



Full wwPDB X-ray Structure Validation Report ⓘ

May 15, 2020 – 07:51 pm BST

PDB ID : 3SKH
Title : I. Novel HCV NS5B Polymerase Inhibitors: Discovery of Indole 2- Carboxylic Acids with C3-Heterocycles
Authors : Lesburg, C.A.; Anilkumar, G.N.
Deposited on : 2011-06-22
Resolution : 2.50 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 following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.11
buster-report : 1.1.7 (2018)
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.11

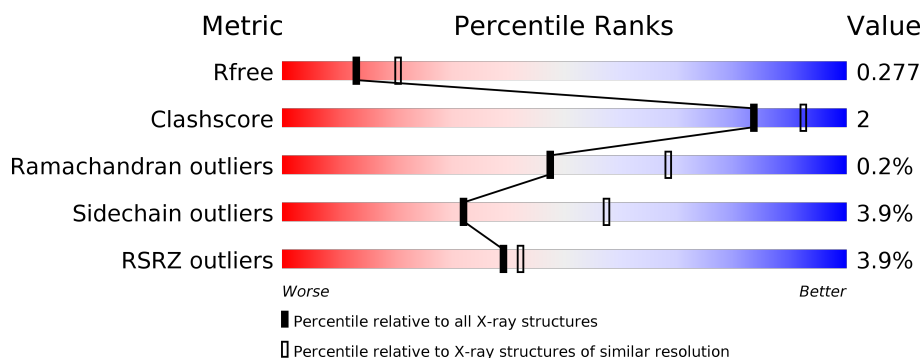
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.50 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}	130704	4661 (2.50-2.50)
Clashscore	141614	5346 (2.50-2.50)
Ramachandran outliers	138981	5231 (2.50-2.50)
Sidechain outliers	138945	5233 (2.50-2.50)
RSRZ outliers	127900	4559 (2.50-2.50)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments on 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	576	 % 88% 8% . .
1	B	576	 7% 87% 9% . .

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 9204 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.

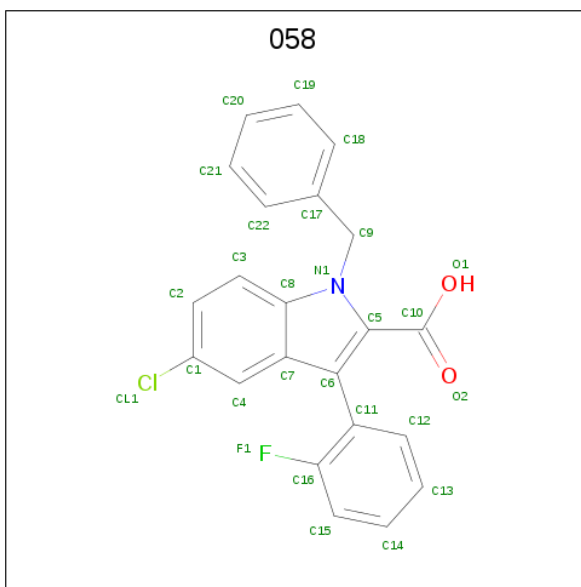
- Molecule 1 is a protein called HCV NS5B RNA_DEPENDENT RNA POLYMERASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	558	Total	C	N	O	S	0	0	0
			4347	2739	769	807	32			
1	B	558	Total	C	N	O	S	0	2	0
			4353	2742	769	809	33			

