



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 6, 2026 – 11:16 AM UTC

PDB ID : 1TNO / pdb_00001tno
Title : Rat Protein Geranylgeranyltransferase Type-I Complexed with a GGPP analog and a KKKSCTKCVIM Peptide Derived from K-Ras4B
Authors : Reid, T.S.; Terry, K.L.; Casey, P.J.; Beese, L.S.
Deposited on : 2004-06-11
Resolution : 2.70 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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)
Xtriage (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

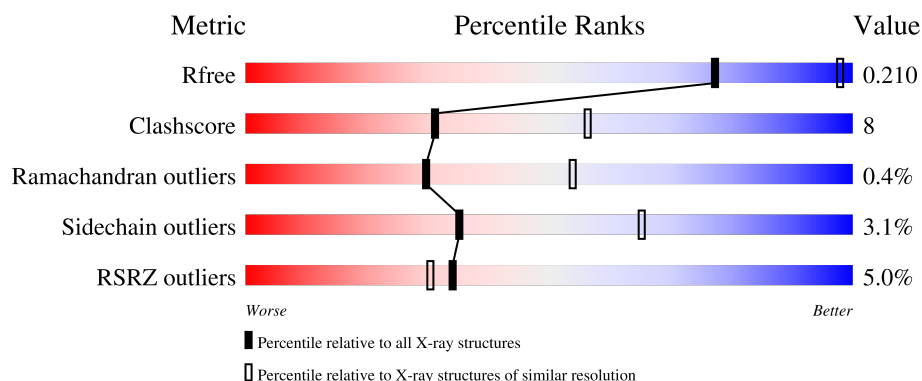
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.70 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	3538 (2.70-2.70)
Clashscore	190562	3843 (2.70-2.70)
Ramachandran outliers	187476	3778 (2.70-2.70)
Sidechain outliers	187428	3778 (2.70-2.70)
RSRZ outliers	180081	3538 (2.70-2.70)

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	377	5% 65% 17% • 17%
1	C	377	4% 67% 16% • 17%
1	E	377	4% 64% 18% • 17%
1	G	377	6% 67% 16% • 17%
1	I	377	4% 66% 17% • 17%

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Mol	Chain	Length	Quality of chain
1	K	377	
2	B	377	
2	D	377	
2	F	377	
2	H	377	
2	J	377	
2	L	377	
3	M	11	
3	N	11	
3	O	11	
3	P	11	
3	Q	11	
3	R	11	

2 Entry composition

There are 8 unique types of molecules in this entry. The entry contains 33292 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 geranylgeranyltransferase type I alpha subunit.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	314	Total	C	N	O	S	0	0	0
			2629	1679	463	482	5			
1	C	314	Total	C	N	O	S	0	0	0
			2643	1689	461	488	5			
1	E	314	Total	C	N	O	S	0	0	0
			2642	1686	461	490	5			
1	G	314	Total	C	N	O	S	0	0	0
			2633	1683	459	486	5			
1	I	314	Total	C	N	O	S	0	0	0
			2656	1694	465	492	5			
1	K	314	Total	C	N	O	S	0	0	0
			2671	1703	467	496	5			

- Molecule 2 is a protein called Geranylgeranyl transferase type I beta subunit.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	346	Total	C	N	O	S	0	0	0
			2697	1707	467	499	24			
2	D	346	Total	C	N	O	S	0	0	0
			2713	1715	472	502	24			
2	F	346	Total	C	N	O	S	0	0	0
			2718	1717	474	503	24			
2	H	346	Total	C	N	O	S	0	0	0
			2694	1706	464	500	24			
2	J	346	Total	C	N	O	S	0	0	0
			2711	1713	471	503	24			
2	L	346	Total	C	N	O	S	0	0	0
			2723	1720	473	506	24			

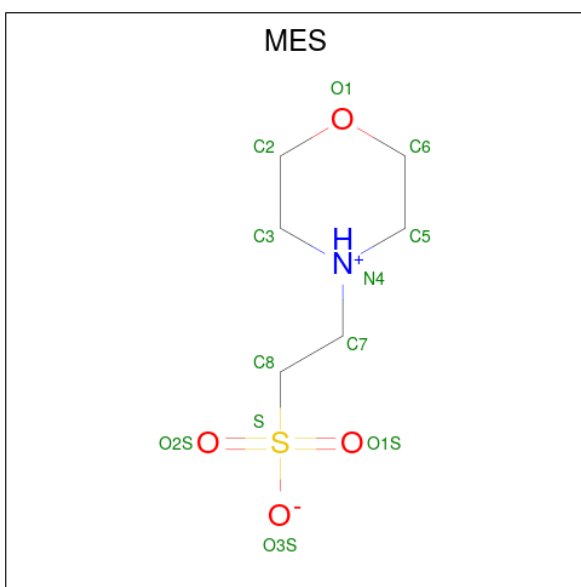
- Molecule 3 is a protein called c-K-ras2 protein isoform b.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	M	6	Total	C	N	O	S	0	0	0
			46	29	7	8	2			
3	N	6	Total	C	N	O	S	0	0	0
			46	29	7	8	2			
3	O	6	Total	C	N	O	S	0	0	0
			46	29	7	8	2			
3	P	6	Total	C	N	O	S	0	0	0
			46	29	7	8	2			
3	Q	6	Total	C	N	O	S	0	0	0
			46	29	7	8	2			
3	R	6	Total	C	N	O	S	0	0	0
			46	29	7	8	2			

- Molecule 4 is ZINC ION (CCD ID: ZN) (formula: Zn).

