W O R L D W I D E
wwPDB
P R O T E I N   D A T A   B A N K

wwPDB X-ray Structure Validation Summary Report (i)

Oct 17, 2021 – 01:29 AM EDT

PDB ID	:	1N7D
Title	:	Extracellular domain of the LDL receptor
Authors	:	Rudenko, G.; Henry, L.; Henderson, K.; Ichtchenko, K.; Brown, M.S.; Goldstein, J.L.; Deisenhofer, J.
Deposited on	:	2002-11-13
Resolution	:	3.70 Å(reported)

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

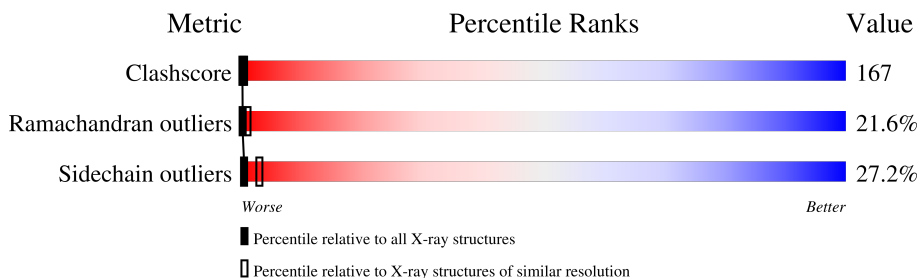|		
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.23.2

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 3.70 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	Percentile Ranks	Value
Clashscore		167
Ramachandran outliers		21.6%
Sidechain outliers		27.2%

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	141614	1027 (3.86-3.54)
Ramachandran outliers	138981	1069 (3.88-3.52)
Sidechain outliers	138945	1065 (3.88-3.52)

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 was not executed.

Mol	Chain	Length	Quality of chain
1	A	699	8% 43% 28% 12% 9%
2	B	5	20% 80%
3	C	4	25% 75%

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	B	1	-	-	X	-
3	NAG	C	1	-	-	X	-

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WORLDWIDE
wwPDB
PROTEIN DATA BANK

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Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
5	KEG	A	6003	-	-	X	-

2 Entry composition ⓘ

There are 5 unique types of molecules in this entry. The entry contains 4956 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 Low-density lipoprotein receptor.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	639	Total 4702	C 2874	N 800	O 966	S 62	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	494	GLN	ASN	engineered mutation	UNP P01130
A	636	GLN	ASN	engineered mutation	UNP P01130

- Molecule 2 is an oligosaccharide called alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyran ose-(1-6)]beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-a cetamido-2-deoxy-beta-D-glucopyranose.
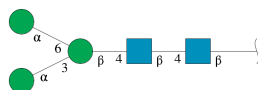
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	B	5	Total 61	C 34	N 2	O 25	0	0	0

- Molecule 3 is an oligosaccharide called alpha-D-mannopyranose-(1-6)-beta-D-mannopyranos e-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-gluco pyranose.
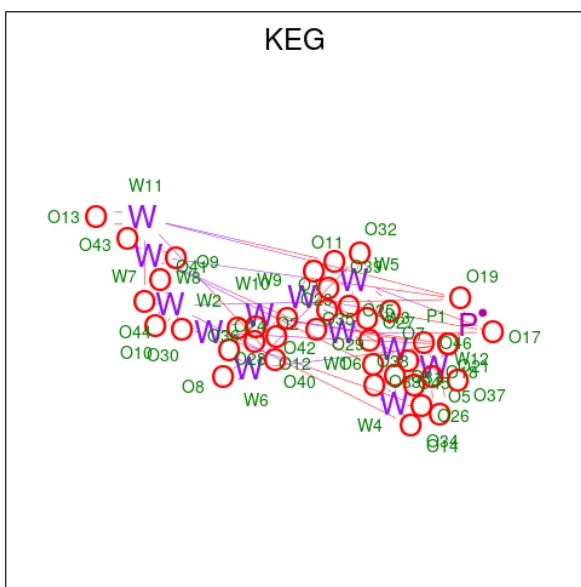
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	C	4	Total	C	N	O	0	0	0
			50	28	2	20			

• Molecule 4 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	8	Total	Ca	0	0
			8	8		

• Molecule 5 is 12-TUNGSTOPHOSPHATE (three-letter code: KEG) (formula: $O_{40}PW_{12}$).

