



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 7, 2026 – 02:25 AM UTC

PDB ID : 6U2F / pdb_00006u2f
Title : PCSK9-Fab 7G7 complex bound to cis-1-amino-4-phenylcyclohexanecarboxyl-WN
LK(hR)IGLLR - NH2
Authors : Ultsch, M.H.; Kirchhofer, D.
Deposited on : 2019-08-19
Resolution : 2.94 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

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>.

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

MolProbity : 4-5-2 with Phenix2.0
Mogul : 2022.3.0, CSD as543be (2022)
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

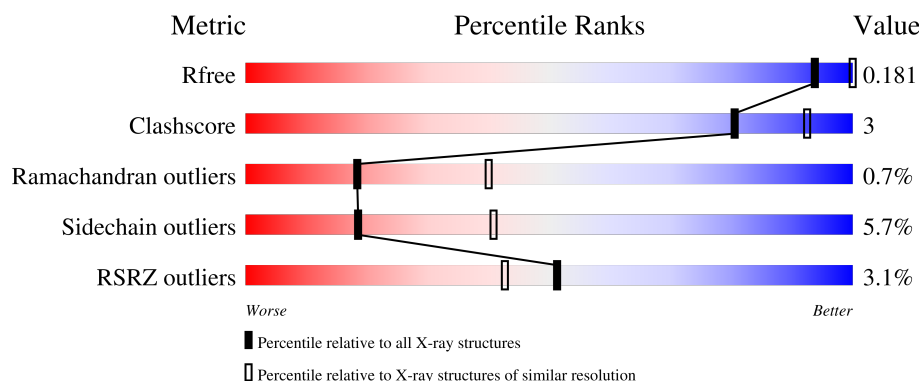
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.94 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	1159 (2.96-2.92)
Clashscore	190562	1184 (2.96-2.92)
Ramachandran outliers	187476	1131 (2.96-2.92)
Sidechain outliers	187428	1131 (2.96-2.92)
RSRZ outliers	180081	1159 (2.96-2.92)

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 $\leq 5\%$. 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	3% 75% 6% 17%
2	B	11	18% 73% 18% 9%
3	H	223	4% 84% 14% ..
4	L	214	% 90% 9%

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 15423 atoms, of which 7598 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
1	A	582	Total	C	H	N	O	S	0	0	0
			8663	2709	4295	808	817	34			

There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	474	ILE	VAL	variant	UNP Q8NBP7
A	660	GLU	ASP	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 Organo-peptide PCSK9 inhibitor.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	11	Total	C	H	N	O	0	0	0
			222	73	117	20	12			

- Molecule 3 is a protein called 7G7 heavy chain.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
3	H	220	Total	C	H	N	O	S	0	0	0
			3286	1066	1609	269	335	7			

- Molecule 4 is a protein called 7G7 light chain.

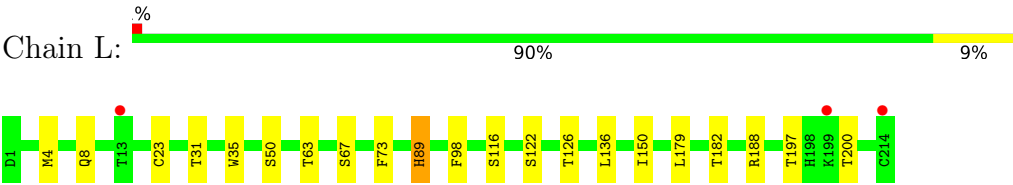
Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
4	L	214	Total	C	H	N	O	S	0	0	0
			3238	1035	1577	278	340	8			

- Molecule 5 is CALCIUM ION (CCD ID: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	1	Total	Ca	0	0
			1	1		

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	9	Total	O	0	0
			9	9		
6	H	2	Total	O	0	0
			2	2		
6	L	2	Total	O	0	0
			2	2		



4 Data and refinement statistics

Property	Value	Source
Space group	I 2 2 2	Depositor
Cell constants a, b, c, α , β , γ	110.57Å 142.74Å 239.29Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	49.37 – 2.94 49.37 – 2.94	Depositor EDS
% Data completeness (in resolution range)	94.2 (49.37-2.94) 94.1 (49.37-2.94)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.14	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.63 (at 2.96Å)	Xtriage
Refinement program	BUSTER 2.11.7	Depositor
R, R_{free}	0.174 , 0.209 0.185 , 0.181	Depositor DCC
R_{free} test set	1895 reflections (4.66%)	wwPDB-VP
Wilson B-factor (Å ²)	60.8	Xtriage
Anisotropy	0.011	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.42 , 54.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	15423	wwPDB-VP
Average B, all atoms (Å ²)	60.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.33% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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: PQG, HRG, CA

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	0.90	1/4454 (0.0%)	1.14	5/6046 (0.1%)
2	B	0.60	0/78	0.85	0/102
3	H	0.87	0/1723	1.08	2/2353 (0.1%)
4	L	0.84	0/1698	1.06	0/2301
All	All	0.88	1/7953 (0.0%)	1.11	7/10802 (0.1%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	546	MET	SD-CE	-5.66	1.65	1.79

