



Full wwPDB X-ray Structure Validation Report ⓘ

Oct 5, 2024 – 07:01 PM EDT

PDB ID : 1LDQ
Title : avidin-homobiotin complex
Authors : Pazy, Y.; Kulik, T.; Bayer, E.A.; Wilchek, M.; Livnah, O.
Deposited on : 2002-04-09
Resolution : 2.70 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

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 : 4.02b-467
Mogul : 2022.3.0, CSD as543be (2022)
Xtrriage (Phenix) : **NOT EXECUTED**
EDS : **NOT EXECUTED**
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) : 2.39

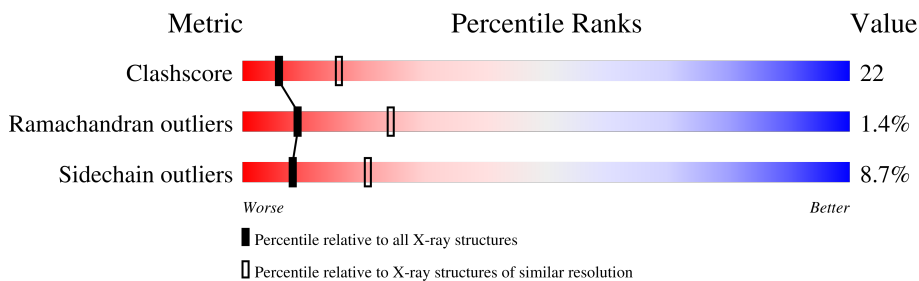
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.70 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))
Clashscore	180529	3684 (2.70-2.70)
Ramachandran outliers	177936	3633 (2.70-2.70)
Sidechain outliers	177891	3633 (2.70-2.70)

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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	128	
1	B	128	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	NAG	A	401	X	-	-	-
2	NAG	B	402	X	-	-	-

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 1823 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.

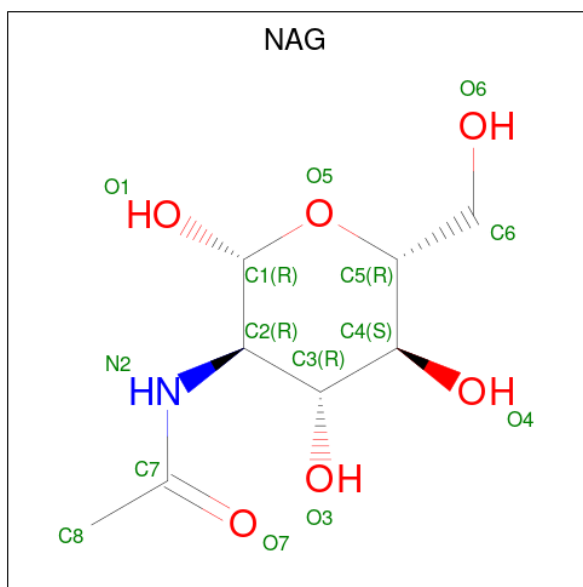
- Molecule 1 is a protein called Avidin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	111	Total 869	C 548	N 149	O 168	S 4	0	0	0
1	B	112	Total 880	C 552	N 154	O 170	S 4	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	34	THR	ILE	conflict	UNP P02701
B	234	THR	ILE	conflict	UNP P02701

- Molecule 2 is 2-acetamido-2-deoxy-beta-D-glucopyranose (three-letter code: NAG) (formula: $C_8H_{15}NO_6$).



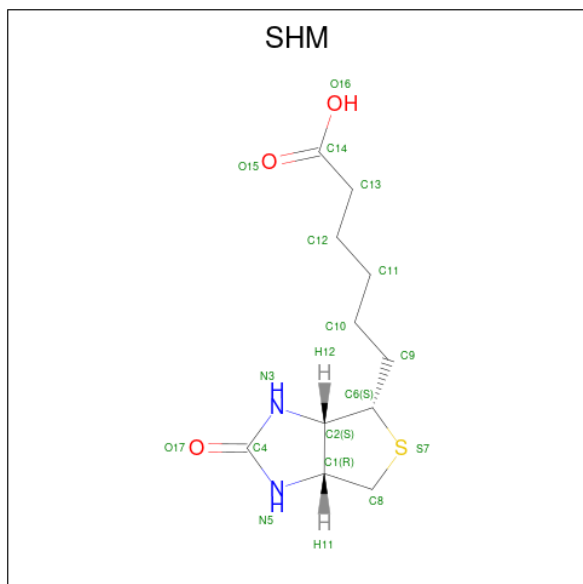
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
2	A	1	Total 14	C 8	N 1	O 5	0	0

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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
2	B	1	14	8	1	5	0	0

- Molecule 3 is HOMOBIOITIN (three-letter code: SHM) (formula: $C_{11}H_{18}N_2O_3S$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	S		
3	A	1	17	11	2	3	1	0	0
3	B	1	17	11	2	3	1	0	0

- Molecule 4 is water.