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	440	GLY	GLU	CONFLICT	UNP O92972
A	520	ILE	THR	CONFLICT	UNP O92972
A	571	GLU	-	EXPRESSION TAG	UNP O92972
A	572	ASN	-	EXPRESSION TAG	UNP O92972
A	573	LEU	-	EXPRESSION TAG	UNP O92972
A	574	TYR	-	EXPRESSION TAG	UNP O92972
A	575	PHE	-	EXPRESSION TAG	UNP O92972
A	576	GLN	-	EXPRESSION TAG	UNP O92972
B	440	GLY	GLU	CONFLICT	UNP O92972
B	520	ILE	THR	CONFLICT	UNP O92972
B	571	GLU	-	EXPRESSION TAG	UNP O92972
B	572	ASN	-	EXPRESSION TAG	UNP O92972
B	573	LEU	-	EXPRESSION TAG	UNP O92972
B	574	TYR	-	EXPRESSION TAG	UNP O92972
B	575	PHE	-	EXPRESSION TAG	UNP O92972
B	576	GLN	-	EXPRESSION TAG	UNP O92972

- Molecule 2 is 1-benzyl-5-chloro-3-(2-fluorophenyl)-1H-indole-2-carboxylic acid (three-letter code: 058) (formula: C₂₂H₁₅ClFNO₂).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
2	A	1	Total	C	Cl	F	N	O	0	0
			27	22	1	1	1	2		
2	B	1	Total	C	Cl	F	N	O	0	0
			27	22	1	1	1	2		

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	230	Total	O	0	0
			230	230		
3	B	220	Total	O	0	0
			220	220		

4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	90.44Å 107.63Å 136.07Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	50.04 – 2.50 50.04 – 2.50	Depositor EDS
% Data completeness (in resolution range)	98.7 (50.04-2.50) 98.7 (50.04-2.50)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.54 (at 2.51Å)	Xtriage
Refinement program	BUSTER	Depositor
R, R_{free}	0.199 , 0.265 0.209 , 0.277	Depositor DCC
R_{free} test set	2286 reflections (4.96%)	wwPDB-VP
Wilson B-factor (Å ²)	40.8	Xtriage
Anisotropy	0.685	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 57.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	9204	wwPDB-VP
Average B, all atoms (Å ²)	49.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.47% of the height of the origin peak. No significant pseudotranslation is detected.*

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: 058

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	0.50	0/4441	0.69	0/6026
1	B	0.50	0/4455	0.68	0/6045
All	All	0.50	0/8896	0.68	0/12071

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	4347	0	4365	18	0
1	B	4353	0	4366	24	0
2	A	27	0	14	0	0
2	B	27	0	14	0	0
3	A	230	0	0	1	0
3	B	220	0	0	0	0
All	All	9204	0	8759	42	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 2.

