



Full wwPDB X-ray Structure Validation Report ⓘ

Aug 31, 2026 – 02:27 PM EDT

PDB ID : 9O8O / pdb_00009o8o
Title : Fab367 in complex with the C-terminal alpha-TSR domain of the P. falciparum circumsporozoite protein
Authors : Moskovitz, R.; Wilson, I.A.
Deposited on : 2025-04-16
Resolution : 2.31 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	:	9.0.015 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.50

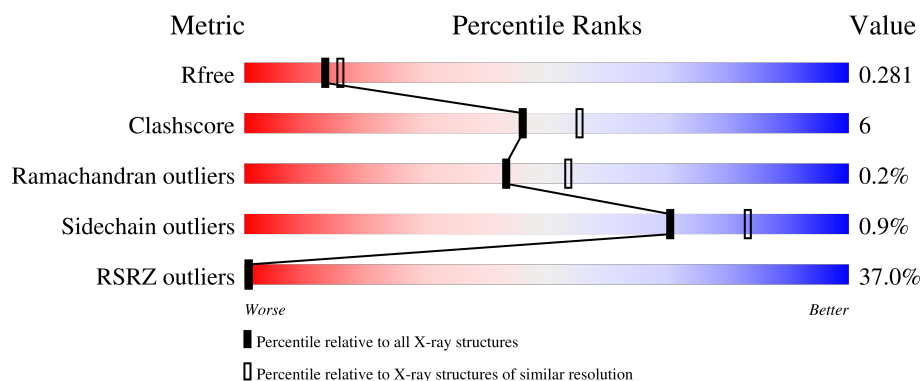
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.31 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	7754 (2.34-2.30)
Clashscore	190562	8383 (2.34-2.30)
Ramachandran outliers	187476	8303 (2.34-2.30)
Sidechain outliers	187428	8303 (2.34-2.30)
RSRZ outliers	180081	7760 (2.34-2.30)

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	C	73	78% 71% 15% 14%
2	H	227	20% 85% 15%
3	L	211	39% 85% 14%

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 3798 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 Circumsporozoite protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	C	63	Total	C	N	O	S	0	0	0
			493	306	85	98	4			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	377	HIS	-	expression tag	UNP Q7K740
C	378	HIS	-	expression tag	UNP Q7K740
C	379	HIS	-	expression tag	UNP Q7K740
C	380	HIS	-	expression tag	UNP Q7K740
C	381	HIS	-	expression tag	UNP Q7K740
C	382	HIS	-	expression tag	UNP Q7K740

- Molecule 2 is a protein called Fab367 Heavy Chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	H	227	Total	C	N	O	S	0	0	0
			1694	1062	289	335	8			

- Molecule 3 is a protein called Fab367 Light Chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	L	210	Total	C	N	O	S	0	0	0
			1575	985	262	322	6			

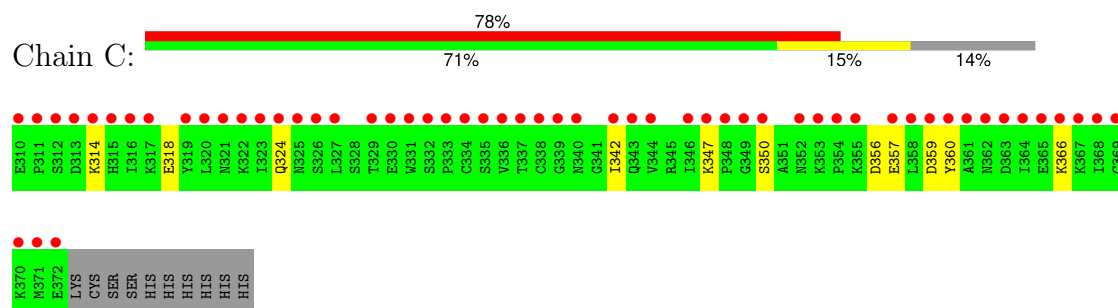
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	H	19	Total	O	0	0
			19	19		
4	L	17	Total	O	0	0
			17	17		

