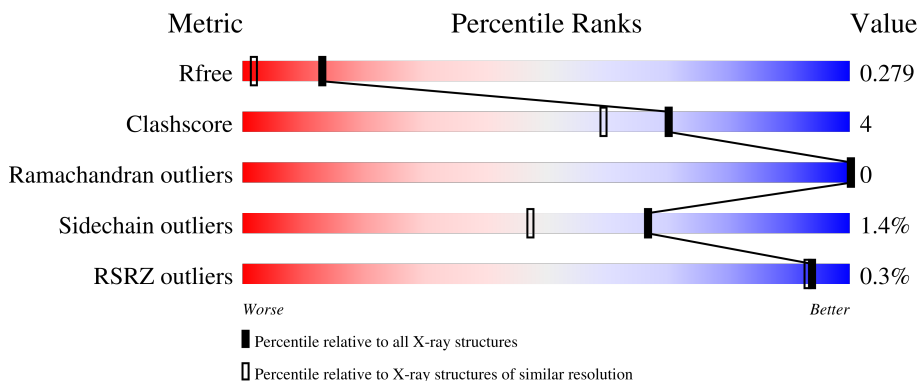
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION



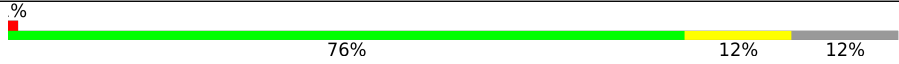
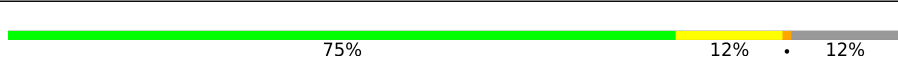
The reported resolution of this entry is 1.60 Å.

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	3398 (1.60-1.60)
Clashscore	141614	3665 (1.60-1.60)
Ramachandran outliers	138981	3564 (1.60-1.60)
Sidechain outliers	138945	3563 (1.60-1.60)
RSRZ outliers	127900	3321 (1.60-1.60)

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 $\leq 5\%$. 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	192	 78% 9% • 12%
1	B	192	 78% 9% • 12%
1	C	192	 76% 12% 12%
1	D	192	 75% 12% • 12%

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 11405 atoms, of which 5240 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 Phenolic acid decarboxylase N55.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
1	A	169	2677	867	1310	235	258	7	40	0	0
1	B	169	2677	867	1310	235	258	7	39	0	0
1	C	169	2677	867	1310	235	258	7	40	0	0
1	D	169	2677	867	1310	235	258	7	40	0	0

- Molecule 2 is SULFATE ION (three-letter code: SO4) (formula: O₄S).



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

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	C	1	Total	O	S	0	0
			5	4	1		
2	D	1	Total	O	S	0	0
			5	4	1		
2	D	1	Total	O	S	0	0
			5	4	1		


- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	166	Total	O	0	0
			166	166		
3	B	178	Total	O	0	0
			178	178		
3	C	166	Total	O	0	0
			166	166		
3	D	162	Total	O	0	0
			162	162		

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: Phenolic acid decarboxylase N55

Chain A: 




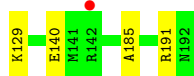
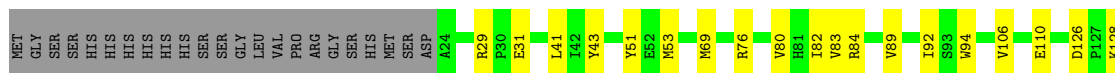
- Molecule 1: Phenolic acid decarboxylase N55

Chain B: 



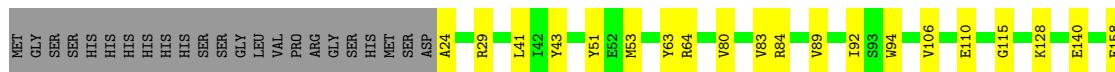
- Molecule 1: Phenolic acid decarboxylase N55

Chain C: 



- Molecule 1: Phenolic acid decarboxylase N55

Chain D: 



4 Data and refinement statistics i

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	58.00Å 105.27Å 81.32Å 90.00° 109.77° 90.00°	Depositor
Resolution (Å)	37.89 – 1.60 37.89 – 1.60	Depositor EDS
% Data completeness (in resolution range)	98.6 (37.89-1.60) 94.1 (37.89-1.60)	Depositor EDS
R_{merge}	0.16	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.14 (at 1.60Å)	Xtrriage
Refinement program	REFMAC 5.8.0267, REFMAC 5.8.0267	Depositor
R, R_{free}	0.230 , 0.272 0.244 , 0.279	Depositor DCC
R_{free} test set	5971 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å ²)	12.9	Xtrriage
Anisotropy	0.187	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.43 , 33.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.45$, $\langle L^2 \rangle = 0.28$	Xtrriage
Estimated twinning fraction	0.199 for h,-k,-h-l	Xtrriage
F_o, F_c correlation	0.90	EDS
Total number of atoms	11405	wwPDB-VP
Average B, all atoms (Å ²)	11.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.42% 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: 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	1.12	2/1403 (0.1%)	1.21	4/1908 (0.2%)
1	B	1.12	4/1403 (0.3%)	1.22	3/1908 (0.2%)
1	C	1.10	4/1403 (0.3%)	1.14	5/1908 (0.3%)
1	D	1.14	6/1403 (0.4%)	1.25	7/1908 (0.4%)
All	All	1.12	16/5612 (0.3%)	1.21	19/7632 (0.2%)

