



# Full wwPDB X-ray Structure Validation Report ⓘ

Nov 5, 2023 – 12:21 PM EST

PDB ID : 5VLP  
Title : PCSK9 complex with LDLR antagonist peptide and Fab7G7  
Authors : Eigenbrot, C.; Ultsch, M.  
Deposited on : 2017-04-25  
Resolution : 2.90 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  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtrriage (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

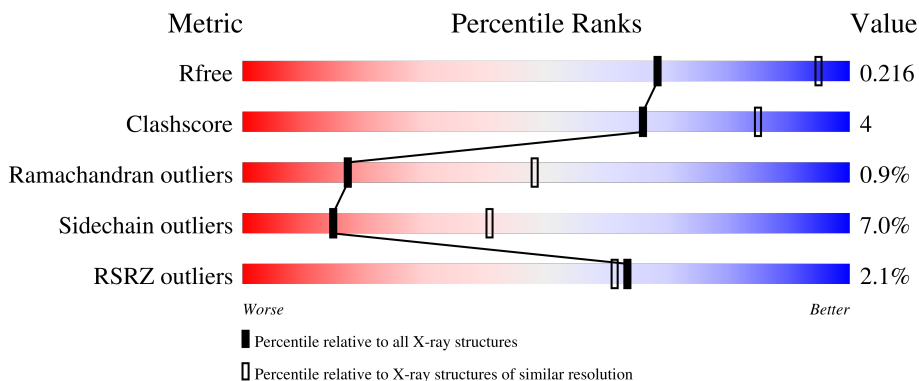
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.90 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	1957 (2.90-2.90)
Clashscore	141614	2172 (2.90-2.90)
Ramachandran outliers	138981	2115 (2.90-2.90)
Sidechain outliers	138945	2117 (2.90-2.90)
RSRZ outliers	127900	1906 (2.90-2.90)

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	700	 6% 71% 11% 18%
2	H	223	 80% 17%
3	L	214	 6% 85% 14%
4	Z	17	 6% 76% 24%

## 2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 7814 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 Proprotein convertase subtilisin/kexin type 9.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	577	4332	2688	802	808	34	0	0	0

There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	474	ILE	VAL	variant	UNP Q8NBP7
A	670	GLU	GLY	variant	UNP Q8NBP7
A	693	HIS	-	expression tag	UNP Q8NBP7
A	694	HIS	-	expression tag	UNP Q8NBP7
A	695	HIS	-	expression tag	UNP Q8NBP7
A	696	HIS	-	expression tag	UNP Q8NBP7
A	697	HIS	-	expression tag	UNP Q8NBP7
A	698	HIS	-	expression tag	UNP Q8NBP7
A	699	HIS	-	expression tag	UNP Q8NBP7
A	700	HIS	-	expression tag	UNP Q8NBP7

- Molecule 2 is a protein called Fab7G7 heavy chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	H	220	1677	1066	269	335	7	0	0	0

- Molecule 3 is a protein called Fab7G7 light chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	L	214	1661	1035	278	340	8	0	0	0

- Molecule 4 is a protein called LDLR antagonist peptide.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace	
4	Z	17	Total	C	N	O	S	0	0	0
			136	90	24	21	1			

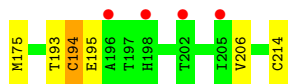
- Molecule 5 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	2	Total	Na	0	0
			2	2		

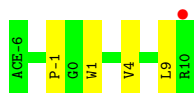
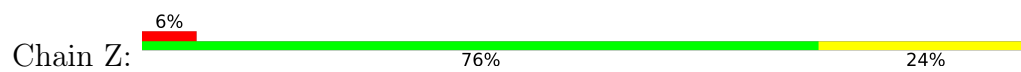
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	3	Total	O	0	0
			3	3		
6	H	1	Total	O	0	0
			1	1		
6	L	2	Total	O	0	0
			2	2		





