Full wwPDB X-ray Structure Validation Report (i)

May 18, 2023 – 02:08 PM JST

PDB ID	:	8HN6
Title	:	Crystal structure of monoclonal antibody complexed with SARS-CoV-2 RBD
Authors	:	Qi, J.; Chen, Y.
Deposited on	:	2022-12-07
Resolution	:	2.07 Å(reported)

The following versions of software and data (see references (i)) were used in the production of this report:

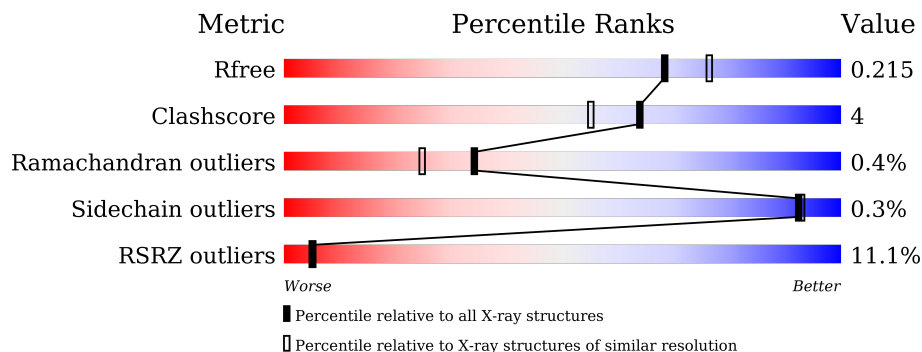|		
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.32.2
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.32.2

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 2.07 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	Percentile Ranks	Value
Rfree		0.215
Clashscore		4
Ramachandran outliers		0.4%
Sidechain outliers		0.3%
RSRZ outliers		11.1%

Worse   *Better*

▮ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	2684 (2.08-2.04)
Clashscore	141614	2801 (2.08-2.04)
Ramachandran outliers	138981	2768 (2.08-2.04)
Sidechain outliers	138945	2768 (2.08-2.04)
RSRZ outliers	127900	2646 (2.08-2.04)

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 <=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	117	11% / 92% / 7% ·
1	C	117	2% / 96% ·
2	B	108	3% / 90% / 8% ·
2	D	108	5% / 88% / 11% ·
3	E	195	22% / 89% / 11% ·
3	F	195	14% / 88% / 12%

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 7012 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 Heavy chain of monoclonal antibody 3G10.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	116	Total	C	N	O	S	0	0	0
			882	553	149	174	6			
1	C	117	Total	C	N	O	S	0	0	0
			887	556	150	175	6			

- Molecule 2 is a protein called Light chain of monoclonal antibody 3G10.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	108	Total	C	N	O	S	0	0	0
			833	533	137	160	3			
2	D	108	Total	C	N	O	S	0	0	0
			827	527	137	160	3			

- Molecule 3 is a protein called Spike protein S1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	E	195	Total	C	N	O	S	0	1	0
			1533	979	257	289	8			
3	F	195	Total	C	N	O	S	0	1	0
			1545	990	257	290	8			

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	57	Total	O	0	0
			57	57		
4	B	71	Total	O	0	0
			71	71		
4	E	107	Total	O	0	0
			107	107		
4	C	87	Total	O	0	0
			87	87		

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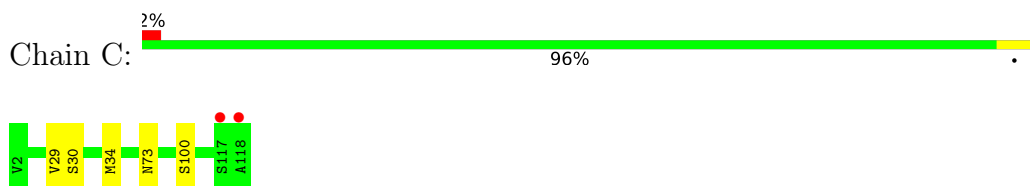| Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	D	64	Total O 64 64	0	0
4	F	119	Total O 119 119	0	0

