



Full wwPDB EM Validation Report ⓘ

Jun 17, 2025 – 12:08 PM JST

PDB ID : 8Z27 / pdb_00008z27
EMDB ID : EMD-39743
Title : The structure of TGEV RBD and dog APN complex
Authors : Sun, J.Q.; Niu, S.
Deposited on : 2024-04-12
Resolution : 2.86 Å(reported)

This is a Full wwPDB EM 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/EMValidationReportHelp>

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:

EMDB validation analysis : **FAILED**
Mogul : 1.8.5 (274361), CSD as541be (2020)
MolProbity : 4-5-2 with Phenix2.0rc1
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ : **FAILED**
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.44

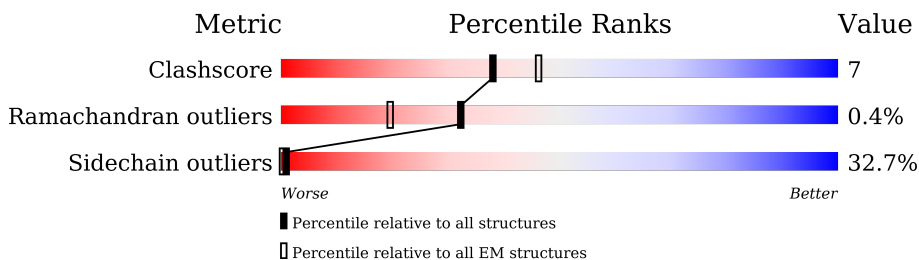
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 2.86 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)	EM structures (#Entries)
Clashscore	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the 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 $\leq 5\%$.

Mol	Chain	Length	Quality of chain
1	a	175	
2	b	943	
3	A	3	
4	B	2	
4	C	2	
4	E	2	
5	D	4	

2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 8596 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, 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 Spike glycoprotein.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	a	142	Total	C	N	O	S	0	0
			1118	706	188	216	8		

- Molecule 2 is a protein called Aminopeptidase N.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	b	905	Total	C	N	O	S	0	0
			7292	4669	1219	1381	23		

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
b	976	GLY	-	expression tag	UNP P79143
b	977	GLY	-	expression tag	UNP P79143
b	978	SER	-	expression tag	UNP P79143

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



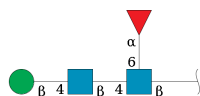
Mol	Chain	Residues	Atoms				AltConf	Trace
3	A	3	Total	C	N	O	0	0
			39	22	2	15		

- Molecule 4 is an oligosaccharide called 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.



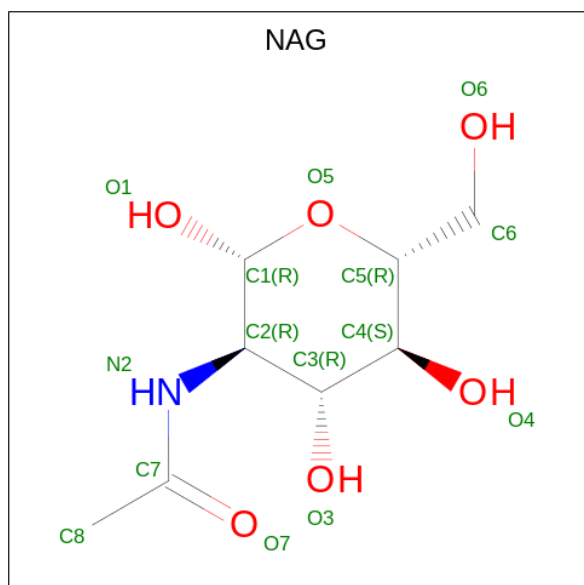
Mol	Chain	Residues	Atoms				AltConf	Trace
4	B	2	Total	C	N	O	0	0
			28	16	2	10		
4	C	2	Total	C	N	O	0	0
			28	16	2	10		
4	E	2	Total	C	N	O	0	0
			28	16	2	10		

- Molecule 5 is an oligosaccharide called beta-D-mannopyranose-(1-4)-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				AltConf	Trace
5	D	4	Total	C	N	O	0	0
			49	28	2	19		

- Molecule 6 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: $C_8H_{15}NO_6$).

