WORLDWIDE wwPDB PROTEIN DATA BANK

Full wwPDB X-ray Structure Validation Report (i)

Oct 30, 2023 – 01:21 PM JST

PDB ID	:	5AZS
Title	:	Crystal structure of a membrane protein from Pseudomonas aeruginosa
Authors	:	Yonehara, R.; Yamashita, E.; Nakagawa, A.
Deposited on	:	2015-10-21
Resolution	:	3.10 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	:	2.36
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)	:	2.36

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 3.10 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.
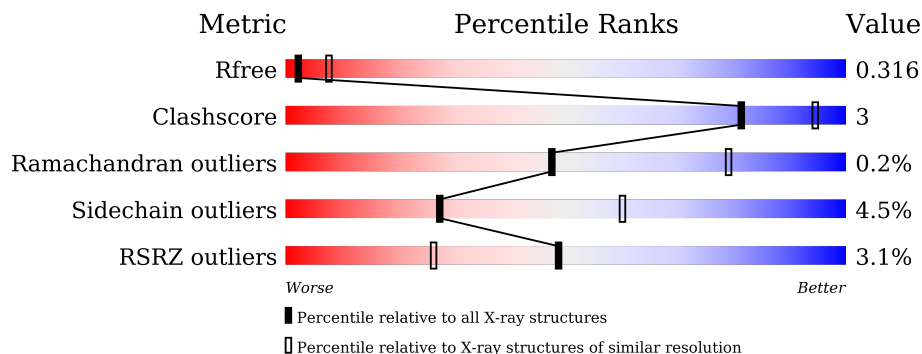
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	1094 (3.10-3.10)
Clashscore	141614	1184 (3.10-3.10)
Ramachandran outliers	138981	1141 (3.10-3.10)
Sidechain outliers	138945	1141 (3.10-3.10)
RSRZ outliers	127900	1067 (3.10-3.10)

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	468	3% 83% 8% 8%
1	B	468	3% 85% 7% 7%
1	C	468	3% 84% 11% 5%

2 Entry composition ⓘ

There is only 1 type of molecule in this entry. The entry contains 10096 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 Outer membrane protein OprJ.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	430	Total	C	N	O	S	0	0	0
			3315	2053	621	637	4			
1	B	435	Total	C	N	O	S	0	0	0
			3347	2072	626	645	4			
1	C	446	Total	C	N	O	S	0	0	0
			3434	2126	643	661	4			

There are 24 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	461	GLY	-	expression tag	UNP Q51397
A	462	SER	-	expression tag	UNP Q51397
A	463	HIS	-	expression tag	UNP Q51397
A	464	HIS	-	expression tag	UNP Q51397
A	465	HIS	-	expression tag	UNP Q51397
A	466	HIS	-	expression tag	UNP Q51397
A	467	HIS	-	expression tag	UNP Q51397
A	468	HIS	-	expression tag	UNP Q51397
B	461	GLY	-	expression tag	UNP Q51397
B	462	SER	-	expression tag	UNP Q51397
B	463	HIS	-	expression tag	UNP Q51397
B	464	HIS	-	expression tag	UNP Q51397
B	465	HIS	-	expression tag	UNP Q51397
B	466	HIS	-	expression tag	UNP Q51397
B	467	HIS	-	expression tag	UNP Q51397
B	468	HIS	-	expression tag	UNP Q51397
C	461	GLY	-	expression tag	UNP Q51397
C	462	SER	-	expression tag	UNP Q51397
C	463	HIS	-	expression tag	UNP Q51397
C	464	HIS	-	expression tag	UNP Q51397
C	465	HIS	-	expression tag	UNP Q51397
C	466	HIS	-	expression tag	UNP Q51397
C	467	HIS	-	expression tag	UNP Q51397

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| Chain	Residue	Modelled	Actual	Comment	Reference
C	468	HIS	-	expression tag	UNP Q51397

