



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 01:26 PM UTC

PDB ID : 4J1L / pdb_00004j1l
Title : Mutant Endotoxin TeNT
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Deposited on : 2013-02-01
Resolution : 2.60 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	:	4-5-2 with Phenix2.0
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

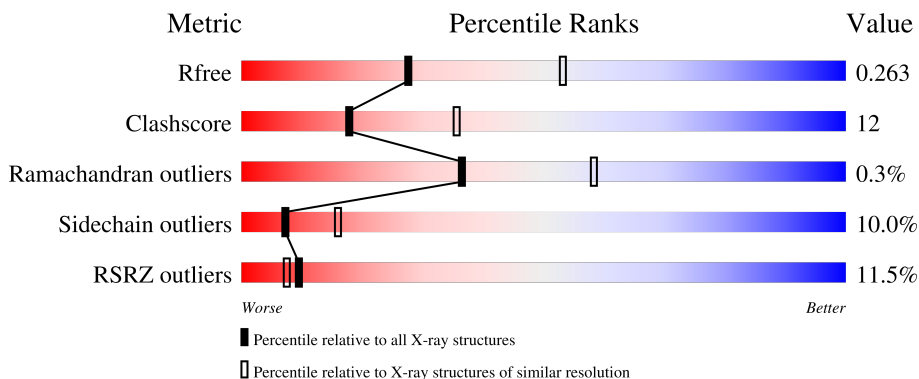
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.60 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}	180053	4008 (2.60-2.60)
Clashscore	190562	4347 (2.60-2.60)
Ramachandran outliers	187476	4277 (2.60-2.60)
Sidechain outliers	187428	4277 (2.60-2.60)
RSRZ outliers	180081	4008 (2.60-2.60)

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	426	11% 64% 23% • 8%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 3317 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 Tetanus toxin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	391	Total	C	N	O	S	0	0	0
			3178	2027	517	619	15			

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	168	GLU	LYS	engineered mutation	UNP P04958
A	230	ILE	LEU	engineered mutation	UNP P04958
A	361	VAL	ILE	conflict	UNP P04958

- Molecule 2 is ZINC ION (CCD ID: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Zn	0	0
			1	1		

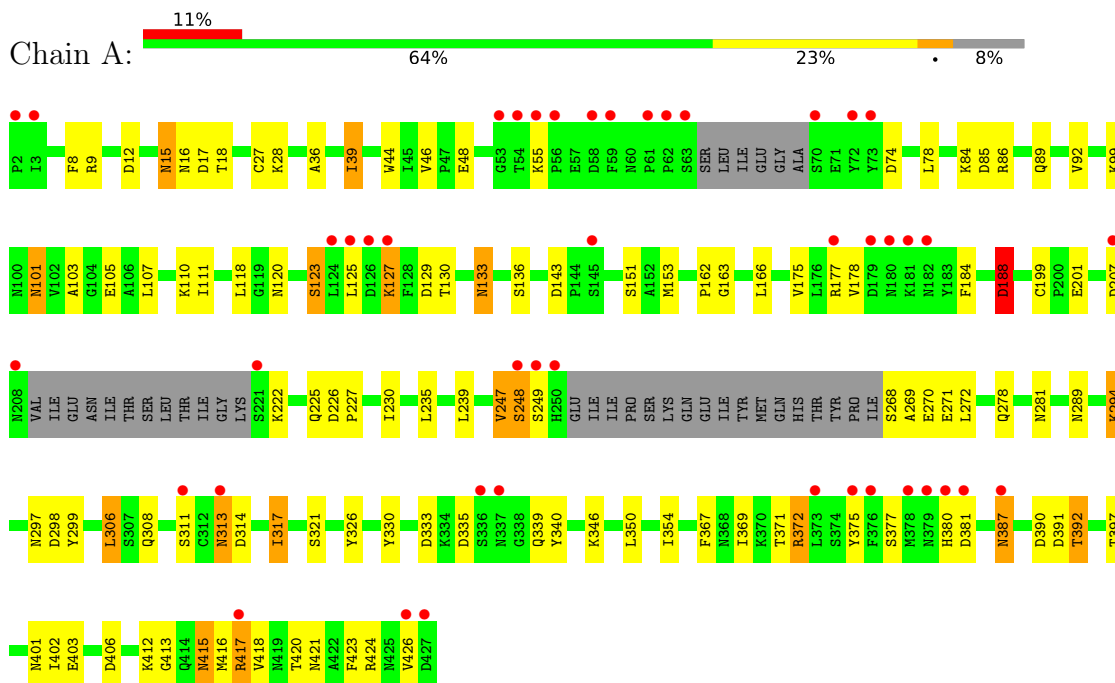
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	138	Total	O	0	0
			138	138		