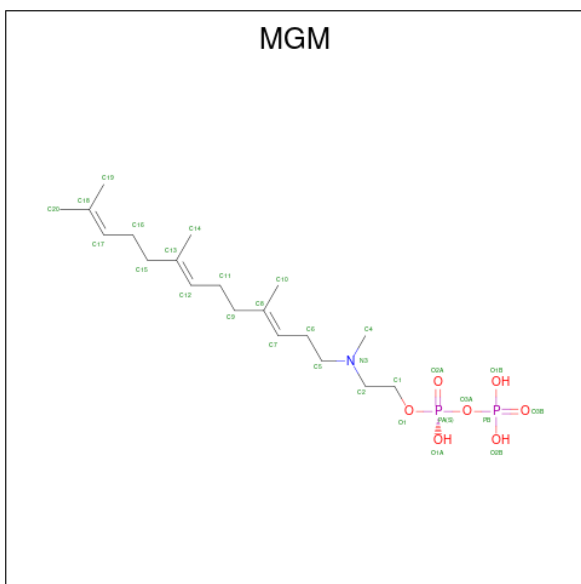
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	1	Total	Zn	0	0
			1	1		
4	D	1	Total	Zn	0	0
			1	1		
4	F	1	Total	Zn	0	0
			1	1		
4	H	1	Total	Zn	0	0
			1	1		
4	J	1	Total	Zn	0	0
			1	1		
4	L	1	Total	Zn	0	0
			1	1		

- Molecule 5 is 2-(N-MORPHOLINO)-ETHANESULFONIC ACID (CCD ID: MES) (formula: C₆H₁₃NO₄S).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
5	B	1	Total	C	N	O	S	0	0
			12	6	1	4	1		
5	F	1	Total	C	N	O	S	0	0
			12	6	1	4	1		

- Molecule 6 is 2-[METHYL-(5-GERANYL-4-METHYL-PENT-3-ENYL)-AMINO]-ETHYL-DIPHOSPHATE (CCD ID: MGM) (formula: $C_{19}H_{37}NO_7P_2$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
6	B	1	Total	C	N	O	P	0	0
			29	19	1	7	2		

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
6	D	1	Total	C	N	O	P	0	0
			29	19	1	7	2		
6	F	1	Total	C	N	O	P	0	0
			29	19	1	7	2		
6	H	1	Total	C	N	O	P	0	0
			29	19	1	7	2		
6	J	1	Total	C	N	O	P	0	0
			29	19	1	7	2		
6	L	1	Total	C	N	O	P	0	0
			29	19	1	7	2		

- Molecule 7 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	D	1	Total	Cl	0	0
			1	1		
7	F	1	Total	Cl	0	0
			1	1		
7	H	1	Total	Cl	0	0
			1	1		
7	L	1	Total	Cl	0	0
			1	1		

- Molecule 8 is water.

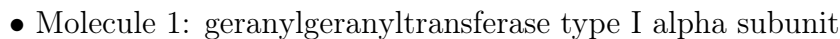
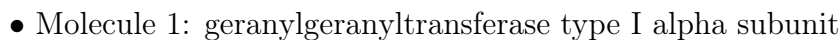
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	A	44	Total	O	0	0
			44	44		
8	B	34	Total	O	0	0
			34	34		
8	C	41	Total	O	0	0
			41	41		
8	D	51	Total	O	0	0
			51	51		
8	E	50	Total	O	0	0
			50	50		
8	F	58	Total	O	0	0
			58	58		
8	G	40	Total	O	0	0
			40	40		
8	H	31	Total	O	0	0
			31	31		

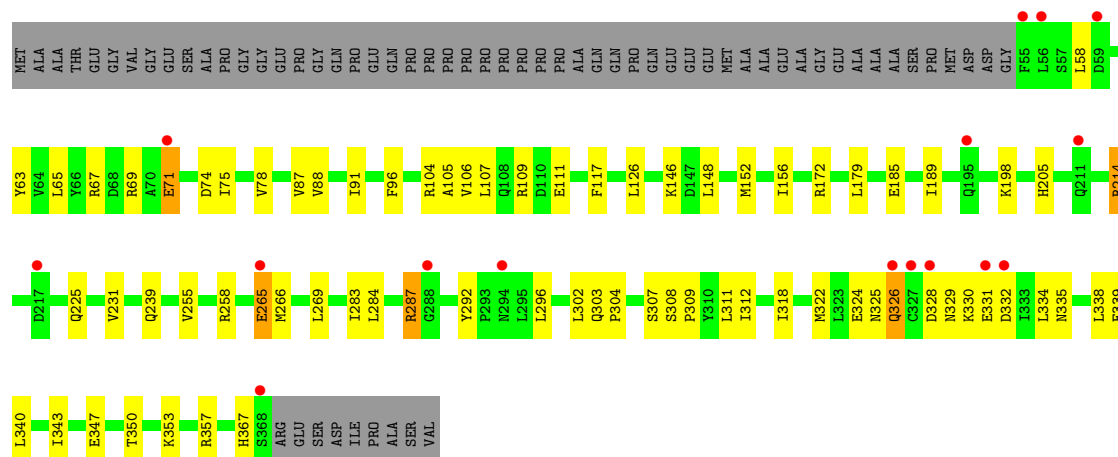
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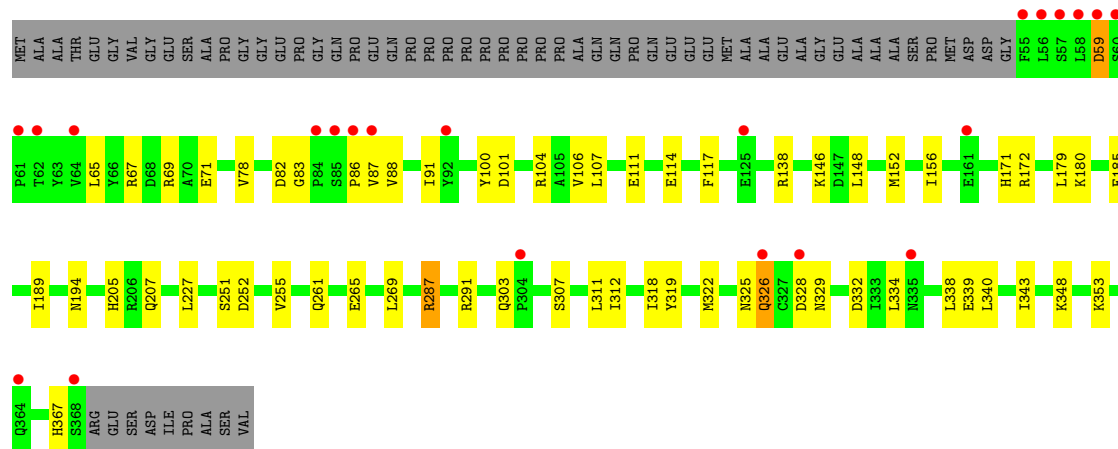
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	I	52	Total 52	O 52	0	0
8	J	47	Total 47	O 47	0	0
8	K	123	Total 123	O 123	0	0
8	L	93	Total 93	O 93	0	0
8	N	2	Total 2	O 2	0	0
8	O	2	Total 2	O 2	0	0
8	P	4	Total 4	O 4	0	0
8	Q	2	Total 2	O 2	0	0
8	R	4	Total 4	O 4	0	0