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.
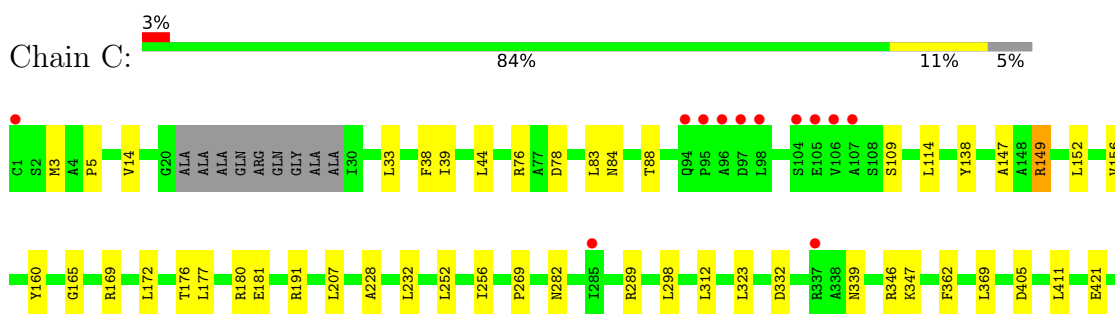
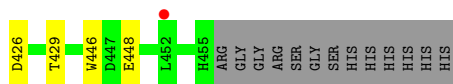- Molecule 1: Outer membrane protein OprJ
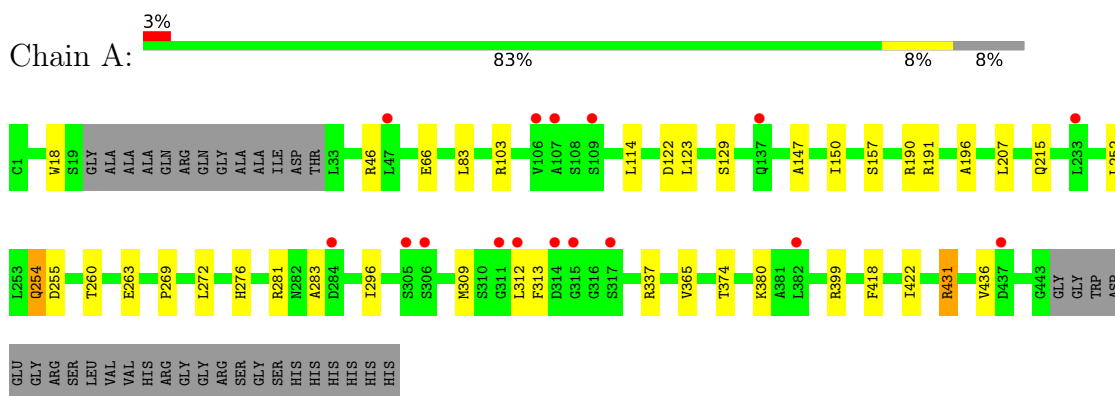
Chain A:

- Molecule 1: Outer membrane protein OprJ

Chain B:

- Molecule 1: Outer membrane protein OprJ

Chain C:
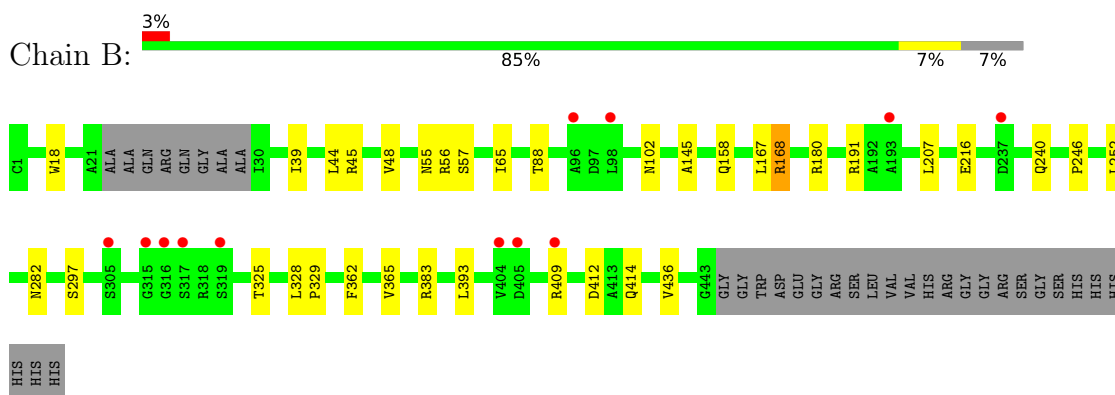
4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	86.33Å 92.39Å 252.76Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	50.00 – 3.10 45.44 – 3.10	Depositor EDS
% Data completeness (in resolution range)	97.2 (50.00-3.10) 97.2 (45.44-3.10)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.83 (at 3.12Å)	Xtriage
Refinement program	REFMAC 5.8.0131	Depositor
R, R_{free}	0.269 , 0.307 0.279 , 0.316	Depositor DCC
R_{free} test set	1807 reflections (4.95%)	wwPDB-VP
Wilson B-factor (Å^2)	88.5	Xtriage
Anisotropy	0.205	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.28 , 43.8	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	0.89	EDS
Total number of atoms	10096	wwPDB-VP
Average B, all atoms (Å^2)	114.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.75% 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	0.40	0/3362	0.66	0/4548
1	B	0.40	0/3394	0.67	0/4592
1	C	0.39	0/3484	0.67	1/4714 (0.0%)
All	All	0.40	0/10240	0.67	1/13854 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	C	149	ARG	NE-CZ-NH2	5.43	123.02	120.30

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	3315	0	3309	19	0
1	B	3347	0	3339	14	0
1	C	3434	0	3417	24	0
All	All	10096	0	10065	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 3.

