



Full wwPDB X-ray Structure Validation Report ⓘ

Jul 25, 2022 – 08:14 PM JST

PDB ID : 7FH2
Title : Crystal structure of the first bromodomain of BRD4 in complex with 16D10
Authors : Yokoyama, T.; Hirasawa, N.
Deposited on : 2021-07-29
Resolution : 2.49 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at <http://www.wwpdb.org/validation/2017/FAQs#types>.

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

MolProbity : 4.02b-467
Mogul : ?? (??), CSD ??CSD?? (????)
Xtriage (Phenix) : 1.13
EDS : 2.29
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) : 2.29

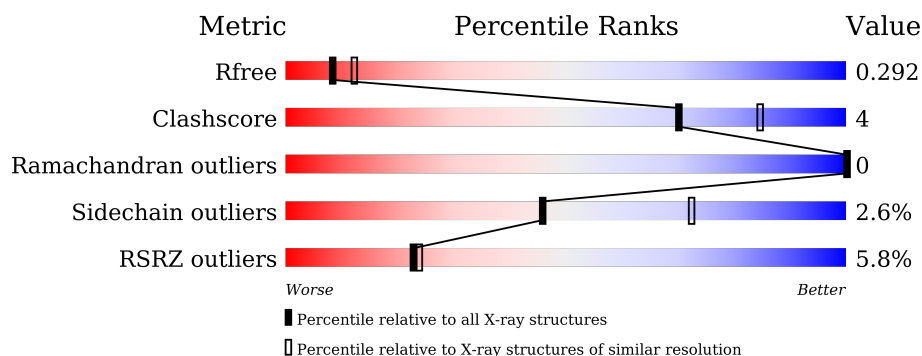
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.49 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 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	135	<div> <div>7%</div> <div>77% 10% 13%</div> </div>
1	B	135	<div> <div>4%</div> <div>79% 9% 13%</div> </div>
1	C	135	<div> <div>7%</div> <div>68% 10% 21%</div> </div>
1	D	135	<div> <div>2%</div> <div>64% 13% 23%</div> </div>

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 3908 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 Bromodomain-containing protein 4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	118	Total	C	N	O	S	0	0	0
			985	642	159	178	6			
1	B	118	Total	C	N	O	S	0	0	0
			979	638	157	178	6			
1	C	106	Total	C	N	O	S	0	0	0
			896	588	144	158	6			
1	D	104	Total	C	N	O	S	0	0	0
			882	579	142	155	6			

There are 32 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	34	MET	-	initiating methionine	UNP O60885
A	35	HIS	-	expression tag	UNP O60885
A	36	HIS	-	expression tag	UNP O60885
A	37	HIS	-	expression tag	UNP O60885
A	38	HIS	-	expression tag	UNP O60885
A	39	HIS	-	expression tag	UNP O60885
A	40	HIS	-	expression tag	UNP O60885
A	41	MET	-	expression tag	UNP O60885
B	34	MET	-	initiating methionine	UNP O60885
B	35	HIS	-	expression tag	UNP O60885
B	36	HIS	-	expression tag	UNP O60885
B	37	HIS	-	expression tag	UNP O60885
B	38	HIS	-	expression tag	UNP O60885
B	39	HIS	-	expression tag	UNP O60885
B	40	HIS	-	expression tag	UNP O60885
B	41	MET	-	expression tag	UNP O60885
C	34	MET	-	initiating methionine	UNP O60885
C	35	HIS	-	expression tag	UNP O60885
C	36	HIS	-	expression tag	UNP O60885
C	37	HIS	-	expression tag	UNP O60885
C	38	HIS	-	expression tag	UNP O60885

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Chain	Residue	Modelled	Actual	Comment	Reference
C	39	HIS	-	expression tag	UNP O60885
C	40	HIS	-	expression tag	UNP O60885
C	41	MET	-	expression tag	UNP O60885
D	34	MET	-	initiating methionine	UNP O60885
D	35	HIS	-	expression tag	UNP O60885
D	36	HIS	-	expression tag	UNP O60885
D	37	HIS	-	expression tag	UNP O60885
D	38	HIS	-	expression tag	UNP O60885
D	39	HIS	-	expression tag	UNP O60885
D	40	HIS	-	expression tag	UNP O60885
D	41	MET	-	expression tag	UNP O60885

- 4JI
-
- Chemical structure diagram of a complex molecule, identified as 4JI. The structure features two benzene rings connected by a central chain. The left benzene ring is substituted with CAW, OAV, CAP, CAD, CAM, CAL, CAK, CAN, and OAX. The right benzene ring is substituted with CAB, CAA, CAD, CAF, CAE, CAC, and CAT. The central chain includes a carbonyl group (OAJ), a double bond (CAH), and a side chain (CAZ) containing an amide group (NH) and a carbonyl group (CBB). The side chain is further substituted with NBA, CBB, OBC, and CBD. The molecule is shown in a 3D perspective with various atoms and bonds highlighted in different colors.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total 30	C 23	N 1	O 6	0	0
2	B	1	Total 30	C 23	N 1	O 6	0	0
2	B	1	Total 30	C 23	N 1	O 6	0	0
2	D	1	Total 30	C 23	N 1	O 6	0	0