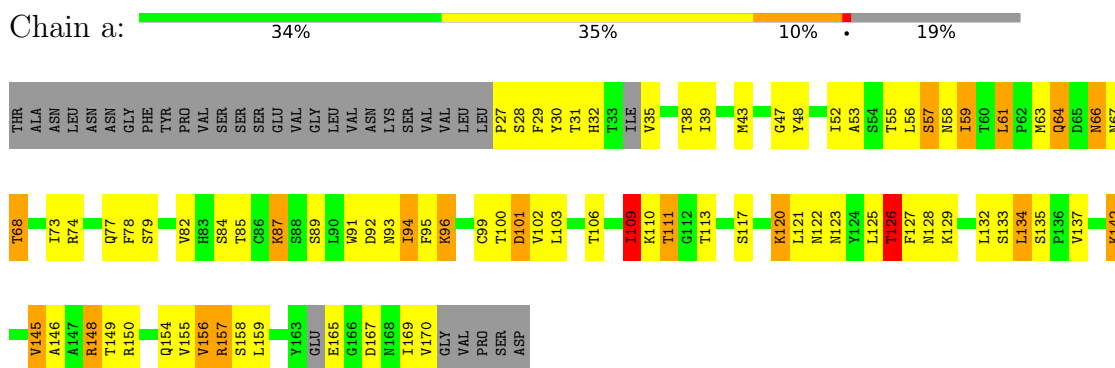


Mol	Chain	Residues	Atoms				AltConf
			Total	C	N	O	
6	a	1	14	8	1	5	0

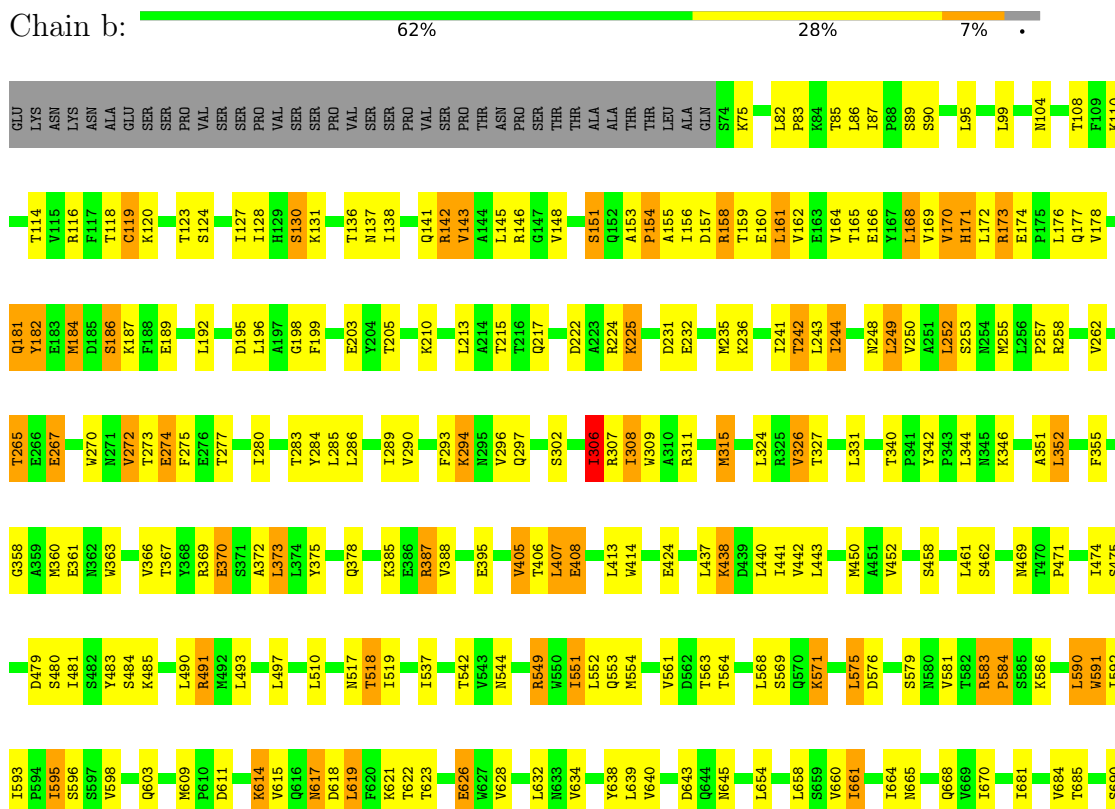
3 Residue-property plots

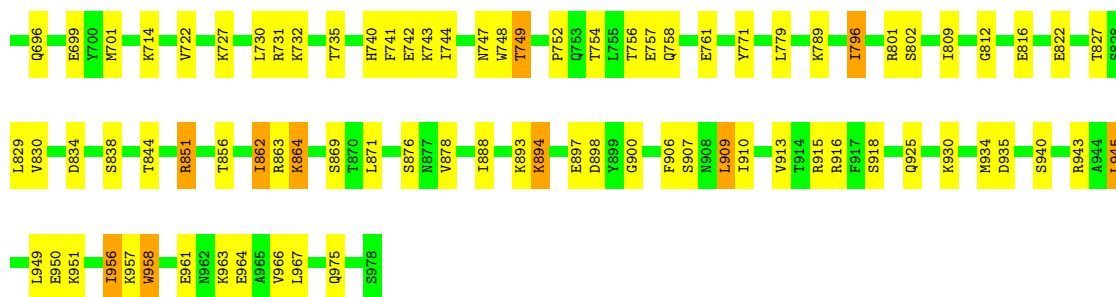
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded 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.

• Molecule 1: Spike glycoprotein

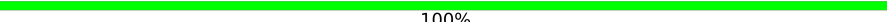


• Molecule 2: Aminopeptidase N



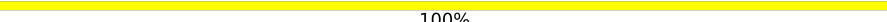


- Molecule 3: beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain A:  100%



- Molecule 4: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain B:  100%

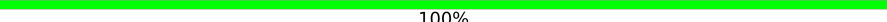


- Molecule 4: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain C:  100%

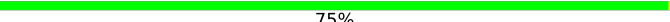
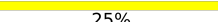


- Molecule 4: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain E:  100%



- Molecule 5: beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-[alpha-L-fucopyranose-(1-6)]2-acetamido-2-deoxy-beta-D-glucopyranose

Chain D:  75%  25%



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	295620	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	60	Depositor
Minimum defocus (nm)	1000	Depositor
Maximum defocus (nm)	2000	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: FUC, BMA, 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	0.58	0/1139	1.23	16/1545 (1.0%)
2	b	0.52	0/7486	0.94	21/10210 (0.2%)
All	All	0.53	0/8625	0.99	37/11755 (0.3%)

There are no bond length outliers.

All (37) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	a	48	TYR	N-CA-C	-9.18	101.60	113.17
2	b	748	TRP	N-CA-C	7.69	122.09	112.24
1	a	67	ASN	N-CA-C	7.43	120.84	108.73
1	a	47	GLY	N-CA-C	-7.21	105.55	114.92
2	b	844	THR	N-CA-C	7.15	119.15	111.36
1	a	111	THR	N-CA-C	7.05	119.90	108.41
2	b	590	LEU	N-CA-C	-6.80	98.12	109.07
2	b	812	GLY	N-CA-C	6.62	121.96	112.82
2	b	518	THR	N-CA-C	6.36	118.84	109.24
1	a	78	PHE	N-CA-C	6.27	119.13	108.90
1	a	122	ASN	N-CA-C	-6.24	104.48	111.28
2	b	217	GLN	N-CA-C	-6.22	99.09	109.24
2	b	900	GLY	N-CA-C	-6.21	105.28	112.73
2	b	157	ASP	N-CA-C	6.16	117.99	111.28
2	b	158	ARG	N-CA-C	6.08	118.65	109.23
1	a	109	ILE	N-CA-C	5.96	116.39	107.51
1	a	57	SER	N-CA-C	-5.89	101.56	110.28
1	a	128	ASN	N-CA-C	-5.84	98.36	110.80
2	b	484	SER	N-CA-C	5.75	117.35	111.14
2	b	378	GLN	N-CA-C	5.70	117.49	111.28
1	a	30	TYR	N-CA-C	-5.55	105.31	111.36
1	a	101	ASP	CB-CA-C	-5.50	110.21	116.54

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	b	327	THR	N-CA-C	5.44	117.21	111.28
2	b	827	THR	N-CA-C	5.43	118.19	110.10
2	b	326	VAL	N-CA-C	5.39	116.12	110.62
2	b	405	VAL	N-CA-C	-5.38	99.33	107.73
1	a	66	ASN	N-CA-C	5.35	117.20	111.36
1	a	58	ASN	N-CA-C	5.35	117.45	107.99
1	a	126	THR	CB-CA-C	-5.29	110.46	116.54
2	b	898	ASP	N-CA-C	5.20	117.02	111.36
2	b	638	TYR	N-CA-C	5.17	117.11	108.99
1	a	126	THR	N-CA-C	5.11	116.07	108.31
2	b	373	LEU	N-CA-C	5.11	116.93	111.36
1	a	134	LEU	N-CA-C	-5.11	106.83	113.16
2	b	231	ASP	N-CA-C	5.07	116.57	108.41
2	b	552	LEU	N-CA-C	5.06	116.88	111.36
2	b	551	ILE	N-CA-C	5.05	115.82	110.72

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	1118	0	1085	29	0
2	b	7292	0	7087	94	0
3	A	39	0	34	0	0
4	B	28	0	25	0	0
4	C	28	0	25	0	0
4	E	28	0	25	0	0
5	D	49	0	43	0	0
6	a	14	0	13	0	0
All	All	8596	0	8337	122	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 7.

