



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 09:27 PM UTC

PDB ID : 2A2N / pdb_00002a2n
Title : Crystal Structure of the peptidylprolyl isomerase domain of Human PPWD1
Authors : Walker, J.R.; Davis, T.L.; Newman, E.M.; Mackenzie, F.; Sundstrom, M.; Arrowsmith, C.; Edwards, A.; Bochkarev, A.; Dhe-Paganon, S.; Structural Genomics Consortium (SGC)
Deposited on : 2005-06-22
Resolution : 1.65 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

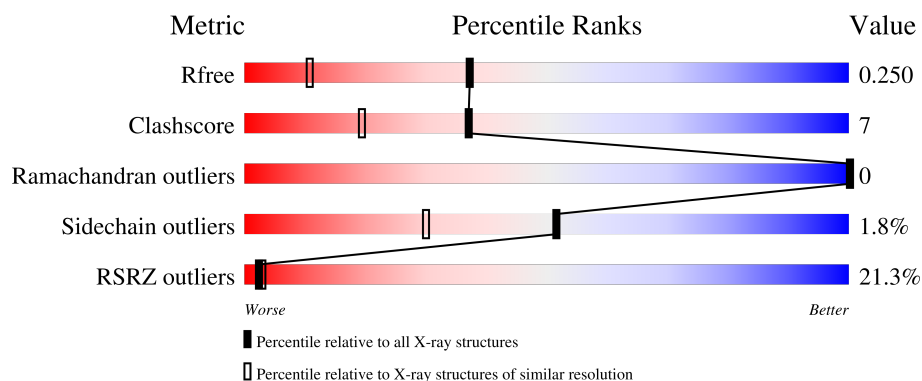
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.65 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	2563 (1.66-1.66)
Clashscore	190562	2662 (1.66-1.66)
Ramachandran outliers	187476	2621 (1.66-1.66)
Sidechain outliers	187428	2621 (1.66-1.66)
RSRZ outliers	180081	2564 (1.66-1.66)

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	176	2% 82% 11% 7%
1	B	176	55% 76% 14% 7%
1	C	176	3% 86% 7% 6%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 4259 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 peptidylprolyl isomerase domain and WD repeat containing 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	164	Total	C	N	O	S	0	0	0
			1286	809	227	243	7			
1	B	164	Total	C	N	O	S	0	0	0
			1286	809	227	243	7			
1	C	165	Total	C	N	O	S	0	0	0
			1293	813	228	245	7			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	471	GLY	-	cloning artifact	UNP Q96BP3
A	472	SER	-	cloning artifact	UNP Q96BP3
B	471	GLY	-	cloning artifact	UNP Q96BP3
B	472	SER	-	cloning artifact	UNP Q96BP3
C	471	GLY	-	cloning artifact	UNP Q96BP3
C	472	SER	-	cloning artifact	UNP Q96BP3

- Molecule 2 is GLYCEROL (CCD ID: GOL) (formula: C₃H₈O₃).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	C	1	Total	C	O	0	0
			6	3	3		

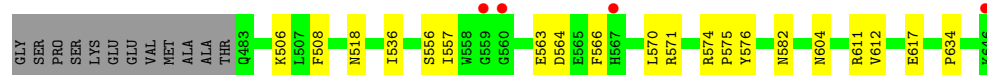
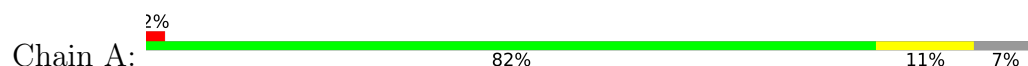
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	156	Total	O	0	0
			156	156		
3	B	65	Total	O	0	0
			65	65		
3	C	167	Total	O	0	0
			167	167		

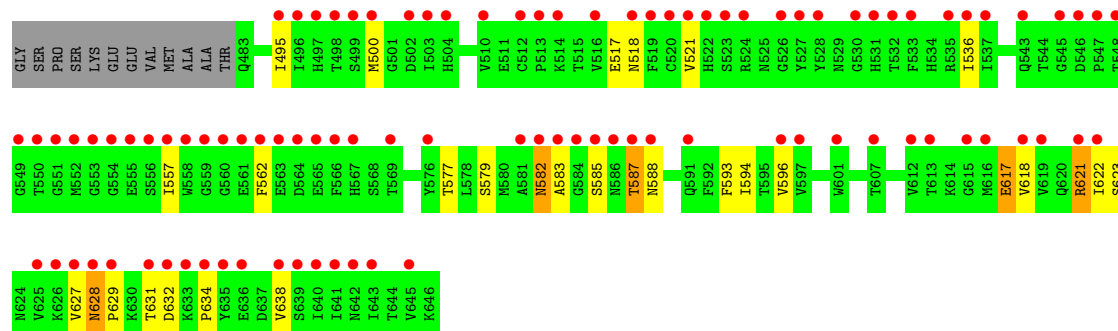
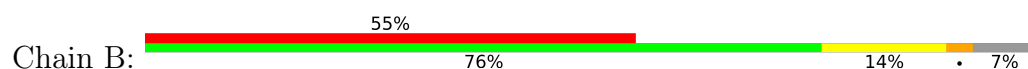
3 Residue-property plots [i](#)