- Molecule 1: geranylgeranyltransferase type I alpha subunit

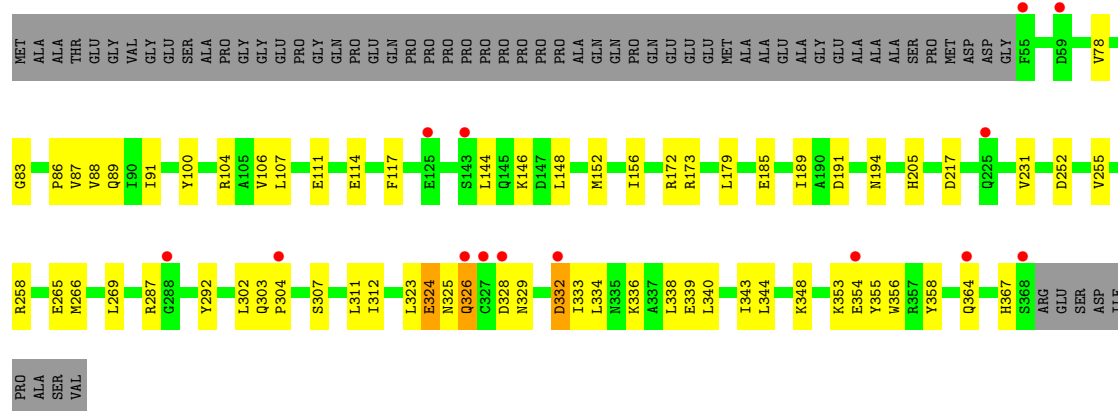




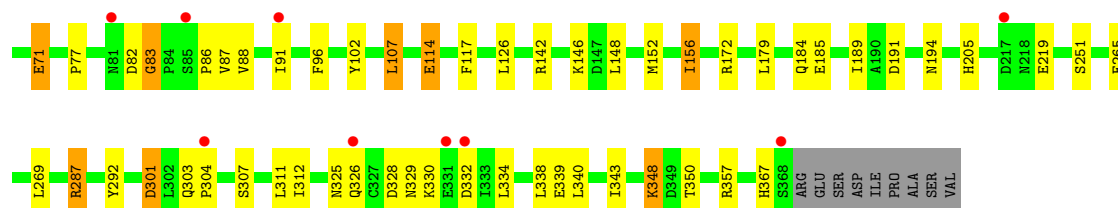
- Molecule 1: geranylgeranyltransferase type I alpha subunit



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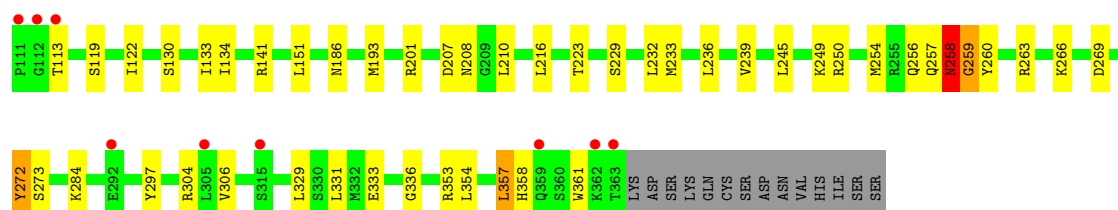


- Molecule 1: geranylgeranyltransferase type I alpha subunit



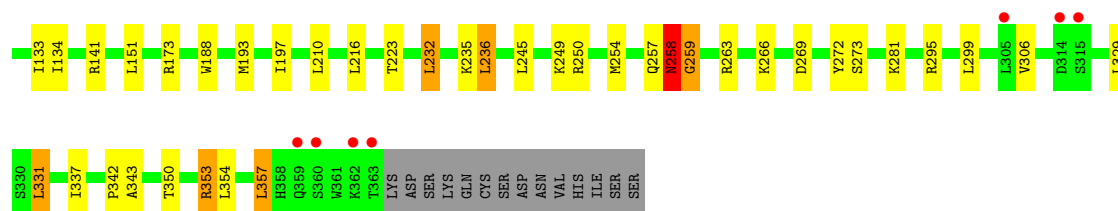
Chain B:

Amino Acid	Count
MET	1
ALA	1
ALA	1
THR	1
GLU	1
ASP	1
ASP	1
ARG	1
LEU	1
ALA	1
GLY	1
SER	1
GLY	1
GLU	1
GLY	1
GLU	1
ARG	1
L18	1
L21	1
R22	1
V26	1
F29	1
Q30	1
L33	1
L36	1
P37	1
E38	1
R39	1
Y40	1
T49	1
I50	1
A54	1
L64	1
S65	1
K69	1
D70	1
I73	1
E74	1
Y77	1
E85	1
R92	1
P104	1
F105	1
H106	1
V108	1



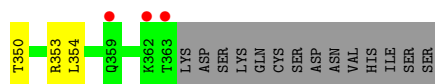
Chain D:

Amino Acid Type	Category
MET	Grey
ALA	Green
ALA	Green
THR	Green
GLU	Green
ASP	Green
ASP	Green
ARG	Green
ARG	Green
LEU	Green
LEU	Green
GLY	Green
SER	Green
GLY	Green
GLU	Green
GLU	Green
GLY	Green
ARG	Green
L18	Red
D19	Green
F20	Yellow
L21	Yellow
R22	Yellow
V26	Yellow
F29	Yellow
Q30	Yellow
L33	Orange
Q34	Orange
V35	Green
L36	Green
P37	Yellow
E38	Yellow
R39	Red
Y40	Red
T49	Yellow
K69	Yellow
I73	Yellow
Y77	Yellow
E85	Red
L101	Yellow
G102	Green
I103	Yellow
P104	Yellow
F105	Green
N106	Yellow
K109	Red
N110	Orange
I122	Yellow
L120	Yellow

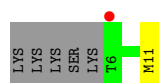


Chain F:

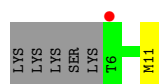
Amino Acid	Count
NET	0
ALA	0
ALA	0
ALA	0
THR	0
GLU	0
ASP	0
ASP	0
ARG	0
LEU	0
ALA	0
GLY	0
SER	0
GLY	0
GLU	0
GLY	0
GLU	0
ARG	0
L18	1
L21	1
F29	1
Q30	1
L33	1
Q34	1
V35	1
L36	1
P37	1
E38	1
R39	1
Y40	1
K69	1
I73	1
Y77	1
E85	1
R92	1
M10	1
P111	1
G112	1
T113	1
A114	1
H115	1
P116	1
S119	1
G120	1
H121	1
I122	1
A123	1
M124	1
S130	1