All (122) 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:59:ILE:HD11	1:a:61:LEU:CD2	1.82	1.09
1:a:59:ILE:CD1	1:a:61:LEU:CD2	2.31	1.08
1:a:59:ILE:HD13	1:a:61:LEU:HD23	1.44	0.99
1:a:56:LEU:H	1:a:157:ARG:NH2	1.65	0.95
1:a:59:ILE:HD13	1:a:61:LEU:CD2	2.02	0.86
1:a:59:ILE:HD11	1:a:61:LEU:HD21	1.54	0.85
2:b:262:VAL:HB	2:b:265:THR:OG1	1.78	0.82
2:b:262:VAL:CG1	2:b:265:THR:OG1	2.29	0.81
2:b:262:VAL:HB	2:b:265:THR:HG1	1.48	0.78
1:a:56:LEU:H	1:a:157:ARG:HH22	1.31	0.77
2:b:308:ILE:HD12	2:b:315:MET:CE	2.17	0.74
2:b:119:CYS:HB2	2:b:182:TYR:OH	1.88	0.73
1:a:59:ILE:HD11	1:a:61:LEU:HD22	1.70	0.72
2:b:262:VAL:CB	2:b:265:THR:OG1	2.38	0.71
2:b:958:TRP:HB3	2:b:963:LYS:HB2	1.71	0.71
2:b:308:ILE:HD12	2:b:315:MET:HE2	1.72	0.71
1:a:63:MET:HA	1:a:68:THR:HA	1.73	0.68
1:a:56:LEU:N	1:a:157:ARG:NH2	2.42	0.67
2:b:856:THR:HA	2:b:862:ILE:HG13	1.78	0.65
2:b:293:PHE:HB2	2:b:309:TRP:HE3	1.63	0.63
2:b:151:SER:HB2	2:b:181:GLN:HB2	1.81	0.62
1:a:59:ILE:CD1	1:a:61:LEU:HD22	2.25	0.62
1:a:87:LYS:HB3	1:a:95:PHE:HB3	1.81	0.60
2:b:137:ASN:HA	2:b:142:ARG:HA	1.83	0.60
2:b:262:VAL:HG11	2:b:265:THR:OG1	2.01	0.60
2:b:963:LYS:HA	2:b:966:VAL:HB	1.83	0.59
2:b:871:LEU:HB2	2:b:909:LEU:HD21	1.84	0.59
2:b:249:LEU:HB3	2:b:290:VAL:HG12	1.87	0.57
2:b:156:ILE:HG12	2:b:172:LEU:HB2	1.87	0.57
2:b:248:ASN:ND2	2:b:249:LEU:HD12	2.18	0.57
1:a:59:ILE:CD1	1:a:61:LEU:HD21	2.21	0.56
2:b:244:ILE:HG22	2:b:270:TRP:HB3	1.86	0.56
2:b:358:GLY:HA2	2:b:369:ARG:HB2	1.87	0.55
1:a:53:ALA:HB1	1:a:156:VAL:HG13	1.88	0.54
2:b:244:ILE:HG23	2:b:272:VAL:HG22	1.89	0.54
2:b:145:LEU:HG	2:b:184:MET:HA	1.89	0.54
1:a:56:LEU:N	1:a:157:ARG:HH22	1.99	0.54
2:b:375:TYR:HB2	2:b:388:VAL:HG21	1.90	0.54
2:b:355:PHE:H	2:b:369:ARG:HG3	1.72	0.53
2:b:83:PRO:HG2	2:b:127:ILE:HD13	1.91	0.53
2:b:131:LYS:HG3	2:b:224:ARG:HB2	1.89	0.53
2:b:372:ALA:HA	2:b:387:ARG:HD3	1.91	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:b:796:ILE:HB	2:b:801:ARG:HG2	1.91	0.52
2:b:145:LEU:HB3	2:b:153:ALA:HB1	1.91	0.51
2:b:143:VAL:HG13	2:b:186:SER:HB3	1.91	0.51
1:a:113:THR:HG21	1:a:142:LYS:HD2	1.93	0.51
2:b:297:GLN:HA	2:b:307:ARG:HG2	1.93	0.50
2:b:471:PRO:HA	2:b:474:ILE:HD12	1.92	0.50
1:a:146:ALA:HA	1:a:155:VAL:HA	1.94	0.49
2:b:242:THR:HG23	2:b:274:GLU:HG2	1.95	0.49
2:b:130:SER:HB3	2:b:168:LEU:HB2	1.95	0.49
2:b:198:GLY:H	2:b:222:ASP:HB3	1.78	0.48
2:b:714:LYS:HB3	2:b:714:LYS:HE3	1.63	0.48
2:b:351:ALA:HB1	2:b:370:GLU:HG3	1.96	0.48
1:a:120:LYS:HD3	1:a:120:LYS:HA	1.59	0.47
2:b:145:LEU:HB2	2:b:155:ALA:HA	1.97	0.47
2:b:142:ARG:HE	2:b:142:ARG:HB3	1.53	0.47
1:a:126:THR:HB	1:a:127:PHE:H	1.57	0.47
2:b:593:ILE:HG22	2:b:595:ILE:HG12	1.95	0.47
2:b:864:LYS:H	2:b:864:LYS:HG2	1.48	0.46
1:a:43:MET:HE3	1:a:43:MET:HB3	1.87	0.46
2:b:176:LEU:HD23	2:b:176:LEU:HA	1.69	0.46
2:b:632:LEU:HA	2:b:665:ASN:HD21	1.81	0.46
2:b:294:LYS:HD3	2:b:294:LYS:HA	1.40	0.45
1:a:52:ILE:HD11	2:b:749:THR:HB	1.99	0.45
2:b:224:ARG:H	2:b:224:ARG:HG3	1.56	0.45
2:b:306:ILE:HB	2:b:307:ARG:H	1.48	0.45
2:b:267:GLU:HB2	2:b:270:TRP:HD1	1.82	0.44
1:a:96:LYS:HD2	1:a:96:LYS:HA	1.64	0.44
2:b:285:LEU:HD22	2:b:363:TRP:H	1.81	0.44
2:b:571:LYS:HE3	2:b:571:LYS:HB3	1.77	0.44
2:b:752:PRO:HB2	2:b:757:GLU:HB3	2.00	0.44
2:b:414:TRP:CZ2	2:b:462:SER:HA	2.52	0.44
2:b:614:LYS:HB3	2:b:614:LYS:HE2	1.65	0.44
2:b:352:LEU:HD22	2:b:352:LEU:HA	1.80	0.44
2:b:617:ASN:OD1	2:b:619:LEU:HD21	2.17	0.43
2:b:170:VAL:HG21	2:b:184:MET:HE1	1.99	0.43
2:b:307:ARG:HA	2:b:324:LEU:HD13	2.01	0.43
2:b:622:THR:HB	2:b:626:GLU:HB2	2.00	0.43
2:b:894:LYS:H	2:b:894:LYS:HG2	1.48	0.43
1:a:146:ALA:HB3	1:a:148:ARG:HH21	1.84	0.42
2:b:796:ILE:H	2:b:796:ILE:HG12	1.56	0.42
2:b:930:LYS:HD2	2:b:945:LEU:HG	2.00	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:b:267:GLU:HB2	2:b:270:TRP:CD1	2.54	0.42
1:a:109:ILE:HA	1:a:145:VAL:HA	2.00	0.42
1:a:103:LEU:HD23	1:a:103:LEU:HA	1.91	0.42
2:b:956:ILE:H	2:b:956:ILE:HG13	1.65	0.42
2:b:407:LEU:HD23	2:b:407:LEU:HA	1.81	0.42
2:b:661:ILE:H	2:b:661:ILE:HG12	1.46	0.42
1:a:27:PRO:HA	1:a:123:ASN:HA	2.02	0.42
2:b:252:LEU:HG	2:b:309:TRP:CZ2	2.55	0.42
2:b:225:LYS:HB2	2:b:225:LYS:HE2	1.26	0.42
2:b:346:LYS:HB3	2:b:346:LYS:HE3	1.70	0.42
2:b:583:ARG:HA	2:b:584:PRO:HD3	1.76	0.42
2:b:159:THR:HB	2:b:168:LEU:HD21	2.01	0.42
2:b:153:ALA:HA	2:b:154:PRO:HD3	1.84	0.41
2:b:727:LYS:HG2	2:b:771:TYR:HD1	1.85	0.41
2:b:742:GLU:HG2	2:b:747:ASN:HA	2.02	0.41
2:b:210:LYS:HD3	2:b:210:LYS:HA	1.87	0.41
2:b:308:ILE:CD1	2:b:315:MET:HE2	2.47	0.41
2:b:161:LEU:HD12	2:b:168:LEU:HD23	2.02	0.41
2:b:549:ARG:HD3	2:b:591:TRP:HA	2.02	0.41
2:b:730:LEU:HD23	2:b:730:LEU:HA	1.79	0.41
2:b:408:GLU:HA	2:b:517:ASN:HD22	1.86	0.41
1:a:126:THR:O	1:a:127:PHE:HB2	2.21	0.41
2:b:173:ARG:H	2:b:173:ARG:HG2	1.50	0.41
1:a:64:GLN:HE21	1:a:64:GLN:HB3	1.60	0.41
2:b:243:LEU:HD23	2:b:243:LEU:HA	1.85	0.41
2:b:257:PRO:HA	2:b:275:PHE:HA	2.03	0.41
2:b:293:PHE:HB2	2:b:309:TRP:CE3	2.50	0.41
2:b:752:PRO:CB	2:b:757:GLU:HB3	2.50	0.41
2:b:851:ARG:HE	2:b:851:ARG:HB3	1.61	0.41
2:b:171:HIS:HB3	2:b:173:ARG:HH12	1.86	0.41
2:b:342:TYR:HE1	2:b:363:TRP:HE1	1.69	0.41
2:b:308:ILE:H	2:b:308:ILE:HG13	1.80	0.40
2:b:99:LEU:HD13	2:b:249:LEU:HD22	2.03	0.40
2:b:306:ILE:H	2:b:306:ILE:HG13	1.62	0.40
1:a:94:ILE:H	1:a:94:ILE:HG13	1.45	0.40
2:b:438:LYS:H	2:b:438:LYS:HG2	1.41	0.40
2:b:491:ARG:HE	2:b:491:ARG:HB3	1.56	0.40
2:b:575:LEU:HD13	2:b:575:LEU:HA	1.94	0.40
2:b:590:LEU:HD23	2:b:590:LEU:HA	1.91	0.40