- WORLDWIDE
PDB
PROTEIN DATA BANK

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total Cl 1 1	0	0
3	B	1	Total Cl 1 1	0	0
3	C	1	Total Cl 1 1	0	0
3	D	1	Total Cl 1 1	0	0

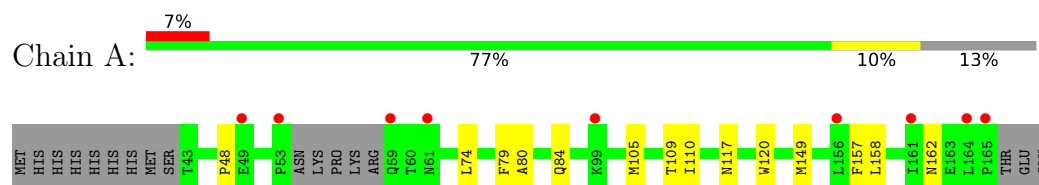
- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	11	Total O 11 11	0	0
4	B	10	Total O 10 10	0	0
4	C	10	Total O 10 10	0	0
4	D	11	Total O 11 11	0	0

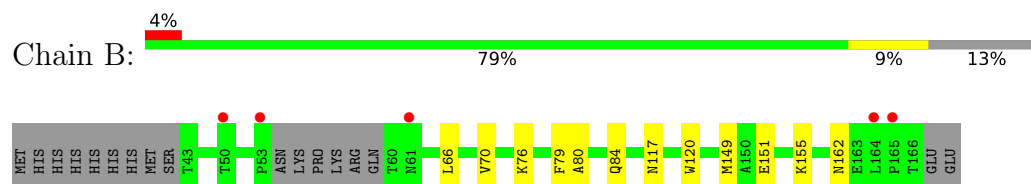
3 Residue-property plots [i](#)

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.

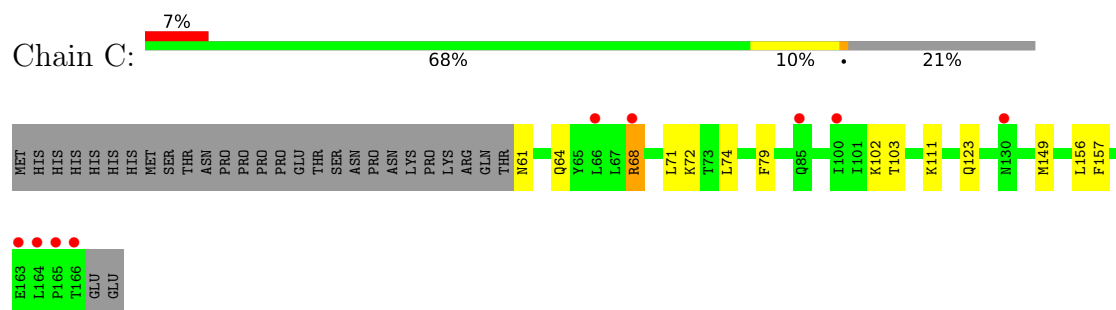
- Molecule 1: Bromodomain-containing protein 4



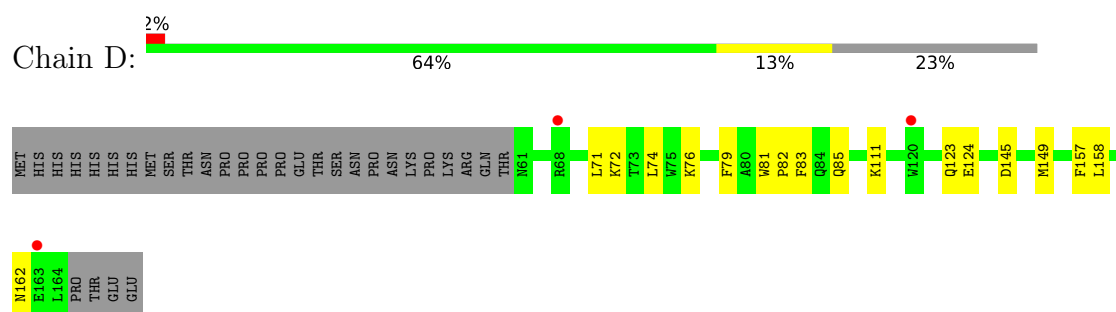
- Molecule 1: Bromodomain-containing protein 4



- Molecule 1: Bromodomain-containing protein 4



- Molecule 1: Bromodomain-containing protein 4



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	73.01Å 75.88Å 110.80Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	19.63 – 2.49 47.52 – 2.49	Depositor EDS
% Data completeness (in resolution range)	98.1 (19.63-2.49) 99.3 (47.52-2.49)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.00 (at 2.48Å)	Xtriage
Refinement program	PHENIX (1.12_2829: ???)	Depositor
R, R_{free}	0.253 , 0.292 0.257 , 0.292	Depositor DCC
R_{free} test set	1100 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	46.9	Xtriage
Anisotropy	1.010	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 45.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtriage
Estimated twinning fraction	0.000 for k,h,-l	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	3908	wwPDB-VP
Average B, all atoms (Å ²)	63.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 50.89 % 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 6.0666e-05. 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 [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: CL, 4JI

