



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 06:46 PM UTC

PDB ID : 9R31 / pdb_00009r31
Title : Three dimensional structure of human carbonic anhydrase XII in complex with sulfonamide
Authors : Eimonta, V.; Leitans, J.; Tars, K.
Deposited on : 2025-05-02
Resolution : 1.25 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 : 4-5-2 with Phenix2.0
Mogul : 2022.3.0, CSD as543be (2022)
Xtrriage (Phenix) : 2.0
EDS : 3.0
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.010 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

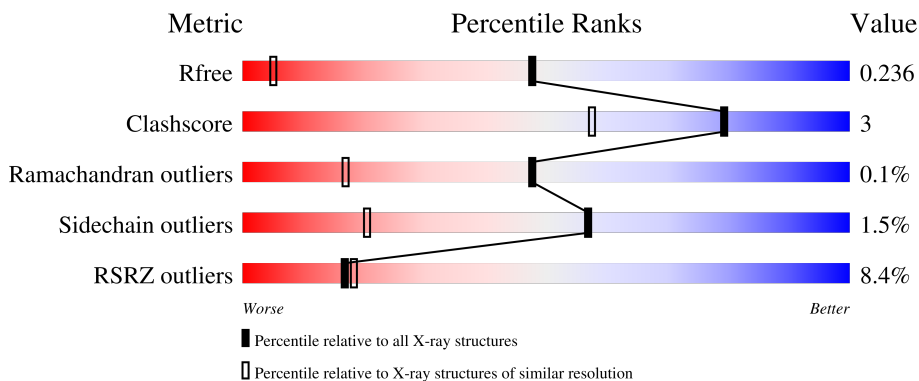
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.25 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))
R_{free}	180053	1693 (1.28-1.24)
Clashscore	190562	1730 (1.28-1.24)
Ramachandran outliers	187476	1695 (1.28-1.24)
Sidechain outliers	187428	1694 (1.28-1.24)
RSRZ outliers	180081	1693 (1.28-1.24)

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 $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	265	 5% (poor fit), 88% (0-3 outliers), 10% (4+ outliers)
1	B	265	 3% (poor fit), 88% (0-3 outliers), 9% (4+ outliers)
1	C	265	 22% (poor fit), 85% (0-3 outliers), 12% (4+ outliers)
1	D	265	 3% (poor fit), 91% (0-3 outliers), 6% (4+ outliers)

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 9428 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 Carbonic anhydrase 12.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	260	Total 2088	C 1328	N 355	O 398	S 7	0	0	0
1	B	260	Total 2088	C 1328	N 355	O 398	S 7	0	0	0
1	C	260	Total 2072	C 1319	N 348	O 398	S 7	0	0	0
1	D	260	Total 2088	C 1328	N 355	O 398	S 7	0	0	0

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	0	GLY	-	expression tag	UNP O43570
A	1	SER	-	expression tag	UNP O43570
A	2	MET	-	expression tag	UNP O43570
B	0	GLY	-	expression tag	UNP O43570
B	1	SER	-	expression tag	UNP O43570
B	2	MET	-	expression tag	UNP O43570
C	0	GLY	-	expression tag	UNP O43570
C	1	SER	-	expression tag	UNP O43570
C	2	MET	-	expression tag	UNP O43570
D	0	GLY	-	expression tag	UNP O43570
D	1	SER	-	expression tag	UNP O43570
D	2	MET	-	expression tag	UNP O43570

- Molecule 2 is ZINC ION (CCD ID: ZN) (formula: Zn).

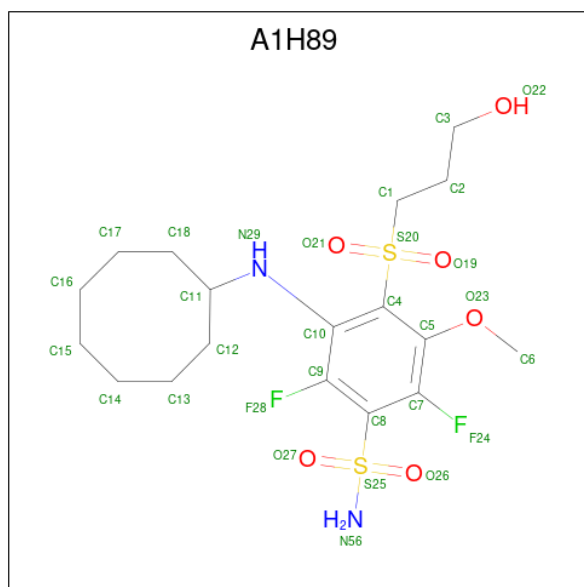
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total 1	Zn 1	0	0
2	B	1	Total 1	Zn 1	0	0

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Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	C	1	Total Zn 1 1	0	0
2	D	1	Total Zn 1 1	0	0

- Molecule 3 is 3-(cyclooctylamino)-2,6-difluoro-4-((3-hydroxypropyl)sulfonyl)-5-methoxy benzenesulfonamide (CCD ID: A1H89) (formula: $C_{18}H_{28}F_2N_2O_6S_2$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	
			Total	C	F	N	O			S
3	A	1	Total 30	C 18	F 2	N 2	O 6	S 2	0	0
3	B	1	Total 30	C 18	F 2	N 2	O 6	S 2	0	0
3	C	1	Total 30	C 18	F 2	N 2	O 6	S 2	0	0
3	D	1	Total 30	C 18	F 2	N 2	O 6	S 2	0	0

- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	276	Total O 276 276	0	0
4	B	235	Total O 235 235	0	0

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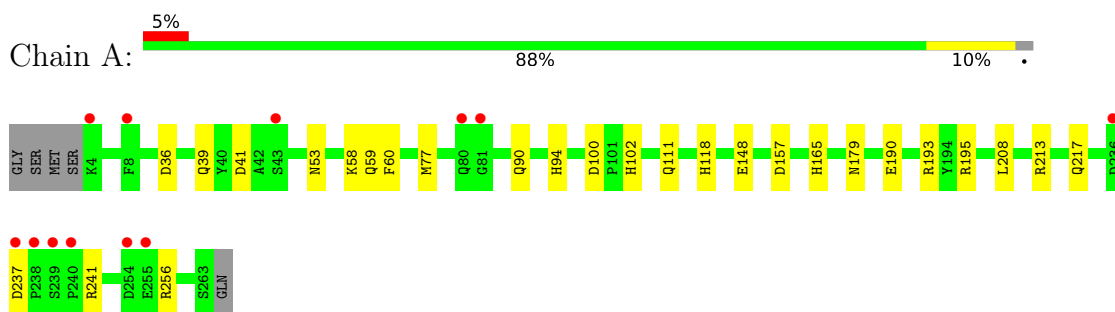
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	C	196	Total 196	O 196	0	0
4	D	261	Total 261	O 261	0	0

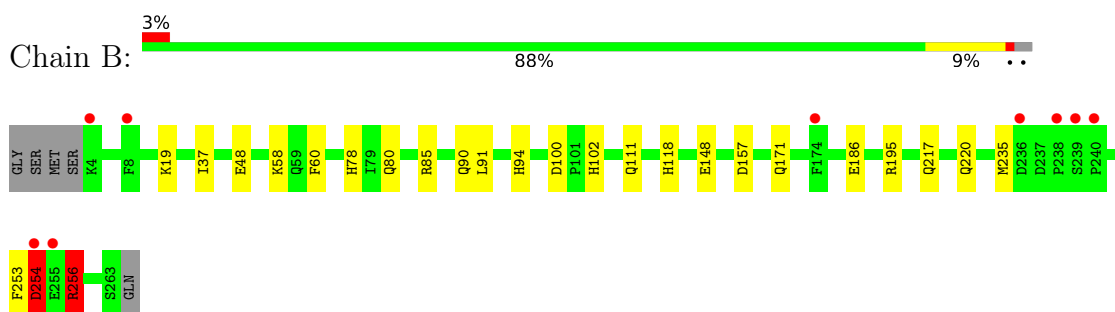
3 Residue-property plots [i](#)

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 and electron density. 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. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). 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.

