



# Full wwPDB X-ray Structure Validation Report ⓘ

Jun 12, 2024 – 09:18 PM EDT

PDB ID : 1HVQ  
Title : CRYSTAL STRUCTURES OF HEVAMINE, A PLANT DEFENCE PROTEIN WITH CHITINASE AND LYSOZYME ACTIVITY, AND ITS COMPLEX WITH AN INHIBITOR  
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Deposited on : 1994-10-13  
Resolution : 2.20 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](mailto: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>.

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

MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36.2
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36.2

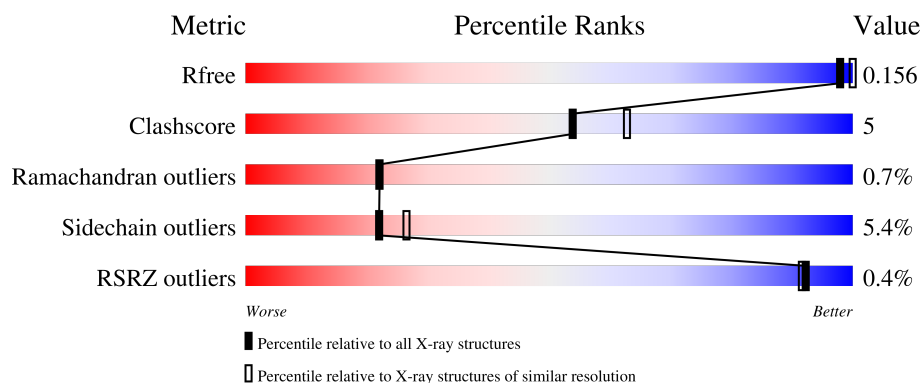
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*



The reported resolution of this entry is 2.20 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))
$R_{free}$	130704	4898 (2.20-2.20)
Clashscore	141614	5594 (2.20-2.20)
Ramachandran outliers	138981	5503 (2.20-2.20)
Sidechain outliers	138945	5504 (2.20-2.20)
RSRZ outliers	127900	4800 (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 of the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 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	273	 78% 19% .
2	B	3	 33% 67%

## 2 Entry composition [i](#)

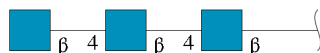
There are 3 unique types of molecules in this entry. The entry contains 2334 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 HEVAMINE A.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	273	Total	C	N	O	S	0	0	0
			2087	1331	351	397	8			

- Molecule 2 is an oligosaccharide called 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	B	3	Total	C	N	O	0	0	0
			43	24	3	16			


- Molecule 3 is water.

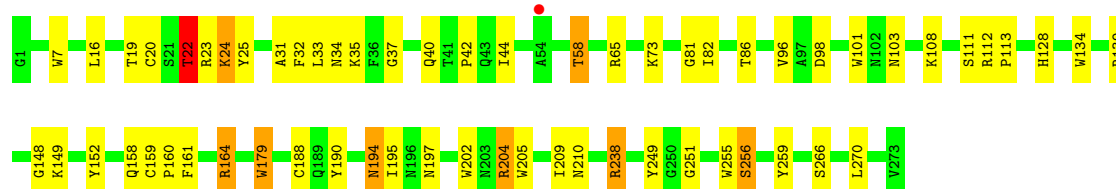
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	204	Total	O	0	0
			204	204		

### 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 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: HEVAMINE A

Chain A: 



- Molecule 2: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain B: 



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	52.30Å 57.36Å 82.68Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	8.00 – 2.20 7.98 – 2.40	Depositor EDS
% Data completeness (in resolution range)	92.7 (8.00-2.20) 92.7 (7.98-2.40)	Depositor EDS
$R_{merge}$	0.08	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	4.64 (at 2.40Å)	Xtriage
Refinement program	X-PLOR	Depositor
R, $R_{free}$	0.144 , 0.244 0.160 , 0.156	Depositor DCC
$R_{free}$ test set	955 reflections (10.44%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	15.0	Xtriage
Anisotropy	0.655	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.28 , 75.0	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	2334	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	12.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.45% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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

### 5.1 Standard geometry

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

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	0.82	0/2142	1.62	51/2914 (1.8%)

There are no bond length outliers.