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: Tetanus toxin



4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 2	Depositor
Cell constants a, b, c, α , β , γ	105.38Å 176.83Å 57.36Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.12 – 2.60 48.12 – 2.60	Depositor EDS
% Data completeness (in resolution range)	97.0 (48.12-2.60) 97.0 (48.12-2.60)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	6.28 (at 2.61Å)	Xtriage
Refinement program	REFMAC 5.6.0117	Depositor
R, R_{free}	0.238 , 0.266 0.232 , 0.263	Depositor DCC
R_{free} test set	820 reflections (4.84%)	wwPDB-VP
Wilson B-factor (Å ²)	39.2	Xtriage
Anisotropy	0.063	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 32.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.52$, $\langle L^2 \rangle = 0.36$	Xtriage
Estimated twinning fraction	0.015 for 1/2*h-1/2*k,-3/2*h-1/2*k,-l 0.005 for 1/2*h+1/2*k,3/2*h-1/2*k,-l	Xtriage
F_o, F_c correlation	0.85	EDS
Total number of atoms	3317	wwPDB-VP
Average B, all atoms (Å ²)	35.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.62% 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: ZN

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	1.05	1/3249 (0.0%)	1.20	11/4396 (0.3%)

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

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	44	TRP	CA-C	-5.20	1.46	1.52

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	289	ASN	N-CA-C	7.07	118.98	111.28
1	A	397	THR	N-CA-C	-6.75	105.60	114.31
1	A	55	LYS	CA-C-N	-5.92	113.52	119.56
1	A	55	LYS	C-N-CA	-5.92	113.52	119.56
1	A	418	VAL	CB-CA-C	-5.83	104.92	111.80
1	A	163	GLY	CA-C-N	5.81	125.28	119.24
1	A	163	GLY	C-N-CA	5.81	125.28	119.24
1	A	78	LEU	CB-CA-C	-5.76	104.45	111.82
1	A	392	THR	N-CA-C	-5.53	106.70	113.50
1	A	188	ASP	CA-C-O	5.28	124.30	118.65
1	A	387	ASN	N-CA-C	5.14	119.18	108.53

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	247	VAL	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	3178	0	3070	77	0
2	A	1	0	0	1	0
3	A	138	0	0	4	0
All	All	3317	0	3070	77	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 12.

All (77) 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:9:ARG:NH2	1:A:85:ASP:OD2	1.57	1.37
1:A:387:ASN:ND2	1:A:390:ASP:HB3	1.78	0.98
1:A:86:ARG:NH2	1:A:201:GLU:OE2	2.00	0.94
1:A:387:ASN:HD22	1:A:390:ASP:HB3	1.32	0.92
1:A:15:ASN:HD21	1:A:18:THR:H	1.22	0.87
1:A:387:ASN:ND2	1:A:390:ASP:CB	2.38	0.86
1:A:9:ARG:NH2	1:A:85:ASP:CG	2.34	0.84
1:A:406:ASP:O	1:A:412:LYS:NZ	2.13	0.80
1:A:372:ARG:HG3	1:A:372:ARG:HH11	1.46	0.80
1:A:175:VAL:HG22	1:A:184:PHE:CE2	2.20	0.75
1:A:271:GLU:HG2	1:A:375:TYR:CZ	2.21	0.75
1:A:367:PHE:HB3	1:A:369:ILE:HD12	1.69	0.75
1:A:120:ASN:H	1:A:123:SER:HB3	1.53	0.73
1:A:415:ASN:HD22	1:A:417:ARG:H	1.37	0.72
1:A:387:ASN:HD21	1:A:390:ASP:CB	2.02	0.70
1:A:130:THR:HG21	1:A:317:ILE:HD13	1.74	0.69
1:A:74:ASP:HB3	1:A:166:LEU:HD11	1.78	0.66

