



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 04:18 AM UTC

PDB ID : 3PRU / pdb_00003pru
Title : Crystal Structure of Phycobilisome 32.1 kDa linker polypeptide, phycocyanin-associated, rod 1 (fragment 14-158) from *Synechocystis* sp. PCC 6803, Northeast Structural Genomics Consortium Target SgR182A
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Deposited on : 2010-11-30
Resolution : 2.68 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)

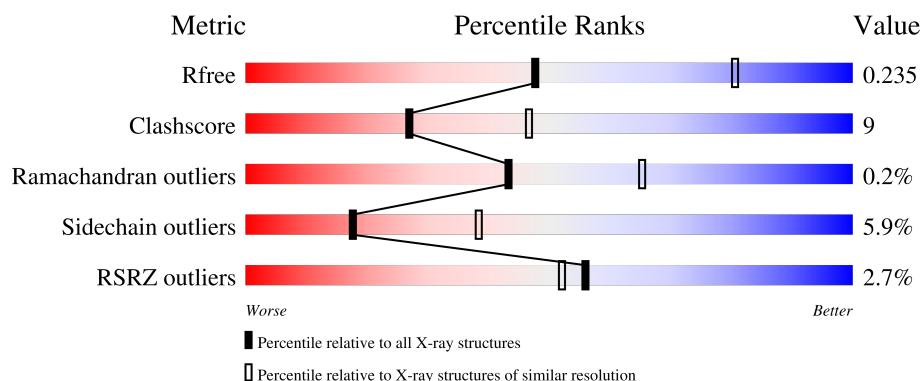
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.68 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	5070 (2.70-2.66)
Clashscore	190562	5409 (2.70-2.66)
Ramachandran outliers	187476	5324 (2.70-2.66)
Sidechain outliers	187428	5324 (2.70-2.66)
RSRZ outliers	180081	5070 (2.70-2.66)

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	154	4% 68% 20% • 8%
1	B	154	3% 75% 17% • 6%
1	C	154	2% 72% 15% • 11%
1	D	154	% 73% 14% • 12%

Validation Pipeline (wwPDB-VP) : 2.49

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 4729 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 Phycobilisome 32.1 kDa linker polypeptide, phycocyanin-associated, rod 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	C	137	Total	C	N	O	Se	0	0	0
			1142	729	192	219	2			
1	A	142	Total	C	N	O	Se	0	0	0
			1186	755	199	230	2			
1	B	144	Total	C	N	O	Se	0	0	0
			1205	768	208	227	2			
1	D	135	Total	C	N	O	Se	0	0	0
			1126	721	188	215	2			

There are 36 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	13	MSE	-	initiating methionine	UNP P73203
C	159	LEU	-	expression tag	UNP P73203
C	160	GLU	-	expression tag	UNP P73203
C	161	HIS	-	expression tag	UNP P73203
C	162	HIS	-	expression tag	UNP P73203
C	163	HIS	-	expression tag	UNP P73203
C	164	HIS	-	expression tag	UNP P73203
C	165	HIS	-	expression tag	UNP P73203
C	166	HIS	-	expression tag	UNP P73203
A	13	MSE	-	initiating methionine	UNP P73203
A	159	LEU	-	expression tag	UNP P73203
A	160	GLU	-	expression tag	UNP P73203
A	161	HIS	-	expression tag	UNP P73203
A	162	HIS	-	expression tag	UNP P73203
A	163	HIS	-	expression tag	UNP P73203
A	164	HIS	-	expression tag	UNP P73203
A	165	HIS	-	expression tag	UNP P73203
A	166	HIS	-	expression tag	UNP P73203
B	13	MSE	-	initiating methionine	UNP P73203
B	159	LEU	-	expression tag	UNP P73203

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Chain	Residue	Modelled	Actual	Comment	Reference
B	160	GLU	-	expression tag	UNP P73203
B	161	HIS	-	expression tag	UNP P73203
B	162	HIS	-	expression tag	UNP P73203
B	163	HIS	-	expression tag	UNP P73203
B	164	HIS	-	expression tag	UNP P73203
B	165	HIS	-	expression tag	UNP P73203
B	166	HIS	-	expression tag	UNP P73203
D	13	MSE	-	initiating methionine	UNP P73203
D	159	LEU	-	expression tag	UNP P73203
D	160	GLU	-	expression tag	UNP P73203
D	161	HIS	-	expression tag	UNP P73203
D	162	HIS	-	expression tag	UNP P73203
D	163	HIS	-	expression tag	UNP P73203
D	164	HIS	-	expression tag	UNP P73203
D	165	HIS	-	expression tag	UNP P73203
D	166	HIS	-	expression tag	UNP P73203

