WORLDWIDE wwPDB PROTEIN DATA BANK

Full wwPDB X-ray Structure Validation Report (i)

Dec 18, 2025 – 03:17 pm GMT

PDB ID	:	9SQT / pdb_00009sqt
Title	:	Joint X-ray/neutron room temperature structure of perdeuterated LecA lectin in complex with deuterated galactose
Authors	:	Arnaud, T.; Gajdos, L.; Devos, J.M.; Blakeley, M.P.; Varrot, A.; Imberty, A.
Deposited on	:	2025-09-23
Resolution	:	1.49 Å(reported)

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

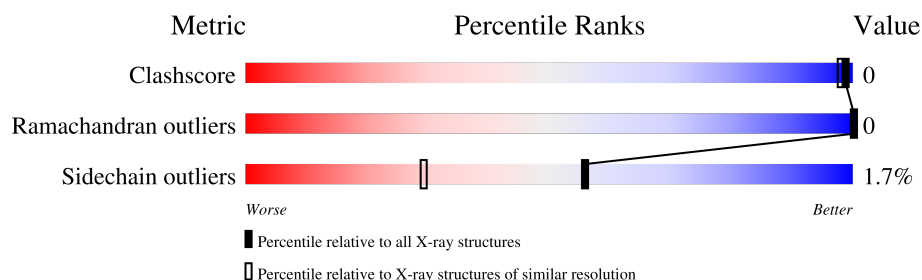|		
MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	2.0
EDS	:	FAILED
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.47

1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION, NEUTRON DIFFRACTION

The reported resolution of this entry is 1.49 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
Clashscore		0
Ramachandran outliers		0
Sidechain outliers		1.7%

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))
Clashscore	180529	4048 (1.50-1.50)
Ramachandran outliers	177936	3970 (1.50-1.50)
Sidechain outliers	177891	3967 (1.50-1.50)

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%

Note EDS failed to run properly.

| Mol	Chain	Length	Quality of chain
1	A	121	96%
1	B	121	98%
1	C	121	97%
1	D	121	99%
1	E	121	100%
1	F	121	96%
1	G	121	99%
1	H	121	98%

2 Entry composition ⓘ

There are 4 unique types of molecules in this entry. The entry contains 16840 atoms, of which 16 are hydrogens and 8664 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 PA-I galactophilic lectin.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	121	Total	C	D	N	O	S	1	0	0
			1764	567	863	156	175	3			
1	B	121	Total	C	D	N	O	S	2	2	0
			1776	570	869	157	177	3			
1	C	121	Total	C	D	N	O	S	5	0	0
			1764	567	863	156	175	3			
1	D	121	Total	C	D	N	O	S	1	0	0
			1764	567	863	156	175	3			
1	E	121	Total	C	D	N	O	S	2	0	0
			1764	567	863	156	175	3			
1	F	121	Total	C	D	N	O	S	1	0	0
			1764	567	863	156	175	3			
1	G	121	Total	C	D	N	O	S	1	1	0
			1781	572	871	158	177	3			
1	H	121	Total	C	D	N	O	S	10	0	0
			1764	567	863	156	175	3			

- Molecule 2 is alpha-D-galactopyranose (CCD ID: GLA) (formula: $C_6H_{12}O_6$) (labeled as "Ligand of Interest" by depositor).

GLA
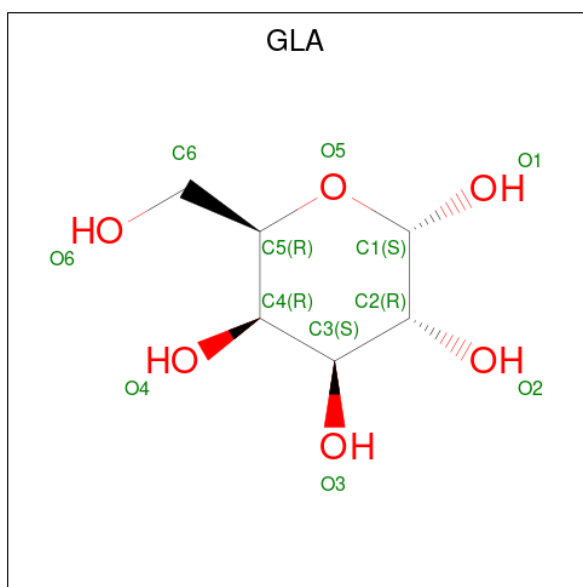
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	D	H	O	0	0
			24	6	10	2	6		
2	B	1	Total	C	D	H	O	0	0
			24	6	10	2	6		
2	C	1	Total	C	D	H	O	0	0
			24	6	10	2	6		
2	D	1	Total	C	D	H	O	0	0
			24	6	10	2	6		
2	E	1	Total	C	D	H	O	0	0
			24	6	10	2	6		
2	F	1	Total	C	D	H	O	0	0
			24	6	10	2	6		
2	G	1	Total	C	D	H	O	0	0
			24	6	10	2	6		
2	H	1	Total	C	D	H	O	0	0
			24	6	10	2	6		

