Full wwPDB X-ray Structure Validation Report ⓘ

Apr 21, 2026 – 06:29 AM JST

PDB ID	:	9UN4 / pdb_00009un4
Title	:	Crystal structure of juvenile hormone acid methyltransferase castaneum JHAMT3 from Tribolium castaneum
Authors	:	Guo, P.C.; Yang, Y.Y.
Deposited on	:	2025-04-23
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 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:

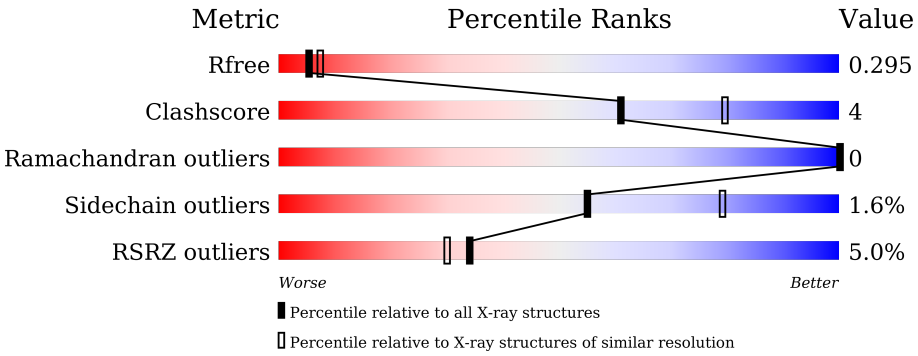
MolProbity	:	4-5-2 with Phenix2.0
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

1 Overall quality at a glance (i)

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}	180053	5829 (2.50-2.50)
Clashscore	190562	6492 (2.50-2.50)
Ramachandran outliers	187476	6378 (2.50-2.50)
Sidechain outliers	187428	6380 (2.50-2.50)
RSRZ outliers	180081	5833 (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 <=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	277	5% 80% 14% • 5%
1	B	277	4% 81% 12% 6%

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 8617 atoms, of which 4289 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 Juvenile hormone acid O-methyltransferase.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	262	Total	C	H	N	O	S	59	0	0
			4307	1404	2148	347	397	11			
1	B	260	Total	C	H	N	O	S	61	1	0
			4290	1400	2141	345	393	11			

- Molecule 2 is MAGNESIUM ION (CCD ID: MG) (formula: Mg) (labeled as "Ligand of Interest" by depositor).

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

- Molecule 3 is water.

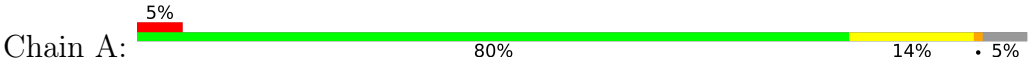
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	9	Total	O	0	0
			9	9		
3	B	9	Total	O	0	0
			9	9		

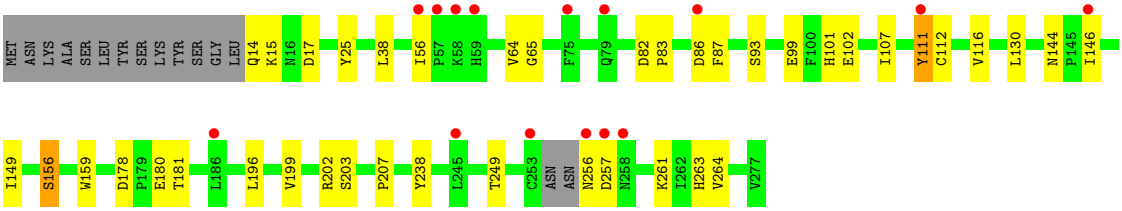
3 Residue-property plots (i)

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: Juvenile hormone acid O-methyltransferase

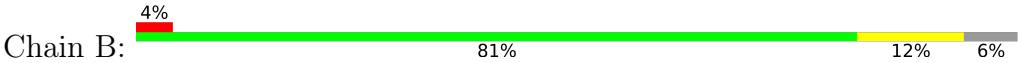
Chain A:

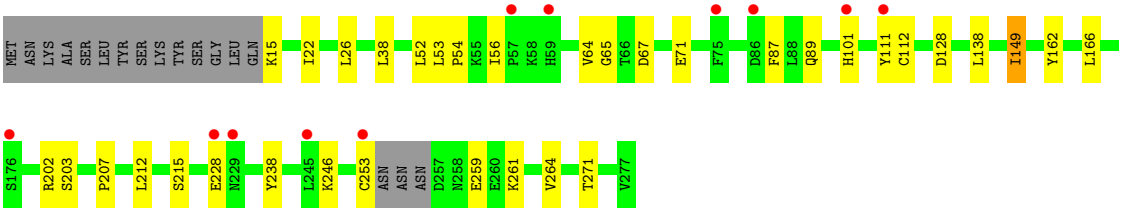




• Molecule 1: Juvenile hormone acid O-methyltransferase

Chain B:





4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	58.60Å 71.48Å 133.98Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.88 – 2.50 48.88 – 2.50	Depositor EDS
% Data completeness (in resolution range)	98.8 (48.88-2.50) 98.8 (48.88-2.50)	Depositor EDS
R_{merge}	0.17	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	3.17 (at 2.51Å)	Xtriage
Refinement program	REFMAC 5.8.0267	Depositor
R, R_{free}	0.245 , 0.294 0.245 , 0.295	Depositor DCC
R_{free} test set	974 reflections (4.84%)	wwPDB-VP
Wilson B-factor (Å^2)	34.8	Xtriage
Anisotropy	0.156	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.37 , 16.7	EDS
L-test for twinning[2]	$< \|L\| > = 0.57$, $< L^2 > = 0.41$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.93	EDS
Total number of atoms	8617	wwPDB-VP
Average B, all atoms (Å^2)	38.0	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 49.23 % 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 7.6791e-05. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ 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: MG

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	0.98	0/2217	1.37	1/2998 (0.0%)
1	B	0.97	0/2211	1.37	3/2990 (0.1%)
All	All	0.98	0/4428	1.37	4/5988 (0.1%)

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	111	TYR	CB-CA-C	-11.67	95.07	112.11
1	A	111	TYR	CB-CA-C	-11.36	94.60	112.09
1	B	212	LEU	CA-C-N	5.04	127.34	120.54
1	B	212	LEU	C-N-CA	5.04	127.34	120.54

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	2159	2148	2138	20	3
1	B	2149	2141	2131	16	3
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	9	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	9	0	0	0	0
All	All	4328	4289	4269	36	3