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	0.26	0/1013	0.42	0/1380
1	B	0.26	0/1007	0.41	0/1374
1	C	0.24	0/920	0.39	0/1249
1	D	0.25	0/905	0.39	0/1227
All	All	0.25	0/3845	0.40	0/5230

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 [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	985	0	977	7	0
1	B	979	0	965	5	0
1	C	896	0	898	8	0
1	D	882	0	884	8	0
2	A	30	0	0	0	0
2	B	60	0	0	0	0
2	D	30	0	0	0	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	C	1	0	0	0	0
3	D	1	0	0	0	0
4	A	11	0	0	0	0
4	B	10	0	0	0	0
4	C	10	0	0	0	0
4	D	11	0	0	0	0
All	All	3908	0	3724	27	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 4.

All (27) 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:105:MET:HE1	1:A:110:ILE:HG13	1.75	0.68
1:C:71:LEU:HD21	1:C:111:LYS:HB2	1.82	0.61
1:D:158:LEU:O	1:D:162:ASN:ND2	2.32	0.58
1:A:105:MET:HE1	1:A:110:ILE:CG1	2.35	0.56
1:C:74:LEU:HD23	1:C:156:LEU:HD23	1.91	0.53
1:D:81:TRP:CD2	1:D:82:PRO:HD3	2.45	0.52
1:D:72:LYS:O	1:D:76:LYS:HG2	2.12	0.50
1:A:74:LEU:HD21	1:A:157:PHE:HB2	1.94	0.49
1:D:82:PRO:HG2	1:D:83:PHE:CE2	2.46	0.49
1:B:79:PHE:HB3	1:B:149:MET:HB3	1.95	0.48
1:D:74:LEU:HD11	1:D:157:PHE:HB2	1.96	0.47
1:C:74:LEU:HD11	1:C:157:PHE:HB2	1.98	0.45
1:A:48:PRO:HD2	1:A:109:THR:HG21	1.99	0.44
1:C:79:PHE:CD1	1:C:149:MET:HG2	2.53	0.43
1:B:151:GLU:O	1:B:155:LYS:HD3	2.17	0.43
1:C:68:ARG:O	1:C:72:LYS:HD2	2.19	0.43
1:C:79:PHE:HB3	1:C:149:MET:HB3	2.01	0.43
1:D:71:LEU:HD22	1:D:111:LYS:HE3	2.01	0.42
1:B:76:LYS:NZ	1:D:124:GLU:OE1	2.34	0.42
1:C:61:ASN:HA	1:C:64:GLN:HE21	1.85	0.42
1:C:103:THR:O	1:C:103:THR:OG1	2.33	0.41
1:A:158:LEU:O	1:A:162:ASN:HB2	2.21	0.41
1:D:79:PHE:CD1	1:D:149:MET:HG2	2.56	0.41
1:A:80:ALA:O	1:A:84:GLN:HG3	2.22	0.40
1:A:79:PHE:HB3	1:A:149:MET:HB3	2.04	0.40
1:B:66:LEU:HD23	1:B:70:VAL:HG21	2.03	0.40
1:B:80:ALA:O	1:B:84:GLN:HG3	2.22	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	114/135 (84%)	113 (99%)	1 (1%)	0	100	100
1	B	114/135 (84%)	114 (100%)	0	0	100	100
1	C	104/135 (77%)	104 (100%)	0	0	100	100
1	D	102/135 (76%)	101 (99%)	1 (1%)	0	100	100
All	All	434/540 (80%)	432 (100%)	2 (0%)	0	100	100

There are no Ramachandran outliers to report.

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	111/128 (87%)	109 (98%)	2 (2%)	59	81
1	B	110/128 (86%)	107 (97%)	3 (3%)	44	71
1	C	99/128 (77%)	96 (97%)	3 (3%)	41	68
1	D	97/128 (76%)	94 (97%)	3 (3%)	40	67
All	All	417/512 (81%)	406 (97%)	11 (3%)	46	72

All (11) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	117	ASN
1	A	120	TRP
1	B	117	ASN
1	B	120	TRP
1	B	162	ASN
1	C	68	ARG
1	C	102	LYS
1	C	123	GLN
1	D	85	GLN
1	D	123	GLN
1	D	145	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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 ⓘ

There are no monosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 8 ligands modelled in this entry, 4 are monoatomic - leaving 4 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

