



wwPDB X-ray Structure Validation Summary Report

Oct 5, 2023 – 02:20 AM EDT

PDB ID : 6VLD
Title : Crystal structure of human alpha 1,6-fucosyltransferase, FUT8 bound to GDP and A2SGP
Authors : Jarva, M.A.; Dramicanin, M.; Lingford, J.P.; Mao, R.; John, A.; Goddard-Borger, E.D.
Deposited on : 2020-01-23
Resolution : 2.28 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 : **FAILED**
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : **FAILED**
buster-report : 1.1.7 (2018)
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.35.1

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 2.28 Å.

There are no overall percentile quality scores available for this entry.

MolProbity and EDS failed to run properly - the sequence quality summary graphics cannot be shown.

2 Entry composition i

There are 6 unique types of molecules in this entry. The entry contains 16219 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 Alpha-(1,6)-fucosyltransferase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	467	3796	2416	669	697	14	0	0	0
1	B	469	3814	2427	672	701	14	0	0	0
1	G	465	3785	2410	667	694	14	0	0	0
1	H	453	3688	2352	648	674	14	0	0	0

There are 40 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	576	HIS	-	expression tag	UNP Q9BYC5
A	577	HIS	-	expression tag	UNP Q9BYC5
A	578	HIS	-	expression tag	UNP Q9BYC5
A	579	HIS	-	expression tag	UNP Q9BYC5
A	580	HIS	-	expression tag	UNP Q9BYC5
A	581	HIS	-	expression tag	UNP Q9BYC5
A	582	HIS	-	expression tag	UNP Q9BYC5
A	583	HIS	-	expression tag	UNP Q9BYC5
A	584	HIS	-	expression tag	UNP Q9BYC5
A	585	HIS	-	expression tag	UNP Q9BYC5
B	576	HIS	-	expression tag	UNP Q9BYC5
B	577	HIS	-	expression tag	UNP Q9BYC5
B	578	HIS	-	expression tag	UNP Q9BYC5
B	579	HIS	-	expression tag	UNP Q9BYC5
B	580	HIS	-	expression tag	UNP Q9BYC5
B	581	HIS	-	expression tag	UNP Q9BYC5
B	582	HIS	-	expression tag	UNP Q9BYC5
B	583	HIS	-	expression tag	UNP Q9BYC5
B	584	HIS	-	expression tag	UNP Q9BYC5
B	585	HIS	-	expression tag	UNP Q9BYC5
G	576	HIS	-	expression tag	UNP Q9BYC5

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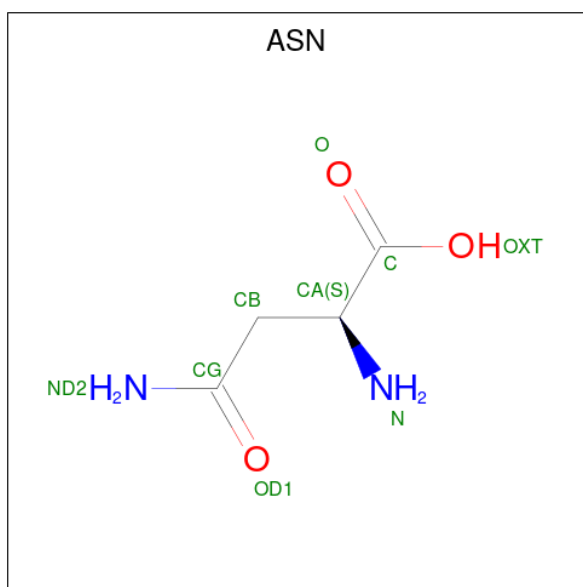
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Chain	Residue	Modelled	Actual	Comment	Reference
G	577	HIS	-	expression tag	UNP Q9BYC5
G	578	HIS	-	expression tag	UNP Q9BYC5
G	579	HIS	-	expression tag	UNP Q9BYC5
G	580	HIS	-	expression tag	UNP Q9BYC5
G	581	HIS	-	expression tag	UNP Q9BYC5
G	582	HIS	-	expression tag	UNP Q9BYC5
G	583	HIS	-	expression tag	UNP Q9BYC5
G	584	HIS	-	expression tag	UNP Q9BYC5
G	585	HIS	-	expression tag	UNP Q9BYC5
H	576	HIS	-	expression tag	UNP Q9BYC5
H	577	HIS	-	expression tag	UNP Q9BYC5
H	578	HIS	-	expression tag	UNP Q9BYC5
H	579	HIS	-	expression tag	UNP Q9BYC5
H	580	HIS	-	expression tag	UNP Q9BYC5
H	581	HIS	-	expression tag	UNP Q9BYC5
H	582	HIS	-	expression tag	UNP Q9BYC5
H	583	HIS	-	expression tag	UNP Q9BYC5
H	584	HIS	-	expression tag	UNP Q9BYC5
H	585	HIS	-	expression tag	UNP Q9BYC5

- Molecule 2 is an oligosaccharide called 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-2)-alpha-D-mannopyranose-(1-3)-[2-acetamido-2-deoxy-beta-D-glucopyranose-(1-2)-alpha-D-mannopyranose-(1-6)]beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.

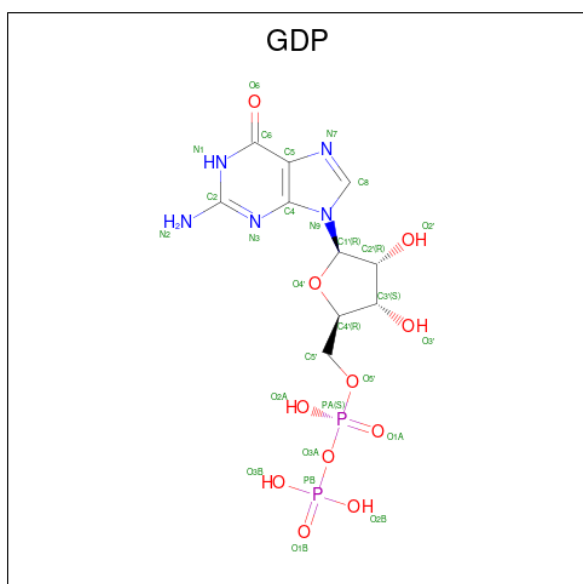
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	C	7	Total	C	N	O	0	0	0
			89	50	4	35			
2	D	7	Total	C	N	O	0	0	0
			89	50	4	35			
2	E	7	Total	C	N	O	0	0	0
			89	50	4	35			
2	F	7	Total	C	N	O	0	0	0
			89	50	4	35			

- Molecule 3 is ASPARAGINE (three-letter code: ASN) (formula: C₄H₈N₂O₃) (labeled as "Ligand of Interest" by depositor).



