



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 8, 2026 – 12:14 PM UTC

PDB ID : 1RUZ / pdb_00001ruz
Title : 1918 H1 Hemagglutinin
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Deposited on : 2003-12-12
Resolution : 2.90 Å(reported)

This is a wwPDB X-ray Structure Validation Summary Report for a publicly released PDB entry.

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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

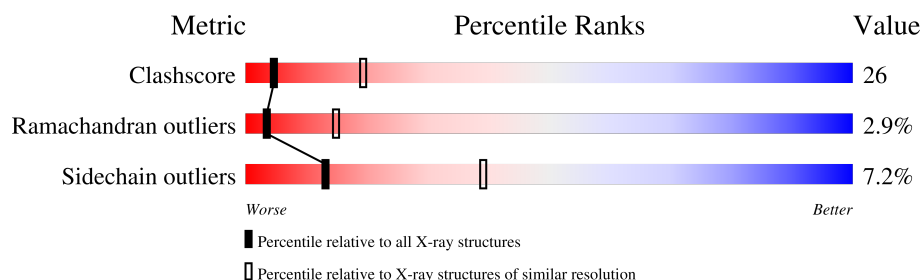
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.90 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	2690 (2.90-2.90)
Ramachandran outliers	187476	2623 (2.90-2.90)
Sidechain outliers	187428	2625 (2.90-2.90)

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	H	328	59% 34% 6% .
1	J	328	60% 33% 5% .
1	L	328	59% 34% 6% .
2	I	160	63% 27% 7% .
2	K	160	59% 32% 7% .
2	M	160	62% 28% 8% .

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 crite-

ria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	NDG	H	640	-	-	X	-
3	NDG	J	650	-	-	X	-
3	NDG	L	660	-	-	X	-

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 12108 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 hemagglutinin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	H	324	Total	C	N	O	S	0	0	0
			2516	1586	434	485	11			
1	J	324	Total	C	N	O	S	0	0	0
			2516	1586	434	485	11			
1	L	324	Total	C	N	O	S	0	0	0
			2516	1586	434	485	11			

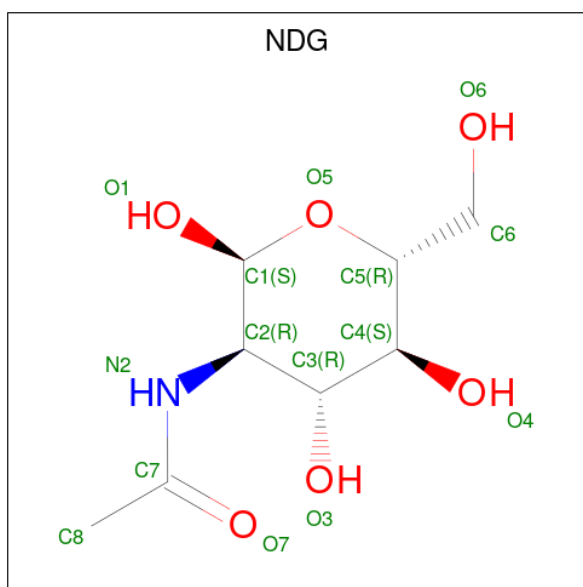
There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
H	326	ALA	SER	conflict	UNP Q9WFZ1
H	327	ARG	ILE	conflict	UNP Q9WFZ1
J	326	ALA	SER	conflict	UNP Q9WFZ1
J	327	ARG	ILE	conflict	UNP Q9WFZ1
L	326	ALA	SER	conflict	UNP Q9WFZ1
L	327	ARG	ILE	conflict	UNP Q9WFZ1

- Molecule 2 is a protein called hemagglutinin.

