



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 09:10 PM UTC

PDB ID : 1CWV / pdb_00001cwv
Title : CRYSTAL STRUCTURE OF INVASIN: A BACTERIAL INTEGRIN-BINDING PROTEIN
Authors : Bjorkman, P.J.; Hamburger, Z.A.
Deposited on : 1999-08-26
Resolution : 2.30 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)	:	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

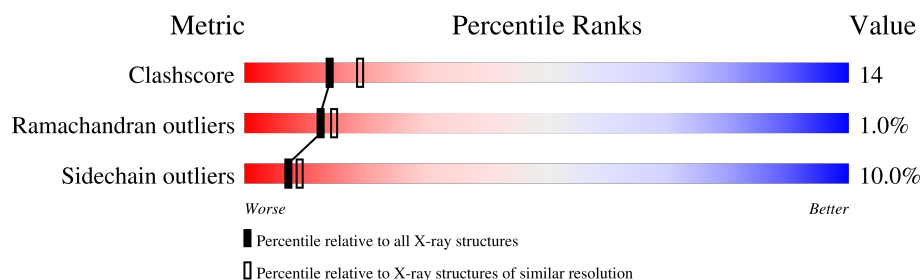
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 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	6919 (2.30-2.30)
Ramachandran outliers	187476	6854 (2.30-2.30)
Sidechain outliers	187428	6854 (2.30-2.30)

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	492	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	CIT	A	994	-	X	-	-

2 Entry composition [i](#)

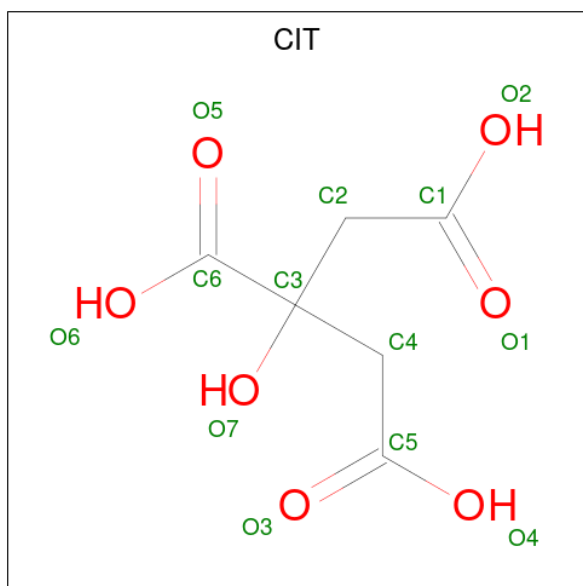
There are 3 unique types of molecules in this entry. The entry contains 3801 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 INVASIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	484	3593	2255	586	742	10	0	0	0

- Molecule 2 is CITRIC ACID (CCD ID: CIT) (formula: $C_6H_8O_7$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
2	A	1	13	6	7	0	0

- Molecule 3 is water.

