W O R L D W I D E
wwPDB
P R O T E I N   D A T A   B A N K

wwPDB X-ray Structure Validation Summary Report (i)

Jan 15, 2024 – 10:12 pm GMT

PDB ID	:	6RF0
Title	:	Crystal structure of the light-driven sodium pump KR2 in the pentameric "dry" form
Authors	:	Kovalev, K.; Polovinkin, V.; Gushchin, I.; Borshchevskiy, V.; Gordeliy, V.
Deposited on	:	2019-04-12
Resolution	:	3.00 Å(reported)

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

|		
MolProbity	:	4.02b-467
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36
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)	:	2.36

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 3.00 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.
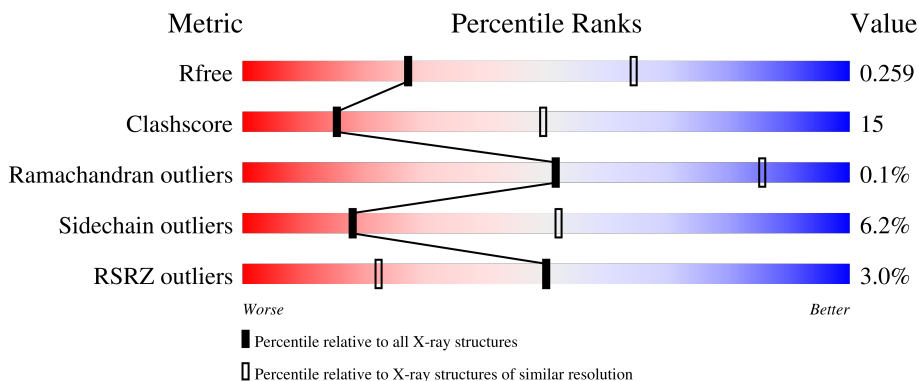
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	2092 (3.00-3.00)
Clashscore	141614	2416 (3.00-3.00)
Ramachandran outliers	138981	2333 (3.00-3.00)
Sidechain outliers	138945	2336 (3.00-3.00)
RSRZ outliers	127900	1990 (3.00-3.00)

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	288	% 73% 20% • 5%
1	B	288	3% 71% 23% • 5%
1	C	288	3% 71% 24% • 5%
1	D	288	3% 66% 27% • 5%
1	E	288	3% 67% 26% • 5%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
4	LFA	C	302	-	-	-	X

2   Entry composition ⓘ

There are 6 unique types of molecules in this entry. The entry contains 11099 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 Sodium pumping rhodopsin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	273	Total	C	N	O	S	0	1	0
			2152	1435	326	382	9			
1	B	274	Total	C	N	O	S	0	1	0
			2140	1428	326	377	9			
1	C	275	Total	C	N	O	S	0	0	0
			2157	1436	328	384	9			
1	D	274	Total	C	N	O	S	0	0	0
			2154	1437	327	381	9			
1	E	274	Total	C	N	O	S	0	0	0
			2149	1431	326	383	9			

There are 40 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	281	LEU	-	expression tag	UNP N0DKS8
A	282	GLU	-	expression tag	UNP N0DKS8
A	283	HIS	-	expression tag	UNP N0DKS8
A	284	HIS	-	expression tag	UNP N0DKS8
A	285	HIS	-	expression tag	UNP N0DKS8
A	286	HIS	-	expression tag	UNP N0DKS8
A	287	HIS	-	expression tag	UNP N0DKS8
A	288	HIS	-	expression tag	UNP N0DKS8
B	281	LEU	-	expression tag	UNP N0DKS8
B	282	GLU	-	expression tag	UNP N0DKS8
B	283	HIS	-	expression tag	UNP N0DKS8
B	284	HIS	-	expression tag	UNP N0DKS8
B	285	HIS	-	expression tag	UNP N0DKS8
B	286	HIS	-	expression tag	UNP N0DKS8
B	287	HIS	-	expression tag	UNP N0DKS8
B	288	HIS	-	expression tag	UNP N0DKS8
C	281	LEU	-	expression tag	UNP N0DKS8
C	282	GLU	-	expression tag	UNP N0DKS8
C	283	HIS	-	expression tag	UNP N0DKS8

