



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 9, 2018 – 07:35 am GMT

PDB ID : 3IBR
Title : Crystal Structure of P. aeruginosa Bacteriophytochrome Photosensory Core
Module Mutant Q188L in the Mixed Pr/Pfr State
Authors : Yang, X.; Kuk, J.; Moffat, K.
Deposited on : 2009-07-16
Resolution : 2.97 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 : 1.7.3 (157068), CSD as539be (2018)
Xtriage (Phenix) : 1.13
EDS : trunk30967
Percentile statistics : 20171227.v01 (using entries in the PDB archive December 27th 2017)
Refmac : 5.8.0158
CCP4 : 7.0 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : trunk30967

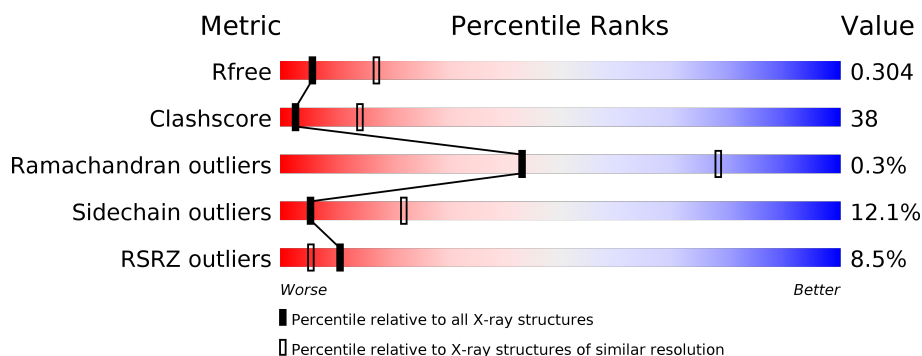
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.97 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}	111664	2374 (3.00-2.96)
Clashscore	122126	2712 (3.00-2.96)
Ramachandran outliers	120053	2626 (3.00-2.96)
Sidechain outliers	120020	2629 (3.00-2.96)
RSRZ outliers	108989	2268 (3.00-2.96)

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. 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	505	<div> <div>8%</div> <div>43%</div> <div>41%</div> <div>7%</div> <div>10%</div> </div>
1	B	505	<div> <div>7%</div> <div>39%</div> <div>45%</div> <div>6%</div> <div>10%</div> </div>

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 7530 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.

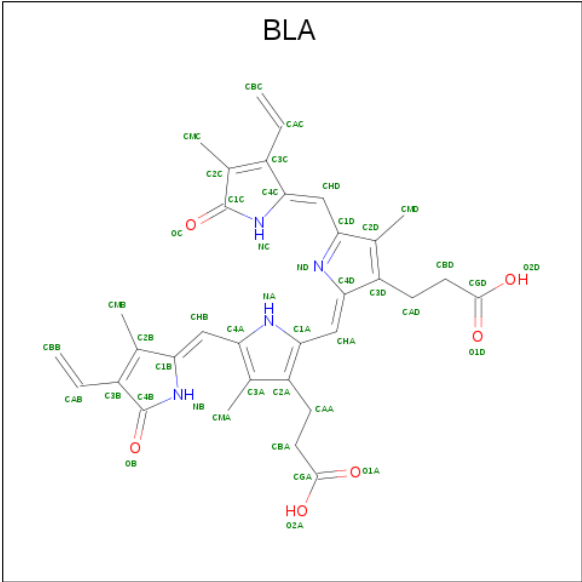
- Molecule 1 is a protein called Bacteriophytochrome.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	457	Total	C	N	O	S	Se	0	6	0
			3666	2313	653	680	9	11			
1	B	457	Total	C	N	O	S	Se	0	9	0
			3690	2326	658	686	9	11			

