WORLDWIDE wwPDB PROTEIN DATA BANK

Full wwPDB X-ray Structure Validation Report ⓘ

Jun 24, 2024 – 09:43 PM EDT

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PDB ID	:	6E9Q
Title	:	The crystal structure of bovine ultralong antibody BOV-6
Authors	:	Dong, J.; Crowe, J.E.
Deposited on	:	2018-08-01
Resolution	:	3.40 Å(reported)

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 3.40 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.
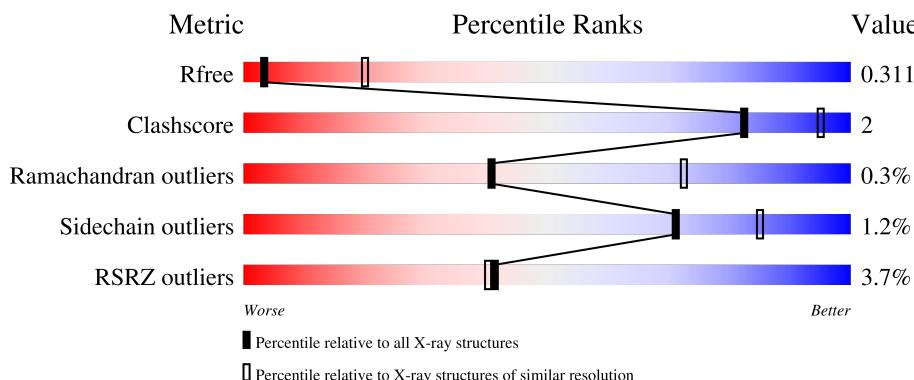
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	1026 (3.48-3.32)
Clashscore	141614	1055 (3.48-3.32)
Ramachandran outliers	138981	1038 (3.48-3.32)
Sidechain outliers	138945	1038 (3.48-3.32)
RSRZ outliers	127900	2173 (3.50-3.30)

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 <=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	263	3% / 81% 6% 13%
1	C	263	2% / 85% 8% 7%
1	E	263	5% / 81% • 15%
1	G	263	7% / 77% 6% 17%
2	B	216	% / 94% 5%

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Full wwPDB X-ray Structure Validation Report

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Mol	Chain	Length	Quality of chain
2	D	216	91% 8%
2	F	216	94% 6%
2	H	216	75% 21%

2 Entry composition ⓘ

There are 2 unique types of molecules in this entry. The entry contains 11743 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 Bovine ultralong antibody BOV-6 heavy chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	229	Total	C	N	O	S	0	0	0
			1537	957	272	298	10			
1	C	245	Total	C	N	O	S	0	0	0
			1689	1058	290	328	13			
1	E	224	Total	C	N	O	S	0	0	0
			1552	969	263	310	10			
1	G	219	Total	C	N	O	S	0	0	0
			1406	875	251	271	9			

- Molecule 2 is a protein called Bovine ultralong antibody BOV-6 light chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	215	Total	C	N	O	S	0	0	0
			1511	931	257	318	5			
2	D	214	Total	C	N	O	S	0	0	0
			1494	918	251	320	5			
2	F	215	Total	C	N	O	S	0	0	0
			1541	947	262	327	5			
2	H	170	Total	C	N	O	S	0	0	0
			1013	610	181	218	4			

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	1	GLU	GLN	conflict	UNP Q3T101
B	5	ASN	THR	conflict	UNP Q3T101
B	82	ALA	PRO	conflict	UNP Q3T101
D	1	GLU	GLN	conflict	UNP Q3T101
D	5	ASN	THR	conflict	UNP Q3T101
D	82	ALA	PRO	conflict	UNP Q3T101
F	1	GLU	GLN	conflict	UNP Q3T101
F	5	ASN	THR	conflict	UNP Q3T101

