



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 12:46 PM UTC

PDB ID : 1CBG / pdb_00001cbg
Title : THE CRYSTAL STRUCTURE OF A CYANOGENIC BETA-GLUCOSIDASE FROM WHITE CLOVER (TRIFOLIUM REPENS L.), A FAMILY 1 GLYCOSYL-HYDROLASE
Authors : Barrett, T.E.; Suresh, C.G.; Tolley, S.P.; Hughes, M.A.
Deposited on : 1995-07-31
Resolution : 2.15 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
Xtriage (Phenix) : **NOT EXECUTED**
EDS : **NOT EXECUTED**
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

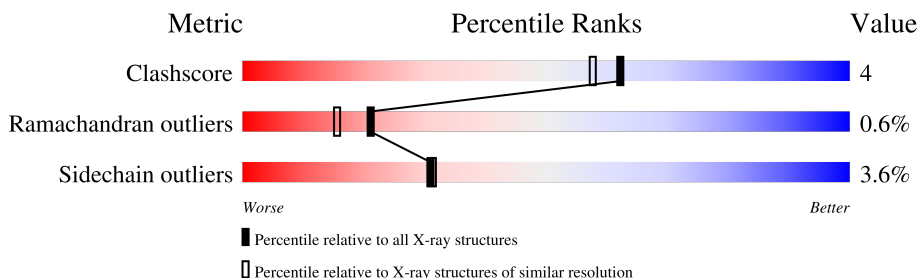
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.15 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))
Clashscore	190562	2159 (2.16-2.16)
Ramachandran outliers	187476	2134 (2.16-2.16)
Sidechain outliers	187428	2133 (2.16-2.16)

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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	490	 74% 21% . .

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 4429 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 CYANOGENIC BETA-GLUCOSIDASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	490	Total	C	N	O	S	40	0	0
			3993	2584	675	720	14			

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	436	Total	O	0	0
			436	436		

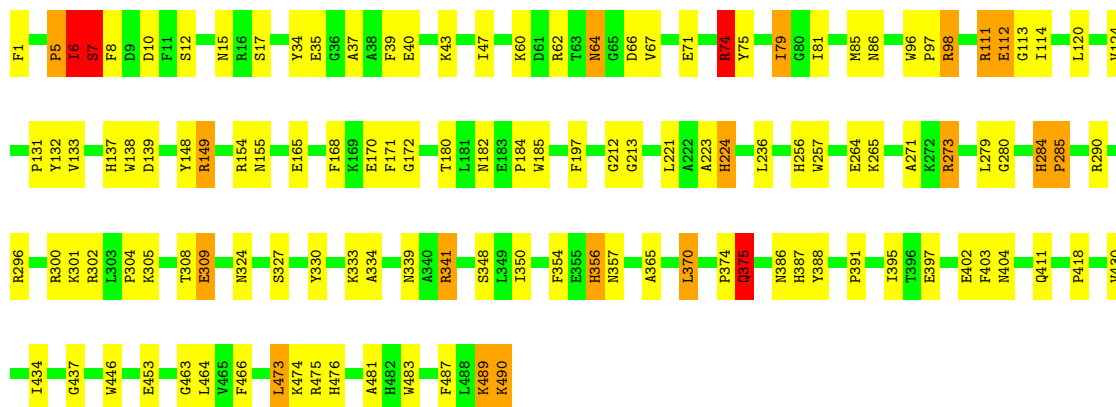
3 Residue-property plots

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. 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. 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.

Note EDS was not executed.

• Molecule 1: CYANOGENIC BETA-GLUCOSIDASE

Chain A:  74% 21% ..