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.
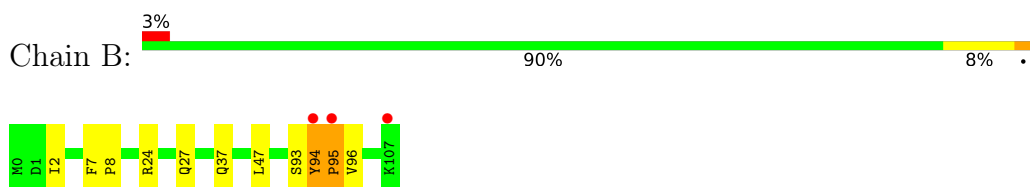
• Molecule 1: Heavy chain of monoclonal antibody 3G10
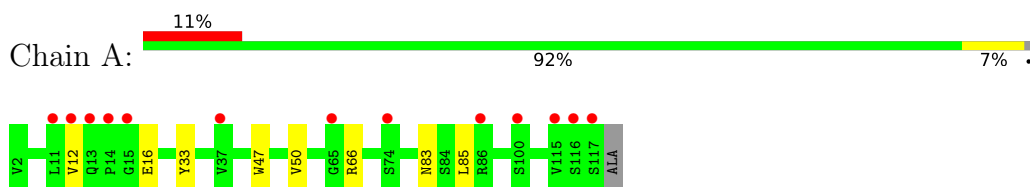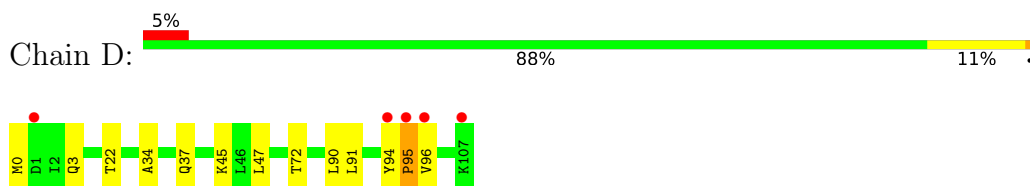
Chain A:

• Molecule 1: Heavy chain of monoclonal antibody 3G10

Chain C:

• Molecule 2: Light chain of monoclonal antibody 3G10

Chain B:

• Molecule 2: Light chain of monoclonal antibody 3G10

Chain D:

• Molecule 3: Spike protein S1

Chain E:

P491 L492 V503 V512 L513 L517 L518 H519 A520 P521 A522 T523 V524 C525 G526 P527

• Molecule 3: Spike protein S1

Chain F:

14%

88%

12%

T333 N334 L335 V341 F342 N343 N354 R357 I358 S359 V362 A363 D364 V367 L368 Y369 N370 S371 A372 S373 F374 S375 T376 F377 K378 C379 C391 D398 P412 F429 C432 V433 I434 N440 L441 K444 V445 L455 T478 L517 L518 H519 A520 P521 A522

G526 P527
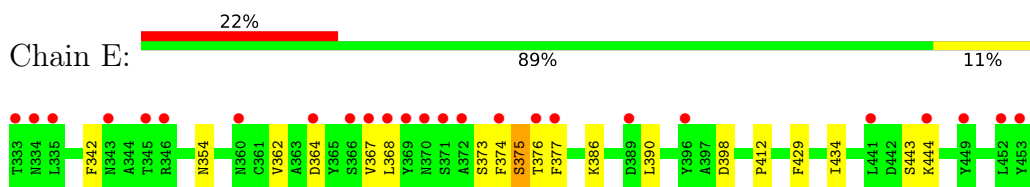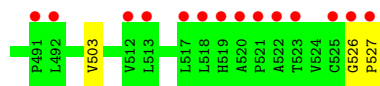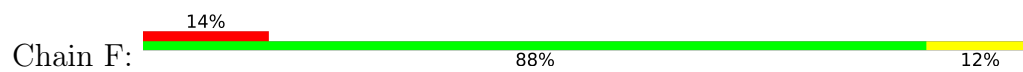
4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α, β, γ	98.68Å　　105.73Å　　209.76Å 90.00°　　90.00°　　90.00°	Depositor
Resolution (Å)	26.43　–　2.07 28.65　–　2.07	Depositor EDS
% Data completeness (in resolution range)	99.6 (26.43-2.07) 99.9 (28.65-2.07)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.03 (at 2.06Å)	Xtriage
Refinement program	PHENIX 1.20.1_4487	Depositor
R, R_{free}	0.192　,　0.214 0.192　,　0.215	Depositor DCC
R_{free} test set	3120 reflections (4.66%)	wwPDB-VP
Wilson B-factor (Å^2)	35.5	Xtriage
Anisotropy	0.269	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.37 , 46.3	EDS
L-test for twinning[2]	$< |L| > = 0.50, < L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	7012	wwPDB-VP
Average B, all atoms (Å^2)	41.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.02% of the height of the origin peak. No significant pseudotranslation is detected.*

