



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 04:14 AM UTC

PDB ID : 3K51 / pdb_00003k51
Title : Crystal Structure of DcR3-TL1A complex
Authors : Zhan, C.; Patskovsky, Y.; Yan, Q.; Li, Z.; Ramagopal, U.A.; Nathenson, S.G.;
Almo, S.C.
Deposited on : 2009-10-06
Resolution : 2.45 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

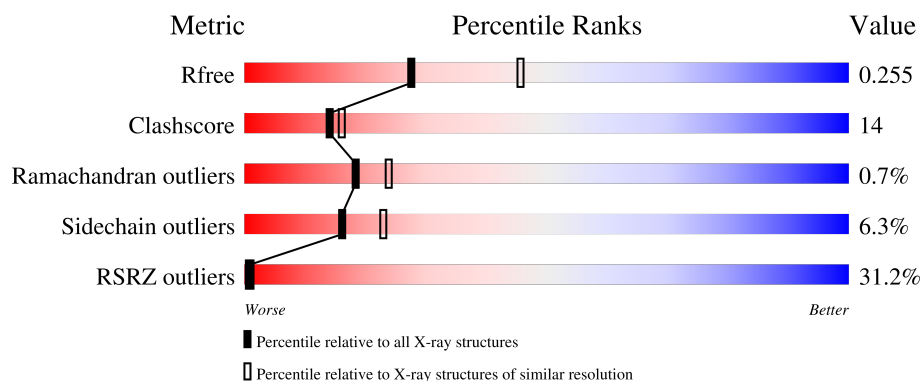
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.45 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	1190 (2.46-2.46)
Clashscore	190562	1229 (2.46-2.46)
Ramachandran outliers	187476	1218 (2.46-2.46)
Sidechain outliers	187428	1218 (2.46-2.46)
RSRZ outliers	180081	1190 (2.46-2.46)

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	184	
2	B	176	

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 2456 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 Tumor necrosis factor ligand superfamily member 15, secreted form.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	143	Total	C	N	O	S	0	5	0
			1154	750	185	214	5			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	GLY	-	expression tag	UNP O95150
A	2	SER	-	expression tag	UNP O95150
A	3	HIS	-	expression tag	UNP O95150
A	4	MET	-	expression tag	UNP O95150
A	95	SER	CYS	engineered mutation	UNP O95150
A	135	SER	CYS	engineered mutation	UNP O95150

- Molecule 2 is a protein called Decoy receptor 3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	161	Total	C	N	O	S	0	1	0
			1219	740	233	228	18			

There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	28	ARG	-	expression tag	UNP O95407
B	29	SER	-	expression tag	UNP O95407
B	196	THR	-	expression tag	UNP O95407
B	197	GLY	-	expression tag	UNP O95407
B	198	HIS	-	expression tag	UNP O95407
B	199	HIS	-	expression tag	UNP O95407
B	200	HIS	-	expression tag	UNP O95407
B	201	HIS	-	expression tag	UNP O95407
B	202	HIS	-	expression tag	UNP O95407

Continued on next page...

Continued from previous page...

Chain	Residue	Modelled	Actual	Comment	Reference
B	203	HIS	-	expression tag	UNP O95407

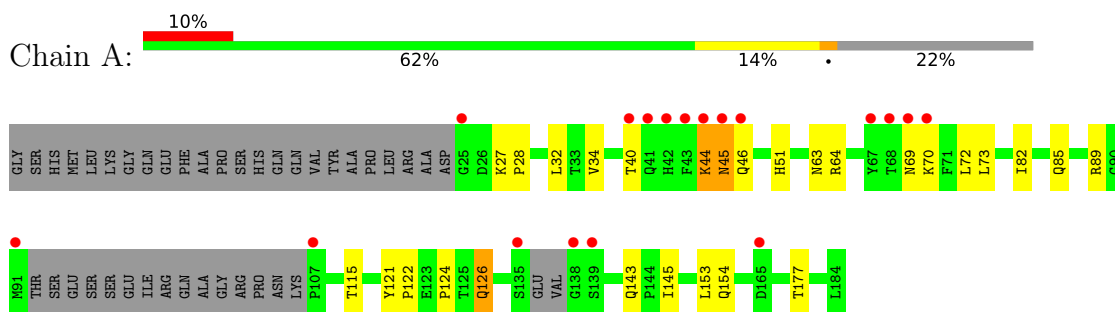
- Molecule 3 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	57	Total O 57 57	0	0
3	B	26	Total O 26 26	0	0

