



Full wwPDB X-ray Structure Validation Report

Feb 27, 2014 – 10:48 PM GMT

PDB ID : 2WL3
Title : CRYSTAL STRUCTURE OF CATECHOL 2,3-DIOXYGENASE
Authors : Cho, H.J.; Kim, K.J.; Kang, B.S.
Deposited on : 2009-06-21
Resolution : 2.20 Å(reported)

This is a full wwPDB validation report for a publicly released PDB entry.
We welcome your comments at validation@mail.wwpdb.org
A user guide is available at <http://wwpdb.org/ValidationPDFNotes.html>

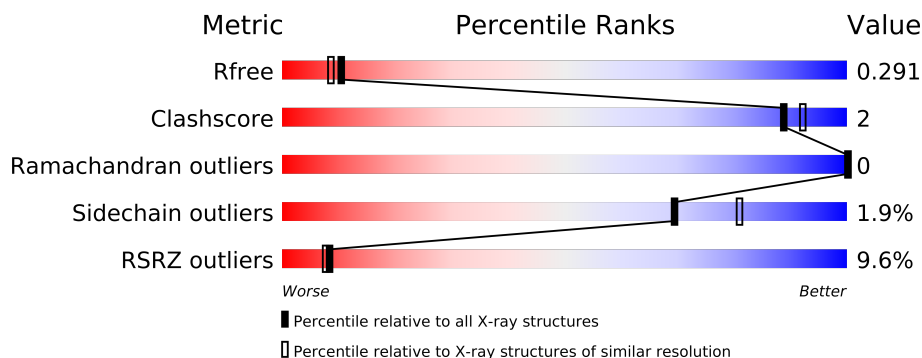
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.15 2013
Xtriage (Phenix) : dev-1323
EDS : stable22639
Percentile statistics : 21963
Refmac : 5.8.0049
CCP4 : 6.3.0 (Settle)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)
Validation Pipeline (wwPDB-VP) : stable22683

1 Overall quality at a glance

The reported resolution of this entry is 2.20 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}	66092	2938 (2.20-2.20)
Clashscore	79885	3751 (2.20-2.20)
Ramachandran outliers	78287	3681 (2.20-2.20)
Sidechain outliers	78261	3682 (2.20-2.20)
RSRZ outliers	66119	2939 (2.20-2.20)

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 on the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Mol	Chain	Length	Quality of chain
1	A	305	
1	B	305	
1	C	305	
1	D	305	

The following table lists non-polymeric compounds that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Geometry	Electron density
4	GOL	B	1289	-	X
4	GOL	C	1287	-	X

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 9238 atoms, of which 0 are hydrogen and 0 are deuterium.

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 CATECHOL 2,3-DIOXYGENASE.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	287	Total	C	N	O	S	Se	0	1	0
			2270	1437	401	423	2	7			
1	B	287	Total	C	N	O	S	Se	0	0	0
			2262	1432	398	422	2	8			
1	C	284	Total	C	N	O	S	Se	0	0	0
			2227	1412	390	416	2	7			
1	D	280	Total	C	N	O	S	Se	0	0	0
			2193	1389	387	408	2	7			

- Molecule 2 is FE (III) ION (three-letter code: FE) (formula: Fe).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	B	1	Total	Fe	0	0
			1	1		
2	A	1	Total	Fe	0	0
			1	1		
2	D	1	Total	Fe	0	0
			1	1		
2	C	1	Total	Fe	0	0
			1	1		

- Molecule 3 is CALCIUM ION (three-letter code: CA) (formula: Ca).

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

- Molecule 4 is GLYCEROL (three-letter code: GOL) (formula: C₃H₈O₃).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	C	O	0	0
			6	3	3		
4	A	1	Total	C	O	0	0
			6	3	3		
4	B	1	Total	C	O	0	0
			6	3	3		
4	C	1	Total	C	O	0	0
			6	3	3		
4	D	1	Total	C	O	0	0
			6	3	3		

- Molecule 5 is water.