All (51) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	31	ALA	CA-C-N	-10.72	93.62	117.20
1	A	31	ALA	O-C-N	10.02	138.73	122.70
1	A	139	ARG	NE-CZ-NH2	-9.85	115.38	120.30
1	A	134	TRP	CD1-CG-CD2	8.67	113.24	106.30
1	A	101	TRP	CD1-CG-CD2	8.59	113.17	106.30
1	A	139	ARG	NE-CZ-NH1	8.35	124.47	120.30
1	A	205	TRP	CD1-CG-CD2	8.34	112.97	106.30
1	A	134	TRP	CE2-CD2-CG	-8.12	100.80	107.30
1	A	179	TRP	CD1-CG-CD2	8.08	112.76	106.30
1	A	164	ARG	NE-CZ-NH1	8.04	124.32	120.30
1	A	32	PHE	N-CA-C	7.67	131.70	111.00
1	A	255	TRP	CA-C-N	-7.51	100.68	117.20
1	A	179	TRP	CE2-CD2-CG	-7.50	101.30	107.30
1	A	255	TRP	CD1-CG-CD2	7.44	112.25	106.30
1	A	255	TRP	CG-CD2-CE3	7.43	140.59	133.90
1	A	101	TRP	CE2-CD2-CG	-7.30	101.46	107.30
1	A	7	TRP	CD1-CG-CD2	7.24	112.09	106.30
1	A	255	TRP	CE2-CD2-CG	-7.24	101.51	107.30
1	A	31	ALA	C-N-CA	7.14	139.55	121.70
1	A	112	ARG	NE-CZ-NH2	-7.13	116.73	120.30
1	A	134	TRP	CG-CD2-CE3	7.10	140.29	133.90
1	A	205	TRP	CE2-CD2-CG	-7.05	101.66	107.30
1	A	7	TRP	CE2-CD2-CG	-6.93	101.76	107.30
1	A	202	TRP	CE2-CD2-CG	-6.63	102.00	107.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	255	TRP	CB-CG-CD1	-6.59	118.43	127.00
1	A	20	CYS	CA-CB-SG	-6.55	102.20	114.00
1	A	33	LEU	N-CA-C	-6.44	93.62	111.00
1	A	65	ARG	NE-CZ-NH1	6.10	123.35	120.30
1	A	256	SER	N-CA-C	6.10	127.47	111.00
1	A	101	TRP	CG-CD1-NE1	-6.09	104.01	110.10
1	A	134	TRP	CG-CD1-NE1	-6.08	104.02	110.10
1	A	202	TRP	CD1-CG-CD2	6.00	111.10	106.30
1	A	96	VAL	CG1-CB-CG2	-5.95	101.38	110.90
1	A	259	TYR	CB-CG-CD1	-5.91	117.45	121.00
1	A	159	CYS	N-CA-C	5.69	126.37	111.00
1	A	58	THR	N-CA-CB	-5.67	99.52	110.30
1	A	205	TRP	CG-CD1-NE1	-5.65	104.45	110.10
1	A	134	TRP	CB-CG-CD1	-5.64	119.67	127.00
1	A	152	TYR	CB-CG-CD2	-5.61	117.63	121.00
1	A	190	TYR	CB-CG-CD1	-5.49	117.71	121.00
1	A	256	SER	CA-CB-OG	-5.47	96.43	111.20
1	A	266	SER	CA-CB-OG	-5.44	96.50	111.20
1	A	238	ARG	NE-CZ-NH2	-5.29	117.65	120.30
1	A	32	PHE	CA-C-N	-5.25	105.64	117.20
1	A	202	TRP	CG-CD2-CE3	5.25	138.62	133.90
1	A	101	TRP	CB-CG-CD1	-5.20	120.24	127.00
1	A	22	THR	N-CA-CB	-5.20	100.42	110.30
1	A	23	ARG	NE-CZ-NH1	5.20	122.90	120.30
1	A	204	ARG	NE-CZ-NH1	5.18	122.89	120.30
1	A	255	TRP	CG-CD1-NE1	-5.05	105.05	110.10
1	A	209	ILE	CA-C-N	-5.02	106.15	117.20

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	2087	0	2020	21	0
2	B	43	0	39	2	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	A	204	0	0	2	1
All	All	2334	0	2059	22	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 5.