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[1]Intensities estimated from amplitudes.

[2]Theoretical values of $< |L| >$, $< L^2 >$ 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	0.43	0/899	0.65	0/1218
1	C	0.51	0/904	0.63	0/1225
2	B	0.43	0/853	0.72	1/1158 (0.1%)
2	D	0.47	0/846	0.73	2/1149 (0.2%)
3	E	0.44	0/1578	0.58	0/2149
3	F	0.44	0/1592	0.63	0/2169
All	All	0.45	0/6672	0.65	3/9068 (0.0%)

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	D	95	PRO	N-CA-C	-6.02	96.45	112.10
2	D	90	LEU	CB-CG-CD2	5.92	121.06	111.00
2	B	95	PRO	N-CA-C	-5.75	97.15	112.10

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	882	0	852	7	0
1	C	887	0	857	3	0
2	B	833	0	823	10	0
2	D	827	0	816	10	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	E	1533	0	1451	15	0
3	F	1545	0	1457	17	0
4	A	57	0	0	0	0
4	B	71	0	0	1	0
4	C	87	0	0	0	0
4	D	64	0	0	1	0
4	E	107	0	0	0	0
4	F	119	0	0	2	0
All	All	7012	0	6256	53	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 4.

All (53) 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:12:VAL:HG22	1:A:16:GLU:HB2	1.73	0.71
3:E:362:VAL:HG13	3:E:527:PRO:HD2	1.73	0.69
2:D:22:THR:HG22	2:D:72:THR:HG22	1.75	0.68
3:F:377:PHE:CD1	3:F:434:ILE:HG12	2.30	0.66
2:B:24:ARG:NH1	3:F:374:PHE:O	2.29	0.66
1:C:30:SER:HB3	1:C:73:ASN:ND2	2.14	0.62
3:E:386:LYS:HE3	3:E:390:LEU:HD21	1.80	0.62
3:F:362:VAL:HG13	3:F:527:PRO:HD2	1.81	0.62
3:E:362:VAL:HG13	3:E:526:GLY:HA2	1.83	0.60
3:F:372:ALA:C	3:F:374:PHE:H	2.05	0.59
2:D:94:TYR:O	2:D:96:VAL:N	2.36	0.58
3:E:443:SER:O	3:E:444:LYS:HE2	2.04	0.57
1:A:50:VAL:HG21	2:B:94:TYR:CZ	2.39	0.57
2:B:94:TYR:O	2:B:96:VAL:N	2.37	0.57
3:F:364:ASP:O	3:F:367:VAL:HG22	2.05	0.56
2:D:45:LYS:HD2	4:D:227:HOH:O	2.06	0.56
3:F:377:PHE:HD1	3:F:434:ILE:HG12	1.72	0.55
3:E:364:ASP:O	3:E:367:VAL:HG22	2.07	0.54
1:A:12:VAL:HG11	1:A:85:LEU:HD13	1.88	0.54
3:F:376:THR:HG22	4:F:669:HOH:O	2.08	0.53
2:D:34:ALA:HB2	2:D:91:LEU:HD21	1.91	0.53
3:E:368:LEU:HD22	3:E:377:PHE:HE2	1.73	0.52
3:F:371:SER:O	3:F:372:ALA:HB3	2.09	0.52
2:D:94:TYR:C	2:D:96:VAL:N	2.65	0.49
3:E:368:LEU:HD22	3:E:377:PHE:CE2	2.49	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:37:GLN:HB2	2:B:47:LEU:HD11	1.96	0.47
3:F:357:ARG:NH1	3:F:359:SER:OG	2.44	0.47