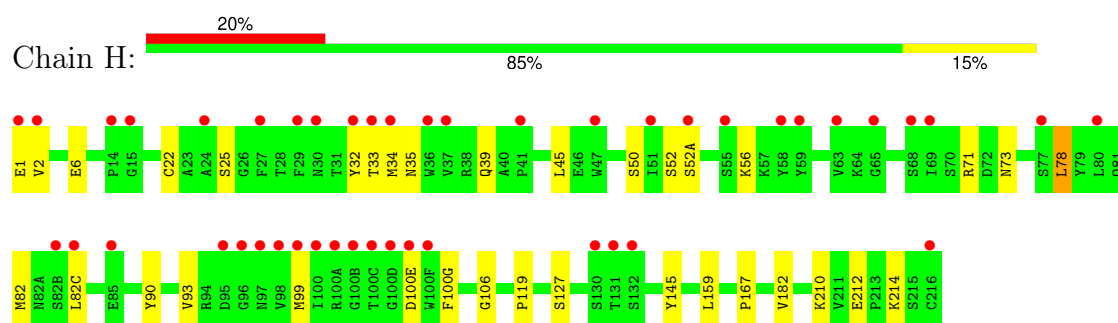
3 Residue-property plots [i](#)

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.

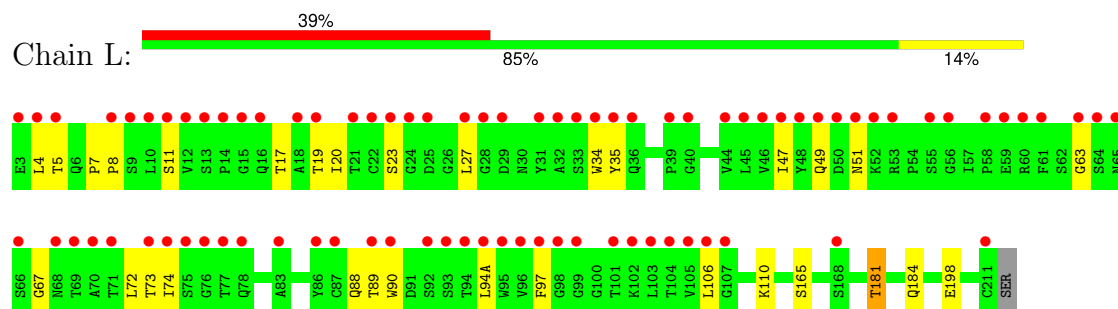
- Molecule 1: Circumsporozoite protein



- Molecule 2: Fab367 Heavy Chain



- Molecule 3: Fab367 Light Chain



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	40.93Å 69.51Å 240.13Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	35.27 – 2.31 35.27 – 2.31	Depositor EDS
% Data completeness (in resolution range)	91.3 (35.27-2.31) 91.5 (35.27-2.31)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.63 (at 2.31Å)	Xtriage
Refinement program	PHENIX (1.21.2_5419: ???)	Depositor
R, R_{free}	0.242 , 0.282 0.242 , 0.281	Depositor DCC
R_{free} test set	1460 reflections (4.68%)	wwPDB-VP
Wilson B-factor (Å ²)	41.1	Xtriage
Anisotropy	0.238	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 52.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	3798	wwPDB-VP
Average B, all atoms (Å ²)	65.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.08% 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	C	0.10	0/501	0.24	0/673
2	H	0.14	0/1733	0.35	0/2356
3	L	0.11	0/1615	0.33	0/2208
All	All	0.12	0/3849	0.33	0/5237

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	C	493	0	490	8	0
2	H	1694	0	1661	24	0
3	L	1575	0	1515	17	0
4	H	19	0	0	0	0
4	L	17	0	0	0	0
All	All	3798	0	3666	43	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 6.