All (42) 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:B:321:VAL:HG21	1:B:365:SER:HB2	1.66	0.76
1:B:321:VAL:HG21	1:B:365:SER:CB	2.21	0.69
1:A:527:ASN:HD21	1:A:534:LEU:H	1.43	0.66
1:B:389:THR:HG23	1:B:492:LEU:HD21	1.83	0.61
1:B:466:LEU:HD21	1:B:547:LEU:HD11	1.82	0.61
1:B:219:TYR:HB3	1:B:320:LEU:HD23	1.84	0.59
1:B:46:SER:HA	1:B:49:GLN:HE21	1.68	0.58
1:A:201:VAL:HG13	1:A:384:LEU:HD13	1.85	0.58
1:A:389:THR:HG23	1:A:492:LEU:HD21	1.86	0.57
1:A:405:ILE:HG13	1:A:446:GLN:HE21	1.70	0.55
1:A:501:ARG:O	1:A:505:ARG:HG2	2.08	0.54
1:B:434:LEU:HD11	1:B:511:LEU:HG	1.90	0.53
1:B:309:GLN:O	1:B:324:CYS:HB2	2.09	0.52
1:B:234:ARG:HG3	1:B:262:ILE:HD11	1.92	0.52
1:A:82:LEU:HD13	1:A:249:ALA:HB2	1.92	0.51
1:A:105:ALA:O	1:A:109:ARG:HG3	2.12	0.48
1:A:17:GLU:HB3	1:A:41:THR:HG22	1.95	0.48
1:A:7:THR:HG21	1:A:273:ASN:ND2	2.29	0.47
1:B:144:VAL:HB	1:B:394:ARG:HG2	1.95	0.47
1:B:447:ILE:HB	1:B:452:TYR:CE1	2.50	0.47
1:A:517:ARG:HA	1:A:520:ILE:HD12	1.99	0.45
1:B:192:GLY:HA3	1:B:316:ASN:OD1	2.16	0.45
1:A:24:ASN:HB3	1:A:27:SER:OG	2.16	0.45
1:B:485:VAL:O	1:B:489:LEU:HG	2.17	0.45
1:B:234:ARG:CG	1:B:262:ILE:HD11	2.47	0.44
1:B:495:PRO:HG2	1:B:503:ARG:HH12	1.82	0.44
1:A:264:GLY:HA3	3:A:603:HOH:O	2.17	0.44
1:B:22:PRO:HG2	1:B:400:ALA:HB1	1.98	0.44
1:B:313:MET:HG2	1:B:322:VAL:HG22	1.99	0.44
1:B:359:ASP:HB3	1:B:362:LEU:HD12	2.00	0.43
1:B:461:GLN:HB3	1:B:542:ALA:HA	2.00	0.43
1:B:48:ARG:NH1	1:B:51:LYS:HD2	2.34	0.43
1:A:542:ALA:HA	1:A:545:LEU:HD12	2.00	0.42
1:B:141:LYS:HD2	1:B:160:ILE:HD11	2.02	0.42
1:A:48:ARG:HG2	1:A:159:LEU:HD13	2.00	0.42
1:A:134:ILE:HG13	1:A:259:ARG:HB3	2.02	0.42
1:A:488:CYS:SG	1:A:492:LEU:HD23	2.60	0.41
1:A:219:TYR:HB3	1:A:320:LEU:HD23	2.02	0.41
1:B:257:THR:HA	1:B:261:TYR:HB2	2.02	0.41
1:B:434:LEU:HG	1:B:439:LEU:HD11	2.02	0.40
1:A:119:ILE:HD13	1:A:169:VAL:HG11	2.02	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:458:ASP:HA	1:B:461:GLN:HE22	1.87	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	554/576 (96%)	531 (96%)	23 (4%)	0	100	100
1	B	556/576 (96%)	529 (95%)	25 (4%)	2 (0%)	34	54
All	All	1110/1152 (96%)	1060 (96%)	48 (4%)	2 (0%)	47	68

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	538	PRO
1	B	532	THR

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	475/490 (97%)	456 (96%)	19 (4%)	31	56
1	B	477/490 (97%)	459 (96%)	18 (4%)	33	58
All	All	952/980 (97%)	915 (96%)	37 (4%)	32	57

All (37) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	18	GLU
1	A	56	ARG
1	A	57	LEU
1	A	100	LYS
1	A	111	LEU
1	A	114	ARG
1	A	121	SER
1	A	184	GLN
1	A	201	VAL
1	A	274	CYS
1	A	315	VAL
1	A	336	LEU
1	A	355	GLN
1	A	379	LYS
1	A	384	LEU
1	A	507	VAL
1	A	544	GLN
1	A	545	LEU
1	A	556	SER
1	B	23	ILE
1	B	31	LEU
1	B	56	ARG
1	B	57	LEU
1	B	81	LYS
1	B	184	GLN
1	B	201	VAL
1	B	262	ILE
1	B	336	LEU
1	B	364	THR
1	B	384	LEU
1	B	434	LEU
1	B	461	GLN
1	B	469	LEU
1	B	484	ARG
1	B	498	ARG
1	B	547	LEU
1	B	556	SER

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (18) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	34	HIS
1	A	35	ASN
1	A	49	GLN
1	A	184	GLN
1	A	194	GLN
1	A	273	ASN
1	A	309	GLN
1	A	411	ASN
1	A	446	GLN
1	A	461	GLN
1	A	514	GLN
1	A	527	ASN
1	A	544	GLN
1	B	35	ASN
1	B	49	GLN
1	B	273	ASN
1	B	428	HIS
1	B	461	GLN

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 carbohydrates in this entry.