There are 18 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	188	LEU	GLN	ENGINEERED	UNP Q9HWR3
A	498	LEU	-	EXPRESSION TAG	UNP Q9HWR3
A	499	GLU	-	EXPRESSION TAG	UNP Q9HWR3
A	500	HIS	-	EXPRESSION TAG	UNP Q9HWR3
A	501	HIS	-	EXPRESSION TAG	UNP Q9HWR3
A	502	HIS	-	EXPRESSION TAG	UNP Q9HWR3
A	503	HIS	-	EXPRESSION TAG	UNP Q9HWR3
A	504	HIS	-	EXPRESSION TAG	UNP Q9HWR3
A	505	HIS	-	EXPRESSION TAG	UNP Q9HWR3
B	188	LEU	GLN	ENGINEERED	UNP Q9HWR3
B	498	LEU	-	EXPRESSION TAG	UNP Q9HWR3
B	499	GLU	-	EXPRESSION TAG	UNP Q9HWR3
B	500	HIS	-	EXPRESSION TAG	UNP Q9HWR3
B	501	HIS	-	EXPRESSION TAG	UNP Q9HWR3
B	502	HIS	-	EXPRESSION TAG	UNP Q9HWR3
B	503	HIS	-	EXPRESSION TAG	UNP Q9HWR3
B	504	HIS	-	EXPRESSION TAG	UNP Q9HWR3
B	505	HIS	-	EXPRESSION TAG	UNP Q9HWR3

- Molecule 2 is BILIVERDINE IX ALPHA (three-letter code: BLA) (formula: $C_{33}H_{34}N_4O_6$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	N	O	0	1
			86	66	8	12		
2	B	1	Total	C	N	O	0	1
			86	66	8	12		

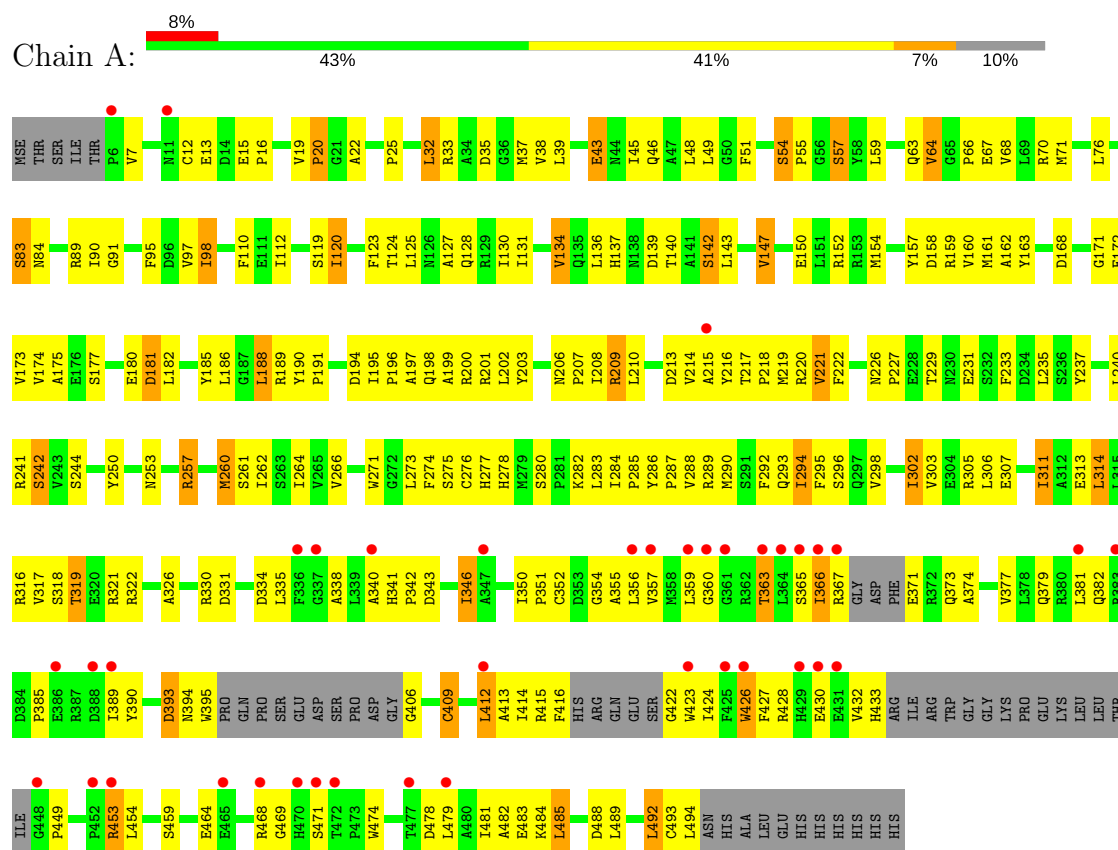
- Molecule 3 is water.