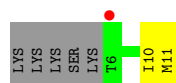
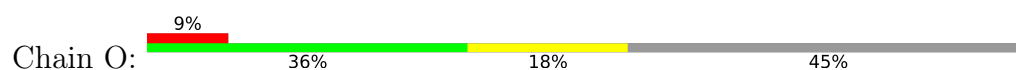
- Molecule 3: c-K-ras2 protein isoform b



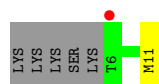
- Molecule 3: c-K-ras2 protein isoform b



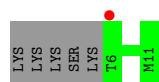
- Molecule 3: c-K-ras2 protein isoform b



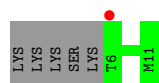
- Molecule 3: c-K-ras2 protein isoform b



- Molecule 3: c-K-ras2 protein isoform b



- Molecule 3: c-K-ras2 protein isoform b



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	272.53Å 268.48Å 185.94Å 90.00° 131.48° 90.00°	Depositor
Resolution (Å)	29.98 – 2.70 29.98 – 2.70	Depositor EDS
% Data completeness (in resolution range)	92.2 (29.98-2.70) 92.2 (29.98-2.70)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.07	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.33 (at 2.54Å)	Xtriage
Refinement program	CNS 1.0	Depositor
R, R_{free}	0.194 , 0.211 0.193 , 0.210	Depositor DCC
R_{free} test set	12637 reflections (4.50%)	wwPDB-VP
Wilson B-factor (Å ²)	56.7	Xtriage
Anisotropy	0.050	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 53.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.089 for -h-2*k,l	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	33292	wwPDB-VP
Average B, all atoms (Å ²)	64.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.20% 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: MGM, CL, MES, ZN

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	0.41	0/2695	0.84	5/3668 (0.1%)
1	C	0.42	0/2709	0.86	5/3684 (0.1%)
1	E	0.44	0/2708	0.85	5/3684 (0.1%)
1	G	0.43	0/2699	0.86	3/3672 (0.1%)
1	I	0.43	0/2722	0.84	6/3700 (0.2%)
1	K	0.46	0/2737	0.86	7/3717 (0.2%)
2	B	0.43	0/2759	0.91	10/3733 (0.3%)
2	D	0.44	0/2775	0.89	7/3752 (0.2%)
2	F	0.45	0/2780	0.91	7/3758 (0.2%)
2	H	0.41	0/2756	0.91	6/3729 (0.2%)
2	J	0.41	0/2773	0.91	10/3750 (0.3%)
2	L	0.47	0/2785	0.91	5/3764 (0.1%)
3	M	0.51	0/45	0.88	0/57
3	N	0.49	0/45	0.93	0/57
3	O	0.50	0/45	0.97	0/57
3	P	0.50	0/45	0.94	0/57
3	Q	0.55	0/45	0.98	0/57
3	R	0.55	0/45	0.89	0/57
All	All	0.44	0/33168	0.88	76/44953 (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
2	B	0	2
2	D	0	1
2	F	0	2
2	H	0	1
2	J	0	1

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Mol	Chain	#Chirality outliers	#Planarity outliers
2	L	0	1
All	All	0	8

There are no bond length outliers.

The worst 5 of 76 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	J	259	GLY	N-CA-C	-9.98	98.33	112.60
2	L	259	GLY	N-CA-C	-9.95	98.37	112.60
2	F	259	GLY	N-CA-C	-9.72	98.69	112.60
2	H	259	GLY	N-CA-C	-9.71	98.71	112.60
2	B	259	GLY	N-CA-C	-9.58	98.90	112.60

There are no chirality outliers.

5 of 8 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	B	272	TYR	Sidechain
2	B	297	TYR	Sidechain
2	D	272	TYR	Sidechain
2	F	272	TYR	Sidechain
2	F	297	TYR	Sidechain

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	2629	0	2520	53	0
1	C	2643	0	2540	40	0
1	E	2642	0	2534	48	0
1	G	2633	0	2524	48	0
1	I	2656	0	2560	45	0
1	K	2671	0	2588	39	0
2	B	2697	0	2600	48	0
2	D	2713	0	2628	47	0
2	F	2718	0	2635	37	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	H	2694	0	2590	55	0
2	J	2711	0	2616	50	0
2	L	2723	0	2643	30	0
3	M	46	0	52	1	0
3	N	46	0	52	1	0
3	O	46	0	52	1	0
3	P	46	0	52	1	0
3	Q	46	0	52	0	0
3	R	46	0	52	0	0
4	B	1	0	0	0	0
4	D	1	0	0	0	0
4	F	1	0	0	0	0
4	H	1	0	0	0	0
4	J	1	0	0	0	0
4	L	1	0	0	0	0
5	B	12	0	13	0	0
5	F	12	0	13	0	0
6	B	29	0	34	0	0
6	D	29	0	34	1	0
6	F	29	0	34	0	0
6	H	29	0	34	1	0
6	J	29	0	34	0	0
6	L	29	0	34	0	0
7	D	1	0	0	0	0
7	F	1	0	0	0	0
7	H	1	0	0	0	0
7	L	1	0	0	0	0
8	A	44	0	0	1	0
8	B	34	0	0	0	0
8	C	41	0	0	2	0
8	D	51	0	0	1	0
8	E	50	0	0	1	0
8	F	58	0	0	0	0
8	G	40	0	0	0	0
8	H	31	0	0	0	0
8	I	52	0	0	1	0
8	J	47	0	0	0	0
8	K	123	0	0	2	0
8	L	93	0	0	0	0
8	N	2	0	0	0	0
8	O	2	0	0	0	0
8	P	4	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
8	Q	2	0	0	0	0
8	R	4	0	0	0	0
All	All	33292	0	31520	523	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 8.

