



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 12, 2026 – 06:18 AM UTC

PDB ID : 5KPJ / pdb_00005kpj
Title : Mouse pgp methylated protein
Authors : Xia, D.; Esser, L.; Zhou, F.
Deposited on : 2016-07-04
Resolution : 3.50 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

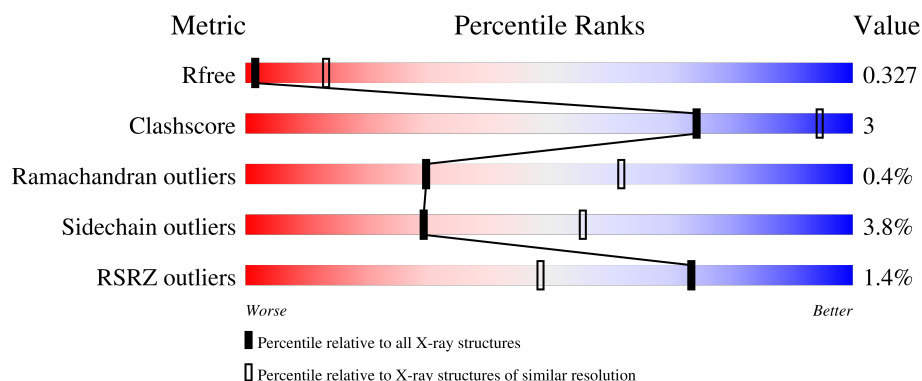
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.50 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	1085 (3.54-3.46)
Clashscore	190562	1140 (3.54-3.46)
Ramachandran outliers	187476	1113 (3.54-3.46)
Sidechain outliers	187428	1114 (3.54-3.46)
RSRZ outliers	180081	1084 (3.54-3.46)

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	1282	81% 10% 8%

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 9139 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 Multidrug resistance protein 1A.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	1177	Total	C	N	O	S	0	0	0
			9137	5879	1547	1673	38			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1277	HIS	-	expression tag	UNP P21447
A	1278	HIS	-	expression tag	UNP P21447
A	1279	HIS	-	expression tag	UNP P21447
A	1280	HIS	-	expression tag	UNP P21447
A	1281	HIS	-	expression tag	UNP P21447
A	1282	HIS	-	expression tag	UNP P21447

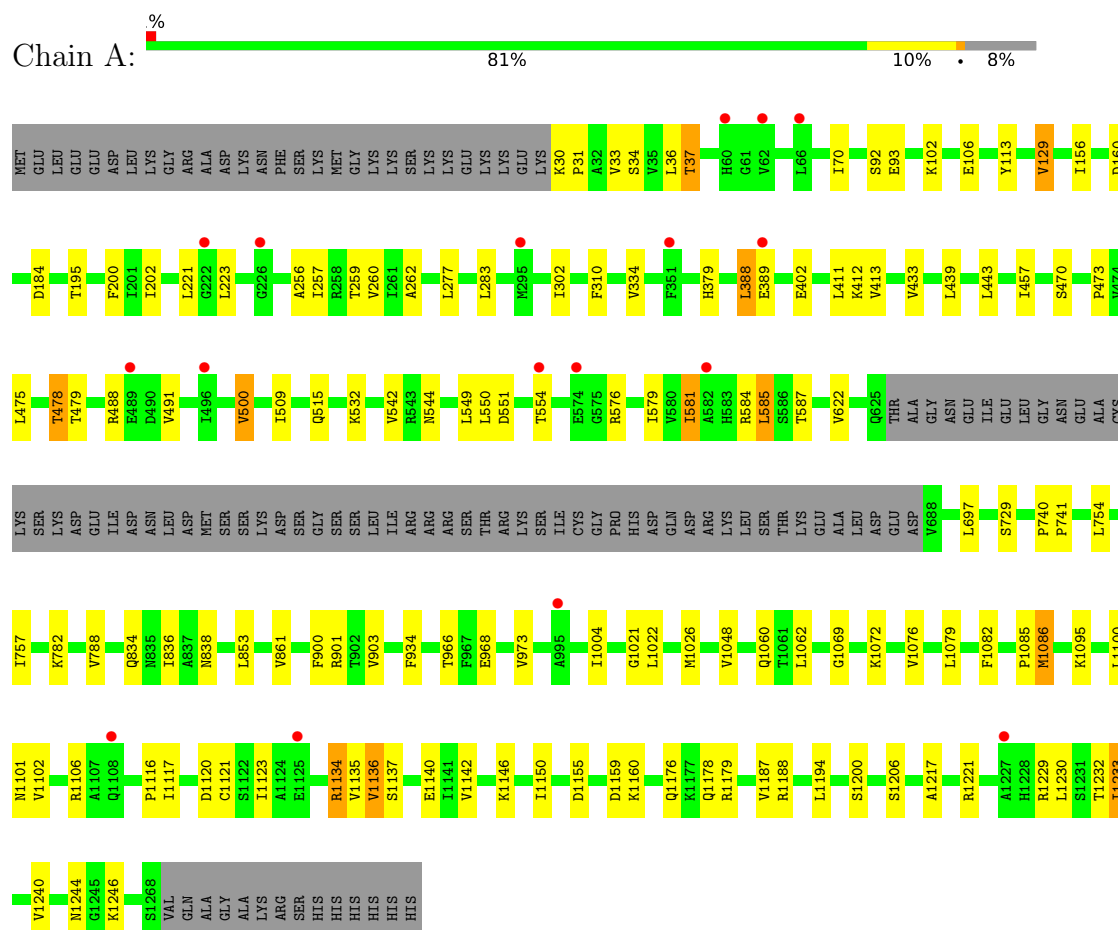
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	2	Total	O	0	0
			2	2		

