



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 11:16 AM UTC

PDB ID : 6UJ0 / pdb_00006uj0
Title : Unbound BACE2 mutant structure
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Deposited on : 2019-10-01
Resolution : 2.15 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

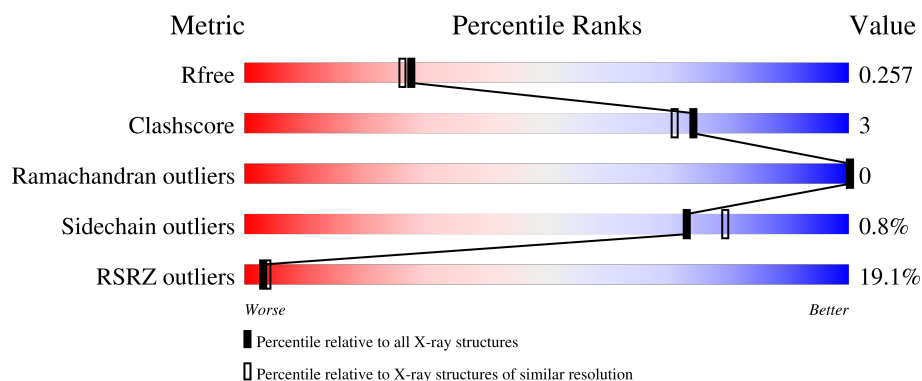
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.15 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	2057 (2.16-2.16)
Clashscore	190562	2159 (2.16-2.16)
Ramachandran outliers	187476	2134 (2.16-2.16)
Sidechain outliers	187428	2133 (2.16-2.16)
RSRZ outliers	180081	2059 (2.16-2.16)

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	460	15% 74% 6% 20%
1	B	460	16% 74% 6% 20%
2	C	7	100%
2	D	7	71% 29%

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 5918 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 Beta-secretase 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	367	Total	C	N	O	S	0	0	0
			2844	1837	452	542	13			
1	B	367	Total	C	N	O	S	0	0	0
			2842	1837	453	540	12			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	269	ALA	GLU	engineered mutation	UNP Q9Y5Z0
B	269	ALA	GLU	engineered mutation	UNP Q9Y5Z0

- Molecule 2 is a protein called unidentified polypeptide.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	C	7	Total	C	N	O	0	0	0
			35	21	7	7			
2	D	5	Total	C	N	O	0	0	0
			25	15	5	5			

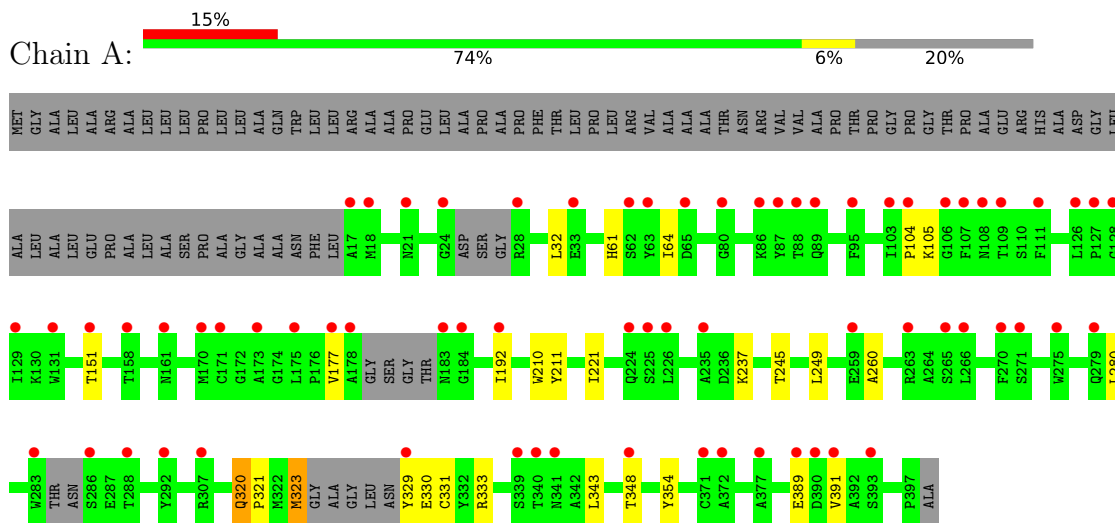
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	99	Total	O	0	0
			99	99		
3	B	71	Total	O	0	0
			71	71		
3	C	1	Total	O	0	0
			1	1		
3	D	1	Total	O	0	0
			1	1		