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Chain	Residue	Modelled	Actual	Comment	Reference
F	82	ALA	PRO	conflict	UNP Q3T101
H	1	GLU	GLN	conflict	UNP Q3T101
H	5	ASN	THR	conflict	UNP Q3T101
H	82	ALA	PRO	conflict	UNP Q3T101

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 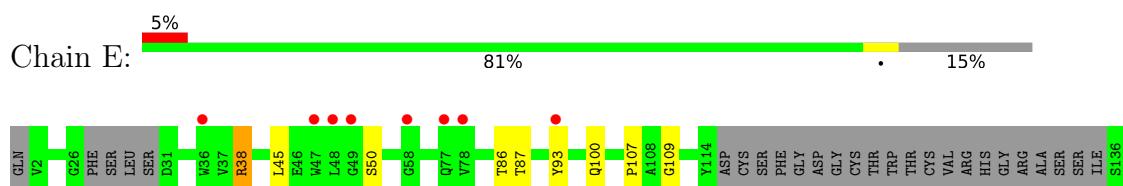second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates 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.

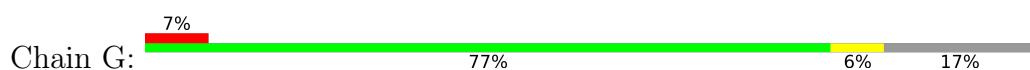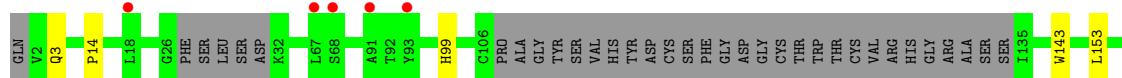• Molecule 1: Bovine ultralong antibody BOV-6 heavy chain

Chain A:

• Molecule 1: Bovine ultralong antibody BOV-6 heavy chain

Chain C:

• Molecule 1: Bovine ultralong antibody BOV-6 heavy chain

Chain E:

• Molecule 1: Bovine ultralong antibody BOV-6 heavy chain

Chain G:

GLN V2 Q3 P14 L18 G26 PHE SER LEU SER ASP K32 L67 S68 A91 T92 Y93 H99 C106 PRO ALA GLY TYR SER VAL HIS TYR ASP CYS SER PHE GLY ASP GLY CYS THR TRP THR CYS VAL ARG HIS GLY ARG ALA SER SER T135 W143 L153

S157 S160 P164 Y167 P168 L169 S170 C173 GLY ASP LYS SER SER SER THR V181 T182 L183 Y190 M191 P192 E193 P194 A213 S225 G231 S232 T233 F238 H244 P245 A246 K258 S259 C260 ASP GLY SER

• Molecule 2: Bovine ultralong antibody BOV-6 light chain

Chain B:
%
94%   5%

GLU A2 T22 S28 N32 G33 Y34 R63 S69 T74 S78 D95 N99 L137 L183 S197 S217

• Molecule 2: Bovine ultralong antibody BOV-6 light chain

Chain D:
%
91%   8%

GLU A2 Q6 G13 S14 S27 S28 N32 G33 D53 R68 A73 D87 Y88 S98 P118 F123 L140 V152 Q172 E199 H202 C216 SER

• Molecule 2: Bovine ultralong antibody BOV-6 light chain

Chain F:
%
94%   6%

GLU A2 G16 S27 G31 Y34 P46 D53 R68 N71 S79 K171 S175 S217

• Molecule 2: Bovine ultralong antibody BOV-6 light chain

Chain H:
5%
75%   21%

GLU A2 Q6 S12 GLY SER LEU GLY GLN ARG V19 G25 G43 SER A45 D62 ARG PHE SER GLY SER ARG S69 I77 SER LEU Q81 Y88 A93 E94 V110 LEU GLY GLN P114 K115 S116 V120 P124 N131 GLY ASN LYS ALA T136 D143

F144 Y145 T150 VAL VAL TRP LYS ALA D156 T159 I160 THR ARG ASN V164 T167 Y177 A178 Y182 LEU SER L185 T186 W190 K191 SER LYS GLY SER TYR S197 T210 VAL LYS PRO SER GLU CYS SER