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 (36) 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:207:PRO:HA	1:B:261:LYS:HG2	1.85	0.57
1:B:253:CYS:HB2	1:B:261:LYS:HG3	1.85	0.57
1:A:249:THR:HB	1:A:263:HIS:HB2	1.88	0.56
1:A:203:SER:HA	1:A:264:VAL:O	2.08	0.53
1:A:180:GLU:HG3	1:A:199:VAL:HG23	1.90	0.53
1:A:93:SER:HB3	1:A:116:VAL:HG13	1.90	0.52
1:A:144:ASN:CG	1:A:146:ILE:HG22	2.33	0.52
1:A:25:TYR:CE1	1:A:196:LEU:HD21	2.46	0.51
1:B:38:LEU:HA	1:B:64:VAL:O	2.11	0.50
1:A:207:PRO:HA	1:A:261:LYS:HG2	1.94	0.49
1:B:67:ASP:O	1:B:89:GLN:HA	2.12	0.49
1:A:17:ASP:HB2	1:A:111:TYR:CE1	2.49	0.47
1:B:52:LEU:HG	1:B:56:ILE:HD11	1.96	0.47
1:B:15:LYS:O	1:B:202:ARG:NH2	2.47	0.47
1:B:166:LEU:HD12	1:B:166:LEU:HA	1.83	0.47
1:A:15:LYS:O	1:A:202:ARG:NH2	2.48	0.46
1:A:146:ILE:HA	1:A:149:ILE:HD12	1.99	0.44
1:A:149:ILE:HG21	1:A:238:TYR:CE2	2.52	0.44
1:B:53:LEU:HB2	1:B:54:PRO:HD3	2.00	0.44
1:B:22:ILE:HG23	1:B:26:LEU:HD22	2.00	0.43
1:B:246:LYS:HA	1:B:246:LYS:HD3	1.82	0.43
1:B:138:LEU:HB2	1:B:271:THR:CG2	2.49	0.43
1:B:259:GLU:HA	1:B:259:GLU:OE1	2.19	0.42
1:B:203:SER:HA	1:B:264:VAL:O	2.19	0.42
1:B:101[B]:HIS:HD2	1:B:128:ASP:HB3	1.83	0.42
1:A:101:HIS:CD2	1:A:102:GLU:HG3	2.55	0.42
1:A:65:GLY:O	1:A:87:PHE:HA	2.20	0.42
1:A:82:ASP:OD1	1:A:83:PRO:HD2	2.20	0.42
1:A:144:ASN:OD1	1:A:146:ILE:HG22	2.19	0.41
1:A:178:ASP:OD2	1:A:181:THR:OG1	2.29	0.41
1:A:107:ILE:HD12	1:A:130:LEU:HG	2.03	0.41
1:A:38:LEU:HA	1:A:64:VAL:O	2.20	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:256:ASN:ND2	1:A:257:ASP:OD2	2.54	0.41
1:B:149:ILE:HG21	1:B:238:TYR:CE2	2.56	0.41
1:A:156:SER:HG	1:A:159:TRP:CD1	2.39	0.40
1:B:65:GLY:O	1:B:87:PHE:HA	2.20	0.40

All (3) 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)
1:A:99:GLU:OE1	1:B:162:TYR:OH[2_554]	2.04	0.16
1:A:86:ASP:OD2	1:B:228:GLU:OE2[2_554]	2.09	0.11
1:A:86:ASP:OD2	1:B:228:GLU:CD[2_554]	2.10	0.10

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	258/277 (93%)	250 (97%)	8 (3%)	0	100	100
1	B	257/277 (93%)	246 (96%)	11 (4%)	0	100	100
All	All	515/554 (93%)	496 (96%)	19 (4%)	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	244/257 (95%)	240 (98%)	4 (2%)	55 79
1	B	243/257 (95%)	239 (98%)	4 (2%)	55 79
All	All	487/514 (95%)	479 (98%)	8 (2%)	55 79

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	14	GLN
1	A	56	ILE
1	A	112	CYS
1	A	156	SER
1	B	71	GLU
1	B	112	CYS
1	B	149	ILE
1	B	215	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	79	GLN
1	A	101	HIS
1	A	121	GLN
1	A	256	ASN
1	B	89	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 oligosaccharides in this entry.

5.6 Ligand geometry

Of 2 ligands modelled in this entry, 2 are monoatomic - leaving 0 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.

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

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, 95^{th} 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	262/277 (94%)	0.39	15 (5%)	29	26	21, 35, 60, 87	0
1	B	260/277 (93%)	0.40	11 (4%)	40	36	16, 35, 62, 78	1 (0%)
All	All	522/554 (94%)	0.39	26 (4%)	34	30	16, 35, 62, 87	1 (0%)

All (26) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	253	CYS	5.1
1	A	86	ASP	4.7
1	B	228	GLU	4.6
1	A	111	TYR	4.4
1	A	59	HIS	3.8
1	B	57	PRO	3.7
1	B	75	PHE	3.3
1	A	253	CYS	3.2
1	A	58	LYS	2.9
1	B	111	TYR	2.8
1	A	57	PRO	2.7
1	A	257	ASP	2.7
1	A	75	PHE	2.6
1	A	56	ILE	2.5
1	B	245	LEU	2.5
1	B	59	HIS	2.4
1	B	101[A]	HIS	2.4
1	B	176	SER	2.3
1	A	245	LEU	2.3
1	B	86	ASP	2.3
1	A	256	ASN	2.3
1	A	186	LEU	2.2
1	B	229	ASN	2.1
1	A	258	ASN	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	146	ILE	2.1
1	A	79	GLN	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)