5.6 Ligand geometry [i](#)

2 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	058	B	577	-	23,30,30	1.33	3 (13%)	29,43,43	0.81	3 (10%)
2	058	A	577	-	23,30,30	1.31	2 (8%)	29,43,43	0.82	1 (3%)

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	058	B	577	-	-	2/8/12/12	0/4/4/4
2	058	A	577	-	-	2/8/12/12	0/4/4/4

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	577	058	C11-C6	-3.43	1.46	1.50
2	A	577	058	C11-C6	-2.96	1.46	1.50
2	A	577	058	C4-C1	2.36	1.41	1.36
2	B	577	058	C3-C2	2.15	1.41	1.36
2	B	577	058	C6-C7	-2.07	1.42	1.47

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	577	058	C6-C5-N1	-2.22	106.05	108.24
2	B	577	058	C6-C5-N1	-2.19	106.08	108.24
2	B	577	058	C15-C16-C11	-2.02	120.83	123.30
2	B	577	058	C12-C11-C16	2.00	118.99	116.10

There are no chirality outliers.

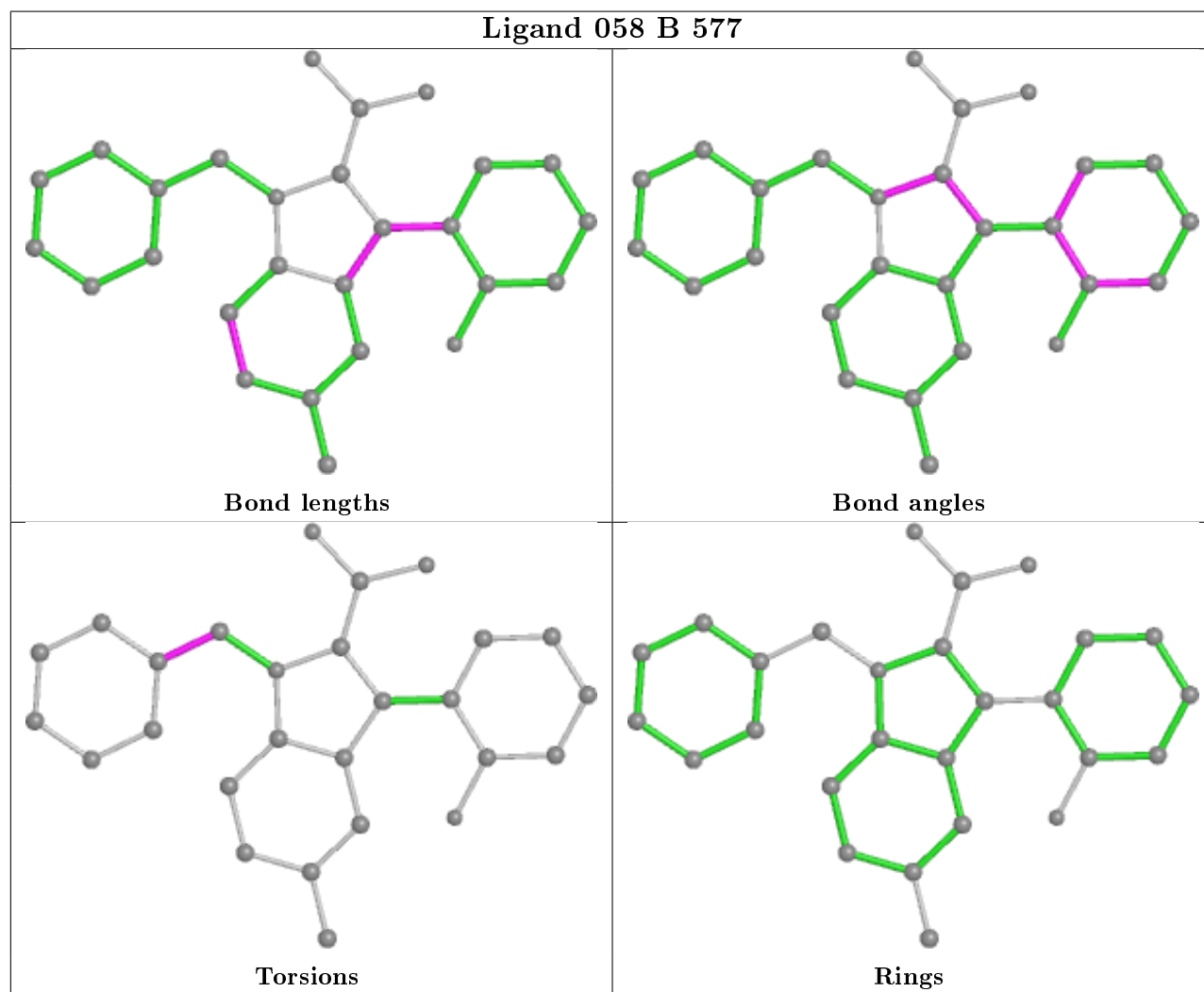
All (4) torsion outliers are listed below:

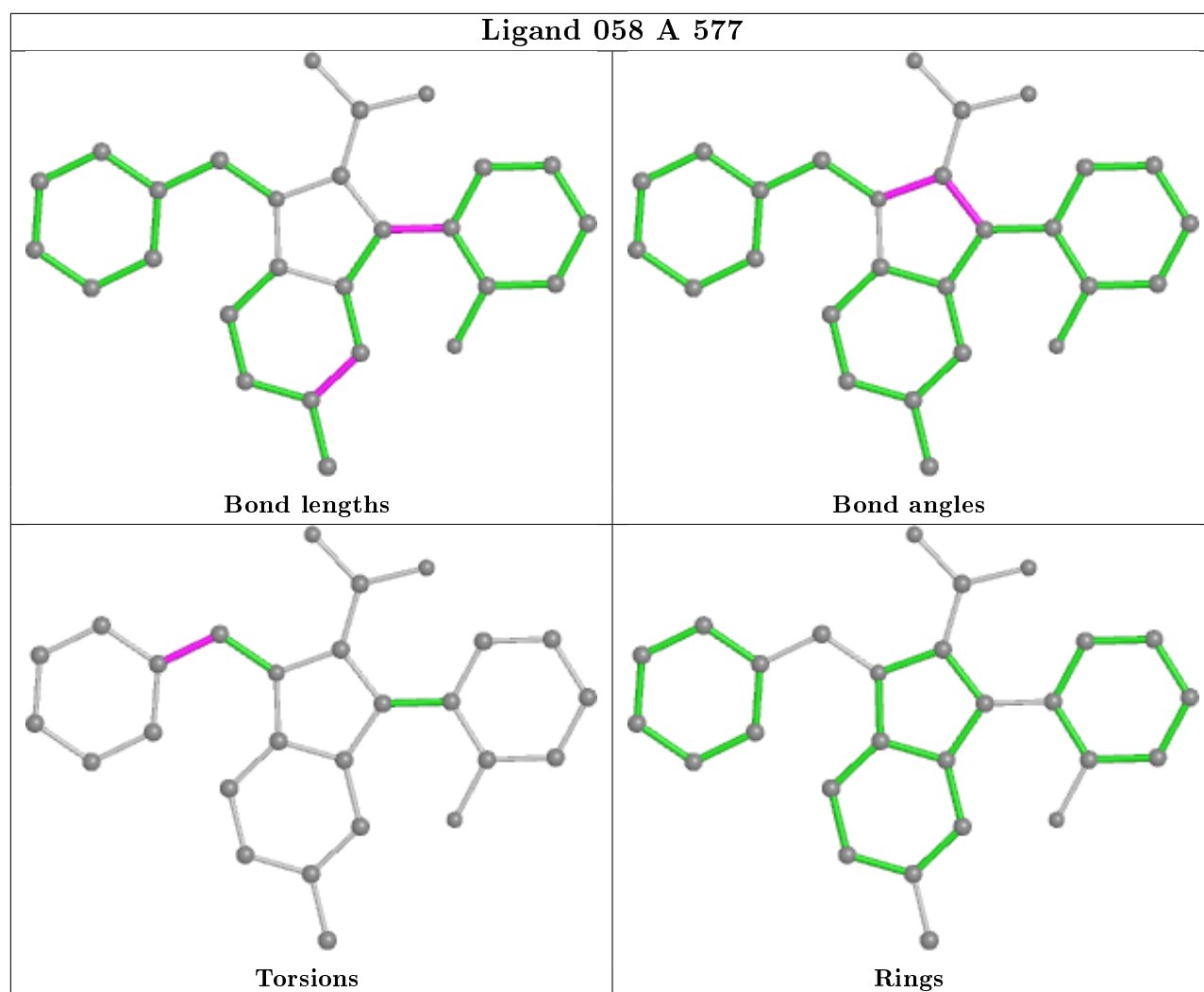
Mol	Chain	Res	Type	Atoms
2	B	577	058	C22-C17-C9-N1
2	A	577	058	C22-C17-C9-N1
2	A	577	058	C18-C17-C9-N1
2	B	577	058	C18-C17-C9-N1