- Molecule 2 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	C	1	Total Cl 1 1	0	0

- Molecule 3 is SODIUM ION (CCD ID: NA) (formula: Na).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total Na 1 1	0	0

- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	C	19	Total O 19 19	0	0
4	A	11	Total O 11 11	0	0
4	B	30	Total O 30 30	0	0
4	D	8	Total O 8 8	0	0

- Molecule 1: Phycobilisome 32.1 kDa linker polypeptide, phycocyanin-associated, rod 1



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	74.35Å 91.53Å 124.67Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.77 – 2.68 47.77 – 2.68	Depositor EDS
% Data completeness (in resolution range)	98.2 (47.77-2.68) 98.2 (47.77-2.68)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	5.82 (at 2.69Å)	Xtriage
Refinement program	PHENIX 1.6.4 _486	Depositor
R, R_{free}	0.193 , 0.241 0.191 , 0.235	Depositor DCC
R_{free} test set	1236 reflections (5.10%)	wwPDB-VP
Wilson B-factor (Å ²)	45.6	Xtriage
Anisotropy	0.790	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 52.1	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	0.95	EDS
Total number of atoms	4729	wwPDB-VP
Average B, all atoms (Å ²)	52.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.82% 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: CL, NA

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	0.50	0/1209	0.90	0/1629
1	B	0.54	0/1231	0.85	0/1657
1	C	0.51	0/1164	0.84	0/1568
1	D	0.50	0/1148	0.81	0/1546
All	All	0.51	0/4752	0.85	0/6400

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	1186	0	1137	27	0
1	B	1205	0	1151	25	0
1	C	1142	0	1103	25	0
1	D	1126	0	1091	14	0
2	C	1	0	0	0	0
3	A	1	0	0	0	0
4	A	11	0	0	0	0
4	B	30	0	0	1	0
4	C	19	0	0	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	D	8	0	0	0	0
All	All	4729	0	4482	84	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 9.