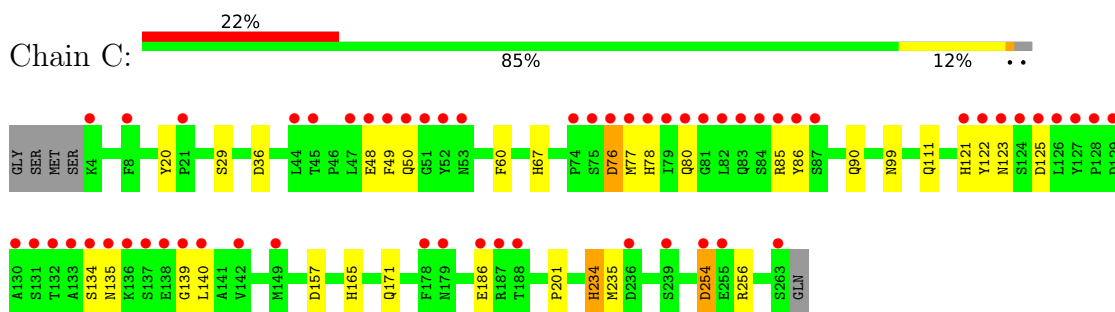
- Molecule 1: Carbonic anhydrase 12



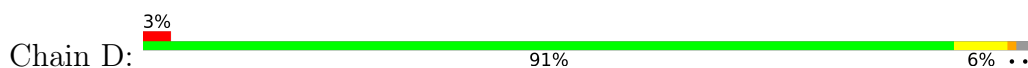
- Molecule 1: Carbonic anhydrase 12

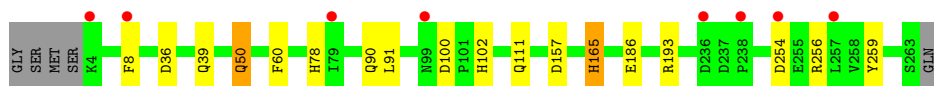


- Molecule 1: Carbonic anhydrase 12



- Molecule 1: Carbonic anhydrase 12





4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	46.62Å 67.47Å 80.86Å 81.17° 84.19° 86.37°	Depositor
Resolution (Å)	41.75 – 1.25 41.75 – 1.25	Depositor EDS
% Data completeness (in resolution range)	95.6 (41.75-1.25) 95.6 (41.75-1.25)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.76 (at 1.25Å)	Xtrriage
Refinement program	REFMAC 5.8.0425	Depositor
R, R_{free}	0.185 , 0.215 (Not available) , 0.236	Depositor DCC
R_{free} test set	12831 reflections (4.79%)	wwPDB-VP
Wilson B-factor (Å ²)	6.1	Xtrriage
Anisotropy	0.598	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 35.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.46$, $\langle L^2 \rangle = 0.29$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	9428	wwPDB-VP
Average B, all atoms (Å ²)	13.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 63.68 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 9.3101e-06. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

¹Intensities estimated from amplitudes.

²Theoretical 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.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: ZN, A1H89

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	0.78	2/2151 (0.1%)	1.13	7/2930 (0.2%)
1	B	0.75	2/2151 (0.1%)	1.09	4/2930 (0.1%)
1	C	0.92	9/2135 (0.4%)	1.14	8/2912 (0.3%)
1	D	0.72	0/2151	1.13	5/2930 (0.2%)
All	All	0.80	13/8588 (0.2%)	1.12	24/11702 (0.2%)

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
1	B	0	2
1	C	0	1
1	D	0	1
All	All	0	6

All (13) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	125	ASP	CG-OD2	11.13	1.46	1.25
1	C	123	ASN	C-O	10.01	1.35	1.24
1	C	49	PHE	C-O	9.65	1.35	1.24
1	C	134	SER	C-O	8.65	1.34	1.24
1	C	77	MET	C-O	8.53	1.34	1.24
1	C	140	LEU	C-O	7.52	1.33	1.23
1	A	118	HIS	ND1-CE1	7.32	1.39	1.32
1	B	94	HIS	ND1-CE1	6.62	1.39	1.32
1	B	118	HIS	ND1-CE1	6.29	1.38	1.32
1	A	94	HIS	CD2-NE2	6.00	1.44	1.37

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	139	GLY	C-O	5.91	1.30	1.23
1	C	67	HIS	CG-CD2	-5.22	1.30	1.35
1	C	140	LEU	C-N	5.02	1.40	1.33

All (24) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	193	ARG	CD-NE-CZ	7.64	135.10	124.40
1	B	254	ASP	CA-CB-CG	7.02	119.62	112.60
1	A	36	ASP	CA-CB-CG	-6.91	105.69	112.60
1	C	254	ASP	CA-CB-CG	6.77	119.37	112.60
1	A	241	ARG	N-CA-CB	6.12	120.20	110.65
1	D	254	ASP	CA-CB-CG	6.08	118.67	112.60
1	C	60	PHE	CA-CB-CG	-6.03	107.77	113.80
1	B	186	GLU	CB-CG-CD	5.80	122.47	112.60
1	A	77	MET	CB-CA-C	-5.79	100.40	109.84
1	C	234	HIS	CA-CB-CG	5.75	119.55	113.80
1	B	48	GLU	CB-CG-CD	-5.68	102.94	112.60
1	A	94	HIS	CE1-NE2-CD2	-5.51	103.49	109.00
1	D	36	ASP	CA-CB-CG	5.42	118.02	112.60
1	C	125	ASP	CA-CB-CG	5.36	117.96	112.60
1	C	36	ASP	CA-CB-CG	5.32	117.92	112.60
1	C	121	HIS	CA-CB-CG	5.27	119.07	113.80
1	C	76	ASP	CA-CB-CG	5.22	117.82	112.60
1	C	29	SER	O-C-N	-5.12	117.00	121.35
1	A	190	GLU	CB-CG-CD	5.07	121.22	112.60
1	D	165	HIS	CB-CG-ND1	5.07	130.31	122.70
1	A	165	HIS	CA-CB-CG	-5.06	108.74	113.80
1	D	60	PHE	CA-CB-CG	-5.03	108.78	113.80
1	B	256	ARG	NE-CZ-NH1	-5.02	116.48	121.50
1	A	118	HIS	ND1-CG-CD2	5.01	111.11	106.10

There are no chirality outliers.

All (6) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	195	ARG	Sidechain
1	A	213	ARG	Sidechain
1	B	195	ARG	Sidechain
1	B	256	ARG	Sidechain
1	C	85	ARG	Sidechain
1	D	256	ARG	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	2088	0	1979	12	0
1	B	2088	0	1979	14	0
1	C	2072	0	1946	16	0
1	D	2088	0	1979	11	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0
2	D	1	0	0	0	0
3	A	30	0	0	0	0
3	B	30	0	0	0	0
3	C	30	0	0	0	0
3	D	30	0	0	0	0
4	A	276	0	0	2	0
4	B	235	0	0	2	1
4	C	196	0	0	3	0
4	D	261	0	0	2	0
All	All	9428	0	7883	44	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 3.