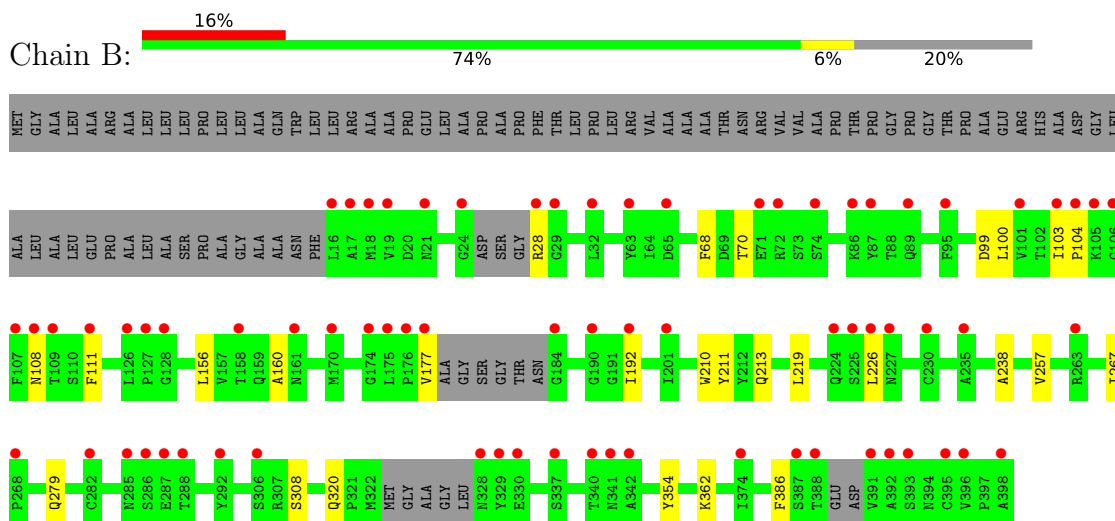
3 Residue-property plots

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: Beta-secretase 2



• Molecule 1: Beta-secretase 2



• Molecule 2: unidentified polypeptide



There are no outlier residues recorded for this chain.

- Molecule 2: unidentified polypeptide

Chain D:  71% 29%



4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	46.60Å 58.98Å 84.56Å 113.39° 93.67° 96.38°	Depositor
Resolution (Å)	28.04 – 2.15 28.04 – 2.15	Depositor EDS
% Data completeness (in resolution range)	97.0 (28.04-2.15) 97.5 (28.04-2.15)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.65 (at 2.14Å)	Xtriage
Refinement program	PHENIX 1.16_3549, PHENIX 1.16_3549	Depositor
R, R_{free}	0.220 , 0.258 0.220 , 0.257	Depositor DCC
R_{free} test set	2200 reflections (4.90%)	wwPDB-VP
Wilson B-factor (Å ²)	34.2	Xtriage
Anisotropy	0.630	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.38 , 45.0	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	0.95	EDS
Total number of atoms	5918	wwPDB-VP
Average B, all atoms (Å ²)	45.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.48% 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	0.51	0/2914	0.54	4/3962 (0.1%)
1	B	0.50	0/2912	0.54	5/3961 (0.1%)
All	All	0.50	0/5826	0.54	9/7923 (0.1%)

There are no bond length outliers.

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	320	GLN	N-CA-C	8.42	121.83	109.62
1	B	320	GLN	N-CA-C	7.96	119.67	109.72
1	B	28	ARG	CA-C-N	7.27	127.25	120.34
1	B	28	ARG	C-N-CA	7.27	127.25	120.34
1	A	320	GLN	CA-C-N	7.04	127.02	119.76
1	A	320	GLN	C-N-CA	7.04	127.02	119.76
1	B	279	GLN	N-CA-C	6.28	119.41	109.50
1	A	237	LYS	N-CA-C	5.73	117.81	108.76
1	B	267	ILE	CB-CA-C	-5.31	105.15	110.89

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	2844	0	2770	19	0
1	B	2842	0	2775	16	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	C	35	0	9	0	0
2	D	25	0	8	0	0
3	A	99	0	0	2	0
3	B	71	0	0	0	0
3	C	1	0	0	0	0
3	D	1	0	0	0	0
All	All	5918	0	5562	35	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 3.