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	A	1	Total	O	P	W	0	0
			53	40	1	12		
5	A	1	Total	O	P	W	0	0
			53	40	1	12		
5	A	1	Total	O	P	W	0	0
			29	21	1	7		

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 was not executed.

• Molecule 1: Low-density lipoprotein receptor

• Molecule 2: alpha-D-mannopyranose-(1-3)-[alpha-D-mannopyranose-(1-6)]beta-D-mannopyrano
se-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyra
nose

Chain B:

20%   80%

NAG1 NAG2 BMA3 MAN4 MAN5

• Molecule 3: alpha-D-mannopyranose-(1-6)-beta-D-mannopyranose-(1-4)-2-acetamido-2-deoxy-b
eta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose

Chain C:

25%   75%

NAG1 NAG2 BMA3 MAN4

4 Data and refinement statistics (i)

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

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, α, β, γ	185.29Å 185.29Å 85.19Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	45.30 – 3.70	Depositor
% Data completeness (in resolution range)	87.8 (45.30-3.70)	Depositor
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.381 , 0.382	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	4956	wwPDB-VP
Average B, all atoms (Å^2)	124.0	wwPDB-VP

5 Model quality ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: MAN, BMA, NAG, CA, KEG

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	0.90	5/4796 (0.1%)	1.77	160/6528 (2.5%)

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
1	A	0	2

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	343	CYS	CB-SG	-8.68	1.67	1.82
1	A	139	CYS	CB-SG	6.30	1.93	1.82
1	A	356	CYS	CB-SG	-6.30	1.71	1.82
1	A	134	CYS	CB-SG	5.64	1.91	1.82
1	A	190	HIS	N-CA	5.32	1.56	1.46

The worst 5 of 160 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	339	ASP	C-N-CD	-14.47	88.76	120.60
1	A	314	GLY	N-CA-C	-12.66	81.45	113.10
1	A	68	CYS	CA-CB-SG	-12.09	92.23	114.00
1	A	473	VAL	N-CA-C	-11.68	79.47	111.00
1	A	517	THR	C-N-CD	-11.25	95.86	120.60

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	167	TYR	Sidechain
1	A	468	TYR	Sidechain

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	4702	0	4113	1510	4
2	B	61	0	50	25	0
3	C	50	0	43	31	0
4	A	8	0	0	0	0
5	A	135	0	0	19	12
All	All	4956	0	4206	1527	16

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 167.

The worst 5 of 1527 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:586:HIS:CB	1:A:602:ILE:HG21	1.37	1.55
1:A:251:ASN:CA	3:C:1:NAG:H82	1.11	1.54
1:A:586:HIS:HB2	1:A:602:ILE:CG2	1.39	1.51
1:A:251:ASN:HB3	3:C:1:NAG:C8	1.41	1.48
1:A:251:ASN:HB3	3:C:1:NAG:C7	1.43	1.47

The worst 5 of 16 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:6003:KEG:P1	5:A:6003:KEG:O17[4_556]	1.52	0.68
5:A:6003:KEG:P1	5:A:6003:KEG:O18[4_556]	1.52	0.68
5:A:6003:KEG:W1	5:A:6003:KEG:O1[4_556]	1.62	0.58
5:A:6003:KEG:W2	5:A:6003:KEG:O2[4_556]	1.63	0.57
5:A:6003:KEG:O18	5:A:6003:KEG:O18[4_556]	1.70	0.50

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	625/699 (89%)	334 (53%)	156 (25%)	135 (22%)	0	1

5 of 135 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	46	THR
1	A	47	CYS
1	A	49	SER
1	A	63	PRO
1	A	64	GLN

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	508/614 (83%)	370 (73%)	138 (27%)	0	3