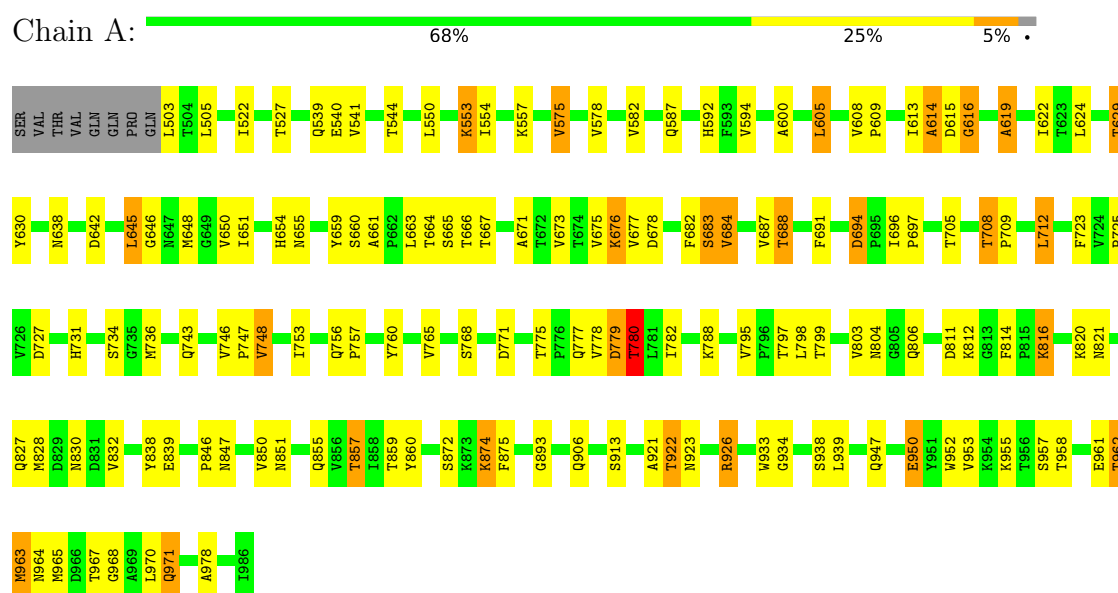
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
3	A	195	195	195	0	0

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: INVASIN



4 Data and refinement statistics

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

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	61.14Å 50.66Å 97.92Å 90.00° 98.34° 90.00°	Depositor
Resolution (Å)	30.00 – 2.30	Depositor
% Data completeness (in resolution range)	95.5 (30.00-2.30)	Depositor
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	X-PLOR	Depositor
R, R_{free}	0.224 , 0.274	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	3801	wwPDB-VP
Average B, all atoms (Å ²)	42.0	wwPDB-VP

5 Model quality ⓘ

5.1 Standard geometry ⓘ

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

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	0.46	0/3665	0.95	11/5015 (0.2%)

There are no bond length outliers.

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	616	GLY	N-CA-C	-7.96	104.33	115.32
1	A	683	SER	N-CA-C	6.16	123.93	110.80
1	A	830	ASN	N-CA-C	6.10	120.51	113.38
1	A	708	THR	CA-C-N	5.62	125.15	119.19
1	A	708	THR	C-N-CA	5.62	125.15	119.19
1	A	594	VAL	N-CA-C	5.54	116.28	108.36
1	A	684	VAL	N-CA-C	-5.51	103.89	109.02
1	A	694	ASP	N-CA-C	-5.40	101.70	109.48
1	A	575	VAL	N-CA-C	5.23	116.23	108.23
1	A	522	ILE	N-CA-C	-5.20	100.97	108.71
1	A	619	ALA	N-CA-C	5.13	117.60	109.50

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	3593	0	3505	102	0
2	A	13	0	8	2	0
3	A	195	0	0	8	1
All	All	3801	0	3513	102	1

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 14.