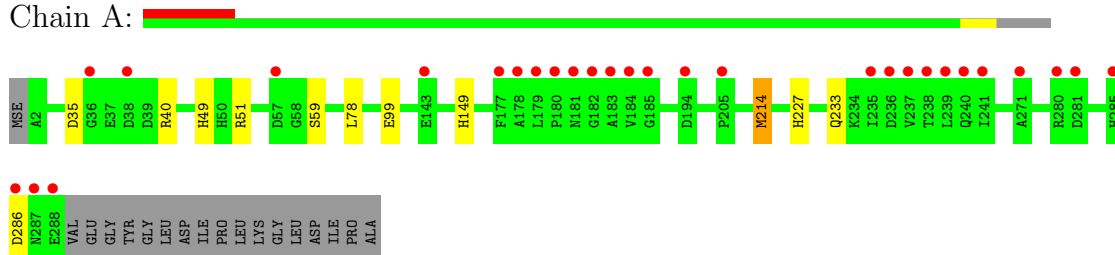
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	76	Total	O	0	0
			76	76		
5	B	63	Total	O	0	0
			63	63		
5	C	53	Total	O	0	0
			53	53		
5	D	59	Total	O	0	0
			59	59		

3 Residue-property plots

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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.

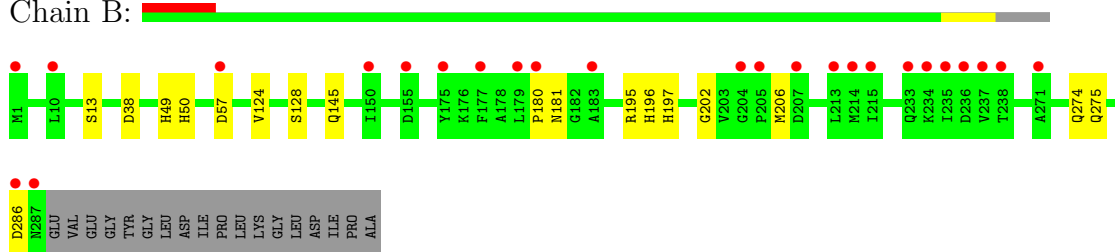
• Molecule 1: CATECHOL 2,3-DIOXYGENASE

Chain A:



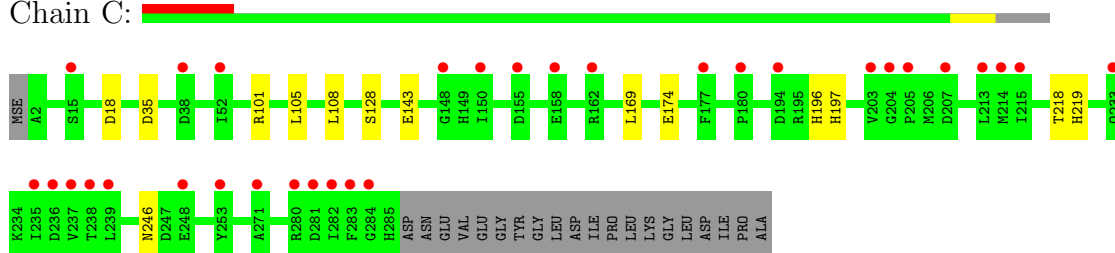
• Molecule 1: CATECHOL 2,3-DIOXYGENASE

Chain B:



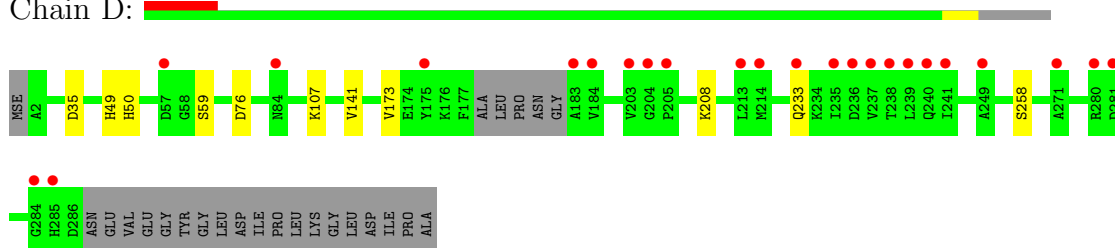
• Molecule 1: CATECHOL 2,3-DIOXYGENASE

Chain C:



• Molecule 1: CATECHOL 2,3-DIOXYGENASE

Chain D:



4 Data and refinement statistics

Property	Value	Source
Space group	P 4	Depositor
Cell constants a, b, c, α , β , γ	102.37Å 102.37Å 142.40Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	29.24 – 2.20 29.23 – 2.20	Depositor EDS
% Data completeness (in resolution range)	97.9 (29.24-2.20) 96.3 (29.23-2.20)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	16.53 (at 2.20Å)	Xtriage
Refinement program	REFMAC 5.5.0088	Depositor
R, R_{free}	0.155 , 0.178 0.256 , 0.291	Depositor DCC
R_{free} test set	3591 reflections (5.03%)	DCC
Wilson B-factor (Å ²)	27.7	Xtriage
Anisotropy	0.142	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.38 , 24.5	EDS
Estimated twinning fraction	0.436 for H, K, L 0.564 for -H, K, -L 0.000 for h,-k,-l	Xtriage
Reported twinning fraction	0.436 for H, K, L 0.564 for -H, K, -L	Depositor
L-test for twinning	$\langle L \rangle = 0.53$, $\langle L^2 \rangle = 0.38$	Xtriage
Outliers	0 of 71651 reflections	Xtriage
F_o, F_c correlation	0.91	EDS
Total number of atoms	9238	wwPDB-VP
Average B, all atoms (Å ²)	27.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.71% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: GOL, CA, FE

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	0.53	0/2329	0.62	1/3151 (0.0%)
1	B	0.59	1/2318 (0.0%)	0.65	0/3138
1	C	0.56	0/2283	0.63	0/3094
1	D	0.58	2/2246 (0.1%)	0.63	0/3040
All	All	0.57	3/9176 (0.0%)	0.63	1/12423 (0.0%)

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	124	VAL	CB-CG1	-6.17	1.39	1.52
1	D	141	VAL	CB-CG2	-5.78	1.40	1.52
1	D	173	VAL	CB-CG1	-5.54	1.41	1.52

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	51	ARG	NE-CZ-NH1	5.03	122.82	120.30

There are no chirality outliers.

There are no planarity outliers.

5.2 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 hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2270	0	0	4	0
1	B	2262	0	11	9	0
1	C	2227	0	0	4	0
1	D	2193	0	0	4	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0
2	D	1	0	0	0	0
3	A	1	0	0	0	0
4	A	12	0	16	1	0
4	B	6	0	8	0	0
4	C	6	0	8	0	0
4	D	6	0	8	0	0
5	A	76	0	0	0	0
5	B	63	0	0	3	0
5	C	53	0	0	0	0
5	D	59	0	0	1	0
All	All	9238	0	51	21	0

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 2.

All (21) close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:B:49:HIS:CD2	1:B:50:HIS:ND1	2.72	0.56
1:A:227:HIS:NE2	4:A:1291:GOL:H2	2.21	0.56
1:C:35:ASP:OD2	1:C:101:ARG:NH2	2.42	0.53
1:A:149:HIS:CE1	1:A:214:MSE:CG	2.93	0.51
1:B:196:HIS:ND1	1:B:197:HIS:CD2	2.79	0.51
1:A:40:ARG:NH1	1:A:99:GLU:OE2	2.43	0.50
1:D:107:LYS:NZ	5:D:2021:HOH:O	2.44	0.49
1:C:174:GLU:OE1	1:C:246:ASN:CB	2.61	0.48
1:C:196:HIS:CD2	1:C:197:HIS:CD2	3.01	0.48
1:C:218:THR:OG1	1:C:219:HIS:CD2	2.67	0.47
1:B:13:SER:OG	1:B:57:ASP:OD2	2.34	0.46
1:D:35:ASP:OD2	1:D:49:HIS:CE1	2.69	0.45
1:B:180:PRO:O	1:B:181:ASN:CB	2.62	0.45
1:B:145:GLN:O	1:B:195:ARG:NE	2.50	0.45
1:B:38:ASP:OD1	1:B:38:ASP:N	2.50	0.44
1:B:206:MSE:CE	5:B:2045:HOH:O	2.65	0.44
1:B:202:GLY:N	5:B:2045:HOH:O	2.50	0.43
1:A:35:ASP:OD2	1:A:49:HIS:CE1	2.72	0.43
1:D:49:HIS:CD2	1:D:50:HIS:ND1	2.88	0.42

