



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 13, 2026 – 10:00 PM UTC

PDB ID : 6X44 / pdb_00006x44
Title : High Resolution Crystal Structure Analysis of SERA5 proenzyme from *Plasmodium falciparum*
Authors : Clarke, O.B.; Smith, N.A.; Lee, M.; Smith, B.J.
Deposited on : 2020-05-22
Resolution : 2.20 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	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

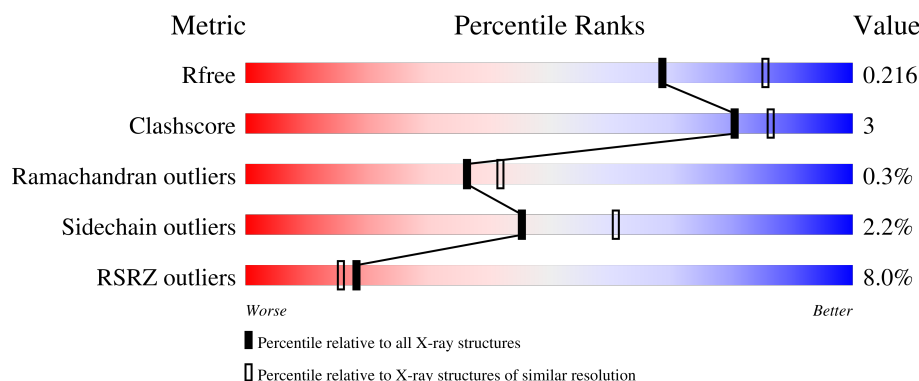
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.20 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}	180053	6164 (2.20-2.20)
Clashscore	190562	6851 (2.20-2.20)
Ramachandran outliers	187476	6768 (2.20-2.20)
Sidechain outliers	187428	6769 (2.20-2.20)
RSRZ outliers	180081	6166 (2.20-2.20)

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	438	6% 79% 8% 12%
1	B	438	8% 82% 7% 11%

2 Entry composition [i](#)

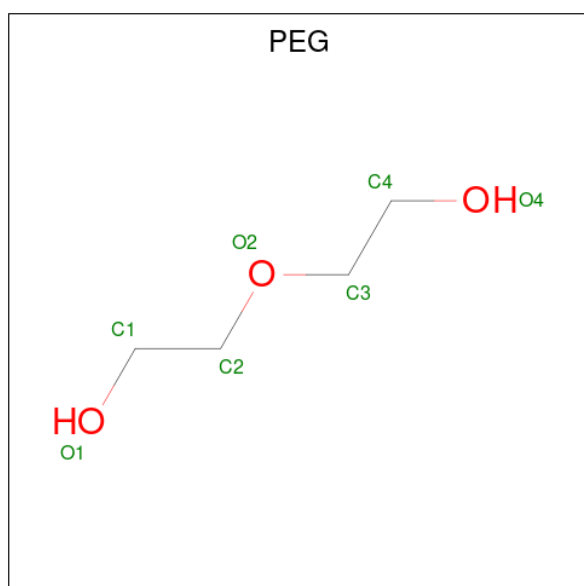
There are 3 unique types of molecules in this entry. The entry contains 12071 atoms, of which 5686 are hydrogens and 0 are deuteriums.

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 Serine repeat antigen 5.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	384	Total	C	H	N	O	S	0	4	0
			5906	1944	2837	502	597	26			
1	B	389	Total	C	H	N	O	S	0	3	0
			5918	1954	2839	504	596	25			

- Molecule 2 is DI(HYDROXYETHYL)ETHER (CCD ID: PEG) (formula: C₄H₁₀O₃).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	H	O	0	0
			17	4	10	3		

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	112	Total	O	0	0
			112	112		

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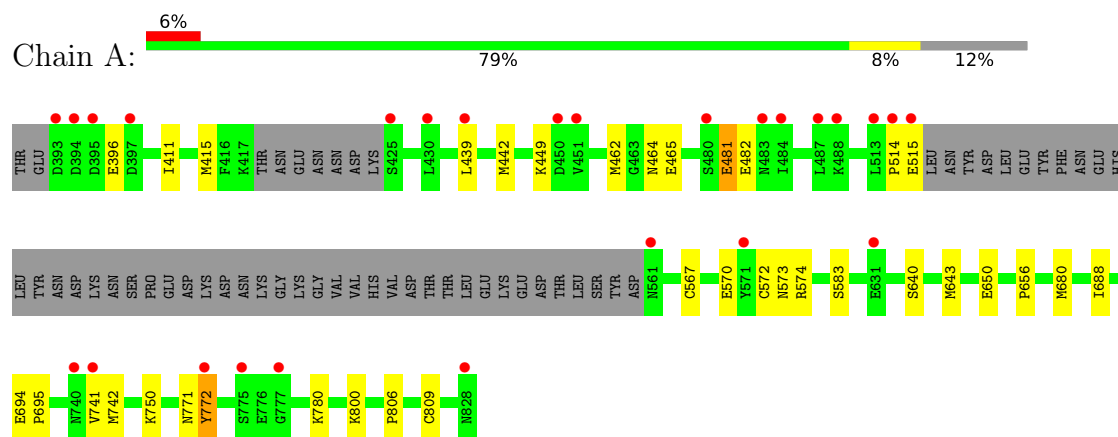
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	B	118	Total	O	0	0
			118	118		