4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, α , β , γ	70.33Å 70.33Å 249.10Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	9.00 – 2.15	Depositor
% Data completeness (in resolution range)	95.0 (9.00-2.15)	Depositor
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	PROLSQ, X-PLOR 3.1	Depositor
R, R_{free}	0.195 , 0.247	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	4429	wwPDB-VP
Average B, all atoms (Å ²)	11.0	wwPDB-VP

5 Model quality

5.1 Standard geometry

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	1.17	7/4119 (0.2%)	2.13	144/5585 (2.6%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	2

All (7) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	6	ILE	C-N	-35.77	0.83	1.33
1	A	7	SER	C-N	-20.68	1.04	1.33
1	A	111	ARG	C-N	-18.13	1.09	1.34
1	A	334	ALA	C-N	-11.66	1.18	1.33
1	A	301	LYS	CA-CB	-8.16	1.40	1.53
1	A	5	PRO	C-N	-6.78	1.24	1.33
1	A	300	ARG	CD-NE	-6.68	1.36	1.46

All (144) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	98	ARG	CD-NE-CZ	31.45	168.44	124.40
1	A	6	ILE	O-C-N	-29.29	85.96	122.57
1	A	62	ARG	CD-NE-CZ	22.92	156.49	124.40
1	A	111	ARG	CA-C-N	15.86	143.12	120.28
1	A	111	ARG	C-N-CA	15.86	143.12	120.28
1	A	74	ARG	CD-NE-CZ	12.89	142.45	124.40
1	A	35	GLU	N-CA-C	11.26	123.12	111.07
1	A	197	PHE	CA-CB-CG	9.85	123.65	113.80
1	A	154	ARG	CA-C-N	9.83	134.44	120.28

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	154	ARG	C-N-CA	9.83	134.44	120.28
1	A	74	ARG	NE-CZ-NH2	-9.52	110.63	119.20
1	A	86	ASN	CA-CB-CG	9.42	122.02	112.60
1	A	111	ARG	CB-CA-C	9.32	126.69	110.85
1	A	279	LEU	CA-C-N	9.29	130.30	119.98
1	A	279	LEU	C-N-CA	9.29	130.30	119.98
1	A	10	ASP	CA-CB-CG	9.28	121.88	112.60
1	A	489	LYS	N-CA-C	8.87	124.78	112.72
1	A	111	ARG	O-C-N	-8.58	112.37	122.15
1	A	171	PHE	CA-C-N	8.52	130.78	120.14
1	A	171	PHE	C-N-CA	8.52	130.78	120.14
1	A	133	VAL	N-CA-C	8.29	119.83	107.80
1	A	280	GLY	CA-C-N	7.89	131.19	120.54
1	A	280	GLY	C-N-CA	7.89	131.19	120.54
1	A	74	ARG	NE-CZ-NH1	7.69	129.19	121.50
1	A	375	GLN	CA-C-N	7.29	128.19	120.03
1	A	375	GLN	C-N-CA	7.29	128.19	120.03
1	A	434	ILE	CA-C-N	7.19	127.96	119.98
1	A	434	ILE	C-N-CA	7.19	127.96	119.98
1	A	111	ARG	CB-CG-CD	7.12	127.67	111.30
1	A	324	ASN	CA-CB-CG	7.08	119.68	112.60
1	A	374	PRO	CA-C-N	6.95	130.29	120.28
1	A	374	PRO	C-N-CA	6.95	130.29	120.28
1	A	273	ARG	CA-C-N	6.94	127.64	119.94
1	A	273	ARG	C-N-CA	6.94	127.64	119.94
1	A	463	GLY	N-CA-C	6.71	122.08	112.82
1	A	1	PHE	CA-CB-CG	6.69	120.49	113.80
1	A	184	PRO	CA-C-N	6.58	129.00	120.44
1	A	184	PRO	C-N-CA	6.58	129.00	120.44
1	A	212	GLY	CA-C-O	-6.51	116.33	122.13
1	A	7	SER	CA-C-N	6.46	133.88	121.54
1	A	7	SER	C-N-CA	6.46	133.88	121.54
1	A	34	TYR	N-CA-C	6.43	121.66	113.55
1	A	168	PHE	CA-CB-CG	6.43	120.23	113.80
1	A	180	THR	CA-CB-OG1	-6.41	99.99	109.60
1	A	411	GLN	CA-C-N	6.36	128.81	120.28
1	A	411	GLN	C-N-CA	6.36	128.81	120.28
1	A	404	ASN	N-CA-C	-6.32	99.58	109.25
1	A	139	ASP	CA-CB-CG	6.31	118.91	112.60
1	A	327	SER	N-CA-CB	-6.24	101.51	111.43
1	A	17	SER	CA-C-N	6.23	129.78	120.31
1	A	17	SER	C-N-CA	6.23	129.78	120.31

