



Full wwPDB X-ray Structure Validation Report ⓘ

Oct 27, 2022 – 10:34 am BST

PDB ID : 7NE5
Title : catalytically non active S532A mutant of oligopeptidase B from *S. proteomaculans* with modified hinge region
Authors : Petrenko, D.E.; Nikolaeva, A.Y.; Lazarenko, V.A.; Dorovatovskiy, P.V.; Vlaskina, A.V.; Mikhailova, A.G.; Rakitina, T.V.; Timofeev, V.I.
Deposited on : 2021-02-03
Resolution : 1.88 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 : 2.31.2
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0267
CCP4 : 7.1.010 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.31.2

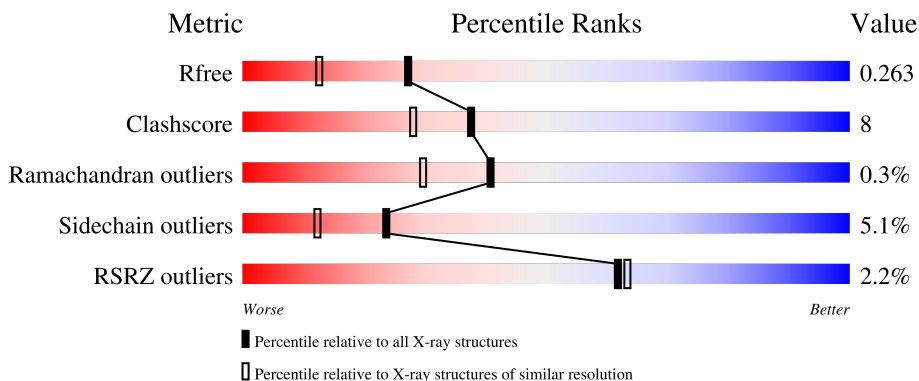
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.88 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	9470 (1.90-1.86)
Clashscore	141614	10282 (1.90-1.86)
Ramachandran outliers	138981	10152 (1.90-1.86)
Sidechain outliers	138945	10152 (1.90-1.86)
RSRZ outliers	127900	9303 (1.90-1.86)

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	676	

2 Entry composition i

There are 3 unique types of molecules in this entry. The entry contains 5991 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.

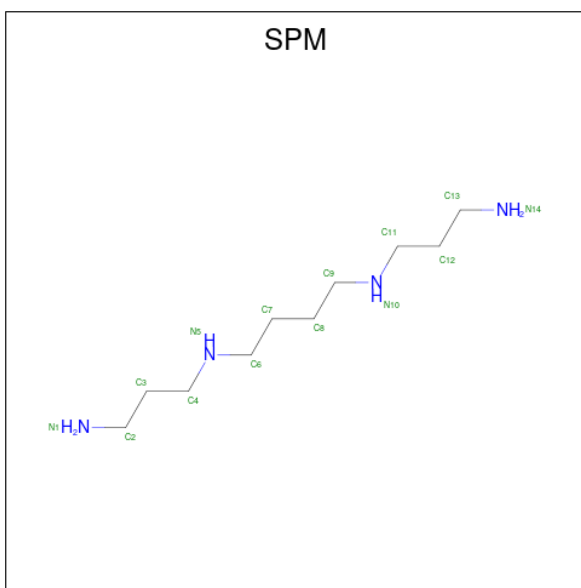
- Molecule 1 is a protein called Oligopeptidase B.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	676	5577	3540	937	1087	13	0	5	0

There are 7 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	71	GLU	ILE	engineered mutation	UNP B3VI58
A	72	ASN	PRO	engineered mutation	UNP B3VI58
A	73	LEU	GLN	engineered mutation	UNP B3VI58
A	74	TYR	GLN	engineered mutation	UNP B3VI58
A	75	PHE	GLU	engineered mutation	UNP B3VI58
A	76	GLN	HIS	engineered mutation	UNP B3VI58
A	532	ALA	SER	engineered mutation	UNP B3VI58

- Molecule 2 is SPERMINE (three-letter code: SPM) (formula: $C_{10}H_{26}N_4$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	C	N	0	0
			14	10	4		
2	A	1	Total	C	N	0	0
			14	10	4		