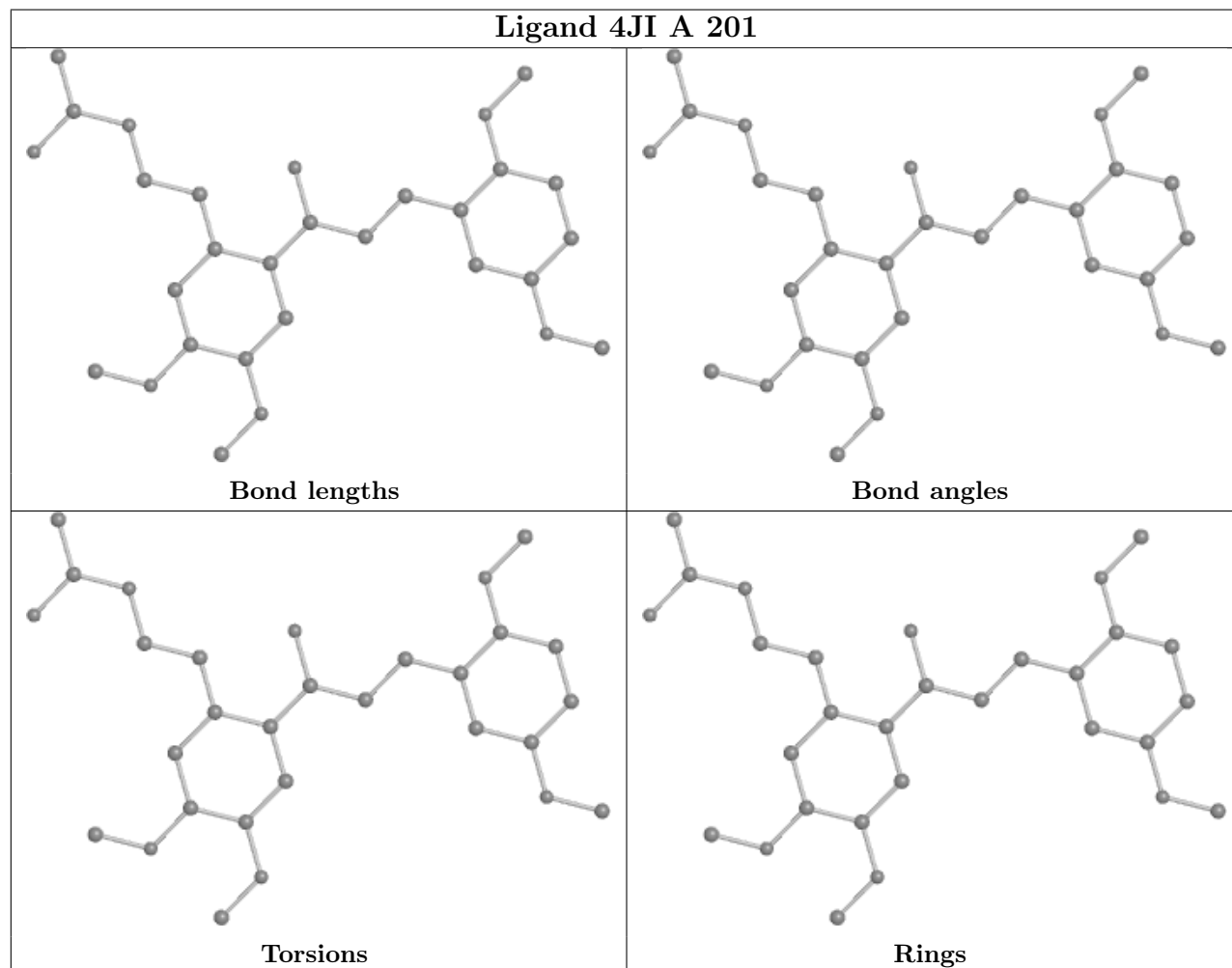
There are no torsion outliers.

There are no ring outliers.

