W O R L D W I D E
wwPDB
PROTEIN DATA BANK

wwPDB X-ray Structure Validation Summary Report ⓘ

Apr 28, 2025 – 08:34 PM JST

PDB ID	:	6IUV / pdb_00006iuv
Title	:	Crystal structure of influenza A virus H5 hemagglutinin globular head in complex with the Fab of antibody 3C11
Authors	:	Wang, P.; Zuo, Y.; Sun, J.; Zhang, L.; Wang, X.
Deposited on	:	2018-11-30
Resolution	:	2.33 Å(reported)

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

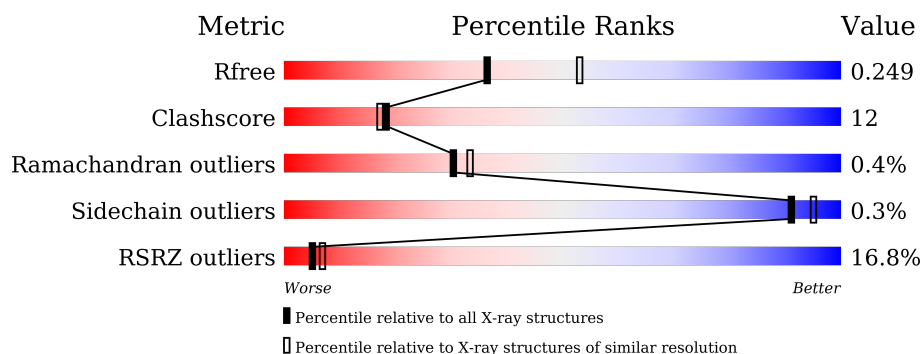|		
MolProbity	:	4-5-2 with Phenix2.0rc1
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	2.0rc1
EDS	:	3.0
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.006 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.43.1

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 2.33 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.
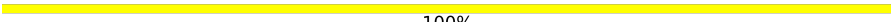
Metric	Percentile Ranks	Value
Rfree		0.249
Clashscore		12
Ramachandran outliers		0.4%
Sidechain outliers		0.3%
RSRZ outliers		16.8%

Worse   *Better*

▌Percentile relative to all X-ray structures

▯Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R$_{free}$	164625	2747 (2.36-2.32)
Clashscore	180529	2936 (2.36-2.32)
Ramachandran outliers	177936	2912 (2.36-2.32)
Sidechain outliers	177891	2912 (2.36-2.32)
RSRZ outliers	164620	2747 (2.36-2.32)

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 <=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	224	7% / 80% / 15% / 5%
1	B	224	11% / 74% / 21% / 5%
2	D	218	30% / 74% / 24% / •
2	L	218	90% / 8% / •
3	C	229	48% / 63% / 34% / •
3	H	229	2% / 87% / 12%

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Mol	Chain	Length	Quality of chain
4	E	3	100%
4	F	3	67% 33%

2 Entry composition ⓘ

There are 5 unique types of molecules in this entry. The entry contains 10833 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	A	213	Total 1712	C 1095	N 292	O 319	S 6	0	0	0
1	B	212	Total 1704	C 1091	N 291	O 316	S 6	0	0	0

- Molecule 2 is a protein called 3C11 Light Chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	L	215	Total 1656	C 1038	N 280	O 332	S 6	0	0	0
2	D	215	Total 1656	C 1038	N 280	O 332	S 6	0	0	0

- Molecule 3 is a protein called 3C11 Heavy Chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	H	228	Total 1723	C 1084	N 286	O 344	S 9	0	0	0
3	C	224	Total 1695	C 1067	N 281	O 339	S 8	0	0	0

- Molecule 4 is an oligosaccharide called 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-[alpha-L-fucopyranose-(1-6)]2-acetamido-2-deoxy-beta-D-glucopyranose.
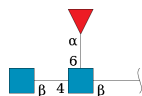
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
4	E	3	Total 38	C 22	N 2	O 14	0	0	0

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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
4	F	3	38	22	2	14	0	0	0

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	147	Total	O	0	0
			147	147		
5	L	172	Total	O	0	0
			172	172		
5	H	167	Total	O	0	0
			167	167		
5	B	34	Total	O	0	0
			34	34		
5	D	57	Total	O	0	0
			57	57		
5	C	34	Total	O	0	0
			34	34		