All (22) 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:103:ASN:HD22	1:A:113:PRO:HD3	1.62	0.63
1:A:19:THR:O	1:A:22:THR:HB	1.99	0.62
1:A:22:THR:HG22	1:A:24:LYS:H	1.64	0.62
1:A:149:LYS:HD3	3:A:447:HOH:O	2.07	0.54
1:A:24:LYS:HG3	1:A:270:LEU:HD22	1.92	0.51
1:A:161:PHE:HB3	1:A:204:ARG:HD2	1.92	0.51
1:A:35:LYS:HE2	1:A:40:GLN:HB3	1.92	0.51
1:A:160:PRO:HD3	1:A:188:CYS:SG	2.54	0.48
1:A:164:ARG:HH11	1:A:164:ARG:HG3	1.78	0.47
1:A:22:THR:HG23	1:A:24:LYS:HD3	1.96	0.47
1:A:35:LYS:O	1:A:42:PRO:HA	2.15	0.46
1:A:210:ASN:HB2	3:A:348:HOH:O	2.15	0.46
1:A:195:ILE:HG12	1:A:238:ARG:NH2	2.33	0.44
1:A:37:GLY:HA3	1:A:86:THR:O	2.17	0.43
1:A:82:ILE:HD12	2:B:1:NAG:H5	2.00	0.43
1:A:194:ASN:ND2	1:A:197:ASN:H	2.17	0.42
1:A:22:THR:CG2	1:A:24:LYS:HB2	2.49	0.42
1:A:16:LEU:HD12	1:A:16:LEU:HA	1.87	0.42
2:B:1:NAG:H62	2:B:2:NAG:H82	2.02	0.41
1:A:22:THR:HG21	1:A:25:TYR:CE2	2.56	0.40
1:A:81:GLY:O	1:A:128:HIS:HE1	2.04	0.40
1:A:249:TYR:CZ	1:A:251:GLY:HA2	2.57	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:457:HOH:O	3:A:468:HOH:O[3_645]	2.16	0.04



## 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	271/273 (99%)	261 (96%)	8 (3%)	2 (1%)	22	22

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	148	GLY
1	A	256	SER

### 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	221/221 (100%)	209 (95%)	12 (5%)	22	26

All (12) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	22	THR
1	A	24	LYS
1	A	34	ASN
1	A	44	ILE
1	A	58	THR
1	A	73	LYS
1	A	98	ASP
1	A	108	LYS
1	A	111	SER

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Mol	Chain	Res	Type
1	A	158	GLN
1	A	179	TRP
1	A	194	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	103	ASN
1	A	128	HIS
1	A	171	ASN
1	A	194	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 ⓘ

3 monosaccharides 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	$\# Z  > 2$
2	NAG	B	1	2	15,15,15	0.92	0	21,21,21	1.37	2 (9%)
2	NAG	B	2	2	14,14,15	1.14	2 (14%)	17,19,21	1.57	3 (17%)
2	NAG	B	3	2	14,14,15	0.87	0	17,19,21	1.29	3 (17%)

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	NAG	B	1	2	-	0/6/26/26	0/1/1/1
2	NAG	B	2	2	-	0/6/23/26	0/1/1/1
2	NAG	B	3	2	-	1/6/23/26	0/1/1/1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	2	NAG	O5-C1	-2.83	1.39	1.43
2	B	2	NAG	O5-C5	-2.33	1.38	1.43

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	1	NAG	C1-C2-C3	-3.51	105.75	110.54
2	B	2	NAG	C1-C2-N2	-3.08	105.23	110.49
2	B	2	NAG	C8-C7-N2	3.05	121.26	116.10
2	B	3	NAG	C1-O5-C5	2.47	115.54	112.19
2	B	3	NAG	C1-C2-N2	2.46	114.69	110.49
2	B	2	NAG	C4-C3-C2	-2.37	107.54	111.02
2	B	3	NAG	O4-C4-C3	-2.33	104.95	110.35
2	B	1	NAG	C8-C7-N2	2.17	119.77	116.10

There are no chirality outliers.

