



# Full wwPDB X-ray Structure Validation Report ⓘ

Sep 10, 2023 – 01:44 PM EDT

PDB ID : 4KSO  
Title : Crystal Structure of Circadian clock protein KaiB from S.Elongatus  
Authors : Pattanayek, R.; Egli, M.  
Deposited on : 2013-05-17  
Resolution : 2.62 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.

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 : 4.02b-467  
Xtriage (Phenix) : 1.13  
EDS : 2.35.1  
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) : 2.35.1

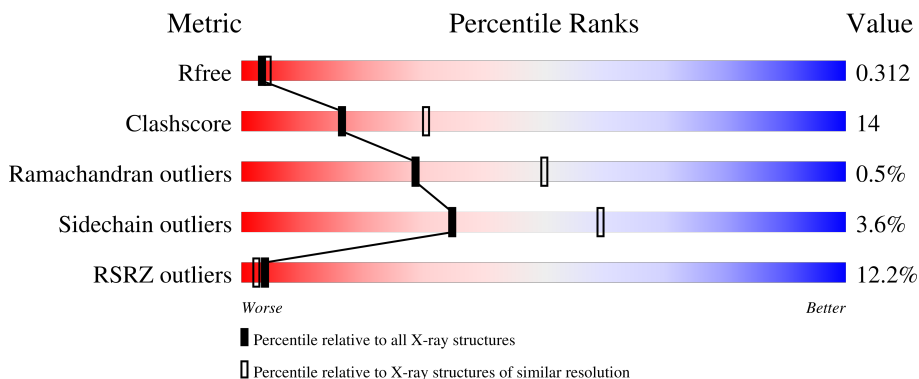
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.62 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	3797 (2.64-2.60)
Clashscore	141614	4168 (2.64-2.60)
Ramachandran outliers	138981	4093 (2.64-2.60)
Sidechain outliers	138945	4093 (2.64-2.60)
RSRZ outliers	127900	3731 (2.64-2.60)

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	102	 5% 67% 25% 7%
1	B	102	 18% 73% 26%
1	C	102	 9% 72% 24% 5%
1	D	102	 17% 70% 29%

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 3263 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 Circadian clock protein KaiB.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	C	102	Total	C	N	O	S	0	0	0
			805	521	133	150	1			
1	D	102	Total	C	N	O	S	0	0	0
			805	521	133	150	1			
1	A	95	Total	C	N	O		0	0	0
			745	483	122	140				
1	B	102	Total	C	N	O	S	0	0	0
			805	521	133	150	1			

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	C	23	Total	O	0	0
			23	23		
2	D	23	Total	O	0	0
			23	23		
2	A	36	Total	O	0	0
			36	36		
2	B	21	Total	O	0	0
			21	21		

### 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.

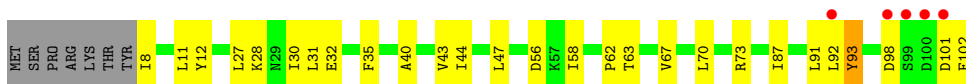
- Molecule 1: Circadian clock protein KaiB



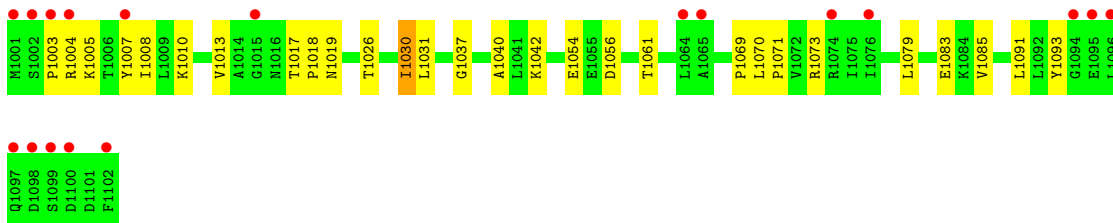
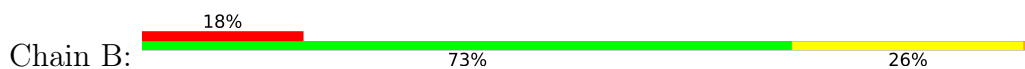
- Molecule 1: Circadian clock protein KaiB