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	64.04Å 72.69Å 452.86Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	23.69 – 3.40 48.83 – 3.40	Depositor EDS
% Data completeness (in resolution range)	100.0 (23.69-3.40) 100.0 (48.83-3.40)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	4.16 (at 3.40Å)	Xtriage
Refinement program	PHENIX (1.14_3211: ???)	Depositor
R, R_{free}	0.254 , 0.311 0.254 , 0.311	Depositor DCC
R_{free} test set	1464 reflections (4.83%)	wwPDB-VP
Wilson B-factor (Å^2)	90.7	Xtriage
Anisotropy	0.405	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.30 , 77.0	EDS
L-test for twinning[2]	$< |L| > = 0.48, < L^2 > = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.86	EDS
Total number of atoms	11743	wwPDB-VP
Average B, all atoms (Å^2)	89.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.93% 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	0.24	0/1568	0.45	0/2148
1	C	0.25	0/1728	0.45	0/2366
1	E	0.24	0/1583	0.45	0/2169
1	G	0.25	0/1437	0.47	0/1977
2	B	0.24	0/1541	0.43	0/2108
2	D	0.25	0/1524	0.43	0/2085
2	F	0.24	0/1571	0.44	0/2144
2	H	0.24	0/1022	0.43	0/1398
All	All	0.24	0/11974	0.45	0/16395

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	G	0	1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	G	191	MET	Peptide

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	1537	0	1277	8	0
1	C	1689	0	1442	13	0
1	E	1552	0	1351	6	0
1	G	1406	0	1037	9	0
2	B	1511	0	1360	7	0
2	D	1494	0	1327	12	0
2	F	1541	0	1431	7	0
2	H	1013	0	667	4	0
All	All	11743	0	9892	54	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 2.