All (1) torsion outliers are listed below:

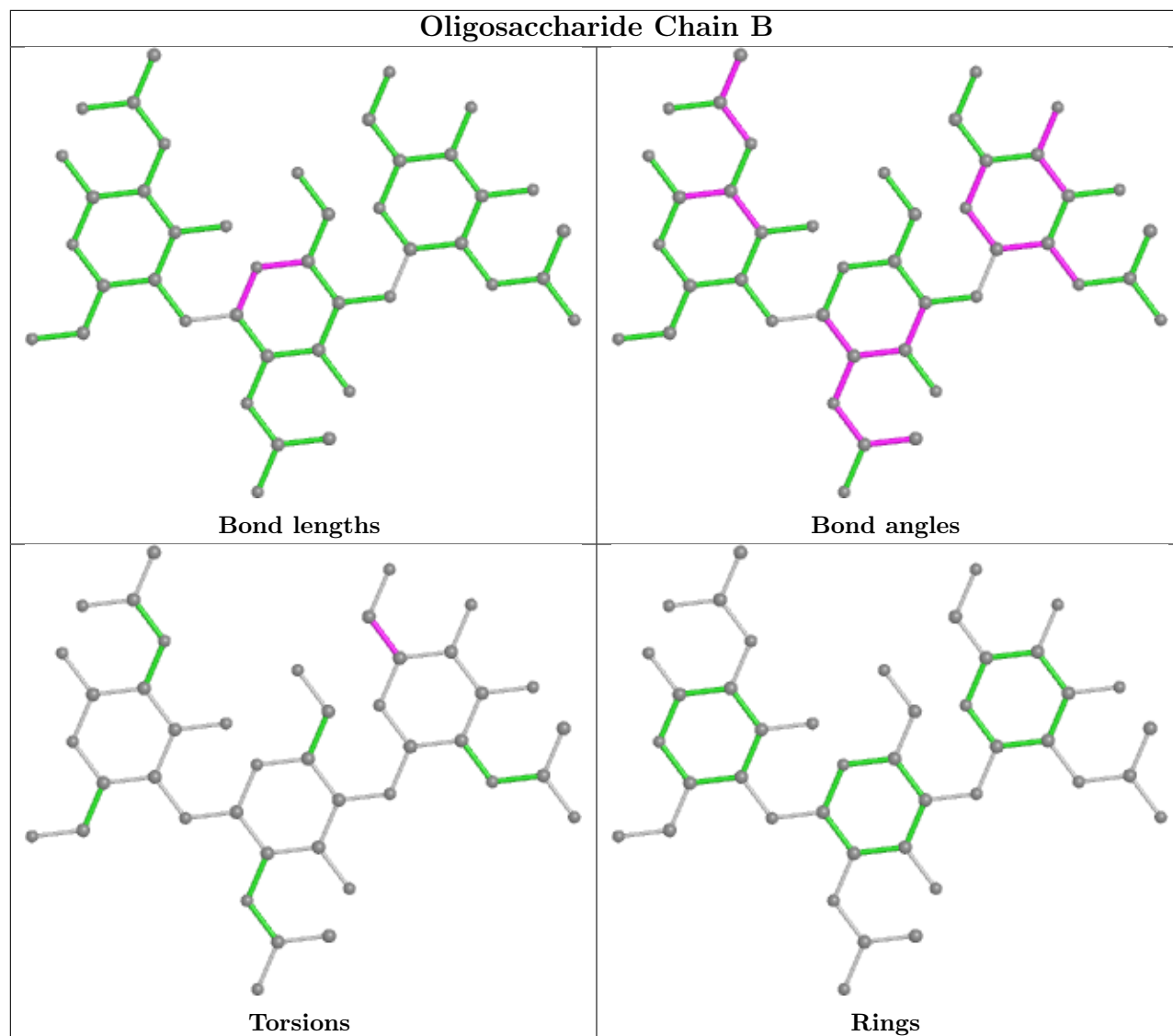
Mol	Chain	Res	Type	Atoms
2	B	3	NAG	O5-C5-C6-O6

There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	2	NAG	1	0
2	B	1	NAG	2	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for oligosaccharide.



## 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](#)

There are no chain breaks in this entry.