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

4 Data and refinement statistics

Xtrriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α , β , γ	71.76Å 79.84Å 42.91Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	30.00 – 2.70	Depositor
% Data completeness (in resolution range)	(Not available) (30.00-2.70)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	0.09	Depositor
Refinement program	CNS	Depositor
R, R_{free}	0.201 , 0.276	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	1823	wwPDB-VP
Average B, all atoms (Å ²)	39.0	wwPDB-VP

5 Model quality [i](#)

5.1 Standard geometry [i](#)

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

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	0/885	0.68	0/1196
1	B	0.42	0/897	0.70	2/1213 (0.2%)
All	All	0.41	0/1782	0.69	2/2409 (0.1%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	249	LEU	CA-CB-CG	6.13	129.40	115.30
1	B	285	ILE	N-CA-C	-5.34	96.59	111.00

There are no chirality outliers.

There are no planarity outliers.

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	869	0	847	36	0
1	B	880	0	855	45	0
2	A	14	0	13	2	0
2	B	14	0	13	1	0
3	A	17	0	17	0	0
3	B	17	0	17	0	0
4	A	6	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	B	6	0	0	1	0
All	All	1823	0	1762	80	0

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 22.

All (80) 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:4:CYS:HA	1:A:91:GLU:OE2	1.71	0.90
1:B:224:ASN:HD21	1:B:228:GLU:HB2	1.43	0.83
1:A:71:LYS:HA	1:A:71:LYS:HE2	1.67	0.76
1:A:16:SER:OG	1:A:35:THR:HG22	1.88	0.74
1:A:122:ARG:HG3	1:A:122:ARG:HH11	1.52	0.73
1:A:117:ILE:HG12	1:A:118:ASN:H	1.55	0.70
1:B:224:ASN:ND2	1:B:228:GLU:HB2	2.06	0.70
1:B:256:ILE:HG22	1:B:257:ASN:N	2.07	0.69
1:B:286:ASP:HB3	1:B:288:ASN:OD1	1.93	0.68
1:A:26:ARG:HH11	1:A:26:ARG:HG3	1.61	0.66
1:B:230:THR:HG22	1:B:231:GLY:N	2.11	0.66
1:A:93:LEU:HB2	1:A:120:PHE:HB2	1.78	0.65
1:B:287:ARG:HH11	1:B:287:ARG:HG3	1.62	0.65
1:B:207:THR:O	1:B:322:ARG:NH2	2.31	0.64
1:A:108:ASP:HB3	1:A:111:LYS:HD3	1.80	0.63
1:A:117:ILE:HG12	1:A:118:ASN:N	2.14	0.62
1:A:49:LEU:C	1:A:49:LEU:HD23	2.22	0.60
1:B:305:ASP:OD1	1:B:307:GLY:N	2.35	0.59
1:B:206:LEU:HD23	1:B:253:GLU:OE1	2.03	0.58
1:B:306:ILE:HG12	1:B:306:ILE:O	2.04	0.58
1:B:208:GLY:HA3	1:B:322:ARG:HH21	1.70	0.57
1:A:123:LEU:HD21	2:A:401:NAG:H61	1.86	0.57
1:B:230:THR:HG22	1:B:231:GLY:H	1.69	0.56
1:A:30:THR:HG22	1:A:31:GLY:N	2.20	0.56