All (44) 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:41:ASP:HA	4:A:409:HOH:O	1.84	0.76
1:A:111:GLN:NE2	1:D:111:GLN:NE2	2.40	0.69
1:B:148:GLU:HG3	1:B:217:GLN:HG2	1.77	0.67
1:B:111:GLN:NE2	1:C:111:GLN:NE2	2.46	0.63
1:A:111:GLN:HE21	1:D:111:GLN:HE22	1.48	0.62
1:B:220:GLN:NE2	4:B:401:HOH:O	2.33	0.61
1:B:58:LYS:HD3	1:B:60:PHE:CZ	2.38	0.58
1:D:78:HIS:HD2	4:D:419:HOH:O	1.86	0.58
1:C:171:GLN:HE22	1:C:235:MET:HE3	1.68	0.57
1:C:254:ASP:O	1:C:256:ARG:HG3	2.05	0.56
1:D:165:HIS:HD2	4:D:625:HOH:O	1.88	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:50:GLN:HB2	1:D:78:HIS:CE1	2.41	0.56
1:C:165:HIS:HE1	4:C:566:HOH:O	1.88	0.56
1:C:99:ASN:HB3	4:C:541:HOH:O	2.07	0.55
1:A:58:LYS:HE3	1:A:60:PHE:CZ	2.42	0.55
1:A:148:GLU:HG3	1:A:217:GLN:HG2	1.91	0.52
1:B:78:HIS:HE1	4:B:600:HOH:O	1.92	0.51
1:C:171:GLN:NE2	1:C:235:MET:HE3	2.24	0.51
1:A:193:ARG:HD2	1:A:208:LEU:HD11	1.92	0.51
1:C:50:GLN:HB2	1:C:78:HIS:CE1	2.47	0.50
1:C:234:HIS:HE1	4:C:560:HOH:O	1.94	0.49
1:D:186:GLU:OE2	1:D:186:GLU:HA	2.14	0.48
1:C:48:GLU:HB2	1:C:80:GLN:HB3	1.95	0.47
1:B:111:GLN:HE21	1:C:111:GLN:HE22	1.63	0.46
1:B:37:ILE:HD12	1:B:253:PHE:CD2	2.50	0.46
1:B:100:ASP:OD1	1:B:102:HIS:HD2	1.98	0.46
1:B:91:LEU:C	1:B:91:LEU:HD12	2.41	0.45
1:A:256:ARG:HD3	4:A:402:HOH:O	2.18	0.44
1:A:39:GLN:HG3	1:C:135:ASN:ND2	2.33	0.44
1:D:91:LEU:HD12	1:D:91:LEU:C	2.43	0.44
1:A:111:GLN:NE2	1:D:111:GLN:HE21	2.15	0.43
1:D:8:PHE:CD1	1:D:8:PHE:C	2.96	0.43
1:B:80:GLN:NE2	1:B:85:ARG:HE	2.17	0.43
1:B:111:GLN:HE21	1:C:111:GLN:NE2	2.17	0.42
1:B:254:ASP:O	1:B:256:ARG:HG3	2.20	0.42
1:D:39:GLN:O	1:D:259:TYR:HA	2.19	0.42
1:A:39:GLN:HG3	1:C:135:ASN:HD21	1.84	0.42
1:A:53:ASN:HA	1:A:179:ASN:HA	2.02	0.42
1:B:171:GLN:HE22	1:B:235:MET:HE3	1.84	0.41
1:A:100:ASP:OD1	1:A:102:HIS:HD2	2.03	0.41
1:C:20:TYR:CG	1:C:201:PRO:HB3	2.56	0.41
1:C:86:TYR:HA	1:C:122:TYR:O	2.21	0.41
1:D:100:ASP:OD1	1:D:102:HIS:HD2	2.03	0.41
1:B:111:GLN:HE22	1:C:111:GLN:HE21	1.69	0.40

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:B:525:HOH:O	4:B:594:HOH:O[1_655]	2.17	0.03

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	258/265 (97%)	252 (98%)	6 (2%)	0	100	100
1	B	258/265 (97%)	252 (98%)	6 (2%)	0	100	100
1	C	258/265 (97%)	252 (98%)	5 (2%)	1 (0%)	30	9
1	D	258/265 (97%)	252 (98%)	6 (2%)	0	100	100
All	All	1032/1060 (97%)	1008 (98%)	23 (2%)	1 (0%)	48	17

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	186	GLU

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	232/236 (98%)	228 (98%)	4 (2%)	53	17
1	B	232/236 (98%)	228 (98%)	4 (2%)	53	17
1	C	229/236 (97%)	226 (99%)	3 (1%)	61	24
1	D	232/236 (98%)	229 (99%)	3 (1%)	61	24
All	All	925/944 (98%)	911 (98%)	14 (2%)	57	20

All (14) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	59	GLN
1	A	90	GLN
1	A	157	ASP
1	A	237	ASP
1	B	19	LYS
1	B	90	GLN
1	B	157	ASP
1	B	254	ASP
1	C	76	ASP
1	C	90	GLN
1	C	157	ASP
1	D	50	GLN
1	D	90	GLN
1	D	157	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (27) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	39	GLN
1	A	57	ASN
1	A	78	HIS
1	A	111	GLN
1	B	57	ASN
1	B	78	HIS
1	B	80	GLN
1	B	112	HIS
1	B	234	HIS
1	B	251	GLN
1	C	14	ASN
1	C	50	GLN
1	C	57	ASN
1	C	67	HIS
1	C	111	GLN
1	C	135	ASN
1	C	164	GLN
1	C	165	HIS
1	C	179	ASN
1	C	220	GLN
1	C	234	HIS
1	D	78	HIS
1	D	111	GLN
1	D	112	HIS
1	D	135	ASN

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Mol	Chain	Res	Type
1	D	165	HIS
1	D	204	ASN

5.3.3 RNA [i](#)

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](#)

Of 8 ligands modelled in this entry, 4 are monoatomic - leaving 4 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
3	A1H89	C	302	2	31,31,31	2.59	11 (35%)	38,45,45	1.92	10 (26%)
3	A1H89	B	302	2	31,31,31	2.74	9 (29%)	38,45,45	2.51	9 (23%)
3	A1H89	A	302	2	31,31,31	2.74	13 (41%)	38,45,45	2.56	8 (21%)
3	A1H89	D	302	2	31,31,31	2.24	8 (25%)	38,45,45	1.92	8 (21%)

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	A1H89	C	302	2	-	7/23/33/33	0/2/2/2
3	A1H89	B	302	2	-	7/23/33/33	0/2/2/2
3	A1H89	A	302	2	-	5/23/33/33	0/2/2/2
3	A1H89	D	302	2	-	7/23/33/33	0/2/2/2

All (41) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	C	302	A1H89	C8-S25	-7.79	1.66	1.78
3	B	302	A1H89	C8-S25	-7.62	1.66	1.78
3	A	302	A1H89	C8-S25	-6.90	1.67	1.78
3	B	302	A1H89	C9-C8	6.75	1.51	1.39
3	A	302	A1H89	C5-C4	5.85	1.49	1.40
3	D	302	A1H89	C8-S25	-5.63	1.69	1.78
3	A	302	A1H89	O19-S20	5.48	1.51	1.44
3	B	302	A1H89	C5-C4	5.40	1.48	1.40
3	B	302	A1H89	C1-S20	-5.36	1.67	1.77
3	A	302	A1H89	C9-C8	5.11	1.48	1.39
3	C	302	A1H89	C10-C9	5.06	1.47	1.39
3	A	302	A1H89	C10-C9	5.03	1.47	1.39
3	D	302	A1H89	C1-S20	-5.00	1.68	1.77
3	C	302	A1H89	C9-C8	4.82	1.47	1.39
3	D	302	A1H89	C9-C8	4.74	1.47	1.39
3	B	302	A1H89	C10-C9	4.24	1.46	1.39
3	D	302	A1H89	C7-C8	4.03	1.46	1.39
3	D	302	A1H89	C5-C4	3.95	1.46	1.40
3	C	302	A1H89	C5-C7	3.75	1.46	1.39
3	C	302	A1H89	C7-C8	3.74	1.45	1.39
3	D	302	A1H89	C10-C9	3.74	1.45	1.39
3	C	302	A1H89	O26-S25	3.62	1.50	1.43
3	C	302	A1H89	C5-C4	3.49	1.45	1.40
3	C	302	A1H89	C1-S20	-3.34	1.71	1.77
3	A	302	A1H89	C1-S20	-3.28	1.71	1.77
3	A	302	A1H89	C4-S20	-3.22	1.64	1.81
3	A	302	A1H89	O21-S20	3.07	1.48	1.44
3	B	302	A1H89	O23-C5	-3.05	1.32	1.38
3	B	302	A1H89	C4-S20	-3.01	1.65	1.81
3	C	302	A1H89	C4-S20	-2.95	1.65	1.81
3	D	302	A1H89	C4-S20	-2.77	1.66	1.81
3	D	302	A1H89	C10-C4	2.68	1.48	1.40
3	A	302	A1H89	C5-C7	2.57	1.43	1.39
3	A	302	A1H89	C12-C11	2.56	1.55	1.52