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	224	ASP	CA-CB-CG	7.69	120.29	112.60
1	A	621	GLN	N-CA-C	5.68	117.43	108.96
3	H	78	ASN	CA-CB-CG	5.58	118.19	112.60
3	H	61	ASN	N-CA-C	-5.28	102.04	109.96
1	A	252	VAL	CB-CA-C	5.15	116.18	110.62
1	A	279	PRO	N-CA-C	5.08	118.58	110.40
1	A	589	VAL	N-CA-C	-5.02	101.24	108.71

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	4368	4295	4299	23	0
2	B	105	117	102	2	0
3	H	1677	1609	1612	12	0
4	L	1661	1577	1580	6	0
5	A	1	0	0	0	0
6	A	9	0	0	0	0
6	H	2	0	0	0	0
6	L	2	0	0	0	0
All	All	7825	7598	7593	40	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 (40) 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)
3:H:163:VAL:HG21	3:H:188:MET:HE1	1.82	0.60
1:A:278:GLN:HB3	1:A:279:PRO:CD	2.39	0.53
4:L:122:SER:O	4:L:126:THR:HG23	2.09	0.52
1:A:560:THR:HB	1:A:633:THR:HG21	1.90	0.52
4:L:4:MET:HE3	4:L:23:CYS:SG	2.51	0.50
1:A:547:GLY:HA3	3:H:101:PHE:CE2	2.48	0.49
4:L:136:LEU:HD12	4:L:136:LEU:N	2.27	0.49
1:A:484:LEU:HD22	1:A:527:CYS:HB2	1.94	0.49
1:A:88:LEU:HD13	1:A:116:HIS:HB3	1.94	0.48
1:A:529:LEU:HD23	1:A:532:ALA:HB2	1.95	0.48
1:A:589:VAL:HG13	1:A:638:LEU:HD13	1.96	0.48
3:H:101:PHE:CD2	3:H:109:TRP:HB3	2.50	0.46
4:L:35:TRP:CE2	4:L:73:PHE:HB2	2.51	0.46
3:H:195:PRO:HG2	3:H:198:THR:HG23	1.98	0.45
1:A:623:THR:HG23	1:A:653:THR:HG23	1.98	0.44
3:H:163:VAL:CG2	3:H:188:MET:HE1	2.47	0.44
1:A:606:LEU:HD11	1:A:679:CYS:SG	2.58	0.44
4:L:150:ILE:HD11	4:L:179:LEU:HD21	1.98	0.44
1:A:441:VAL:HG11	2:B:6:HRG:HD2	2.00	0.44
3:H:18:VAL:HG22	3:H:86:LEU:HD11	1.98	0.44
1:A:341:ALA:HB2	2:B:2:TRP:CD2	2.53	0.43
1:A:470:MET:HA	1:A:470:MET:HE2	2.00	0.43
3:H:149:LEU:HB3	3:H:221:LEU:HD13	2.01	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:L:89:HIS:HB2	4:L:98:PHE:CD2	2.54	0.43
1:A:563:SER:HB2	1:A:597:HIS:HB2	2.01	0.42
3:H:33:TYR:CE2	3:H:52:TYR:HB2	2.53	0.42
1:A:551:HIS:CE1	1:A:553:HIS:HB3	2.54	0.42
3:H:23:LYS:HA	3:H:78:ASN:HB3	2.01	0.42
3:H:134:PRO:HB2	3:H:221:LEU:HD23	2.02	0.42
1:A:332:GLU:H	1:A:332:GLU:CD	2.27	0.41
1:A:278:GLN:CB	1:A:279:PRO:CD	2.97	0.41
3:H:12:VAL:HG11	3:H:18:VAL:HG13	2.01	0.41
1:A:483:LEU:CD1	1:A:524:ALA:HB1	2.50	0.41
1:A:529:LEU:HD23	1:A:532:ALA:CB	2.50	0.41
1:A:278:GLN:HB3	1:A:279:PRO:HD3	2.02	0.41
1:A:403:GLU:O	1:A:406:LEU:HB2	2.21	0.41
1:A:484:LEU:HB3	1:A:633:THR:HG23	2.03	0.41
1:A:603:ALA:HB3	1:A:606:LEU:HB2	2.03	0.41
3:H:12:VAL:HG11	3:H:18:VAL:CG1	2.51	0.40
1:A:484:LEU:HB3	1:A:633:THR:CG2	2.50	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	574/700 (82%)	542 (94%)	29 (5%)	3 (0%)	24	49
2	B	8/11 (73%)	8 (100%)	0	0	100	100
3	H	216/223 (97%)	206 (95%)	6 (3%)	4 (2%)	6	17
4	L	212/214 (99%)	208 (98%)	4 (2%)	0	100	100
All	All	1010/1148 (88%)	964 (95%)	39 (4%)	7 (1%)	18	40

All (7) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	278	GLN
1	A	530	PRO
3	H	139	CYS
3	H	160	SER
3	H	198	THR
3	H	166	ASN
1	A	186	ASP

