



# Full wwPDB X-ray Structure Validation Report ⓘ

Sep 3, 2023 – 10:42 AM EDT

PDB ID : 3SIS  
Title : Crystal structure of Porcine CRW-8 Rotavirus VP8\* in complex with  
aceramido-GM3\_Gc  
Authors : Blanchard, H.; Yu, X.  
Deposited on : 2011-06-20  
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 : 2.35  
buster-report : 1.1.7 (2018)  
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) : 2.35

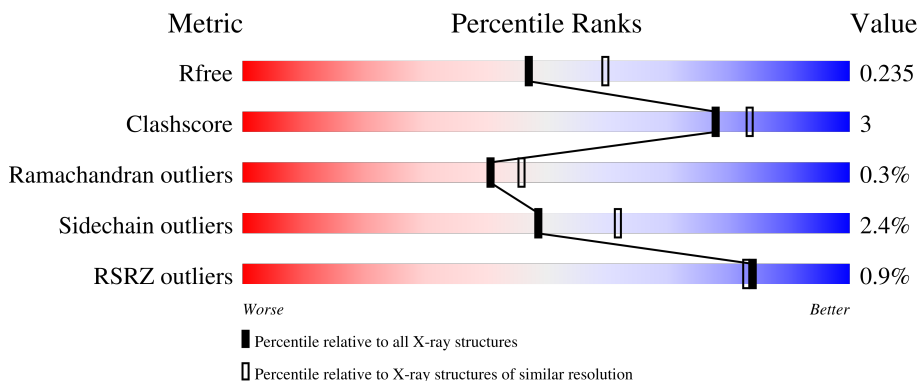
# 1 Overall quality at a glance

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	163	 90% 10%
1	B	163	 88% 10%
2	C	3	 33% 67%

## 2 Entry composition i

There are 6 unique types of molecules in this entry. The entry contains 2814 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.

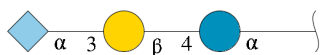
- Molecule 1 is a protein called Outer capsid protein VP4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	163	1309	837	211	257	4	0	1	0
1	B	159	1287	823	207	253	4	0	2	0

There are 12 discrepancies between the modelled and reference sequences:

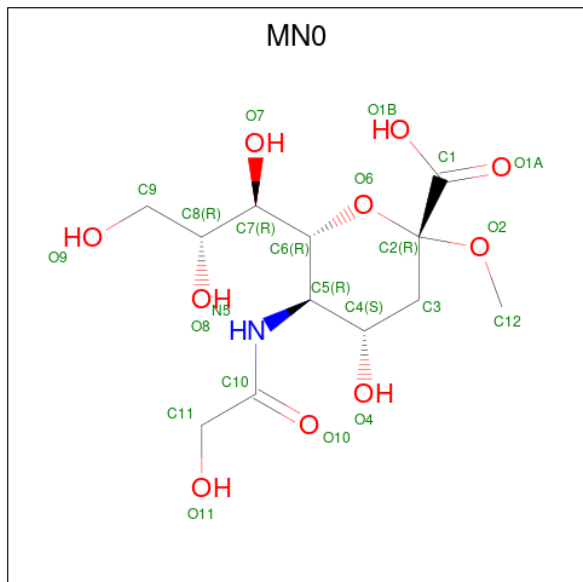
Chain	Residue	Modelled	Actual	Comment	Reference
A	62	GLY	-	expression tag	UNP P0C6Y8
A	63	SER	-	expression tag	UNP P0C6Y8
A	70	GLN	ARG	engineered mutation	UNP P0C6Y8
A	82	ILE	VAL	engineered mutation	UNP P0C6Y8
A	151	ASN	SER	engineered mutation	UNP P0C6Y8
A	201	SER	LEU	engineered mutation	UNP P0C6Y8
B	62	GLY	-	expression tag	UNP P0C6Y8
B	63	SER	-	expression tag	UNP P0C6Y8
B	70	GLN	ARG	engineered mutation	UNP P0C6Y8
B	82	ILE	VAL	engineered mutation	UNP P0C6Y8
B	151	ASN	SER	engineered mutation	UNP P0C6Y8
B	201	SER	LEU	engineered mutation	UNP P0C6Y8

- Molecule 2 is an oligosaccharide called N-glycolyl-alpha-neuraminic acid-(2-3)-beta-D-galactopyranose-(1-4)-alpha-D-glucopyranose.