- Molecule 3 is CALCIUM ION (CCD ID: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Ca	0	0
			1	1		
3	B	1	Total	Ca	0	0
			1	1		
3	C	1	Total	Ca	0	0
			1	1		
3	D	1	Total	Ca	0	0
			1	1		

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	E	1	Total 1	Ca 1	0	0
3	F	1	Total 1	Ca 1	0	0
3	G	1	Total 1	Ca 1	0	0
3	H	1	Total 1	Ca 1	0	0

- Molecule 4 is water.

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	99	Total 297	D 198	O 99	0	0
4	B	88	Total 264	D 176	O 88	0	0
4	C	108	Total 324	D 216	O 108	0	0
4	D	95	Total 285	D 190	O 95	0	0
4	E	117	Total 351	D 234	O 117	0	0
4	F	108	Total 324	D 216	O 108	0	0
4	G	107	Total 321	D 214	O 107	0	0
4	H	111	Total 333	D 222	O 111	0	0

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 failed to run properly.

• Molecule 1: PA-I galactophilic lectin

Chain A:

• Molecule 1: PA-I galactophilic lectin

Chain B:

• Molecule 1: PA-I galactophilic lectin

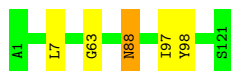Chain C:

• Molecule 1: PA-I galactophilic lectin

Chain D:

• Molecule 1: PA-I galactophilic lectin

Chain E:

There are no outlier residues recorded for this chain.
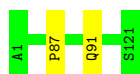
• Molecule 1: PA-I galactophilic lectin

Chain F:

A1 L7 G63 N88 I97 Y98 S121

• Molecule 1: PA-I galactophilic lectin

Chain G:

99%

A1 I97 S121

• Molecule 1: PA-I galactophilic lectin

Chain H:

98%

A1 P87 Q91 S121

4 Data and refinement statistics ⓘ

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

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	50.80Å 106.52Å 83.30Å 90.00° 94.63° 90.00°	Depositor
Resolution (Å)	41.52 – 1.49	Depositor
% Data completeness (in resolution range)	98.7 (41.52-1.49)	Depositor
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.74 (at 1.49Å)	Xtriage
Refinement program	PHENIX 1.17.1	Depositor
R, R_{free}	0.157 , 0.185	Depositor
Wilson B-factor (Å²)	11.9	Xtriage
Anisotropy	0.920	Xtriage
L-test for twinning[2]	$< |L| > = 0.49, < L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	16840	wwPDB-VP
Average B, all atoms (Å²)	31.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.93% 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: GLA, CA

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	0.86	0/924	0.88	0/1262
1	B	0.82	0/937	0.89	1/1280 (0.1%)
1	C	0.92	0/924	0.90	0/1262
1	D	0.83	0/924	0.87	0/1262
1	E	0.85	0/924	0.90	0/1262
1	F	0.90	0/924	0.89	0/1262
1	G	0.83	0/933	0.87	0/1274
1	H	0.93	0/924	0.92	0/1262
All	All	0.87	0/7414	0.89	1/10126 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	120	GLN	CA-CB-CG	7.11	128.32	114.10

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	1764	0	861	1	0
1	B	1776	0	857	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	C	1764	0	861	1	0
1	D	1764	0	861	0	0
1	E	1764	0	861	0	0
1	F	1764	0	861	2	0
1	G	1781	0	868	0	0
1	H	1764	0	861	0	0
2	A	22	2	9	0	0
2	B	22	2	10	0	0
2	C	22	2	10	0	0
2	D	22	2	10	0	0
2	E	22	2	9	0	0
2	F	22	2	9	0	0
2	G	22	2	9	0	0
2	H	22	2	9	0	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
3	C	1	0	0	0	0
3	D	1	0	0	0	0
3	E	1	0	0	0	0
3	F	1	0	0	0	0
3	G	1	0	0	0	0
3	H	1	0	0	0	0
4	A	297	0	0	0	0
4	B	264	0	0	1	0
4	C	324	0	0	0	0
4	D	285	0	0	0	1
4	E	351	0	0	0	0
4	F	324	0	0	0	1
4	G	321	0	0	0	0
4	H	333	0	0	0	0
All	All	16824	16	6966	5	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 0.