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	468/565 (83%)	443 (95%)	25 (5%)	20	43
2	B	8/8 (100%)	8 (100%)	0	100	100
3	H	190/193 (98%)	177 (93%)	13 (7%)	14	33
4	L	189/189 (100%)	178 (94%)	11 (6%)	18	40
All	All	855/955 (90%)	806 (94%)	49 (6%)	18	41

All (49) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	104	ARG
1	A	109	THR
1	A	119	LEU
1	A	132	GLU
1	A	147	SER
1	A	188	SER
1	A	252	VAL
1	A	265	LEU
1	A	272	ARG
1	A	276	LEU
1	A	303	ARG
1	A	361	LEU
1	A	419	SER
1	A	435	VAL
1	A	468	THR

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Mol	Chain	Res	Type
1	A	484	LEU
1	A	530	PRO
1	A	546	MET
1	A	564	SER
1	A	589	VAL
1	A	608	CYS
1	A	623	THR
1	A	642	SER
1	A	679	CYS
1	A	680	ARG
3	H	50	ARG
3	H	71	THR
3	H	87	THR
3	H	88	SER
3	H	113	VAL
3	H	128	THR
3	H	141	ASP
3	H	151	CYS
3	H	161	VAL
3	H	169	SER
3	H	172	SER
3	H	191	SER
3	H	206	CYS
4	L	8	GLN
4	L	31	THR
4	L	50	SER
4	L	63	THR
4	L	67	SER
4	L	89	HIS
4	L	116	SER
4	L	182	THR
4	L	188	ARG
4	L	197	THR
4	L	200	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (10) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	139	HIS
1	A	387	GLN
1	A	513	ASN
1	A	553	HIS

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Mol	Chain	Res	Type
1	A	557	HIS
1	A	597	HIS
3	H	63	ASN
3	H	166	ASN
4	L	37	GLN
4	L	190	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

2 non-standard protein/DNA/RNA residues are 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	$\# Z > 2$
2	PQG	B	1	2	12,16,17	0.62	0	18,22,24	1.50	3 (16%)
2	HRG	B	6	2	10,11,12	2.26	2 (20%)	6,12,14	1.24	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
2	PQG	B	1	2	-	2/6/19/22	0/2/2/2
2	HRG	B	6	2	-	0/9/10/12	-

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	6	HRG	CZ-NE	6.49	1.45	1.33

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	6	HRG	CZ-NH2	2.43	1.43	1.34

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	1	PQG	C-CA-N	-4.27	100.44	109.35
2	B	1	PQG	C95-C96-C97	-2.96	108.65	111.46
2	B	1	PQG	C99-CA-C	2.11	114.19	108.47

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	1	PQG	O-C-CA-C99
2	B	1	PQG	O-C-CA-C95

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	6	HRG	1	0

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 1 ligands modelled in this entry, 1 is 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, 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	582/700 (83%)	0.16	19 (3%) 49 41	30, 55, 86, 117	0
2	B	9/11 (81%)	0.57	2 (22%) 2 2	48, 61, 83, 123	0
3	H	220/223 (98%)	0.21	8 (3%) 46 38	34, 62, 93, 114	0
4	L	214/214 (100%)	0.11	3 (1%) 73 66	34, 61, 87, 108	0
All	All	1025/1148 (89%)	0.17	32 (3%) 51 43	30, 58, 89, 123	0

All (32) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	H	169	SER	7.3
1	A	660	GLU	6.4
1	A	453	TRP	5.3
3	H	222	GLU	5.3
1	A	280	VAL	5.0
4	L	214	CYS	4.6
1	A	279	PRO	4.5
3	H	172	SER	4.0
1	A	682	ARG	3.4
1	A	446	PRO	3.0
3	H	139	CYS	2.9
1	A	201	MET	2.8
1	A	218	ARG	2.8
3	H	160	SER	2.7
1	A	61	THR	2.5
1	A	281	GLY	2.4
1	A	378	CYS	2.4
1	A	116	HIS	2.4
3	H	141	ASP	2.4
1	A	573	THR	2.3
1	A	641	THR	2.3

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Mol	Chain	Res	Type	RSRZ
1	A	194	ARG	2.3
1	A	197	GLU	2.3
4	L	13	THR	2.3
3	H	216	THR	2.2
2	B	11	ARG	2.2
4	L	199	LYS	2.2
1	A	186	ASP	2.2
1	A	505	GLY	2.1
2	B	10	LEU	2.1
1	A	277	VAL	2.0
3	H	203	THR	2.0

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, 95th 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 ²)	Q<0.9
2	HRG	B	6	12/13	0.95	0.13	45,52,57,63	0
2	PQG	B	1	15/16	0.96	0.09	50,61,66,67	0

6.3 Carbohydrates [i](#)

There are no oligosaccharides 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, 95th 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 ²)	Q<0.9
5	CA	A	801	1/1	0.96	0.09	87,87,87,87	0

6.5 Other polymers [i](#)

There are no such residues in this entry.