All (54) 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:C:107:PRO:HB2	1:G:3:GLN:HE22	1.43	0.83
1:C:209:HIS:HD2	2:D:172:GLN:HB3	1.59	0.67
1:C:39:GLN:HB2	1:C:45:LEU:HD23	1.76	0.67
1:A:11:LEU:HD13	1:A:192:PRO:HG3	1.83	0.60
1:A:140:THR:HA	2:B:32:ASN:HD21	1.67	0.58
1:C:164:PRO:HB3	1:C:190:TYR:HB3	1.85	0.58
1:E:50:SER:OG	1:E:100:GLN:OE1	2.15	0.58
1:C:47:TRP:NE1	2:D:98:SER:O	2.39	0.54
1:A:164:PRO:HB3	1:A:190:TYR:HB3	1.90	0.53
1:G:164:PRO:HB3	1:G:190:TYR:HB3	1.90	0.53
1:C:209:HIS:CD2	2:D:172:GLN:HB3	2.42	0.53
1:A:4:LEU:HD21	1:A:95:CYS:HB3	1.92	0.52
2:F:27:SER:HA	2:F:31:GLY:HA3	1.94	0.50
1:G:99:HIS:O	1:G:143:TRP:HA	2.11	0.50
1:G:183:LEU:HD12	1:G:238:PHE:HD2	1.77	0.49
1:E:45:LEU:H	1:E:45:LEU:HD23	1.78	0.49
2:D:6:GLN:NE2	2:D:88:TYR:O	2.39	0.48
1:G:244:HIS:CE1	1:G:246:ALA:HB3	2.48	0.48
1:C:107:PRO:HB2	1:G:3:GLN:NE2	2.19	0.48
1:G:14:PRO:HD3	1:G:157:SER:O	2.14	0.48
1:C:195:VAL:HG12	1:C:223:LEU:HD21	1.95	0.48
1:C:66:ARG:NH1	1:C:89:ASP:OD2	2.44	0.47
1:C:97:THR:O	1:C:146:ASP:N	2.47	0.47
2:B:22:THR:HG22	2:B:74:THR:HG22	1.96	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:F:53:ASP:OD2	2:F:68:ARG:NE	2.34	0.46
1:G:193:GLU:N	1:G:194:PRO:CD	2.79	0.46
1:E:107:PRO:O	1:E:109:GLY:N	2.43	0.46
1:A:244:HIS:CE1	1:A:246:ALA:HB3	2.51	0.45
2:D:123:PHE:HE2	2:D:140:LEU:HD12	1.80	0.45
1:G:153:LEU:HD21	1:G:193:GLU:OE1	2.16	0.45
1:E:38:ARG:NH1	1:E:93:TYR:OH	2.49	0.45
1:A:131:ARG:HE	1:A:131:ARG:HB2	1.63	0.44
2:B:137:LEU:HB2	2:B:183:LEU:HB3	1.99	0.44
2:D:118:PRO:HD3	2:D:202:HIS:CD2	2.53	0.44
1:A:140:THR:HA	2:B:32:ASN:ND2	2.31	0.44
2:H:6:GLN:NE2	2:H:88:TYR:O	2.47	0.44
2:D:32:ASN:OD1	2:D:33:GLY:N	2.51	0.44
2:D:118:PRO:HD3	2:D:202:HIS:HD2	1.83	0.43
2:H:116:SER:N	2:H:145:TYR:O	2.49	0.43
2:B:28:SER:N	2:D:28:SER:OG	2.51	0.43
2:B:95:ASP:OD2	2:D:27:SER:OG	2.36	0.43
2:F:2:ALA:N	2:H:25:GLY:O	2.52	0.43
2:D:68:ARG:HA	2:D:73:ALA:HA	2.01	0.42
1:A:66:ARG:NH1	1:A:89:ASP:OD2	2.51	0.42
2:F:71:ASN:ND2	2:H:94:GLU:OE2	2.52	0.42
1:C:196:THR:O	1:C:242:VAL:HA	2.19	0.42
1:E:148:TRP:CD2	2:F:46:PRO:HB2	2.54	0.41
2:F:16:GLY:HA2	2:F:79:SER:HA	2.02	0.41
1:C:112:VAL:HA	1:C:126:CYS:SG	2.60	0.41
2:B:63:ARG:HB3	2:B:78:SER:O	2.21	0.41
2:F:171:LYS:HZ3	2:F:175:SER:HA	1.86	0.41
1:C:51:ILE:HD13	1:C:71:GLN:HB2	2.02	0.40
2:D:152:VAL:HG23	2:D:199:GLU:HB3	2.03	0.40
1:E:86:THR:OG1	1:E:87:THR:N	2.55	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	217/263 (82%)	201 (93%)	16 (7%)	0	100	100
1	C	237/263 (90%)	219 (92%)	17 (7%)	1 (0%)	34	67
1	E	214/263 (81%)	202 (94%)	11 (5%)	1 (0%)	29	61
1	G	211/263 (80%)	197 (93%)	12 (6%)	2 (1%)	17	49
2	B	213/216 (99%)	201 (94%)	12 (6%)	0	100	100
2	D	212/216 (98%)	204 (96%)	7 (3%)	1 (0%)	29	61
2	F	213/216 (99%)	197 (92%)	16 (8%)	0	100	100
2	H	148/216 (68%)	137 (93%)	11 (7%)	0	100	100
All	All	1665/1916 (87%)	1558 (94%)	102 (6%)	5 (0%)	41	72

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	E	192	PRO
1	G	192	PRO
1	C	107	PRO
1	G	160	SER
2	D	53	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	130/224 (58%)	126 (97%)	4 (3%)	40	68
1	C	154/224 (69%)	152 (99%)	2 (1%)	69	84
1	E	147/224 (66%)	146 (99%)	1 (1%)	84	92
1	G	94/224 (42%)	93 (99%)	1 (1%)	73	86
2	B	156/184 (85%)	154 (99%)	2 (1%)	69	84
2	D	154/184 (84%)	153 (99%)	1 (1%)	86	94