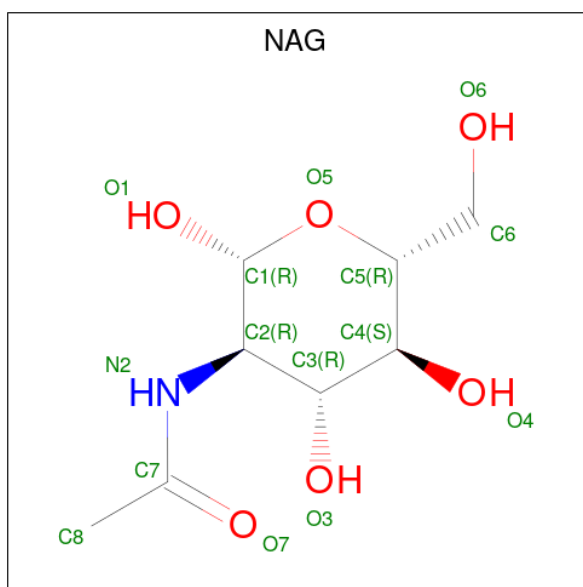
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	I	160	Total	C	N	O	S	0	0	0
			1282	802	220	254	6			
2	K	160	Total	C	N	O	S	0	0	0
			1282	802	220	254	6			
2	M	160	Total	C	N	O	S	0	0	0
			1282	802	220	254	6			

- Molecule 3 is 2-acetamido-2-deoxy- α -D-glucopyranose (CCD ID: NDG) (formula: $C_8H_{15}NO_6$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	H	1	Total	C	N	O	0	0
			15	8	1	6		
3	H	1	Total	C	N	O	0	0
			15	8	1	6		
3	H	1	Total	C	N	O	0	0
			15	8	1	6		
3	J	1	Total	C	N	O	0	0
			15	8	1	6		
3	J	1	Total	C	N	O	0	0
			15	8	1	6		
3	K	1	Total	C	N	O	0	0
			15	8	1	6		
3	L	1	Total	C	N	O	0	0
			15	8	1	6		
3	L	1	Total	C	N	O	0	0
			15	8	1	6		
3	M	1	Total	C	N	O	0	0
			15	8	1	6		

- Molecule 4 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: $C_8H_{15}NO_6$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	H	1	Total	C	N	O	0	0
			15	8	1	6		
4	H	1	Total	C	N	O	0	0
			15	8	1	6		

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	H	95	Total	O	0	0
			95	95		
5	I	75	Total	O	0	0
			75	75		
5	J	100	Total	O	0	0
			100	100		
5	K	78	Total	O	0	0
			78	78		
5	L	128	Total	O	0	0
			128	128		
5	M	73	Total	O	0	0
			73	73		

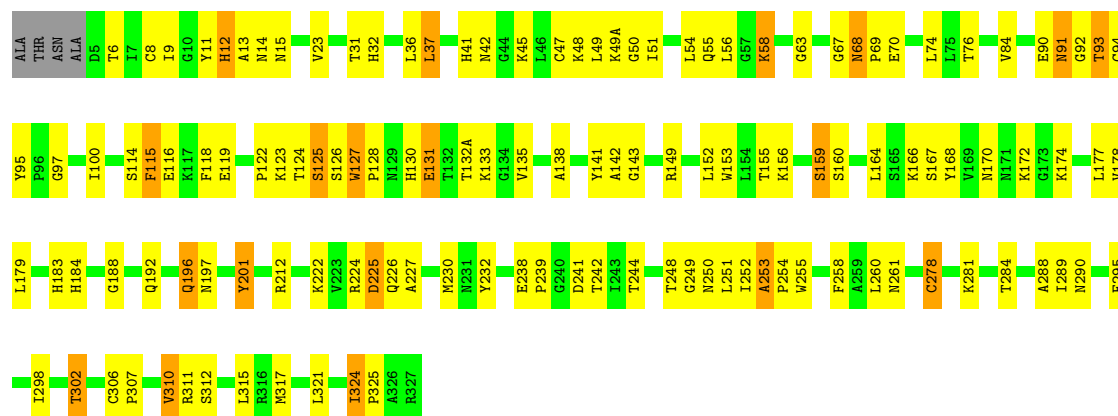
3 Residue-property plots

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.