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: Multidrug resistance protein 1A



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	88.65Å 137.17Å 186.09Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	21.45 – 3.50 21.45 – 3.50	Depositor EDS
% Data completeness (in resolution range)	93.6 (21.45-3.50) 93.0 (21.45-3.50)	Depositor EDS
R_{merge}	0.14	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.98 (at 3.48Å)	Xtriage
Refinement program	PHENIX (dev_2443: ???)	Depositor
R, R_{free}	0.285 , 0.315 0.299 , 0.327	Depositor DCC
R_{free} test set	1359 reflections (4.63%)	wwPDB-VP
Wilson B-factor (Å ²)	109.6	Xtriage
Anisotropy	0.473	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.20 , 8.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.31$, $\langle L^2 \rangle = 0.14$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.91	EDS
Total number of atoms	9139	wwPDB-VP
Average B, all atoms (Å ²)	127.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.42% 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: M3L

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	0.24	0/9282	0.67	7/12550 (0.1%)

There are no bond length outliers.

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	1159	ASP	CA-C-N	5.51	132.07	121.54
1	A	1159	ASP	C-N-CA	5.51	132.07	121.54
1	A	478	THR	OG1-CB-CG2	-5.02	99.26	109.30
1	A	1134	ARG	CA-C-N	5.01	129.23	120.86
1	A	1134	ARG	C-N-CA	5.01	129.23	120.86
1	A	1137	SER	CA-C-N	5.01	127.30	120.54
1	A	1137	SER	C-N-CA	5.01	127.30	120.54