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
2	F	169/184 (92%)	168 (99%)	1 (1%)	86	94
2	H	63/184 (34%)	62 (98%)	1 (2%)	62	81
All	All	1067/1632 (65%)	1054 (99%)	13 (1%)	71	85

All (13) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	3	GLN
1	A	67	LEU
1	A	107	PRO
1	A	209	HIS
2	B	34	TYR
2	B	69	SER
1	C	114	TYR
1	C	124	TRP
2	D	87	ASP
1	E	38	ARG
2	F	34	TYR
1	G	191	MET
2	H	143	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	G	3	GLN

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 (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	229/263 (87%)	0.21	8 (3%)	44	43	55, 85, 141, 195	0
1	C	245/263 (93%)	0.22	6 (2%)	59	57	52, 73, 149, 203	0
1	E	224/263 (85%)	0.36	14 (6%)	20	21	67, 95, 148, 168	0
1	G	219/263 (83%)	0.43	18 (8%)	11	13	63, 105, 163, 271	0
2	B	215/216 (99%)	0.04	3 (1%)	75	74	49, 64, 99, 148	0
2	D	214/216 (99%)	0.15	2 (0%)	84	83	50, 72, 107, 134	0
2	F	215/216 (99%)	0.24	2 (0%)	84	83	60, 84, 119, 204	0
2	H	170/216 (78%)	0.49	11 (6%)	18	20	66, 117, 173, 198	0
All	All	1731/1916 (90%)	0.26	64 (3%)	41	40	49, 85, 148, 271	0

All (64) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	G	232	SER	6.8
2	F	2	ALA	6.0
1	E	181	VAL	5.9
1	A	30	SER	5.2
1	G	183	LEU	4.9
1	E	77	GLN	4.7
1	E	230	PRO	4.4
2	H	159	THR	4.3
1	G	231	GLY	4.3
2	H	167	THR	4.0
1	C	108	ALA	3.9
1	E	229	VAL	3.6
1	G	167	TYR	3.6
2	H	178	ALA	3.6
1	C	34	VAL	3.5
1	G	233	THR	3.4

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Mol	Chain	Res	Type	RSRZ
2	H	186	THR	3.3
1	G	259	SER	3.2
2	F	217	SER	3.2
2	H	124	PRO	3.1
1	C	260	CYS	3.1
1	E	78	VAL	3.1
2	H	185	LEU	3.0
1	A	31	ASP	3.0
1	C	204	LEU	3.0
2	H	190	TRP	2.9
1	A	144	TYR	2.8
1	A	259	SER	2.7
2	B	99	ASN	2.7
1	C	36	TRP	2.6
2	H	120	VAL	2.6
2	H	93	ALA	2.6
1	E	47	TRP	2.6
1	G	68	SER	2.6
1	G	213	ALA	2.6
2	B	217	SER	2.6
1	C	53	THR	2.5
1	E	58	GLY	2.4
1	E	93	TYR	2.4
1	G	170	SER	2.4
1	G	18	LEU	2.3
2	B	197	SER	2.3
1	A	143	TRP	2.3
1	G	91	ALA	2.3
1	E	255	VAL	2.3
1	G	173	CYS	2.3
1	A	238	PHE	2.2
1	A	33	ALA	2.2
1	G	168	PRO	2.2
2	D	14	SER	2.2
1	G	258	LYS	2.2
1	E	159	ALA	2.2
1	G	182	THR	2.2
1	E	49	GLY	2.2
1	E	172	CYS	2.1
1	E	36	TRP	2.1
2	H	177	TYR	2.1
2	H	94	GLU	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	240	CYS	2.1
1	E	48	LEU	2.1
1	G	67	LEU	2.1
2	D	13	GLY	2.1
1	G	225	SER	2.0
1	G	93	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.