



# wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 18, 2026 – 06:21 AM UTC

PDB ID : 1DOF / pdb\_00001dof  
Title : THE CRYSTAL STRUCTURE OF ADENYLOSUCCINATE LYASE FROM  
PYROBACULUM AEROPHILUM: INSIGHTS INTO THERMAL STABIL-  
ITY AND HUMAN PATHOLOGY  
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Deposited on : 1999-12-20  
Resolution : 2.10 Å(reported)

This is a wwPDB X-ray Structure Validation Summary Report for a publicly released PDB entry.

We welcome your comments at [validation@mail.wwpdb.org](mailto: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>.

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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

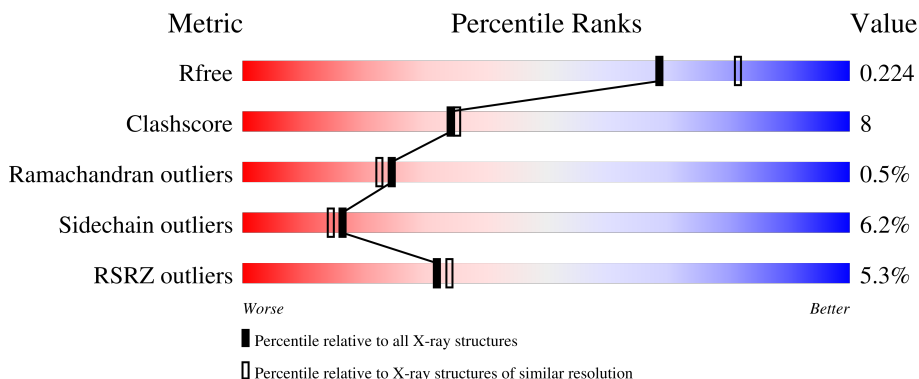
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.10 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))
$R_{free}$	180053	6658 (2.10-2.10)
Clashscore	190562	7164 (2.10-2.10)
Ramachandran outliers	187476	7099 (2.10-2.10)
Sidechain outliers	187428	7100 (2.10-2.10)
RSRZ outliers	180081	6662 (2.10-2.10)

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  $\geq 3$ , 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	403	 4% 74% 17% . .
1	B	403	 7% 69% 22% . . .
1	C	403	 4% 69% 21% 5% . .
1	D	403	 5% 68% 22% . . .

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 12664 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 ADENYLOSUCCINATE LYASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	385	2977	1900	522	543	12	0	0	0
1	B	385	2961	1890	520	539	12	0	0	0
1	C	385	2963	1892	518	541	12	0	0	0
1	D	385	2971	1896	520	543	12	0	0	0

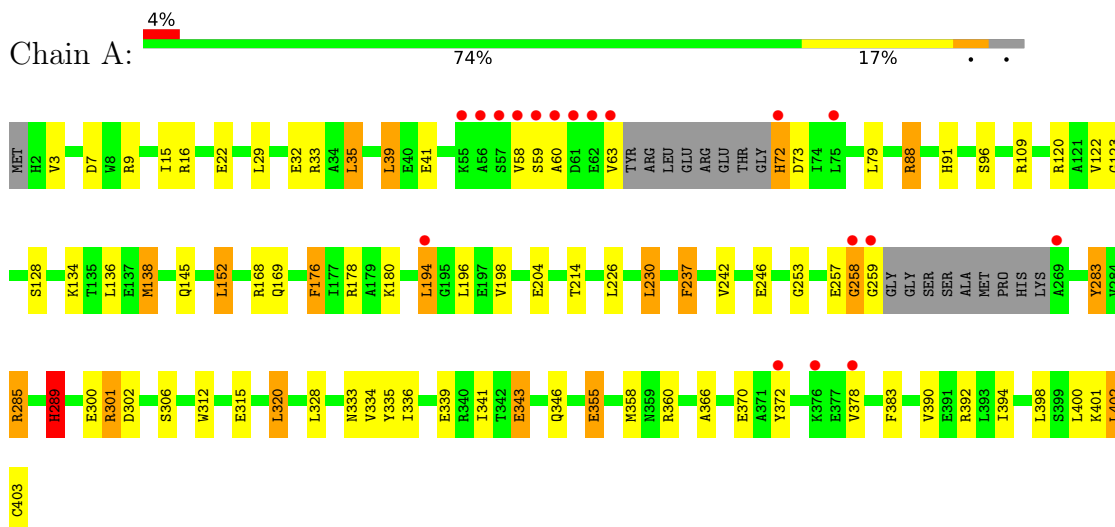
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	197	Total 197	O 197	0	0
2	B	198	Total 198	O 198	0	0
2	C	202	Total 202	O 202	0	0
2	D	195	Total 195	O 195	0	0