All (5) 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:F:88:ASN:OD1	1:F:88:ASN:N	2.28	0.64
1:B:48:ARG:NH2	4:B:303:HOH:O	2.49	0.44
1:A:63:GLY:HA2	1:A:98:TYR:CZ	2.48	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:F:63:GLY:HA2	1:F:98:TYR:CZ	2.48	0.43
1:C:63:GLY:HA2	1:C:98:TYR:CZ	2.50	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)
4:D:386:HOH:O	4:F:385:HOH:O[2_555]	1.80	0.40

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	119/121 (98%)	115 (97%)	4 (3%)	0	100	100
1	B	121/121 (100%)	118 (98%)	3 (2%)	0	100	100
1	C	119/121 (98%)	116 (98%)	3 (2%)	0	100	100
1	D	119/121 (98%)	115 (97%)	4 (3%)	0	100	100
1	E	119/121 (98%)	115 (97%)	4 (3%)	0	100	100
1	F	119/121 (98%)	116 (98%)	3 (2%)	0	100	100
1	G	120/121 (99%)	117 (98%)	3 (2%)	0	100	100
1	H	119/121 (98%)	113 (95%)	6 (5%)	0	100	100
All	All	955/968 (99%)	925 (97%)	30 (3%)	0	100	100

There are no Ramachandran outliers to report.

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	94/94 (100%)	91 (97%)	3 (3%)	34	9
1	B	96/94 (102%)	95 (99%)	1 (1%)	73	53
1	C	94/94 (100%)	92 (98%)	2 (2%)	48	20
1	D	94/94 (100%)	93 (99%)	1 (1%)	70	48
1	E	94/94 (100%)	94 (100%)	0	100	100
1	F	94/94 (100%)	91 (97%)	3 (3%)	34	9
1	G	95/94 (101%)	94 (99%)	1 (1%)	70	48
1	H	94/94 (100%)	92 (98%)	2 (2%)	48	20
All	All	755/752 (100%)	742 (98%)	13 (2%)	56	29

All (13) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	5	GLU
1	A	88	ASN
1	A	97	ILE
1	B	97	ILE
1	C	7	LEU
1	C	97	ILE
1	D	90	VAL
1	F	7	LEU
1	F	88	ASN
1	F	97	ILE
1	G	97	ILE
1	H	87	PRO
1	H	91	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (10) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	89	ASN
1	C	21	ASN
1	C	78	ASN
1	C	91	GLN
1	D	53	GLN

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Mol	Chain	Res	Type
1	D	89	ASN
1	E	89	ASN
1	G	78	ASN
1	H	78	ASN
1	H	115	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 ⓘ

There are no oligosaccharides in this entry.

5.6   Ligand geometry ⓘ

Of 16 ligands modelled in this entry, 8 are monoatomic - leaving 8 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	#$|Z| > 2$
2	GLA	C	201	3	12,12,12	1.48	1 (8%)	17,17,17	1.45	2 (11%)
2	GLA	E	201	3	12,12,12	1.21	2 (16%)	17,17,17	1.79	4 (23%)
2	GLA	F	201	3	12,12,12	1.40	1 (8%)	17,17,17	1.71	4 (23%)
2	GLA	G	201	3	12,12,12	1.35	1 (8%)	17,17,17	1.32	1 (5%)
2	GLA	D	201	3	12,12,12	1.42	1 (8%)	17,17,17	1.12	2 (11%)
2	GLA	B	201	3	12,12,12	1.28	1 (8%)	17,17,17	1.23	2 (11%)
2	GLA	H	201	3	12,12,12	1.25	1 (8%)	17,17,17	1.05	1 (5%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	#|Z| > 2	Counts	RMSZ	#|Z| > 2
2	GLA	A	201	3	12,12,12	1.15	1 (8%)	17,17,17	1.33	2 (11%)

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	GLA	C	201	3	-	0/2/22/22	0/1/1/1
2	GLA	E	201	3	-	0/2/22/22	0/1/1/1
2	GLA	F	201	3	-	0/2/22/22	0/1/1/1
2	GLA	G	201	3	-	0/2/22/22	0/1/1/1
2	GLA	D	201	3	-	0/2/22/22	0/1/1/1
2	GLA	B	201	3	-	0/2/22/22	0/1/1/1
2	GLA	H	201	3	-	0/2/22/22	0/1/1/1
2	GLA	A	201	3	-	0/2/22/22	0/1/1/1