5 of 138 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	596	LYS
1	A	617	ASP
1	A	664	PRO
1	A	256	GLU
1	A	254	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 14

such sidechains are listed below:

Mol	Chain	Res	Type
1	A	345	GLN
1	A	407	ASN
1	A	543	ASN
1	A	507	HIS
1	A	538	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 ⓘ

9 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	B	1	2,1	14,14,15	0.77	0	17,19,21	0.66	0
2	NAG	B	2	2	14,14,15	0.84	1 (7%)	17,19,21	0.56	0
2	BMA	B	3	2	11,11,12	0.77	0	15,15,17	0.41	0
2	MAN	B	4	2	11,11,12	14.13	1 (9%)	15,15,17	4.93	2 (13%)
2	MAN	B	5	2	11,11,12	0.92	1 (9%)	15,15,17	0.72	0
3	NAG	C	1	1,3	14,14,15	0.78	0	17,19,21	0.65	0
3	NAG	C	2	3	14,14,15	0.83	1 (7%)	17,19,21	0.54	0
3	BMA	C	3	3	11,11,12	0.77	0	15,15,17	0.40	0
3	MAN	C	4	3	11,11,12	0.91	1 (9%)	15,15,17	0.73	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	B	1	2,1	-	0/6/23/26	0/1/1/1
2	NAG	B	2	2	-	0/6/23/26	0/1/1/1
2	BMA	B	3	2	-	0/2/19/22	0/1/1/1
2	MAN	B	4	2	-	0/2/19/22	0/1/1/1
2	MAN	B	5	2	-	2/2/19/22	0/1/1/1
3	NAG	C	1	1,3	-	0/6/23/26	0/1/1/1
3	NAG	C	2	3	-	0/6/23/26	0/1/1/1
3	BMA	C	3	3	-	0/2/19/22	0/1/1/1
3	MAN	C	4	3	-	2/2/19/22	0/1/1/1

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	4	MAN	O6-C6	46.85	3.40	1.42
2	B	5	MAN	C2-C3	2.40	1.56	1.52
3	C	4	MAN	C2-C3	2.36	1.56	1.52
2	B	2	NAG	C1-C2	2.10	1.55	1.52
3	C	2	NAG	C1-C2	2.07	1.55	1.52

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	B	4	MAN	O6-C6-C5	18.88	176.06	111.29
2	B	4	MAN	C1-O5-C5	2.15	115.11	112.19

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	5	MAN	O5-C5-C6-O6
3	C	4	MAN	O5-C5-C6-O6
2	B	5	MAN	C4-C5-C6-O6
3	C	4	MAN	C4-C5-C6-O6

There are no ring outliers.

2 monomers are involved in 56 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	C	1	NAG	31	0

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Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	1	NAG	25	0