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Chain	Residue	Modelled	Actual	Comment	Reference
C	284	HIS	-	expression tag	UNP N0DKS8
C	285	HIS	-	expression tag	UNP N0DKS8
C	286	HIS	-	expression tag	UNP N0DKS8
C	287	HIS	-	expression tag	UNP N0DKS8
C	288	HIS	-	expression tag	UNP N0DKS8
D	281	LEU	-	expression tag	UNP N0DKS8
D	282	GLU	-	expression tag	UNP N0DKS8
D	283	HIS	-	expression tag	UNP N0DKS8
D	284	HIS	-	expression tag	UNP N0DKS8
D	285	HIS	-	expression tag	UNP N0DKS8
D	286	HIS	-	expression tag	UNP N0DKS8
D	287	HIS	-	expression tag	UNP N0DKS8
D	288	HIS	-	expression tag	UNP N0DKS8
E	281	LEU	-	expression tag	UNP N0DKS8
E	282	GLU	-	expression tag	UNP N0DKS8
E	283	HIS	-	expression tag	UNP N0DKS8
E	284	HIS	-	expression tag	UNP N0DKS8
E	285	HIS	-	expression tag	UNP N0DKS8
E	286	HIS	-	expression tag	UNP N0DKS8
E	287	HIS	-	expression tag	UNP N0DKS8
E	288	HIS	-	expression tag	UNP N0DKS8

- Molecule 2 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	2	Total 2	Na 2	0	0
2	B	1	Total 1	Na 1	0	0
2	C	1	Total 1	Na 1	0	0
2	D	1	Total 1	Na 1	0	0

- Molecule 3 is (2R)-2,3-dihydroxypropyl (9Z)-octadec-9-enoate (three-letter code: OLC) (formula: $C_{21}H_{40}O_4$).

OLC

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total 12	C 8	O 4	0	0
3	B	1	Total 12	C 8	O 4	0	0
3	C	1	Total 13	C 9	O 4	0	0
3	D	1	Total 12	C 8	O 4	0	0
3	E	1	Total 12	C 8	O 4	0	0

• Molecule 4 is EICOSANE (three-letter code: LFA) (formula: $C_{20}H_{42}$).

LFA
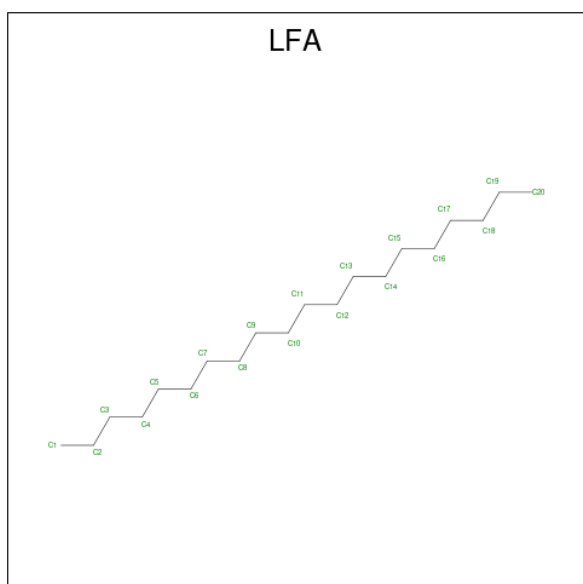
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total 15	C 15	0	0
4	B	1	Total 14	C 14	0	0
4	B	1	Total 14	C 14	0	0
4	B	1	Total 16	C 16	0	0
4	C	1	Total 12	C 12	0	0
4	C	1	Total 14	C 14	0	0
4	D	1	Total 14	C 14	0	0
4	D	1	Total 14	C 14	0	0
4	E	1	Total 14	C 14	0	0
4	E	1	Total 13	C 13	0	0

- Molecule 5 is RETINAL (three-letter code: RET) (formula: $C_{20}H_{28}O$).