All (43) 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)
3:L:20:ILE:HD12	3:L:72:LEU:HD23	1.75	0.69
3:L:51:ASN:ND2	3:L:63:GLY:O	2.26	0.68
2:H:33:THR:HG22	2:H:52:SER:HA	1.77	0.67
1:C:342:ILE:HD11	1:C:366:LYS:HB2	1.77	0.66
3:L:181:THR:HG22	3:L:184:GLN:H	1.60	0.66
2:H:71:ARG:NH1	2:H:73:ASN:OD1	2.27	0.63
3:L:5:THR:HB	3:L:23:SER:HB2	1.81	0.60
2:H:82:MET:HB3	2:H:82(C):LEU:HD21	1.85	0.58
1:C:359:ASP:OD1	1:C:360:TYR:N	2.38	0.57
2:H:119:PRO:HB3	2:H:145:TYR:HB3	1.87	0.56
2:H:2:VAL:HA	2:H:25:SER:O	2.09	0.51
2:H:34:MET:HG2	2:H:71:ARG:NH2	2.25	0.51
2:H:52:SER:HB3	2:H:56:LYS:HB2	1.93	0.50
2:H:100(E):ASP:O	3:L:88:GLN:NE2	2.45	0.49
3:L:19:THR:HG22	3:L:73:THR:HG22	1.93	0.49
3:L:110:LYS:HE3	3:L:198:GLU:HG3	1.95	0.48
2:H:22:CYS:HB3	2:H:78:LEU:HB3	1.98	0.46
2:H:39:GLN:HB2	2:H:45:LEU:HD23	1.96	0.46
2:H:93:VAL:HG11	2:H:100(G):PHE:HB3	1.99	0.45
3:L:90:TRP:HA	3:L:94(A):LEU:O	2.17	0.45
2:H:32:TYR:O	2:H:71:ARG:NH2	2.50	0.45
2:H:100(G):PHE:N	3:L:35:TYR:OH	2.49	0.45
3:L:17:THR:HA	3:L:74:ILE:O	2.16	0.44
1:C:357:GLU:O	2:H:56:LYS:NZ	2.30	0.44
2:H:127:SER:HB3	2:H:214:LYS:HD2	1.99	0.44
2:H:159:LEU:HD21	2:H:182:VAL:HG21	2.00	0.44
3:L:49:GLN:O	3:L:51:ASN:N	2.48	0.44
2:H:6:GLU:OE1	2:H:6:GLU:N	2.52	0.43
1:C:314:LYS:O	1:C:318:GLU:HG2	2.20	0.42
3:L:88:GLN:HB2	3:L:97:PHE:CD1	2.54	0.42
2:H:35:ASN:OD1	2:H:50:SER:OG	2.22	0.42
3:L:11:SER:HB3	3:L:106:LEU:HD11	2.01	0.42
2:H:90:TYR:O	2:H:106:GLY:HA2	2.19	0.42
2:H:167:PRO:HG2	3:L:165:SER:OG	2.20	0.42
1:C:356:ASP:OD1	1:C:356:ASP:N	2.50	0.42
2:H:210:LYS:HE3	2:H:212:GLU:OE2	2.20	0.41
2:H:71:ARG:HD3	2:H:73:ASN:ND2	2.35	0.41
3:L:4:LEU:HD11	3:L:89:THR:HG22	2.02	0.41
3:L:34:TRP:HB2	3:L:47:ILE:HB	2.02	0.41
1:C:324:GLN:HB2	2:H:99:MET:CE	2.51	0.41
1:C:347:LYS:HB3	1:C:350:SER:HB2	2.01	0.40
3:L:7:PRO:HA	3:L:8:PRO:HD3	1.97	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:356:ASP:OD2	2:H:52(A):SER:OG	2.32	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	C	61/73 (84%)	58 (95%)	3 (5%)	0	100	100
2	H	225/227 (99%)	217 (96%)	8 (4%)	0	100	100
3	L	208/211 (99%)	198 (95%)	9 (4%)	1 (0%)	24	30
All	All	494/511 (97%)	473 (96%)	20 (4%)	1 (0%)	43	53