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 B

Bond lengths

Bond angles

Torsions

Rings

Oligosaccharide Chain C

Bond lengths

Bond angles

Torsions

Rings
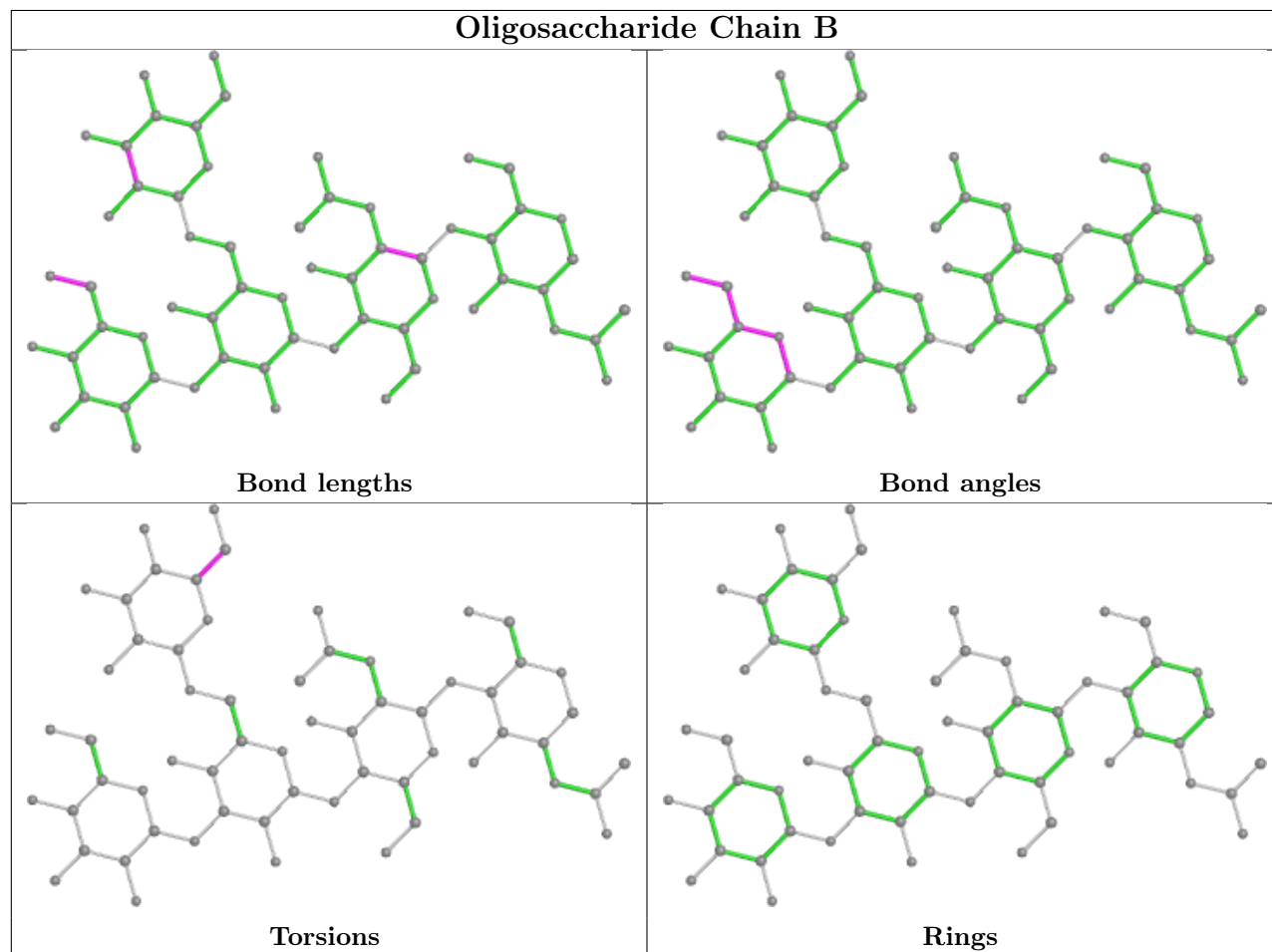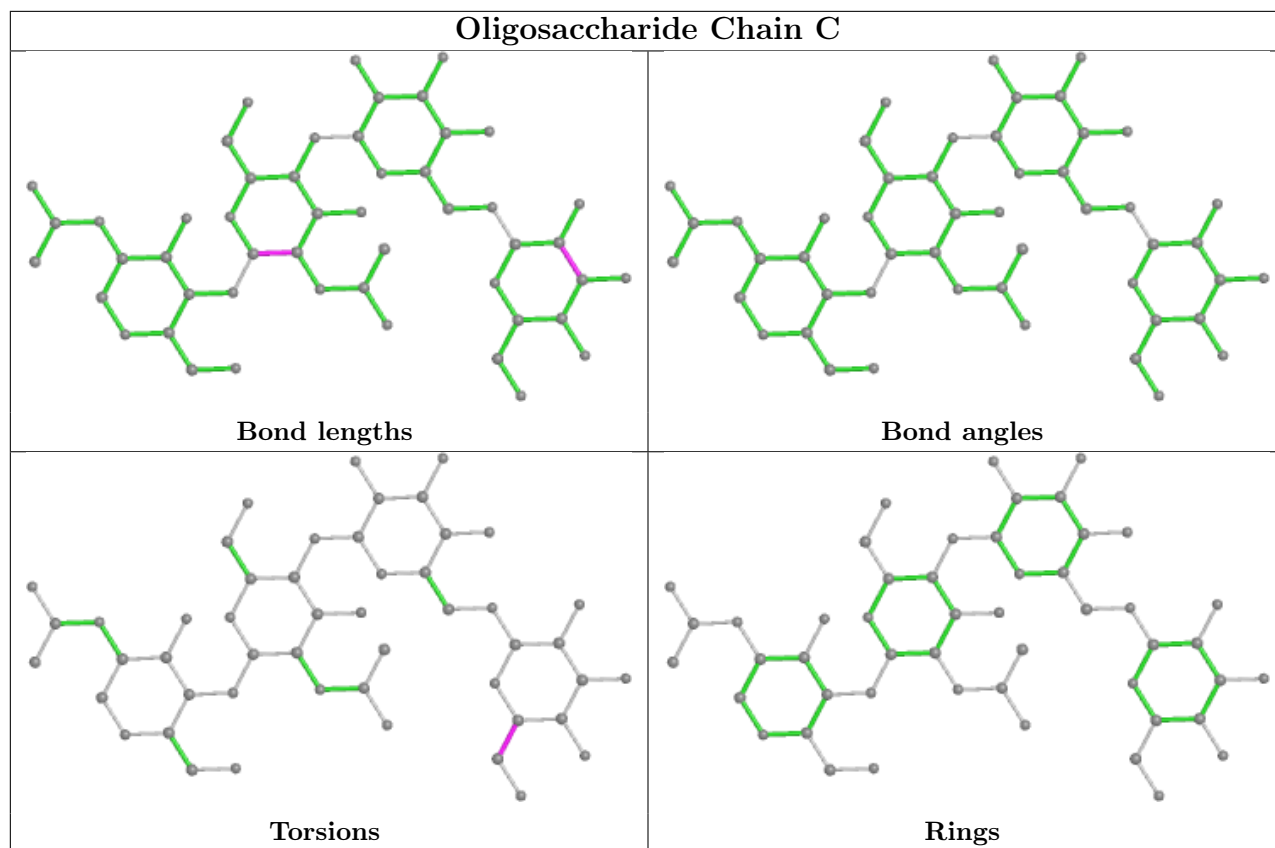
5.6 Ligand geometry ⓘ