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	490	LYS	N-CA-CB	6.18	121.01	110.50
1	A	172	GLY	CA-C-N	6.15	129.66	120.31
1	A	172	GLY	C-N-CA	6.15	129.66	120.31
1	A	34	TYR	CA-CB-CG	6.14	124.95	113.90
1	A	223	ALA	CA-C-N	6.12	128.40	120.44
1	A	223	ALA	C-N-CA	6.12	128.40	120.44
1	A	10	ASP	CA-C-N	6.08	129.54	120.31
1	A	10	ASP	C-N-CA	6.08	129.54	120.31
1	A	487	PHE	CA-CB-CG	6.06	119.86	113.80
1	A	475	ARG	CD-NE-CZ	5.95	132.73	124.40
1	A	264	GLU	CA-CB-CG	5.90	125.90	114.10
1	A	155	ASN	CA-C-N	5.86	128.49	120.46
1	A	155	ASN	C-N-CA	5.86	128.49	120.46
1	A	418	PRO	CA-C-N	5.86	128.61	120.29
1	A	418	PRO	C-N-CA	5.86	128.61	120.29
1	A	300	ARG	CD-NE-CZ	5.83	132.56	124.40
1	A	327	SER	N-CA-C	5.81	118.25	109.41
1	A	308	THR	CA-C-N	5.81	128.07	120.28
1	A	308	THR	C-N-CA	5.81	128.07	120.28
1	A	403	PHE	CA-CB-CG	5.80	119.60	113.80
1	A	301	LYS	N-CA-CB	5.79	118.75	110.06
1	A	5	PRO	O-C-N	-5.76	114.87	122.64
1	A	453	GLU	CB-CG-CD	5.74	122.35	112.60
1	A	39	PHE	CA-CB-CG	5.74	119.53	113.80
1	A	466	PHE	CA-CB-CG	5.69	119.49	113.80
1	A	354	PHE	CA-CB-CG	5.63	119.43	113.80
1	A	138	TRP	CA-C-N	5.60	130.34	122.05
1	A	138	TRP	C-N-CA	5.60	130.34	122.05
1	A	12	SER	CA-C-N	5.60	130.06	120.72
1	A	12	SER	C-N-CA	5.60	130.06	120.72
1	A	71	GLU	CB-CG-CD	5.59	122.11	112.60
1	A	302	ARG	CA-C-N	5.59	129.38	121.61
1	A	302	ARG	C-N-CA	5.59	129.38	121.61
1	A	309	GLU	CB-CG-CD	5.58	122.08	112.60
1	A	114	ILE	CA-C-N	5.57	127.75	120.28
1	A	114	ILE	C-N-CA	5.57	127.75	120.28
1	A	285	PRO	CA-C-N	5.57	128.30	120.28
1	A	285	PRO	C-N-CA	5.57	128.30	120.28
1	A	330	TYR	N-CA-CB	5.56	119.34	110.16
1	A	341	ARG	N-CA-C	-5.55	103.05	109.93
1	A	224	HIS	CA-CB-CG	5.52	119.32	113.80
1	A	5	PRO	CA-C-N	5.49	131.86	121.97