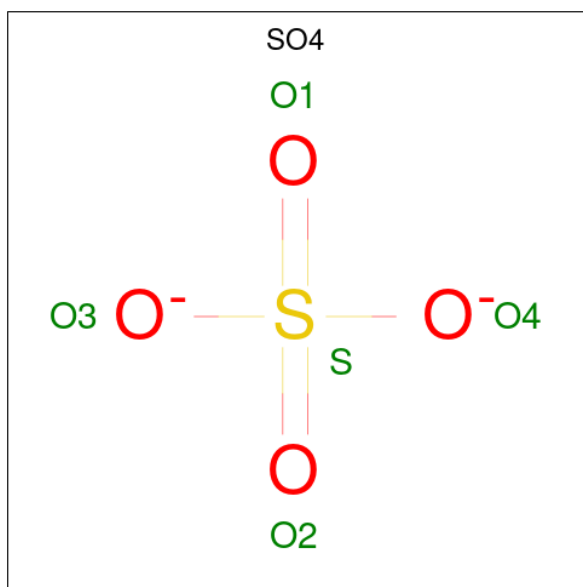
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
3	A	1	9	4	2	3	0	0
3	B	1	9	4	2	3	0	0
3	G	1	9	4	2	3	0	0
3	H	1	9	4	2	3	0	0

- Molecule 4 is GUANOSINE-5'-DIPHOSPHATE (three-letter code: GDP) (formula: $C_{10}H_{15}N_5O_{11}P_2$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
			Total	C	N	O			P
4	A	1	28	10	5	11	2	0	0
4	B	1	28	10	5	11	2	0	0

- Molecule 5 is SULFATE ION (three-letter code: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O S		
5	A	1	5	4 1	0	0
5	A	1	5	4 1	0	0
5	A	1	5	4 1	0	0
5	A	1	5	4 1	0	0
5	B	1	5	4 1	0	0
5	G	1	5	4 1	0	0
5	G	1	5	4 1	0	0
5	H	1	5	4 1	0	0
5	H	1	5	4 1	0	0
5	H	1	5	4 1	0	0

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	H	1	Total	O	S	0	0
			5	4	1		
5	H	1	Total	O	S	0	0
			5	4	1		

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	200	Total	O	0	0
			200	200		
6	B	87	Total	O	0	0
			87	87		
6	G	69	Total	O	0	0
			69	69		
6	H	272	Total	O	0	0
			272	272		

MolProbity and EDS failed to run properly - this section is therefore empty.

3 Data and refinement statistics

EDS failed to run properly - this section is therefore incomplete.

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	208.31Å 68.45Å 249.98Å 90.00° 111.21° 90.00°	Depositor
Resolution (Å)	48.55 – 2.28	Depositor
% Data completeness (in resolution range)	99.9 (48.55-2.28)	Depositor
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.42 (at 2.29Å)	Xtrriage
Refinement program	PHENIX 1.16_3549	Depositor
R, R_{free}	0.191 , 0.224	Depositor
Wilson B-factor (Å ²)	48.4	Xtrriage
Anisotropy	0.155	Xtrriage
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	16219	wwPDB-VP
Average B, all atoms (Å ²)	64.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.21% of the height of the origin peak. No significant pseudotranslation is detected.*

¹ Intensities estimated from amplitudes.

² 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.

4 Model quality [i](#)

4.1 Standard geometry [i](#)

MolProbity failed to run properly - this section is therefore empty.

4.2 Too-close contacts [i](#)

MolProbity failed to run properly - this section is therefore empty.

4.3 Torsion angles [i](#)

4.3.1 Protein backbone [i](#)

MolProbity failed to run properly - this section is therefore empty.

4.3.2 Protein sidechains [i](#)

MolProbity failed to run properly - this section is therefore empty.

4.3.3 RNA [i](#)

MolProbity failed to run properly - this section is therefore empty.

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

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

4.5 Carbohydrates [i](#)

28 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	C	1	2,3	14,14,15	0.24	0	17,19,21	0.45	0
2	NAG	C	2	2	14,14,15	0.24	0	17,19,21	0.36	0
2	BMA	C	3	2	11,11,12	0.74	0	15,15,17	0.67	0
2	MAN	C	4	2	11,11,12	0.71	0	15,15,17	1.08	2 (13%)
2	NAG	C	5	2	14,14,15	0.18	0	17,19,21	0.45	0
2	MAN	C	6	2	11,11,12	0.86	0	15,15,17	0.98	0
2	NAG	C	7	2	14,14,15	0.31	0	17,19,21	0.39	0
2	NAG	D	1	2,3	14,14,15	0.20	0	17,19,21	0.44	0
2	NAG	D	2	2	14,14,15	0.30	0	17,19,21	0.36	0
2	BMA	D	3	2	11,11,12	0.72	0	15,15,17	0.71	0
2	MAN	D	4	2	11,11,12	0.67	0	15,15,17	1.15	2 (13%)
2	NAG	D	5	2	14,14,15	0.23	0	17,19,21	0.39	0
2	MAN	D	6	2	11,11,12	0.74	0	15,15,17	1.05	2 (13%)
2	NAG	D	7	2	14,14,15	0.25	0	17,19,21	0.38	0
2	NAG	E	1	2,3	14,14,15	0.24	0	17,19,21	0.39	0
2	NAG	E	2	2	14,14,15	0.26	0	17,19,21	0.36	0
2	BMA	E	3	2	11,11,12	0.69	0	15,15,17	0.70	0
2	MAN	E	4	2	11,11,12	0.76	0	15,15,17	1.03	2 (13%)
2	NAG	E	5	2	14,14,15	0.24	0	17,19,21	0.40	0
2	MAN	E	6	2	11,11,12	0.77	0	15,15,17	1.05	2 (13%)
2	NAG	E	7	2	14,14,15	0.28	0	17,19,21	0.38	0
2	NAG	F	1	2,3	14,14,15	0.38	0	17,19,21	0.43	0
2	NAG	F	2	2	14,14,15	0.39	0	17,19,21	0.37	0
2	BMA	F	3	2	11,11,12	0.73	0	15,15,17	0.70	0
2	MAN	F	4	2	11,11,12	0.71	0	15,15,17	1.13	2 (13%)
2	NAG	F	5	2	14,14,15	0.31	0	17,19,21	0.36	0
2	MAN	F	6	2	11,11,12	0.90	0	15,15,17	1.08	1 (6%)
2	NAG	F	7	2	14,14,15	0.33	0	17,19,21	0.37	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
2	NAG	C	1	2,3	-	0/6/23/26	0/1/1/1
2	NAG	C	2	2	-	0/6/23/26	0/1/1/1
2	BMA	C	3	2	-	2/2/19/22	0/1/1/1
2	MAN	C	4	2	-	0/2/19/22	0/1/1/1
2	NAG	C	5	2	-	2/6/23/26	0/1/1/1
2	MAN	C	6	2	-	0/2/19/22	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	NAG	C	7	2	-	0/6/23/26	0/1/1/1
2	NAG	D	1	2,3	-	0/6/23/26	0/1/1/1
2	NAG	D	2	2	-	0/6/23/26	0/1/1/1
2	BMA	D	3	2	-	0/2/19/22	0/1/1/1
2	MAN	D	4	2	-	0/2/19/22	0/1/1/1
2	NAG	D	5	2	-	2/6/23/26	0/1/1/1
2	MAN	D	6	2	-	0/2/19/22	0/1/1/1
2	NAG	D	7	2	-	2/6/23/26	0/1/1/1
2	NAG	E	1	2,3	-	0/6/23/26	0/1/1/1
2	NAG	E	2	2	-	0/6/23/26	0/1/1/1
2	BMA	E	3	2	-	0/2/19/22	0/1/1/1
2	MAN	E	4	2	-	0/2/19/22	0/1/1/1
2	NAG	E	5	2	-	2/6/23/26	0/1/1/1
2	MAN	E	6	2	-	0/2/19/22	0/1/1/1
2	NAG	E	7	2	-	2/6/23/26	0/1/1/1
2	NAG	F	1	2,3	-	0/6/23/26	0/1/1/1
2	NAG	F	2	2	-	0/6/23/26	0/1/1/1
2	BMA	F	3	2	-	0/2/19/22	0/1/1/1
2	MAN	F	4	2	-	0/2/19/22	0/1/1/1
2	NAG	F	5	2	-	2/6/23/26	0/1/1/1
2	MAN	F	6	2	-	0/2/19/22	0/1/1/1
2	NAG	F	7	2	-	0/6/23/26	0/1/1/1