Of 11 ligands modelled in this entry, 8 are monoatomic - leaving 3 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	#$\|Z\| > 2$
5	KEG	A	6003	-	19,37,76	1.36	5 (26%)	0,95,234	-	-
5	KEG	A	6002	-	76,76,76	2.62	32 (42%)	6,234,234	2.76	3 (50%)
5	KEG	A	6001	-	76,76,76	3.16	42 (55%)	6,234,234	1.38	2 (33%)

The worst 5 of 79 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	A	6001	KEG	P1-O18	-7.87	1.27	1.54

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	A	6001	KEG	W2-O28	-7.75	1.55	1.93
5	A	6001	KEG	W6-O36	-7.25	1.58	1.93
5	A	6001	KEG	W1-O29	-7.09	1.60	1.91
5	A	6001	KEG	W3-O33	-6.97	1.61	1.91

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
5	A	6002	KEG	O18-P1-O17	-4.86	99.61	108.92
5	A	6002	KEG	O19-P1-O18	3.89	116.37	108.92
5	A	6002	KEG	O19-P1-O17	2.33	113.38	108.92
5	A	6001	KEG	O19-P1-O18	-2.19	104.72	108.92
5	A	6001	KEG	O21-P1-O18	2.09	112.92	108.92

There are no chirality outliers.