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
2	C	3	44	23	1	20	0	0	0

- Molecule 3 is methyl 3,5-dideoxy-5-[(hydroxyacetyl)amino]-D-glycero-alpha-D-galacto-non-2-ulopyranosidonic acid (three-letter code: MN0) (formula:  $C_{12}H_{21}NO_{10}$ ).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
3	A	1	23	12	1	10	0	0

- Molecule 4 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Na		
4	A	1	1	1	0	0
4	B	1	1	1	0	0

- Molecule 5 is (4S)-2-METHYL-2,4-PENTANEDIOL (three-letter code: MPD) (formula:  $C_6H_{14}O_2$ ).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	B	1	Total C O 8 6 2	0	0

- Molecule 6 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	77	Total O 77 77	0	0
6	B	64	Total O 64 64	0	0



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	55.31Å 56.77Å 110.70Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	39.12 – 2.20 39.12 – 2.20	Depositor EDS
% Data completeness (in resolution range)	98.4 (39.12-2.20) 98.4 (39.12-2.20)	Depositor EDS
$R_{merge}$	0.05	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	4.09 (at 2.20Å)	Xtrriage
Refinement program	REFMAC 5.5.0110	Depositor
R, $R_{free}$	0.193 , 0.238 0.192 , 0.235	Depositor DCC
$R_{free}$ test set	929 reflections (5.15%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	31.0	Xtrriage
Anisotropy	0.103	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.36 , 34.7	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	0.037 for k,h,-l	Xtrriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	2814	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	28.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.57% 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: NGC, GLC, NA, GAL, MN0, MPD

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	0.41	0/1349	0.53	0/1850
1	B	0.42	0/1330	0.53	0/1825
All	All	0.41	0/2679	0.53	0/3675

There are no bond length outliers.

There are no bond angle outliers.

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	1309	0	1256	9	0
1	B	1287	0	1233	6	1
2	C	44	0	27	0	0
3	A	23	0	19	0	0
4	A	1	0	0	0	0
4	B	1	0	0	0	0
5	B	8	0	14	1	0
6	A	77	0	0	0	0
6	B	64	0	0	0	0
All	All	2814	0	2549	15	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 3.

All (15) 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:B:167:VAL:HG12	1:B:176:THR:HG22	1.77	0.66
1:A:108:ILE:HD11	1:A:141:ILE:HD12	1.83	0.60
1:B:108:ILE:HD11	1:B:141:ILE:HD12	1.85	0.59
1:A:174:ILE:HD11	1:A:197:VAL:HG21	1.90	0.54
1:A:167:VAL:HG12	1:A:176:THR:HG22	1.92	0.51
1:A:108:ILE:HD11	1:A:141:ILE:CD1	2.41	0.50
1:A:161:THR:HB	1:A:162:PRO:HD3	1.95	0.49
1:A:209:PRO:HB2	1:A:211:ASN:OD1	2.12	0.49
1:B:82:ILE:O	1:B:166:ALA:HA	2.16	0.46
1:A:82:ILE:O	1:A:166:ALA:HA	2.19	0.43
1:B:83:LEU:HB3	1:B:206:TYR:HB2	2.01	0.42
1:A:108:ILE:CD1	1:A:141:ILE:CD1	2.98	0.41
1:B:203:CYS:HB3	5:B:4210:MPD:CM	2.50	0.41
1:A:64:LEU:HD22	1:A:212:GLN:OE1	2.21	0.41
1:B:76:PRO:HB3	1:B:82:ILE:HD11	2.03	0.41

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)
1:B:131:GLU:OE2	1:B:194:TYR:OH[3_555]	2.15	0.05

## 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	162/163 (99%)	154 (95%)	8 (5%)	0	100 100
1	B	159/163 (98%)	148 (93%)	10 (6%)	1 (1%)	25 26

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
All	All	321/326 (98%)	302 (94%)	18 (6%)	1 (0%)	41 46

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	122	PHE

### 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	149/148 (101%)	145 (97%)	4 (3%)	44 57
1	B	147/148 (99%)	143 (97%)	4 (3%)	44 57
All	All	296/296 (100%)	288 (97%)	8 (3%)	49 57

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	133	THR
1	A	178	ASN
1	A	198	ASN
1	A	212	GLN
1	B	66	ASP
1	B	74	PHE
1	B	178[A]	ASN
1	B	178[B]	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	178	ASN
1	A	198	ASN

### 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](#)

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	GLC	C	1	2	12,12,12	1.09	0	17,17,17	1.08	2 (11%)
2	GAL	C	2	2	11,11,12	0.91	0	15,15,17	0.92	0
2	NGC	C	3	2	21,21,22	1.26	1 (4%)	25,29,32	1.24	2 (8%)