3:F:391:CYS:HB3	3:F:522:ALA:HB1	1.97	0.46
3:F:354:ASN:O	3:F:398:ASP:HA	2.15	0.46
2:B:2:ILE:CD1	2:B:27:GLN:HB2	2.46	0.46
2:D:95:PRO:HG2	4:F:718:HOH:O	2.16	0.46
3:E:503:VAL:HG12	2:D:0:MET:CE	2.48	0.44
3:E:376:THR:HG23	2:D:3:GLN:OE1	2.17	0.44
3:F:372:ALA:C	3:F:374:PHE:N	2.70	0.44
1:A:47:TRP:CG	2:B:96:VAL:HB	2.54	0.43
1:C:29:VAL:HG13	1:C:34:MET:HG3	2.00	0.43
2:B:7:PHE:HA	2:B:8:PRO:C	2.39	0.43
2:D:37:GLN:HB2	2:D:47:LEU:HD11	2.00	0.43
3:F:368:LEU:O	3:F:371:SER:HB3	2.18	0.43
3:F:369:TYR:HA	3:F:374:PHE:CD2	2.53	0.43
1:A:33:TYR:HB3	2:B:94:TYR:OH	2.19	0.43
3:E:374:PHE:O	3:E:375:SER:C	2.57	0.43
1:C:100:SER:HB3	3:F:455:LEU:HD11	2.01	0.42
1:A:50:VAL:HG21	2:B:94:TYR:CE1	2.54	0.42
3:E:412:PRO:HG3	3:E:429:PHE:HB3	2.02	0.42
2:B:27:GLN:NE2	4:B:205:HOH:O	2.52	0.41
3:E:503:VAL:HG12	2:D:0:MET:HE1	2.01	0.41
1:A:66:ARG:HG2	1:A:83:ASN:O	2.19	0.41
3:E:342:PHE:CZ	3:E:368:LEU:HD11	2.55	0.41
3:E:354:ASN:O	3:E:398:ASP:HA	2.21	0.40
3:F:412:PRO:HG3	3:F:429:PHE:HB3	2.02	0.40
3:E:376:THR:O	3:E:434:ILE:HA	2.22	0.40
3:F:379:CYS:HA	3:F:432:CYS:HA	2.04	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	114/117 (97%)	113 (99%)	1 (1%)	0	100	100
1	C	115/117 (98%)	113 (98%)	2 (2%)	0	100	100
2	B	106/108 (98%)	101 (95%)	4 (4%)	1 (1%)	17	8
2	D	106/108 (98%)	100 (94%)	6 (6%)	0	100	100
3	E	194/195 (100%)	183 (94%)	9 (5%)	2 (1%)	15	6
3	F	194/195 (100%)	185 (95%)	9 (5%)	0	100	100
All	All	829/840 (99%)	795 (96%)	31 (4%)	3 (0%)	34	25

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
3	E	375	SER
3	E	373	SER
2	B	95	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	95/95 (100%)	95 (100%)	0	100	100
1	C	95/95 (100%)	95 (100%)	0	100	100
2	B	92/92 (100%)	90 (98%)	2 (2%)	52	46
2	D	91/92 (99%)	91 (100%)	0	100	100
3	E	167/168 (99%)	167 (100%)	0	100	100
3	F	168/168 (100%)	168 (100%)	0	100	100
All	All	708/710 (100%)	706 (100%)	2 (0%)	92	93

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	B	93	SER
2	B	94	TYR

![Worldwide Protein Data Bank logo]

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	13	GLN
2	B	3	GLN
1	C	73	ASN
3	F	343	ASN
3	F	450	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 ⓘ

There are no monosaccharides in this entry.

5.6 Ligand geometry ⓘ

There are no ligands in this entry.