The worst 5 of 523 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:K:156:ILE:HG12	1:K:172:ARG:HH12	1.02	1.10
1:I:156:ILE:HG12	1:I:172:ARG:HH12	1.09	1.09
1:A:156:ILE:HG12	1:A:172:ARG:HH12	1.18	1.07
1:E:156:ILE:HG12	1:E:172:ARG:HH12	1.10	1.05
1:C:156:ILE:HG12	1:C:172:ARG:HH12	1.15	1.04

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	312/377 (83%)	289 (93%)	22 (7%)	1 (0%)	36	60
1	C	312/377 (83%)	293 (94%)	18 (6%)	1 (0%)	36	60
1	E	312/377 (83%)	290 (93%)	21 (7%)	1 (0%)	36	60
1	G	312/377 (83%)	292 (94%)	19 (6%)	1 (0%)	36	60
1	I	312/377 (83%)	292 (94%)	19 (6%)	1 (0%)	36	60
1	K	312/377 (83%)	293 (94%)	19 (6%)	0	100	100
2	B	344/377 (91%)	333 (97%)	10 (3%)	1 (0%)	36	60
2	D	344/377 (91%)	333 (97%)	10 (3%)	1 (0%)	36	60

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
2	F	344/377 (91%)	332 (96%)	11 (3%)	1 (0%)	36	60
2	H	344/377 (91%)	329 (96%)	14 (4%)	1 (0%)	36	60
2	J	344/377 (91%)	329 (96%)	11 (3%)	4 (1%)	10	27
2	L	344/377 (91%)	332 (96%)	11 (3%)	1 (0%)	36	60
3	M	4/11 (36%)	4 (100%)	0	0	100	100
3	N	4/11 (36%)	4 (100%)	0	0	100	100
3	O	4/11 (36%)	4 (100%)	0	0	100	100
3	P	4/11 (36%)	4 (100%)	0	0	100	100
3	Q	4/11 (36%)	4 (100%)	0	0	100	100
3	R	4/11 (36%)	4 (100%)	0	0	100	100
All	All	3960/4590 (86%)	3761 (95%)	185 (5%)	14 (0%)	30	54

5 of 14 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	258	ASN
1	E	326	GLN
1	G	326	GLN
2	J	333	GLU
2	J	362	LYS

5.3.2 Protein sidechains ⓘ

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	280/338 (83%)	273 (98%)	7 (2%)	42	71
1	C	283/338 (84%)	276 (98%)	7 (2%)	42	71
1	E	284/338 (84%)	277 (98%)	7 (2%)	42	71
1	G	281/338 (83%)	276 (98%)	5 (2%)	51	78
1	I	287/338 (85%)	281 (98%)	6 (2%)	47	75
1	K	291/338 (86%)	283 (97%)	8 (3%)	39	69

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
2	B	289/326 (89%)	277 (96%)	12 (4%)	26	55
2	D	293/326 (90%)	280 (96%)	13 (4%)	25	53
2	F	294/326 (90%)	282 (96%)	12 (4%)	27	56
2	H	288/326 (88%)	277 (96%)	11 (4%)	29	58
2	J	292/326 (90%)	282 (97%)	10 (3%)	32	62
2	L	296/326 (91%)	285 (96%)	11 (4%)	30	59
3	M	6/11 (54%)	6 (100%)	0	100	100
3	N	6/11 (54%)	6 (100%)	0	100	100
3	O	6/11 (54%)	6 (100%)	0	100	100
3	P	6/11 (54%)	6 (100%)	0	100	100
3	Q	6/11 (54%)	6 (100%)	0	100	100
3	R	6/11 (54%)	6 (100%)	0	100	100
All	All	3494/4050 (86%)	3385 (97%)	109 (3%)	35	65

5 of 109 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	F	355	ARG
2	H	329	LEU
2	L	33	LEU
1	G	107	LEU
2	H	151	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 80 such sidechains are listed below:

Mol	Chain	Res	Type
1	I	81	ASN
1	K	135	HIS
1	I	135	HIS
2	J	208	ASN
1	K	285	GLN

5.3.3 RNA ⓘ

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 18 ligands modelled in this entry, 10 are monoatomic - leaving 8 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	$\# Z > 2$
6	MGM	L	380	-	27,28,28	1.00	2 (7%)	34,37,37	2.05	6 (17%)
6	MGM	J	379	-	27,28,28	1.00	2 (7%)	34,37,37	2.02	7 (20%)
5	MES	B	379	-	12,12,12	9.12	8 (66%)	15,16,16	2.07	5 (33%)
6	MGM	H	380	-	27,28,28	0.91	2 (7%)	34,37,37	1.97	6 (17%)
5	MES	F	380	-	12,12,12	9.31	8 (66%)	15,16,16	2.10	5 (33%)
6	MGM	D	380	-	27,28,28	0.97	2 (7%)	34,37,37	2.04	6 (17%)
6	MGM	B	380	-	27,28,28	1.00	2 (7%)	34,37,37	2.02	6 (17%)
6	MGM	F	381	-	27,28,28	0.99	2 (7%)	34,37,37	2.03	6 (17%)

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
6	MGM	L	380	-	-	9/31/31/31	-
6	MGM	J	379	-	-	10/31/31/31	-
5	MES	B	379	-	-	1/6/14/14	0/1/1/1
6	MGM	H	380	-	-	9/31/31/31	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	MES	F	380	-	-	3/6/14/14	0/1/1/1
6	MGM	D	380	-	-	10/31/31/31	-
6	MGM	B	380	-	-	9/31/31/31	-
6	MGM	F	381	-	-	10/31/31/31	-

The worst 5 of 28 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	F	380	MES	C8-S	-24.47	1.43	1.77
5	B	379	MES	C8-S	-22.70	1.45	1.77
5	B	379	MES	O2S-S	13.57	1.83	1.45
5	F	380	MES	O2S-S	13.01	1.81	1.45
5	B	379	MES	O1S-S	13.00	1.81	1.45

The worst 5 of 47 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	B	380	MGM	C1-C2-N3	7.48	131.26	113.30
6	F	381	MGM	C1-C2-N3	7.39	131.04	113.30
6	D	380	MGM	C1-C2-N3	7.35	130.95	113.30
6	L	380	MGM	C1-C2-N3	7.26	130.73	113.30
6	J	379	MGM	C1-C2-N3	7.23	130.65	113.30

There are no chirality outliers.