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
3	L	67	GLY

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	C	57/68 (84%)	57 (100%)	0	100	100
2	H	192/192 (100%)	190 (99%)	2 (1%)	68	81

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
3	L	177/178 (99%)	175 (99%)	2 (1%)	65	80
All	All	426/438 (97%)	422 (99%)	4 (1%)	70	83

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	H	1	GLU
2	H	78	LEU
3	L	27	LEU
3	L	181	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	C	324	GLN
1	C	343	GLN
2	H	3	GLN
3	L	41	GLN

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	C	63/73 (86%)	3.12	57 (90%)	0 0	90, 106, 122, 132	0
2	H	227/227 (100%)	1.09	45 (19%)	3 3	26, 56, 89, 97	0
3	L	210/211 (99%)	1.54	83 (39%)	1 0	24, 63, 100, 118	0
All	All	500/511 (97%)	1.53	185 (37%)	1 1	24, 65, 110, 132	0

All (185) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	368	ILE	5.6
1	C	372	GLU	5.4
2	H	100(B)	GLY	5.3
3	L	90	TRP	5.1
1	C	346	ILE	5.0
3	L	29	ASP	4.7
1	C	360	TYR	4.7
3	L	31	TYR	4.7
1	C	311	PRO	4.6
2	H	100(C)	THR	4.6
1	C	364	ILE	4.6
3	L	32	ALA	4.5
2	H	98	VAL	4.5
2	H	100	ILE	4.4
3	L	211	CYS	4.4
3	L	21	THR	4.3
3	L	12	VAL	4.2
3	L	10	LEU	4.2
1	C	323	ILE	4.1
3	L	50	ASP	4.1
3	L	65	ASN	4.1
1	C	354	PRO	4.1
1	C	329	THR	4.0

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Mol	Chain	Res	Type	RSRZ
1	C	314	LYS	4.0
1	C	353	LYS	4.0
1	C	344	VAL	4.0
1	C	361	ALA	4.0
2	H	97	ASN	4.0
2	H	59	TYR	4.0
3	L	52	LYS	3.9
1	C	320	LEU	3.9
3	L	5	THR	3.9
3	L	73	THR	3.9
3	L	96	VAL	3.9
3	L	15	GLY	3.8
3	L	95	TRP	3.8
1	C	347	LYS	3.8
1	C	366	LYS	3.8
3	L	77	THR	3.8
1	C	369	CYS	3.8
3	L	47	ILE	3.7
3	L	94(A)	LEU	3.7
2	H	100(A)	ARG	3.7
1	C	310	GLU	3.7
3	L	48	TYR	3.7
3	L	33	SER	3.7
1	C	342	ILE	3.6
1	C	327	LEU	3.6
3	L	87	CYS	3.6
2	H	58	TYR	3.6
1	C	334	CYS	3.6
2	H	95	ASP	3.6
3	L	102	LYS	3.6
3	L	74	ILE	3.5
1	C	363	ASP	3.5
3	L	58	PRO	3.5
3	L	59	GLU	3.5
1	C	316	ILE	3.4
3	L	104	THR	3.3
3	L	64	SER	3.3
2	H	96	GLY	3.3
1	C	358	LEU	3.3
3	L	61	PHE	3.2
3	L	75	SER	3.2
3	L	69	THR	3.2