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.

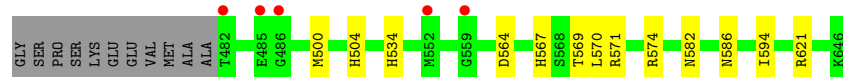
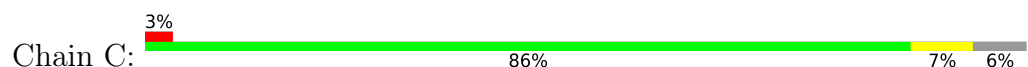
- Molecule 1: peptidylprolyl isomerase domain and WD repeat containing 1



- Molecule 1: peptidylprolyl isomerase domain and WD repeat containing 1



- Molecule 1: peptidylprolyl isomerase domain and WD repeat containing 1



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	139.66Å 39.89Å 115.64Å 90.00° 122.33° 90.00°	Depositor
Resolution (Å)	23.20 – 1.65 23.20 – 1.65	Depositor EDS
% Data completeness (in resolution range)	91.4 (23.20-1.65) 91.4 (23.20-1.65)	Depositor EDS
R_{merge}	0.04	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.76 (at 1.65Å)	Xtriage
Refinement program	REFMAC 5.2.0005	Depositor
R, R_{free}	0.199 , 0.245 0.206 , 0.250	Depositor DCC
R_{free} test set	3027 reflections (4.63%)	wwPDB-VP
Wilson B-factor (Å ²)	29.2	Xtriage
Anisotropy	0.426	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 47.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	4259	wwPDB-VP
Average B, all atoms (Å ²)	46.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.37% 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: GOL

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	0/1319	0.86	0/1787
1	B	0.67	0/1319	0.90	2/1787 (0.1%)
1	C	0.95	1/1326 (0.1%)	0.89	0/1797
All	All	0.85	1/3964 (0.0%)	0.88	2/5371 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	594	ILE	CA-CB	5.09	1.61	1.54

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	628	ASN	CA-C-N	5.84	125.52	119.56
1	B	628	ASN	C-N-CA	5.84	125.52	119.56

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	1286	0	1246	16	0
1	B	1286	0	1246	27	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	C	1293	0	1253	11	0
2	C	6	0	8	0	0
3	A	156	0	0	2	0
3	B	65	0	0	1	0
3	C	167	0	0	3	0
All	All	4259	0	3753	54	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 7.