All (16) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	140	GLU	CD-OE1	10.09	1.36	1.25
1	D	110	GLU	CD-OE2	-7.13	1.17	1.25
1	C	140	GLU	CD-OE1	6.85	1.33	1.25
1	C	110	GLU	CD-OE1	6.18	1.32	1.25
1	B	182	GLU	CD-OE1	-5.71	1.19	1.25
1	B	31	GLU	CD-OE1	5.70	1.31	1.25
1	A	46	ASP	CG-OD1	5.67	1.38	1.25
1	B	161	THR	C-O	5.65	1.34	1.23
1	C	31	GLU	CD-OE2	-5.56	1.19	1.25
1	C	185	ALA	C-O	5.47	1.33	1.23
1	D	167	ASP	CG-OD1	5.43	1.37	1.25
1	D	158	GLU	CD-OE2	-5.38	1.19	1.25
1	D	140	GLU	CD-OE1	5.34	1.31	1.25
1	D	177	ALA	C-O	5.04	1.32	1.23
1	B	52	GLU	CD-OE2	5.01	1.31	1.25
1	D	173	GLU	CD-OE1	-5.01	1.20	1.25

All (19) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	112	ARG	NE-CZ-NH2	-11.05	114.78	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	111	ARG	NE-CZ-NH2	9.47	125.03	120.30
1	D	191	ARG	NE-CZ-NH1	-8.53	116.04	120.30
1	D	167	ASP	CB-CG-OD1	8.35	125.81	118.30
1	D	64	ARG	NE-CZ-NH2	-7.77	116.42	120.30
1	B	76	ARG	NE-CZ-NH1	-6.85	116.88	120.30
1	C	29	ARG	NE-CZ-NH2	-6.80	116.90	120.30
1	C	84	ARG	NE-CZ-NH2	-6.65	116.97	120.30
1	C	76	ARG	NE-CZ-NH1	-6.59	117.00	120.30
1	D	165	MET	CG-SD-CE	-6.26	90.18	100.20
1	C	191	ARG	NE-CZ-NH1	-5.96	117.32	120.30
1	C	69	MET	CG-SD-CE	5.91	109.66	100.20
1	A	29	ARG	NE-CZ-NH1	-5.81	117.39	120.30
1	D	84	ARG	NE-CZ-NH2	5.79	123.20	120.30
1	B	112	ARG	NH1-CZ-NH2	5.65	125.62	119.40
1	D	29	ARG	NE-CZ-NH1	-5.55	117.52	120.30
1	A	45	TYR	CZ-CE2-CD2	5.50	124.75	119.80
1	A	192	ASN	CA-C-O	-5.33	108.90	120.10
1	D	115	GLY	O-C-N	5.23	131.07	122.70