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

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	9137	0	9326	57	0
2	A	2	0	0	0	0
All	All	9139	0	9326	57	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 (57) 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:1134:ARG:HG2	1:A:1136:VAL:HG23	1.74	0.68
1:A:379:HIS:HB3	1:A:457:ILE:HG22	1.80	0.62
1:A:277:LEU:HB3	1:A:782:LYS:HG3	1.85	0.59
1:A:1022:LEU:HB2	1:A:1100:LEU:HD23	1.84	0.59
1:A:544:ASN:OD1	1:A:576:ARG:NH2	2.38	0.56
1:A:1026:MET:SD	1:A:1095:LYS:NZ	2.78	0.56
1:A:788:VAL:HG21	1:A:1004:ILE:HD12	1.88	0.56
1:A:1069:GLY:H	1:A:1072:M3L:HM32	1.72	0.55
1:A:1229:ARG:O	1:A:1232:THR:OG1	2.26	0.53
1:A:102:LYS:NZ	1:A:106:GLU:OE2	2.40	0.52
1:A:70:ILE:HD13	1:A:113:TYR:HB3	1.90	0.52
1:A:1079:LEU:HD23	1:A:1194:LEU:HD21	1.91	0.52
1:A:1176:GLN:HG2	1:A:1179:ARG:HH21	1.74	0.52
1:A:473:PRO:HG2	1:A:532:LYS:HB3	1.91	0.52
1:A:1106:ARG:O	1:A:1188:ARG:NH1	2.44	0.51
1:A:491:VAL:HG21	1:A:542:VAL:HG13	1.95	0.49
1:A:433:VAL:HG13	1:A:549:LEU:HD23	1.95	0.49
1:A:256:ALA:HB2	1:A:1117:ILE:HG21	1.95	0.48
1:A:388:LEU:HB2	1:A:413:VAL:HB	1.96	0.48
1:A:1136:VAL:HG13	1:A:1140:GLU:HB2	1.94	0.48
1:A:1086:MET:SD	1:A:1086:MET:N	2.87	0.48
1:A:200:PHE:HE1	1:A:334:VAL:HG13	1.79	0.48
1:A:156:ILE:HD13	1:A:439:LEU:HG	1.96	0.47
1:A:1244:ASN:HB2	1:A:1246:M3L:HM13	1.97	0.47
1:A:221:LEU:HD22	1:A:302:ILE:HD13	1.97	0.46
1:A:257:ILE:HA	1:A:260:VAL:HG12	1.98	0.46
1:A:1116:PRO:HG3	1:A:1178:GLN:HA	1.98	0.45
1:A:554:THR:HG21	1:A:587:THR:HG21	1.99	0.45
1:A:729:SER:OG	1:A:968:GLU:O	2.34	0.45
1:A:389:GLU:HG2	1:A:412:LYS:HG2	2.00	0.44
1:A:92:SER:OG	1:A:93:GLU:N	2.50	0.44
1:A:34:SER:OG	1:A:37:THR:OG1	2.35	0.44
1:A:1217:ALA:O	1:A:1221:ARG:NH1	2.51	0.44
1:A:262:ALA:HB2	1:A:1082:PHE:HZ	1.83	0.43
1:A:500:VAL:HG11	1:A:509:ILE:HD12	2.01	0.43
1:A:129:VAL:HG23	1:A:184:ASP:HB3	2.00	0.43
1:A:478:THR:HG22	1:A:479:THR:H	1.82	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:834:GLN:O	1:A:838:ASN:N	2.51	0.43
1:A:1072:M3L:H	1:A:1072:M3L:HG2	1.59	0.43
1:A:1076:VAL:HG13	1:A:1194:LEU:HB3	1.99	0.43
1:A:160:ASP:OD1	1:A:901:ARG:NH2	2.52	0.43
1:A:900:PHE:HA	1:A:903:VAL:HG12	2.01	0.42
1:A:754:LEU:HD12	1:A:757:ILE:HD12	2.00	0.42
1:A:584:ARG:O	1:A:587:THR:OG1	2.31	0.42
1:A:740:PRO:HA	1:A:741:PRO:HD3	1.91	0.42
1:A:30:LYS:HA	1:A:31:PRO:HD3	1.91	0.42
1:A:1142:VAL:HG22	1:A:1146:LYS:HE3	2.00	0.42
1:A:488:ARG:HG2	1:A:491:VAL:HG23	2.01	0.41
1:A:551:ASP:HA	1:A:581:ILE:HB	2.01	0.41
1:A:853:LEU:HB3	1:A:973:VAL:HG11	2.01	0.41
1:A:585:LEU:HD23	1:A:622:VAL:HG13	2.03	0.41
1:A:1021:GLY:HA3	1:A:1101:ASN:HB2	2.01	0.41
1:A:475:LEU:HD23	1:A:475:LEU:HA	1.89	0.41
1:A:388:LEU:HD23	1:A:579:ILE:HD11	2.03	0.40
1:A:1230:LEU:HD23	1:A:1230:LEU:HA	1.88	0.40
1:A:1062:LEU:HD11	1:A:1240:VAL:HG23	2.03	0.40
1:A:1230:LEU:O	1:A:1233:ILE:HG22	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	1171/1282 (91%)	1128 (96%)	38 (3%)	5 (0%)	30 62