5 of 61 torsion outliers are listed below:

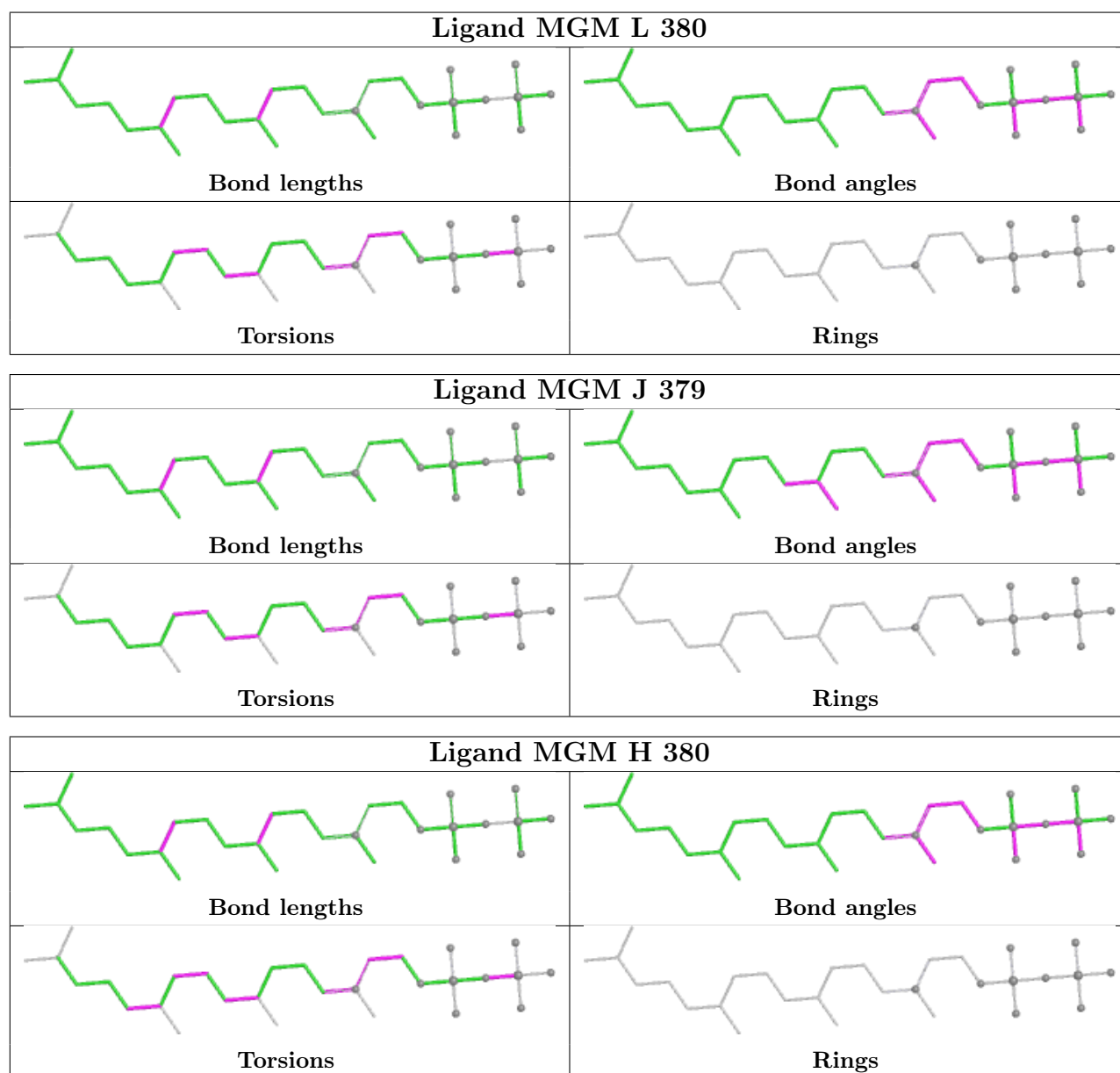
Mol	Chain	Res	Type	Atoms
5	F	380	MES	C7-C8-S-O2S
5	F	380	MES	C7-C8-S-O3S
6	B	380	MGM	C1-C2-N3-C4
6	B	380	MGM	O1-C1-C2-N3
6	B	380	MGM	PA-O3A-PB-O1B