There are no symmetry-related clashes.

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 PDB entries followed by that with respect to all EM entries.

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	136/175 (78%)	129 (95%)	6 (4%)	1 (1%)	19	36
2	b	903/943 (96%)	891 (99%)	9 (1%)	3 (0%)	37	55
All	All	1039/1118 (93%)	1020 (98%)	15 (1%)	4 (0%)	32	49

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	a	91	TRP
2	b	306	ILE
2	b	584	PRO
2	b	154	PRO

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 PDB entries followed by that with respect to all EM entries.

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	130/159 (82%)	70 (54%)	60 (46%)	0	0
2	b	806/840 (96%)	560 (70%)	246 (30%)	0	0
All	All	936/999 (94%)	630 (67%)	306 (33%)	1	0

All (306) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	a	28	SER
1	a	29	PHE

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Mol	Chain	Res	Type
1	a	31	THR
1	a	32	HIS
1	a	35	VAL
1	a	38	THR
1	a	39	ILE
1	a	55	THR
1	a	57	SER
1	a	59	ILE
1	a	61	LEU
1	a	64	GLN
1	a	66	ASN
1	a	68	THR
1	a	73	ILE
1	a	74	ARG
1	a	77	GLN
1	a	79	SER
1	a	82	VAL
1	a	84	SER
1	a	85	THR
1	a	87	LYS
1	a	89	SER
1	a	92	ASP
1	a	93	ASN
1	a	94	ILE
1	a	96	LYS
1	a	99	CYS
1	a	100	THR
1	a	101	ASP
1	a	102	VAL
1	a	106	THR
1	a	109	ILE
1	a	110	LYS
1	a	111	THR
1	a	117	SER
1	a	120	LYS
1	a	121	LEU
1	a	125	LEU
1	a	126	THR
1	a	129	LYS
1	a	132	LEU
1	a	133	SER
1	a	134	LEU

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Mol	Chain	Res	Type
1	a	135	SER
1	a	137	VAL
1	a	142	LYS
1	a	145	VAL
1	a	148	ARG
1	a	149	THR
1	a	150	ARG
1	a	154	GLN
1	a	156	VAL
1	a	157	ARG
1	a	158	SER
1	a	159	LEU
1	a	165	GLU
1	a	167	ASP
1	a	169	ILE
1	a	170	VAL
2	b	75	LYS
2	b	82	LEU
2	b	85	THR
2	b	86	LEU
2	b	87	ILE
2	b	89	SER
2	b	90	SER
2	b	95	LEU
2	b	104	ASN
2	b	108	THR
2	b	110	LYS
2	b	114	THR
2	b	116	ARG
2	b	118	THR
2	b	119	CYS
2	b	120	LYS
2	b	123	THR
2	b	124	SER
2	b	128	ILE
2	b	130	SER
2	b	136	THR
2	b	138	ILE
2	b	141	GLN
2	b	142	ARG
2	b	143	VAL
2	b	146	ARG

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Mol	Chain	Res	Type
2	b	148	VAL
2	b	151	SER
2	b	158	ARG
2	b	160	GLU
2	b	161	LEU
2	b	162	VAL
2	b	164	VAL
2	b	165	THR
2	b	166	GLU
2	b	168	LEU
2	b	169	VAL
2	b	170	VAL
2	b	171	HIS
2	b	173	ARG
2	b	174	GLU
2	b	177	GLN
2	b	178	VAL
2	b	181	GLN
2	b	182	TYR
2	b	184	MET
2	b	186	SER
2	b	187	LYS
2	b	189	GLU
2	b	192	LEU
2	b	195	ASP
2	b	196	LEU
2	b	199	PHE
2	b	203	GLU
2	b	205	THR
2	b	213	LEU
2	b	215	THR
2	b	225	LYS
2	b	232	GLU
2	b	235	MET
2	b	236	LYS
2	b	241	ILE
2	b	242	THR
2	b	244	ILE
2	b	249	LEU
2	b	250	VAL
2	b	252	LEU
2	b	253	SER