All (84) 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:B:24:ARG:HD3	1:B:24:ARG:H	1.26	0.98
1:A:19:ARG:HB3	1:A:20:PRO:HA	1.55	0.86
1:A:37:ARG:HH22	1:B:19:ARG:HH22	1.26	0.81
1:A:15:TYR:CE1	1:B:37:ARG:HG2	2.18	0.78
1:A:15:TYR:C	1:A:17:GLU:H	1.92	0.76
1:A:33:LYS:O	1:A:37:ARG:HG3	1.89	0.73
1:A:19:ARG:HB3	1:A:20:PRO:CA	2.20	0.70
1:D:74:ARG:NH2	1:D:135:ASP:OD1	2.25	0.69
1:B:24:ARG:H	1:B:24:ARG:CD	1.95	0.69
1:C:49:ILE:HD13	1:C:49:ILE:H	1.59	0.67
1:C:19:ARG:CZ	1:C:19:ARG:HB2	2.26	0.65
1:A:118:LEU:O	1:A:122:GLU:HG2	1.98	0.64
1:D:55:LEU:HD12	1:D:76:VAL:HG22	1.79	0.64
1:A:15:TYR:C	1:A:17:GLU:N	2.55	0.64
1:A:154:ASN:C	1:A:154:ASN:HD22	2.06	0.63
1:C:29:LEU:HD23	1:C:29:LEU:O	1.99	0.63
1:C:54:ARG:NH1	4:C:177:HOH:O	2.32	0.62
1:A:81:LEU:O	1:A:85:LYS:HG3	1.99	0.62
1:C:118:LEU:O	1:C:122:GLU:HG2	2.01	0.61
1:C:29:LEU:HD21	1:C:33:LYS:HE3	1.83	0.60
1:D:84:LYS:HA	1:D:88:TYR:CD2	2.37	0.59
1:B:70:ARG:HG3	1:B:139:TYR:CE1	2.38	0.59
1:B:24:ARG:HD3	1:B:24:ARG:N	2.08	0.58
1:C:42:GLN:HG2	1:C:149:PRO:O	2.03	0.57
1:A:55:LEU:O	1:A:59:GLU:HG3	2.05	0.57
1:B:163:HIS:CD2	1:B:165:HIS:HB3	2.41	0.56
1:C:29:LEU:CD2	1:C:33:LYS:HE3	2.37	0.55
1:C:152:ARG:HH21	1:C:155:ASN:HB3	1.71	0.55
1:B:49:ILE:HG22	1:B:54:ARG:HG3	1.90	0.54
1:D:24:ARG:HB3	1:D:25:PRO:HD2	1.88	0.54
1:D:19:ARG:N	1:D:20:PRO:CD	2.71	0.53
1:A:37:ARG:NH2	1:B:19:ARG:HH22	2.00	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:116:PHE:C	1:A:116:PHE:CD1	2.87	0.52
1:A:15:TYR:CD1	1:A:15:TYR:N	2.76	0.52
1:B:84:LYS:HA	1:B:88:TYR:CD2	2.45	0.52
1:D:41:ARG:HD3	1:D:47:ASP:OD2	2.10	0.51
1:C:49:ILE:H	1:C:49:ILE:CD1	2.24	0.51
1:A:17:GLU:HA	1:A:17:GLU:OE2	2.11	0.50
1:B:41:ARG:HH11	1:B:41:ARG:HB2	1.77	0.50
1:C:49:ILE:HG22	1:C:85:LYS:NZ	2.28	0.49
1:B:96:ILE:HD13	1:B:117:HIS:HB2	1.95	0.49
1:B:92:GLN:OE1	1:B:92:GLN:HA	2.12	0.49
1:C:74:ARG:NH2	1:C:135:ASP:OD1	2.46	0.48
1:A:16:ASN:HD22	1:B:33:LYS:HG2	1.79	0.48
1:C:81:LEU:O	1:C:85:LYS:HG3	2.15	0.47
1:A:72:PHE:O	1:A:76:VAL:HG23	2.15	0.46
1:C:53:GLU:HB3	1:C:81:LEU:HD11	1.95	0.46
1:B:117:HIS:CE1	1:B:164:HIS:HE2	2.33	0.46
1:A:69:VAL:O	1:A:73:VAL:HG23	2.15	0.46
1:D:41:ARG:HB2	1:D:41:ARG:HH11	1.81	0.46
1:A:50:MSE:H	1:A:50:MSE:HG2	1.43	0.45
1:D:19:ARG:HG2	1:D:20:PRO:HD3	1.99	0.45
1:A:15:TYR:CD1	1:B:37:ARG:HG2	2.51	0.45
1:C:139:TYR:C	1:C:139:TYR:CD1	2.95	0.45
1:B:78:LYS:O	1:B:83:LYS:HE3	2.17	0.45
1:A:19:ARG:HB2	1:B:48:TYR:CD1	2.51	0.44
1:C:21:VAL:HG13	1:C:34:MSE:HE3	2.00	0.44
1:B:54:ARG:NH2	1:B:59:GLU:OE1	2.50	0.44
1:C:33:LYS:O	1:C:37:ARG:HG3	2.18	0.44
1:B:109:PHE:HD2	1:B:162:HIS:HB3	1.82	0.44
1:D:55:LEU:CD1	1:D:76:VAL:HG22	2.47	0.44
1:A:92:GLN:OE1	1:A:92:GLN:HA	2.19	0.43
1:C:42:GLN:NE2	1:C:42:GLN:HA	2.34	0.43
1:B:24:ARG:CD	1:B:24:ARG:N	2.69	0.43
1:C:34:MSE:HA	1:C:37:ARG:NH1	2.33	0.43
1:D:37:ARG:HB2	1:D:37:ARG:NH1	2.33	0.43
1:C:39:VAL:HG22	1:C:148:VAL:HG13	2.00	0.43
1:C:152:ARG:HH11	1:C:152:ARG:HG3	1.84	0.43
1:B:163:HIS:HD2	1:B:165:HIS:HB3	1.84	0.42
1:B:65:GLY:HA2	4:B:173:HOH:O	2.18	0.42
1:D:150:TYR:C	1:D:150:TYR:CD2	2.97	0.42
1:A:29:LEU:HD21	1:A:33:LYS:NZ	2.35	0.42
1:A:29:LEU:HD12	1:A:63:THR:HG21	2.01	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:129:ASP:O	1:A:130:ILE:C	2.63	0.42
1:D:152:ARG:O	1:D:153:PHE:C	2.63	0.42
1:A:79:SER:O	1:A:83:LYS:HG3	2.20	0.41
1:D:71:GLU:OE2	1:D:74:ARG:HD2	2.21	0.41
1:C:24:ARG:H	1:C:24:ARG:HG2	1.65	0.41
1:B:139:TYR:C	1:B:139:TYR:CD1	2.99	0.41
1:C:25:PRO:O	1:C:26:ASP:HB2	2.20	0.41
1:A:151:TYR:CD2	1:B:85:LYS:HE3	2.56	0.40
1:D:139:TYR:CD1	1:D:139:TYR:C	2.99	0.40
1:C:29:LEU:HD23	1:C:29:LEU:C	2.45	0.40
1:C:49:ILE:HG22	1:C:85:LYS:HZ1	1.87	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	140/154 (91%)	134 (96%)	5 (4%)	1 (1%)	18	37
1	B	140/154 (91%)	137 (98%)	3 (2%)	0	100	100
1	C	135/154 (88%)	134 (99%)	1 (1%)	0	100	100
1	D	133/154 (86%)	125 (94%)	8 (6%)	0	100	100
All	All	548/616 (89%)	530 (97%)	17 (3%)	1 (0%)	43	65