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	C	302	A1H89	C10-C4	2.47	1.47	1.40
3	A	302	A1H89	C18-C11	2.38	1.55	1.52
3	C	302	A1H89	O23-C5	-2.38	1.34	1.38
3	A	302	A1H89	O23-C5	-2.26	1.34	1.38
3	B	302	A1H89	C10-C4	2.05	1.46	1.40
3	B	302	A1H89	F28-C9	-2.01	1.32	1.34
3	A	302	A1H89	C7-C8	2.01	1.42	1.39

All (35) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	302	A1H89	C7-C8-C9	-11.43	108.83	116.65
3	B	302	A1H89	C7-C8-C9	-11.11	109.05	116.65
3	D	302	A1H89	C7-C8-C9	-7.65	111.41	116.65
3	C	302	A1H89	C7-C8-C9	-6.64	112.11	116.65
3	B	302	A1H89	C5-C7-C8	5.15	128.57	121.36
3	A	302	A1H89	C5-C7-C8	5.13	128.54	121.36
3	B	302	A1H89	C7-C8-S25	4.23	131.63	121.34
3	A	302	A1H89	C7-C8-S25	4.13	131.38	121.34
3	C	302	A1H89	O19-S20-O21	-4.12	114.04	118.45
3	A	302	A1H89	F24-C7-C8	-3.90	113.74	120.76
3	D	302	A1H89	O27-S25-N56	3.52	112.43	107.35
3	C	302	A1H89	C7-C5-C4	3.47	123.61	116.95
3	B	302	A1H89	O19-S20-O21	-3.44	114.77	118.45
3	C	302	A1H89	C10-C9-C8	3.25	127.37	121.81
3	A	302	A1H89	C10-C9-C8	3.20	127.28	121.81
3	B	302	A1H89	F24-C7-C8	-3.00	115.36	120.76
3	D	302	A1H89	C7-C5-C4	2.95	122.62	116.95
3	D	302	A1H89	C10-C9-C8	2.91	126.79	121.81
3	B	302	A1H89	C10-C9-C8	2.84	126.68	121.81
3	A	302	A1H89	F28-C9-C8	-2.66	115.98	120.76
3	C	302	A1H89	O26-S25-C8	-2.60	103.46	107.28
3	D	302	A1H89	C7-C8-S25	2.57	127.60	121.34
3	D	302	A1H89	F28-C9-C8	-2.55	116.18	120.76
3	B	302	A1H89	F28-C9-C8	-2.47	116.31	120.76
3	C	302	A1H89	C2-C1-S20	-2.45	106.46	113.33
3	C	302	A1H89	F28-C9-C8	-2.43	116.38	120.76
3	D	302	A1H89	C5-C7-C8	2.39	124.70	121.36
3	C	302	A1H89	O27-S25-C8	2.35	110.73	107.28
3	B	302	A1H89	F24-C7-C5	-2.30	115.90	119.39
3	C	302	A1H89	F28-C9-C10	-2.24	116.22	119.54
3	A	302	A1H89	C10-C4-C5	-2.24	115.30	119.42

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	302	A1H89	C6-O23-C5	2.21	120.75	114.74
3	C	302	A1H89	O23-C5-C4	-2.19	117.20	120.75
3	D	302	A1H89	O19-S20-C1	-2.07	104.79	108.18
3	A	302	A1H89	O26-S25-N56	-2.07	104.37	107.35

There are no chirality outliers.

All (26) torsion outliers are listed below:

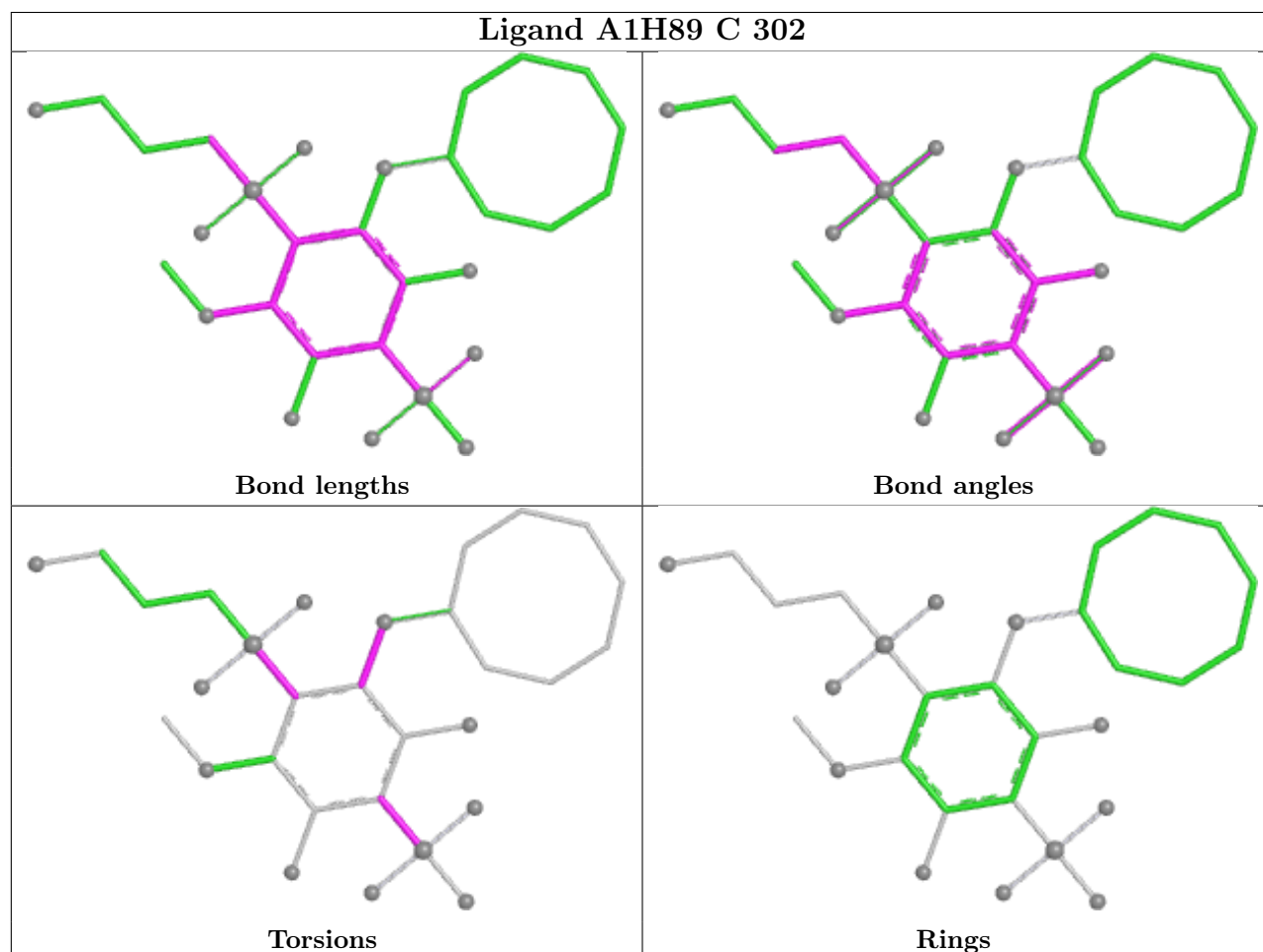
Mol	Chain	Res	Type	Atoms
3	A	302	A1H89	C7-C8-S25-O27
3	A	302	A1H89	C7-C8-S25-N56
3	A	302	A1H89	C10-C4-S20-O21
3	A	302	A1H89	C10-C4-S20-C1
3	B	302	A1H89	C9-C8-S25-O27
3	B	302	A1H89	C7-C8-S25-O27
3	B	302	A1H89	C7-C8-S25-N56
3	B	302	A1H89	C10-C4-S20-O21
3	B	302	A1H89	C10-C4-S20-C1
3	B	302	A1H89	C10-C4-S20-O19
3	C	302	A1H89	C7-C8-S25-O27
3	C	302	A1H89	C7-C8-S25-N56
3	C	302	A1H89	C10-C4-S20-O21
3	C	302	A1H89	C10-C4-S20-C1
3	D	302	A1H89	C7-C8-S25-O27
3	D	302	A1H89	C7-C8-S25-N56
3	D	302	A1H89	C10-C4-S20-O21
3	D	302	A1H89	C10-C4-S20-C1
3	D	302	A1H89	C10-C4-S20-O19
3	A	302	A1H89	C9-C8-S25-O27
3	D	302	A1H89	C9-C8-S25-O27
3	C	302	A1H89	C9-C8-S25-O27
3	C	302	A1H89	C9-C8-S25-N56
3	D	302	A1H89	C9-C8-S25-N56
3	B	302	A1H89	C9-C10-N29-C11
3	C	302	A1H89	C9-C10-N29-C11