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:101:ASN:HD22	1:A:103:ALA:H	1.42	0.65
1:A:101:ASN:ND2	1:A:103:ALA:H	1.95	0.65
1:A:247:VAL:HG11	1:A:269:ALA:HB3	1.82	0.62
1:A:367:PHE:CB	1:A:369:ILE:HD12	2.30	0.61
1:A:15:ASN:C	1:A:15:ASN:HD22	2.09	0.60
1:A:372:ARG:HG3	1:A:372:ARG:NH1	2.14	0.60
1:A:278:GLN:NE2	1:A:281:ASN:HD22	1.99	0.60
1:A:387:ASN:HD21	1:A:390:ASP:HB2	1.65	0.60
1:A:225:GLN:HE21	1:A:226:ASP:H	1.47	0.59
1:A:271:GLU:OE2	2:A:501:ZN:ZN	1.50	0.59
1:A:27:CYS:O	1:A:28:LYS:C	2.43	0.58
1:A:162:PRO:HG3	1:A:199:CYS:HB2	1.87	0.57
1:A:350:LEU:O	1:A:354:ILE:HG12	2.05	0.56
1:A:188:ASP:HB2	3:A:678:HOH:O	2.05	0.56
1:A:227:PRO:HA	1:A:230:ILE:HD12	1.87	0.56
1:A:313:ASN:C	1:A:313:ASN:HD22	2.13	0.56
1:A:225:GLN:NE2	1:A:226:ASP:H	2.04	0.54
1:A:421:ASN:OD1	1:A:424:ARG:NH2	2.29	0.54
1:A:380:HIS:O	1:A:381:ASP:C	2.50	0.54
1:A:15:ASN:ND2	1:A:18:THR:H	1.98	0.52
1:A:15:ASN:O	1:A:16:ASN:HB2	2.10	0.51
1:A:110:LYS:HG2	1:A:239:LEU:HD11	1.92	0.51
1:A:36:ALA:HB2	1:A:46:VAL:HG22	1.91	0.51
1:A:313:ASN:HD22	1:A:314:ASP:N	2.09	0.50
1:A:415:ASN:ND2	3:A:663:HOH:O	2.33	0.50
1:A:85:ASP:O	1:A:89:GLN:HG2	2.11	0.49
1:A:101:ASN:HD22	1:A:103:ALA:N	2.07	0.49
1:A:127:LYS:HA	1:A:311:SER:O	2.13	0.49
1:A:15:ASN:HD22	1:A:17:ASP:H	1.61	0.48
1:A:136:SER:HA	1:A:153:MET:O	2.13	0.48
1:A:416:MET:HE3	1:A:423:PHE:CE2	2.49	0.48
1:A:333:ASP:OD1	1:A:346:LYS:HE2	2.14	0.48
1:A:130:THR:CG2	1:A:317:ILE:HD13	2.44	0.47
1:A:306:LEU:HD13	1:A:340:TYR:CE2	2.50	0.47
1:A:415:ASN:ND2	1:A:417:ARG:H	2.07	0.47
1:A:129:ASP:OD2	3:A:664:HOH:O	2.20	0.47
1:A:48:GLU:OE2	1:A:84:LYS:NZ	2.45	0.47
1:A:118:LEU:HG	1:A:326:TYR:OH	2.15	0.47
1:A:15:ASN:C	1:A:15:ASN:ND2	2.73	0.47
1:A:15:ASN:ND2	1:A:17:ASP:H	2.13	0.46
1:A:248:SER:OG	1:A:249:SER:N	2.48	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:299:TYR:CE2	1:A:330:TYR:HD1	2.34	0.46
1:A:9:ARG:HB2	1:A:12:ASP:OD1	2.15	0.46
1:A:39:ILE:HD11	1:A:92:VAL:HA	1.98	0.44
1:A:294:LYS:HE3	1:A:298:ASP:OD2	2.18	0.43
1:A:269:ALA:O	1:A:270:GLU:C	2.63	0.42
1:A:133:ASN:HD22	1:A:133:ASN:N	2.18	0.42
1:A:15:ASN:HD22	1:A:17:ASP:N	2.17	0.42
1:A:111:ILE:CD1	1:A:235:LEU:HB3	2.50	0.41
1:A:133:ASN:HD22	1:A:133:ASN:H	1.67	0.41
1:A:129:ASP:HA	1:A:313:ASN:OD1	2.20	0.41
1:A:335:ASP:OD1	1:A:339:GLN:HB3	2.20	0.41
1:A:226:ASP:HA	1:A:227:PRO:HD2	1.92	0.41
1:A:401:ASN:HD22	1:A:413:GLY:HA3	1.86	0.41
1:A:36:ALA:CB	1:A:46:VAL:HG22	2.51	0.41
1:A:177:ARG:HA	1:A:177:ARG:HD2	1.93	0.41
1:A:371:THR:HA	3:A:636:HOH:O	2.21	0.40
1:A:387:ASN:ND2	1:A:390:ASP:HB2	2.23	0.40
1:A:101:ASN:HD22	1:A:101:ASN:C	2.29	0.40
1:A:130:THR:HG21	1:A:317:ILE:CD1	2.48	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	383/426 (90%)	357 (93%)	25 (6%)	1 (0%)	36 58

