



# Full wwPDB X-ray Structure Validation Report ⓘ

Aug 20, 2020 – 09:19 AM BST

PDB ID : 6V8E  
Title : Computationally designed C3-symmetric homotrimer from TPR repeat protein  
Authors : Sankaran, B.; Ueda, G.; Zwart, P.H.; Baker, D.  
Deposited on : 2019-12-10  
Resolution : 2.53 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](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.

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

MolProbity : 4.02b-467  
Xtriage (Phenix) : 1.13  
EDS : 2.13  
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) : 2.13

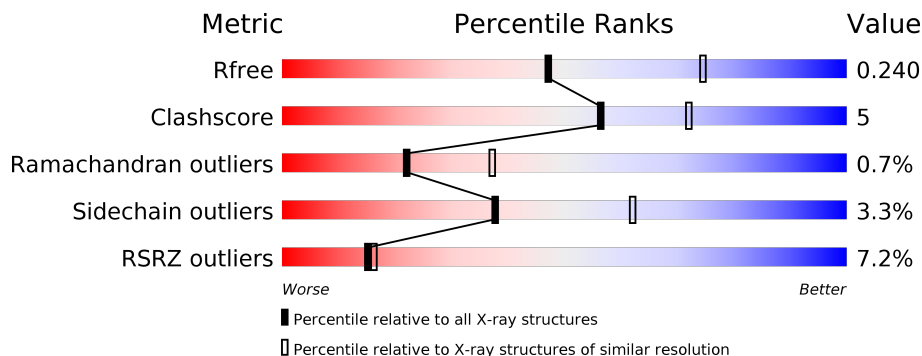
# 1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.53 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	5743 (2.54-2.50)
Clashscore	141614	6463 (2.54-2.50)
Ramachandran outliers	138981	6335 (2.54-2.50)
Sidechain outliers	138945	6337 (2.54-2.50)
RSRZ outliers	127900	5630 (2.54-2.50)

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 on 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	119	3% (Poor fit) 89% (Green) 8% (Yellow) . 1% (Orange) .
1	B	119	17% (Poor fit) 88% (Green) 8% (Yellow) . . . 1% (Orange) .
1	C	119	88% (Green) 12% (Yellow)
1	D	119	22% (Poor fit) 87% (Green) 8% (Yellow) . . . 1% (Orange) .
1	E	119	% (Poor fit) 83% (Green) 16% (Yellow) .
1	F	119	84% (Green) 15% (Yellow) .

## 2 Entry composition [i](#)

There are 2 unique types of molecules in this entry. The entry contains 5938 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 Designed protein.

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf	Trace	
			Total	C	N				O
1	A	119	978	621	161	196	0	0	0
1	B	117	965	614	158	193	0	0	0
1	C	119	979	621	161	197	0	0	0
1	D	118	974	619	160	195	0	0	0
1	E	118	980	623	161	196	0	1	0
1	F	119	978	621	161	196	0	0	0

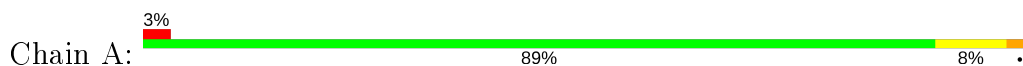
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	17	Total	O	0	0
			17	17		
2	B	10	Total	O	0	0
			10	10		
2	C	18	Total	O	0	0
			18	18		
2	D	8	Total	O	0	0
			8	8		
2	E	16	Total	O	0	0
			16	16		
2	F	15	Total	O	0	0
			15	15		

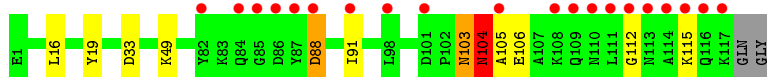
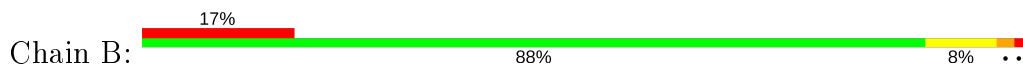
### 3 Residue-property plots [i](#)

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.