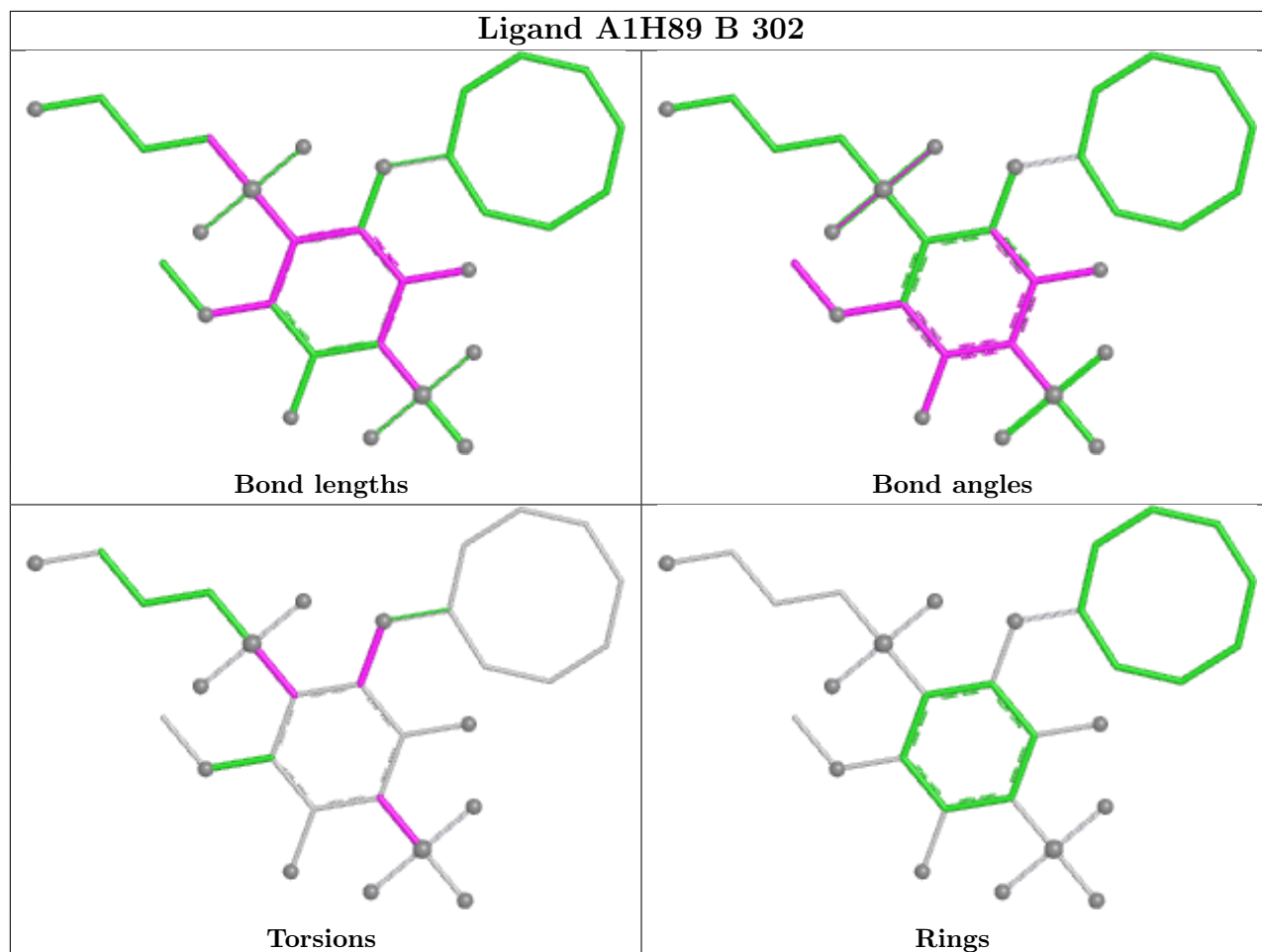
There are no ring outliers.