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

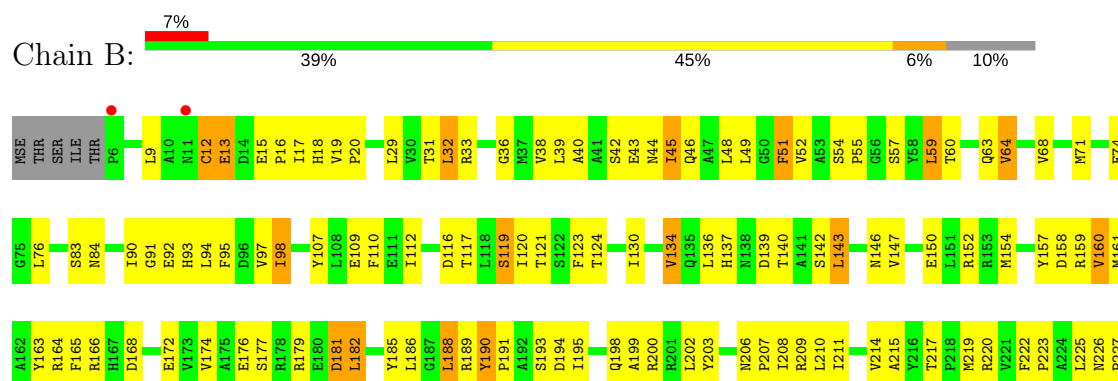
3 Residue-property plots

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of 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: Bacteriophytochrome



• Molecule 1: Bacteriophytochrome





4 Data and refinement statistics

Property	Value	Source
Space group	P 65	Depositor
Cell constants a, b, c, α , β , γ	108.90Å 108.90Å 188.90Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	37.74 – 2.97 35.65 – 2.61	Depositor EDS
% Data completeness (in resolution range)	84.7 (37.74-2.97) 54.6 (35.65-2.61)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.04 (at 2.61Å)	Xtriage
Refinement program	PHENIX (phenix.refine)	Depositor
R, R_{free}	0.233 , 0.307 0.234 , 0.304	Depositor DCC
R_{free} test set	1067 reflections (5.08%)	wwPDB-VP
Wilson B-factor (Å ²)	94.2	Xtriage
Anisotropy	0.013	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.28 , 66.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.430 for h,-h-k,-l	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	7530	wwPDB-VP
Average B, all atoms (Å ²)	136.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.10% 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: BLA

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	0.37	0/3735	0.61	0/5050
1	B	0.36	0/3760	0.60	0/5084
All	All	0.36	0/7495	0.61	0/10134

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 [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	3666	0	3592	264	0
1	B	3690	0	3605	285	0
2	A	86	0	62	32	0
2	B	86	0	62	35	0
3	A	1	0	0	1	0
3	B	1	0	0	0	0
All	All	7530	0	7321	563	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 38.