- Molecule 1: Circadian clock protein KaiB



- Molecule 1: Circadian clock protein KaiB



## 4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	69.82Å 116.12Å 53.23Å 90.00° 98.28° 90.00°	Depositor
Resolution (Å)	29.69 – 2.62 29.69 – 2.62	Depositor EDS
% Data completeness (in resolution range)	71.0 (29.69-2.62) 51.1 (29.69-2.62)	Depositor EDS
$R_{merge}$	0.06	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.25 (at 2.61Å)	Xtrriage
Refinement program	PHENIX (phenix.refine: 1.8.2_1309)	Depositor
R, $R_{free}$	0.279 , 0.310 0.280 , 0.312	Depositor DCC
$R_{free}$ test set	423 reflections (4.71%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	38.5	Xtrriage
Anisotropy	1.031	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.33 , 53.6	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.47$ , $\langle L^2 \rangle = 0.30$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.89	EDS
Total number of atoms	3263	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	66.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 10.77% 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	0.25	0/754	0.55	0/1023
1	B	0.27	0/816	0.45	0/1106
1	C	0.25	0/816	0.54	0/1106
1	D	0.24	0/816	0.46	0/1106
All	All	0.25	0/3202	0.50	0/4341

There are no bond length outliers.

There are no bond angle outliers.

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	745	0	795	20	0
1	B	805	0	858	18	0
1	C	805	0	861	41	0
1	D	805	0	858	20	0
2	A	36	0	0	1	0
2	B	21	0	0	0	0
2	C	23	0	0	2	0
2	D	23	0	0	0	0
All	All	3263	0	3372	93	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 14.