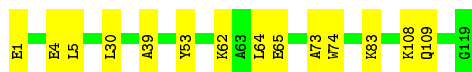
- Molecule 1: Designed protein



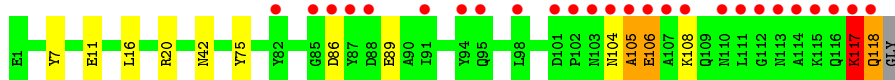
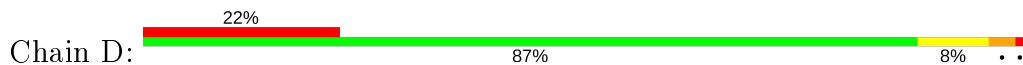
- Molecule 1: Designed protein



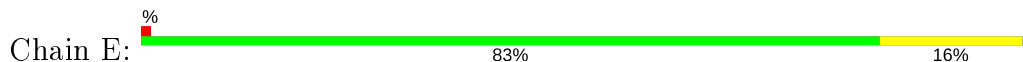
- Molecule 1: Designed protein



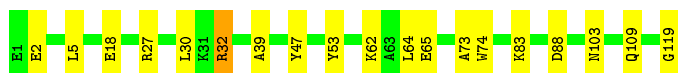
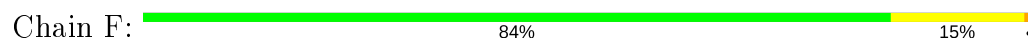
- Molecule 1: Designed protein



- Molecule 1: Designed protein



- Molecule 1: Designed protein



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	69.47Å 64.91Å 99.03Å 90.00° 106.33° 90.00°	Depositor
Resolution (Å)	38.87 – 2.53 38.87 – 2.53	Depositor EDS
% Data completeness (in resolution range)	99.9 (38.87-2.53) 99.9 (38.87-2.53)	Depositor EDS
$R_{merge}$	0.14	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.35 (at 2.54Å)	Xtrriage
Refinement program	REFMAC 5.8.0258	Depositor
R, $R_{free}$	0.186 , 0.232 0.195 , 0.240	Depositor DCC
$R_{free}$ test set	1442 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	37.1	Xtrriage
Anisotropy	0.428	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.37 , 45.1	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	5938	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	51.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 10.79% of the height of the origin peak. No significant pseudotranslation is detected.*

<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	0.65	1/1000 (0.1%)	0.76	0/1354
1	B	0.64	0/987	0.78	0/1337
1	C	0.74	0/1001	0.78	0/1354
1	D	0.64	0/996	0.81	0/1349
1	E	0.67	0/1005	0.75	0/1361
1	F	0.71	0/1000	0.80	1/1354 (0.1%)
All	All	0.68	1/5989 (0.0%)	0.78	1/8109 (0.0%)

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	B	0	1
1	D	0	1
All	All	0	2

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	119	GLY	C-O	5.70	1.32	1.23

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	F	88	ASP	CB-CG-OD2	-5.12	113.69	118.30

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	104	ASN	Peptide
1	D	105	ALA	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	978	0	913	11	0
1	B	965	0	902	11	0
1	C	979	0	913	8	0
1	D	974	0	910	8	0
1	E	980	0	918	11	0
1	F	978	0	913	12	0
2	A	17	0	0	2	0
2	B	10	0	0	1	0
2	C	18	0	0	0	0
2	D	8	0	0	1	0
2	E	16	0	0	1	0
2	F	15	0	0	1	0
All	All	5938	0	5469	56	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 5.

All (56) 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:F:27:ARG:NH2	1:F:47:TYR:OH	1.98	0.97
2:E:205:HOH:O	1:F:32:ARG:HD2	1.72	0.88
1:B:103:ASN:OD1	1:B:104:ASN:N	2.12	0.82
1:A:32:ARG:HH11	1:A:32:ARG:HG3	1.46	0.78
1:B:88:ASP:O	1:B:91:ILE:HG13	1.88	0.74
1:B:33:ASP:OD1	2:B:201:HOH:O	2.08	0.70
1:A:117:LYS:O	1:A:119:GLY:N	2.26	0.68
1:E:112:GLY:O	1:E:116:GLN:HG2	1.96	0.66
1:B:19:TYR:CZ	1:B:49:LYS:HG2	2.33	0.64
1:A:32:ARG:HG3	1:A:32:ARG:NH1	2.12	0.63