1:B:305:ASP:C	1:B:307:GLY:H	2.10	0.54
1:A:36:ALA:HA	1:A:44:ILE:HA	1.89	0.53
1:A:119:ILE:HD12	1:A:119:ILE:N	2.24	0.53
1:A:54:ASN:CB	1:A:63:THR:HG22	2.38	0.53
1:A:23:VAL:HA	1:A:28:GLU:O	2.09	0.52
1:B:224:ASN:OD1	1:B:226:ARG:N	2.41	0.52
1:A:16:SER:CB	1:A:35:THR:HG22	2.40	0.52
1:B:217:ASN:ND2	2:B:402:NAG:C7	2.73	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:291:GLU:OE1	1:B:322:ARG:HD2	2.11	0.51
1:B:261:GLN:OE1	1:B:284:PHE:HA	2.10	0.51
1:B:260:THR:O	1:B:262:PRO:HD3	2.11	0.51
1:B:308:ASP:HB3	1:B:311:LYS:NZ	2.27	0.50
1:A:54:ASN:HB3	1:A:63:THR:HG22	1.95	0.49
1:A:26:ARG:HG3	1:A:26:ARG:NH1	2.28	0.48
1:B:293:LEU:HB2	1:B:320:PHE:HB2	1.96	0.48
1:B:208:GLY:HA3	1:B:322:ARG:NH2	2.29	0.48
1:B:287:ARG:HG3	1:B:287:ARG:NH1	2.27	0.47
1:B:262:PRO:HD2	1:B:283:CYS:HB3	1.95	0.47
1:B:261:GLN:HB3	1:B:283:CYS:O	2.15	0.47
1:B:249:LEU:HD22	1:B:249:LEU:O	2.15	0.47
1:A:117:ILE:HG21	1:B:317:ILE:HD13	1.96	0.47
1:B:257:ASN:O	1:B:258:LYS:C	2.53	0.46
1:B:256:ILE:CG2	1:B:257:ASN:N	2.78	0.46
1:B:230:THR:CG2	1:B:231:GLY:N	2.76	0.46
1:B:255:THR:O	1:B:256:ILE:C	2.53	0.46
1:A:51:GLY:HA3	1:A:66:PHE:HB3	1.98	0.46
1:A:106:ILE:HG12	1:A:106:ILE:O	2.16	0.46
1:A:57:ASN:CB	1:A:59:ARG:HE	2.27	0.45
1:A:57:ASN:HB3	1:A:59:ARG:HE	1.80	0.45
1:B:249:LEU:HD22	1:B:249:LEU:C	2.36	0.45
1:B:223:VAL:HA	1:B:228:GLU:O	2.17	0.45
1:A:30:THR:CG2	1:A:31:GLY:N	2.80	0.45
1:A:122:ARG:HG3	1:A:122:ARG:NH1	2.25	0.44
1:A:26:ARG:NH2	1:A:28:GLU:OE1	2.51	0.44
1:A:110:TRP:CE2	1:A:111:LYS:HD2	2.53	0.43
1:A:122:ARG:NH1	1:A:122:ARG:CG	2.79	0.43
1:A:91:GLU:OE1	1:A:122:ARG:NH1	2.51	0.43
1:B:306:ILE:O	1:B:306:ILE:CG1	2.67	0.43
1:B:212:ASN:HD21	1:B:216:SER:HB2	1.83	0.43
1:B:271:LYS:HA	1:B:271:LYS:HD2	1.75	0.43
1:B:305:ASP:C	1:B:307:GLY:N	2.72	0.42
1:A:17:ASN:ND2	2:A:401:NAG:C7	2.82	0.42
1:B:297:TRP:CZ2	1:B:316:GLY:HA3	2.55	0.42
1:B:230:THR:CG2	1:B:231:GLY:H	2.31	0.42
1:A:54:ASN:HB2	1:A:63:THR:HG22	2.01	0.42
1:A:64:PHE:C	1:A:64:PHE:CD1	2.93	0.42
1:B:256:ILE:HG22	1:B:257:ASN:H	1.81	0.41
1:B:275:SER:OG	1:B:301:SER:HA	2.20	0.41
1:A:11:THR:HA	1:A:16:SER:O	2.21	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:204:CYS:HA	1:B:291:GLU:OE2	2.20	0.41
1:A:56:ILE:HD13	1:A:56:ILE:HA	1.89	0.41
1:B:231:GLY:C	1:B:249:LEU:HD13	2.41	0.41
1:B:318:ASN:HD22	1:B:318:ASN:HA	1.70	0.41
1:B:252:THR:HG22	4:B:505:HOH:O	2.20	0.40
1:A:12:ASN:OD1	1:A:15:GLY:N	2.42	0.40
1:B:305:ASP:O	1:B:307:GLY:N	2.55	0.40

There are no symmetry-related clashes.