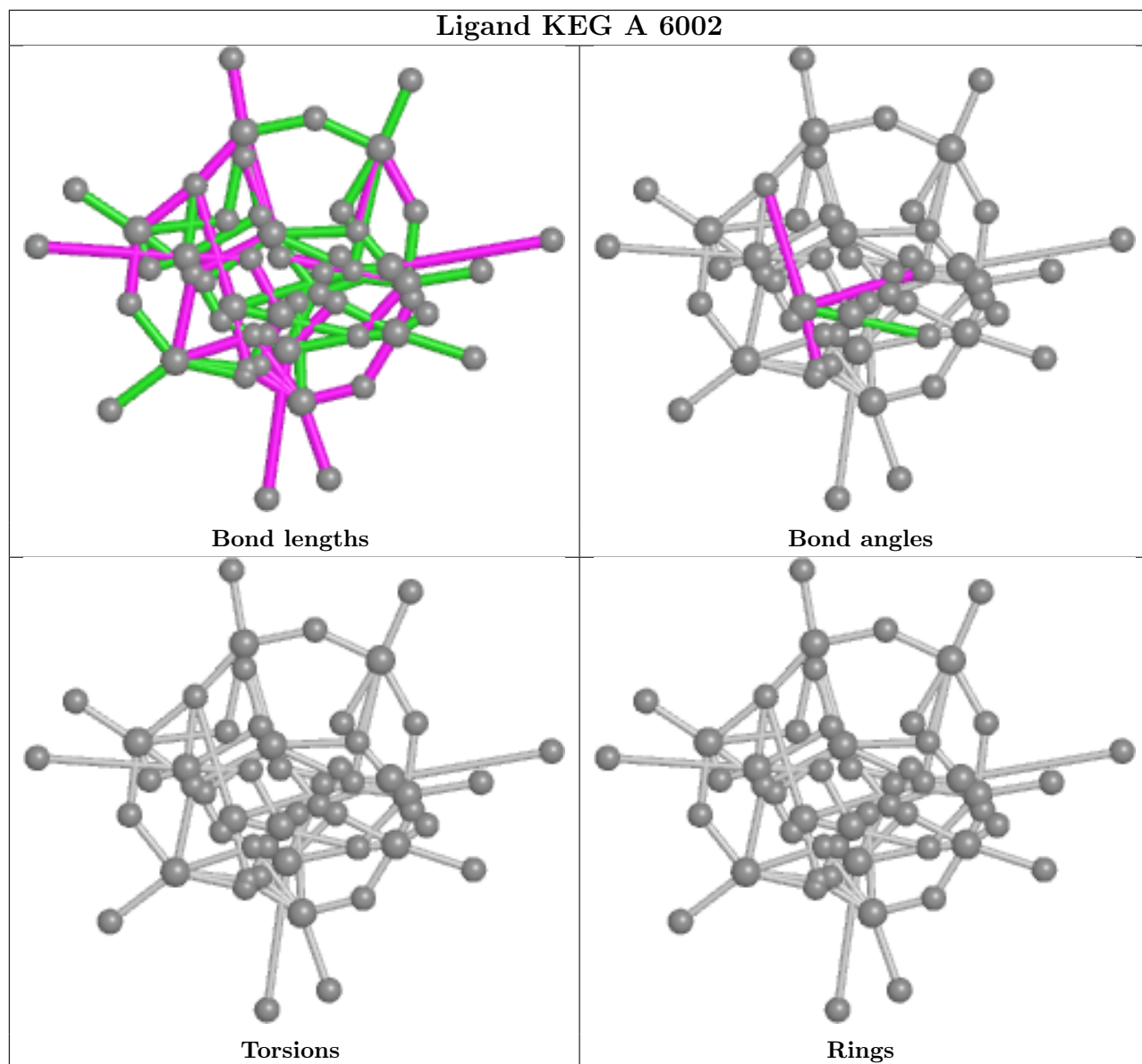There are no torsion outliers.