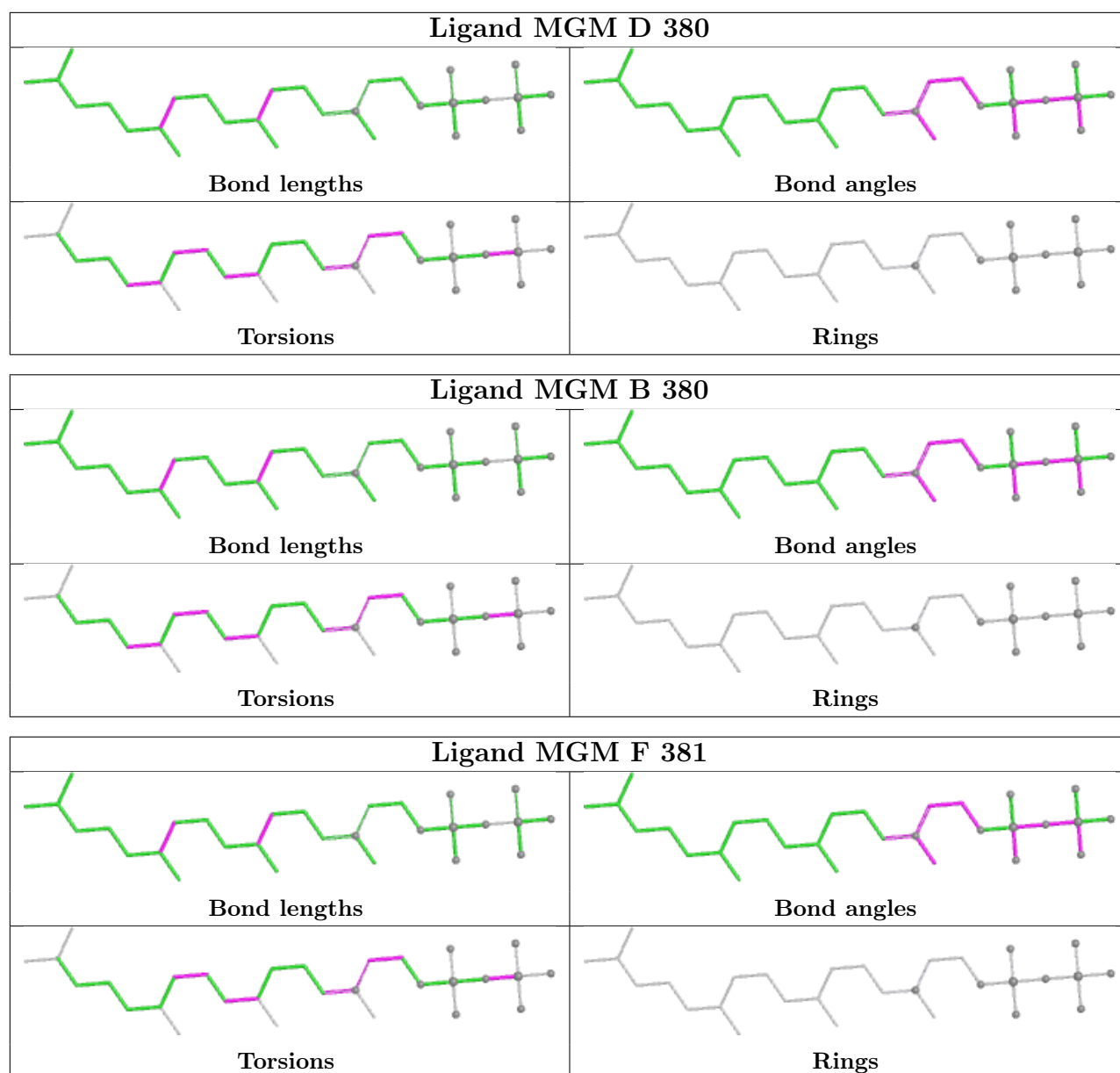
There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	H	380	MGM	1	0
6	D	380	MGM	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less 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	314/377 (83%)	0.37	20 (6%)	25	22	47, 69, 102, 119	0
1	C	314/377 (83%)	0.36	15 (4%)	35	32	44, 66, 94, 111	0
1	E	314/377 (83%)	0.39	16 (5%)	33	29	42, 67, 96, 113	0
1	G	314/377 (83%)	0.39	22 (7%)	22	19	43, 65, 96, 109	0
1	I	314/377 (83%)	0.45	14 (4%)	38	34	43, 68, 98, 109	0
1	K	314/377 (83%)	-0.06	13 (4%)	41	37	35, 55, 80, 94	0
2	B	346/377 (91%)	0.12	16 (4%)	37	34	48, 63, 89, 112	0
2	D	346/377 (91%)	0.01	14 (4%)	42	38	43, 59, 86, 103	0
2	F	346/377 (91%)	-0.06	10 (2%)	53	50	42, 56, 84, 108	0
2	H	346/377 (91%)	0.49	30 (8%)	16	13	44, 72, 102, 119	0
2	J	346/377 (91%)	0.21	15 (4%)	40	36	45, 65, 92, 117	0
2	L	346/377 (91%)	-0.14	10 (2%)	53	50	39, 53, 77, 106	0
3	M	6/11 (54%)	0.71	1 (16%)	4	3	53, 57, 78, 88	0
3	N	6/11 (54%)	0.45	1 (16%)	4	3	53, 59, 78, 83	0
3	O	6/11 (54%)	0.89	1 (16%)	4	3	50, 58, 77, 85	0
3	P	6/11 (54%)	1.07	1 (16%)	4	3	60, 69, 86, 92	0
3	Q	6/11 (54%)	0.97	1 (16%)	4	3	51, 63, 82, 91	0
3	R	6/11 (54%)	0.37	1 (16%)	4	3	47, 58, 76, 84	0
All	All	3996/4590 (87%)	0.21	201 (5%)	34	30	35, 63, 93, 119	0

The worst 5 of 201 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	18	LEU	7.0
1	E	55	PHE	6.7
2	F	18	LEU	6.6

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Mol	Chain	Res	Type	RSRZ
1	C	55	PHE	6.2
1	G	55	PHE	6.1

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.

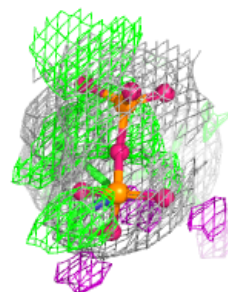
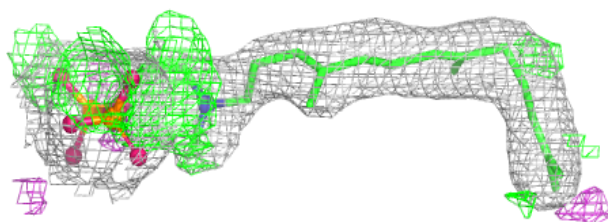
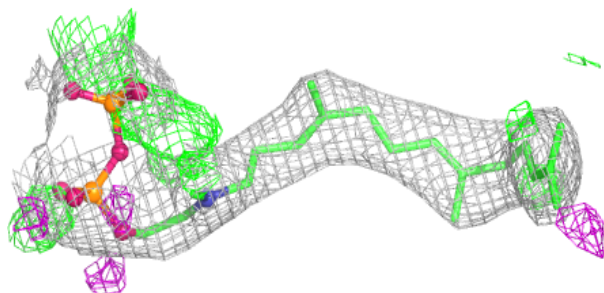
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
5	MES	B	379	12/12	0.86	0.20	99,108,110,110	0
5	MES	F	380	12/12	0.93	0.15	86,94,97,97	0
6	MGM	J	379	29/29	0.94	0.13	50,58,70,71	0
6	MGM	L	380	29/29	0.94	0.13	41,54,65,67	0
6	MGM	H	380	29/29	0.95	0.13	56,65,74,75	0
6	MGM	D	380	29/29	0.95	0.12	50,59,67,69	0
6	MGM	F	381	29/29	0.95	0.11	49,56,66,69	0
6	MGM	B	380	29/29	0.96	0.11	52,59,69,72	0
7	CL	F	379	1/1	0.98	0.04	55,55,55,55	0
7	CL	H	379	1/1	0.98	0.06	69,69,69,69	0
7	CL	L	379	1/1	0.98	0.06	59,59,59,59	0
7	CL	D	379	1/1	0.99	0.06	62,62,62,62	0
4	ZN	B	378	1/1	1.00	0.01	51,51,51,51	0
4	ZN	D	378	1/1	1.00	0.01	53,53,53,53	0
4	ZN	F	378	1/1	1.00	0.01	48,48,48,48	0
4	ZN	H	378	1/1	1.00	0.01	60,60,60,60	0
4	ZN	J	378	1/1	1.00	0.01	53,53,53,53	0
4	ZN	L	378	1/1	1.00	0.01	46,46,46,46	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.