All (93) 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:8:ILE:HG22	1:A:40:ALA:HB3	1.30	1.13
1:C:96:LEU:HG	1:C:100:ASP:O	1.57	1.04
1:C:99:SER:N	1:C:100:ASP:HA	1.92	0.84
1:C:96:LEU:HD21	1:C:99:SER:HB3	1.59	0.84
1:C:96:LEU:HD21	1:C:99:SER:CB	2.10	0.81
1:C:96:LEU:CG	1:C:100:ASP:O	2.36	0.73
1:C:97:GLN:NE2	2:C:215:HOH:O	2.21	0.69
1:C:98:ASP:C	1:C:100:ASP:HB3	2.14	0.68
1:C:57:LYS:NZ	1:A:91:LEU:O	2.26	0.67
1:A:70:LEU:HA	1:A:73:ARG:HB2	1.76	0.67
1:C:6:THR:OG1	1:C:7:TYR:N	2.28	0.66
1:C:87:ILE:HG22	1:C:88:GLY:H	1.62	0.64
1:A:28:LYS:NZ	1:A:32:GLU:OE2	2.29	0.64
1:C:14:ALA:HB2	1:C:87:ILE:HD11	1.78	0.62
1:D:1004:ARG:NH2	1:D:1097:GLN:O	2.32	0.62
1:C:64:LEU:HB3	1:C:89:LEU:HD11	1.81	0.62
1:C:98:ASP:CA	1:C:100:ASP:HB3	2.29	0.62
1:C:98:ASP:N	1:C:100:ASP:HB3	2.15	0.61
1:C:28:LYS:NZ	2:C:215:HOH:O	2.33	0.61
1:B:1003:PRO:HG3	1:B:1037:GLY:HA3	1.83	0.60
1:C:97:GLN:O	1:C:99:SER:N	2.31	0.60
1:C:31:LEU:HD12	1:C:41:LEU:HB2	1.83	0.60
1:B:1010:LYS:HG2	1:B:1042:LYS:HB3	1.84	0.59
1:C:41:LEU:O	1:C:97:GLN:NE2	2.38	0.57
1:A:62:PRO:HG2	1:B:1054:GLU:HG3	1.86	0.57
1:D:1063:THR:HA	1:D:1066:LYS:HE3	1.86	0.57
1:C:86:LEU:HG	1:C:87:ILE:O	2.08	0.54
1:B:1010:LYS:NZ	1:B:1056:ASP:OD1	2.31	0.54
1:A:31:LEU:HA	1:A:35:PHE:HD2	1.74	0.53
1:A:11:LEU:HB2	1:A:43:VAL:HG22	1.91	0.53
1:C:8:ILE:HG22	1:C:40:ALA:HB3	1.90	0.53
1:C:27:LEU:HD22	1:C:41:LEU:HD13	1.90	0.52
1:C:96:LEU:CG	1:C:99:SER:HB2	2.40	0.52
1:D:1062:PRO:HA	1:D:1065:ALA:HB3	1.92	0.51
1:D:1010:LYS:HE2	1:D:1092:LEU:HD13	1.92	0.51
1:B:1004:ARG:HG2	1:B:1005:LYS:H	1.77	0.49
1:A:8:ILE:HG13	1:A:8:ILE:O	2.11	0.49
1:A:8:ILE:HG22	1:A:40:ALA:CB	2.21	0.49
1:C:5:LYS:HB3	1:C:6:THR:HB	1.94	0.49
1:C:63:THR:O	1:A:63:THR:HG23	2.13	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:12:TYR:CD2	1:A:44:ILE:HD11	2.47	0.49
1:B:1026:THR:O	1:B:1030:ILE:HG23	2.13	0.49
1:A:12:TYR:HD2	1:A:44:ILE:HD11	1.78	0.49
1:A:92:LEU:HB2	1:A:93:TYR:HA	1.94	0.48
1:C:27:LEU:HD22	1:C:41:LEU:HD22	1.95	0.48
1:D:1064:LEU:HD12	1:D:1089:LEU:HG	1.95	0.48
1:C:96:LEU:HD11	1:C:99:SER:HB2	1.94	0.48
1:C:87:ILE:HD12	1:D:1046:VAL:HG12	1.95	0.48
1:D:1038:VAL:HG23	1:D:1039:TYR:H	1.80	0.47
1:C:98:ASP:N	1:C:100:ASP:CB	2.77	0.46
1:C:58:ILE:HD12	1:D:1058:ILE:HD12	1.96	0.46
1:A:93:TYR:H	1:A:93:TYR:HD1	1.62	0.46
1:D:1097:GLN:HA	1:D:1098:ASP:HA	1.50	0.46
1:D:1030:ILE:HA	1:D:1033:VAL:HG22	1.98	0.46
1:B:1070:LEU:N	1:B:1071:PRO:HD2	2.31	0.45
1:D:1019:ASN:OD1	1:D:1019:ASN:N	2.42	0.45
1:A:28:LYS:O	1:A:31:LEU:HG	2.17	0.45
1:D:1013:VAL:HG13	1:D:1085:VAL:HG12	1.98	0.45
1:B:1070:LEU:HD12	1:B:1073:ARG:HB2	1.98	0.45
1:D:1017:THR:HB	1:D:1018:PRO:HD2	1.99	0.44
1:C:7:TYR:HB3	1:C:91:LEU:HD11	1.99	0.44
1:A:27:LEU:O	1:A:30:ILE:HG22	2.16	0.44
1:B:1070:LEU:O	1:B:1073:ARG:HB2	2.17	0.44
1:C:58:ILE:HG22	1:C:88:GLY:HA3	1.98	0.44
1:D:1049:ASN:OD1	1:D:1049:ASN:N	2.50	0.44
1:C:98:ASP:C	1:C:100:ASP:CA	2.86	0.43
1:B:1013:VAL:HB	1:B:1085:VAL:HG12	2.00	0.43
1:C:99:SER:N	1:C:100:ASP:CA	2.72	0.43
1:A:58:ILE:HD13	1:A:87:ILE:HD11	2.00	0.43
1:C:84:LYS:H	1:C:84:LYS:HG2	1.64	0.43
1:B:1070:LEU:HA	1:B:1073:ARG:CG	2.49	0.43
1:C:2:SER:HA	1:C:3:PRO:C	2.38	0.43
1:B:1008:ILE:HD13	1:B:1040:ALA:HB3	2.01	0.43
1:D:1061:THR:HA	1:D:1089:LEU:CD2	2.49	0.43
1:D:1048:LYS:HD3	1:D:1048:LYS:HA	1.84	0.42
1:B:1007:TYR:HB3	1:B:1091:LEU:HD21	2.01	0.42
1:B:1017:THR:HG22	1:B:1019:ASN:H	1.84	0.42
1:C:64:LEU:HB3	1:C:89:LEU:CD1	2.47	0.42
1:D:1046:VAL:HG21	1:D:1087:ILE:HD12	2.00	0.42
1:D:1027:LEU:HB2	1:D:1075:ILE:HG21	2.01	0.42
1:B:1017:THR:HA	1:B:1018:PRO:HD2	1.88	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:1069:PRO:O	1:B:1073:ARG:HG2	2.21	0.41
1:C:84:LYS:HE3	1:D:1051:GLN:OE1	2.20	0.41
1:C:96:LEU:HD11	1:C:99:SER:CB	2.51	0.41
1:A:73:ARG:NH2	2:A:209:HOH:O	2.46	0.41
1:C:96:LEU:HD21	1:C:99:SER:HB2	1.97	0.41
1:A:58:ILE:HG21	1:A:87:ILE:HD12	2.03	0.40
1:B:1083:GLU:HB3	1:B:1085:VAL:HG23	2.03	0.40
1:D:1002:SER:HA	1:D:1003:PRO:HA	1.81	0.40
1:C:70:LEU:N	1:C:71:PRO:HD2	2.35	0.40
1:C:98:ASP:C	1:C:100:ASP:CB	2.86	0.40
1:A:101:ASP:H	1:A:102:PHE:HA	1.87	0.40
1:B:1030:ILE:HG13	1:B:1031:LEU:N	2.35	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	93/102 (91%)	87 (94%)	6 (6%)	0	100	100
1	B	100/102 (98%)	89 (89%)	11 (11%)	0	100	100
1	C	100/102 (98%)	86 (86%)	12 (12%)	2 (2%)	7	13
1	D	100/102 (98%)	95 (95%)	5 (5%)	0	100	100
All	All	393/408 (96%)	357 (91%)	34 (9%)	2 (0%)	29	50