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	105/128 (82%)	100 (95%)	5 (5%)	0	100	100
1	B	108/128 (84%)	102 (94%)	3 (3%)	3 (3%)	4	10
All	All	213/256 (83%)	202 (95%)	8 (4%)	3 (1%)	9	24

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	256	ILE
1	B	306	ILE
1	B	258	LYS

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	97/112 (87%)	85 (88%)	12 (12%)	4	9
1	B	98/112 (88%)	93 (95%)	5 (5%)	20	45
All	All	195/224 (87%)	178 (91%)	17 (9%)	8	20

All (17) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	4	CYS
1	A	23	VAL
1	A	49	LEU
1	A	57	ASN
1	A	63	THR
1	A	69	ASN
1	A	86	ASP
1	A	96	MET
1	A	102	SER
1	A	111	LYS
1	A	118	ASN
1	A	121	THR
1	B	249	LEU
1	B	263	THR
1	B	269	ASN
1	B	318	ASN
1	B	321	THR

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	69	ASN
1	A	82	GLN
1	B	282	GLN
1	B	318	ASN

5.3.3 RNA

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](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

4 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
2	NAG	B	402	1	14,14,15	0.57	0	17,19,21	0.99	1 (5%)
3	SHM	B	2	-	18,18,18	1.84	4 (22%)	24,24,24	1.97	9 (37%)
3	SHM	A	402	-	18,18,18	1.79	4 (22%)	24,24,24	1.83	9 (37%)
2	NAG	A	401	1	14,14,15	0.62	0	17,19,21	1.02	1 (5%)

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	402	1	1/1/5/7	3/6/23/26	0/1/1/1
3	SHM	B	2	-	-	4/8/29/29	0/2/2/2
3	SHM	A	402	-	-	3/8/29/29	0/2/2/2
2	NAG	A	401	1	1/1/5/7	2/6/23/26	0/1/1/1

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	402	SHM	O15-C14	4.96	1.38	1.22

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	2	SHM	O15-C14	4.84	1.37	1.22
3	B	2	SHM	C9-C6	3.08	1.60	1.52
3	A	402	SHM	C6-C2	2.92	1.61	1.53
3	B	2	SHM	C6-C2	2.85	1.61	1.53
3	A	402	SHM	C9-C6	2.78	1.60	1.52
3	B	2	SHM	C13-C14	2.38	1.56	1.50
3	A	402	SHM	C13-C14	2.34	1.56	1.50

All (20) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	2	SHM	C1-C8-S7	-3.95	100.62	106.06
3	B	2	SHM	C2-C6-S7	-3.31	101.27	105.03
3	B	2	SHM	C8-C1-C2	3.19	114.11	109.06
2	A	401	NAG	C2-N2-C7	-3.12	118.72	122.90
3	A	402	SHM	C8-C1-C2	3.12	114.00	109.06
3	A	402	SHM	C1-C8-S7	-3.06	101.85	106.06
3	A	402	SHM	C2-C1-N5	2.98	105.74	102.43
3	B	2	SHM	C2-C1-N5	2.84	105.58	102.43
3	B	2	SHM	O16-C14-C13	2.62	122.28	114.00
3	A	402	SHM	C8-S7-C6	2.53	95.24	89.98
3	A	402	SHM	O16-C14-C13	2.52	121.95	114.00
3	A	402	SHM	C2-C6-S7	-2.47	102.22	105.03
3	B	2	SHM	C8-S7-C6	2.43	95.03	89.98
3	B	2	SHM	N5-C4-N3	2.36	111.58	108.85
3	B	2	SHM	C10-C9-C6	2.33	119.40	114.04
3	B	2	SHM	O16-C14-O15	-2.29	117.45	123.33
3	A	402	SHM	N5-C4-N3	2.23	111.42	108.85
2	B	402	NAG	C4-C3-C2	2.09	114.08	111.02
3	A	402	SHM	O16-C14-O15	-2.08	117.97	123.33
3	A	402	SHM	C6-C2-N3	2.06	115.53	113.34

All (2) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
2	A	401	NAG	C1
2	B	402	NAG	C1

All (12) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	402	NAG	C4-C5-C6-O6