There are no ring outliers.
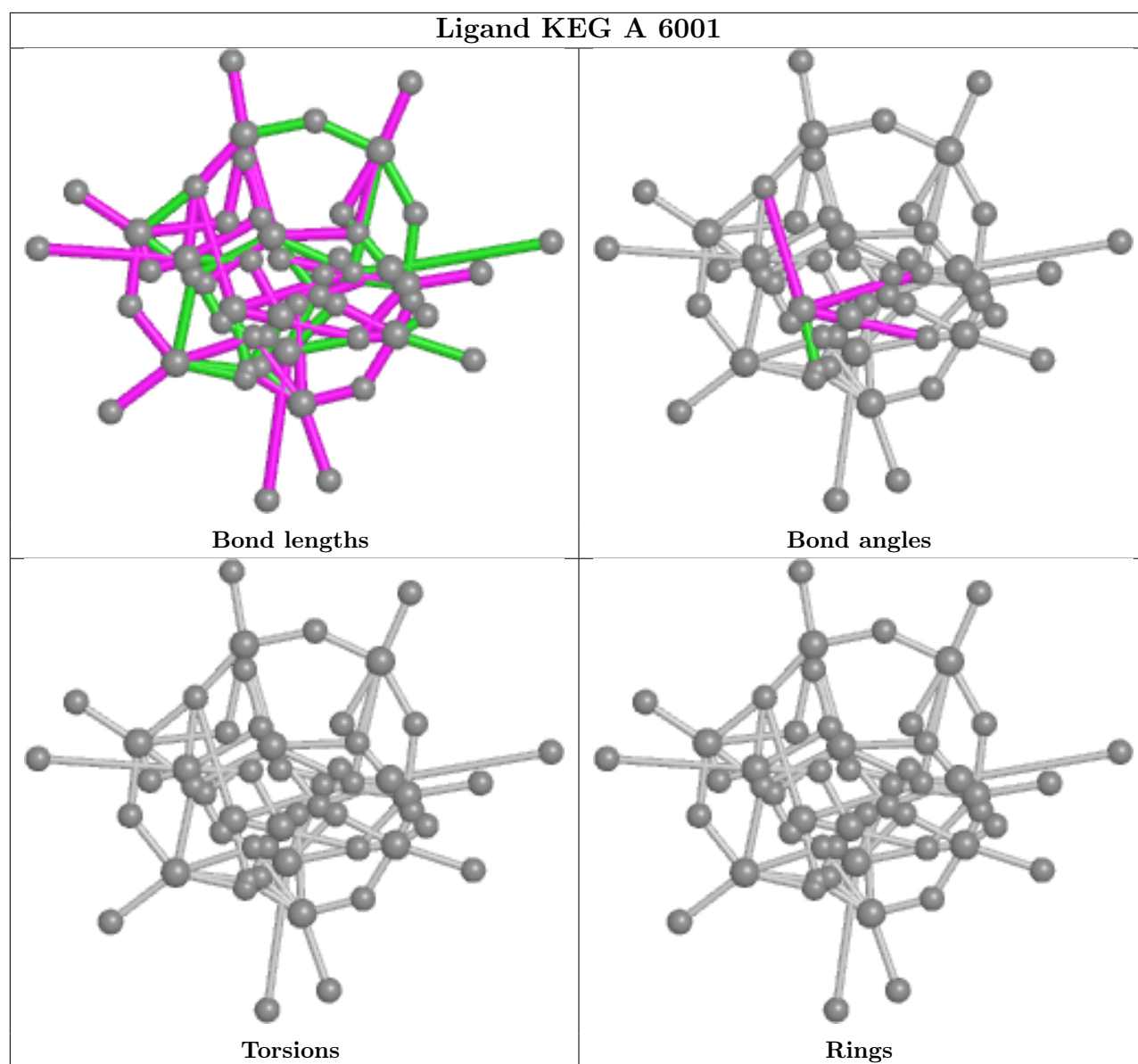
3 monomers are involved in 31 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	A	6003	KEG	6	12
5	A	6002	KEG	7	0
5	A	6001	KEG	6	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 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 KEG A 6003