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 t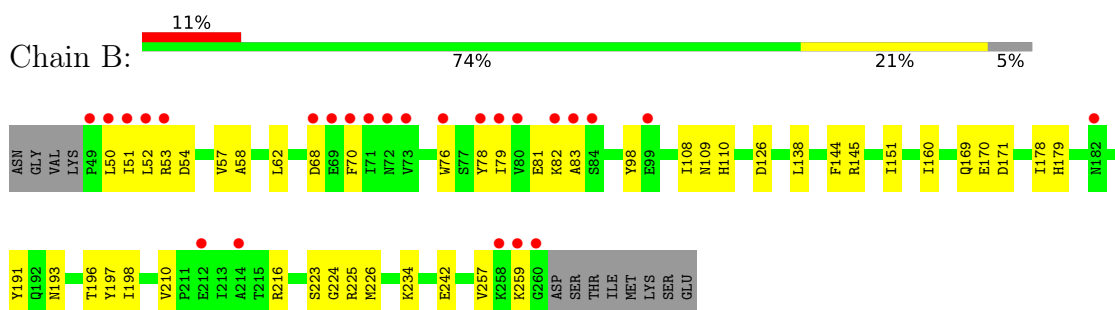he various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 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.
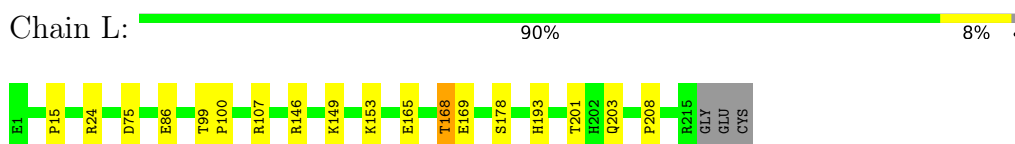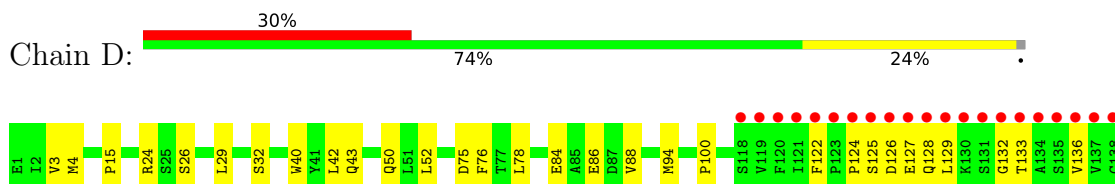
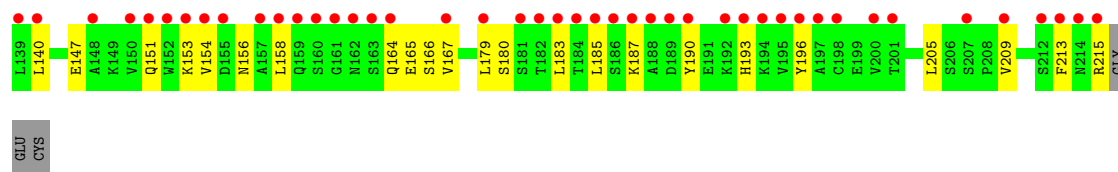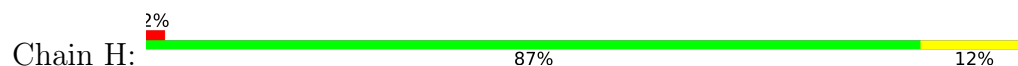- Molecule 1: Hemagglutinin

Chain A:

- Molecule 1: Hemagglutinin

Chain B:

- Molecule 2: 3C11 Light Chain

Chain L:

- Molecule 2: 3C11 Light Chain

Chain D:

L139 L140 E147 A148 K149 V150 Q151 W152 K153 V154 D155 N156 A157 L158 Q159 S160 G161 N162 S163 Q164 E165 S166 V167 L179 S180 S181 T182 L183 T184 L185 S186 K187 A188 D189 Y190 E191 K192 H193 K194 V195 Y196 A197 C198 E199 V200 T201 L205 S206 S207 P208 V209 S212 F213 N214 R215 GLY

GLU CYS

• Molecule 3: 3C11 Heavy Chain

Chain H:

2%
87%   12%

GLN V2 V11 N28 W36 V37 M40 N43 G44 W47 M48 G49 R50 Y94 R98 G107 T123 K130 G131 P132 S143 T144 S145 G146 K156 D157 P160 L188 S199 L202 N212 H213 K214 T218 C229

• Molecule 3: 3C11 Heavy Chain

Chain C:

48%
63%   34%

GLN V2 Q3 L4 K12 E13 T14 G15 E16 S17 L18 K23 V24 S25 G26 N27 N28 F29 W36 V37 R38 Q39 M40 N43 G44 W47 M48 G49 R50 I51 D52 P53 S54 D55 S56 D57 T58 R61 P62 G66 H67 V68 S71 K74 S75 T76 S77 T78 Q82 W83

R84 S85 L86 A92 M93 Y94 R98 R99 A100 T101 Y102 F110 F113 W116 G119 T120 M121 V122 T123 V124 S125 S126 A127 S128 T129 K130 G131 P132 S133 V134 F135 P136 L137 A138 P139 S140 S141 K142 S143 T144 S145 G146 G147 T148 A149 A150 L151 G152 C153 L154 V155 K156 D157 Y158

F159 P160 E161 P162 V163 T164 V165 S166 W167 N168 S169 G170 A171 L172 V176 F179 P180 A181 V182 L183 Q184 S185 S186 G187 L188 Y189 S190 L191 S192 S193 V194 V195 T196 V197 P198 S199 S200 S201 L202 G203 T204 Q205 T206 Y207 I208 C209 N210 V211 N212 H213 K214 P215 S216 N217 T218 K219 V220 D221

K222 K223 V224 E225 PRO LYS SER CYS

• Molecule 4: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-[alpha-L-fucopyranose-(1-6)]2-ace
tamido-2-deoxy-beta-D-glucopyranose

Chain E:
100%

NAG1 NAG2 FUC3

• Molecule 4: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-[alpha-L-fucopyranose-(1-6)]2-ace
tamido-2-deoxy-beta-D-glucopyranose

Chain F:
67%   33%

NAG1 NAG2 FUC3

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	126.78Å 62.24Å 127.83Å 90.00° 117.21° 90.00°	Depositor
Resolution (Å)	43.24 – 2.33 43.24 – 2.33	Depositor EDS
% Data completeness (in resolution range)	99.4 (43.24-2.33) 99.4 (43.24-2.33)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	5.94 (at 2.34Å)	Xtriage
Refinement program	PHENIX (1.11.1_2575: ???)	Depositor
R, R_{free}	0.207 , 0.246 0.212 , 0.249	Depositor DCC
R_{free} test set	3646 reflections (4.80%)	wwPDB-VP
Wilson B-factor (Å^2)	32.1	Xtriage
Anisotropy	0.564	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 39.5	EDS
L-test for twinning[2]	$< |L| > = 0.49, < L^2 > = 0.32$	Xtriage
Estimated twinning fraction	0.013 for l,-k,h	Xtriage
F_o,F_c correlation	0.93	EDS
Total number of atoms	10833	wwPDB-VP
Average B, all atoms (Å^2)	43.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 9.45% of the height of the origin peak. No significant pseudotranslation is detected.*

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[1]Intensities estimated from amplitudes.
[2]Theoretical values of $< |L| >$, $< L^2 >$ 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: FUC, 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	0.40	0/1761	0.60	0/2397
1	B	0.38	0/1753	0.58	0/2386
2	D	0.37	0/1693	0.63	0/2301
2	L	0.42	0/1693	0.64	0/2301
3	C	0.40	0/1739	0.74	1/2370 (0.0%)
3	H	0.46	1/1768 (0.1%)	0.63	0/2409
All	All	0.41	1/10407 (0.0%)	0.64	1/14164 (0.0%)

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
3	C	0	1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	H	98	ARG	C-O	-5.39	1.17	1.24

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	C	136	PRO	N-CA-C	-5.16	103.09	111.19

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
3	C	161	GLU	Peptide

5.2 Too-close contacts (i)

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	1712	0	1659	21	0
1	B	1704	0	1655	39	0
2	D	1656	0	1614	82	0
2	L	1656	0	1614	18	0
3	C	1695	0	1626	96	0
3	H	1723	0	1656	19	0
4	E	38	0	34	0	0
4	F	38	0	34	0	0
5	A	147	0	0	2	3
5	B	34	0	0	4	0
5	C	34	0	0	4	0
5	D	57	0	0	10	0
5	H	167	0	0	7	2
5	L	172	0	0	9	1
All	All	10833	0	9892	240	4

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 12.