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:104:ASN:CG	1:B:104:ASN:O	2.38	0.62
1:D:105:ALA:O	1:D:108:LYS:N	2.30	0.61
1:B:88:ASP:O	1:B:91:ILE:CG1	2.47	0.61
1:E:82:TYR:OH	1:E:113:ASN:ND2	2.34	0.61
1:D:42:ASN:ND2	2:D:201:HOH:O	2.35	0.57
1:A:2:GLU:HB3	1:A:32:ARG:HH12	1.70	0.57
1:F:27:ARG:NH2	1:F:47:TYR:HH	2.02	0.54
1:C:53:TYR:CZ	1:C:83:LYS:HD2	2.43	0.53
1:F:53:TYR:CZ	1:F:83:LYS:HD2	2.44	0.53
1:E:15:LYS:HE2	1:F:18:GLU:OE1	2.10	0.52
1:F:2:GLU:HB3	1:F:32:ARG:NH1	2.26	0.51
1:C:1:GLU:OE1	1:C:1:GLU:N	2.37	0.50
1:A:16:LEU:HD11	1:B:16:LEU:HD13	1.93	0.49
1:B:112:GLY:HA2	1:B:115:LYS:HG2	1.94	0.49
1:F:119:GLY:O	2:F:201:HOH:O	2.20	0.48
1:A:6:ALA:HA	1:C:5:LEU:HD11	1.96	0.48
1:E:117:LYS:O	1:E:118:GLN:NE2	2.46	0.48
1:F:62:LYS:HA	1:F:65:GLU:OE1	2.14	0.48
1:C:64:LEU:HD21	1:C:73:ALA:HB3	1.96	0.47
1:C:62:LYS:HA	1:C:65:GLU:OE1	2.14	0.47
1:F:64:LEU:HD21	1:F:73:ALA:HB3	1.97	0.47
1:B:104:ASN:O	1:B:106:GLU:N	2.49	0.46
1:D:86:ASP:HB3	1:D:89:GLU:OE1	2.16	0.46
1:A:86:ASP:HB3	1:A:89:GLU:OE1	2.16	0.45
1:D:117:LYS:O	1:D:118:GLN:NE2	2.50	0.45
1:D:7:TYR:CE2	1:D:11:GLU:OE2	2.70	0.44
1:E:86:ASP:HB3	1:E:89:GLU:OE1	2.17	0.44
1:F:30:LEU:HD21	1:F:39:ALA:HB3	2.00	0.44
1:E:104:ASN:O	1:E:106:GLU:N	2.49	0.43
1:E:82:TYR:OH	1:E:113:ASN:CG	2.57	0.43
1:B:88:ASP:N	1:B:88:ASP:OD1	2.50	0.43
1:C:64:LEU:HD22	1:C:74:TRP:CE2	2.54	0.43
1:D:104:ASN:O	1:D:105:ALA:HB3	2.19	0.42
1:D:16:LEU:HD11	1:E:16:LEU:HD13	2.01	0.42
1:A:32:ARG:NH2	2:A:203:HOH:O	2.52	0.42
1:D:75:TYR:OH	1:D:106:GLU:HG2	2.20	0.42
1:A:117:LYS:C	1:A:119:GLY:H	2.23	0.42
1:C:30:LEU:HD21	1:C:39:ALA:HB3	2.01	0.41
1:B:19:TYR:OH	1:B:49:LYS:HG2	2.20	0.41
1:F:64:LEU:HD22	1:F:74:TRP:CE2	2.55	0.41
1:A:117:LYS:C	1:A:119:GLY:N	2.74	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:1:GLU:HA	1:F:103:ASN:HD21	1.86	0.41
1:A:15:LYS:NZ	2:A:204:HOH:O	2.54	0.41
1:E:30:LEU:HD21	1:E:39:ALA:HB3	2.03	0.40
1:E:64:LEU:HD21	1:E:73:ALA:HB3	2.04	0.40
1:E:104:ASN:O	1:E:105:ALA:HB3	2.21	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	117/119 (98%)	114 (97%)	1 (1%)	2 (2%)	9	15
1	B	115/119 (97%)	112 (97%)	2 (2%)	1 (1%)	17	30
1	C	117/119 (98%)	116 (99%)	1 (1%)	0	100	100
1	D	116/119 (98%)	111 (96%)	3 (3%)	2 (2%)	9	15
1	E	117/119 (98%)	115 (98%)	2 (2%)	0	100	100
1	F	117/119 (98%)	116 (99%)	1 (1%)	0	100	100
All	All	699/714 (98%)	684 (98%)	10 (1%)	5 (1%)	22	37