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:B:275:GLN:NE2	5:B:2062:HOH:O	2.52	0.41
1:D:208:LYS:NZ	1:D:258:SER:O	2.53	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	286/305 (94%)	278 (97%)	8 (3%)	0	100	100
1	B	285/305 (93%)	279 (98%)	6 (2%)	0	100	100
1	C	282/305 (92%)	272 (96%)	10 (4%)	0	100	100
1	D	276/305 (90%)	268 (97%)	8 (3%)	0	100	100
All	All	1129/1220 (92%)	1097 (97%)	32 (3%)	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	233/240 (97%)	228 (98%)	5 (2%)	66	78
1	B	232/240 (97%)	229 (99%)	3 (1%)	80	89
1	C	227/240 (95%)	221 (97%)	6 (3%)	59	70
1	D	222/240 (92%)	219 (99%)	3 (1%)	78	88
All	All	914/960 (95%)	897 (98%)	17 (2%)	69	81

All (17) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	59	SER
1	A	78	LEU
1	A	214	MSE
1	A	233	GLN
1	A	286	ASP
1	B	128	SER
1	B	274	GLN
1	B	286	ASP
1	C	18	ASP
1	C	105	LEU
1	C	108	LEU
1	C	128	SER
1	C	143	GLU
1	C	169	LEU
1	D	59	SER
1	D	76	ASP
1	D	233	GLN

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

5.3.3 RNA ⓘ

There are no RNA chains in this entry.

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

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates ⓘ

There are no carbohydrates in this entry.

5.6 Ligand geometry ⓘ

Of 10 ligands modelled in this entry, 5 are monoatomic - leaving 5 for Mogul analysis.

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	GOL	A	1291	-	5,5,5	0.40	0	5,5,5	0.31	0
4	GOL	A	1292	-	5,5,5	0.32	0	5,5,5	0.30	0
4	GOL	B	1289	-	5,5,5	0.43	0	5,5,5	0.35	0
4	GOL	C	1287	-	5,5,5	0.42	0	5,5,5	0.35	0
4	GOL	D	1288	-	5,5,5	0.30	0	5,5,5	0.41	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	GOL	A	1291	-	-	0/4/4/4	0/0/0/0
4	GOL	A	1292	-	-	0/4/4/4	0/0/0/0
4	GOL	B	1289	-	-	0/4/4/4	0/0/0/0
4	GOL	C	1287	-	-	0/4/4/4	0/0/0/0
4	GOL	D	1288	-	-	0/4/4/4	0/0/0/0

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.

5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues

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	287/305 (94%)	0.71	29 (10%) 7 7	13, 25, 52, 62	0
1	B	287/305 (94%)	0.55	25 (8%) 10 10	11, 25, 42, 51	0
1	C	284/305 (93%)	0.66	32 (11%) 6 5	12, 27, 47, 60	0
1	D	280/305 (91%)	0.64	24 (8%) 11 10	13, 27, 48, 58	0
All	All	1138/1220 (93%)	0.64	110 (9%) 8 7	11, 26, 47, 62	0

All (110) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	178	ALA	8.8
1	A	182	GLY	7.2
1	A	183	ALA	7.0
1	A	180	PRO	7.0
1	A	181	ASN	6.8
1	D	236	ASP	6.2
1	A	287	ASN	5.6
1	D	238	THR	5.6
1	A	177	PHE	5.4
1	A	235	ILE	5.3
1	D	183	ALA	5.1
1	C	236	ASP	5.0
1	D	184	VAL	4.9
1	D	237	VAL	4.8
1	B	1	MSE	4.8
1	B	180	PRO	4.6
1	A	179	LEU	4.5
1	A	184	VAL	4.3
1	D	281	ASP	4.1
1	C	180	PRO	4.1
1	B	183	ALA	3.9