Bond lengths

Bond angles

Torsions

Rings

Ligand KEG A 6002

Bond lengths

Bond angles

Torsions

Rings

Ligand KEG A 6001

Bond lengths

Bond angles

Torsions

Rings
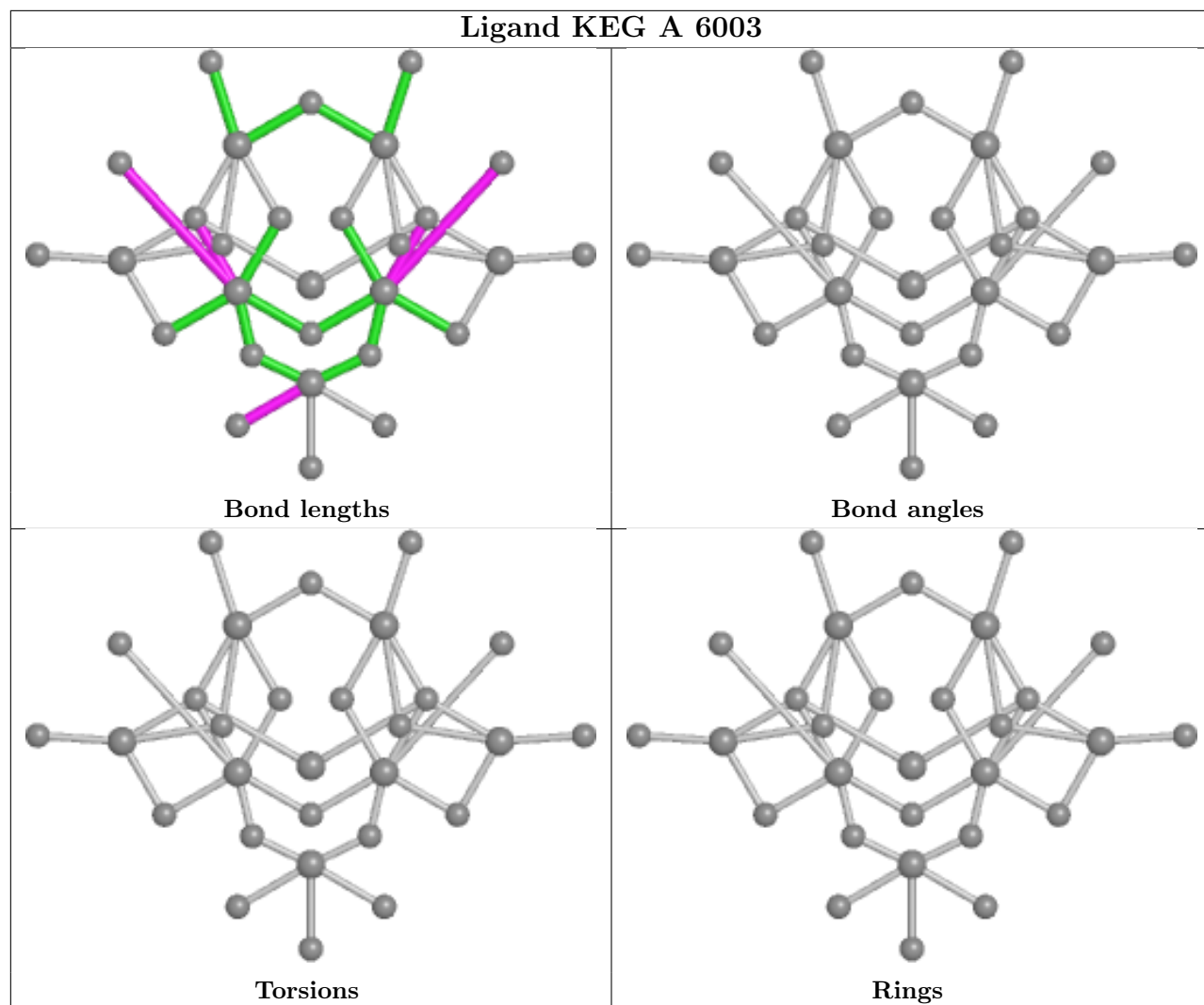
5.7 Other polymers ⓘ

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 was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates ⓘ

EDS was not executed - this section is therefore empty.

6.4 Ligands ⓘ

EDS was not executed - this section is therefore empty.

6.5 Other polymers ⓘ

EDS was not executed - this section is therefore empty.