All (35) 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:320:GLN:HE22	1:A:348:THR:HG21	1.27	0.97
1:B:111:PHE:HE1	1:B:160:ALA:HB2	1.49	0.77
1:A:320:GLN:HE22	1:A:348:THR:CG2	1.97	0.75
1:B:103:ILE:O	1:B:103:ILE:HD12	1.87	0.74
1:B:111:PHE:CE1	1:B:160:ALA:HB2	2.34	0.62
1:A:280:LEU:HD22	1:A:333:ARG:HB3	1.87	0.57
1:A:320:GLN:NE2	1:A:348:THR:CG2	2.67	0.56
1:A:329:TYR:C	1:A:329:TYR:CD1	2.85	0.54
1:A:320:GLN:NE2	1:A:348:THR:HG21	2.09	0.54
1:B:104:PRO:HA	1:B:108:ASN:HB3	1.90	0.52
1:A:245:THR:O	1:A:348:THR:HG23	2.11	0.51
1:B:210:TRP:CG	1:B:211:TYR:H	2.29	0.51
1:A:151:THR:HG23	3:A:404:HOH:O	2.11	0.50
1:A:210:TRP:CG	1:A:211:TYR:H	2.31	0.48
1:B:111:PHE:CE1	1:B:156:LEU:HD12	2.48	0.48
1:A:323:MET:HE1	1:A:331:CYS:SG	2.54	0.47
1:A:192:ILE:HG23	1:A:354:TYR:HE2	1.80	0.47
1:A:104:PRO:O	1:A:105:LYS:HD3	2.15	0.47
1:A:330:GLU:OE1	3:A:401:HOH:O	2.21	0.44
1:B:219:LEU:CB	1:B:226:LEU:HD12	2.48	0.44
1:A:320:GLN:HA	1:A:321:PRO:HD3	1.61	0.43
1:A:61:HIS:HB3	1:A:64:ILE:HG12	2.00	0.43
1:A:323:MET:HB2	1:A:323:MET:HE2	1.61	0.43
1:A:249:LEU:HD23	1:A:343:LEU:HG	2.01	0.43
1:B:219:LEU:HB3	1:B:226:LEU:HD12	2.01	0.42
1:B:68:PHE:CE2	1:B:70:THR:HG22	2.55	0.42
1:B:308:SER:N	1:B:386:PHE:O	2.53	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:32:LEU:HD23	1:A:32:LEU:H	1.84	0.42
1:A:221:ILE:HD12	1:A:260:ALA:HB3	2.02	0.41
1:B:99:ASP:OD1	1:B:100:LEU:N	2.48	0.41
1:B:213:GLN:HA	1:B:238:ALA:O	2.20	0.41
1:B:226:LEU:HD11	1:B:257:VAL:HG22	2.02	0.41
1:B:210:TRP:CD1	1:B:211:TYR:H	2.39	0.41
1:B:362:LYS:HE2	1:B:362:LYS:HB3	1.96	0.41
1:B:192:ILE:HG23	1:B:354:TYR:HE2	1.86	0.41

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	357/460 (78%)	349 (98%)	8 (2%)	0	100	100
1	B	357/460 (78%)	350 (98%)	7 (2%)	0	100	100
All	All	714/920 (78%)	699 (98%)	15 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	A	308/368 (84%)	304 (99%)	4 (1%)	61	68

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	B	308/368 (84%)	307 (100%)	1 (0%)	86	91
All	All	616/736 (84%)	611 (99%)	5 (1%)	73	79

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	177	VAL
1	A	323	MET
1	A	389	GLU
1	A	391	VAL
1	B	177	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	161	ASN
1	A	320	GLN
1	A	361	GLN
1	B	123	ASN
1	B	361	GLN
1	B	394	ASN

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	367/460 (79%)	1.09	68 (18%) 3 4	24, 41, 71, 95	0
1	B	367/460 (79%)	1.27	72 (19%) 3 4	28, 45, 77, 107	0
2	C	0/7	-	-	-	-
2	D	0/7	-	-	-	-
All	All	734/934 (78%)	1.18	140 (19%) 3 4	24, 43, 73, 107	0

All (140) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	288	THR	6.0
1	B	230	CYS	5.3
1	A	17	ALA	5.2
1	B	16	LEU	5.1
1	A	390	ASP	5.1
1	B	104	PRO	5.0
1	B	17	ALA	4.7
1	B	225	SER	4.6
1	B	24	GLY	4.5
1	B	341	ASN	4.5
1	B	65	ASP	4.3
1	A	391	VAL	4.2
1	B	103	ILE	4.2
1	A	372	ALA	4.2
1	B	286	SER	4.1
1	B	398	ALA	4.1
1	B	329	TYR	4.1
1	A	107	PHE	3.9
1	A	62	SER	3.8
1	A	28	ARG	3.8
1	B	340	THR	3.7
1	B	391	VAL	3.7