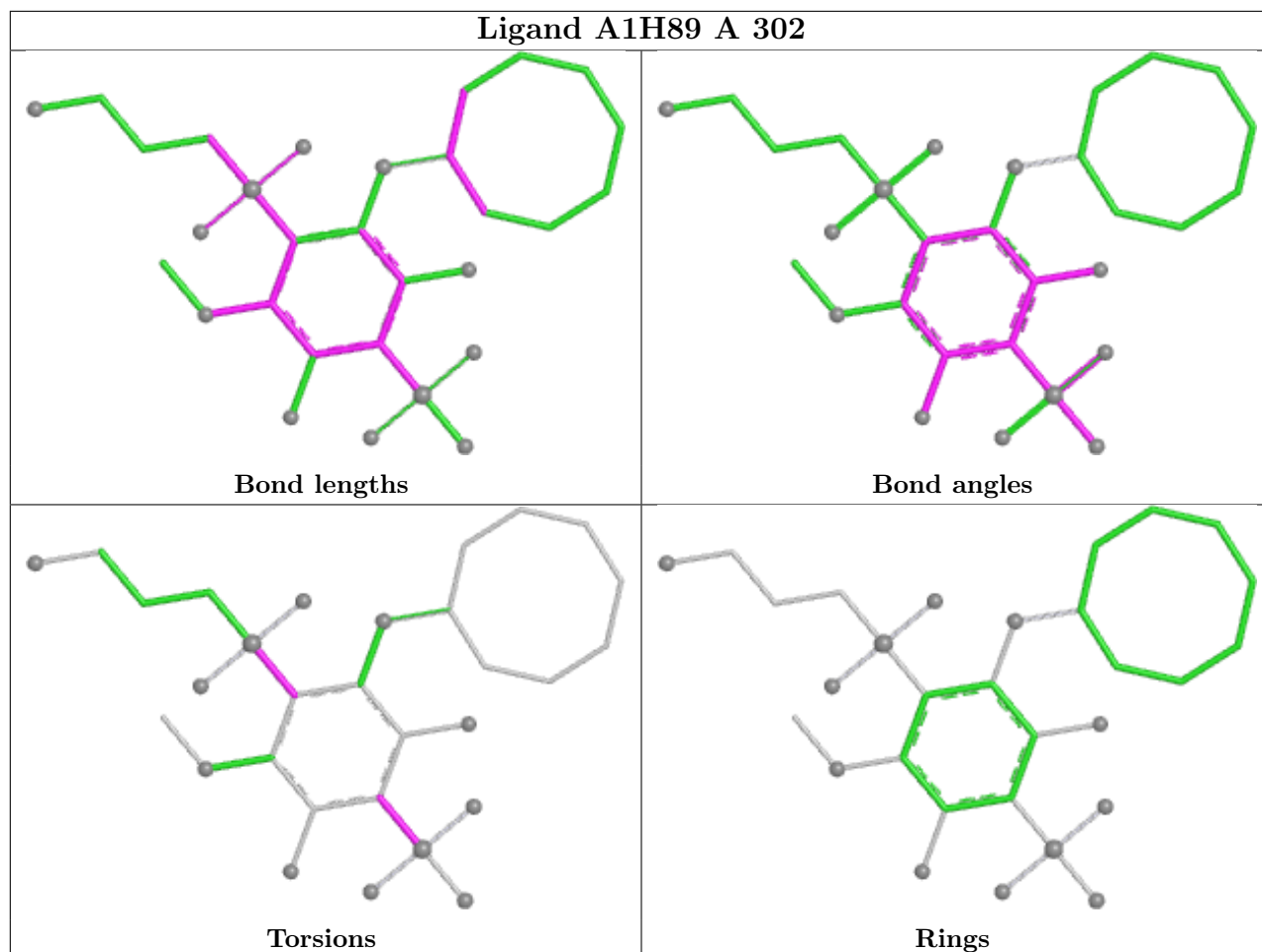
No monomer is involved in short contacts.

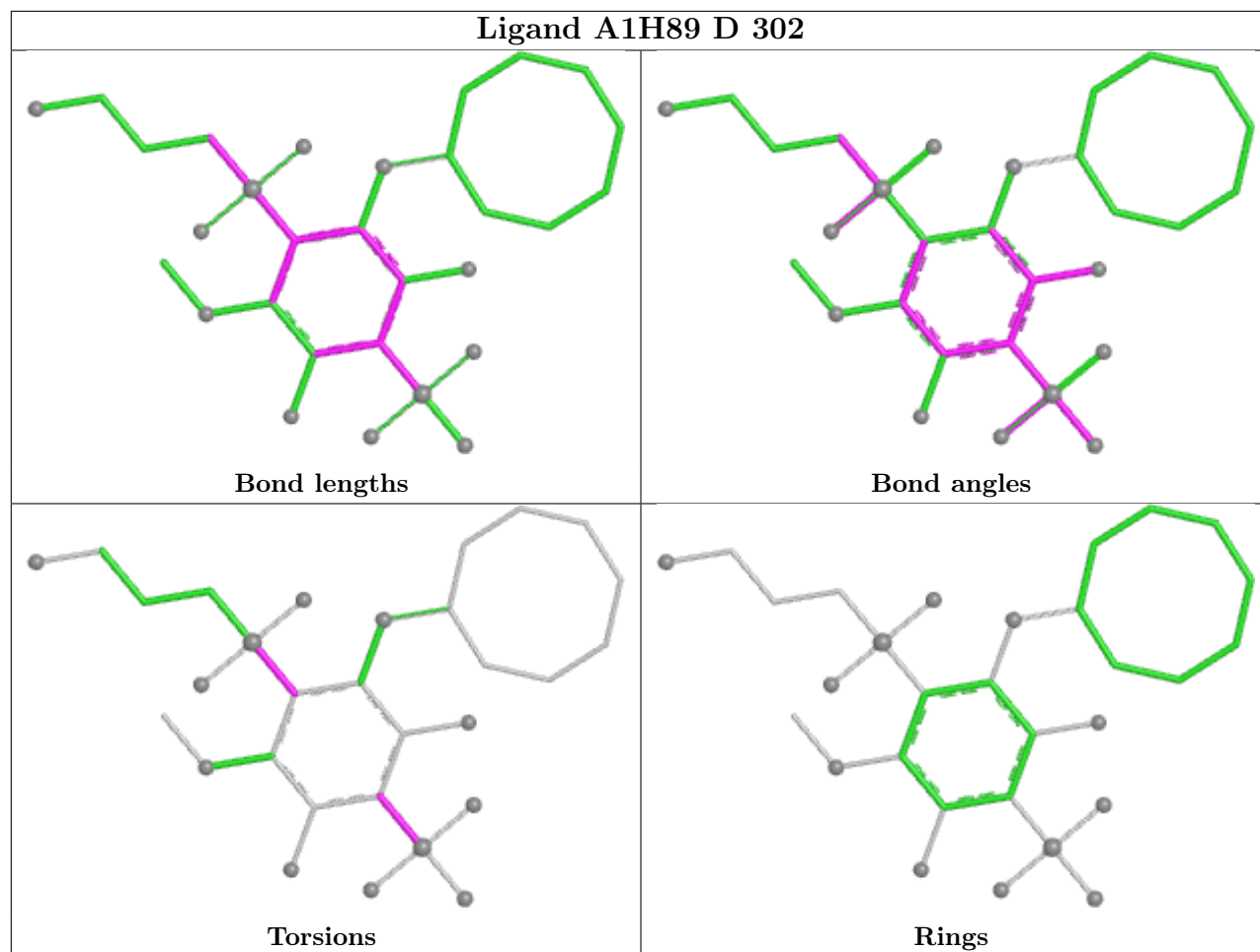
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will

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.









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

6.1 Protein, DNA and RNA chains

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q < 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	260/265 (98%)	0.10	12 (4%) 37 38	4, 9, 19, 49	0
1	B	260/265 (98%)	0.10	9 (3%) 47 49	4, 10, 22, 44	0
1	C	260/265 (98%)	1.15	58 (22%) 2 3	6, 16, 42, 57	0
1	D	260/265 (98%)	0.04	8 (3%) 51 53	4, 9, 18, 32	0
All	All	1040/1060 (98%)	0.35	87 (8%) 17 18	4, 10, 32, 57	0

All (87) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	127	TYR	9.6
1	C	133	ALA	9.2
1	C	135	ASN	7.6
1	C	130	ALA	7.0
1	C	86	TYR	6.6
1	C	132	THR	6.3
1	C	131	SER	6.1
1	C	123	ASN	5.9
1	C	79	ILE	5.7
1	C	140	LEU	5.7
1	C	77	MET	5.5
1	C	50	GLN	5.3
1	A	238	PRO	5.3
1	C	21	PRO	5.2
1	C	125	ASP	5.0
1	C	81	GLY	5.0
1	C	134	SER	4.8
1	C	139	GLY	4.6
1	C	49	PHE	4.6
1	C	128	PRO	4.6
1	C	126	LEU	4.5