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. '2' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	GLC	C	1	2	-	2/2/22/22	0/1/1/1
2	GAL	C	2	2	-	2/2/19/22	0/1/1/1
2	NGC	C	3	2	-	0/19/36/40	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	3	NGC	C2-C1	3.24	1.55	1.52

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	3	NGC	O11-C11-C10	3.41	118.86	111.62
2	C	3	NGC	C6-O6-C2	2.59	116.89	111.34
2	C	1	GLC	C4-C3-C2	2.43	115.07	110.82
2	C	1	GLC	C1-C2-C3	2.01	114.48	110.31

There are no chirality outliers.

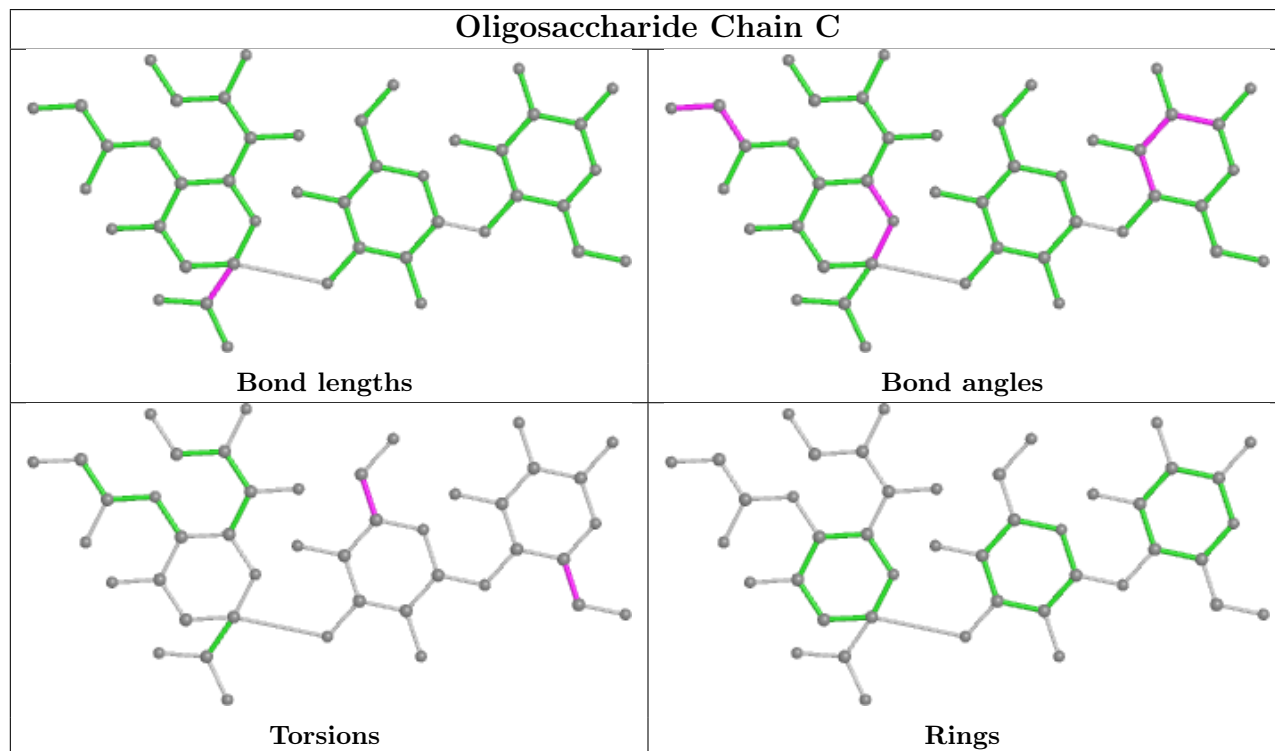
All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	C	1	GLC	O5-C5-C6-O6
2	C	2	GAL	O5-C5-C6-O6
2	C	1	GLC	C4-C5-C6-O6
2	C	2	GAL	C4-C5-C6-O6

There are no ring outliers.

No monomer is involved in short contacts.