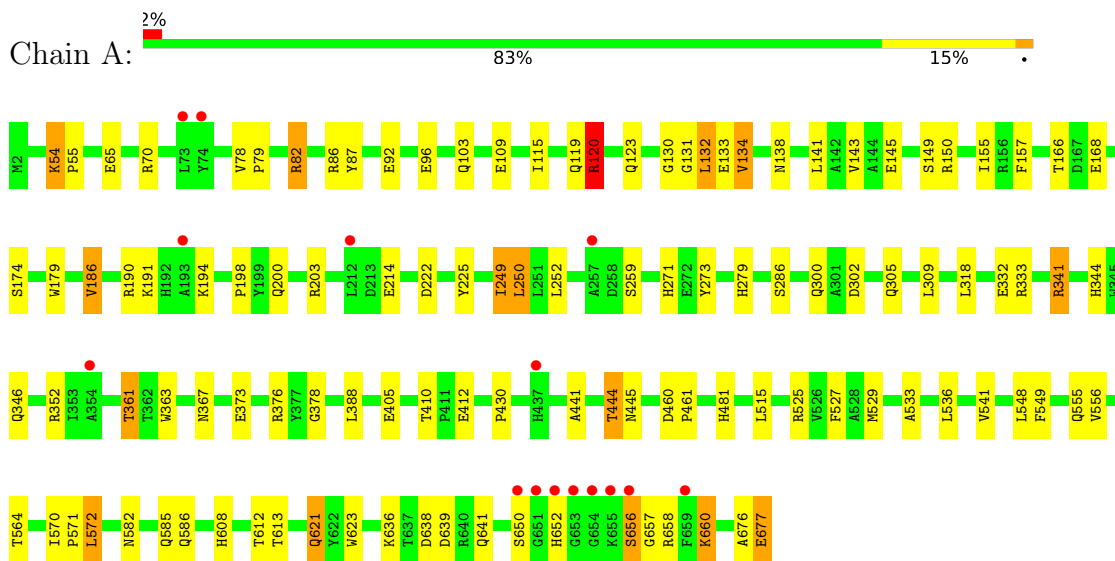
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	386	Total	O	0	0
			386	386		

3 Residue-property plots

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: Oligopeptidase B



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	70.71Å 100.40Å 108.67Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.79 – 1.88 47.79 – 1.88	Depositor EDS
% Data completeness (in resolution range)	99.8 (47.79-1.88) 99.8 (47.79-1.88)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.85 (at 1.88Å)	Xtriage
Refinement program	REFMAC 5.8.0267	Depositor
R, R_{free}	0.207 , 0.252 0.214 , 0.263	Depositor DCC
R_{free} test set	3138 reflections (4.96%)	wwPDB-VP
Wilson B-factor (Å ²)	25.3	Xtriage
Anisotropy	0.109	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	(Not available) , (Not available)	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	5991	wwPDB-VP
Average B, all atoms (Å ²)	31.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.41% 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: SPM

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	0.75	0/5722	0.91	5/7778 (0.1%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	1

There are no bond length outliers.

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
1	A	341	ARG	NE-CZ-NH1	8.97	124.78	120.30
1	A	341	ARG	NE-CZ-NH2	-8.89	115.85	120.30
1	A	333	ARG	NE-CZ-NH2	-6.04	117.28	120.30
1	A	120	ARG	NE-CZ-NH2	-5.57	117.52	120.30
1	A	82	ARG	NE-CZ-NH1	5.47	123.04	120.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	656	SER	Peptide

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	5577	0	5278	80	0
2	A	28	0	52	4	0
3	A	386	0	0	15	0
All	All	5991	0	5330	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 8.

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:A:132:LEU:CD2	1:A:141:LEU:HD11	1.77	1.15
1:A:367:ASN:HD21	1:A:376:ARG:H	1.15	0.95
1:A:332:GLU:OE1	1:A:341:ARG:HD3	1.70	0.92
1:A:132:LEU:HD21	1:A:141:LEU:HD11	1.57	0.87
1:A:130:GLY:C	3:A:810:HOH:O	2.14	0.85
1:A:78:VAL:HG23	3:A:853:HOH:O	1.78	0.83
1:A:96:GLU:OE1	1:A:652:HIS:CE1	2.42	0.73
1:A:677:GLU:OE2	1:A:677:GLU:C	2.27	0.73
1:A:441:ALA:H	1:A:445:ASN:HD21	1.37	0.72
1:A:82:ARG:NH2	3:A:802:HOH:O	2.22	0.72
1:A:361:THR:HG21	1:A:460:ASP:HB3	1.71	0.71
1:A:96:GLU:HG2	1:A:656:SER:HB2	1.73	0.69
1:A:87:TYR:OH	1:A:134:VAL:HG11	1.93	0.68
1:A:621:GLN:HG3	1:A:623:TRP:CH2	2.28	0.68
1:A:132:LEU:HD22	1:A:141:LEU:HD11	1.73	0.68
1:A:571:PRO:O	1:A:572:LEU:HB2	1.93	0.67
1:A:361:THR:CG2	1:A:461:PRO:O	2.43	0.67
1:A:441:ALA:O	1:A:444:THR:HB	1.94	0.66
1:A:86:ARG:HH11	1:A:103:GLN:HE21	1.43	0.65
1:A:203:ARG:NH2	1:A:259:SER:O	2.30	0.65
1:A:271:HIS:HE1	1:A:286:SER:OG	1.82	0.63
1:A:639:ASP:N	1:A:639:ASP:OD1	2.31	0.62
1:A:279:HIS:HE1	3:A:844:HOH:O	1.82	0.62
2:A:702:SPM:H91	3:A:979:HOH:O	1.99	0.62