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Mol	Chain	Res	Type
2	b	255	MET
2	b	258	ARG
2	b	265	THR
2	b	267	GLU
2	b	272	VAL
2	b	273	THR
2	b	274	GLU
2	b	277	THR
2	b	280	ILE
2	b	283	THR
2	b	284	TYR
2	b	286	LEU
2	b	289	ILE
2	b	294	LYS
2	b	296	VAL
2	b	302	SER
2	b	306	ILE
2	b	308	ILE
2	b	311	ARG
2	b	315	MET
2	b	326	VAL
2	b	331	LEU
2	b	340	THR
2	b	344	LEU
2	b	352	LEU
2	b	360	MET
2	b	361	GLU
2	b	366	VAL
2	b	367	THR
2	b	370	GLU
2	b	373	LEU
2	b	385	LYS
2	b	387	ARG
2	b	395	GLU
2	b	405	VAL
2	b	406	THR
2	b	407	LEU
2	b	408	GLU
2	b	413	LEU
2	b	424	GLU
2	b	437	LEU
2	b	438	LYS

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Mol	Chain	Res	Type
2	b	440	LEU
2	b	441	ILE
2	b	442	VAL
2	b	443	LEU
2	b	450	MET
2	b	452	VAL
2	b	458	SER
2	b	461	LEU
2	b	469	ASN
2	b	475	SER
2	b	479	ASP
2	b	480	SER
2	b	481	ILE
2	b	483	TYR
2	b	485	LYS
2	b	490	LEU
2	b	491	ARG
2	b	493	LEU
2	b	497	LEU
2	b	510	LEU
2	b	518	THR
2	b	519	ILE
2	b	537	ILE
2	b	542	THR
2	b	544	ASN
2	b	549	ARG
2	b	551	ILE
2	b	553	GLN
2	b	554	MET
2	b	561	VAL
2	b	563	THR
2	b	564	THR
2	b	568	LEU
2	b	569	SER
2	b	571	LYS
2	b	575	LEU
2	b	576	ASP
2	b	579	SER
2	b	581	VAL
2	b	583	ARG
2	b	586	LYS
2	b	591	TRP

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Mol	Chain	Res	Type
2	b	592	ILE
2	b	595	ILE
2	b	596	SER
2	b	598	VAL
2	b	603	GLN
2	b	609	MET
2	b	611	ASP
2	b	614	LYS
2	b	615	VAL
2	b	617	ASN
2	b	618	ASP
2	b	619	LEU
2	b	621	LYS
2	b	623	THR
2	b	626	GLU
2	b	628	VAL
2	b	634	VAL
2	b	639	LEU
2	b	640	VAL
2	b	643	ASP
2	b	645	ASN
2	b	654	LEU
2	b	658	LEU
2	b	660	VAL
2	b	661	ILE
2	b	664	ILE
2	b	668	GLN
2	b	670	ILE
2	b	681	ILE
2	b	684	VAL
2	b	685	THR
2	b	690	SER
2	b	696	GLN
2	b	699	GLU
2	b	701	MET
2	b	722	VAL
2	b	731	ARG
2	b	732	LYS
2	b	735	THR
2	b	740	HIS
2	b	741	PHE
2	b	743	LYS

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Mol	Chain	Res	Type
2	b	744	ILE
2	b	749	THR
2	b	754	THR
2	b	756	THR
2	b	758	GLN
2	b	761	GLU
2	b	779	LEU
2	b	789	LYS
2	b	796	ILE
2	b	802	SER
2	b	809	ILE
2	b	816	GLU
2	b	822	GLU
2	b	829	LEU
2	b	830	VAL
2	b	834	ASP
2	b	838	SER
2	b	851	ARG
2	b	862	ILE
2	b	863	ARG
2	b	864	LYS
2	b	869	SER
2	b	876	SER
2	b	878	VAL
2	b	888	ILE
2	b	893	LYS
2	b	894	LYS
2	b	897	GLU
2	b	906	PHE
2	b	907	SER
2	b	909	LEU
2	b	910	ILE
2	b	913	VAL
2	b	915	ARG
2	b	916	ARG
2	b	918	SER
2	b	925	GLN
2	b	934	MET
2	b	935	ASP
2	b	940	SER
2	b	943	ARG
2	b	945	LEU

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Mol	Chain	Res	Type
2	b	949	LEU
2	b	950	GLU
2	b	951	LYS
2	b	956	ILE
2	b	957	LYS
2	b	958	TRP
2	b	961	GLU
2	b	964	GLU
2	b	967	LEU
2	b	975	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (29) such sidechains are listed below:

Mol	Chain	Res	Type
1	a	64	GLN
1	a	77	GLN
1	a	93	ASN
1	a	140	ASN
2	b	134	ASN
2	b	179	ASN
2	b	207	ASN
2	b	219	GLN
2	b	240	ASN
2	b	269	ASN
2	b	297	GLN
2	b	337	HIS
2	b	356	ASN
2	b	398	HIS
2	b	399	GLN
2	b	403	ASN
2	b	517	ASN
2	b	612	ASN
2	b	665	ASN
2	b	668	GLN
2	b	733	GLN
2	b	794	ASN
2	b	818	ASN
2	b	858	ASN
2	b	891	ASN
2	b	911	GLN
2	b	925	GLN
2	b	933	ASN

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Mol	Chain	Res	Type
2	b	975	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 ⓘ

13 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	$\# Z > 2$
3	NAG	A	1	1,3	14,14,15	0.34	0	17,19,21	0.46	0
3	NAG	A	2	3	14,14,15	0.35	0	17,19,21	0.78	0
3	BMA	A	3	3	11,11,12	0.25	0	15,15,17	0.56	0
4	NAG	B	1	4,2	14,14,15	0.47	0	17,19,21	1.33	2 (11%)
4	NAG	B	2	4	14,14,15	0.35	0	17,19,21	0.87	1 (5%)
4	NAG	C	1	4,2	14,14,15	0.37	0	17,19,21	0.70	0
4	NAG	C	2	4	14,14,15	0.38	0	17,19,21	0.69	0
5	NAG	D	1	5,2	14,14,15	0.45	0	17,19,21	0.83	0
5	NAG	D	2	5	14,14,15	0.42	0	17,19,21	0.74	0
5	BMA	D	3	5	11,11,12	0.29	0	15,15,17	0.69	0
5	FUC	D	4	5	10,10,11	0.30	0	14,14,16	1.69	4 (28%)
4	NAG	E	1	4,2	14,14,15	0.38	0	17,19,21	0.68	0
4	NAG	E	2	4	14,14,15	0.35	0	17,19,21	0.60	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
3	NAG	A	1	1,3	-	2/6/23/26	0/1/1/1
3	NAG	A	2	3	-	2/6/23/26	0/1/1/1
3	BMA	A	3	3	-	0/2/19/22	0/1/1/1
4	NAG	B	1	4,2	-	2/6/23/26	0/1/1/1
4	NAG	B	2	4	-	2/6/23/26	0/1/1/1
4	NAG	C	1	4,2	-	2/6/23/26	0/1/1/1
4	NAG	C	2	4	-	4/6/23/26	0/1/1/1
5	NAG	D	1	5,2	-	2/6/23/26	0/1/1/1
5	NAG	D	2	5	-	2/6/23/26	0/1/1/1
5	BMA	D	3	5	-	2/2/19/22	0/1/1/1
5	FUC	D	4	5	-	-	0/1/1/1
4	NAG	E	1	4,2	-	4/6/23/26	0/1/1/1
4	NAG	E	2	4	-	2/6/23/26	0/1/1/1

There are no bond length outliers.