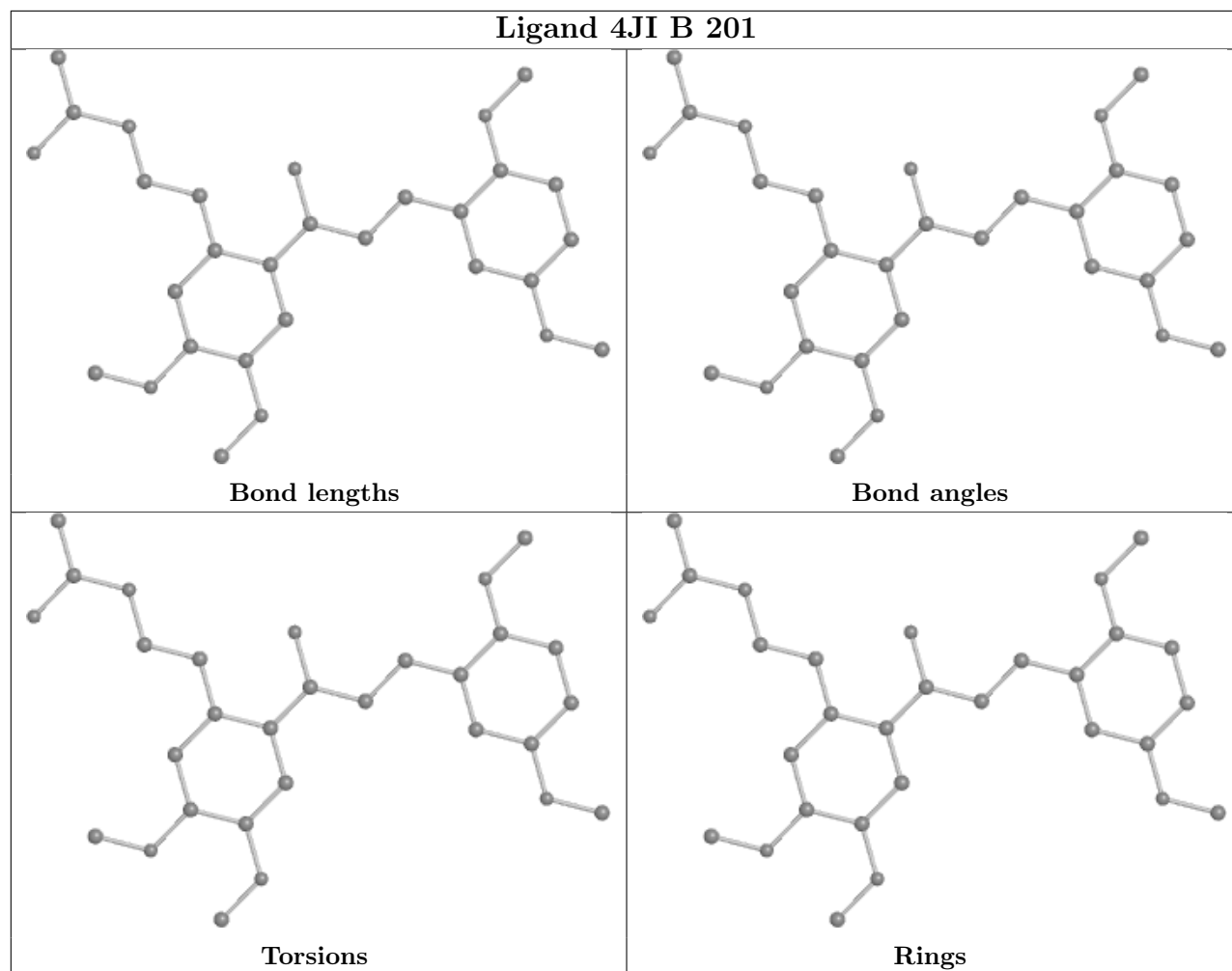
No monomer is involved in short contacts.

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

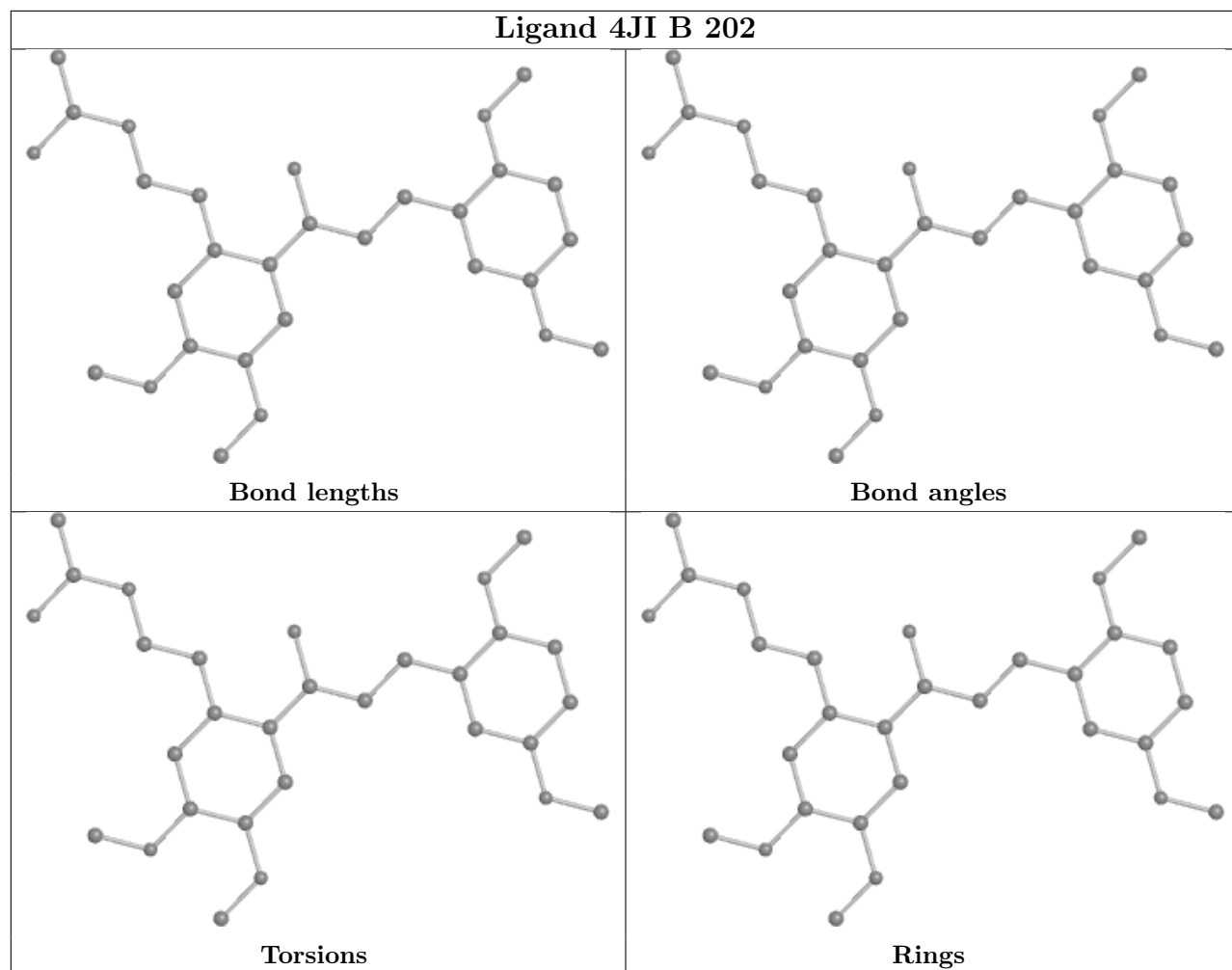
addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. 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.