All (9) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	F	201	GLA	O5-C1	3.95	1.52	1.42
2	D	201	GLA	O5-C1	3.78	1.52	1.42
2	C	201	GLA	O5-C1	3.57	1.51	1.42
2	G	201	GLA	O5-C1	3.40	1.51	1.42
2	H	201	GLA	O5-C1	3.38	1.51	1.42
2	B	201	GLA	O5-C1	2.80	1.49	1.42
2	A	201	GLA	O3-C3	2.32	1.48	1.43
2	E	201	GLA	C3-C2	-2.21	1.46	1.52
2	E	201	GLA	O3-C3	2.16	1.48	1.43

All (18) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	E	201	GLA	O4-C4-C3	-4.28	100.44	110.35
2	F	201	GLA	O5-C5-C4	3.53	116.10	109.69
2	G	201	GLA	O4-C4-C3	-3.38	102.53	110.35
2	F	201	GLA	O3-C3-C4	-3.34	102.63	110.35
2	C	201	GLA	O5-C5-C4	3.25	115.60	109.69
2	E	201	GLA	O5-C5-C4	3.21	115.53	109.69
2	A	201	GLA	O4-C4-C3	-3.11	103.16	110.35
2	A	201	GLA	C4-C3-C2	2.80	115.71	110.82
2	C	201	GLA	C1-C2-C3	2.75	116.02	110.31

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	E	201	GLA	O2-C2-C1	-2.74	102.80	109.16
2	B	201	GLA	O3-C3-C4	-2.59	104.36	110.35
2	E	201	GLA	O1-C1-O5	-2.50	102.86	110.38
2	B	201	GLA	O4-C4-C3	-2.39	104.82	110.35
2	D	201	GLA	O4-C4-C3	-2.38	104.84	110.35
2	H	201	GLA	O3-C3-C4	-2.28	105.08	110.35
2	D	201	GLA	O5-C5-C4	2.16	113.61	109.69
2	F	201	GLA	C1-C2-C3	2.14	114.75	110.31
2	F	201	GLA	C3-C4-C5	-2.11	106.48	110.24

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.
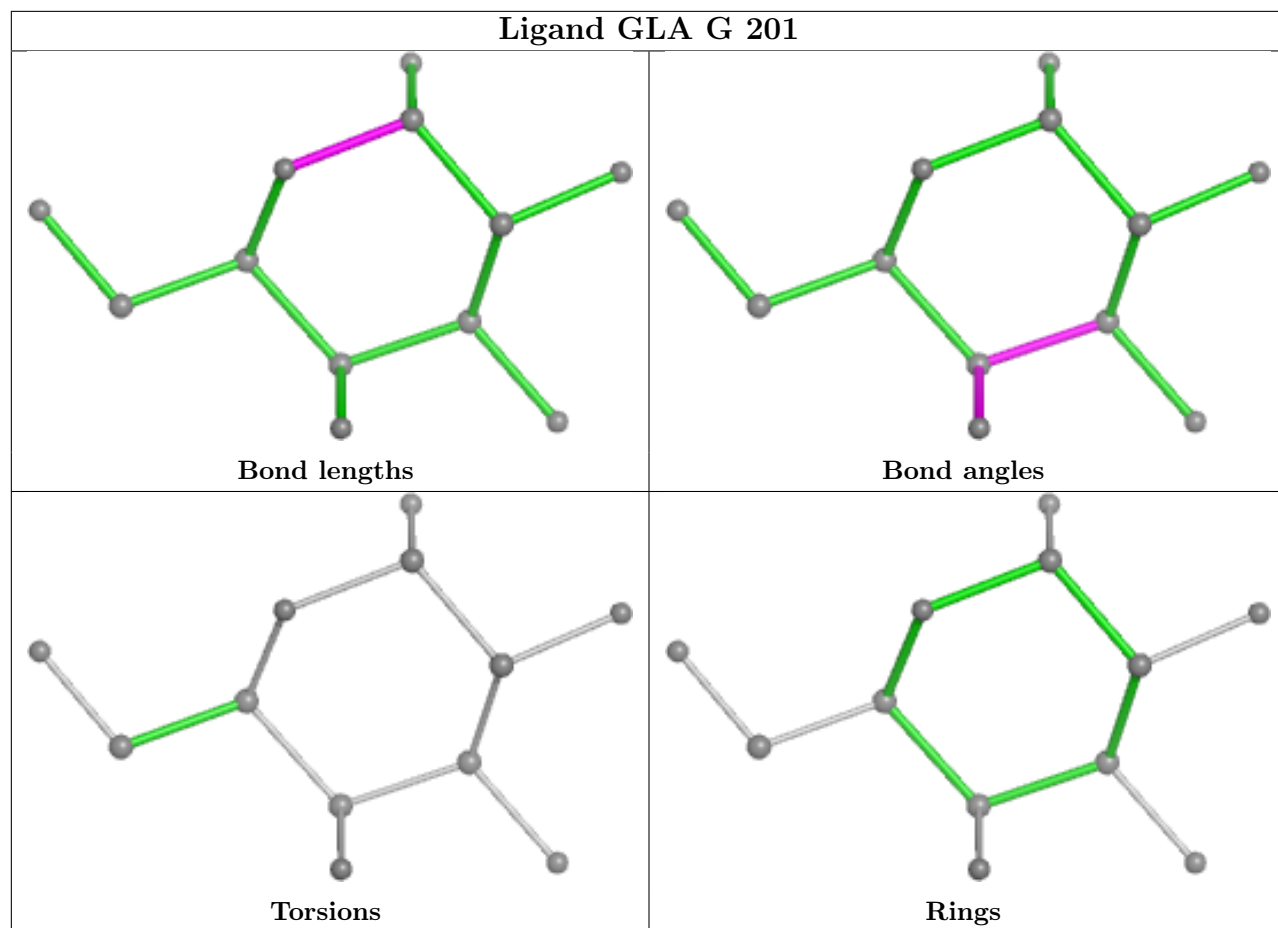
No monomer is involved in short contacts.