All (102) 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:964:ASN:HD22	1:A:967:THR:H	1.18	0.90
1:A:921:ALA:HB1	1:A:963:MET:HE3	1.62	0.80
1:A:806:GLN:HG3	1:A:926:ARG:HG2	1.63	0.79
1:A:964:ASN:ND2	1:A:967:THR:HG23	1.98	0.78
1:A:777:GLN:HG3	1:A:782:ILE:HG13	1.64	0.78
1:A:804:ASN:HB3	1:A:926:ARG:HH22	1.49	0.78
1:A:859:THR:HG23	1:A:860:TYR:CD1	2.25	0.72
1:A:964:ASN:ND2	1:A:967:THR:H	1.88	0.72
1:A:753:ILE:HD11	1:A:760:TYR:HB3	1.72	0.71
1:A:832:VAL:HG22	3:A:82:HOH:O	1.91	0.69
1:A:964:ASN:HD22	1:A:967:THR:N	1.89	0.68
1:A:922:THR:CG2	1:A:963:MET:HE2	2.24	0.67
1:A:859:THR:HG23	1:A:860:TYR:HD1	1.60	0.67
1:A:654:HIS:HE1	1:A:660:SER:HB2	1.60	0.67
1:A:893:GLY:O	1:A:906:GLN:HG2	1.94	0.67
1:A:922:THR:HG22	1:A:963:MET:HE2	1.78	0.66
1:A:614:ALA:HB3	1:A:731:HIS:CE1	2.31	0.65
1:A:779:ASP:HB2	3:A:63:HOH:O	1.96	0.65
1:A:777:GLN:HG3	1:A:782:ILE:CG1	2.29	0.63
1:A:779:ASP:O	1:A:780:THR:HB	1.99	0.63
1:A:798:LEU:HD12	1:A:828:MET:SD	2.39	0.62
1:A:952:TRP:CD1	1:A:978:ALA:HB3	2.34	0.62
1:A:965:MET:HE3	1:A:965:MET:HA	1.82	0.61
1:A:952:TRP:NE1	1:A:978:ALA:HB3	2.16	0.60
1:A:727:ASP:OD2	1:A:731:HIS:HB2	2.02	0.60
1:A:811:ASP:OD1	1:A:812:LYS:HE3	2.01	0.60
1:A:857:THR:CG2	3:A:153:HOH:O	2.51	0.59
1:A:539:GLN:O	1:A:557:LYS:HA	2.03	0.59
1:A:804:ASN:HB3	1:A:926:ARG:NH2	2.18	0.58
1:A:622:ILE:HG21	1:A:673:VAL:HG11	1.86	0.58
1:A:629:THR:HB	3:A:22:HOH:O	2.04	0.57