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	558/576 (96%)	-0.19	4 (0%)	87 89	29, 43, 65, 93	0
1	B	558/576 (96%)	0.23	39 (6%)	16 16	26, 50, 87, 122	3 (0%)
All	All	1116/1152 (96%)	0.02	43 (3%)	39 42	26, 46, 77, 122	3 (0%)

All (43) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	544	GLN	8.5
1	B	542	ALA	8.3
1	B	545	LEU	7.2
1	B	534	LEU	6.7
1	B	242	CYS	6.4
1	B	26	LEU	4.8
1	B	24	ASN	4.7
1	B	531	ARG	4.7
1	B	23	ILE	4.5
1	B	529	ALA	4.4
1	B	548	SER	4.0
1	B	541	ALA	3.9
1	B	536	LEU	3.9
1	B	563	SER	3.8
1	B	543	SER	3.5
1	B	547	LEU	3.0
1	B	532	THR	3.0
1	A	535	LYS	2.9
1	B	479	PRO	2.9
1	B	562	HIS	2.9
1	B	435	ALA	2.8
1	B	537	THR	2.7
1	B	514	GLN	2.6
1	B	25	PRO	2.5

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Mol	Chain	Res	Type	RSRZ
1	B	19	SER	2.5
1	B	372	VAL	2.4
1	A	14	CYS	2.4
1	B	213	CYS	2.3
1	B	380	ARG	2.3
1	B	513	SER	2.3
1	B	528	TRP	2.2
1	B	483	ASN	2.2
1	B	14	CYS	2.2
1	B	327	ALA	2.2
1	A	15	ALA	2.2
1	A	16	ALA	2.2
1	B	540	PRO	2.2
1	B	519	ALA	2.1
1	B	501	ARG	2.1
1	B	401	ARG	2.0
1	B	451[A]	CYS	2.0
1	B	492	LEU	2.0
1	B	212	LYS	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 carbohydrates 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.