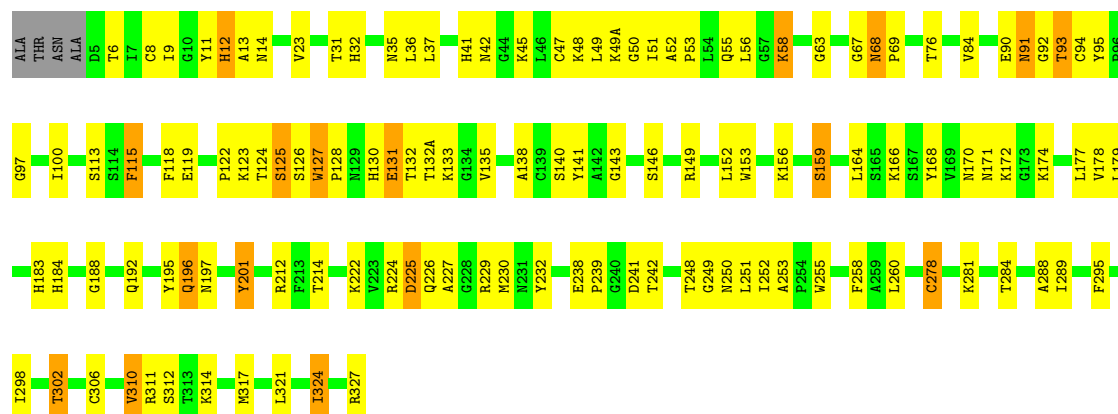
• Molecule 1: hemagglutinin

Chain H: 



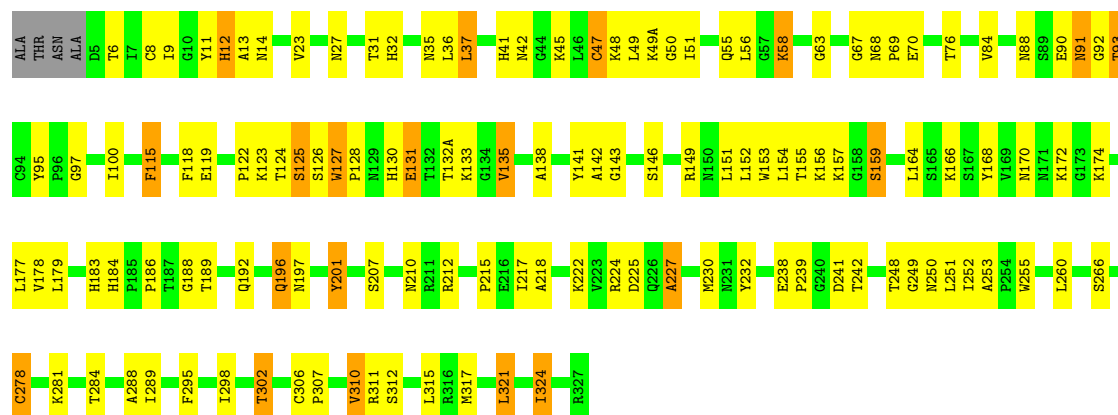
• Molecule 1: hemagglutinin

Chain J: 

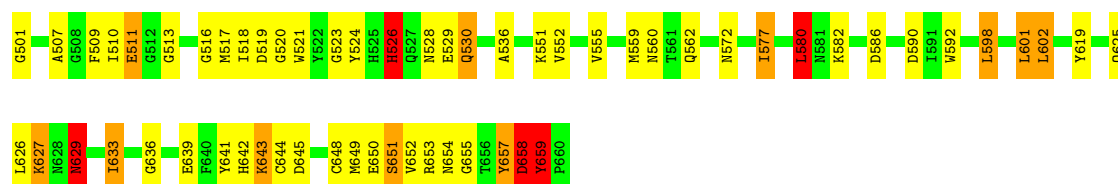


• Molecule 1: hemagglutinin

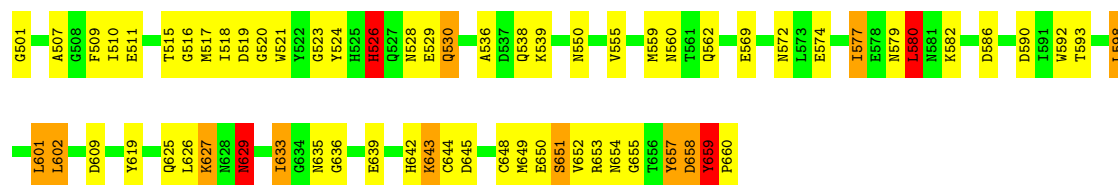
Chain L: 