The worst 5 of 240 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)
2:D:128:GLN:HG3	3:C:135:PHE:CZ	1.13	1.63
2:D:128:GLN:HG3	3:C:135:PHE:CE1	1.37	1.56
2:D:128:GLN:CG	3:C:135:PHE:CZ	1.96	1.46
2:D:128:GLN:HG3	3:C:135:PHE:CE2	1.68	1.29
2:D:128:GLN:CG	3:C:135:PHE:CE1	2.13	1.21

All (4) 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)
5:A:544:HOH:O	5:A:545:HOH:O[2_9410]	1.91	0.29
5:A:487:HOH:O	5:H:376:HOH:O[2_9510]	2.04	0.16
5:A:441:HOH:O	5:A:473:HOH:O[2_9510]	2.06	0.14
5:L:363:HOH:O	5:H:424:HOH:O[2_10410]	2.19	0.01

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	211/224 (94%)	201 (95%)	10 (5%)	0	100	100
1	B	210/224 (94%)	201 (96%)	9 (4%)	0	100	100
2	D	213/218 (98%)	208 (98%)	5 (2%)	0	100	100
2	L	213/218 (98%)	207 (97%)	6 (3%)	0	100	100
3	C	222/229 (97%)	212 (96%)	7 (3%)	3 (1%)	9	7
3	H	226/229 (99%)	217 (96%)	7 (3%)	2 (1%)	14	14
All	All	1295/1342 (96%)	1246 (96%)	44 (3%)	5 (0%)	30	33

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
3	H	144	THR
3	C	162	PRO
3	H	145	SER
3	C	85	SER
3	C	101	THR

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	190/200 (95%)	190 (100%)	0	100	100
1	B	189/200 (94%)	189 (100%)	0	100	100
2	D	189/191 (99%)	189 (100%)	0	100	100
2	L	189/191 (99%)	188 (100%)	1 (0%)	86	92
3	C	191/196 (97%)	190 (100%)	1 (0%)	86	92
3	H	195/196 (100%)	194 (100%)	1 (0%)	86	92
All	All	1143/1174 (97%)	1140 (100%)	3 (0%)	91	95

All (3) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	L	168	THR
3	H	199	SER
3	C	136	PRO

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 13 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	193	ASN
2	D	43	GLN
3	C	213	HIS
3	C	28	ASN
3	C	39	GLN

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 ⓘ

6 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	#$|Z| > 2$
4	NAG	E	1	4,1	14,14,15	0.84	1 (7%)	17,19,21	0.64	0
4	NAG	E	2	4	14,14,15	1.03	1 (7%)	17,19,21	0.75	1 (5%)
4	FUC	E	3	4	10,10,11	0.87	0	14,14,16	1.49	2 (14%)
4	NAG	F	1	4,1	14,14,15	0.28	0	17,19,21	0.57	0
4	NAG	F	2	4	14,14,15	0.43	0	17,19,21	0.35	0
4	FUC	F	3	4	10,10,11	1.05	1 (10%)	14,14,16	1.04	1 (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
4	NAG	E	1	4,1	-	2/6/23/26	0/1/1/1
4	NAG	E	2	4	-	2/6/23/26	0/1/1/1
4	FUC	E	3	4	-	-	0/1/1/1
4	NAG	F	1	4,1	-	0/6/23/26	0/1/1/1
4	NAG	F	2	4	-	4/6/23/26	0/1/1/1
4	FUC	F	3	4	-	-	0/1/1/1

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	E	2	NAG	O5-C1	-3.75	1.37	1.43
4	E	1	NAG	O5-C1	-3.05	1.38	1.43
4	F	3	FUC	C1-C2	2.56	1.58	1.52

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	E	3	FUC	C1-O5-C5	3.38	120.44	112.78
4	E	3	FUC	O5-C5-C4	3.04	114.97	109.52
4	E	2	NAG	C1-O5-C5	2.42	115.47	112.19

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	F	3	FUC	C1-C2-C3	2.27	112.46	109.67

There are no chirality outliers.

5 of 8 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	E	2	NAG	O5-C5-C6-O6
4	F	2	NAG	C4-C5-C6-O6
4	F	2	NAG	C8-C7-N2-C2
4	F	2	NAG	O7-C7-N2-C2
4	F	2	NAG	O5-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.