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:70:ARG:NH1	3:A:803:HOH:O	2.33	0.61
1:A:332:GLU:OE1	1:A:341:ARG:CD	2.49	0.59
1:A:344:HIS:HD2	1:A:346:GLN:H	1.50	0.58
1:A:361:THR:CG2	1:A:460:ASP:HB3	2.36	0.56
1:A:361:THR:HG22	1:A:461:PRO:O	2.06	0.56
1:A:174:SER:HA	1:A:191:LYS:HE3	1.88	0.56
1:A:115:ILE:HD11	1:A:120:ARG:HD2	1.88	0.54
1:A:133:GLU:OE1	3:A:801:HOH:O	2.19	0.54
1:A:636:LYS:NZ	1:A:638:ASP:OD2	2.40	0.53
1:A:109:GLU:HB2	3:A:1155:HOH:O	2.09	0.52
1:A:344:HIS:CD2	1:A:346:GLN:H	2.26	0.51
1:A:302[B]:ASP:OD1	1:A:302[B]:ASP:N	2.44	0.50
1:A:157:PHE:HB2	1:A:166:THR:HG22	1.92	0.50
1:A:652:HIS:HB3	1:A:657:GLY:HA3	1.93	0.50
1:A:300:GLN:OE1	1:A:305:GLN:HG2	2.12	0.50
1:A:271:HIS:HD2	3:A:893:HOH:O	1.94	0.49
1:A:361:THR:HG23	1:A:461:PRO:O	2.10	0.49
1:A:65:GLU:HG3	3:A:1166:HOH:O	2.12	0.49
1:A:249:ILE:HG13	1:A:273:TYR:CE1	2.48	0.48
1:A:279:HIS:HD2	3:A:919:HOH:O	1.95	0.48
1:A:250:LEU:CD1	1:A:250:LEU:N	2.77	0.48
1:A:541[A]:VAL:CG1	1:A:549:PHE:CE2	2.97	0.47
1:A:120:ARG:CD	1:A:145:GLU:OE1	2.62	0.47
1:A:367:ASN:ND2	1:A:376:ARG:H	1.98	0.47
1:A:157:PHE:HB2	1:A:166:THR:CG2	2.45	0.46
1:A:582:ASN:HB3	1:A:585:GLN:HE22	1.79	0.46
1:A:143:VAL:O	1:A:155:ILE:HA	2.14	0.46
2:A:702:SPM:C9	3:A:979:HOH:O	2.59	0.46
1:A:410:THR:HG22	1:A:412:GLU:CD	2.35	0.46
1:A:78:VAL:HG21	1:A:388:LEU:CD2	2.46	0.46
1:A:361:THR:HG21	1:A:460:ASP:CB	2.44	0.46
1:A:529:MET:CE	1:A:555:GLN:NE2	2.80	0.45
1:A:621:GLN:HG3	1:A:623:TRP:CZ2	2.50	0.45
1:A:564:THR:HA	1:A:570:ILE:HD12	1.97	0.45
2:A:701:SPM:H131	3:A:924:HOH:O	2.16	0.45
1:A:363:TRP:CE2	1:A:378:GLY:HA3	2.51	0.45
1:A:78:VAL:HG21	1:A:388:LEU:HD22	1.97	0.45
1:A:525:ARG:NH1	1:A:676:ALA:O	2.50	0.45
1:A:608:HIS:ND1	1:A:641:GLN:HG2	2.32	0.44
1:A:79:PRO:HA	1:A:87:TYR:O	2.16	0.44
1:A:132:LEU:HD23	1:A:141:LEU:HD11	1.83	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:190:ARG:HB3	1:A:200:GLN:HB2	1.99	0.43
1:A:660:LYS:HA	1:A:660:LYS:CE	2.48	0.43
1:A:120:ARG:HD3	1:A:145:GLU:OE1	2.19	0.43
1:A:166:THR:CG2	1:A:168:GLU:OE2	2.67	0.43
1:A:166:THR:HG23	1:A:168:GLU:OE2	2.19	0.42
2:A:701:SPM:C13	3:A:924:HOH:O	2.67	0.42
1:A:430:PRO:HG2	1:A:481:HIS:HB2	2.00	0.42
1:A:198:PRO:HG3	1:A:225:TYR:CE1	2.55	0.42
1:A:556:VAL:HG12	1:A:613:THR:HA	2.01	0.42
1:A:179:TRP:CE3	1:A:186:VAL:HG12	2.55	0.41
1:A:410:THR:HG22	1:A:412:GLU:OE2	2.20	0.41
1:A:555:GLN:HA	1:A:612:THR:OG1	2.20	0.41
1:A:54:LYS:N	1:A:55:PRO:CD	2.83	0.41
1:A:533:ALA:O	1:A:536:LEU:HB3	2.20	0.41
1:A:141:LEU:HG	1:A:143:VAL:HG13	2.03	0.41
1:A:131:GLY:N	3:A:810:HOH:O	2.46	0.40
1:A:134:VAL:CG2	1:A:138:ASN:HA	2.51	0.40
1:A:527:PHE:CE2	1:A:676:ALA:HB2	2.56	0.40
1:A:564:THR:HA	1:A:570:ILE:CD1	2.52	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	679/676 (100%)	650 (96%)	27 (4%)	2 (0%)	41 30