There are no bond length outliers.

The worst 5 of 13 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	4	MAN	O2-C2-C3	-2.61	104.91	110.14
2	F	4	MAN	C1-O5-C5	2.54	115.63	112.19
2	D	4	MAN	C1-O5-C5	2.49	115.57	112.19
2	C	4	MAN	C1-O5-C5	2.46	115.52	112.19
2	F	4	MAN	O2-C2-C3	-2.37	105.40	110.14

There are no chirality outliers.

5 of 14 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	C	5	NAG	C8-C7-N2-C2
2	C	5	NAG	O7-C7-N2-C2
2	D	5	NAG	C8-C7-N2-C2

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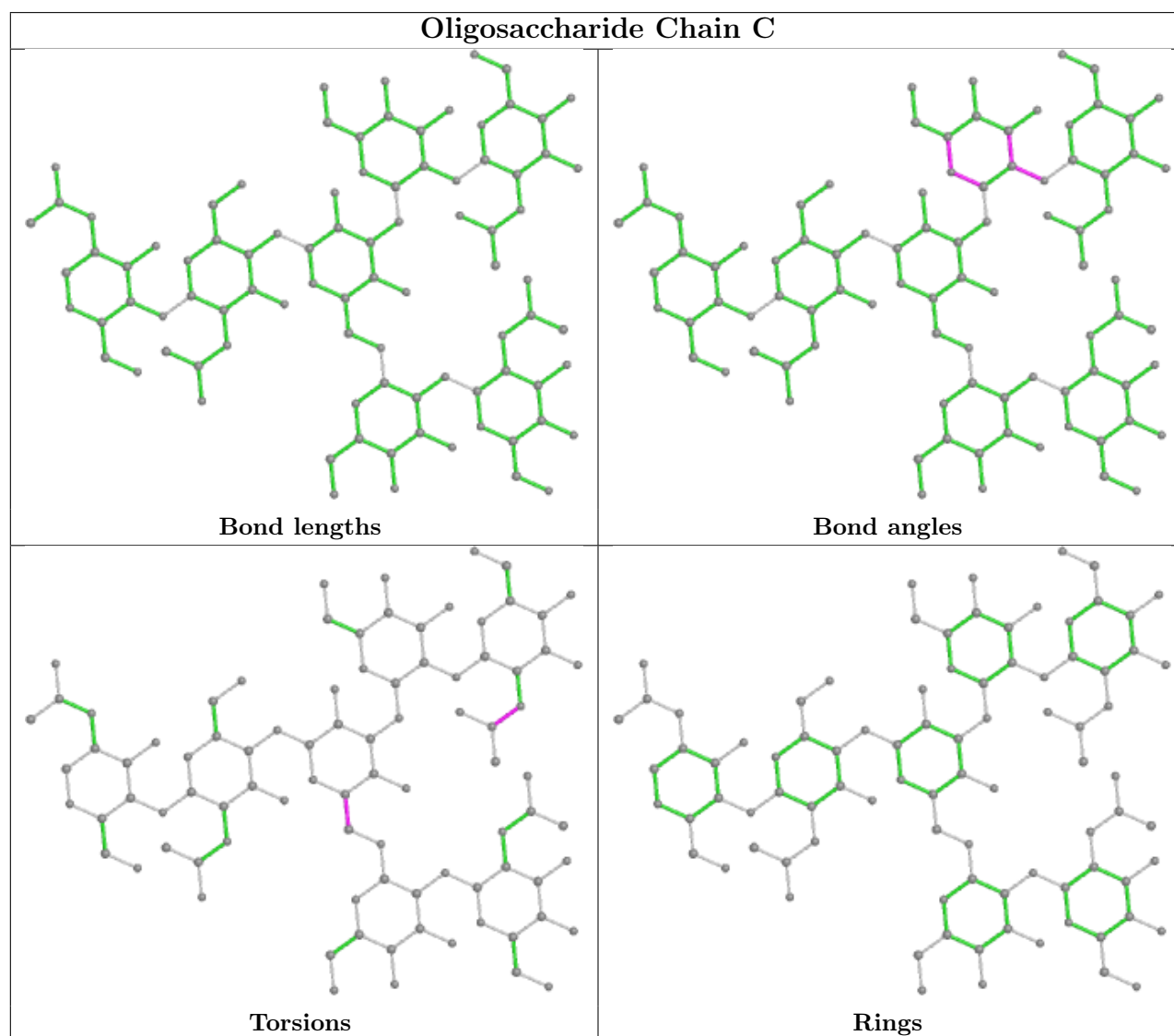
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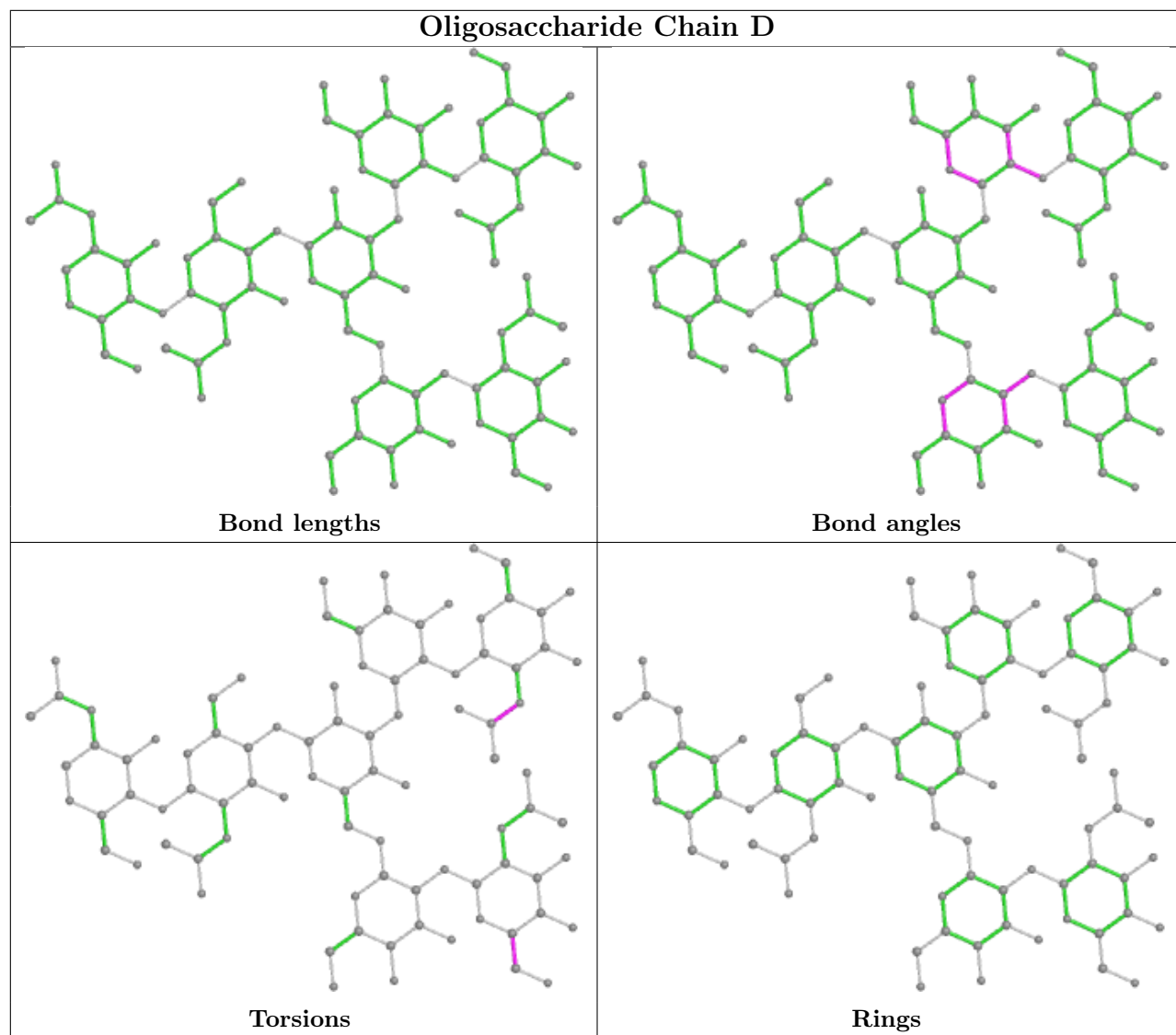
Mol	Chain	Res	Type	Atoms
2	D	5	NAG	O7-C7-N2-C2
2	E	5	NAG	C8-C7-N2-C2