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	1367	1310	1304	13	0
1	B	1367	1310	1304	8	0
1	C	1367	1310	1304	9	0
1	D	1367	1310	1304	10	0
2	B	10	0	0	1	0
2	C	5	0	0	0	0
2	D	10	0	0	1	0
3	A	166	0	0	4	0
3	B	178	0	0	1	0
3	C	166	0	0	1	0
3	D	162	0	0	2	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	6165	5240	5216	39	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 (39) 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:D:167:ASP:HB2	3:D:330:HOH:O	1.42	1.15
1:D:24:ALA:N	3:D:301:HOH:O	1.98	0.93
1:A:158:GLU:CG	3:A:211:HOH:O	2.23	0.87
1:A:158:GLU:CD	3:A:211:HOH:O	2.11	0.86
1:A:158:GLU:HG3	3:A:211:HOH:O	1.83	0.75
2:B:202:SO4:O2	3:B:301:HOH:O	2.08	0.72
1:B:165:MET:H	1:B:192:ASN:HD21	1.38	0.71
1:A:165:MET:H	1:A:192:ASN:HD21	1.48	0.61
1:B:49:TRP:CH2	1:B:69:MET:HG2	2.39	0.58
1:C:126:ASP:HB3	1:C:129:LYS:HE3	1.86	0.58
1:A:167:ASP:HB3	3:A:299:HOH:O	2.07	0.55
1:B:80:VAL:HG12	1:B:94:TRP:HB3	1.89	0.54
1:C:128:LYS:HD3	3:C:359:HOH:O	2.08	0.53
1:D:63:TYR:OH	2:D:202:SO4:O3	2.22	0.53
1:B:43:TYR:CE2	1:B:51:TYR:HB2	2.45	0.52
1:A:192:ASN:C	1:A:192:ASN:HD22	2.14	0.50
1:A:80:VAL:HG12	1:A:94:TRP:HB3	1.93	0.50
1:A:43:TYR:CE2	1:A:51:TYR:HB2	2.49	0.47
1:D:53:MET:SD	1:D:92:ILE:HD12	2.56	0.46
1:C:43:TYR:CE2	1:C:51:TYR:HB2	2.51	0.45
1:D:43:TYR:CE2	1:D:51:TYR:HB2	2.51	0.45
1:C:53:MET:SD	1:C:92:ILE:HD12	2.58	0.44
1:D:89:VAL:HA	1:D:106:VAL:O	2.19	0.43
1:A:129:LYS:HE2	1:A:144:TYR:CE1	2.54	0.42
1:B:80:VAL:HG23	1:B:82:ILE:HG13	2.01	0.42
1:D:80:VAL:HG12	1:D:94:TRP:HB3	2.00	0.42
1:B:159:PHE:CZ	1:C:83:VAL:HB	2.55	0.42
1:C:80:VAL:HG23	1:C:82:ILE:HG13	2.02	0.41
1:D:128:LYS:HA	1:D:128:LYS:HD3	1.88	0.41
1:A:92:ILE:HD12	1:A:92:ILE:N	2.34	0.41
1:B:192:ASN:HD22	1:B:192:ASN:C	2.24	0.41
1:C:128:LYS:HD2	1:C:128:LYS:N	2.35	0.41
1:A:159:PHE:CZ	1:D:83:VAL:HB	2.56	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:39:LYS:NZ	1:A:167:ASP:OD1	2.32	0.41
1:C:89:VAL:HA	1:C:106:VAL:O	2.21	0.40
1:A:192:ASN:C	1:A:192:ASN:ND2	2.73	0.40
1:B:92:ILE:HD12	1:B:92:ILE:N	2.37	0.40
1:C:80:VAL:HG12	1:C:94:TRP:HB3	2.01	0.40
1:D:191:ARG:HH21	1:D:191:ARG:HD3	1.74	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	167/192 (87%)	165 (99%)	2 (1%)	0	100	100
1	B	167/192 (87%)	164 (98%)	3 (2%)	0	100	100
1	C	167/192 (87%)	164 (98%)	3 (2%)	0	100	100
1	D	167/192 (87%)	165 (99%)	2 (1%)	0	100	100
All	All	668/768 (87%)	658 (98%)	10 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	145/165 (88%)	143 (99%)	2 (1%)	67	47
1	B	145/165 (88%)	141 (97%)	4 (3%)	43	18
1	C	145/165 (88%)	144 (99%)	1 (1%)	84	73
1	D	145/165 (88%)	144 (99%)	1 (1%)	84	73
All	All	580/660 (88%)	572 (99%)	8 (1%)	67	47

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	41	LEU
1	A	192	ASN
1	B	41	LEU
1	B	69	MET
1	B	191	ARG
1	B	192	ASN
1	C	41	LEU
1	D	41	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	192	ASN
1	B	192	ASN
1	C	121	GLN

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 [i](#)

5 ligands 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	SO4	D	201	-	4,4,4	0.31	0	6,6,6	0.17	0
2	SO4	D	202	-	4,4,4	0.47	0	6,6,6	0.27	0
2	SO4	B	202	-	4,4,4	0.47	0	6,6,6	0.47	0
2	SO4	B	201	-	4,4,4	0.36	0	6,6,6	0.29	0
2	SO4	C	201	-	4,4,4	0.49	0	6,6,6	0.19	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.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	D	202	SO4	1	0
2	B	202	SO4	1	0

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	A	169/192 (88%)	0.16	0 100 100	6, 10, 16, 21	0
1	B	169/192 (88%)	0.15	1 (0%) 89 89	6, 10, 15, 26	0
1	C	169/192 (88%)	0.24	1 (0%) 89 89	7, 10, 17, 23	0
1	D	169/192 (88%)	0.14	0 100 100	6, 9, 15, 20	0
All	All	676/768 (88%)	0.17	2 (0%) 94 93	6, 10, 16, 26	0

All (2) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	142	ARG	2.6
1	B	191	ARG	2.1

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(\AA^2)	Q<0.9
2	SO4	C	201	5/5	0.91	0.17	44,46,50,55	0
2	SO4	D	202	5/5	0.92	0.15	31,34,39,45	0
2	SO4	D	201	5/5	0.93	0.14	42,45,57,64	0
2	SO4	B	202	5/5	0.94	0.20	29,36,54,61	0
2	SO4	B	201	5/5	0.95	0.09	36,36,39,39	0

6.5 Other polymers [i](#)

There are no such residues in this entry.