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](#)

Of 4 ligands modelled in this entry, 2 are monoatomic - leaving 2 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
5	MPD	B	4210	-	7,7,7	0.26	0	9,10,10	0.28	0
3	MN0	A	6535	-	23,23,23	1.16	3 (13%)	28,33,33	1.23	2 (7%)

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
5	MPD	B	4210	-	-	1/5/5/5	-
3	MN0	A	6535	-	-	6/24/43/43	0/1/1/1

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	6535	MN0	O6-C2	2.81	1.46	1.42
3	A	6535	MN0	O6-C6	2.36	1.47	1.44
3	A	6535	MN0	C3-C2	2.06	1.55	1.52

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	6535	MN0	O11-C11-C10	3.06	118.11	111.62
3	A	6535	MN0	O6-C6-C7	-2.58	103.31	107.29

There are no chirality outliers.

All (7) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	6535	MN0	O1B-C1-C2-O2
3	A	6535	MN0	C1-C2-O2-C12
3	A	6535	MN0	C3-C2-O2-C12
3	A	6535	MN0	O6-C2-O2-C12

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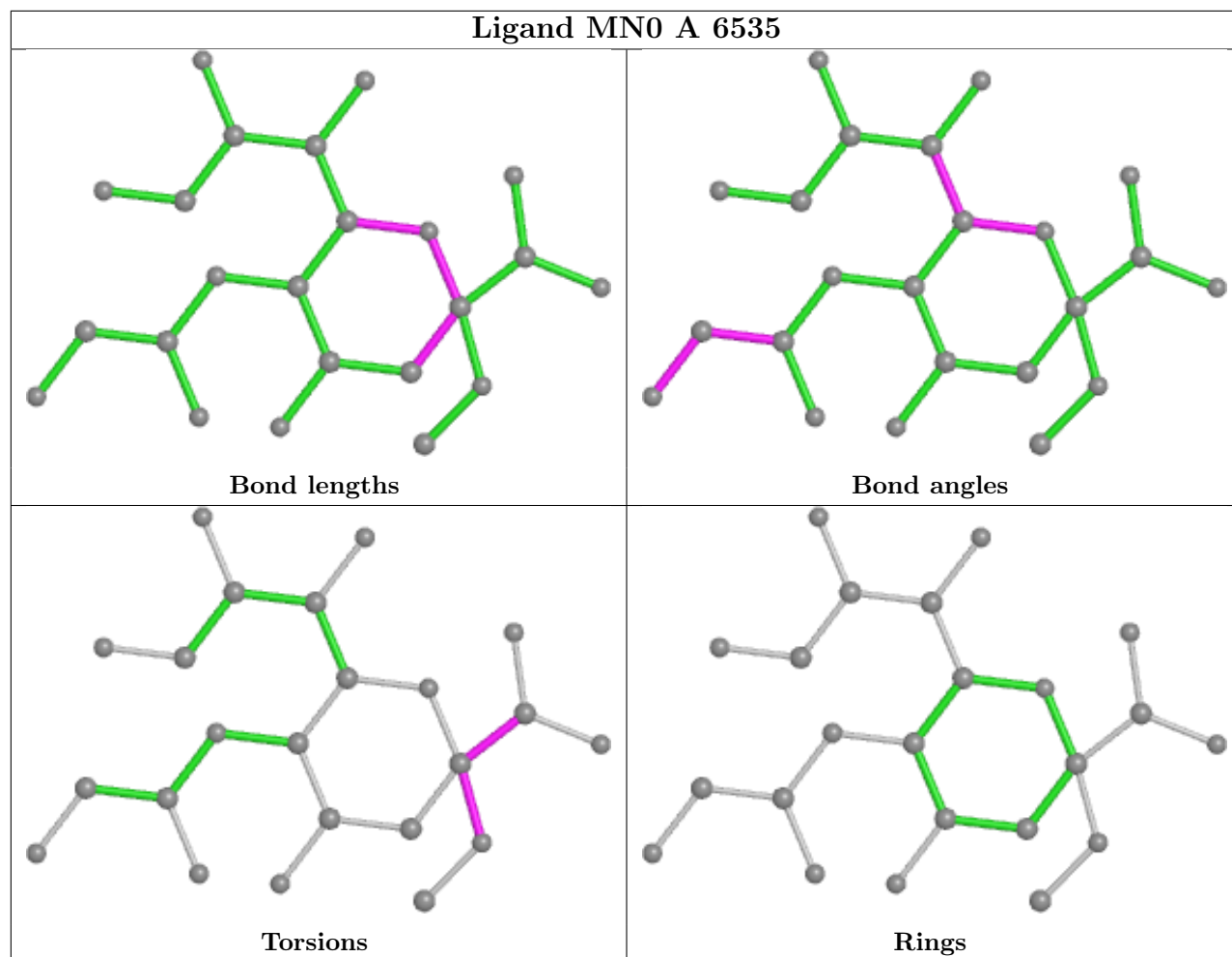
Mol	Chain	Res	Type	Atoms
3	A	6535	MN0	O1A-C1-C2-O2
5	B	4210	MPD	CM-C2-C3-C4
3	A	6535	MN0	O1B-C1-C2-O6