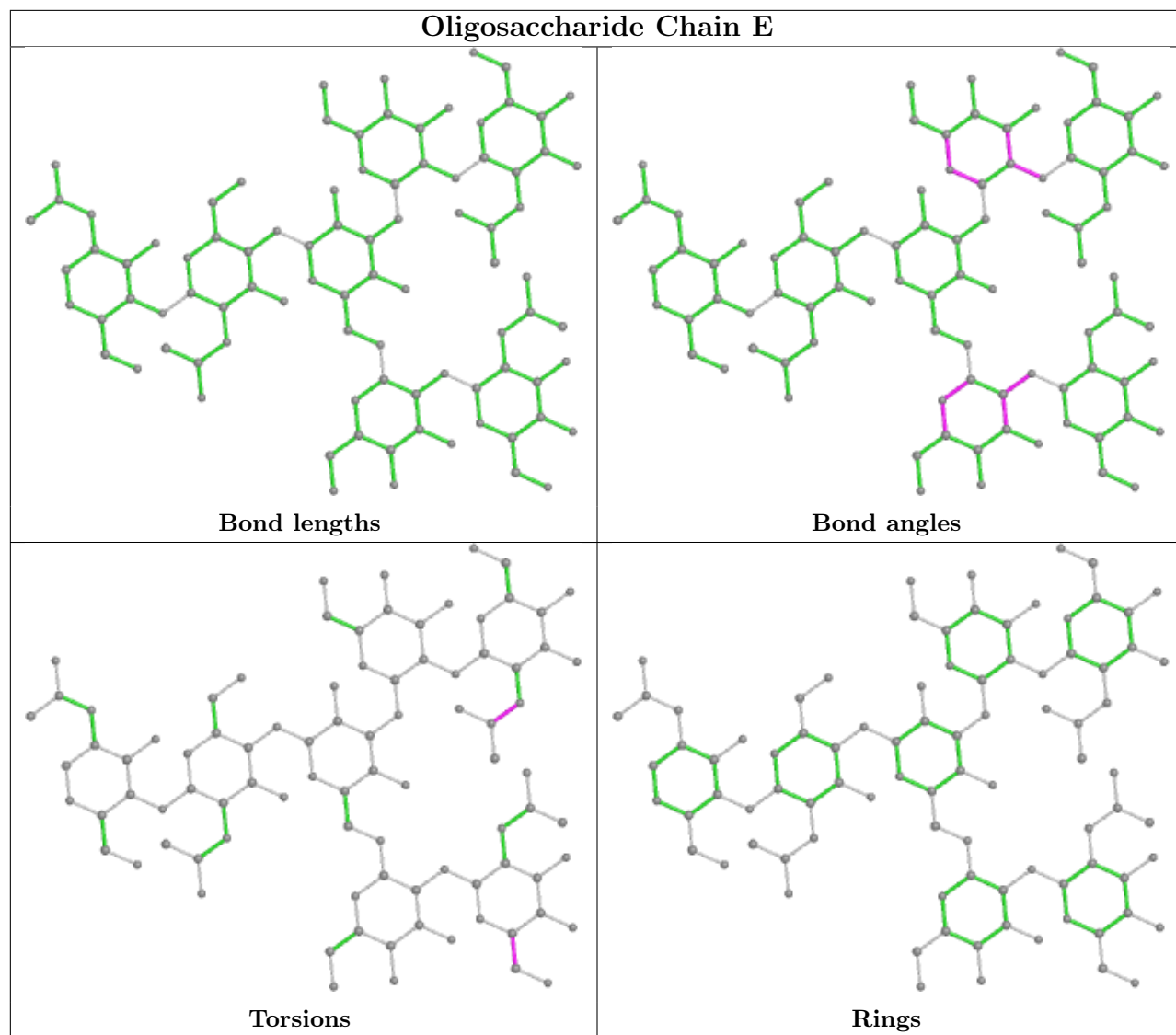
There are no ring outliers.