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	B	1	NAG	O5-C1-C2	-4.08	104.84	111.29
5	D	4	FUC	O5-C1-C2	-3.27	105.73	110.77
5	D	4	FUC	O5-C5-C4	3.02	114.94	109.52
5	D	4	FUC	C6-C5-C4	-2.49	108.47	113.07
4	B	2	NAG	O5-C1-C2	-2.04	108.06	111.29
5	D	4	FUC	C1-C2-C3	-2.03	107.17	109.67
4	B	1	NAG	C3-C4-C5	2.02	113.84	110.24

There are no chirality outliers.

All (26) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	B	2	NAG	C8-C7-N2-C2
4	B	2	NAG	O7-C7-N2-C2
4	E	2	NAG	O5-C5-C6-O6
4	E	2	NAG	C4-C5-C6-O6
4	B	1	NAG	C4-C5-C6-O6
5	D	3	BMA	O5-C5-C6-O6
4	C	2	NAG	O5-C5-C6-O6
4	E	1	NAG	O5-C5-C6-O6

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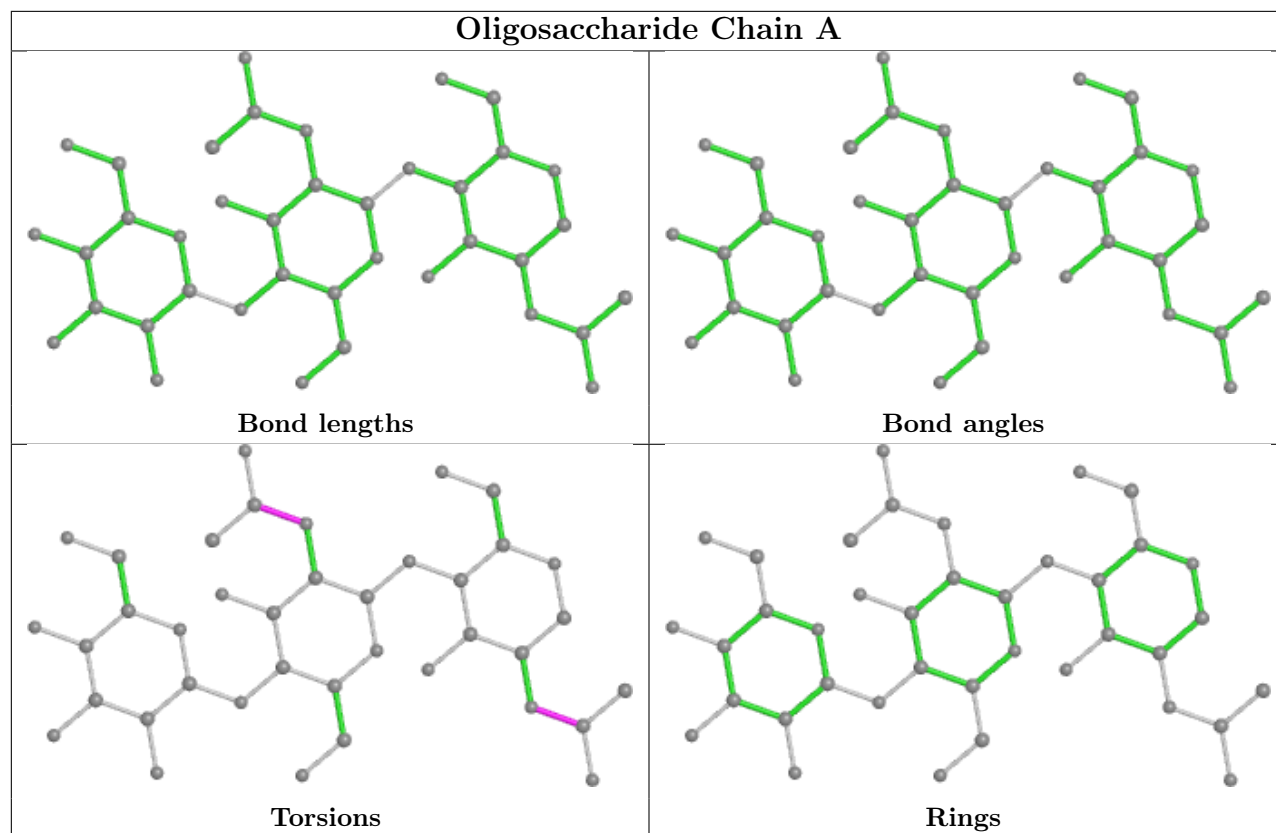
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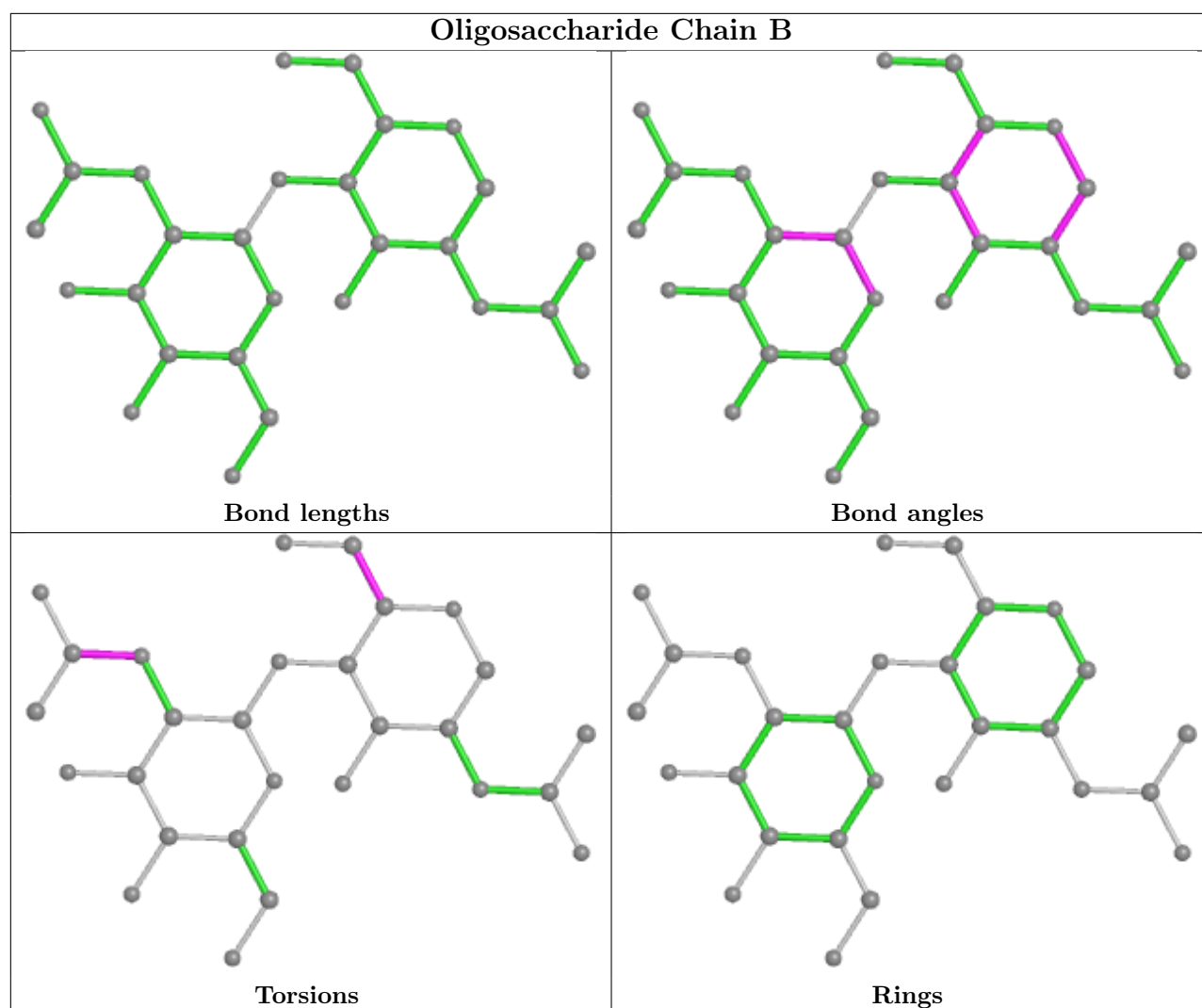
Mol	Chain	Res	Type	Atoms
5	D	3	BMA	C4-C5-C6-O6
3	A	2	NAG	C8-C7-N2-C2
5	D	1	NAG	C8-C7-N2-C2
4	E	1	NAG	C4-C5-C6-O6
5	D	1	NAG	O7-C7-N2-C2
4	C	2	NAG	C4-C5-C6-O6
4	B	1	NAG	O5-C5-C6-O6
3	A	2	NAG	O7-C7-N2-C2
4	C	1	NAG	C8-C7-N2-C2
3	A	1	NAG	C8-C7-N2-C2
4	E	1	NAG	C8-C7-N2-C2
3	A	1	NAG	O7-C7-N2-C2
4	C	1	NAG	O7-C7-N2-C2
4	E	1	NAG	O7-C7-N2-C2
5	D	2	NAG	C8-C7-N2-C2
4	C	2	NAG	C8-C7-N2-C2
4	C	2	NAG	O7-C7-N2-C2
5	D	2	NAG	O7-C7-N2-C2