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	B	4210	MPD	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



## 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	163/163 (100%)	-0.37	1 (0%) 89   88	19, 25, 37, 47	0
1	B	159/163 (97%)	-0.24	2 (1%) 77   75	20, 27, 43, 53	0
All	All	322/326 (98%)	-0.31	3 (0%) 84   83	19, 26, 42, 53	0

All (3) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	224	LEU	3.8
1	A	212	GLN	2.4
1	B	124	GLN	2.2

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

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

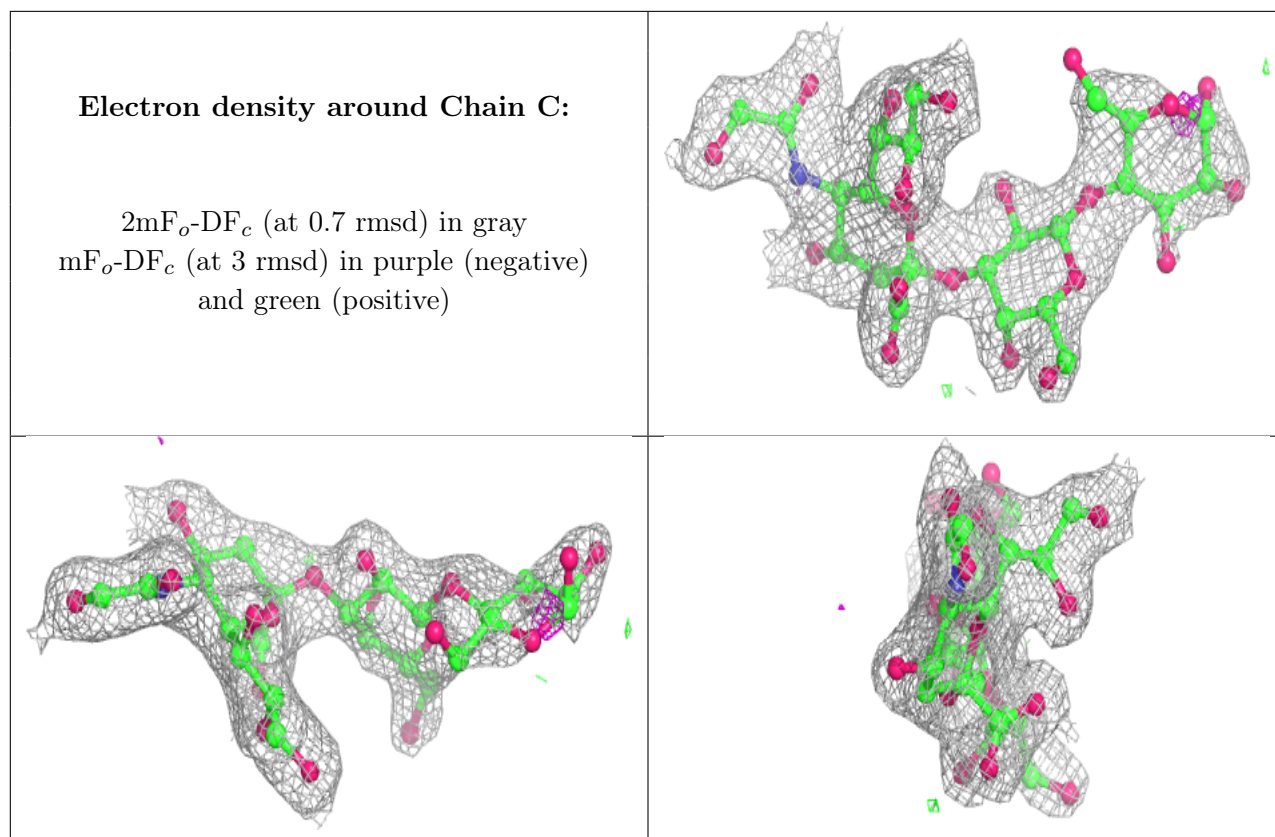
### 6.3 Carbohydrates [i](#)

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	GLC	C	1	12/12	0.80	0.23	50,57,58,58	0
2	GAL	C	2	11/12	0.91	0.13	37,44,45,46	0
2	NGC	C	3	21/22	0.96	0.15	26,29,32,33	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.