All (54) 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:B:495:ILE:HG23	3:B:265:HOH:O	1.68	0.91
1:C:500:MET:CE	1:C:621:ARG:HG2	2.00	0.91
1:A:574:ARG:HD2	1:A:611:ARG:HD3	1.72	0.71
1:C:564:ASP:H	1:C:586:ASN:HD22	1.37	0.70
1:A:536:ILE:HD12	1:A:634:PRO:HG3	1.74	0.69
1:C:570:LEU:O	1:C:571:ARG:HD3	1.93	0.68
1:B:500:MET:SD	1:B:638:VAL:HG21	2.35	0.67
1:C:500:MET:HE3	1:C:621:ARG:HG2	1.76	0.66
1:B:500:MET:HE3	1:B:621:ARG:HH21	1.61	0.66
1:B:617:GLU:H	1:B:617:GLU:CD	2.03	0.65
1:B:583:ALA:N	1:B:587:THR:OG1	2.26	0.65
1:A:563:GLU:HG2	1:A:564:ASP:O	1.97	0.65
1:A:518:ASN:ND2	1:A:557:ILE:H	1.95	0.65
1:A:574:ARG:HD2	1:A:611:ARG:CD	2.26	0.64
1:B:631:THR:O	1:B:632:ASP:HB2	2.00	0.61
1:C:574:ARG:NH1	3:C:327:HOH:O	2.34	0.61
1:B:596:VAL:HG11	1:B:623:SER:HB3	1.81	0.61
3:A:30:HOH:O	1:C:534:HIS:HE1	1.89	0.55
1:B:521:VAL:HB	1:B:557:ILE:HG21	1.89	0.55
1:B:500:MET:HB3	1:B:621:ARG:HH22	1.73	0.54
1:B:500:MET:CE	1:B:621:ARG:NH2	2.72	0.53
1:A:566:PHE:HB3	1:A:604:ASN:ND2	2.25	0.52
1:A:518:ASN:HD22	1:A:557:ILE:H	1.57	0.52
1:A:518:ASN:HD21	1:A:556:SER:HA	1.76	0.51
1:B:518:ASN:ND2	1:B:557:ILE:H	2.09	0.51
1:C:534:HIS:HD2	3:C:17:HOH:O	1.95	0.50
1:B:500:MET:HB3	1:B:621:ARG:NH2	2.28	0.49
1:B:517:GLU:O	1:B:521:VAL:HG23	2.13	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:567:HIS:HD2	1:C:569:THR:OG1	1.95	0.49
1:B:536:ILE:HD13	1:B:622:ILE:O	2.14	0.48
1:B:627:VAL:HA	1:B:634:PRO:HA	1.96	0.48
1:B:577:THR:O	1:B:594:ILE:HA	2.13	0.48
1:C:504:HIS:HD2	3:C:366:HOH:O	1.96	0.48
1:A:506:LYS:HE2	1:A:508:PHE:HE1	1.79	0.47
1:B:500:MET:SD	1:B:638:VAL:CG2	3.02	0.47
1:B:518:ASN:HD22	1:B:557:ILE:H	1.63	0.47
1:B:583:ALA:H	1:B:587:THR:HG1	1.56	0.47
1:A:574:ARG:NH2	3:A:254:HOH:O	2.47	0.47
1:A:576:TYR:HB3	1:A:612:VAL:HB	1.97	0.47
1:B:579:SER:HB2	1:B:593:PHE:CZ	2.50	0.46
1:B:500:MET:CB	1:B:621:ARG:HH22	2.27	0.46
1:B:631:THR:O	1:B:632:ASP:CB	2.63	0.46
1:B:596:VAL:HG11	1:B:623:SER:CB	2.46	0.46
1:A:570:LEU:O	1:A:571:ARG:HD3	2.17	0.45
1:C:567:HIS:CD2	1:C:569:THR:OG1	2.70	0.45
1:B:618:VAL:O	1:B:622:ILE:HG13	2.17	0.45
1:A:570:LEU:C	1:A:571:ARG:HD3	2.42	0.44
1:A:571:ARG:HA	1:A:571:ARG:HD2	1.73	0.43
1:C:571:ARG:HD3	1:C:571:ARG:HA	1.71	0.43
1:B:562:PHE:O	1:B:588:ASN:HB2	2.18	0.43
1:A:574:ARG:HB2	1:A:575:PRO:HD2	2.00	0.42
1:A:574:ARG:CD	1:A:611:ARG:HD3	2.45	0.42
1:B:628:ASN:HA	1:B:629:PRO:HD3	1.83	0.41
1:B:582:ASN:OD1	1:B:582:ASN:C	2.63	0.41

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	162/176 (92%)	153 (94%)	9 (6%)	0	100	100
1	B	162/176 (92%)	150 (93%)	12 (7%)	0	100	100
1	C	163/176 (93%)	154 (94%)	9 (6%)	0	100	100
All	All	487/528 (92%)	457 (94%)	30 (6%)	0	100	100

There are no Ramachandran outliers to report.

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	144/153 (94%)	142 (99%)	2 (1%)	59	39
1	B	144/153 (94%)	139 (96%)	5 (4%)	32	10
1	C	145/153 (95%)	144 (99%)	1 (1%)	76	64
All	All	433/459 (94%)	425 (98%)	8 (2%)	51	30

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	582	ASN
1	A	617	GLU
1	B	582	ASN
1	B	585	SER
1	B	587	THR
1	B	617	GLU
1	B	621	ARG
1	C	582	ASN

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	518	ASN
1	A	624	ASN

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Mol	Chain	Res	Type
1	B	518	ASN
1	B	624	ASN
1	C	534	HIS
1	C	567	HIS
1	C	586	ASN
1	C	604	ASN
1	C	620	GLN
1	C	624	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

1 ligand 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	$\# Z > 2$
2	GOL	C	401	-	5,5,5	0.30	0	5,5,5	1.14	1 (20%)