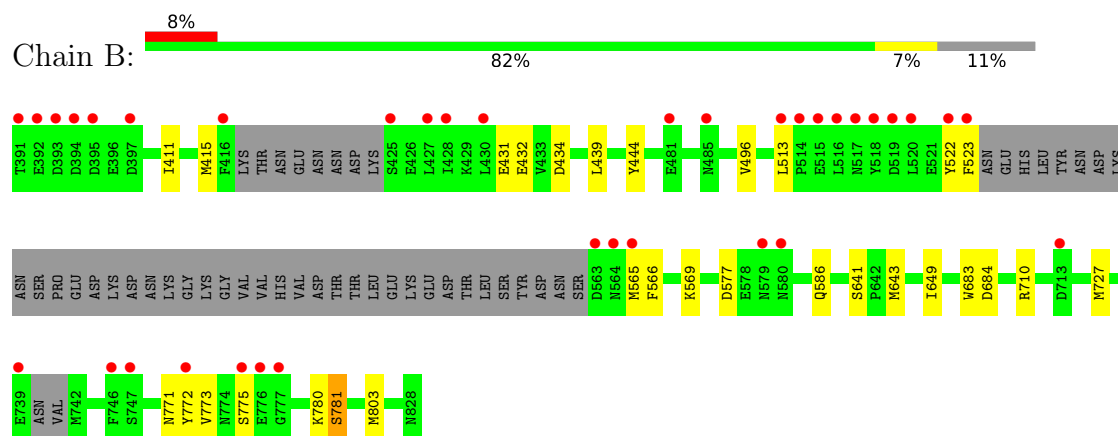
3 Residue-property plots [i](#)

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: Serine repeat antigen 5



• Molecule 1: Serine repeat antigen 5



4 Data and refinement statistics

Property	Value	Source
Space group	P 2 2 21	Depositor
Cell constants a, b, c, α , β , γ	77.67Å 78.94Å 178.71Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.55 – 2.20 47.55 – 2.20	Depositor EDS
% Data completeness (in resolution range)	99.1 (47.55-2.20) 99.0 (47.55-2.20)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.89 (at 2.20Å)	Xtriage
Refinement program	PHENIX 1.10.1_2155	Depositor
R, R_{free}	0.180 , 0.214 0.181 , 0.216	Depositor DCC
R_{free} test set	2850 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å ²)	34.6	Xtriage
Anisotropy	0.365	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.38 , 42.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.019 for k,h,-l	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	12071	wwPDB-VP
Average B, all atoms (Å ²)	46.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 15.06% 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

5.1 Standard geometry

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

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	0.52	0/3154	0.61	0/4270
1	B	0.49	0/3157	0.59	0/4272
All	All	0.50	0/6311	0.60	0/8542

There are no bond length outliers.

There are no bond angle outliers.

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	3069	2837	2822	19	0
1	B	3079	2839	2811	12	1
2	A	7	10	10	2	0
3	A	112	0	0	0	0
3	B	118	0	0	0	0
All	All	6385	5686	5643	31	1

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 (31) 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:573:ASN:HD21	2:A:901:PEG:H32	1.70	0.55
1:B:411:ILE:O	1:B:415:MET:HG2	2.08	0.52
1:B:641:SER:OG	1:B:643:MET:HE2	2.09	0.52
1:B:771:ASN:OD1	1:B:781:SER:HB3	2.10	0.52
1:A:411:ILE:O	1:A:415:MET:HG2	2.09	0.52
1:B:772:TYR:CE1	1:B:780:LYS:HB2	2.45	0.51
1:B:566:PHE:CE2	1:B:577:ASP:HB2	2.46	0.50
1:A:514:PRO:O	1:A:515:GLU:HB2	2.11	0.50
1:A:514:PRO:HG3	1:A:643:MET:HE2	1.97	0.47
1:A:449:LYS:HD2	1:A:462:MET:HE1	1.96	0.46
1:A:694:GLU:HB3	1:A:695:PRO:HD2	1.97	0.46
1:A:800:LYS:HE3	2:A:901:PEG:H42	1.99	0.44
1:A:567:CYS:HA	1:A:572:CYS:HA	2.00	0.44
1:A:741:VAL:HG12	1:A:742:MET:HG3	2.00	0.44
1:A:772:TYR:CE1	1:A:780:LYS:HB2	2.52	0.44
1:A:442:MET:HE2	1:A:464:ASN:HA	2.00	0.43
1:B:649:ILE:CG2	1:B:683:TRP:CE2	3.02	0.43
1:A:442:MET:HG2	1:A:465:GLU:HG3	2.00	0.43
1:A:656:PRO:HA	1:A:680[A]:MET:O	2.19	0.43
1:B:710:ARG:O	1:B:710:ARG:HG3	2.19	0.42
1:B:522:TYR:O	1:B:523:PHE:C	2.62	0.42
1:B:444:TYR:OH	1:B:496:VAL:HG21	2.18	0.42
1:B:513:LEU:HD12	1:B:513:LEU:H	1.85	0.42
1:A:574:ARG:O	1:A:583:SER:OG	2.37	0.42
1:A:462:MET:HE3	1:A:462:MET:HB2	1.91	0.41
1:A:806:PRO:HG2	1:A:809:CYS:SG	2.60	0.41
1:B:569:LYS:CD	1:B:727:MET:HE1	2.50	0.41
1:A:481:GLU:O	1:A:482:GLU:C	2.64	0.41
1:A:570:GLU:OE2	1:A:771:ASN:ND2	2.53	0.41
1:A:439:LEU:O	1:A:439:LEU:HD13	2.21	0.40
1:B:781:SER:HB2	1:B:803:MET:HE3	2.04	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:565:MET:O	1:B:565:MET:O[3_554]	2.15	0.05