The worst 5 of 563 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:363:THR:HG21	1:A:371:GLU:HB2	1.27	1.16
1:A:194:ASP:HB3	2:A:900[A]:BLA:HHB	1.34	1.05
2:B:900[A]:BLA:HBC1	2:B:900[A]:BLA:HMC1	1.33	1.04
1:A:209[A]:ARG:HH11	1:A:209[A]:ARG:HG2	1.27	1.00
1:B:182:LEU:HD13	1:B:279:MSE:HE3	1.41	1.00

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	453/505 (90%)	409 (90%)	42 (9%)	2 (0%)	36	74
1	B	456/505 (90%)	403 (88%)	52 (11%)	1 (0%)	49	83
All	All	909/1010 (90%)	812 (89%)	94 (10%)	3 (0%)	43	78

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	456	PRO
1	A	342	PRO
1	A	20	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	394/419 (94%)	344 (87%)	50 (13%)	5	20
1	B	397/419 (95%)	350 (88%)	47 (12%)	6	23
All	All	791/838 (94%)	694 (88%)	97 (12%)	5	21

5 of 97 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	409	CYS
1	B	45	ILE
1	B	412	LEU
1	A	426	TRP
1	A	492	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 8 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	373	GLN
1	B	373	GLN
1	B	206	ASN
1	A	206	ASN
1	B	135	GLN

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 ⓘ

4 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	BLA	A	900[A]	-	36,46,46	3.10	15 (41%)	47,67,67	1.98	9 (19%)
2	BLA	A	900[B]	-	36,46,46	3.12	17 (47%)	47,67,67	2.09	12 (25%)
2	BLA	B	900[A]	-	36,46,46	2.99	16 (44%)	47,67,67	2.00	8 (17%)
2	BLA	B	900[B]	-	36,46,46	3.17	15 (41%)	47,67,67	2.05	13 (27%)

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	BLA	A	900[A]	-	-	0/17/74/74	0/4/4/4
2	BLA	A	900[B]	-	-	0/17/74/74	0/4/4/4
2	BLA	B	900[A]	-	-	0/17/74/74	0/4/4/4
2	BLA	B	900[B]	-	-	0/17/74/74	0/4/4/4

The worst 5 of 63 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	900[B]	BLA	C4D-C3D	-3.99	1.39	1.45
2	B	900[B]	BLA	C4D-C3D	-3.88	1.39	1.45
2	A	900[A]	BLA	C4D-C3D	-3.83	1.39	1.45
2	B	900[B]	BLA	C1B-C2B	-3.68	1.38	1.45
2	A	900[B]	BLA	C1B-C2B	-3.65	1.38	1.45

The worst 5 of 42 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	900[A]	BLA	C1A-CHA-C4D	-7.93	119.34	128.81
2	B	900[A]	BLA	C1A-CHA-C4D	-7.91	119.36	128.81
2	A	900[B]	BLA	C4C-CHD-C1D	-7.60	109.39	128.09
2	B	900[A]	BLA	C4C-CHD-C1D	-6.31	112.58	128.09
2	A	900[A]	BLA	C4C-CHD-C1D	-5.97	113.41	128.09

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

4 monomers are involved in 67 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	900[A]	BLA	16	0
2	A	900[B]	BLA	16	0
2	B	900[A]	BLA	15	0
2	B	900[B]	BLA	20	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	446/505 (88%)	0.23	39 (8%) 10 5	60, 115, 249, 498	0
1	B	446/505 (88%)	0.19	37 (8%) 11 5	52, 113, 268, 462	0
All	All	892/1010 (88%)	0.21	76 (8%) 11 5	52, 114, 258, 498	0

The worst 5 of 76 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	363	THR	22.8
1	A	430	GLU	18.7
1	A	471	SER	14.2
1	B	389	ILE	13.5
1	A	360	GLY	11.6

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
2	BLA	A	900[B]	43/43	0.90	0.32	69,122,152,156	43
2	BLA	A	900[A]	43/43	0.90	0.32	104,133,154,159	43
2	BLA	B	900[A]	43/43	0.92	0.27	85,111,135,158	43
2	BLA	B	900[B]	43/43	0.92	0.27	63,100,136,157	43

6.5 Other polymers [i](#)

There are no such residues in this entry.