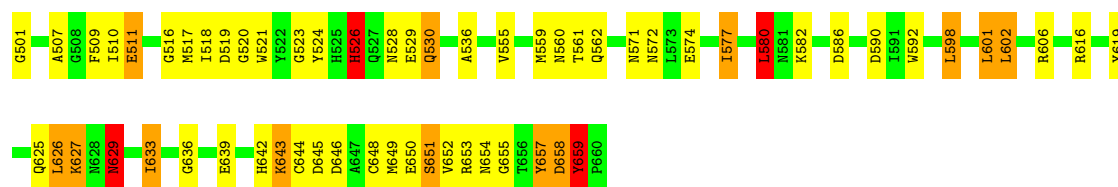
• Molecule 2: hemagglutinin



• Molecule 2: hemagglutinin



• Molecule 2: hemagglutinin



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	171.46Å 171.46Å 153.44Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	20.00 – 2.90	Depositor
% Data completeness (in resolution range)	(Not available) (20.00-2.90)	Depositor
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	CNS 1.0	Depositor
R, R_{free}	0.248 , 0.289	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	12108	wwPDB-VP
Average B, all atoms (Å ²)	73.0	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: NAG, NDG

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	H	0.45	0/2580	0.97	15/3514 (0.4%)
1	J	0.46	0/2580	0.98	16/3514 (0.5%)
1	L	0.46	0/2580	0.97	14/3514 (0.4%)
2	I	0.46	0/1308	0.84	4/1762 (0.2%)
2	K	0.48	0/1308	0.84	3/1762 (0.2%)
2	M	0.48	0/1308	0.84	3/1762 (0.2%)
All	All	0.46	0/11664	0.93	55/15828 (0.3%)

There are no bond length outliers.

The worst 5 of 55 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	L	127	TRP	N-CA-C	7.38	121.59	109.79
1	J	127	TRP	N-CA-C	7.22	121.34	109.79
1	H	127	TRP	N-CA-C	7.20	121.30	109.79
1	L	84	VAL	N-CA-C	7.10	118.28	107.77
1	H	253	ALA	N-CA-C	7.05	120.53	110.24

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	H	2516	0	2442	129	0
1	J	2516	0	2442	123	0
1	L	2516	0	2442	139	0
2	I	1282	0	1200	74	0
2	K	1282	0	1200	82	0
2	M	1282	0	1200	75	0
3	H	45	0	36	15	0
3	J	30	0	24	13	0
3	K	15	0	12	4	0
3	L	30	0	24	10	0
3	M	15	0	12	1	0
4	H	30	0	30	8	0
5	H	95	0	0	14	0
5	I	75	0	0	14	0
5	J	100	0	0	21	0
5	K	78	0	0	15	0
5	L	128	0	0	32	0
5	M	73	0	0	13	0
All	All	12108	0	11064	586	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 26.

The worst 5 of 586 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:H:290:ASN:CG	4:H:644:NAG:HN2	1.72	0.96
1:H:13:ALA:HB1	5:H:699:HOH:O	1.68	0.94
2:K:633:ILE:HD11	2:K:639:GLU:HB2	1.54	0.90
2:I:629:ASN:N	2:I:629:ASN:HD22	1.69	0.89
2:M:633:ILE:HD11	2:M:639:GLU:HB2	1.52	0.89

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	H	322/328 (98%)	282 (88%)	36 (11%)	4 (1%)	10	34
1	J	322/328 (98%)	282 (88%)	36 (11%)	4 (1%)	10	34
1	L	322/328 (98%)	281 (87%)	37 (12%)	4 (1%)	10	34
2	I	158/160 (99%)	131 (83%)	17 (11%)	10 (6%)	1	3
2	K	158/160 (99%)	133 (84%)	16 (10%)	9 (6%)	1	4
2	M	158/160 (99%)	131 (83%)	16 (10%)	11 (7%)	1	2
All	All	1440/1464 (98%)	1240 (86%)	158 (11%)	42 (3%)	3	15

5 of 42 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	H	125	SER
2	I	643	LYS
2	I	659	TYR
1	J	125	SER
2	K	643	LYS