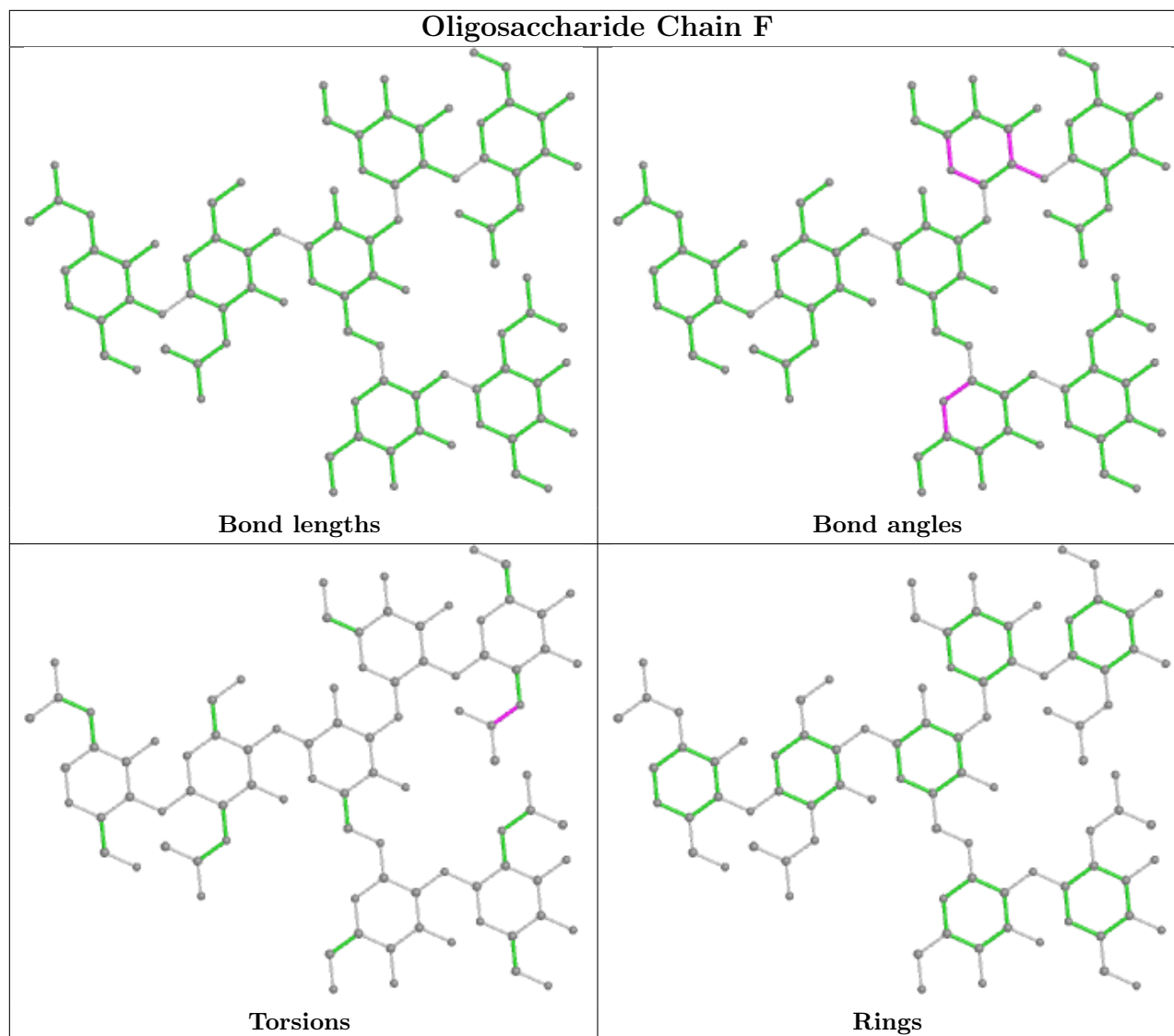
No monomer is involved in short contacts.

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









4.6 Ligand geometry [i](#)

18 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	$\# Z > 2$
5	SO4	H	609	-	4,4,4	0.14	0	6,6,6	0.05	0
5	SO4	G	610	-	4,4,4	0.14	0	6,6,6	0.08	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
5	SO4	A	610	-	4,4,4	0.14	0	6,6,6	0.05	0
4	GDP	A	609	-	24,30,30	0.96	1 (4%)	30,47,47	1.16	4 (13%)
5	SO4	H	612	-	4,4,4	0.14	0	6,6,6	0.06	0
4	GDP	B	609	-	24,30,30	0.95	1 (4%)	30,47,47	1.16	4 (13%)
5	SO4	A	611	-	4,4,4	0.14	0	6,6,6	0.05	0
5	SO4	B	610	-	4,4,4	0.14	0	6,6,6	0.04	0
3	ASN	H	601	2	6,8,8	0.91	1 (16%)	8,10,10	1.19	2 (25%)
3	ASN	A	601	2	6,8,8	0.91	1 (16%)	8,10,10	1.24	2 (25%)
5	SO4	G	609	-	4,4,4	0.14	0	6,6,6	0.07	0
5	SO4	A	613	-	4,4,4	0.14	0	6,6,6	0.05	0
5	SO4	H	610	-	4,4,4	0.15	0	6,6,6	0.06	0
5	SO4	H	611	-	4,4,4	0.14	0	6,6,6	0.06	0
5	SO4	H	613	-	4,4,4	0.15	0	6,6,6	0.13	0
3	ASN	B	601	2	6,8,8	0.91	1 (16%)	8,10,10	1.19	2 (25%)
3	ASN	G	601	2	6,8,8	0.92	1 (16%)	8,10,10	1.22	2 (25%)
5	SO4	A	612	-	4,4,4	0.14	0	6,6,6	0.04	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
4	GDP	A	609	-	-	4/12/32/32	0/3/3/3
4	GDP	B	609	-	-	4/12/32/32	0/3/3/3
3	ASN	H	601	2	-	0/8/8/8	-
3	ASN	A	601	2	-	2/8/8/8	-
3	ASN	B	601	2	-	2/8/8/8	-
3	ASN	G	601	2	-	5/8/8/8	-