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:18:TRP:CZ2	1:A:365:VAL:HG21	2.34	0.62
1:C:228:ALA:O	1:C:232:LEU:HD12	2.00	0.61
1:B:18:TRP:HH2	1:B:362:PHE:HA	1.68	0.58
1:A:252:LEU:HD22	1:A:436:VAL:HG22	1.86	0.58
1:A:129:SER:OG	1:A:283:ALA:O	2.23	0.57
1:C:44:LEU:HD13	1:C:160:TYR:CD2	2.39	0.57
1:B:329:PRO:HA	1:C:84:ASN:HB3	1.89	0.54
1:A:123:LEU:HD22	1:A:296:ILE:HD12	1.89	0.53
1:C:147:ALA:HB2	1:C:269:PRO:HB2	1.92	0.51
1:C:172:LEU:HD21	1:C:421:GLU:HB3	1.93	0.51
1:C:165:GLY:HA3	1:C:429:THR:HG21	1.93	0.49
1:A:272:LEU:O	1:A:276:HIS:ND1	2.43	0.49
1:A:157:SER:OG	1:A:436:VAL:HG11	2.13	0.48
1:C:38:PHE:CE1	1:C:256:ILE:HD11	2.49	0.48
1:A:254:GLN:HE21	1:A:254:GLN:CA	2.26	0.48
1:B:329:PRO:HA	1:C:84:ASN:CB	2.43	0.48
1:B:167:LEU:HD11	1:B:246:PRO:HB3	1.95	0.48
1:A:260:THR:HB	1:A:263:GLU:HG3	1.96	0.47
1:A:254:GLN:HE21	1:A:254:GLN:HA	1.78	0.47
1:A:190:ARG:CB	1:A:196:ALA:HB2	2.45	0.47
1:C:3:MET:O	1:C:289:ARG:NH1	2.45	0.47
1:B:55:ASN:OD1	1:B:56:ARG:N	2.48	0.46
1:B:325:THR:HG23	1:C:88:THR:HG22	1.97	0.46
1:C:33:LEU:HD11	1:C:38:PHE:CA	2.45	0.46
1:C:5:PRO:O	1:C:282:ASN:ND2	2.48	0.45
1:C:180:ARG:HD2	1:C:207:LEU:HB3	1.98	0.45
1:A:254:GLN:HG3	1:A:431:ARG:NH2	2.32	0.45
1:B:207:LEU:HD11	1:B:414:GLN:HG3	1.99	0.44
1:A:150:ILE:HD12	1:A:269:PRO:HG2	1.99	0.44
1:A:18:TRP:CZ2	1:A:365:VAL:CG2	3.00	0.44
1:C:83:LEU:HD21	1:C:114:LEU:HD22	2.00	0.43
1:C:176:THR:O	1:C:180:ARG:HG2	2.18	0.43
1:B:18:TRP:CH2	1:B:365:VAL:HB	2.54	0.43
1:B:39:ILE:HG23	1:B:44:LEU:HD23	2.01	0.43
1:C:169:ARG:NE	1:C:426:ASP:OD1	2.50	0.43
1:A:374:THR:HG23	1:B:216:GLU:HB3	2.01	0.42
1:B:393:LEU:HD22	1:B:414:GLN:HA	2.01	0.42
1:C:149:ARG:NH1	1:C:448:GLU:HG3	2.34	0.42
1:B:167:LEU:HD12	1:B:168:ARG:N	2.35	0.42
1:C:14:VAL:HG11	1:C:362:PHE:CD1	2.55	0.42
1:A:418:PHE:CZ	1:A:422:ILE:HD11	2.56	0.41
1:C:38:PHE:CE2	1:C:252:LEU:HD23	2.54	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:190:ARG:HB3	1:A:196:ALA:HB2	2.02	0.41
1:C:39:ILE:HG23	1:C:44:LEU:HD23	2.03	0.41
1:C:152:LEU:O	1:C:156:VAL:HG23	2.20	0.41
1:C:177:LEU:O	1:C:181:GLU:HG3	2.21	0.41
1:C:207:LEU:HD21	1:C:411:LEU:HD12	2.02	0.41
1:B:65:ILE:HD11	1:B:145:ALA:CB	2.51	0.41
1:A:83:LEU:HD11	1:A:114:LEU:HB3	2.03	0.40
1:B:158:GLN:HG3	1:B:436:VAL:HG11	2.02	0.40
1:C:33:LEU:HD11	1:C:38:PHE:HA	2.02	0.40
1:A:147:ALA:HB2	1:A:269:PRO:HB2	2.02	0.40
1:A:190:ARG:HB2	1:A:196:ALA:HB2	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	426/468 (91%)	420 (99%)	6 (1%)	0	100	100
1	B	431/468 (92%)	422 (98%)	9 (2%)	0	100	100
1	C	442/468 (94%)	428 (97%)	12 (3%)	2 (0%)	29	64
All	All	1299/1404 (92%)	1270 (98%)	27 (2%)	2 (0%)	47	79