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	5	PRO	C-N-CA	5.49	131.86	121.97
1	A	182	ASN	N-CA-CB	5.49	119.21	110.65
1	A	300	ARG	NE-CZ-NH2	5.49	124.14	119.20
1	A	296	ARG	NE-CZ-NH2	5.47	124.13	119.20
1	A	79	ILE	CA-C-N	5.44	125.98	119.94
1	A	79	ILE	C-N-CA	5.44	125.98	119.94
1	A	473	LEU	CA-C-N	5.43	128.42	120.71
1	A	473	LEU	C-N-CA	5.43	128.42	120.71
1	A	464	LEU	N-CA-C	-5.42	106.50	113.23
1	A	98	ARG	NE-CZ-NH2	5.36	124.03	119.20
1	A	437	GLY	N-CA-C	5.36	122.99	115.43
1	A	111	ARG	NE-CZ-NH2	5.35	124.01	119.20
1	A	402	GLU	CB-CG-CD	5.34	121.68	112.60
1	A	137	HIS	CA-C-N	5.34	134.41	125.02
1	A	137	HIS	C-N-CA	5.34	134.41	125.02
1	A	10	ASP	N-CA-C	-5.33	101.19	109.24
1	A	47	ILE	CA-C-N	5.30	128.37	120.31
1	A	47	ILE	C-N-CA	5.30	128.37	120.31
1	A	112	GLU	N-CA-CB	5.30	118.38	110.22
1	A	446	TRP	CA-C-N	5.29	131.23	121.70
1	A	446	TRP	C-N-CA	5.29	131.23	121.70
1	A	213	GLY	N-CA-C	5.29	118.48	110.97
1	A	71	GLU	CA-C-N	5.28	127.67	120.54
1	A	71	GLU	C-N-CA	5.28	127.67	120.54
1	A	334	ALA	CA-C-N	5.26	125.16	119.85
1	A	334	ALA	C-N-CA	5.26	125.16	119.85
1	A	37	ALA	CA-C-N	5.25	128.30	120.31
1	A	37	ALA	C-N-CA	5.25	128.30	120.31
1	A	113	GLY	N-CA-C	-5.25	106.14	112.49
1	A	149	ARG	CD-NE-CZ	5.25	131.75	124.40
1	A	79	ILE	CB-CG1-CD1	5.25	124.82	113.80
1	A	67	VAL	CA-C-O	-5.25	115.37	120.30
1	A	212	GLY	N-CA-C	-5.20	105.61	111.85
1	A	271	ALA	CA-C-N	5.19	127.23	120.28
1	A	271	ALA	C-N-CA	5.19	127.23	120.28
1	A	40	GLU	N-CA-C	5.16	118.53	110.32
1	A	430	VAL	N-CA-C	-5.15	105.47	110.42
1	A	257	TRP	N-CA-C	-5.14	101.33	109.76
1	A	265	LYS	CA-C-N	5.13	127.16	120.28
1	A	265	LYS	C-N-CA	5.13	127.16	120.28
1	A	356	HIS	CA-CB-CG	-5.12	108.68	113.80
1	A	357	ASN	CA-CB-CG	5.12	117.72	112.60

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	395	ILE	CA-C-O	-5.11	114.47	120.76
1	A	170	GLU	N-CA-C	5.10	117.96	111.69
1	A	397	GLU	CB-CG-CD	5.07	121.22	112.60
1	A	296	ARG	NH1-CZ-NH2	-5.04	112.75	119.30
1	A	386	ASN	N-CA-C	5.04	118.58	112.23
1	A	120	LEU	CA-C-N	5.01	126.87	120.56
1	A	120	LEU	C-N-CA	5.01	126.87	120.56
1	A	185	TRP	CA-C-N	5.00	125.49	119.94
1	A	185	TRP	C-N-CA	5.00	125.49	119.94

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	5	PRO	Mainchain
1	A	6	ILE	Mainchain

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	3993	0	3841	32	0
2	A	436	0	0	13	0
All	All	4429	0	3841	32	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 (32) 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:387:HIS:HD2	2:A:921:HOH:O	1.28	1.15
1:A:483:TRP:HD1	2:A:900:HOH:O	0.83	1.14
1:A:483:TRP:CD1	2:A:900:HOH:O	1.64	0.96
1:A:15:ASN:ND2	2:A:904:HOH:O	2.31	0.63