The worst 5 of 6 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	609	GDP	C6-N1	-2.42	1.34	1.37
4	B	609	GDP	C6-N1	-2.35	1.34	1.37
3	G	601	ASN	OXT-C	-2.12	1.23	1.30
3	A	601	ASN	OXT-C	-2.11	1.23	1.30
3	H	601	ASN	OXT-C	-2.11	1.23	1.30

The worst 5 of 16 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	B	609	GDP	PA-O3A-PB	-2.75	123.40	132.83
4	A	609	GDP	PA-O3A-PB	-2.70	123.55	132.83
3	G	601	ASN	OXT-C-O	-2.60	118.17	124.09
3	A	601	ASN	OXT-C-O	-2.59	118.21	124.09
3	B	601	ASN	OXT-C-O	-2.58	118.22	124.09

There are no chirality outliers.

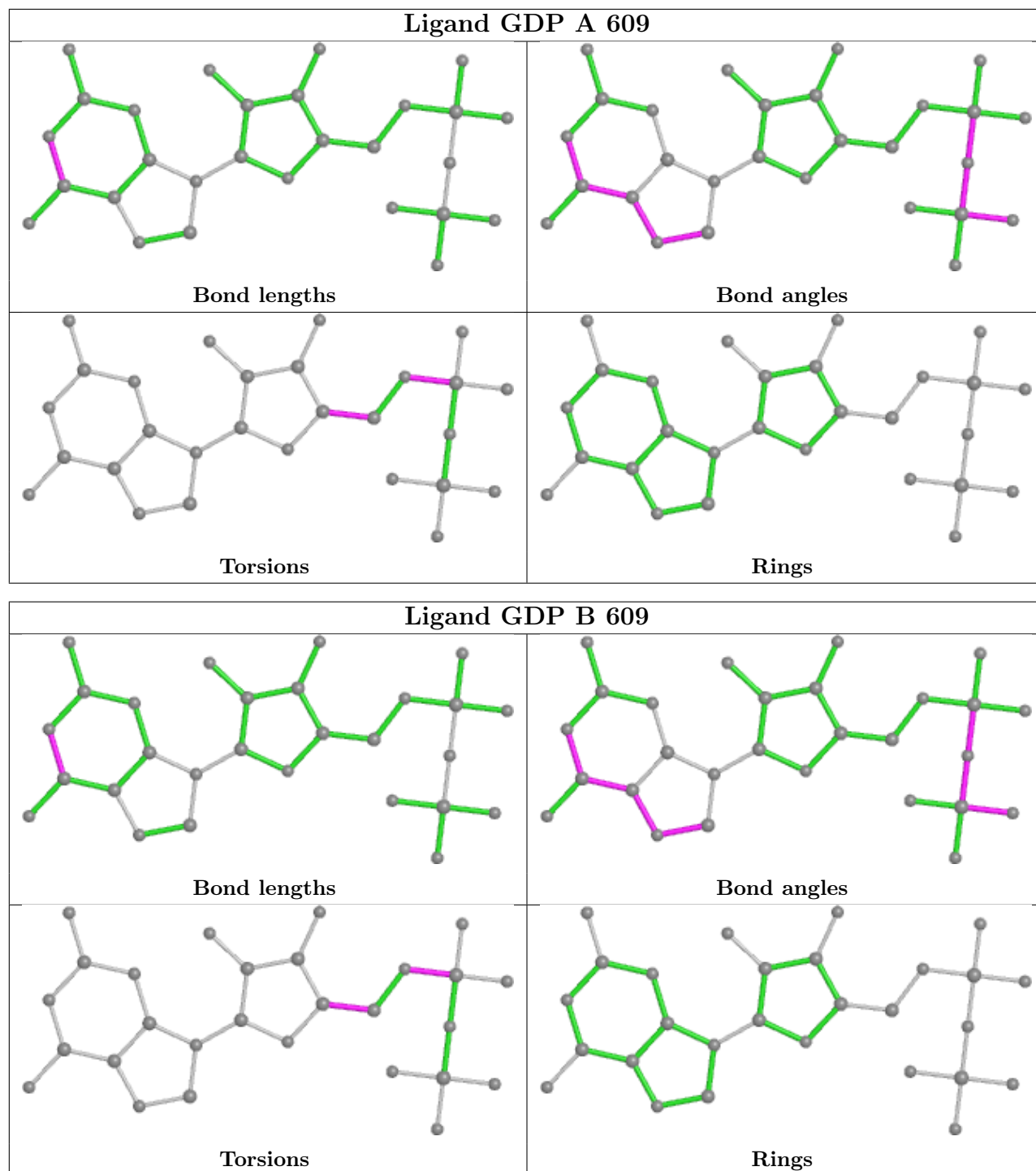
5 of 17 torsion outliers are listed below:

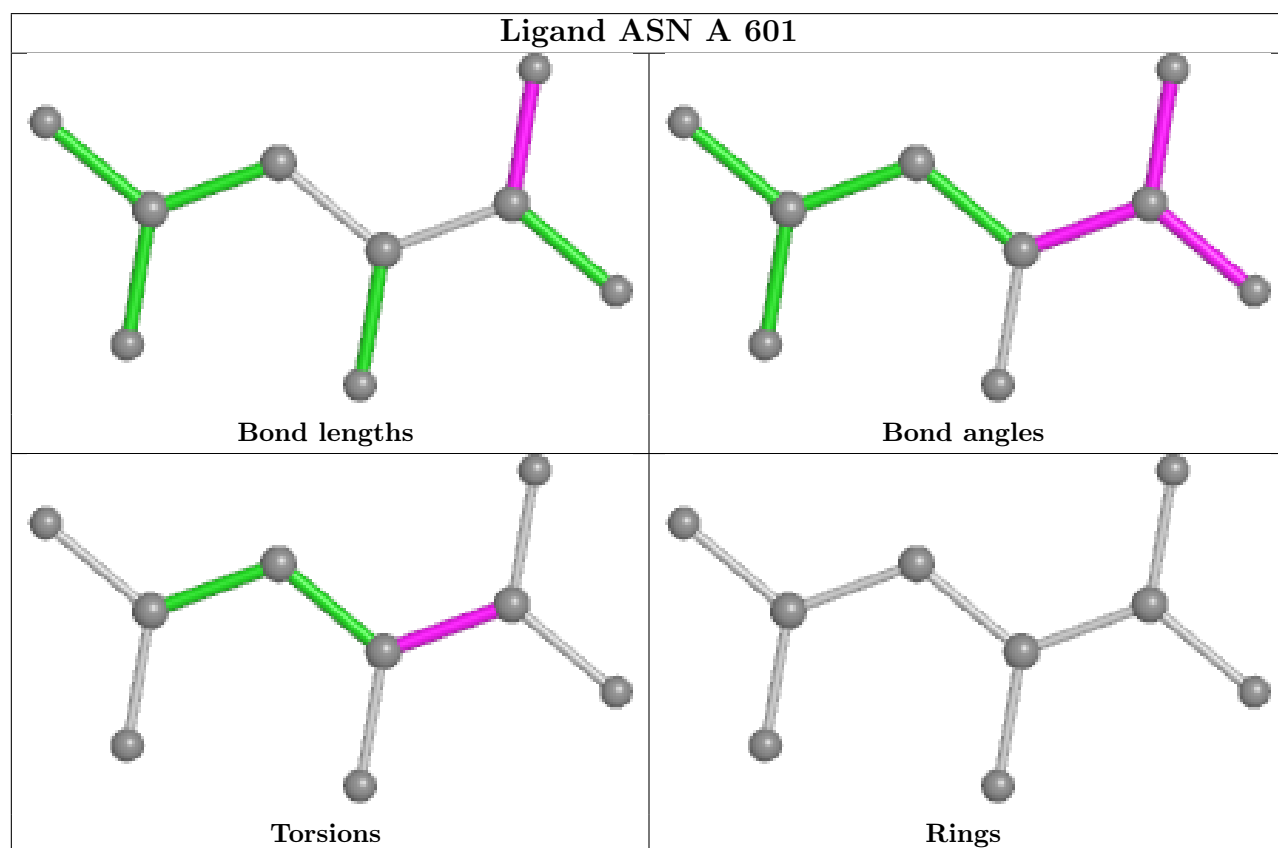
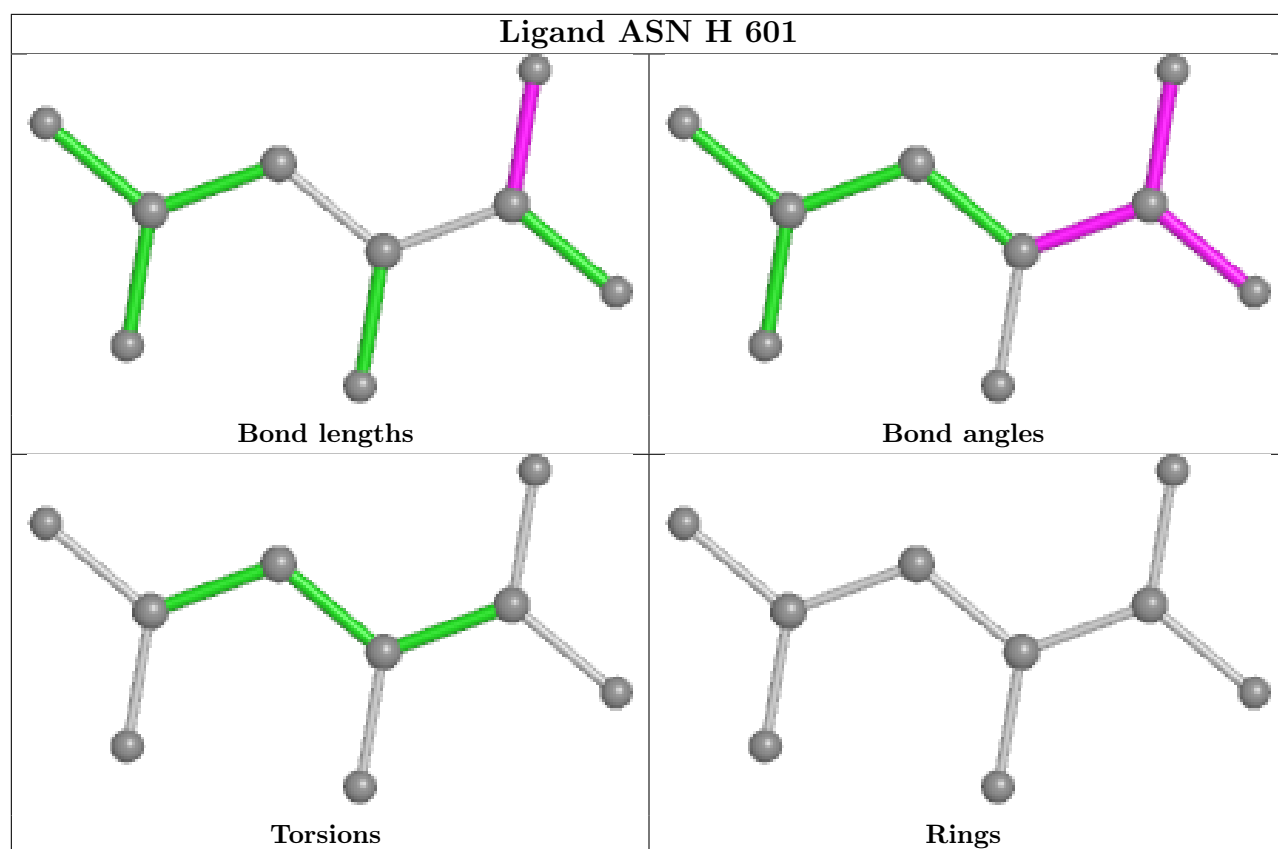
Mol	Chain	Res	Type	Atoms
3	A	601	ASN	O-C-CA-N
3	B	601	ASN	C-CA-CB-CG
4	A	609	GDP	C5'-O5'-PA-O3A
4	A	609	GDP	C5'-O5'-PA-O1A
4	B	609	GDP	C5'-O5'-PA-O3A