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	572	LEU
1	A	222	ASP

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	594/589 (101%)	563 (95%)	31 (5%)	23 12

All (31) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	54	LYS
1	A	92	GLU
1	A	119	GLN
1	A	120	ARG
1	A	123	GLN
1	A	132	LEU
1	A	134	VAL
1	A	149	SER
1	A	150	ARG
1	A	186	VAL
1	A	194	LYS
1	A	214[A]	GLU
1	A	214[B]	GLU
1	A	249	ILE
1	A	250	LEU
1	A	252	LEU
1	A	309	LEU
1	A	318	LEU
1	A	352	ARG
1	A	361	THR
1	A	373	GLU
1	A	405	GLU
1	A	444	THR
1	A	515	LEU
1	A	548	LEU
1	A	586	GLN
1	A	621	GLN
1	A	650	SER
1	A	658	ARG
1	A	660	LYS

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Mol	Chain	Res	Type
1	A	677	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (17) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	83	HIS
1	A	95	ASN
1	A	103	GLN
1	A	119	GLN
1	A	181	ASN
1	A	220	GLN
1	A	271	HIS
1	A	279	HIS
1	A	307	GLN
1	A	344	HIS
1	A	367	ASN
1	A	445	ASN
1	A	518	GLN
1	A	555	GLN
1	A	585	GLN
1	A	586	GLN
1	A	652	HIS

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](#)

2 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	SPM	A	702	-	13,13,13	0.19	0	12,12,12	0.61	0
2	SPM	A	701	-	13,13,13	0.19	0	12,12,12	0.26	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	SPM	A	702	-	-	6/11/11/11	-
2	SPM	A	701	-	-	2/11/11/11	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (8) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	702	SPM	C11-C12-C13-N14
2	A	702	SPM	C7-C8-C9-N10
2	A	702	SPM	C8-C9-N10-C11
2	A	701	SPM	C7-C6-N5-C4
2	A	701	SPM	C7-C8-C9-N10
2	A	702	SPM	N1-C2-C3-C4
2	A	702	SPM	N10-C11-C12-C13
2	A	702	SPM	C3-C4-N5-C6

There are no ring outliers.

2 monomers are involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	702	SPM	2	0

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Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	701	SPM	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 [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	676/676 (100%)	0.02	15 (2%) 62 63	16, 28, 52, 108	0

All (15) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	655	LYS	5.7
1	A	654	GLY	5.4
1	A	653	GLY	5.3
1	A	651	GLY	4.9
1	A	74	TYR	3.4
1	A	354	ALA	2.7
1	A	650	SER	2.7
1	A	193	ALA	2.6
1	A	73	LEU	2.5
1	A	656	SER	2.3
1	A	652	HIS	2.3
1	A	437	HIS	2.1
1	A	659	PHE	2.1
1	A	257	ALA	2.1
1	A	212	LEU	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 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(Å ²)	Q<0.9
2	SPM	A	702	14/14	0.71	0.27	44,50,68,69	0
2	SPM	A	701	14/14	0.80	0.25	52,54,61,62	0

6.5 Other polymers [i](#)

There are no such residues in this entry.