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Mol	Chain	Res	Type	RSRZ
1	B	108	ASN	3.7
1	A	329	TYR	3.7
1	A	86	LYS	3.6
1	A	288	THR	3.6
1	B	107	PHE	3.6
1	A	21	ASN	3.6
1	B	227	ASN	3.6
1	B	268	PRO	3.5
1	A	177	VAL	3.5
1	A	348	THR	3.5
1	B	393	SER	3.5
1	B	89	GLN	3.5
1	B	176	PRO	3.4
1	B	177	VAL	3.4
1	B	263	ARG	3.4
1	A	175	LEU	3.4
1	B	175	LEU	3.4
1	B	18	MET	3.3
1	A	224	GLN	3.3
1	B	226	LEU	3.3
1	A	286	SER	3.2
1	B	388	THR	3.2
1	A	109	THR	3.2
1	B	395	CYS	3.2
1	B	161	ASN	3.2
1	B	235	ALA	3.1
1	B	105	LYS	3.1
1	A	270	PHE	3.1
1	A	183	ASN	3.1
1	A	63	TYR	3.1
1	A	95	PHE	3.0
1	A	24	GLY	3.0
1	A	235	ALA	2.9
1	A	108	ASN	2.9
1	B	63	TYR	2.9
1	A	283	TRP	2.9
1	A	266	LEU	2.9
1	A	158	THR	2.9
1	A	104	PRO	2.9
1	B	396	VAL	2.9
1	B	328	ASN	2.9
1	B	29	GLY	2.9

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Mol	Chain	Res	Type	RSRZ
1	B	127	PRO	2.8
1	A	65	ASP	2.8
1	B	109	THR	2.8
1	B	190	GLY	2.8
1	A	341	ASN	2.8
1	A	89	GLN	2.8
1	B	128	GLY	2.8
1	A	377	ALA	2.8
1	A	226	LEU	2.7
1	A	106	GLY	2.7
1	A	151	THR	2.7
1	B	19	VAL	2.7
1	A	307	ARG	2.7
1	B	111	PHE	2.6
1	B	170	MET	2.6
1	A	292	TYR	2.6
1	A	389	GLU	2.6
1	B	392	ALA	2.6
1	B	28	ARG	2.6
1	B	374	ILE	2.6
1	B	306	SER	2.6
1	A	87	TYR	2.5
1	B	21	ASN	2.5
1	B	224	GLN	2.5
1	B	106	GLY	2.5
1	A	339	SER	2.4
1	A	184	GLY	2.4
1	A	279	GLN	2.4
1	A	371	CYS	2.4
1	A	271	SER	2.4
1	B	126	LEU	2.4
1	A	18	MET	2.4
1	A	33	GLU	2.4
1	B	72	ARG	2.4
1	B	101	VAL	2.4
1	B	287	GLU	2.3
1	A	263	ARG	2.3
1	A	129	ILE	2.3
1	A	225	SER	2.3
1	A	265	SER	2.3
1	B	387	SER	2.3
1	A	127	PRO	2.3

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Mol	Chain	Res	Type	RSRZ
1	A	171	CYS	2.3
1	A	111	PHE	2.3
1	A	88	THR	2.3
1	B	87	TYR	2.3
1	B	86	LYS	2.3
1	B	192	ILE	2.3
1	A	161	ASN	2.3
1	B	282	CYS	2.3
1	A	80	GLY	2.3
1	A	259	GLU	2.2
1	A	131	TRP	2.2
1	A	178	ALA	2.2
1	B	292	TYR	2.2
1	B	74	SER	2.2
1	A	103	ILE	2.2
1	B	95	PHE	2.1
1	A	128	GLY	2.1
1	B	337	SER	2.1
1	A	173	ALA	2.1
1	B	342	ALA	2.1
1	B	330	GLU	2.1
1	B	201	ILE	2.1
1	A	275	TRP	2.1
1	A	393	SER	2.1
1	B	285	ASN	2.1
1	A	340	THR	2.1
1	B	158	THR	2.1
1	A	192	ILE	2.1
1	A	126	LEU	2.0
1	B	71	GLU	2.0
1	A	170	MET	2.0
1	B	32	LEU	2.0
1	B	174	GLY	2.0
1	B	184	GLY	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.