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	GOL	C	401	-	-	2/4/4/4	-

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	401	GOL	C3-C2-C1	-2.47	102.74	111.80

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	C	401	GOL	O2-C2-C3-O3
2	C	401	GOL	C1-C2-C3-O3

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	164/176 (93%)	0.51	4 (2%) 59 65	29, 37, 48, 61	0
1	B	164/176 (93%)	2.34	96 (58%) 0 0	37, 58, 79, 84	0
1	C	165/176 (93%)	0.44	5 (3%) 52 57	28, 36, 50, 68	0
All	All	493/528 (93%)	1.09	105 (21%) 2 3	28, 41, 71, 84	0

All (105) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	627	VAL	5.5
1	B	562	PHE	5.3
1	B	625	VAL	5.3
1	B	583	ALA	5.1
1	B	500	MET	4.8
1	B	641	ILE	4.5
1	B	631	THR	4.4
1	B	547	PRO	4.3
1	B	554	GLY	4.3
1	B	618	VAL	4.2
1	B	566	PHE	4.2
1	B	567	HIS	4.1
1	B	560	GLY	4.1
1	B	558	TRP	4.0
1	B	635	TYR	4.0
1	B	632	ASP	4.0
1	B	640	ILE	3.9
1	B	634	PRO	3.9
1	B	564	ASP	3.8
1	B	533	PHE	3.7
1	B	584	GLY	3.7
1	B	615	GLY	3.7
1	B	537	ILE	3.6

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Mol	Chain	Res	Type	RSRZ
1	B	557	ILE	3.6
1	B	587	THR	3.6
1	A	559	GLY	3.6
1	B	643	ILE	3.5
1	B	530	GLY	3.5
1	B	622	ILE	3.4
1	B	563	GLU	3.4
1	B	522	HIS	3.4
1	B	556	SER	3.4
1	B	621	ARG	3.3
1	A	567	HIS	3.3
1	B	527	TYR	3.3
1	B	532	THR	3.3
1	B	628	ASN	3.3
1	B	552	MET	3.2
1	B	528	TYR	3.2
1	B	629	PRO	3.1
1	B	523	SER	3.1
1	B	551	GLY	3.1
1	C	482	THR	3.1
1	B	503	ILE	3.1
1	B	536	ILE	3.1
1	B	550	THR	3.1
1	B	504	HIS	3.0
1	B	521	VAL	3.0
1	C	559	GLY	3.0
1	B	510	VAL	2.9
1	C	552	MET	2.9
1	B	545	GLY	2.9
1	B	586	ASN	2.9
1	C	486	GLY	2.8
1	B	601	TRP	2.8
1	B	497	HIS	2.8
1	B	619	VAL	2.8
1	B	616	MET	2.8
1	B	581	ALA	2.8
1	B	585	SER	2.8
1	B	596	VAL	2.8
1	B	495	ILE	2.8
1	B	553	GLY	2.8
1	C	485	GLU	2.6
1	B	496	ILE	2.6

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Mol	Chain	Res	Type	RSRZ
1	B	639	SER	2.6
1	B	588	ASN	2.6
1	B	613	THR	2.6
1	B	633	LYS	2.6
1	B	561	GLU	2.6
1	B	499	SER	2.5
1	B	645	VAL	2.5
1	B	514	LYS	2.5
1	B	526	GLY	2.5
1	B	626	LYS	2.5
1	A	560	GLY	2.5
1	B	535	ARG	2.5
1	B	569	THR	2.5
1	B	576	TYR	2.4
1	B	516	VAL	2.4
1	B	636	GLU	2.4
1	B	638	VAL	2.4
1	B	555	GLU	2.3
1	B	519	PHE	2.3
1	B	597	VAL	2.3
1	B	546	ASP	2.3
1	B	498	THR	2.3
1	B	512	CYS	2.3
1	B	524	ARG	2.3
1	A	646	LYS	2.3
1	B	582	ASN	2.3
1	B	549	GLY	2.3
1	B	559	GLY	2.3
1	B	502	ASP	2.2
1	B	591	GLN	2.2
1	B	565	GLU	2.2
1	B	520	CYS	2.2
1	B	531	HIS	2.2
1	B	612	VAL	2.1
1	B	642	ASN	2.1
1	B	518	ASN	2.1
1	B	548	THR	2.1
1	B	513	PRO	2.1
1	B	543	GLN	2.0
1	B	607	THR	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 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($\text{\AA}^2$)	Q<0.9
2	GOL	C	401	6/6	0.78	0.18	48,48,56,60	0

6.5 Other polymers [i](#)

There are no such residues in this entry.