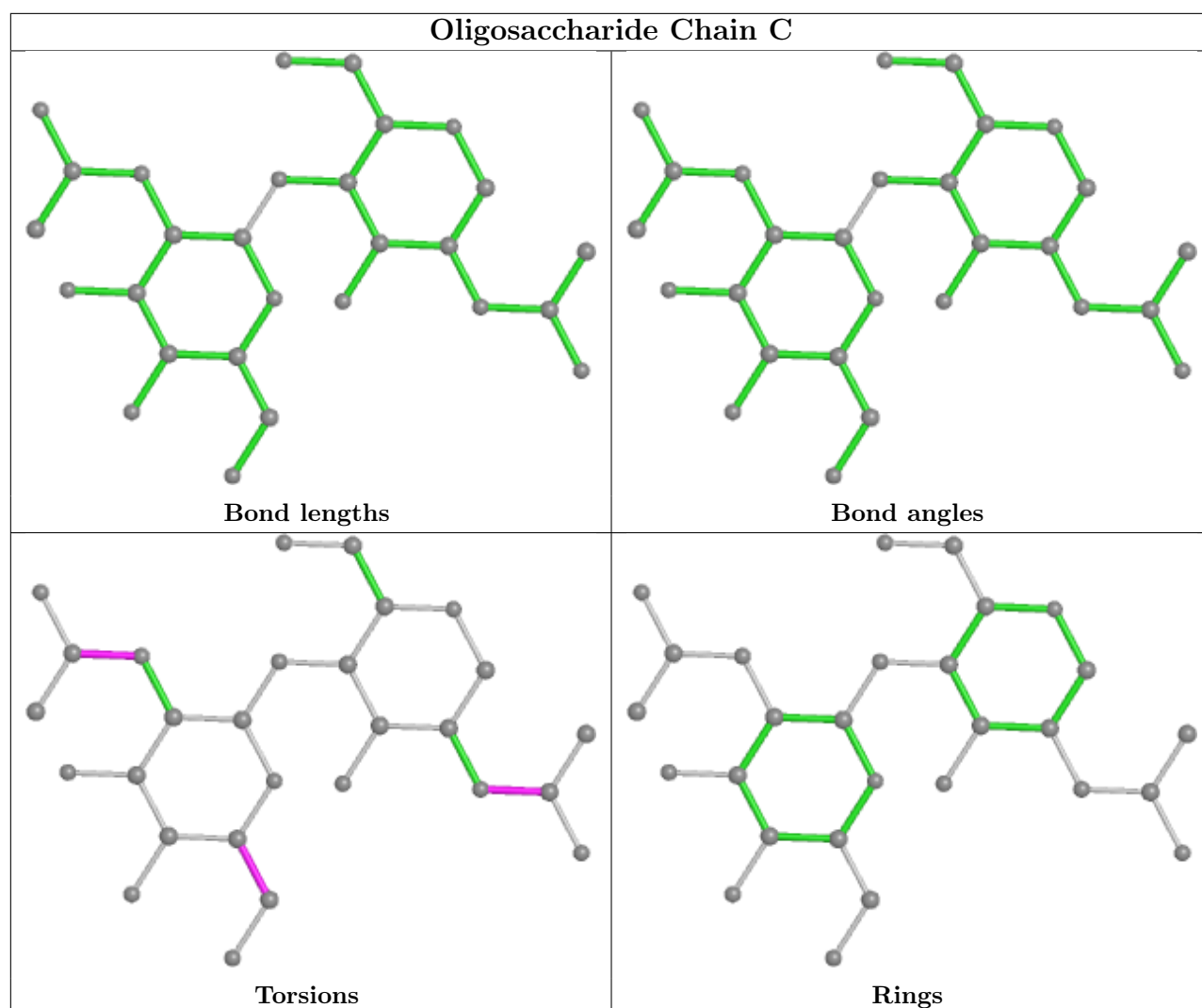
There are no ring outliers.