- Molecule 4: LDLR antagonist peptide



## 4 Data and refinement statistics

Property	Value	Source
Space group	I 2 2 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	110.86Å 142.17Å 239.37Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	70.60 – 2.90 70.60 – 2.90	Depositor EDS
% Data completeness (in resolution range)	99.9 (70.60-2.90) 99.9 (70.60-2.90)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.26 (at 2.91Å)	Xtrriage
Refinement program	BUSTER 2.11.6	Depositor
R, $R_{free}$	0.171 , 0.209 0.180 , 0.216	Depositor DCC
$R_{free}$ test set	2164 reflections (5.12%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	51.1	Xtrriage
Anisotropy	0.595	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 51.6	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	7814	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	53.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.60% 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](#)

Bond lengths and bond angles in the following residue types are not validated in this section: NA, HRG, ACE

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	0.47	0/4415	0.72	0/5988
2	H	0.45	0/1723	0.71	0/2353
3	L	0.43	0/1698	0.68	0/2301
4	Z	0.40	0/124	0.57	0/166
All	All	0.45	0/7960	0.71	0/10808

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	4332	0	4263	34	0
2	H	1677	0	1612	16	0
3	L	1661	0	1580	12	0
4	Z	136	0	140	3	0
5	A	2	0	0	0	0
6	A	3	0	0	0	0
6	H	1	0	0	0	0
6	L	2	0	0	0	0
All	All	7814	0	7595	62	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 4.