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:619:ALA:HB2	1:A:664:THR:HG22	1.86	0.56
1:A:665:SER:HB3	1:A:691:PHE:CD2	2.41	0.56
1:A:613:ILE:HG22	1:A:615:ASP:HB2	1.88	0.54
1:A:613:ILE:O	1:A:615:ASP:N	2.32	0.54
1:A:654:HIS:CE1	1:A:660:SER:HB2	2.42	0.53
1:A:697:PRO:HG3	1:A:736:MET:HE1	1.91	0.53
1:A:874:LYS:HD2	1:A:875:PHE:CE1	2.44	0.52
1:A:736:MET:HE2	1:A:778:VAL:HG11	1.91	0.52
1:A:746:VAL:CG2	1:A:768:SER:HB2	2.39	0.52
1:A:779:ASP:CB	3:A:63:HOH:O	2.52	0.52
1:A:648:MET:HE2	1:A:661:ALA:CB	2.40	0.52
1:A:638:ASN:HD22	1:A:678:ASP:HA	1.74	0.52
1:A:953:VAL:HG21	1:A:970:LEU:HD11	1.92	0.52
1:A:955:LYS:HE3	1:A:961:GLU:CD	2.35	0.51
1:A:642:ASP:O	1:A:673:VAL:HA	2.11	0.51
1:A:638:ASN:ND2	1:A:678:ASP:HA	2.26	0.51
1:A:675:VAL:HG12	1:A:676:LYS:N	2.25	0.51
1:A:630:TYR:HB2	3:A:140:HOH:O	2.11	0.50
1:A:952:TRP:CE2	1:A:978:ALA:HB3	2.46	0.50
1:A:746:VAL:HG12	1:A:771:ASP:O	2.11	0.50
1:A:614:ALA:O	1:A:731:HIS:HE1	1.94	0.49
1:A:663:LEU:HG	1:A:691:PHE:HZ	1.77	0.49
1:A:677:VAL:HG22	1:A:682:PHE:HB2	1.94	0.49
1:A:746:VAL:HG23	1:A:747:PRO:HD2	1.95	0.49
1:A:820:LYS:O	1:A:821:ASN:HB2	2.12	0.49
1:A:712:LEU:HD13	1:A:875:PHE:CD1	2.47	0.49
1:A:587:GLN:HB2	2:A:994:CIT:O1	2.13	0.49
1:A:964:ASN:ND2	1:A:967:THR:N	2.56	0.47
1:A:575:VAL:HG22	1:A:592:HIS:CD2	2.47	0.47
1:A:648:MET:HE2	1:A:661:ALA:HB3	1.96	0.47
1:A:743:GLN:HE22	1:A:748:VAL:H	1.63	0.47
1:A:746:VAL:CG2	1:A:747:PRO:HD2	2.44	0.47
1:A:645:LEU:HD12	1:A:646:GLY:N	2.30	0.47
1:A:933:TRP:CD2	1:A:968:GLY:HA3	2.49	0.47
1:A:962:THR:HG22	1:A:971:GLN:HG2	1.97	0.46
1:A:816:LYS:HA	1:A:816:LYS:HD3	1.54	0.46
1:A:938:SER:HA	1:A:965:MET:HE2	1.98	0.45
1:A:748:VAL:HG22	1:A:765:VAL:O	2.16	0.45
1:A:756:GLN:HB3	1:A:757:PRO:CD	2.46	0.45
1:A:600:ALA:HA	1:A:682:PHE:CZ	2.52	0.45
1:A:616:GLY:HA3	1:A:666:THR:HG22	1.99	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:694:ASP:HB3	1:A:727:ASP:HB2	1.99	0.44
1:A:851:ASN:HB2	3:A:9:HOH:O	2.16	0.44
1:A:799:THR:OG1	1:A:827:GLN:NE2	2.50	0.44
1:A:803:VAL:O	1:A:804:ASN:C	2.60	0.44
1:A:659:TYR:N	1:A:659:TYR:CD1	2.86	0.44
1:A:723:PHE:CZ	1:A:725:PRO:HB3	2.53	0.43
1:A:708:THR:HA	1:A:709:PRO:HD3	1.76	0.43
1:A:503:LEU:HD12	1:A:503:LEU:C	2.44	0.43
1:A:964:ASN:HB3	1:A:967:THR:OG1	2.18	0.43
1:A:814:PHE:CD2	1:A:814:PHE:C	2.96	0.43
1:A:696:ILE:HA	1:A:697:PRO:HD3	1.91	0.43
1:A:505:LEU:O	2:A:994:CIT:H21	2.19	0.42
1:A:926:ARG:HD2	1:A:934:GLY:O	2.18	0.42
1:A:955:LYS:HE3	1:A:961:GLU:OE2	2.20	0.42
1:A:613:ILE:C	1:A:615:ASP:N	2.78	0.42
1:A:544:THR:HG22	1:A:553:LYS:HD2	2.02	0.42
1:A:779:ASP:O	1:A:780:THR:CB	2.66	0.42
1:A:850:VAL:HA	1:A:855:GLN:O	2.20	0.41
1:A:923:ASN:HB2	3:A:46:HOH:O	2.21	0.41
1:A:838:TYR:CD2	1:A:872:SER:HA	2.55	0.41
1:A:846:PRO:O	1:A:859:THR:HG22	2.20	0.41
1:A:846:PRO:O	1:A:847:ASN:C	2.63	0.41
1:A:922:THR:HB	1:A:933:TRP:HB3	2.02	0.41
1:A:950:GLU:HG3	1:A:962:THR:CG2	2.50	0.41
1:A:671:ALA:O	1:A:688:THR:HA	2.20	0.41
1:A:541:VAL:HG13	1:A:582:VAL:HG22	2.03	0.40
1:A:608:VAL:HA	1:A:609:PRO:HA	1.82	0.40
1:A:712:LEU:HD13	1:A:875:PHE:CE1	2.57	0.40
1:A:922:THR:OG1	1:A:923:ASN:N	2.55	0.40
1:A:605:LEU:HD13	1:A:687:VAL:HG22	2.04	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:A:82:HOH:O	3:A:177:HOH:O[1_554]	2.04	0.16