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Mol	Chain	Res	Type	RSRZ
1	C	83	GLN	4.4
1	C	82	LEU	4.3
1	C	48	GLU	4.2
1	B	254	ASP	4.1
1	C	52	TYR	4.0
1	C	8	PHE	3.7
1	B	238	PRO	3.7
1	D	238	PRO	3.7
1	C	129	ASP	3.7
1	C	51	GLY	3.7
1	C	78	HIS	3.6
1	B	239	SER	3.6
1	C	187	ARG	3.5
1	C	84	SER	3.5
1	C	85	ARG	3.4
1	C	80	GLN	3.4
1	A	43	SER	3.4
1	C	263	SER	3.4
1	C	122	TYR	3.3
1	A	236	ASP	3.3
1	A	254	ASP	3.2
1	C	87	SER	3.2
1	C	124	SER	3.2
1	C	74	PRO	3.2
1	D	8	PHE	3.2
1	C	76	ASP	3.2
1	C	75	SER	3.1
1	C	137	SER	3.1
1	C	53	ASN	3.0
1	C	178	PHE	3.0
1	C	188	THR	3.0
1	B	8	PHE	3.0
1	C	136	LYS	3.0
1	A	255	GLU	2.9
1	D	254	ASP	2.9
1	A	80	GLN	2.9
1	A	237	ASP	2.8
1	C	179	ASN	2.8
1	A	239	SER	2.8
1	C	4	LYS	2.7
1	D	4	LYS	2.7
1	B	255	GLU	2.7

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Mol	Chain	Res	Type	RSRZ
1	C	138	GLU	2.7
1	C	254	ASP	2.7
1	C	47	LEU	2.6
1	C	44	LEU	2.6
1	C	255	GLU	2.6
1	C	45	THR	2.5
1	B	236	ASP	2.5
1	B	174	PHE	2.5
1	D	236	ASP	2.4
1	A	8	PHE	2.4
1	A	81	GLY	2.3
1	C	236	ASP	2.3
1	B	4	LYS	2.2
1	A	240	PRO	2.2
1	D	257	LEU	2.2
1	D	79	ILE	2.1
1	B	240	PRO	2.1
1	C	121	HIS	2.1
1	C	149	MET	2.1
1	C	239	SER	2.1
1	D	99	ASN	2.1
1	C	142	VAL	2.1
1	A	4	LYS	2.0
1	C	186	GLU	2.0

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

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

6.3 Carbohydrates [i](#)

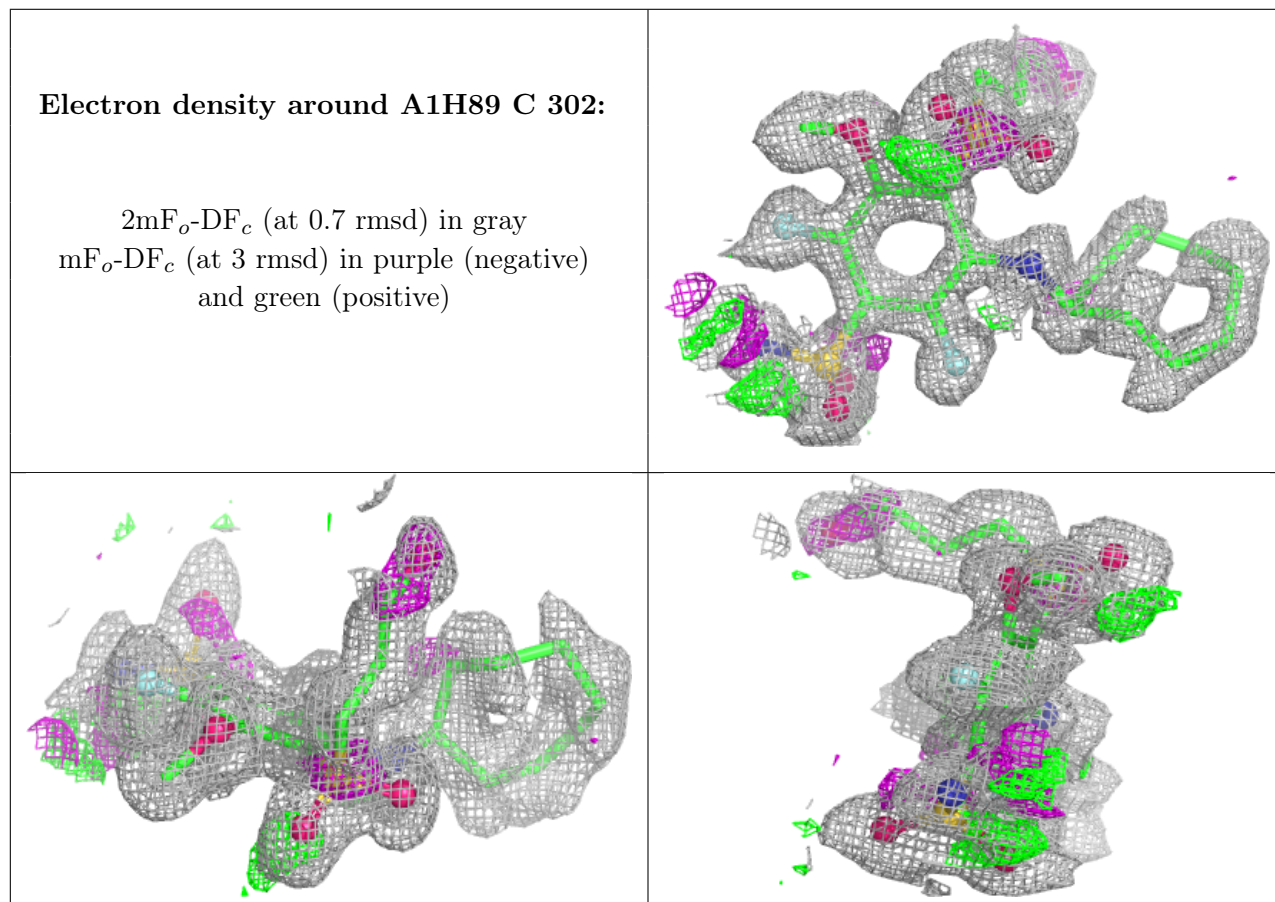
There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

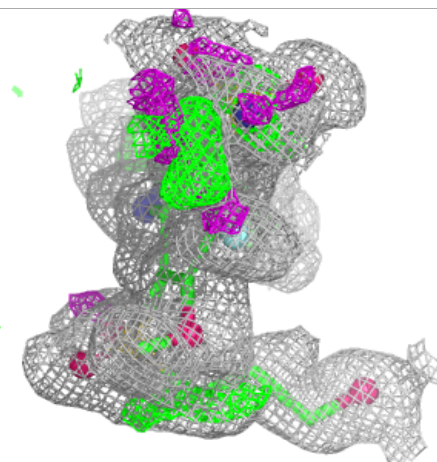
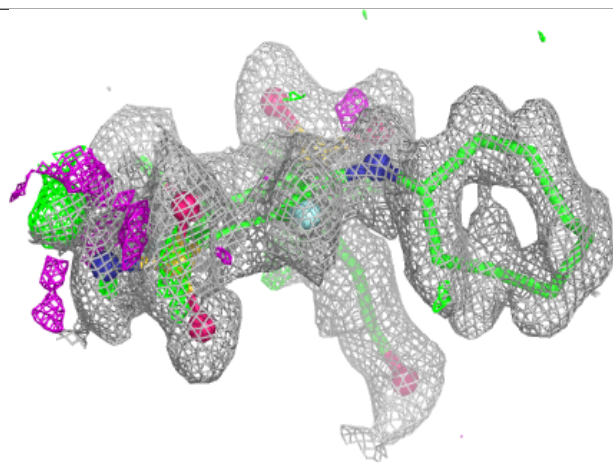
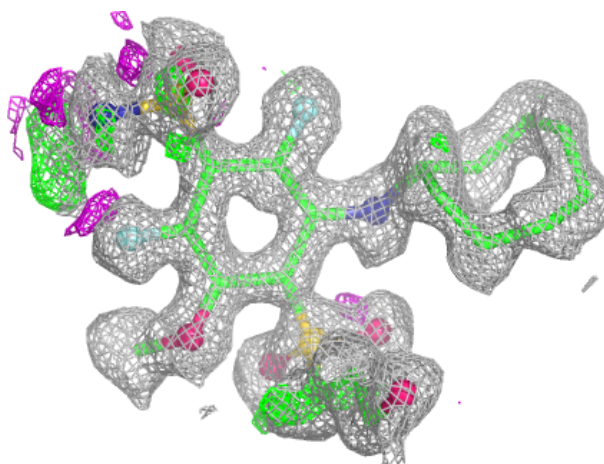
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
3	A1H89	C	302	30/30	0.97	0.08	10,13,21,22	0
3	A1H89	B	302	30/30	0.98	0.06	8,9,15,16	0
3	A1H89	A	302	30/30	0.98	0.05	5,7,10,12	0
3	A1H89	D	302	30/30	0.98	0.05	5,6,9,11	0
2	ZN	B	301	1/1	0.99	0.03	6,6,6,6	0
2	ZN	C	301	1/1	0.99	0.03	10,10,10,10	0
2	ZN	A	301	1/1	0.99	0.03	5,5,5,5	0
2	ZN	D	301	1/1	1.00	0.02	5,5,5,5	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.