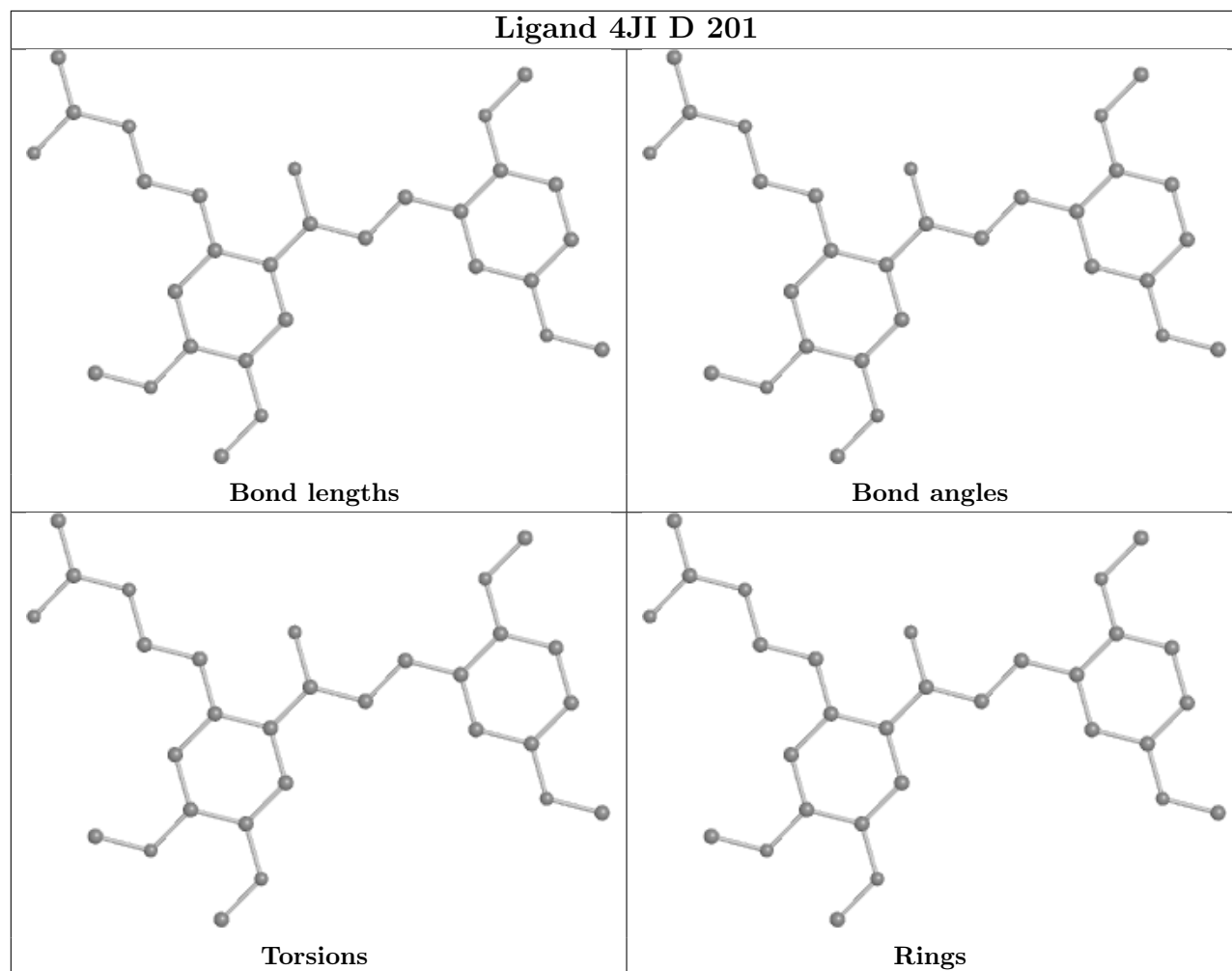


Ligand 4JI B 201



Ligand 4JI B 202





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	118/135 (87%)	0.74	9 (7%) 13 14	50, 62, 88, 113	0
1	B	118/135 (87%)	0.69	5 (4%) 36 39	49, 62, 87, 106	0
1	C	106/135 (78%)	0.87	9 (8%) 10 10	50, 61, 90, 131	0
1	D	104/135 (77%)	0.59	3 (2%) 51 55	45, 56, 78, 106	0
All	All	446/540 (82%)	0.72	26 (5%) 23 24	45, 61, 88, 131	0

All (26) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	165	PRO	11.4
1	A	59	GLN	5.0
1	C	166	THR	4.5
1	B	165	PRO	4.0
1	A	165	PRO	3.8
1	A	53	PRO	3.6
1	C	164	LEU	3.3
1	D	68	ARG	3.2
1	A	164	LEU	3.1
1	C	100	ILE	2.8
1	C	163	GLU	2.8
1	B	53	PRO	2.7
1	C	68	ARG	2.6
1	D	120	TRP	2.6
1	B	164	LEU	2.5
1	A	161	ILE	2.5
1	A	156	LEU	2.5
1	B	50	THR	2.4
1	C	130	ASN	2.4
1	A	99	LYS	2.3
1	C	85	GLN	2.3