5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

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(Å²)	Q<0.9
1	A	116/117 (99%)	0.63	13 (11%)	5	5	29, 40, 62, 90	0
1	C	117/117 (100%)	0.21	2 (1%)	70	71	26, 33, 50, 78	0
2	B	108/108 (100%)	0.05	3 (2%)	53	56	25, 33, 50, 69	0
2	D	108/108 (100%)	0.25	5 (4%)	32	33	27, 37, 58, 78	0
3	E	195/195 (100%)	1.04	42 (21%)	0	0	28, 40, 90, 121	0
3	F	195/195 (100%)	0.76	28 (14%)	2	2	25, 36, 79, 100	0
All	All	839/840 (99%)	0.57	93 (11%)	5	5	25, 37, 73, 121	0

All (93) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	E	333	THR	8.2
2	D	94	TYR	7.8
3	E	372	ALA	7.4
3	E	519	HIS	6.9
2	B	94	TYR	6.8
1	A	117	SER	6.6
3	E	374	PHE	6.2
3	F	333	THR	5.7
3	E	518	LEU	5.7
3	E	345	THR	5.4
3	F	335	LEU	5.4
3	F	518	LEU	5.4
3	E	521	PRO	5.3
3	E	527	PRO	5.0
3	F	527	PRO	4.9
3	F	519	HIS	4.7
3	E	346	ARG	4.7
1	A	13	GLN	4.1
3	E	520	ALA	4.1

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Mol	Chain	Res	Type	RSRZ
3	F	334	ASN	4.0
3	F	517	LEU	3.9
3	E	371	SER	3.9
3	F	367	VAL	3.8
1	A	100	SER	3.8
1	C	118	ALA	3.8
3	E	523	THR	3.7
3	E	368	LEU	3.6
3	F	343	ASN	3.5
3	F	370	ASN	3.5
1	A	11	LEU	3.5
3	F	520	ALA	3.4
3	E	335	LEU	3.4
3	E	455	LEU	3.3
3	E	369	TYR	3.3
3	F	374	PHE	3.3
3	F	526	GLY	3.3
3	E	492	LEU	3.2
3	F	362	VAL	3.2
1	A	115	VAL	3.2
1	A	116	SER	3.1
3	E	366	SER	3.0
3	E	513	LEU	3.0
2	D	95	PRO	3.0
3	E	517	LEU	3.0
3	E	522	ALA	3.0
1	A	37	VAL	2.9
3	E	441	LEU	2.9
3	E	389	ASP	2.8
1	C	117	SER	2.8
2	D	107	LYS	2.8
3	E	377	PHE	2.7
3	F	441	LEU	2.7
3	F	478	THR	2.7
3	F	341	VAL	2.6
3	F	369	TYR	2.6
3	E	370	ASN	2.6
2	D	1	ASP	2.6
3	E	376	THR	2.6
3	E	367	VAL	2.5
1	A	86	ARG	2.5
1	A	12	VAL	2.5

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Mol	Chain	Res	Type	RSRZ
3	E	526	GLY	2.5
2	B	95	PRO	2.5
1	A	65	GLY	2.5
3	E	525	CYS	2.5
3	E	512	VAL	2.5
3	E	479	PRO	2.5
1	A	14	PRO	2.5
3	E	444	LYS	2.5
1	A	15	GLY	2.5
3	E	364	ASP	2.5
3	F	521	PRO	2.5
3	E	343	ASN	2.4
3	E	360	ASN	2.4
3	F	440[A]	ASN	2.4
1	A	74	SER	2.4
3	E	478	THR	2.4
3	F	444	LYS	2.4
3	E	491	PRO	2.3
3	E	334	ASN	2.3
3	F	372	ALA	2.3
3	F	445	VAL	2.3
3	F	522	ALA	2.3
3	E	453	TYR	2.3
3	F	364	ASP	2.2
2	D	96	VAL	2.1
2	B	107	LYS	2.1
3	F	373	SER	2.1
3	F	455	LEU	2.1
3	E	449	TYR	2.1
3	E	452	LEU	2.1
3	F	433	VAL	2.0
3	E	396	TYR	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 monosaccharides in this entry.

6.4 Ligands ⓘ

There are no ligands in this entry.

6.5 Other polymers ⓘ

There are no such residues in this entry.