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	117	LYS
1	A	118	GLN
1	B	105	ALA
1	D	106	GLU
1	D	117	LYS

### 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	92/92 (100%)	88 (96%)	4 (4%)	29	50
1	B	91/92 (99%)	88 (97%)	3 (3%)	38	62
1	C	92/92 (100%)	89 (97%)	3 (3%)	38	62
1	D	92/92 (100%)	89 (97%)	3 (3%)	38	62
1	E	93/92 (101%)	91 (98%)	2 (2%)	52	75
1	F	92/92 (100%)	89 (97%)	3 (3%)	38	62
All	All	552/552 (100%)	534 (97%)	18 (3%)	38	62

All (18) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	20	ARG
1	A	31	LYS
1	A	99	GLU
1	A	118	GLN
1	B	88	ASP
1	B	103	ASN
1	B	104	ASN
1	C	4	GLU
1	C	108	LYS
1	C	109	GLN
1	D	20	ARG
1	D	117	LYS
1	D	118	GLN
1	E	108	LYS
1	E	109	GLN
1	F	5	LEU
1	F	32	ARG
1	F	109	GLN

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (9) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	42	ASN
1	A	118	GLN
1	B	42	ASN
1	B	61	GLN
1	B	69	ASN
1	C	61	GLN
1	C	95	GLN
1	D	35	ASN
1	E	103	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 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 [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	119/119 (100%)	0.33	4 (3%) 45 49	28, 45, 78, 96	0
1	B	117/119 (98%)	0.97	20 (17%) 1 1	27, 58, 123, 150	0
1	C	119/119 (100%)	0.05	0 100 100	30, 43, 66, 99	0
1	D	118/119 (99%)	0.79	26 (22%) 0 0	31, 51, 108, 130	0
1	E	118/119 (99%)	0.17	1 (0%) 86 88	26, 49, 82, 98	0
1	F	119/119 (100%)	0.03	0 100 100	29, 39, 64, 87	0
All	All	710/714 (99%)	0.39	51 (7%) 15 16	26, 45, 97, 150	0

All (51) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	114	ALA	6.8
1	B	115	LYS	6.3
1	D	112	GLY	5.6
1	B	82	TYR	5.1
1	B	88	ASP	4.7
1	B	116	GLN	4.7
1	B	87	TYR	4.7
1	B	85	GLY	4.7
1	B	91	ILE	4.6
1	D	107	ALA	4.5
1	D	111	LEU	4.0
1	B	112	GLY	4.0
1	D	104	ASN	3.9
1	B	110	ASN	3.8
1	D	102	PRO	3.8
1	D	114	ALA	3.7
1	D	115	LYS	3.6
1	B	111	LEU	3.5
1	D	105	ALA	3.4

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Mol	Chain	Res	Type	RSRZ
1	D	103	ASN	3.2
1	D	87	TYR	3.2
1	D	98	LEU	3.2
1	D	82	TYR	3.2
1	B	117	LYS	3.1
1	D	91	ILE	3.1
1	B	84	GLN	3.1
1	D	86	ASP	3.0
1	D	118	GLN	2.9
1	D	106	GLU	2.9
1	D	94	TYR	2.8
1	D	113	ASN	2.8
1	D	110	ASN	2.7
1	B	108	LYS	2.7
1	B	101	ASP	2.7
1	E	103	ASN	2.7
1	A	116	GLN	2.7
1	D	116	GLN	2.7
1	B	109	GLN	2.6
1	D	117	LYS	2.6
1	D	101	ASP	2.5
1	D	88	ASP	2.5
1	B	98	LEU	2.4
1	D	108	LYS	2.4
1	A	87	TYR	2.3
1	A	82	TYR	2.3
1	B	86	ASP	2.3
1	D	95	GLN	2.2
1	A	86	ASP	2.2
1	B	113	ASN	2.1
1	D	85	GLY	2.1
1	B	105	ALA	2.1

## 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 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.