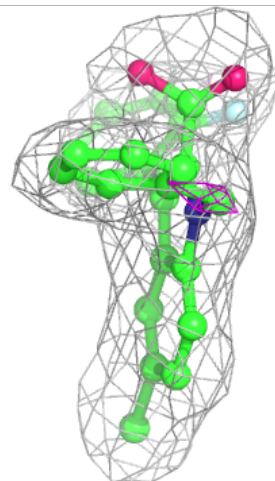
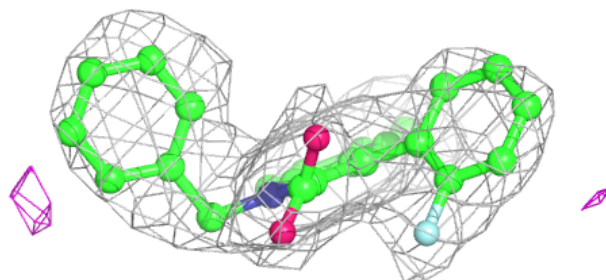
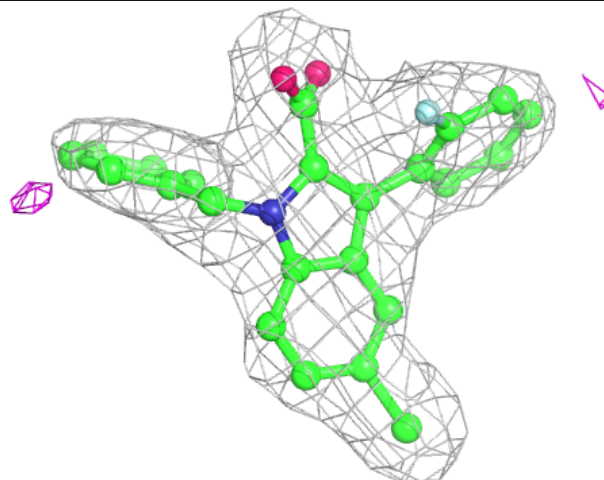
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
2	058	A	577	27/27	0.94	0.16	40,48,51,53	0
2	058	B	577	27/27	0.95	0.14	44,54,57,58	0

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.

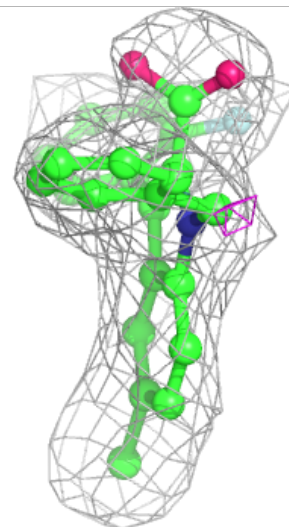
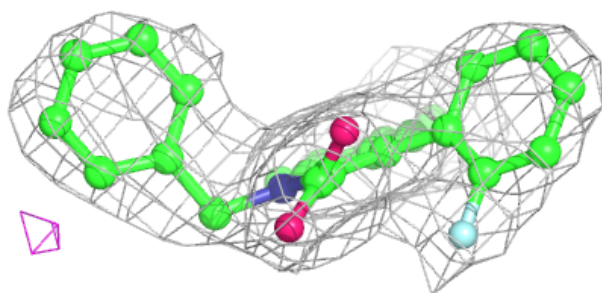
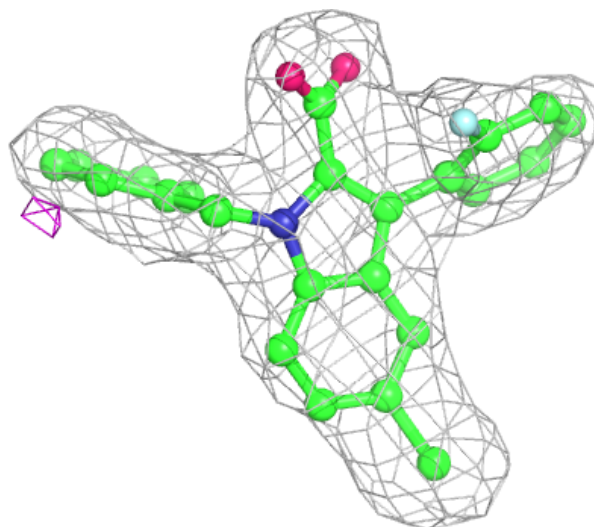
Electron density around 058 A 577:

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



Electron density around 058 B 577:

$2mF_o-DF_c$ (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.