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	382/438 (87%)	358 (94%)	23 (6%)	1 (0%)	36	42
1	B	384/438 (88%)	369 (96%)	14 (4%)	1 (0%)	36	42
All	All	766/876 (87%)	727 (95%)	37 (5%)	2 (0%)	36	42

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	432	GLU
1	A	640	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	329/400 (82%)	323 (98%)	6 (2%)	51	68
1	B	322/400 (80%)	314 (98%)	8 (2%)	42	56
All	All	651/800 (81%)	637 (98%)	14 (2%)	45	61

All (14) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	396	GLU
1	A	481	GLU
1	A	650	GLU
1	A	688	ILE

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Mol	Chain	Res	Type
1	A	750	LYS
1	A	772	TYR
1	B	431	GLU
1	B	434	ASP
1	B	439	LEU
1	B	586	GLN
1	B	684	ASP
1	B	773	VAL
1	B	775	SER
1	B	781	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	584	ASN
1	A	647	GLN
1	B	592	ASN
1	B	691	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

1 ligand is 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	PEG	A	901	-	6,6,6	0.52	0	5,5,5	0.65	0

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	PEG	A	901	-	-	0/4/4/4	-

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.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	901	PEG	2	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

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	384/438 (87%)	0.19	26 (6%)	23 20	21, 41, 76, 107	3 (0%)
1	B	389/438 (88%)	0.25	36 (9%)	14 12	19, 43, 84, 113	2 (0%)
All	All	773/876 (88%)	0.22	62 (8%)	18 16	19, 42, 80, 113	5 (0%)

All (62) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	523	PHE	8.4
1	B	391	THR	6.6
1	B	563	ASP	5.9
1	A	394	ASP	5.7
1	A	561	ASN	5.5
1	A	828	ASN	5.1
1	B	516	LEU	4.6
1	A	484	ILE	4.6
1	B	392	GLU	4.6
1	B	520	LEU	4.5
1	B	518	TYR	4.3
1	B	517	ASN	4.2
1	B	394	ASP	4.1
1	A	393	ASP	4.0
1	A	395	ASP	4.0
1	A	775	SER	3.8
1	B	522	TYR	3.7
1	A	397	ASP	3.6
1	B	481	GLU	3.6
1	B	746	PHE	3.3
1	B	514	PRO	3.0
1	B	513	LEU	3.0
1	B	515	GLU	3.0
1	B	777	GLY	3.0

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Mol	Chain	Res	Type	RSRZ
1	A	430	LEU	2.9
1	A	571	TYR	2.9
1	A	741	VAL	2.8
1	A	425	SER	2.8
1	B	416	PHE	2.8
1	A	450	ASP	2.8
1	B	519	ASP	2.7
1	B	772	TYR	2.6
1	A	483	ASN	2.6
1	B	739	GLU	2.5
1	B	564	ASN	2.5
1	B	775	SER	2.5
1	B	565	MET	2.5
1	B	425	SER	2.5
1	B	747	SER	2.5
1	B	580	ASN	2.5
1	B	393	ASP	2.4
1	B	713	ASP	2.4
1	A	439	LEU	2.4
1	A	487	LEU	2.4
1	B	579	ASN	2.4
1	A	451	VAL	2.4
1	B	776	GLU	2.3
1	A	515	GLU	2.3
1	B	395	ASP	2.3
1	B	485	ASN	2.3
1	A	488	LYS	2.3
1	B	397	ASP	2.3
1	A	740	ASN	2.2
1	A	772	TYR	2.2
1	A	480	SER	2.2
1	B	427	LEU	2.2
1	A	514	PRO	2.1
1	A	777	GLY	2.1
1	A	631	GLU	2.1
1	A	513	LEU	2.0
1	B	428	ILE	2.0
1	B	430	LEU	2.0

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

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

6.3 Carbohydrates [i](#)

There are no oligosaccharides 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($\text{\AA}^2$)	Q<0.9
2	PEG	A	901	7/7	0.83	0.17	52,69,104,104	0

6.5 Other polymers [i](#)

There are no such residues in this entry.