All (62) 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:586:ASN:H	1:A:586:ASN:HD22	1.32	0.78
1:A:272:ARG:HE	1:A:275:GLN:HE21	1.38	0.71
1:A:560:THR:HB	1:A:633:THR:HG21	1.72	0.71
2:H:23:LYS:HA	2:H:78:ASN:HB3	1.74	0.68
3:L:37:GLN:HB2	3:L:47:LEU:HD11	1.76	0.67
2:H:33:TYR:CE2	2:H:52:TYR:HB2	2.36	0.60
1:A:490:SER:HB2	1:A:520:VAL:HG12	1.83	0.60
1:A:346:VAL:HG22	1:A:366:GLU:HB2	1.84	0.60
2:H:174:VAL:HG22	2:H:192:VAL:HG23	1.84	0.59
1:A:66:ARG:HH11	1:A:73:ARG:HD2	1.67	0.59
3:L:3:VAL:H	3:L:26:SER:HB3	1.67	0.58
2:H:35:ASN:HD22	2:H:47:TRP:HE1	1.50	0.58
1:A:66:ARG:HD3	1:A:73:ARG:CZ	2.34	0.57
3:L:2:ILE:HG12	3:L:27:GLN:HG2	1.87	0.56
2:H:101:PHE:CD1	2:H:109:TRP:HB3	2.40	0.56
1:A:615:ILE:HD12	1:A:622:VAL:HG13	1.87	0.55
1:A:560:THR:HB	1:A:633:THR:CG2	2.35	0.55
1:A:586:ASN:HD22	1:A:586:ASN:N	2.02	0.55
1:A:99:GLN:HG3	1:A:109:THR:HG22	1.89	0.55
2:H:38:LYS:HB2	2:H:48:ILE:HD11	1.88	0.54
3:L:195:GLU:HG2	3:L:206:VAL:HG22	1.90	0.53
2:H:18:VAL:HG22	2:H:86:LEU:HD11	1.92	0.52
1:A:88:LEU:HD13	1:A:116:HIS:HB3	1.92	0.51
3:L:149:LYS:HB2	3:L:193:THR:HB	1.92	0.51
1:A:476:ARG:HH21	1:A:503:GLN:HE22	1.58	0.50
1:A:364:PRO:HB3	4:Z:1:TRP:CH2	2.46	0.50
1:A:407:THR:HG23	1:A:410:GLU:H	1.77	0.49
1:A:369:ILE:HG13	4:Z:-1:PRO:HB3	1.95	0.49
1:A:69:LYS:HG3	1:A:71:PRO:HD2	1.95	0.48
1:A:484:LEU:HD22	1:A:527:CYS:HB2	1.95	0.48
2:H:30:THR:HA	2:H:53:PRO:HB2	1.95	0.48
3:L:117:ILE:HD12	3:L:194:CYS:HB3	1.95	0.48
3:L:163:TRP:CD2	3:L:175:MET:HG3	2.49	0.47
3:L:3:VAL:H	3:L:26:SER:CB	2.27	0.47
2:H:130:PRO:HB3	2:H:156:TYR:HB3	1.96	0.47
1:A:548:THR:HG21	1:A:581:PRO:HG2	1.96	0.47
3:L:122:SER:O	3:L:126:THR:HG23	2.15	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:Z:4:VAL:HG12	4:Z:9:LEU:HB2	1.97	0.46
1:A:338:ALA:HB1	1:A:365:GLY:HA3	1.97	0.46
2:H:33:TYR:CZ	2:H:52:TYR:HB2	2.50	0.46
1:A:586:ASN:H	1:A:586:ASN:ND2	2.05	0.46
1:A:529:LEU:HD21	1:A:606:LEU:HD22	1.97	0.46
1:A:426:GLU:HB3	1:A:434:ARG:HG2	1.97	0.45
1:A:180:VAL:HG11	1:A:397:ALA:HA	1.99	0.44
1:A:186:ASP:OD2	1:A:288:PRO:HG2	2.16	0.44
1:A:332:GLU:H	1:A:332:GLU:CD	2.21	0.44
2:H:27:TYR:OH	2:H:34:ILE:HD11	2.18	0.44
2:H:114:TRP:HB2	3:L:43:SER:HB2	1.99	0.44
2:H:35:ASN:ND2	2:H:47:TRP:HE1	2.14	0.44
3:L:35:TRP:CE2	3:L:73:PHE:HB2	2.54	0.43
1:A:407:THR:HG22	1:A:410:GLU:CG	2.48	0.43
1:A:453:TRP:HH2	1:A:604:PRO:HG2	1.83	0.42
1:A:82:LEU:HD13	1:A:86:THR:HG21	2.02	0.42
3:L:124:GLN:HE22	3:L:131:SER:H	1.69	0.41
1:A:560:THR:O	1:A:633:THR:HG22	2.20	0.41
2:H:163:VAL:HG22	2:H:208:VAL:HG22	2.03	0.41
1:A:276:LEU:HD12	1:A:276:LEU:HA	1.87	0.41
2:H:149:LEU:HB3	2:H:221:LEU:HD22	2.01	0.41
1:A:576:PRO:HA	1:A:577:PRO:HD3	1.99	0.40
2:H:133:TYR:HA	2:H:134:PRO:HD3	2.01	0.40
1:A:343:ASP:O	1:A:424:ILE:HA	2.21	0.40
1:A:554:GLN:HB2	1:A:557:HIS:HB2	2.02	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	563/700 (80%)	531 (94%)	27 (5%)	5 (1%)	<b>17</b> 48

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
2	H	216/223 (97%)	199 (92%)	13 (6%)	4 (2%)	8	28
3	L	212/214 (99%)	206 (97%)	6 (3%)	0	100	100
4	Z	14/17 (82%)	14 (100%)	0	0	100	100
All	All	1005/1154 (87%)	950 (94%)	46 (5%)	9 (1%)	17	48

All (9) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	225	SER
1	A	530	PRO
1	A	546	MET
2	H	159	GLU
2	H	166	ASN
2	H	168	GLY
1	A	604	PRO
2	H	160	SER
1	A	616	PRO

### 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	464/566 (82%)	429 (92%)	35 (8%)	13	37
2	H	190/193 (98%)	177 (93%)	13 (7%)	16	42
3	L	189/189 (100%)	177 (94%)	12 (6%)	18	46
4	Z	13/13 (100%)	13 (100%)	0	100	100
All	All	856/961 (89%)	796 (93%)	60 (7%)	15	41