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	391	ASP

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	359/391 (92%)	323 (90%)	36 (10%)	7 16

All (36) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	8	PHE
1	A	15	ASN
1	A	39	ILE
1	A	99	LYS
1	A	101	ASN
1	A	105	GLU
1	A	107	LEU
1	A	123	SER
1	A	125	LEU
1	A	127	LYS
1	A	133	ASN
1	A	143	ASP
1	A	151	SER
1	A	178	VAL
1	A	188	ASP
1	A	207	ASP
1	A	222	LYS
1	A	248	SER
1	A	268	SER
1	A	272	LEU
1	A	294	LYS
1	A	297	ASN
1	A	306	LEU
1	A	308	GLN
1	A	313	ASN
1	A	317	ILE
1	A	321	SER
1	A	372	ARG
1	A	377	SER
1	A	392	THR

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Mol	Chain	Res	Type
1	A	402	ILE
1	A	403	GLU
1	A	415	ASN
1	A	417	ARG
1	A	420	THR
1	A	426	VAL

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

Mol	Chain	Res	Type
1	A	6	ASN
1	A	15	ASN
1	A	100	ASN
1	A	101	ASN
1	A	131	ASN
1	A	133	ASN
1	A	138	ASN
1	A	225	GLN
1	A	250	HIS
1	A	278	GLN
1	A	304	ASN
1	A	313	ASN
1	A	324	GLN
1	A	348	GLN
1	A	368	ASN
1	A	380	HIS
1	A	387	ASN
1	A	401	ASN
1	A	415	ASN
1	A	419	ASN

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 1 ligands modelled in this entry, 1 is 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 ⓘ

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	391/426 (91%)	0.88	45 (11%) 9 7	15, 31, 67, 112	0

All (45) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	379	ASN	7.9
1	A	63	SER	5.7
1	A	72	TYR	5.6
1	A	378	MET	5.0
1	A	208	ASN	4.8
1	A	426	VAL	4.6
1	A	2	PRO	4.3
1	A	427	ASP	4.2
1	A	250	HIS	4.1
1	A	373	LEU	4.1
1	A	180	ASN	3.9
1	A	62	PRO	3.9
1	A	417	ARG	3.7
1	A	249	SER	3.6
1	A	380	HIS	3.5
1	A	313	ASN	3.5
1	A	53	GLY	3.5
1	A	181	LYS	3.5
1	A	126	ASP	3.5
1	A	248	SER	3.3
1	A	179	ASP	3.3
1	A	70	SER	3.1
1	A	124	LEU	3.0
1	A	59	PHE	3.0
1	A	127	LYS	2.9
1	A	375	TYR	2.8
1	A	61	PRO	2.8

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Mol	Chain	Res	Type	RSRZ
1	A	376	PHE	2.8
1	A	207	ASP	2.7
1	A	336	SER	2.7
1	A	125	LEU	2.6
1	A	56	PRO	2.6
1	A	177	ARG	2.5
1	A	387	ASN	2.5
1	A	145	SER	2.5
1	A	337	ASN	2.5
1	A	311	SER	2.5
1	A	381	ASP	2.5
1	A	73	TYR	2.5
1	A	221	SER	2.4
1	A	55	LYS	2.3
1	A	58	ASP	2.3
1	A	182	ASN	2.1
1	A	54	THR	2.0
1	A	3	ILE	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	ZN	A	501	1/1	0.99	0.05	38,38,38,38	0

6.5 Other polymers [i](#)

There are no such residues in this entry.