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Mol	Chain	Res	Type	RSRZ
3	L	94	THR	3.1
1	C	357	GLU	3.1
1	C	315	HIS	3.1
3	L	28	GLY	3.1
3	L	71	THR	3.1
3	L	23	SER	3.1
1	C	362	ASN	3.1
1	C	336	VAL	3.1
1	C	312	SER	3.0
3	L	98	GLY	3.0
3	L	44	VAL	3.0
1	C	332	SER	3.0
3	L	24	GLY	3.0
1	C	370	LYS	3.0
3	L	93	SER	3.0
1	C	330	GLU	3.0
1	C	319	TYR	3.0
1	C	337	THR	3.0
2	H	47	TRP	3.0
3	L	70	ALA	2.9
1	C	335	SER	2.9
2	H	15	GLY	2.9
3	L	76	GLY	2.9
3	L	97	PHE	2.9
3	L	106	LEU	2.9
1	C	313	ASP	2.9
3	L	19	THR	2.8
3	L	89	THR	2.8
2	H	100(E)	ASP	2.8
2	H	55	SER	2.8
2	H	216	CYS	2.8
1	C	352	ASN	2.7
1	C	331	TRP	2.7
2	H	65	GLY	2.7
1	C	365	GLU	2.7
3	L	45	LEU	2.7
2	H	27	PHE	2.7
1	C	350	SER	2.7
3	L	34	TRP	2.7
2	H	99	MET	2.7
1	C	326	SER	2.7
2	H	130	SER	2.7

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Mol	Chain	Res	Type	RSRZ
3	L	11	SER	2.7
3	L	60	ARG	2.6
1	C	340	ASN	2.6
2	H	32	TYR	2.6
3	L	105	VAL	2.6
1	C	371	MET	2.6
3	L	168	SER	2.6
3	L	22	CYS	2.6
2	H	100(F)	TRP	2.6
1	C	325	ASN	2.6
1	C	324	GLN	2.6
1	C	359	ASP	2.6
1	C	338	CYS	2.5
1	C	333	PRO	2.5
1	C	348	PRO	2.5
1	C	349	GLY	2.5
2	H	1	GLU	2.5
3	L	14	PRO	2.5
3	L	63	GLY	2.5
3	L	107	GLY	2.5
2	H	63	VAL	2.5
3	L	27	LEU	2.5
3	L	16	GLN	2.5
3	L	92	SER	2.5
2	H	68	SER	2.4
3	L	86	TYR	2.4
1	C	339	GLY	2.4
2	H	85	GLU	2.4
3	L	39	PRO	2.4
1	C	317	LYS	2.4
3	L	4	LEU	2.4
2	H	131	THR	2.4
3	L	101	THR	2.4
1	C	343	GLN	2.4
3	L	40	GLY	2.4
2	H	2	VAL	2.4
3	L	8	PRO	2.3
2	H	33	THR	2.3
3	L	36	GLN	2.3
2	H	77	SER	2.3
3	L	35	TYR	2.3
3	L	18	ALA	2.3

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Mol	Chain	Res	Type	RSRZ
3	L	49	GLN	2.3
3	L	46	VAL	2.3
3	L	51	ASN	2.3
3	L	56	GLY	2.3
2	H	24	ALA	2.3
3	L	83	ALA	2.3
2	H	34	MET	2.2
3	L	99	GLY	2.2
3	L	3	GLU	2.2
1	C	322	LYS	2.2
3	L	78	GLN	2.2
2	H	100(D)	GLY	2.2
1	C	367	LYS	2.2
1	C	321	ASN	2.2
2	H	29	PHE	2.2
3	L	13	SER	2.2
2	H	69	ILE	2.1
2	H	82(C)	LEU	2.1
2	H	37	VAL	2.1
3	L	9	SER	2.1
3	L	66	SER	2.1
2	H	41	PRO	2.1
2	H	51	ILE	2.1
2	H	80	LEU	2.1
2	H	14	PRO	2.1
2	H	132	SER	2.1
2	H	36	TRP	2.1
2	H	52(A)	SER	2.0
2	H	82(B)	SER	2.0
3	L	55	SER	2.0
3	L	103	LEU	2.0
1	C	355	LYS	2.0
2	H	30	ASN	2.0
3	L	25	ASP	2.0
3	L	68	ASN	2.0
3	L	53	ARG	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 [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.