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 then 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.
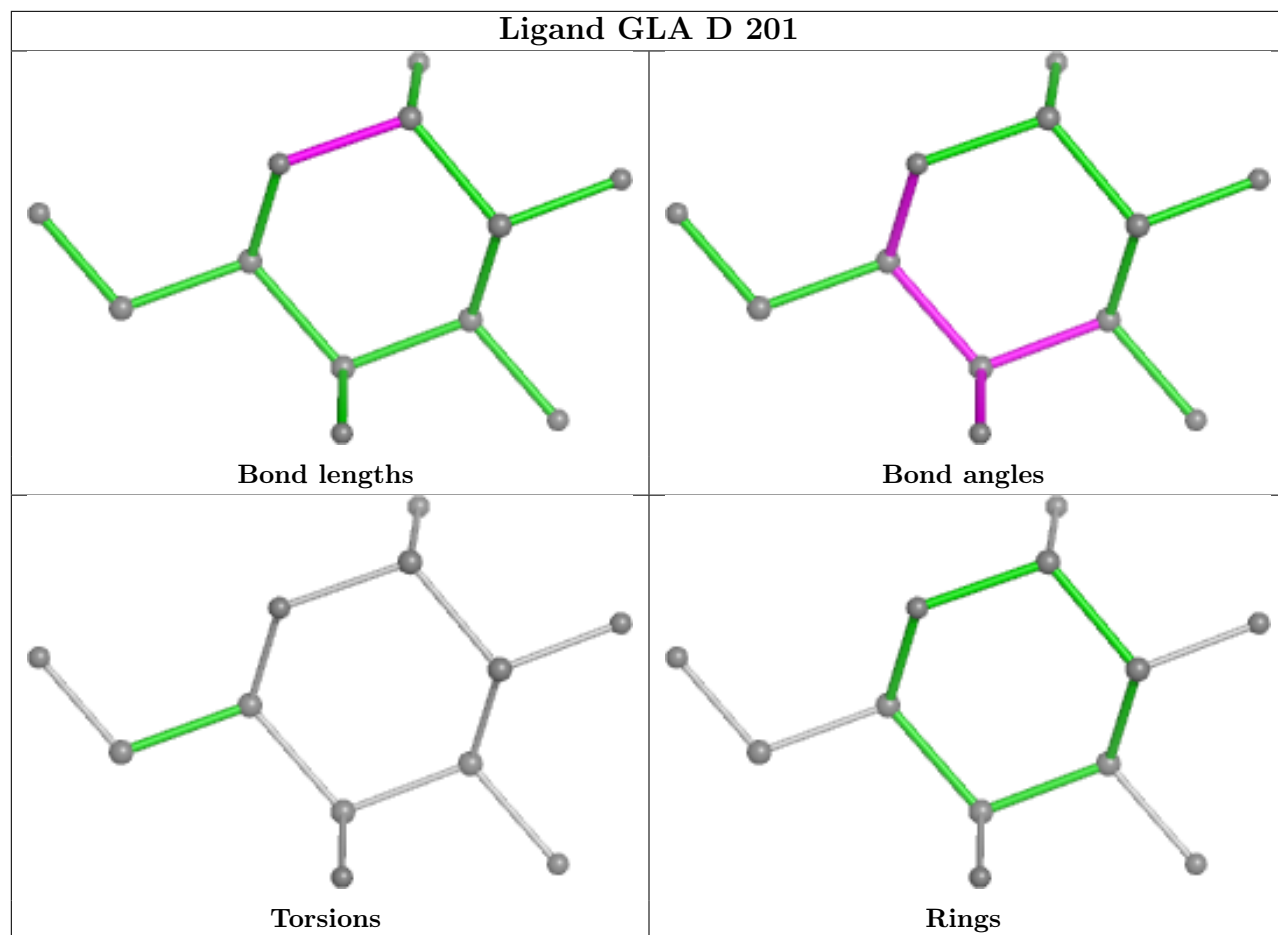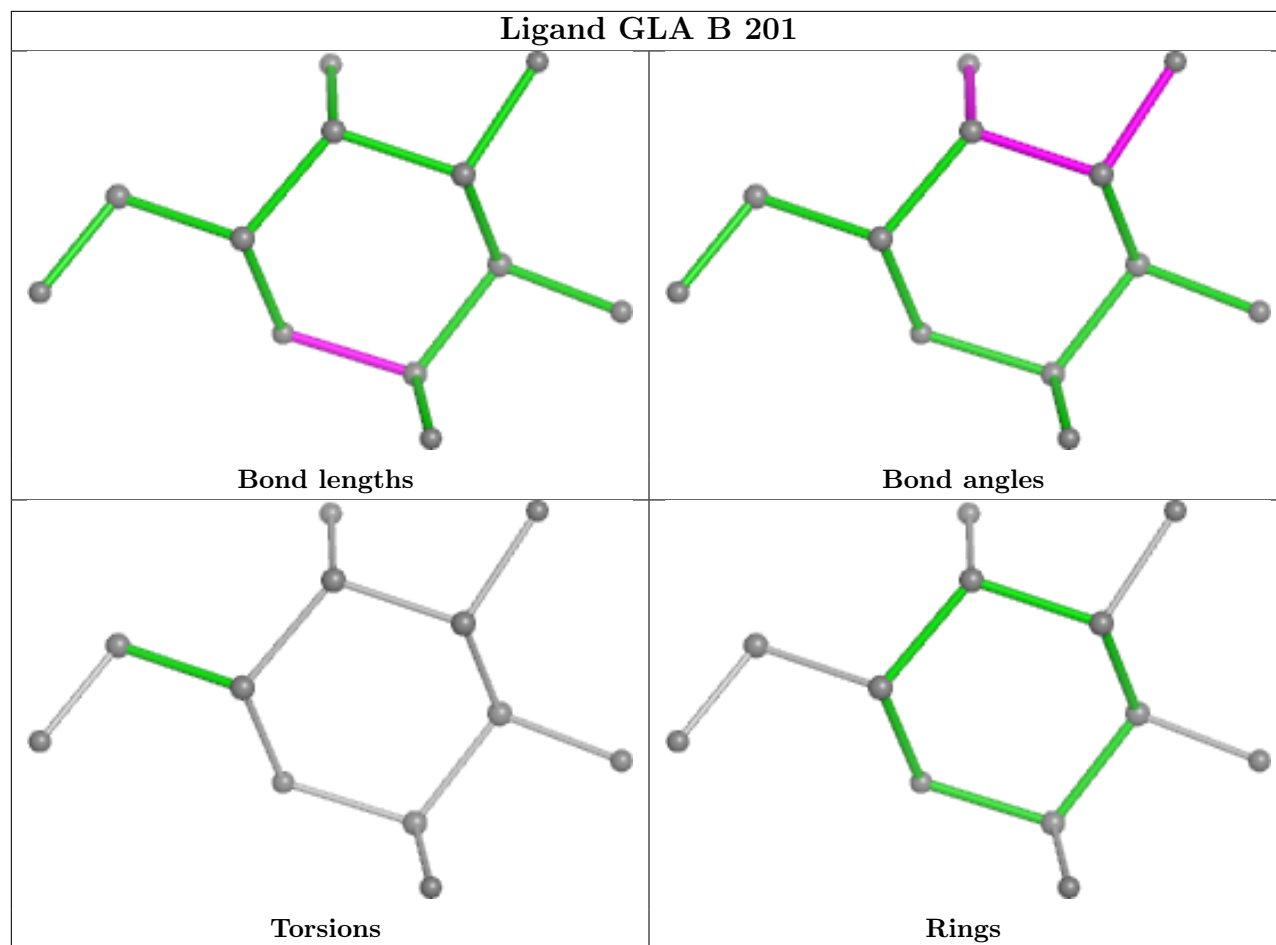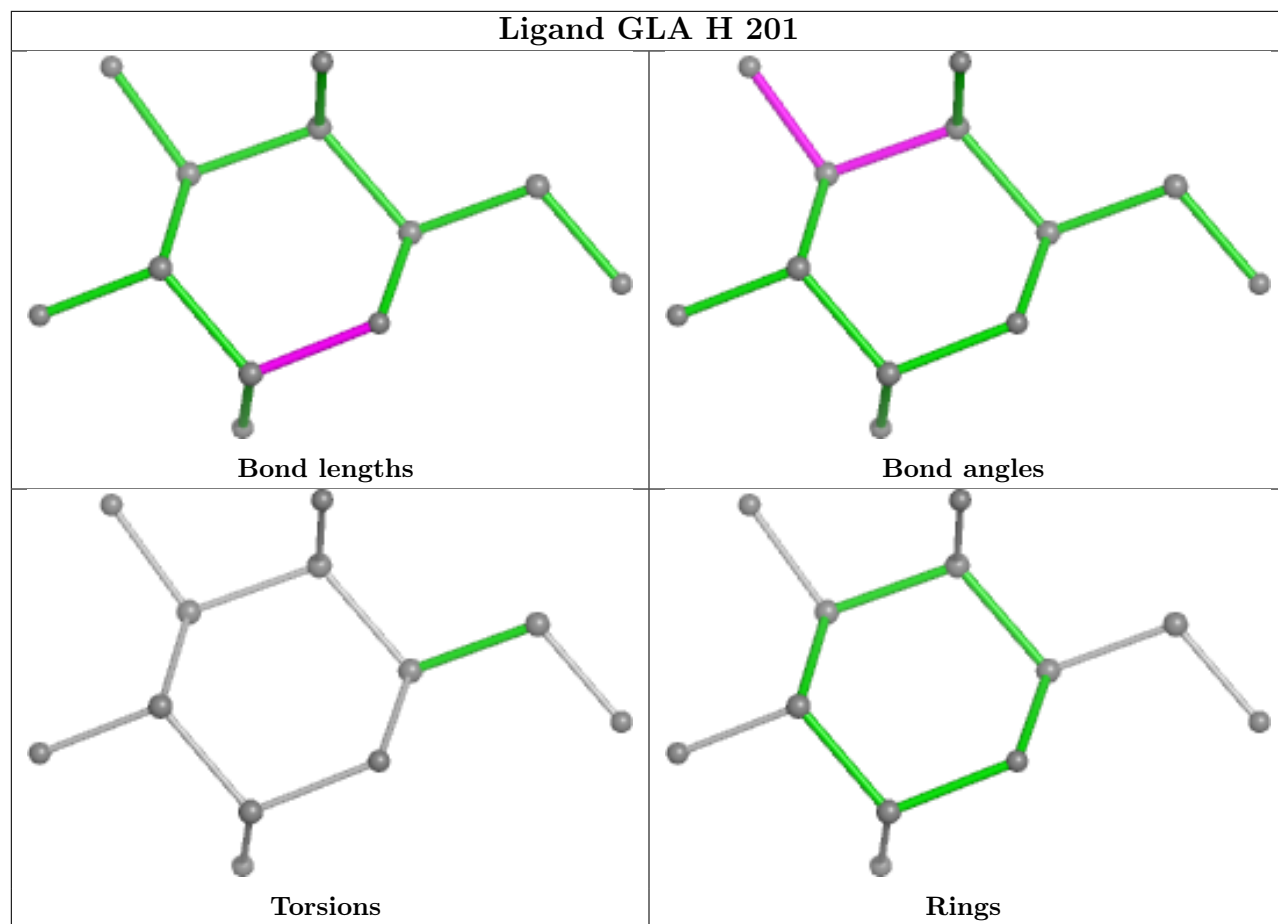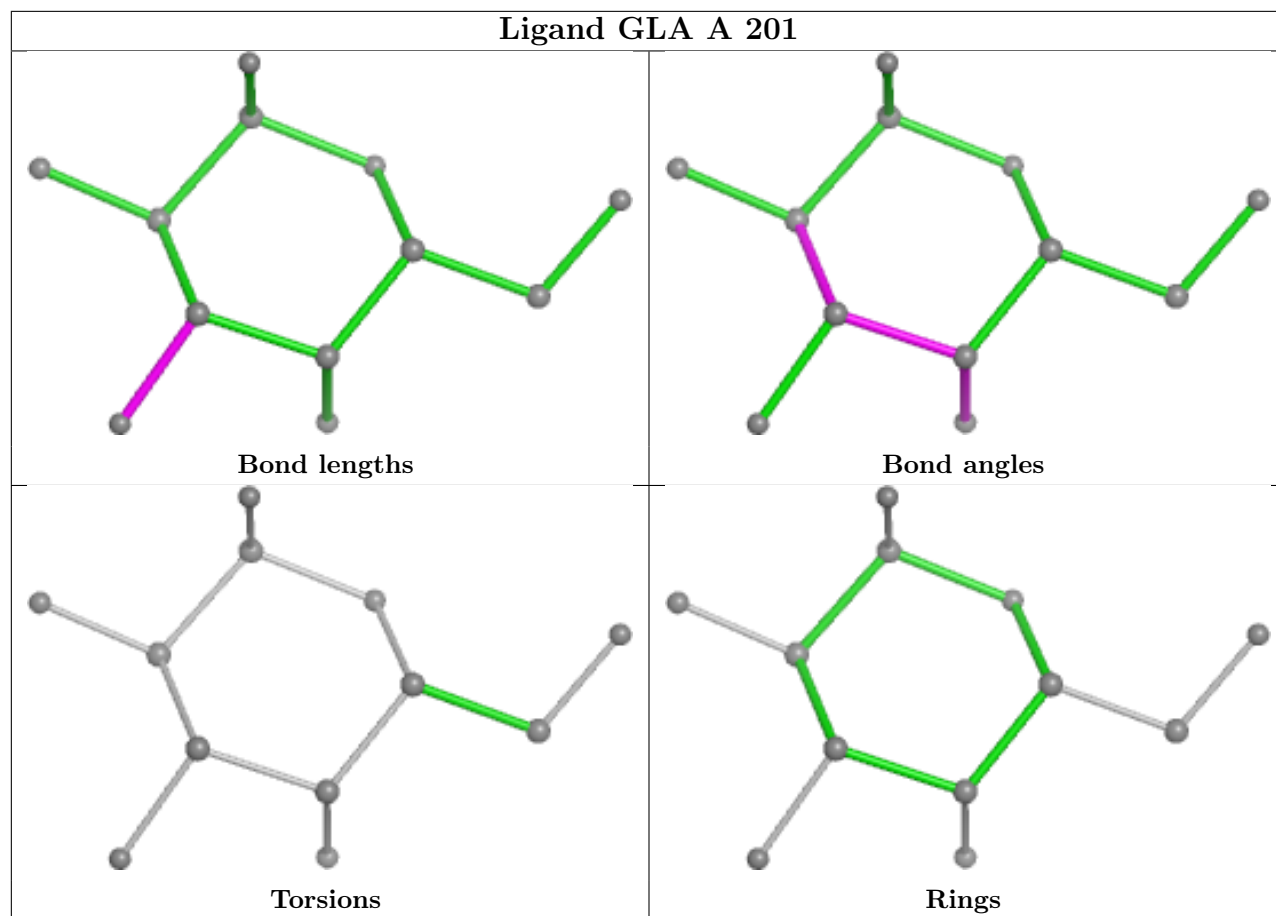
Ligand GLA C 201

Bond lengths

Bond angles

Torsions

Rings

Ligand GLA E 201

Bond lengths

Bond angles

Torsions

Rings

Ligand GLA F 201

Bond lengths

Bond angles

Torsions

Rings

Ligand GLA G 201

Bond lengths

Bond angles

Torsions

Rings

Ligand GLA D 201

Bond lengths

Bond angles

Torsions

Rings

Ligand GLA B 201

Bond lengths

Bond angles

Torsions

Rings

Ligand GLA H 201

Bond lengths

Bond angles

Torsions

Rings

Ligand GLA A 201

Bond lengths

Bond angles

Torsions

Rings

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 ⓘ

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

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

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

6.3 Carbohydrates ⓘ

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

6.4 Ligands ⓘ

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

6.5 Other polymers ⓘ

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