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	1160	LYS

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Mol	Chain	Res	Type
1	A	515	GLN
1	A	1136	VAL
1	A	1120	ASP
1	A	411	LEU

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	969/1061 (91%)	932 (96%)	37 (4%)	29 55

All (37) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	33	VAL
1	A	36	LEU
1	A	37	THR
1	A	129	VAL
1	A	195	THR
1	A	202	ILE
1	A	223	LEU
1	A	259	THR
1	A	283	LEU
1	A	310	PHE
1	A	388	LEU
1	A	402	GLU
1	A	443	LEU
1	A	470	SER
1	A	500	VAL
1	A	550	LEU
1	A	581	ILE
1	A	585	LEU
1	A	697	LEU
1	A	836	ILE
1	A	861	VAL
1	A	934	PHE

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Mol	Chain	Res	Type
1	A	966	THR
1	A	1048	VAL
1	A	1060	GLN
1	A	1085	PRO
1	A	1086	MET
1	A	1102	VAL
1	A	1121	CYS
1	A	1123	ILE
1	A	1135	VAL
1	A	1150	ILE
1	A	1155	ASP
1	A	1187	VAL
1	A	1200	SER
1	A	1206	SER
1	A	1233	ILE

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	90	ASN
1	A	145	GLN
1	A	274	ASN
1	A	458	ASN
1	A	566	GLN
1	A	608	HIS
1	A	721	GLN
1	A	1103	GLN
1	A	1228	HIS
1	A	1250	HIS

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	$\# Z > 2$
1	M3L	A	1072	1	10,11,12	0.52	0	9,14,16	0.68	0
1	M3L	A	1246	1	10,11,12	0.49	0	9,14,16	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
1	M3L	A	1072	1	-	8/9/10/12	-
1	M3L	A	1246	1	-	3/9/10/12	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (11) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	1072	M3L	N-CA-CB-CG
1	A	1246	M3L	N-CA-CB-CG
1	A	1246	M3L	C-CA-CB-CG
1	A	1072	M3L	CD-CE-NZ-CM1
1	A	1072	M3L	CD-CE-NZ-CM2
1	A	1072	M3L	CG-CD-CE-NZ
1	A	1072	M3L	CD-CE-NZ-CM3
1	A	1072	M3L	CE-CD-CG-CB
1	A	1246	M3L	CG-CD-CE-NZ
1	A	1072	M3L	CA-CB-CG-CD
1	A	1072	M3L	C-CA-CB-CG

There are no ring outliers.

2 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	A	1072	M3L	2	0

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Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	A	1246	M3L	1	0

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](#)

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, 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	1175/1282 (91%)	-0.12	17 (1%)	73 48	30, 124, 181, 225	0

All (17) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	582	ALA	3.7
1	A	60	HIS	3.4
1	A	62	VAL	3.3
1	A	226	GLY	3.0
1	A	389	GLU	2.9
1	A	496	ILE	2.8
1	A	489	GLU	2.8
1	A	295	MET	2.7
1	A	351	PHE	2.6
1	A	554	THR	2.6
1	A	1227	ALA	2.5
1	A	1125	GLU	2.5
1	A	995	ALA	2.2
1	A	574	GLU	2.1
1	A	222	GLY	2.1
1	A	1108	GLN	2.1
1	A	66	LEU	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($\text{\AA}^2$)	Q<0.9
1	M3L	A	1072	12/13	0.76	0.20	122,127,134,140	0
1	M3L	A	1246	12/13	0.90	0.09	75,91,101,107	0

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.