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	B	238	THR	3.9
1	B	286	ASP	3.9
1	C	204	GLY	3.9
1	A	286	ASP	3.7
1	D	204	GLY	3.6
1	C	282	ILE	3.5
1	D	284	GLY	3.5
1	D	285	HIS	3.4
1	C	235	ILE	3.4
1	D	84	ASN	3.3
1	C	284	GLY	3.3
1	D	280	ARG	3.2
1	B	205	PRO	3.2
1	A	185	GLY	3.2
1	C	238	THR	3.2
1	B	287	ASN	3.2
1	C	280	ARG	3.2
1	C	205	PRO	3.2
1	A	238	THR	3.1
1	C	237	VAL	3.1
1	D	205	PRO	3.1
1	B	175	TYR	3.0
1	A	240	GLN	3.0
1	A	237	VAL	3.0
1	B	237	VAL	3.0
1	B	10	LEU	2.9
1	C	239	LEU	2.9
1	A	57	ASP	2.9
1	A	280	ARG	2.9
1	D	233	GLN	2.9
1	D	214	MSE	2.9
1	B	235	ILE	2.9
1	C	207	ASP	2.9
1	C	177	PHE	2.8
1	B	234	LYS	2.8
1	B	179	LEU	2.8
1	D	213	LEU	2.8
1	B	236	ASP	2.7
1	D	235	ILE	2.7
1	D	249	ALA	2.7
1	A	38	ASP	2.7
1	B	271	ALA	2.7

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	C	52	ILE	2.7
1	A	236	ASP	2.6
1	C	203	VAL	2.6
1	B	207	ASP	2.6
1	B	214	MSE	2.6
1	D	271	ALA	2.6
1	C	281	ASP	2.6
1	A	288	GLU	2.5
1	C	155	ASP	2.5
1	D	203	VAL	2.5
1	C	158	GLU	2.5
1	B	57	ASP	2.5
1	A	239	LEU	2.4
1	D	239	LEU	2.4
1	C	233	GLN	2.4
1	D	240	GLN	2.4
1	D	57	ASP	2.4
1	B	213	LEU	2.4
1	A	205	PRO	2.4
1	A	241	ILE	2.4
1	C	248	GLU	2.4
1	C	38	ASP	2.4
1	A	194	ASP	2.4
1	C	253	TYR	2.3
1	C	215	ILE	2.3
1	C	148	GLY	2.3
1	B	177	PHE	2.3
1	D	241	ILE	2.3
1	C	214	MSE	2.3
1	C	271	ALA	2.2
1	C	194	ASP	2.2
1	A	285	HIS	2.2
1	A	143	GLU	2.2
1	B	204	GLY	2.2
1	A	271	ALA	2.2
1	B	233	GLN	2.1
1	A	36	GLY	2.1
1	B	215	ILE	2.1
1	C	162	ARG	2.1
1	C	150	ILE	2.1
1	A	281	ASP	2.1
1	C	283	PHE	2.1

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	B	150	ILE	2.1
1	D	175	TYR	2.1
1	C	213	LEU	2.0
1	B	155	ASP	2.0
1	C	15	SER	2.0

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

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates ⓘ

There are no carbohydrates in this entry.

6.4 Ligands ⓘ

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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	RSR	LLDF	B-factors(Å ²)	Q<0.9
4	GOL	C	1287	6/6	0.34	16.73	54,55,55,55	0
4	GOL	B	1289	6/6	0.19	2.02	37,37,38,38	0
4	GOL	A	1291	6/6	0.29	0.28	55,56,57,58	0
4	GOL	D	1288	6/6	0.20	0.27	51,52,52,52	0
4	GOL	A	1292	6/6	0.18	-0.25	65,66,66,67	0
2	FE	B	1288	1/1	0.16	-0.47	42,42,42,42	0
2	FE	D	1287	1/1	0.14	-1.63	55,55,55,55	0
3	CA	A	1290	1/1	0.06	-1.96	30,30,30,30	0
2	FE	A	1289	1/1	0.06	-2.98	44,44,44,44	0
2	FE	C	1286	1/1	0.07	-3.43	51,51,51,51	0

6.5 Other polymers ⓘ

There are no such residues in this entry.