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Mol	Chain	Res	Type	RSRZ
1	A	49	GLU	2.3
1	A	61	ASN	2.2
1	C	66	LEU	2.1
1	B	61	ASN	2.1
1	D	163	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 monosaccharides in this entry.

6.4 Ligands [i](#)

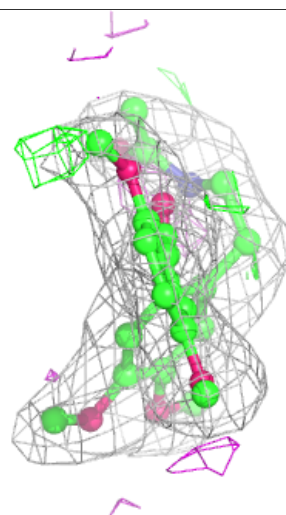
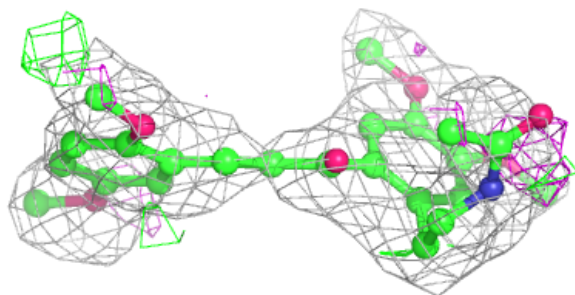
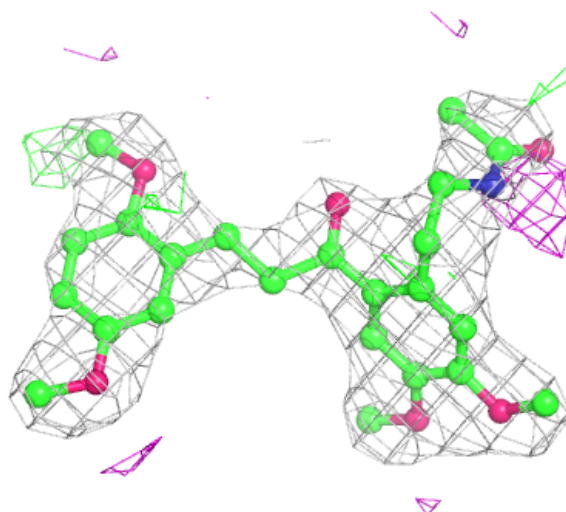
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	CL	B	203	1/1	0.68	0.15	74,74,74,74	0
3	CL	A	202	1/1	0.78	0.17	69,69,69,69	0
2	4JI	B	202	30/30	0.88	0.25	37,52,56,57	0
2	4JI	D	201	30/30	0.91	0.21	37,50,54,55	0
3	CL	D	202	1/1	0.91	0.18	61,61,61,61	0
2	4JI	B	201	30/30	0.93	0.20	45,48,53,55	0
3	CL	C	201	1/1	0.94	0.22	65,65,65,65	0
2	4JI	A	201	30/30	0.94	0.21	42,51,58,60	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.