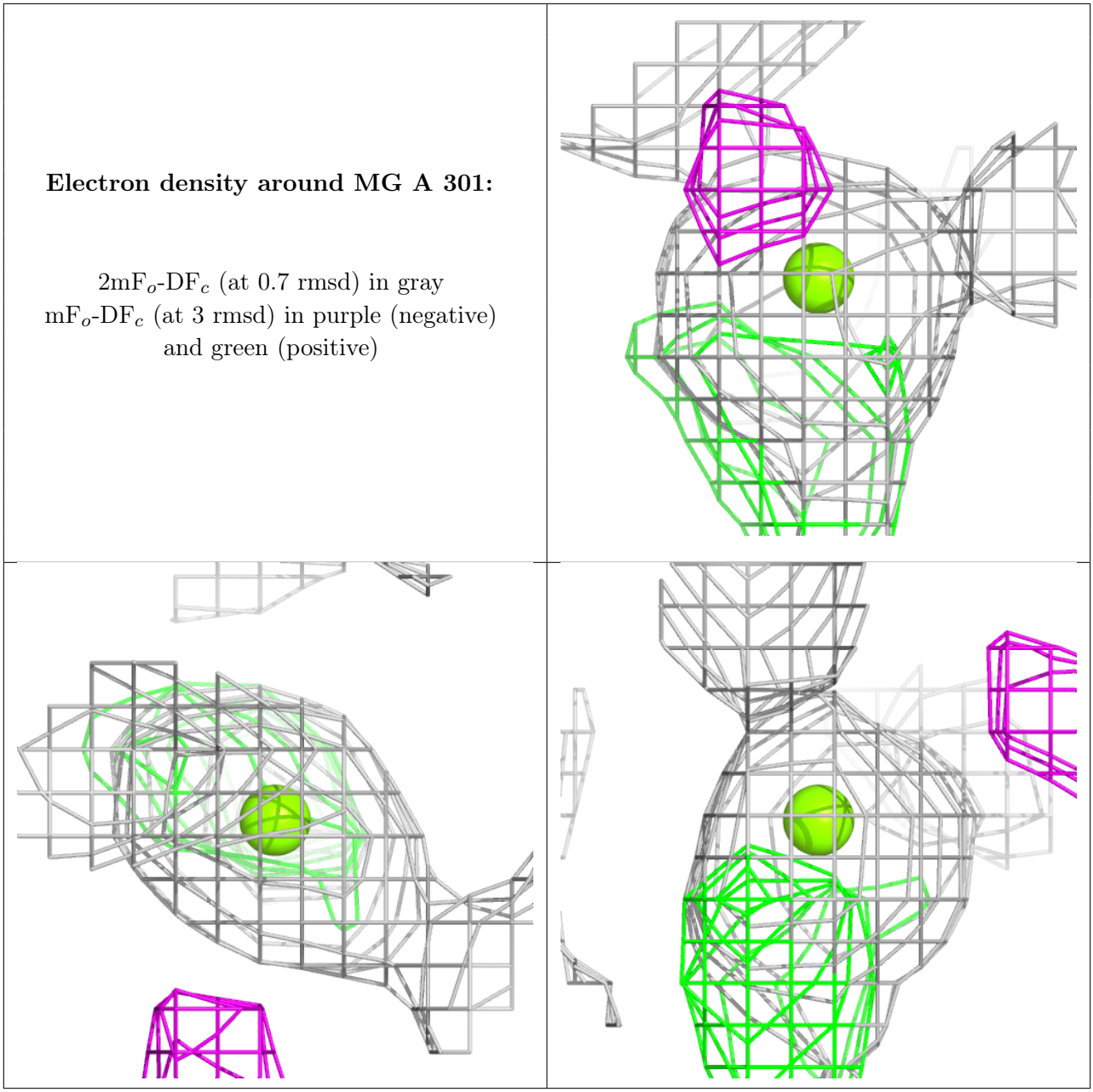
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' 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
2	MG	A	301	1/1	0.77	0.18	30,30,30,30	0
2	MG	B	301	1/1	0.97	0.08	30,30,30,30	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.