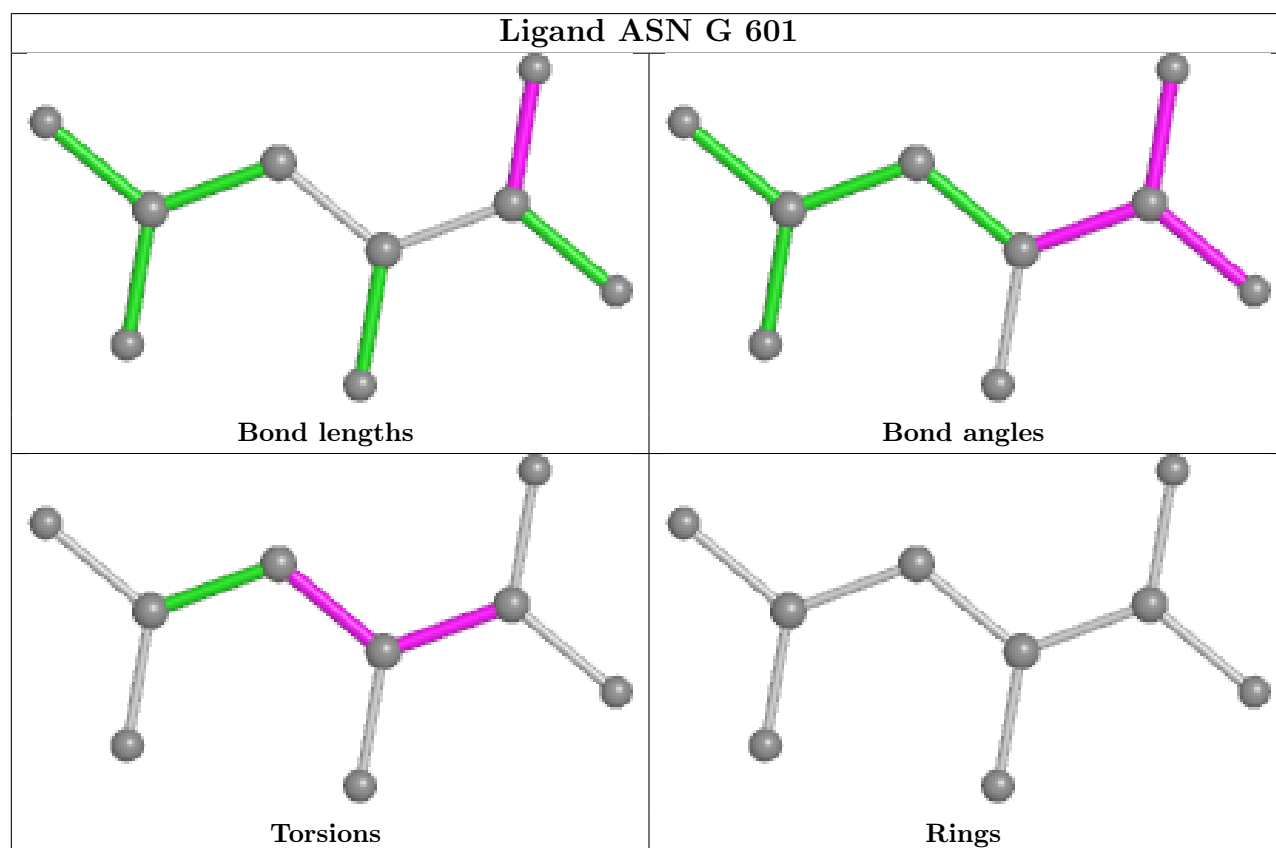
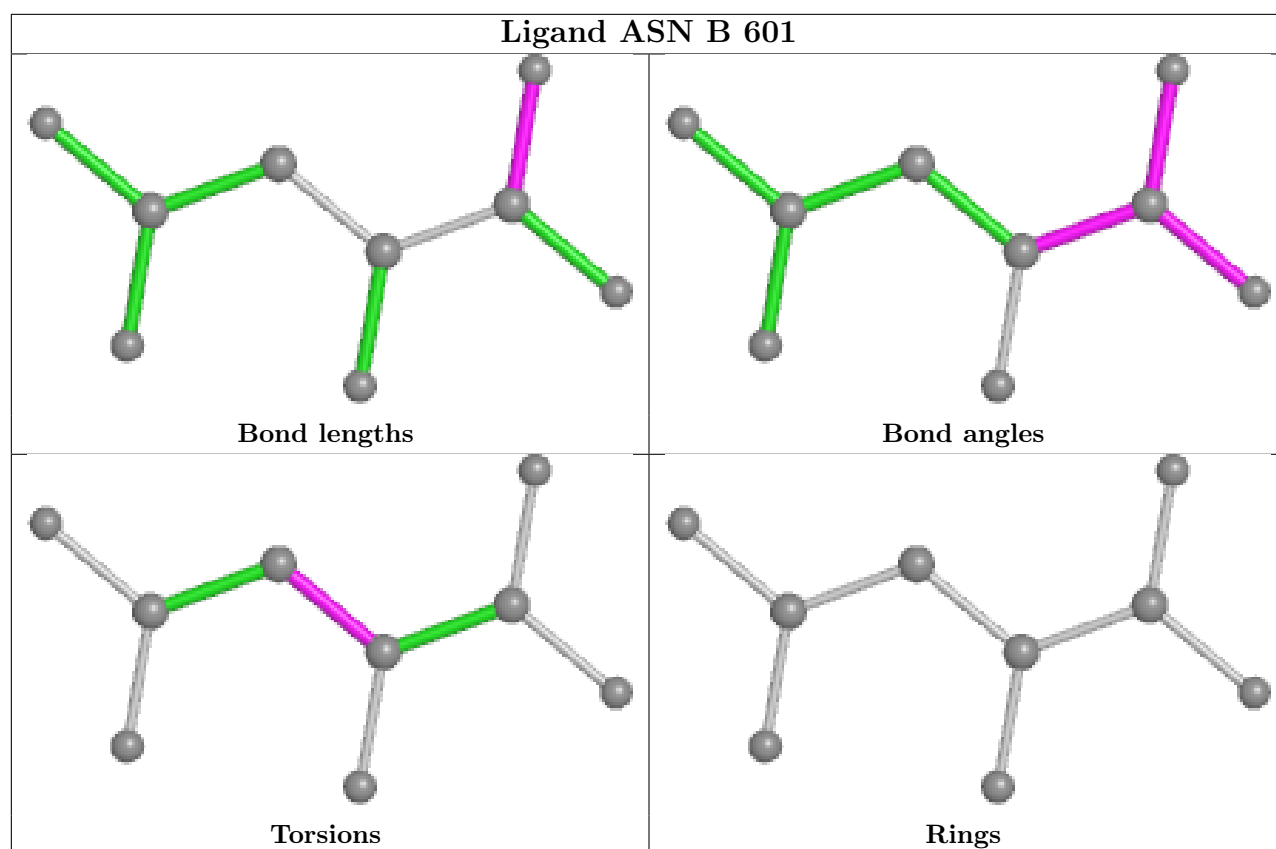
There are no ring outliers.

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 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.







4.7 Other polymers

There are no such residues in this entry.

4.8 Polymer linkage issues

There are no chain breaks in this entry.

5 Fit of model and data

5.1 Protein, DNA and RNA chains

EDS failed to run properly - this section is therefore empty.

5.2 Non-standard residues in protein, DNA, RNA chains

EDS failed to run properly - this section is therefore empty.

5.3 Carbohydrates

EDS failed to run properly - this section is therefore empty.

5.4 Ligands

EDS failed to run properly - this section is therefore empty.

5.5 Other polymers

EDS failed to run properly - this section is therefore empty.