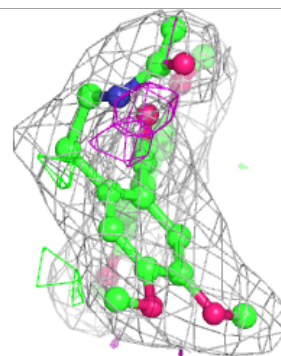
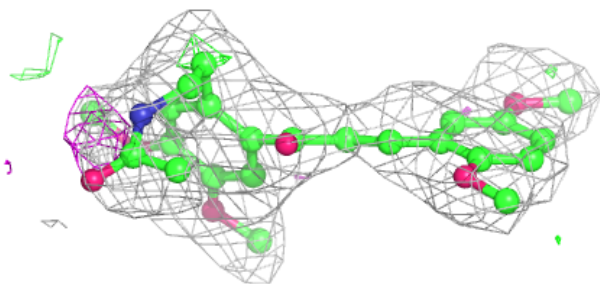
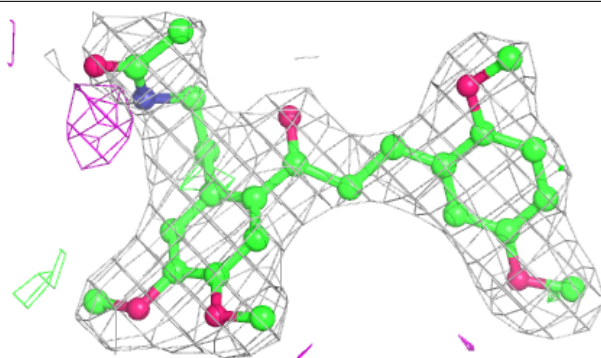
Electron density around 4JI B 202:

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

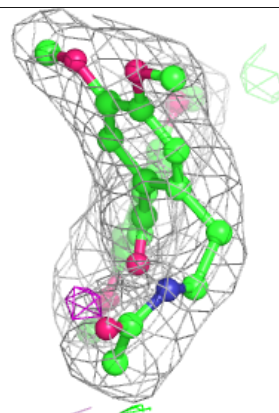
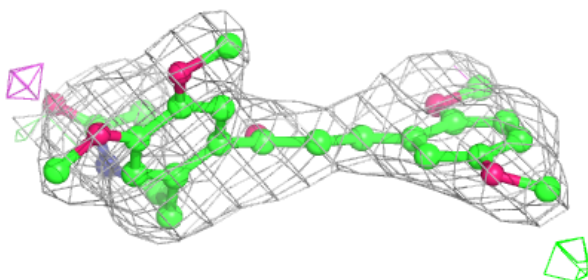
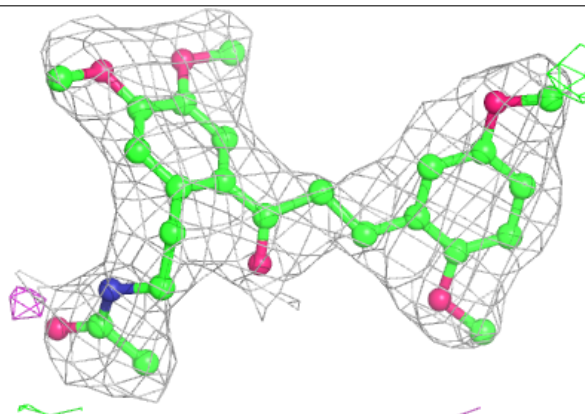


Electron density around 4JI D 201:

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

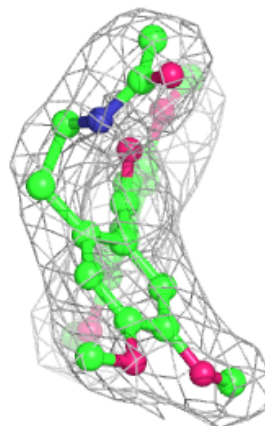
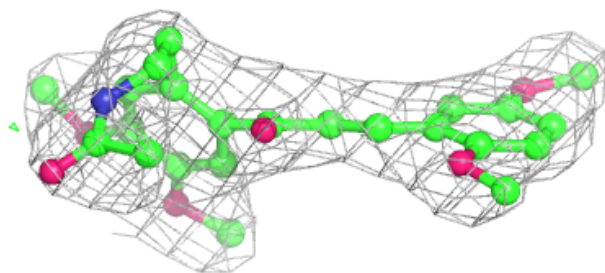
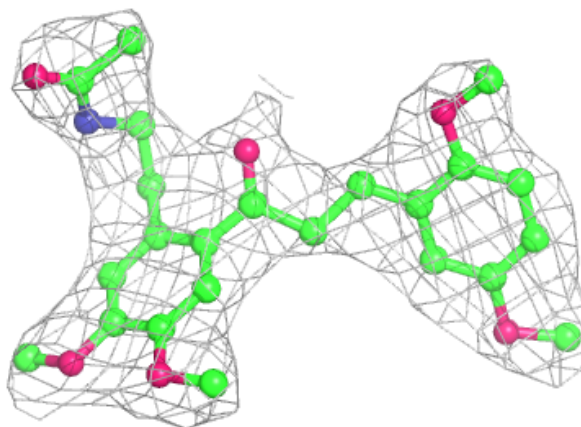
**Electron density around 4JI B 201:**

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



Electron density around 4JI A 201:

$2mF_o-DF_c$ (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.