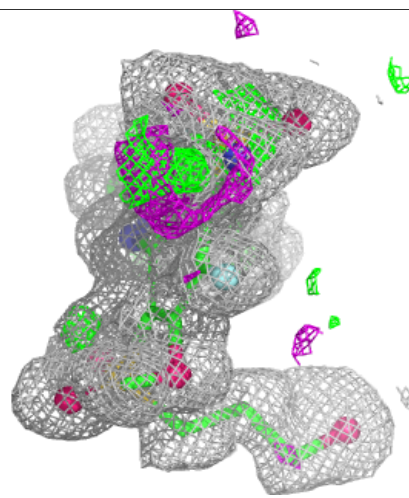
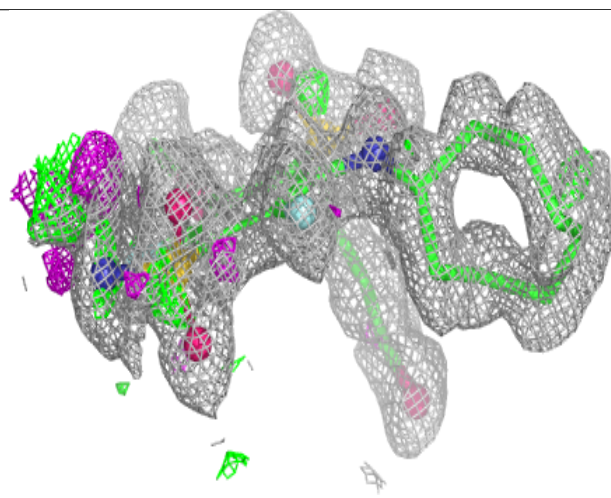
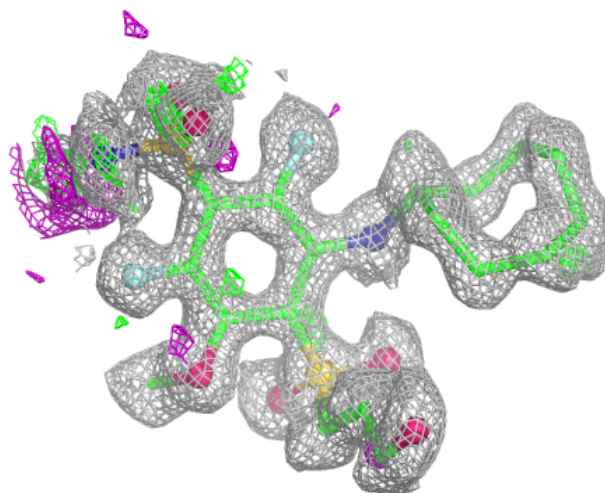
Electron density around A1H89 B 302:

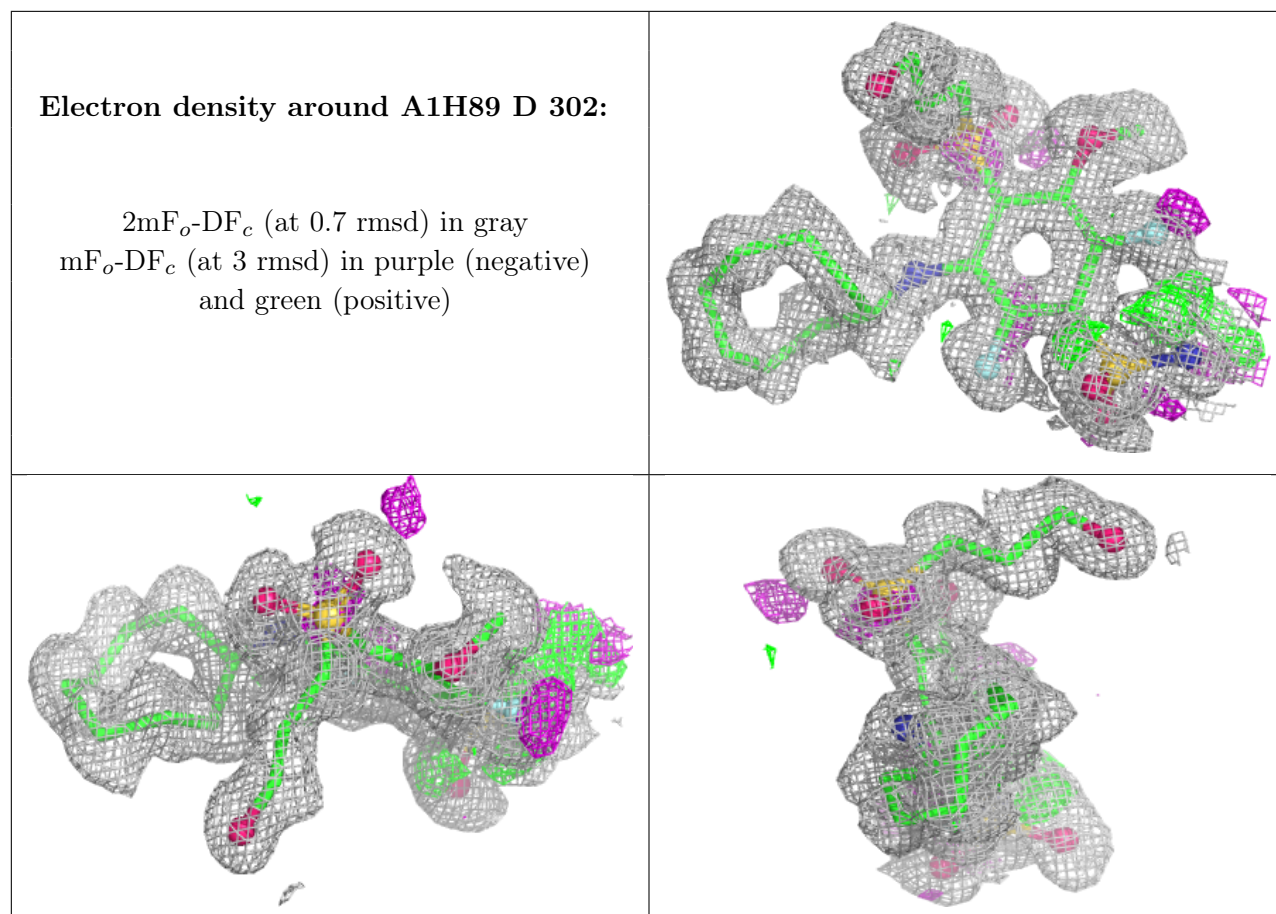
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around A1H89 A 302:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)





6.5 Other polymers [i](#)

There are no such residues in this entry.