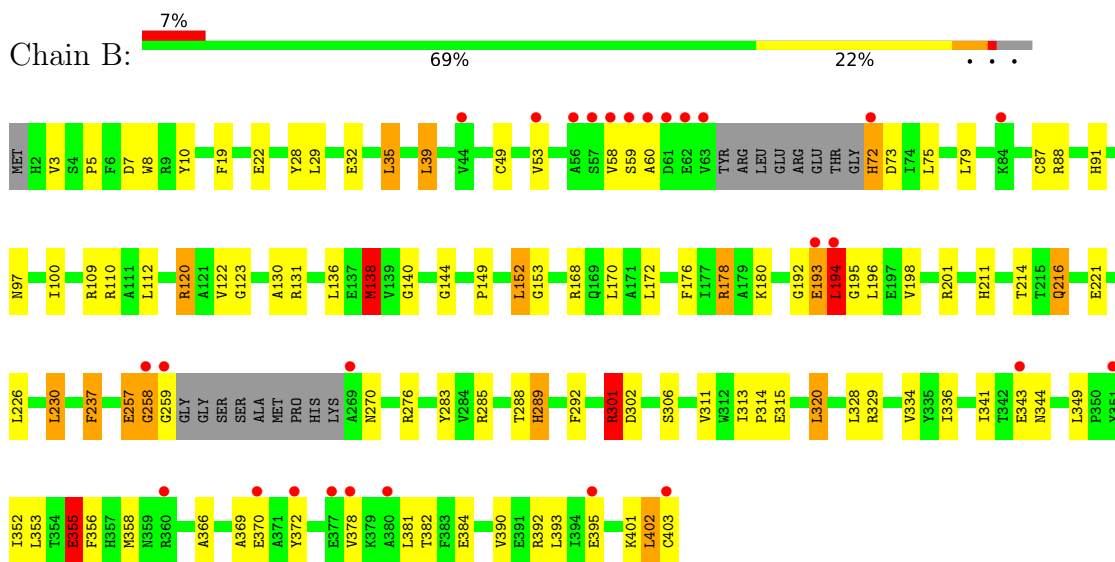
### 3 Residue-property plots

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: ADENYLOSUCCINATE LYASE

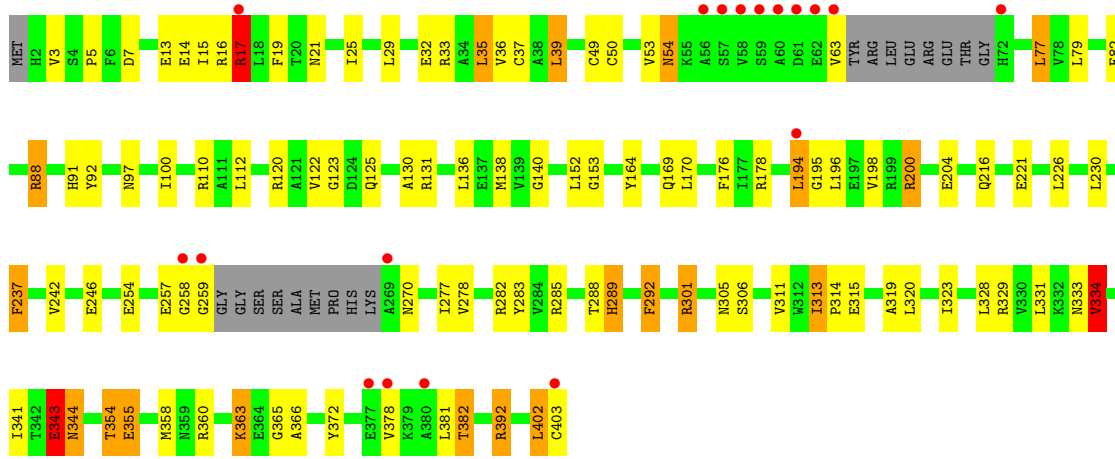


#### • Molecule 1: ADENYLOSUCCINATE LYASE

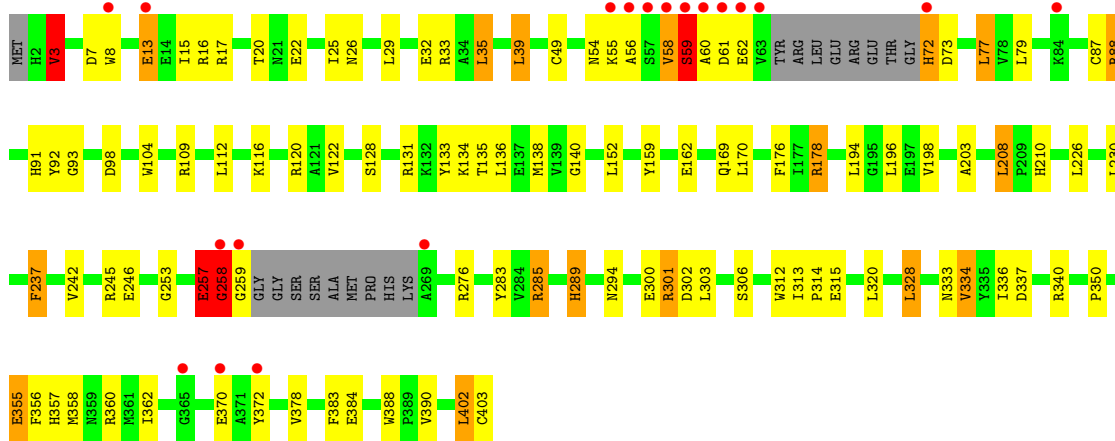


#### • Molecule 1: ADENYLOSUCCINATE LYASE





• Molecule 1: ADENYLOSUCCINATE LYASE



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	65.62Å 150.31Å 173.01Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	50.00 – 2.10 50.00 – 2.10	Depositor EDS
% Data completeness (in resolution range)	(Not available) (50.00-2.10) 99.8 (50.00-2.10)	Depositor EDS
$R_{merge}$	0.08	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	6.41 (at 2.10Å)	Xtrriage
Refinement program	REFMAC	Depositor
R, $R_{free}$	0.203 , 0.245 0.187 , 0.224	Depositor DCC
$R_{free}$ test set	5017 reflections (4.99%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	18.8	Xtrriage
Anisotropy	0.623	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.37 , 55.7	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.59$ , $\langle L^2 \rangle = 0.45$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	12664	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	23.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 46.91 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 1.0701e-04. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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	0.98	7/3028 (0.2%)	1.77	54/4109 (1.3%)
1	B	1.12	10/3012 (0.3%)	1.86	53/4090 (1.3%)
1	C	1.12	5/3014 (0.2%)	1.89	59/4093 (1.4%)
1	D	1.11	13/3022 (0.4%)	2.30	76/4102 (1.9%)
All	All	1.09	35/12076 (0.3%)	1.96	242/16394 (1.5%)

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	D	0	2

The worst 5 of 35 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	344	ASN	N-CA	26.56	1.78	1.46
1	B	259	GLY	N-CA	-22.25	1.09	1.45
1	D	59	SER	C-N	21.95	1.62	1.33
1	C	259	GLY	N-CA	-17.02	1.18	1.45
1	C	258	GLY	CA-C	-16.81	1.28	1.51