All (60) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	110	LYS
1	A	132	GLU

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<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>
1	A	181	GLU
1	A	189	ILE
1	A	237	ARG
1	A	272	ARG
1	A	274	SER
1	A	276	LEU
1	A	344	GLN
1	A	361	LEU
1	A	369	ILE
1	A	375	CYS
1	A	381	SER
1	A	398	MET
1	A	405	GLU
1	A	411	LEU
1	A	435	VAL
1	A	444	LEU
1	A	470	MET
1	A	474	ILE
1	A	484	LEU
1	A	485	SER
1	A	491	ARG
1	A	501	GLU
1	A	533	ASN
1	A	535	SER
1	A	546	MET
1	A	548	THR
1	A	558	VAL
1	A	564	SER
1	A	586	ASN
1	A	623	THR
1	A	638	LEU
1	A	680	ARG
1	A	682	ARG
2	H	10	GLU
2	H	12	VAL
2	H	18	VAL
2	H	23	LYS
2	H	50	ARG
2	H	62	GLU
2	H	67	LYS
2	H	71	THR
2	H	82	GLN

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Mol	Chain	Res	Type
2	H	128	THR
2	H	139	CYS
2	H	159	GLU
2	H	191	SER
3	L	12	SER
3	L	31	THR
3	L	50	SER
3	L	60	ASP
3	L	80	SER
3	L	116	SER
3	L	125	LEU
3	L	134	CYS
3	L	153	SER
3	L	160	LEU
3	L	194	CYS
3	L	214	CYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	99	GLN
1	A	101	GLN
1	A	275	GLN
1	A	278	GLN
1	A	344	GLN
1	A	382	GLN
1	A	425	ASN
1	A	586	ASN
1	A	643	HIS
2	H	35	ASN
2	H	182	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](#)

1 non-standard protein/DNA/RNA residue is modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul

statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
4	HRG	Z	5	4	10,11,12	0.75	0	6,12,14	0.46	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	HRG	Z	5	4	-	1/9/10/12	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	Z	5	HRG	NH2-CZ-NE-CD

There are no ring outliers.

No monomer is involved in short contacts.

## 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 2 ligands modelled in this entry, 2 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

## 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	577/700 (82%)	0.20	7 (1%) 79 79	29, 46, 75, 108	0
2	H	220/223 (98%)	0.11	1 (0%) 91 91	32, 59, 87, 109	0
3	L	214/214 (100%)	0.44	13 (6%) 21 17	32, 53, 81, 101	0
4	Z	15/17 (88%)	0.84	1 (6%) 17 13	42, 53, 79, 82	1 (6%)
All	All	1026/1154 (88%)	0.24	22 (2%) 63 61	29, 50, 80, 109	1 (0%)

All (22) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	453	TRP	4.4
3	L	156	GLN	3.8
4	Z	10	ARG	3.5
3	L	13	THR	3.4
3	L	16	GLY	2.8
1	A	178	SER	2.6
3	L	157	ASN	2.5
3	L	11	MET	2.5
2	H	172	SER	2.5
3	L	202	THR	2.4
3	L	198	HIS	2.4
3	L	107	LYS	2.4
3	L	15	GLY	2.4
1	A	177	GLY	2.3
3	L	205	ILE	2.3
1	A	642	SER	2.3
1	A	531	GLN	2.3
1	A	671	ALA	2.3
3	L	9	LYS	2.2
3	L	12	SER	2.2
3	L	196	ALA	2.2
1	A	279	PRO	2.1



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

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
4	HRG	Z	5	12/13	0.97	0.24	44,48,53,55	0

## 6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
5	NA	A	801	1/1	0.85	0.18	39,39,39,39	0
5	NA	A	802	1/1	0.92	0.15	59,59,59,59	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.