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	96	LEU
1	C	87	ILE

### 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	84/91 (92%)	79 (94%)	5 (6%)	19	37
1	B	91/91 (100%)	87 (96%)	4 (4%)	28	52
1	C	91/91 (100%)	88 (97%)	3 (3%)	38	62
1	D	91/91 (100%)	90 (99%)	1 (1%)	73	88
All	All	357/364 (98%)	344 (96%)	13 (4%)	35	59

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

Mol	Chain	Res	Type
1	C	98	ASP
1	C	99	SER
1	C	100	ASP
1	D	1038	VAL
1	A	47	LEU
1	A	56	ASP
1	A	67	VAL
1	A	93	TYR
1	A	98	ASP
1	B	1030	ILE
1	B	1061	THR
1	B	1079	LEU
1	B	1093	TYR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

### 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

### 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, 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	95/102 (93%)	0.39	5 (5%) 26 21	24, 48, 103, 173	0
1	B	102/102 (100%)	0.81	18 (17%) 1 0	22, 72, 147, 163	0
1	C	102/102 (100%)	0.39	9 (8%) 10 7	19, 48, 140, 164	0
1	D	102/102 (100%)	0.75	17 (16%) 1 1	26, 67, 139, 152	0
All	All	401/408 (98%)	0.59	49 (12%) 4 2	19, 57, 144, 173	0

All (49) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	1102	PHE	8.5
1	B	1001	MET	7.1
1	B	1099	SER	7.0
1	D	1002	SER	6.3
1	C	96	LEU	5.1
1	D	1101	ASP	5.1
1	B	1003	PRO	5.1
1	C	102	PHE	4.7
1	B	1002	SER	4.5
1	D	1095	GLU	4.5
1	B	1098	ASP	4.1
1	D	1003	PRO	4.1
1	A	100	ASP	3.9
1	C	2	SER	3.9
1	A	99	SER	3.8
1	C	3	PRO	3.7
1	B	1096	LEU	3.7
1	C	82	ARG	3.6
1	A	101	ASP	3.6
1	D	1068	LEU	3.6
1	B	1094	GLY	3.5

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Mol	Chain	Res	Type	RSRZ
1	B	1102	PHE	3.4
1	C	101	ASP	3.4
1	D	1099	SER	3.4
1	A	98	ASP	3.4
1	B	1097	GLN	3.3
1	B	1095	GLU	3.3
1	B	1004	ARG	3.2
1	B	1015	GLY	3.0
1	B	1100	ASP	2.9
1	C	1	MET	2.9
1	D	1093	TYR	2.8
1	B	1074	ARG	2.8
1	D	1076	ILE	2.8
1	C	40	ALA	2.8
1	B	1065	ALA	2.7
1	D	1005	LYS	2.7
1	D	1001	MET	2.7
1	B	1064	LEU	2.6
1	D	1078	ASP	2.6
1	B	1007	TYR	2.5
1	D	1082	ARG	2.4
1	B	1076	ILE	2.3
1	A	92	LEU	2.2
1	C	4	ARG	2.2
1	D	1007	TYR	2.1
1	D	1098	ASP	2.1
1	D	1096	LEU	2.0
1	D	1077	GLY	2.0

## 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 monosaccharides 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.