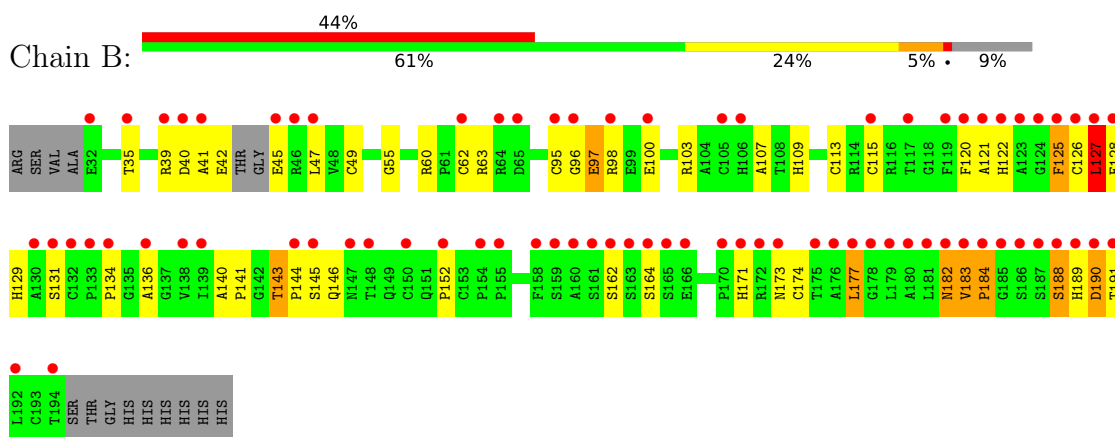
3 Residue-property plots [i](#)

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: Tumor necrosis factor ligand superfamily member 15, secreted form



- Molecule 2: Decoy receptor 3



4 Data and refinement statistics

Property	Value	Source
Space group	P 3 2 1	Depositor
Cell constants a, b, c, α , β , γ	74.89Å 74.89Å 143.12Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	36.23 – 2.45 36.23 – 2.45	Depositor EDS
% Data completeness (in resolution range)	99.9 (36.23-2.45) 99.9 (36.23-2.45)	Depositor EDS
R_{merge}	0.13	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.24 (at 2.45Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.223 , 0.262 0.222 , 0.255	Depositor DCC
R_{free} test set	566 reflections (3.18%)	wwPDB-VP
Wilson B-factor (Å ²)	44.6	Xtriage
Anisotropy	0.054	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 55.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.038 for -h,-k,l	Xtriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	2456	wwPDB-VP
Average B, all atoms (Å ²)	79.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.73% 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](#)

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	0.46	0/1197	0.70	2/1621 (0.1%)
2	B	0.43	0/1259	0.79	4/1718 (0.2%)
All	All	0.44	0/2456	0.75	6/3339 (0.2%)

There are no bond length outliers.

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	44	LYS	N-CA-C	-7.21	104.08	113.17
2	B	190	ASP	CB-CA-C	-5.85	109.84	116.63
2	B	127	LEU	N-CA-C	5.47	118.65	109.95
1	A	45	ASN	N-CA-C	-5.34	104.89	113.28
2	B	183	VAL	C-N-CD	-5.17	103.81	125.00
2	B	97	GLU	CB-CA-C	-5.04	110.79	116.63

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	1154	0	1137	19	0
2	B	1219	0	1101	45	0
3	A	57	0	0	1	0
3	B	26	0	0	0	0
All	All	2456	0	2238	64	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 14.