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	H	279/281 (99%)	260 (93%)	19 (7%)	14	42
1	J	279/281 (99%)	260 (93%)	19 (7%)	14	42
1	L	279/281 (99%)	260 (93%)	19 (7%)	14	42
2	I	135/135 (100%)	124 (92%)	11 (8%)	11	33
2	K	135/135 (100%)	124 (92%)	11 (8%)	11	33
2	M	135/135 (100%)	124 (92%)	11 (8%)	11	33
All	All	1242/1248 (100%)	1152 (93%)	90 (7%)	13	39

5 of 90 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	K	653	ARG
1	L	201	TYR
2	K	659	TYR
1	L	90	GLU
1	L	284	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 45 such sidechains are listed below:

Mol	Chain	Res	Type
2	K	642	HIS
1	L	196	GLN
2	K	654	ASN
1	L	170	ASN
2	M	530	GLN

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](#)

11 ligands 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
3	NDG	K	661	-	15,15,15	0.94	1 (6%)	21,21,21	0.87	0
3	NDG	H	646	-	15,15,15	0.79	0	21,21,21	0.61	0
4	NAG	H	644	-	15,15,15	0.61	0	21,21,21	0.56	0
3	NDG	H	640	-	15,15,15	0.41	0	21,21,21	0.63	0
3	NDG	J	650	-	15,15,15	0.39	0	21,21,21	0.65	0
3	NDG	L	664	-	15,15,15	0.74	0	21,21,21	0.71	0
3	NDG	M	665	-	15,15,15	0.84	0	21,21,21	0.63	0
3	NDG	H	645	-	15,15,15	0.62	0	21,21,21	0.76	1 (4%)
3	NDG	J	651	-	15,15,15	0.48	0	21,21,21	0.59	0
4	NAG	H	641	-	15,15,15	0.72	1 (6%)	21,21,21	1.69	4 (19%)
3	NDG	L	660	-	15,15,15	0.42	0	21,21,21	0.55	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
3	NDG	K	661	-	-	3/6/26/26	0/1/1/1
3	NDG	H	646	-	-	3/6/26/26	0/1/1/1
4	NAG	H	644	-	-	6/6/26/26	0/1/1/1
3	NDG	H	640	-	-	5/6/26/26	0/1/1/1
3	NDG	J	650	-	-	4/6/26/26	0/1/1/1
3	NDG	L	664	-	-	3/6/26/26	0/1/1/1
3	NDG	M	665	-	-	6/6/26/26	0/1/1/1
3	NDG	H	645	-	-	5/6/26/26	0/1/1/1
3	NDG	J	651	-	-	4/6/26/26	0/1/1/1
4	NAG	H	641	-	-	4/6/26/26	0/1/1/1
3	NDG	L	660	-	-	5/6/26/26	0/1/1/1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	K	661	NDG	C1-C2	2.98	1.56	1.52
4	H	641	NAG	C1-C2	2.03	1.55	1.52

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	H	641	NAG	C1-C2-C3	4.24	116.33	110.54
4	H	641	NAG	O5-C1-C2	3.86	113.39	109.52
4	H	641	NAG	C1-C2-N2	-2.80	107.48	110.73
3	H	645	NDG	C1-C2-C3	-2.14	107.63	110.54
4	H	641	NAG	C4-C3-C2	2.07	113.42	110.40

There are no chirality outliers.

5 of 48 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	H	640	NDG	C1-C2-N2-C7
3	H	645	NDG	C1-C2-N2-C7
3	H	645	NDG	C8-C7-N2-C2
3	H	645	NDG	O7-C7-N2-C2
3	H	646	NDG	C8-C7-N2-C2

There are no ring outliers.

11 monomers are involved in 48 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	K	661	NDG	4	0
3	H	646	NDG	1	0
4	H	644	NAG	4	0
3	H	640	NDG	13	0
3	J	650	NDG	13	0
3	L	664	NDG	1	0
3	M	665	NDG	1	0
3	H	645	NDG	1	0
3	J	651	NDG	3	0
4	H	641	NAG	4	0
3	L	660	NDG	9	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.