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	19	ARG

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	130/138 (94%)	116 (89%)	14 (11%)	6	14
1	B	131/138 (95%)	124 (95%)	7 (5%)	20	43
1	C	125/138 (91%)	121 (97%)	4 (3%)	34	61
1	D	123/138 (89%)	118 (96%)	5 (4%)	27	52
All	All	509/552 (92%)	479 (94%)	30 (6%)	18	38

All (30) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	49	ILE
1	C	93	THR
1	C	118	LEU
1	C	155	ASN
1	A	15	TYR
1	A	47	ASP
1	A	50	MSE
1	A	60	SER
1	A	83	LYS
1	A	91	PHE
1	A	93	THR
1	A	115	ILE
1	A	118	LEU
1	A	119	ASP
1	A	132	SER
1	A	141	GLU
1	A	152	ARG
1	A	154	ASN
1	B	24	ARG
1	B	41	ARG
1	B	66	SER
1	B	81	LEU
1	B	93	THR
1	B	160	GLU

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Mol	Chain	Res	Type
1	B	165	HIS
1	D	29	LEU
1	D	35	VAL
1	D	41	ARG
1	D	60	SER
1	D	81	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (20) such sidechains are listed below:

Mol	Chain	Res	Type
1	C	42	GLN
1	C	46	ASN
1	C	64	ASN
1	C	155	ASN
1	A	16	ASN
1	A	42	GLN
1	A	102	HIS
1	A	117	HIS
1	A	123	ASN
1	A	146	ASN
1	A	154	ASN
1	B	42	GLN
1	B	89	ASN
1	B	123	ASN
1	B	162	HIS
1	B	163	HIS
1	B	165	HIS
1	D	42	GLN
1	D	102	HIS
1	D	124	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 [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 2 ligands modelled in this entry, 2 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 [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	140/154 (90%)	-0.17	6 (4%) 40 35	32, 48, 83, 108	0
1	B	142/154 (92%)	-0.30	5 (3%) 47 42	28, 45, 77, 109	0
1	C	135/154 (87%)	-0.35	3 (2%) 62 59	31, 44, 74, 107	0
1	D	133/154 (86%)	-0.22	1 (0%) 82 81	36, 54, 81, 107	0
All	All	550/616 (89%)	-0.26	15 (2%) 56 52	28, 48, 79, 109	0

All (15) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	48	TYR	5.1
1	D	153	PHE	4.8
1	A	48	TYR	4.8
1	A	15	TYR	3.6
1	A	16	ASN	3.3
1	B	158	GLY	3.2
1	B	165	HIS	3.1
1	C	155	ASN	2.9
1	B	159	LEU	2.8
1	A	156	GLN	2.7
1	B	153	PHE	2.5
1	A	18	SER	2.4
1	A	19	ARG	2.2
1	C	46	ASN	2.1
1	B	161	HIS	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 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	CL	C	1	1/1	0.98	0.05	40,40,40,40	0
3	NA	A	1	1/1	0.98	0.08	57,57,57,57	0

6.5 Other polymers [i](#)

There are no such residues in this entry.