The worst 5 of 242 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	178	ARG	CD-NE-CZ	38.31	178.03	124.40
1	D	59	SER	O-C-N	35.34	163.20	123.27
1	B	258	GLY	O-C-N	31.31	163.40	122.70
1	D	59	SER	CA-C-N	-29.52	79.94	120.38
1	D	59	SER	C-N-CA	-29.52	79.94	120.38

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	D	257	GLU	Mainchain
1	D	72	HIS	Mainchain

## 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	2977	0	2952	35	3
1	B	2961	0	2932	45	0
1	C	2963	0	2926	59	0
1	D	2971	0	2941	54	3
2	A	197	0	0	1	0
2	B	198	0	0	3	3
2	C	202	0	0	2	3
2	D	195	0	0	4	0
All	All	12664	0	11751	169	6

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 8.

The worst 5 of 169 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:344:ASN:N	1:C:344:ASN:CA	1.78	1.42
1:D:13:GLU:HG2	2:D:549:HOH:O	1.13	1.26
1:C:17:ARG:HH11	1:C:17:ARG:HG2	1.21	1.06
1:C:343:GLU:C	1:C:344:ASN:CA	2.35	0.98
1:C:14:GLU:HA	1:C:17:ARG:NH1	1.84	0.92

The worst 5 of 6 symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:360:ARG:NH1	2:B:563:HOH:O[2_454]	0.60	1.60

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:360:ARG:CZ	2:B:563:HOH:O[2_454]	1.01	1.19
1:D:360:ARG:CZ	2:C:565:HOH:O[2_555]	1.14	1.06
1:D:360:ARG:NH1	2:C:565:HOH:O[2_555]	1.19	1.01
1:A:360:ARG:NH2	2:B:563:HOH:O[2_454]	1.73	0.47

## 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	379/403 (94%)	368 (97%)	10 (3%)	1 (0%)	36	36
1	B	379/403 (94%)	368 (97%)	9 (2%)	2 (0%)	24	22
1	C	379/403 (94%)	366 (97%)	12 (3%)	1 (0%)	36	36
1	D	379/403 (94%)	363 (96%)	13 (3%)	3 (1%)	16	12
All	All	1516/1612 (94%)	1465 (97%)	44 (3%)	7 (0%)	24	22

5 of 7 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	301	ARG
1	B	301	ARG
1	C	301	ARG
1	D	301	ARG
1	B	8	TRP

### 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	294/329 (89%)	280 (95%)	14 (5%)	23	23
1	B	292/329 (89%)	275 (94%)	17 (6%)	18	16
1	C	291/329 (88%)	271 (93%)	20 (7%)	14	12
1	D	293/329 (89%)	272 (93%)	21 (7%)	13	11
All	All	1170/1316 (89%)	1098 (94%)	72 (6%)	16	14

5 of 72 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	59	SER
1	D	388	TRP
1	D	79	LEU
1	D	226	LEU
1	B	230	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 22 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	145	GLN
1	D	91	HIS
1	C	333	ASN
1	D	169	GLN
1	B	125	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](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	D	1
1	B	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	D	59:SER	C	60:ALA	N	1.62
1	B	258:GLY	C	259:GLY	N	1.15

## 6 Fit of model and data [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	385/403 (95%)	-0.12	18 (4%) 36 38	10, 19, 47, 84	0
1	B	385/403 (95%)	-0.01	27 (7%) 22 24	9, 19, 48, 84	0
1	C	385/403 (95%)	-0.18	18 (4%) 36 38	10, 18, 50, 78	0
1	D	385/403 (95%)	-0.15	19 (4%) 35 37	10, 19, 42, 87	0
All	All	1540/1612 (95%)	-0.11	82 (5%) 32 34	9, 19, 47, 87	0

The worst 5 of 82 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	63	VAL	7.3
1	B	56	ALA	6.3
1	B	60	ALA	6.3
1	D	63	VAL	6.2
1	A	258	GLY	6.0

### 6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

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.