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:305:LYS:HE3	2:A:915:HOH:O	2.01	0.61
1:A:256:HIS:HD2	2:A:635:HOH:O	1.83	0.60
1:A:132:TYR:OH	2:A:575:HOH:O	2.05	0.55
1:A:64:ASN:HD22	1:A:66:ASP:H	1.55	0.54
1:A:476:HIS:HE1	2:A:905:HOH:O	1.92	0.51
1:A:43:LYS:HG3	1:A:98:ARG:HA	1.93	0.51
1:A:388:TYR:O	1:A:391:PRO:HD3	2.12	0.50
1:A:75:TYR:O	1:A:79:ILE:HG12	2.11	0.50
1:A:387:HIS:CD2	2:A:921:HOH:O	2.19	0.49
1:A:339:ASN:CG	1:A:339:ASN:O	2.56	0.49
1:A:375:GLN:HE21	1:A:375:GLN:H	1.60	0.48
1:A:74:ARG:NH2	1:A:473:LEU:HB2	2.28	0.48
1:A:348:SER:HB2	1:A:350:ILE:HD12	1.95	0.48
1:A:356:HIS:HD2	2:A:824:HOH:O	1.96	0.48
1:A:273:ARG:HB2	1:A:350:ILE:HD11	1.95	0.48
1:A:165:GLU:HB2	1:A:236:LEU:HD21	1.97	0.45
1:A:284:HIS:HB3	1:A:290:ARG:O	2.16	0.45
1:A:333:LYS:HE3	2:A:875:HOH:O	2.18	0.44
1:A:81:ILE:HG23	1:A:85:MET:HE3	1.99	0.43
1:A:85:MET:HE2	1:A:481:ALA:HB1	2.00	0.43
1:A:256:HIS:HE1	2:A:906:HOH:O	2.01	0.43
1:A:96:TRP:HB3	1:A:97:PRO:HD3	2.01	0.42
1:A:365:ALA:HB3	1:A:370:LEU:HG	2.01	0.42
1:A:224:HIS:CD2	1:A:304:PRO:HB2	2.54	0.42
1:A:148:TYR:O	1:A:149:ARG:HB2	2.19	0.41
1:A:79:ILE:HD12	1:A:124:VAL:HG22	2.03	0.41
1:A:284:HIS:CB	1:A:285:PRO:HD3	2.51	0.40
1:A:131:PRO:HD2	2:A:599:HOH:O	2.22	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	488/490 (100%)	471 (96%)	14 (3%)	3 (1%)	21 15

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	7	SER
1	A	8	PHE
1	A	6	ILE

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	417/417 (100%)	402 (96%)	15 (4%)	31 31

All (15) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	7	SER
1	A	60	LYS
1	A	64	ASN
1	A	74	ARG
1	A	111	ARG
1	A	112	GLU
1	A	221	LEU
1	A	284	HIS
1	A	309	GLU
1	A	341	ARG
1	A	370	LEU
1	A	375	GLN
1	A	474	LYS
1	A	489	LYS
1	A	490	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (15) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	64	ASN
1	A	127	ASN
1	A	137	HIS
1	A	224	HIS
1	A	230	HIS
1	A	245	GLN
1	A	256	HIS
1	A	284	HIS
1	A	375	GLN
1	A	386	ASN
1	A	387	HIS
1	A	398	ASN
1	A	451	ASN
1	A	476	HIS
1	A	482	HIS

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](#)

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](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	A	4

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	A	334:ALA	C	335:PRO	N	1.18
1	A	111:ARG	C	112:GLU	N	1.09
1	A	7:SER	C	8:PHE	N	1.04
1	A	6:ILE	C	7:SER	N	0.83

6 Fit of model and data

6.1 Protein, DNA and RNA chains

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

6.4 Ligands

EDS was not executed - this section is therefore empty.

6.5 Other polymers

EDS was not executed - this section is therefore empty.