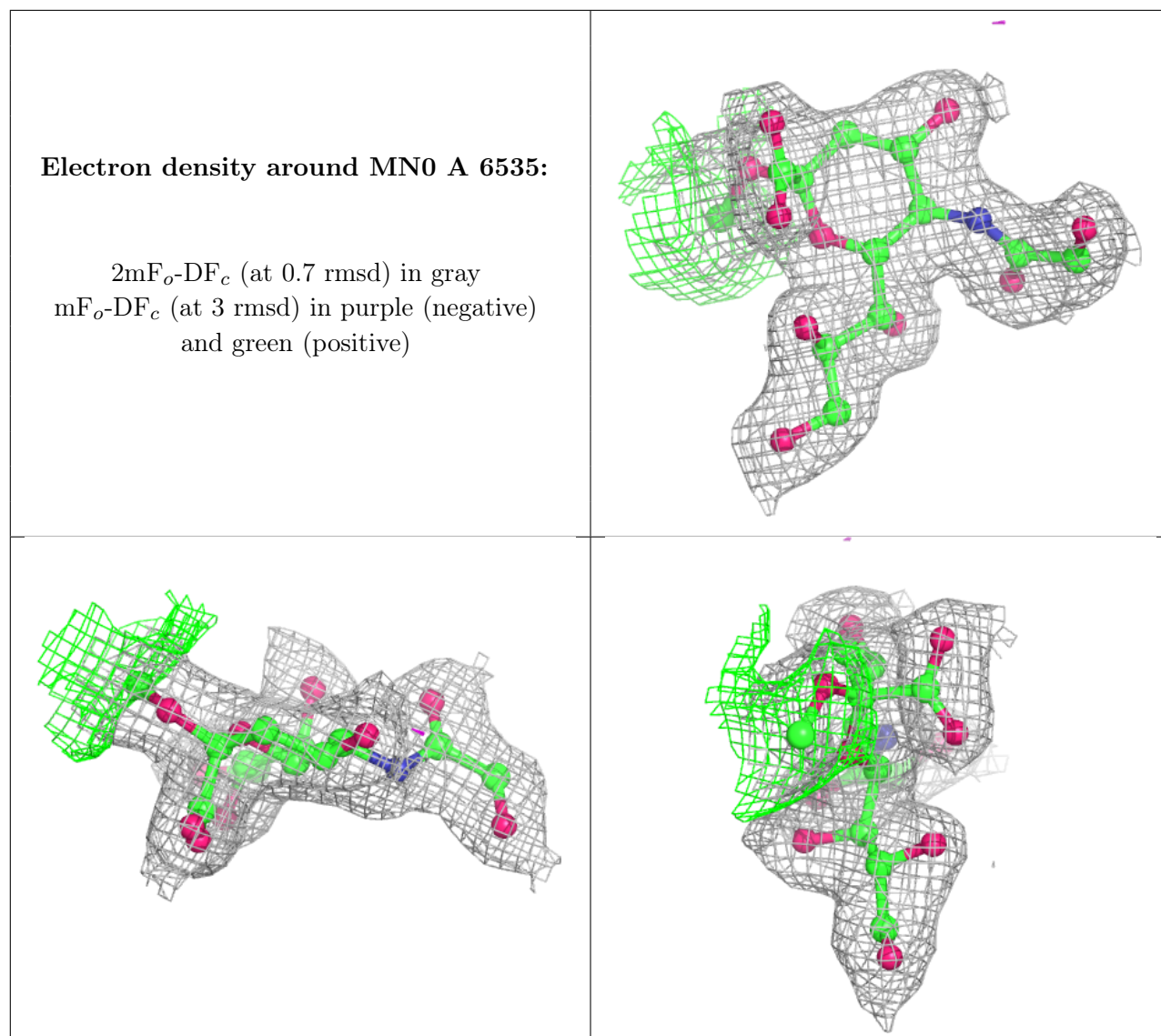


## 6.4 Ligands [i](#)

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( $\text{\AA}^2$ )	Q<0.9
5	MPD	B	4210	8/8	0.89	0.18	48,49,50,50	0
3	MN0	A	6535	23/23	0.92	0.15	21,25,27,27	0
4	NA	B	3001	1/1	0.95	0.06	19,19,19,19	0
4	NA	A	3000	1/1	0.97	0.09	22,22,22,22	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.



## 6.5 Other polymers [\(i\)](#)

There are no such residues in this entry.