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	312	LEU
1	C	446	TRP

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	333/358 (93%)	316 (95%)	17 (5%)	24	56
1	B	336/358 (94%)	320 (95%)	16 (5%)	25	58
1	C	345/358 (96%)	332 (96%)	13 (4%)	33	66
All	All	1014/1074 (94%)	968 (96%)	46 (4%)	27	60

All (46) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	46	ARG
1	A	66	GLU
1	A	103	ARG
1	A	122	ASP
1	A	191	ARG
1	A	207	LEU
1	A	215	GLN
1	A	254	GLN
1	A	255	ASP
1	A	281	ARG
1	A	309	MET
1	A	312	LEU
1	A	313	PHE
1	A	337	ARG
1	A	380	LYS
1	A	399	ARG
1	A	431	ARG
1	B	45	ARG
1	B	48	VAL
1	B	57	SER
1	B	88	THR
1	B	102	ASN
1	B	168	ARG
1	B	180	ARG
1	B	191	ARG
1	B	240	GLN

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Mol	Chain	Res	Type
1	B	252	LEU
1	B	282	ASN
1	B	297	SER
1	B	328	LEU
1	B	383	ARG
1	B	409	ARG
1	B	412	ASP
1	C	76	ARG
1	C	78	ASP
1	C	109	SER
1	C	138	TYR
1	C	191	ARG
1	C	298	LEU
1	C	323	LEU
1	C	332	ASP
1	C	339	ASN
1	C	346	ARG
1	C	347	LYS
1	C	369	LEU
1	C	405	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	92	GLN
1	A	227	ASN
1	A	254	GLN
1	A	359	GLN
1	B	218	ASN
1	B	240	GLN
1	C	227	ASN
1	C	420	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(Å^2)	Q<0.9
1	A	430/468 (91%)	0.31	16 (3%)	41	21	91, 118, 156, 186	0
1	B	435/468 (92%)	0.30	12 (2%)	53	30	77, 107, 152, 176	0
1	C	446/468 (95%)	0.23	13 (2%)	51	28	77, 106, 141, 167	0
All	All	1311/1404 (93%)	0.28	41 (3%)	49	26	77, 111, 151, 186	0

All (41) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	316	GLY	4.0
1	B	319	SER	3.6
1	C	98	LEU	3.6
1	A	137	GLN	3.6
1	A	312	LEU	3.1
1	A	314	ASP	3.1
1	B	305	SER	3.1
1	A	437	ASP	3.1
1	B	98	LEU	2.9
1	C	1	CYS	2.9
1	C	94	GLN	2.7
1	C	104	SER	2.7
1	B	193	ALA	2.7
1	A	306	SER	2.6
1	B	409	ARG	2.6
1	C	106	VAL	2.6
1	C	96	ALA	2.6
1	A	315	GLY	2.5
1	A	233	LEU	2.5
1	A	305	SER	2.5
1	C	95	PRO	2.5
1	C	337	ARG	2.5
1	B	404	VAL	2.5

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Mol	Chain	Res	Type	RSRZ
1	B	315	GLY	2.5
1	C	285	ILE	2.5
1	C	107	ALA	2.4
1	A	107	ALA	2.4
1	B	317	SER	2.4
1	A	47	LEU	2.4
1	A	109	SER	2.3
1	C	105	GLU	2.2
1	C	452	LEU	2.2
1	A	284	ASP	2.2
1	B	237	ASP	2.2
1	B	96	ALA	2.1
1	A	106	VAL	2.1
1	A	317	SER	2.1
1	B	405	ASP	2.1
1	C	97	ASP	2.1
1	A	382	LEU	2.0
1	A	311	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 ⓘ

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.