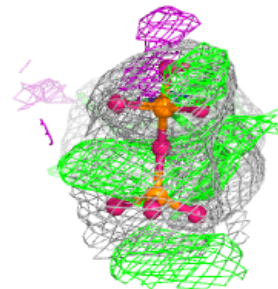
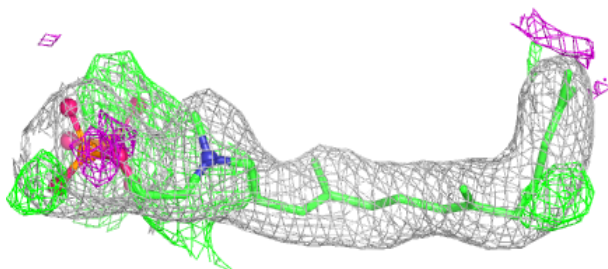
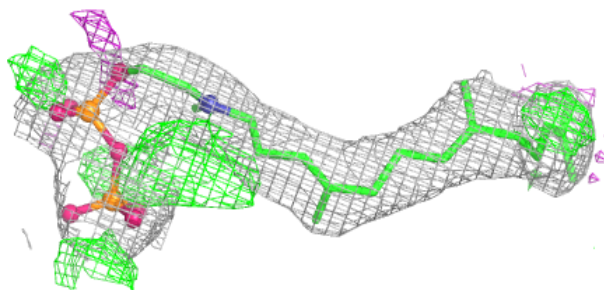
Electron density around MGM J 379:

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



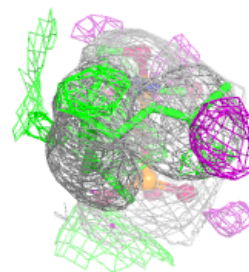
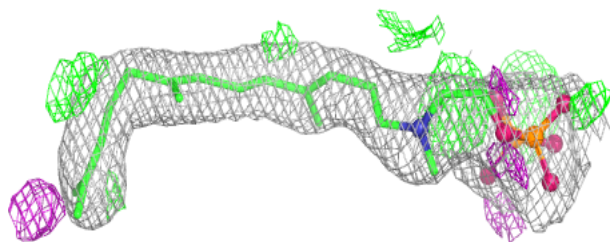
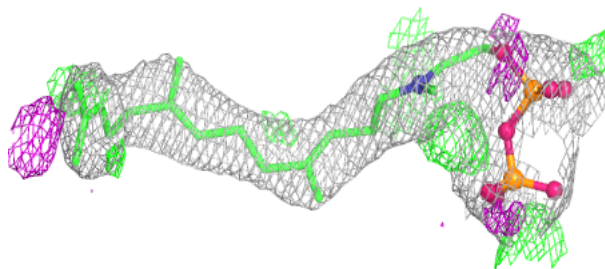
Electron density around MGM L 380:

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

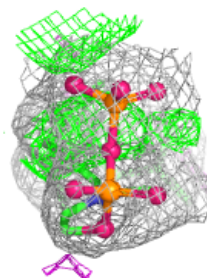
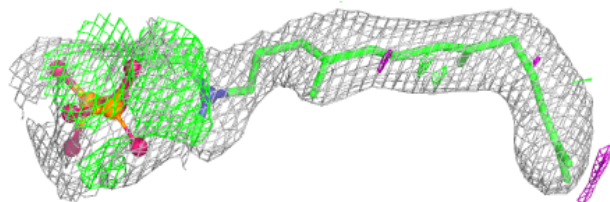
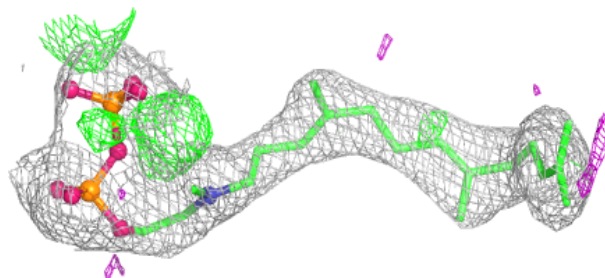


Electron density around MGM H 380:

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

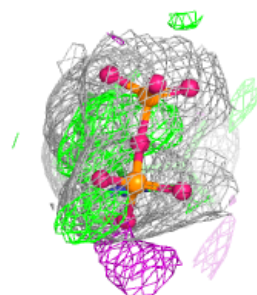
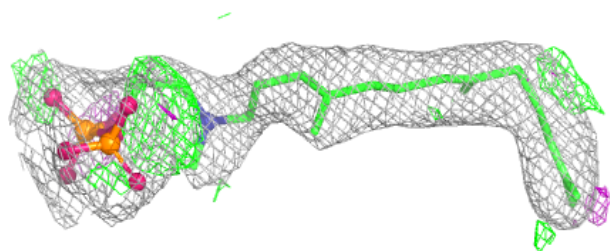
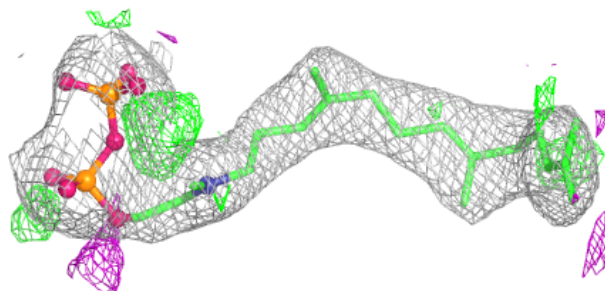
**Electron density around MGM D 380:**

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

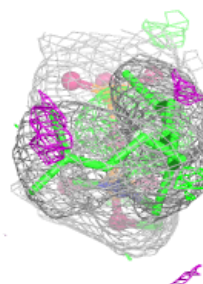
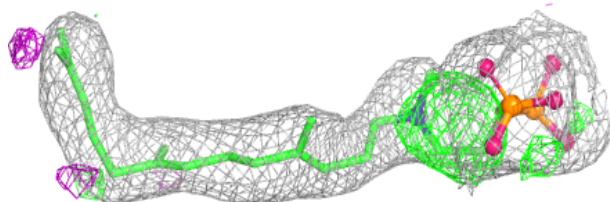
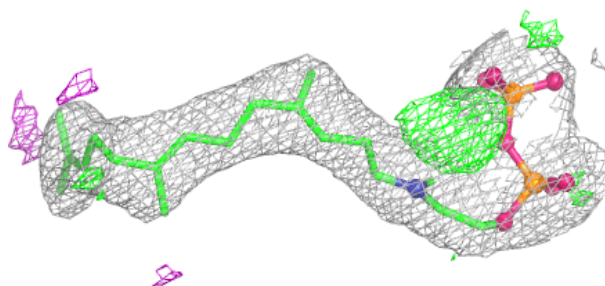


Electron density around MGM F 381:

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

**Electron density around MGM B 380:**

$2mF_o-DF_c$ (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.