## 6 Fit of model and data [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	273/273 (100%)	-0.88	1 (0%) 92 91	2, 9, 26, 39	0

All (1) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	54	ALA	2.0

### 6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

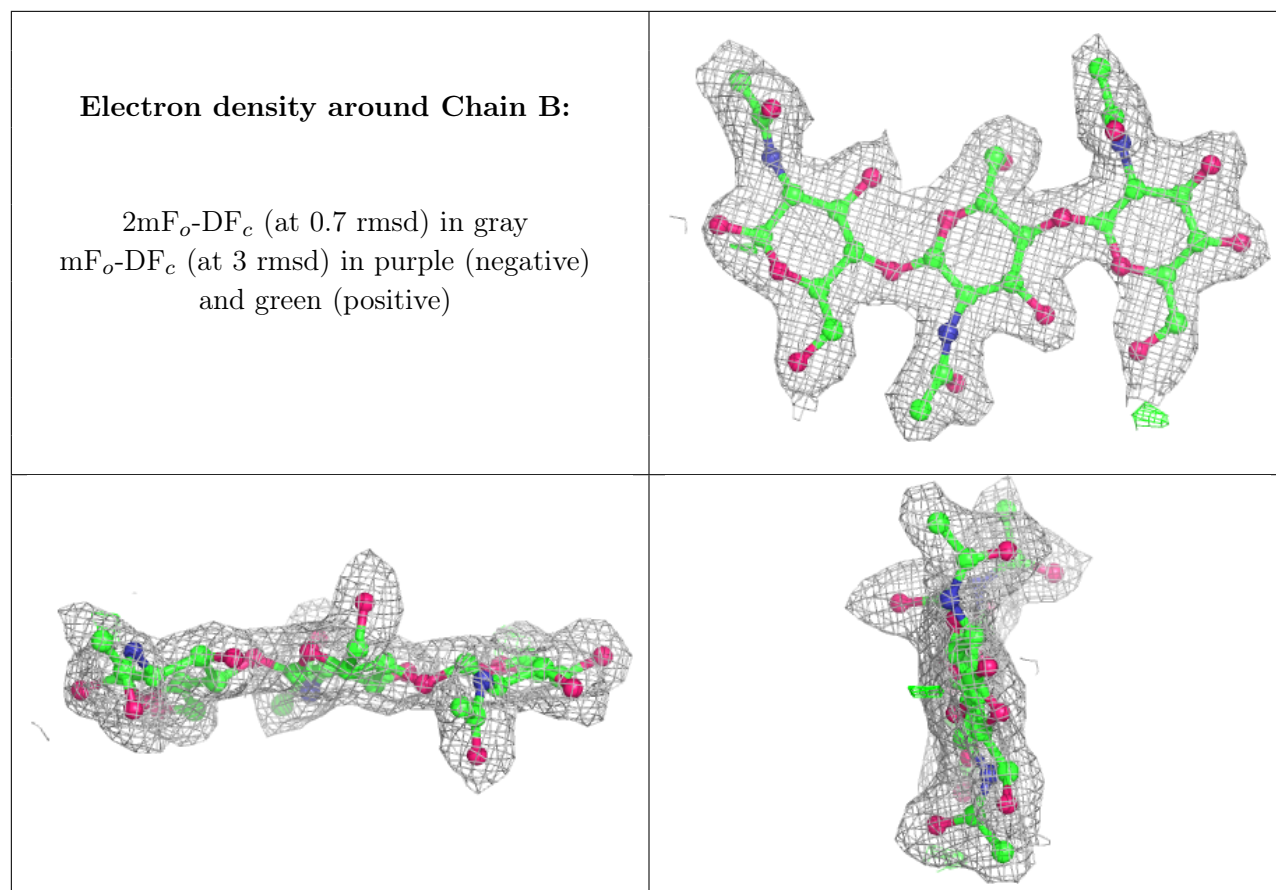
There are no non-standard protein/DNA/RNA residues in this entry.

### 6.3 Carbohydrates [i](#)

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, 95<sup>th</sup> 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(Å <sup>2</sup> )	Q<0.9
2	NAG	B	3	14/15	0.96	0.11	12,16,18,22	0
2	NAG	B	1	15/15	0.97	0.08	6,10,15,20	0
2	NAG	B	2	14/15	0.98	0.06	2,6,12,14	0

The following is a graphical depiction of the model fit to experimental electron density for oligosaccharide. Each fit is shown from different orientation to approximate a three-dimensional view.



## 6.4 Ligands [i](#)

There are no ligands in this entry.

## 6.5 Other polymers [i](#)

There are no such residues in this entry.