All (64) 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)
2:B:49:CYS:CB	2:B:62:CYS:SG	2.29	1.21
2:B:127:LEU:H	2:B:127:LEU:HD23	1.13	1.13
2:B:127:LEU:H	2:B:127:LEU:CD2	1.65	1.09
2:B:96:GLY:O	2:B:97:GLU:HG2	1.54	1.06
2:B:95:CYS:SG	2:B:113:CYS:CB	2.44	1.05
2:B:49:CYS:SG	2:B:62:CYS:CB	2.49	1.00
2:B:97:GLU:HG3	2:B:98:ARG:H	1.26	0.97
2:B:127:LEU:CD2	2:B:127:LEU:N	2.30	0.87
2:B:127:LEU:HD23	2:B:127:LEU:N	1.89	0.85
2:B:97:GLU:CG	2:B:98:ARG:H	1.91	0.80
1:A:69:ASN:O	1:A:70:LYS:HB2	1.79	0.79
2:B:39:ARG:H	2:B:39:ARG:HD2	1.49	0.77
2:B:182:ASN:OD1	2:B:183:VAL:N	2.20	0.75
2:B:97:GLU:HG3	2:B:98:ARG:N	2.01	0.74
2:B:182:ASN:OD1	2:B:182:ASN:C	2.30	0.74
2:B:115:CYS:SG	2:B:121:ALA:HB2	2.31	0.71
1:A:51:HIS:CE1	1:A:70:LYS:HE3	2.25	0.70
1:A:69:ASN:O	1:A:70:LYS:CB	2.41	0.69
2:B:97:GLU:CG	2:B:98:ARG:N	2.50	0.68
2:B:95:CYS:CB	2:B:113:CYS:SG	2.80	0.67
2:B:127:LEU:N	2:B:127:LEU:HD22	2.09	0.63
2:B:39:ARG:HD2	2:B:39:ARG:N	2.14	0.63
2:B:127:LEU:H	2:B:127:LEU:HD22	1.59	0.62
2:B:188:SER:O	2:B:189:HIS:HB2	2.00	0.61
1:A:51:HIS:CE1	1:A:70:LYS:CE	2.83	0.61
1:A:32:LEU:HD11	1:A:72:LEU:HD13	1.85	0.59
1:A:82[A]:ILE:HD11	1:A:153:LEU:HD11	1.87	0.57
2:B:143:THR:C	2:B:145:SER:H	2.14	0.56
1:A:63:ASN:O	1:A:64:ARG:HB2	2.07	0.53
1:A:89[A]:ARG:HH21	1:A:89[A]:ARG:HG3	1.73	0.53
2:B:120:PHE:O	2:B:127:LEU:HD23	2.09	0.52
2:B:173:ASN:O	2:B:177:LEU:HB2	2.11	0.51
2:B:96:GLY:O	2:B:97:GLU:CG	2.44	0.51
1:A:44:LYS:O	1:A:45:ASN:CB	2.60	0.50
2:B:49:CYS:CA	2:B:62:CYS:SG	2.98	0.50
2:B:143:THR:O	2:B:145:SER:N	2.45	0.50
2:B:125:PHE:HD2	2:B:126:CYS:H	1.60	0.50

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:188:SER:O	2:B:189:HIS:CB	2.60	0.50
2:B:40:ASP:OD1	2:B:41:ALA:N	2.45	0.49
2:B:143:THR:C	2:B:145:SER:N	2.70	0.49
2:B:171:HIS:HD2	2:B:190:ASP:HA	1.78	0.49
2:B:143:THR:HG23	2:B:146:GLN:H	1.77	0.48
2:B:184:PRO:HA	2:B:191:THR:HG22	1.95	0.47
2:B:95:CYS:SG	2:B:113:CYS:HB3	2.48	0.46
2:B:60:ARG:HH21	2:B:63:ARG:HD2	1.82	0.45
1:A:126[A]:GLN:NE2	3:A:226:HOH:O	2.44	0.44
1:A:115:THR:CG2	1:A:124:PRO:HB2	2.48	0.44
1:A:44:LYS:C	1:A:46:GLN:H	2.24	0.44
2:B:55:GLY:HA2	2:B:107:ALA:O	2.18	0.43
2:B:136:ALA:HA	2:B:152:PRO:HA	1.99	0.43
2:B:131:SER:HA	2:B:164:SER:HB3	2.00	0.43
1:A:89[A]:ARG:HG3	1:A:89[A]:ARG:NH2	2.33	0.43
1:A:51:HIS:CE1	1:A:70:LYS:HE2	2.53	0.43
2:B:42:GLU:HG2	2:B:45:GLU:OE2	2.18	0.42
1:A:72:LEU:HD12	1:A:72:LEU:HA	1.92	0.42
2:B:134:PRO:HD3	2:B:162:SER:HB3	2.02	0.41
1:A:85:GLN:HA	1:A:145:ILE:O	2.20	0.41
2:B:103:ARG:NH1	2:B:109:HIS:CE1	2.89	0.41
2:B:128:GLU:HG3	2:B:129:HIS:N	2.35	0.41
2:B:171:HIS:HA	2:B:190:ASP:OD1	2.20	0.41
1:A:27:LYS:HA	1:A:28:PRO:HD3	1.94	0.40
2:B:140:ALA:HA	2:B:141:PRO:HD2	1.90	0.40
1:A:34:VAL:HB	1:A:177:THR:HB	2.04	0.40
1:A:121:TYR:HA	1:A:122:PRO:HD3	1.85	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	142/184 (77%)	137 (96%)	5 (4%)	0	100	100
2	B	158/176 (90%)	147 (93%)	9 (6%)	2 (1%)	9	9
All	All	300/360 (83%)	284 (95%)	14 (5%)	2 (1%)	18	24