Oligosaccharide Chain E

Bond lengths

Bond angles

Torsions

Rings

Oligosaccharide Chain F
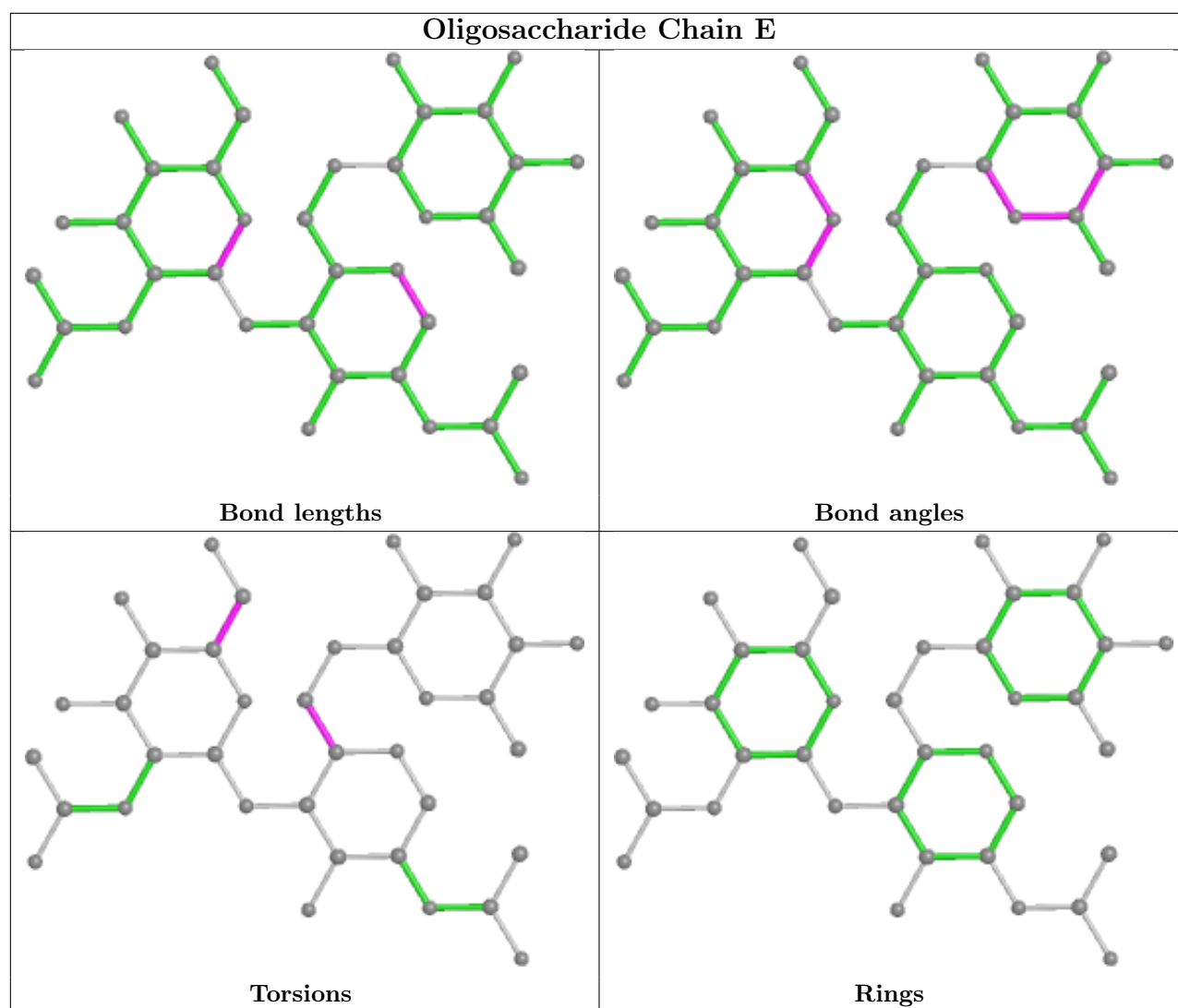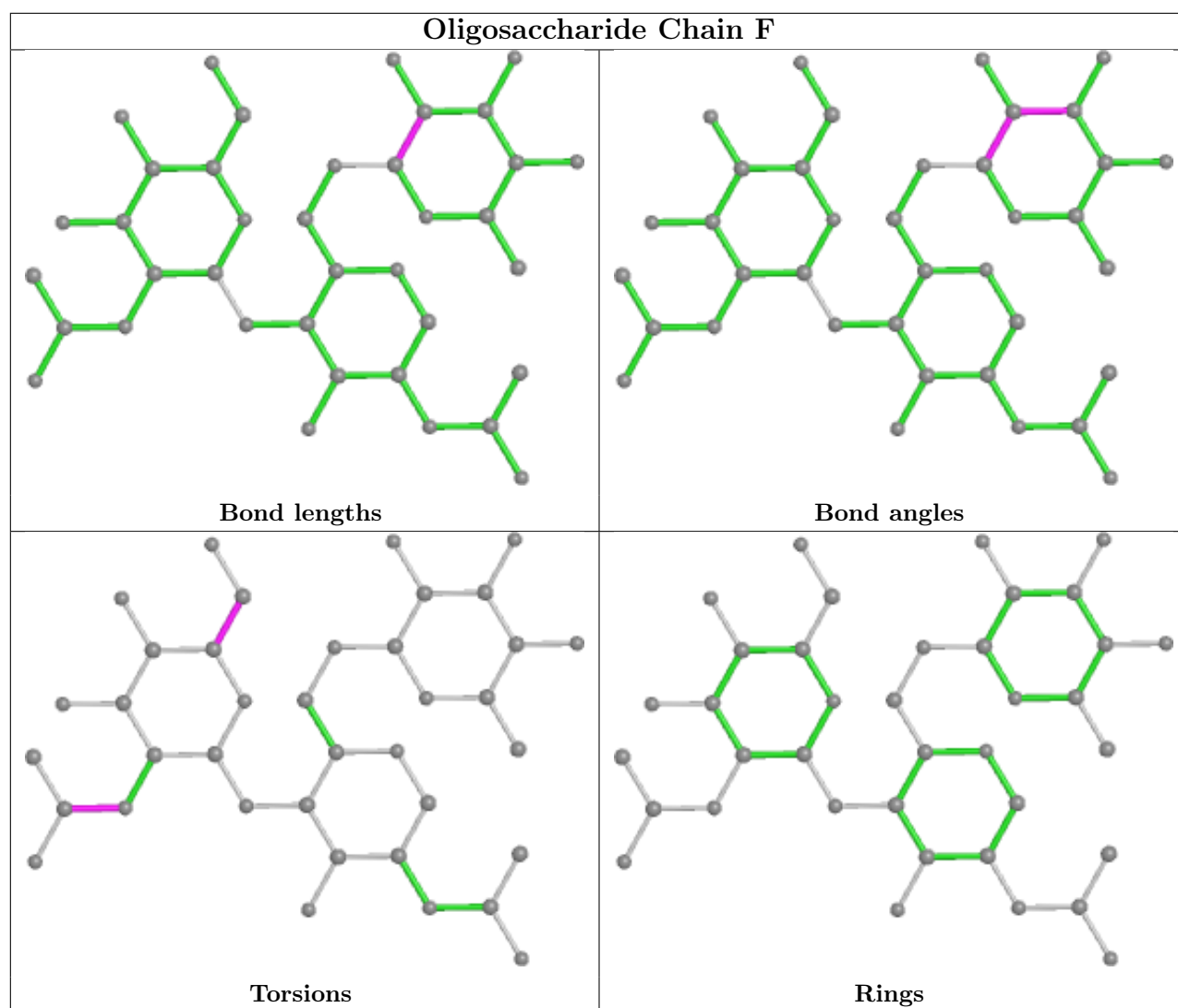
5.6 Ligand geometry ⓘ

There are no ligands in this entry.

5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

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, 95th 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(Å²)	Q<0.9
1	A	213/224 (95%)	-0.06	15 (7%)	24	30	18, 27, 65, 112	0
1	B	212/224 (94%)	0.75	25 (11%)	10	13	29, 46, 78, 101	0
2	D	215/218 (98%)	1.36	65 (30%)	1	1	28, 45, 107, 116	0
2	L	215/218 (98%)	-0.29	0	100	100	18, 27, 36, 44	0
3	C	224/229 (97%)	2.44	110 (49%)	0	0	30, 65, 107, 114	0
3	H	228/229 (99%)	-0.27	4 (1%)	67	72	17, 25, 43, 69	0
All	All	1307/1342 (97%)	0.66	219 (16%)	5	7	17, 36, 96, 116	0

The worst 5 of 219 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	C	220	VAL	7.7
3	C	158	TYR	7.6
2	D	196	TYR	7.2
3	C	155	VAL	7.2
3	C	223	LYS	7.1

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

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

6.3 Carbohydrates ⓘ

SUGAR-RSR INFOmissingINFO

6.4 Ligands ⓘ

There are no ligands in this entry.

6.5 Other polymers (i)

There are no such residues in this entry.