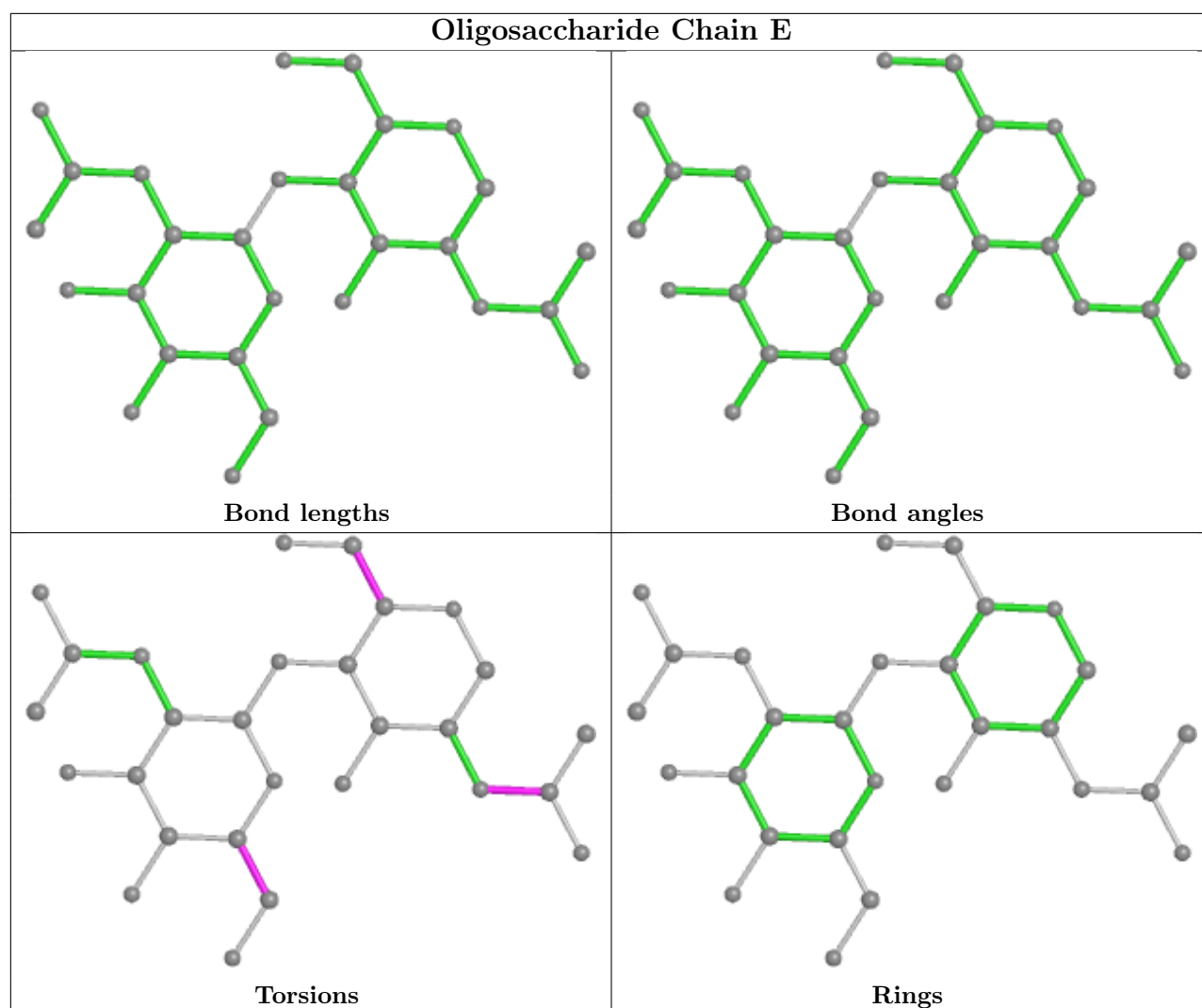
No monomer is involved in short contacts.

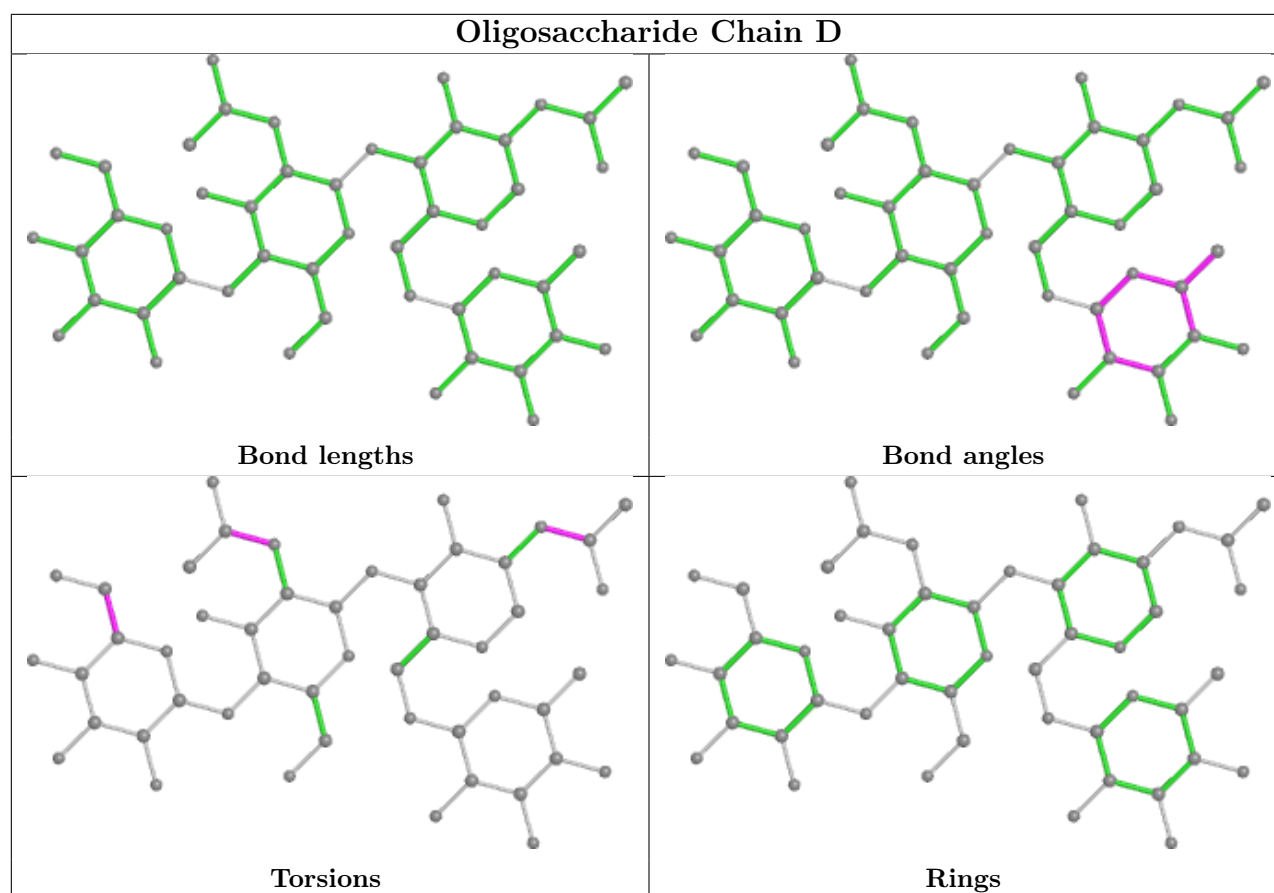
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for oligosaccharide.











5.6 Ligand geometry [i](#)

1 ligand is 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	$\# Z > 2$
6	NAG	a	201	1	14,14,15	0.34	0	17,19,21	0.82	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
6	NAG	a	201	1	-	2/6/23/26	0/1/1/1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	a	201	NAG	C8-C7-N2-C2
6	a	201	NAG	O7-C7-N2-C2

There are no ring outliers.

No monomer is involved in short contacts.

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.