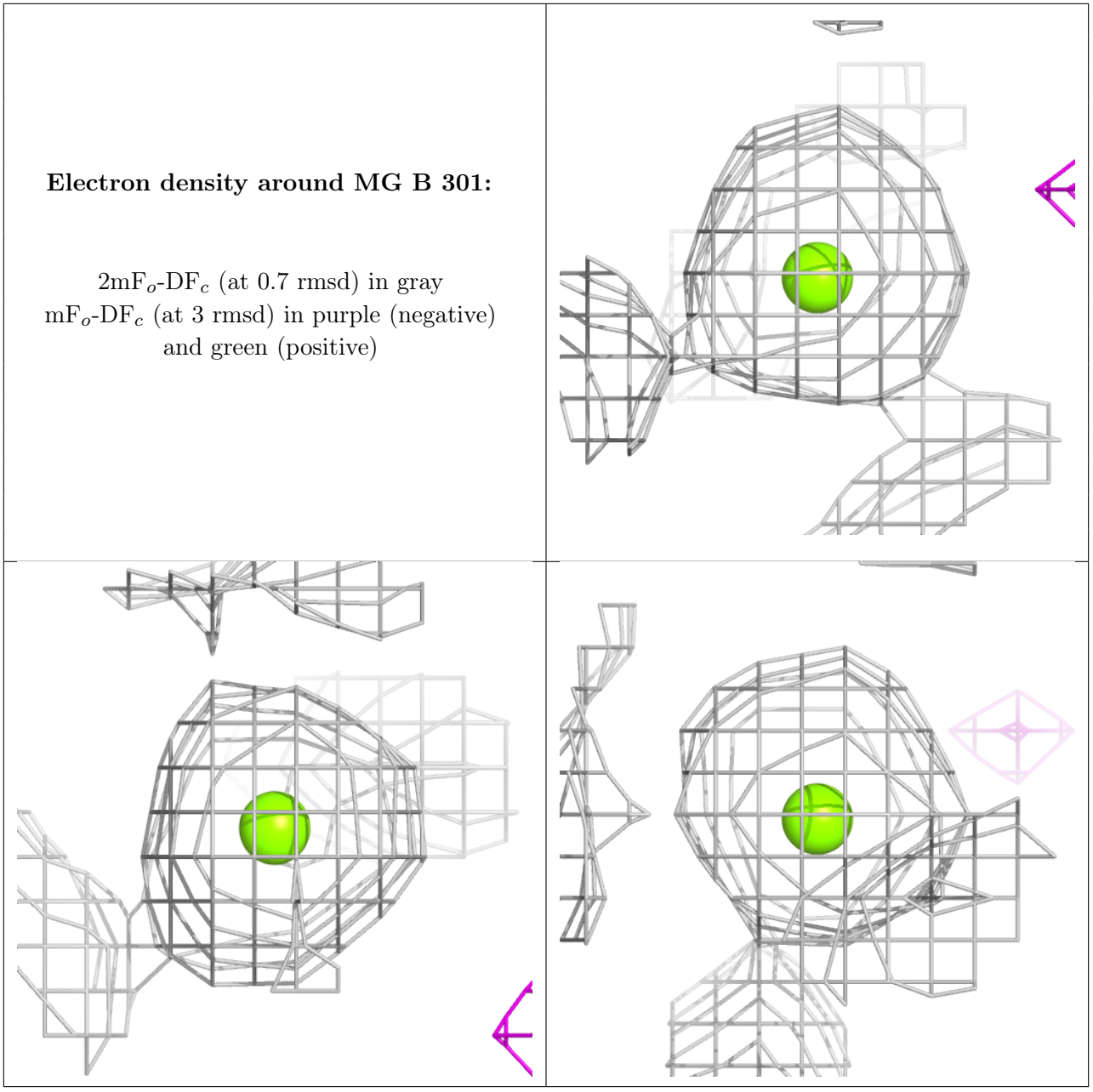
Electron density around MG A 301:

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



Electron density around MG B 301:

$2mF_o$-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

There are no such residues in this entry.