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	482/492 (98%)	443 (92%)	34 (7%)	5 (1%)	12 15

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	779	ASP
1	A	683	SER
1	A	780	THR
1	A	614	ALA
1	A	655	ASN

5.3.2 Protein sidechains [i](#)

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	401/409 (98%)	361 (90%)	40 (10%)	7 9

All (40) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	527	THR
1	A	540	GLU
1	A	550	LEU
1	A	553	LYS
1	A	554	ILE
1	A	578	VAL

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Mol	Chain	Res	Type
1	A	605	LEU
1	A	624	LEU
1	A	629	THR
1	A	645	LEU
1	A	650	VAL
1	A	651	ILE
1	A	667	THR
1	A	676	LYS
1	A	684	VAL
1	A	688	THR
1	A	705	THR
1	A	712	LEU
1	A	734	SER
1	A	748	VAL
1	A	775	THR
1	A	780	THR
1	A	788	LYS
1	A	795	VAL
1	A	797	THR
1	A	816	LYS
1	A	839	GLU
1	A	857	THR
1	A	874	LYS
1	A	913	SER
1	A	922	THR
1	A	926	ARG
1	A	939	LEU
1	A	947	GLN
1	A	950	GLU
1	A	957	SER
1	A	958	THR
1	A	962	THR
1	A	963	MET
1	A	971	GLN

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	561	ASN
1	A	585	GLN
1	A	638	ASN
1	A	654	HIS

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Mol	Chain	Res	Type
1	A	690	ASN
1	A	731	HIS
1	A	743	GLN
1	A	787	GLN
1	A	827	GLN
1	A	964	ASN

5.3.3 RNA ⓘ

There are no RNA molecules 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 oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

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	CIT	A	994	-	12,12,12	3.77	5 (41%)	17,17,17	6.71	11 (64%)

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	CIT	A	994	-	-	10/16/16/16	-

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	994	CIT	C3-C6	9.84	1.63	1.53
2	A	994	CIT	O6-C6	4.88	1.47	1.30
2	A	994	CIT	O4-C5	4.20	1.44	1.30
2	A	994	CIT	O2-C1	4.02	1.44	1.30
2	A	994	CIT	O5-C6	2.25	1.29	1.22

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	994	CIT	O7-C3-C6	-18.65	82.50	108.96
2	A	994	CIT	C4-C3-C6	-11.37	84.89	110.03
2	A	994	CIT	C2-C3-C6	-10.12	87.64	110.03
2	A	994	CIT	O7-C3-C2	7.74	127.03	109.38
2	A	994	CIT	O6-C6-C3	7.68	127.87	113.14
2	A	994	CIT	O2-C1-O1	-3.72	113.77	123.33
2	A	994	CIT	O6-C6-O5	-3.63	112.23	123.86
2	A	994	CIT	O7-C3-C4	3.12	116.49	109.38
2	A	994	CIT	O3-C5-C4	3.10	131.72	122.95
2	A	994	CIT	O4-C5-O3	-2.84	116.03	123.33
2	A	994	CIT	O1-C1-C2	2.61	130.35	122.95

There are no chirality outliers.

All (10) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	994	CIT	C2-C3-C4-C5
2	A	994	CIT	C2-C3-C6-O5
2	A	994	CIT	C2-C3-C6-O6
2	A	994	CIT	O7-C3-C6-O5
2	A	994	CIT	O7-C3-C6-O6
2	A	994	CIT	C1-C2-C3-O7
2	A	994	CIT	C1-C2-C3-C4
2	A	994	CIT	O7-C3-C4-C5
2	A	994	CIT	C4-C3-C6-O6
2	A	994	CIT	C4-C3-C6-O5

There are no ring outliers.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	994	CIT	2	0

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

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.