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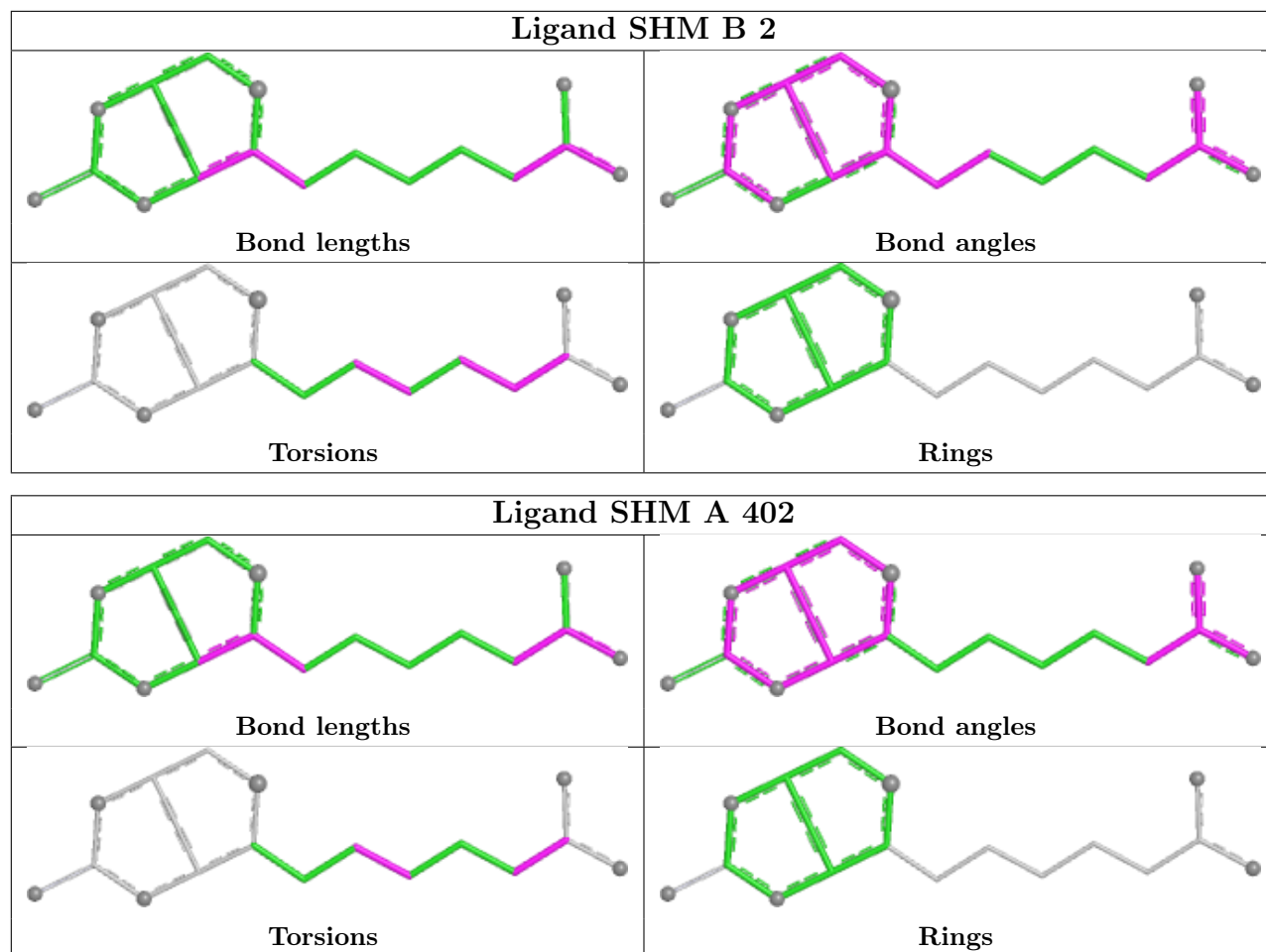
Mol	Chain	Res	Type	Atoms
2	B	402	NAG	O5-C5-C6-O6
2	A	401	NAG	O5-C5-C6-O6
2	A	401	NAG	C4-C5-C6-O6
3	B	2	SHM	C9-C10-C11-C12
3	B	2	SHM	C11-C12-C13-C14
3	A	402	SHM	C9-C10-C11-C12
3	A	402	SHM	C12-C13-C14-O15
2	B	402	NAG	C1-C2-N2-C7
3	A	402	SHM	C12-C13-C14-O16
3	B	2	SHM	C12-C13-C14-O15
3	B	2	SHM	C12-C13-C14-O16

There are no ring outliers.

2 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	402	NAG	1	0
2	A	401	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 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](#)

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates [i](#)

EDS was not executed - this section is therefore empty.

6.4 Ligands [i](#)

EDS was not executed - this section is therefore empty.

6.5 Other polymers [i](#)

EDS was not executed - this section is therefore empty.