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	184	PRO
2	B	144	PRO

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	128/163 (78%)	122 (95%)	6 (5%)	23	35
2	B	132/148 (89%)	121 (92%)	11 (8%)	10	12
All	All	260/311 (84%)	243 (94%)	17 (6%)	16	21

All (17) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	40	THR
1	A	73	LEU
1	A	126[A]	GLN
1	A	126[B]	GLN
1	A	143	GLN
1	A	154	GLN
2	B	35	THR
2	B	47	LEU
2	B	100	GLU
2	B	122	HIS
2	B	125	PHE
2	B	127	LEU
2	B	143	THR
2	B	174	CYS

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
2	B	177	LEU
2	B	182	ASN
2	B	188	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	51	HIS
1	A	85	GLN
2	B	59	GLN
2	B	109	HIS
2	B	169	GLN
2	B	171	HIS
2	B	189	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

There are no ligands in this entry.

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	143/184 (77%)	0.51	18 (12%)	8 6	24, 51, 99, 122	5 (3%)
2	B	161/176 (91%)	1.96	77 (47%)	0 0	32, 114, 153, 163	1 (0%)
All	All	304/360 (84%)	1.28	95 (31%)	1 1	24, 65, 148, 163	6 (1%)

All (95) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	125	PHE	5.2
1	A	41	GLN	5.0
2	B	65	ASP	4.7
2	B	127	LEU	4.6
2	B	144	PRO	4.6
1	A	43	PHE	4.5
2	B	47	LEU	4.5
1	A	45	ASN	4.5
2	B	176	ALA	4.4
2	B	187	SER	4.3
2	B	145	SER	4.2
2	B	123	ALA	4.2
2	B	126	CYS	4.1
2	B	62	CYS	4.1
2	B	32	GLU	4.0
2	B	179	LEU	3.9
1	A	40	THR	3.9
2	B	194	THR	3.9
2	B	184	PRO	3.9
1	A	135	SER	3.8
2	B	183	VAL	3.8
2	B	180	ALA	3.7
2	B	119	PHE	3.7
2	B	40	ASP	3.6

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	A	46	GLN	3.6
2	B	170	PRO	3.5
2	B	175	THR	3.5
2	B	152	PRO	3.5
2	B	121	ALA	3.5
1	A	25	GLY	3.4
2	B	134	PRO	3.4
2	B	160	ALA	3.4
2	B	171	HIS	3.4
2	B	165	SER	3.4
2	B	172	ARG	3.3
2	B	148	THR	3.3
2	B	124	GLY	3.3
2	B	158	PHE	3.3
2	B	182	ASN	3.3
2	B	122	HIS	3.3
2	B	173	ASN	3.2
2	B	46	ARG	3.2
2	B	185	GLY	3.2
2	B	41	ALA	3.2
2	B	188	SER	3.2
2	B	98	ARG	3.1
2	B	163	SER	3.1
2	B	177	LEU	3.1
2	B	115	CYS	3.1
2	B	45	GLU	3.1
2	B	181	LEU	3.0
2	B	130	ALA	3.0
2	B	186	SER	3.0
1	A	69	ASN	2.9
2	B	189	HIS	2.8
2	B	39	ARG	2.8
1	A	42	HIS	2.8
1	A	44	LYS	2.8
1	A	67	TYR	2.8
2	B	155	PRO	2.8
2	B	64	ARG	2.8
2	B	166	GLU	2.8
2	B	190	ASP	2.8
2	B	164	SER	2.7
2	B	117	THR	2.7
2	B	178	GLY	2.7

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
2	B	136	ALA	2.7
2	B	120	PHE	2.5
1	A	70	LYS	2.5
2	B	159	SER	2.5
2	B	95	CYS	2.5
2	B	162	SER	2.5
2	B	191	THR	2.5
1	A	68	THR	2.4
2	B	139	ILE	2.4
2	B	128	GLU	2.4
2	B	133	PRO	2.3
2	B	154	PRO	2.3
2	B	161	SER	2.3
2	B	96	GLY	2.3
1	A	165	ASP	2.3
1	A	91	MET	2.3
1	A	107	PRO	2.3
2	B	132	CYS	2.3
1	A	138	GLY	2.2
2	B	150	CYS	2.2
2	B	147	ASN	2.2
2	B	106	HIS	2.2
2	B	192	LEU	2.2
2	B	138	VAL	2.2
2	B	105	CYS	2.2
2	B	100	GLU	2.1
2	B	131	SER	2.1
2	B	35	THR	2.1
1	A	139	SER	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 ⓘ

There are no oligosaccharides in this entry.

6.4 Ligands ⓘ

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.