RET
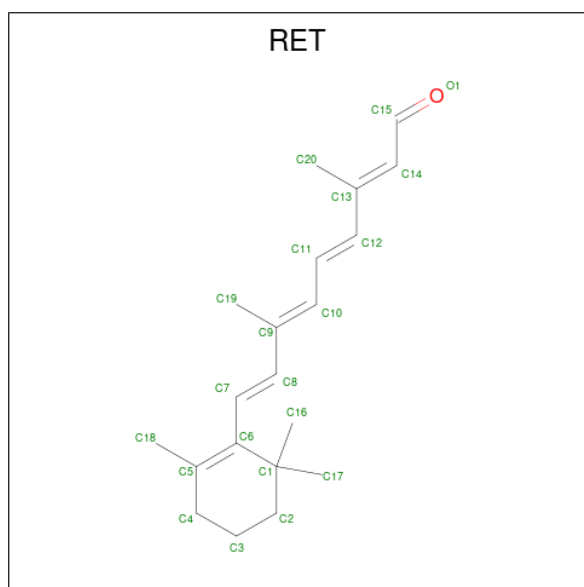
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	1	Total 20	C 20	0	0
5	B	1	Total 20	C 20	0	0

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	C	1	Total 20	C 20	0	0
5	D	1	Total 20	C 20	0	0
5	E	1	Total 20	C 20	0	0

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	9	Total 9	O 9	0	0
6	B	6	Total 6	O 6	0	0
6	C	10	Total 10	O 10	0	0
6	D	9	Total 9	O 9	0	0
6	E	7	Total 7	O 7	0	0

3   Residue-property plots ⓘ

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: Sodium pumping rhodopsin

- Molecule 1: Sodium pumping rhodopsin

- Molecule 1: Sodium pumping rhodopsin

N272 K273 E274 L275 V276 E277 A278 ASN SER LEU GLU HIS HIS HIS HIS HIS HIS

• Molecule 1: Sodium pumping rhodopsin

Chain D:

66%   27%   • 5%

3%

MET THR GLN E4 N9 F10 E11 N12 F13 T17 I23 H30 L34 G35 Y36 A37 V38 M39 L40 A41 G42 L43 L44 V53 D54 K55 K56 F57 Q58 V66 V69 S70 A71 L74 L75 Y76 E90 E91 V92 P99 S100 G101 D102 G107 Y108 R109 Y110 L111

N112 W113 L114 I115 D116 V117 P118 M119 F122 S129 L130 T131 T132 S133 K134 S137 S145 I150 F158 V161 S162 N163 F167 I173 S174 S175 A176 F177 F178 F179 H180 V184 M185 V188 I189 G195 I196 S197 P198 K202 W208 Y218 P219 Y222

L223 M224 P225 G229 VAL D231 L234 G239 V240 L245 I249 A250 D251 V252 S253 S254 K255 N264 T268 I269 S270 K271 N272 L275 A278 ASN SER LEU GLU HIS HIS HIS HIS HIS HIS

• Molecule 1: Sodium pumping rhodopsin

Chain E:

67%   26%   • 5%

3%

MET THR Q3 F10 E11 E18 I23 H30 L34 V38 M39 L40 L43 L44 V53 K56 F57 Q58 L63 S64 A65 V66 V69 L74 N81 F88 N89 E90 E91 V92 G93 P99 S100 G101 D102 G107 Y108 R109 Y110 L111 N112 W113 L114 I115

D116 V117 P118 M119 F122 Q123 I124 S129 L130 T131 T132 S133 K134 F135 S136 S137 I150 F158 N163 L164 F167 H180 V184 I189 N190 E191 I196 S197 P198 L204 W208 Y218 P219 Y222 L223 M224 P225 T228 T229 VAL D231 G232 F233 L234

G239 V240 M241 A242 L245 I249 L262 G263 N264 I267 T268 E274 L275 V276 E277 ALA ASN SER LEU GLU HIS HIS HIS HIS HIS HIS

4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α, β, γ	128.18Å 239.72Å 131.91Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.32 – 3.00 47.28 – 3.00	Depositor EDS
% Data completeness (in resolution range)	99.9 (47.32-3.00) 100.0 (47.28-3.00)	Depositor EDS
R_{merge}	0.30	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.77 (at 3.01Å)	Xtriage
Refinement program	REFMAC 5.8.0222	Depositor
R, R_{free}	0.217 , 0.252 0.227 , 0.259	Depositor DCC
R_{free} test set	2059 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å^2)	54.1	Xtriage
Anisotropy	0.596	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 60.2	EDS
L-test for twinning [2]	$< |L| > = 0.50, < L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.91	EDS
Total number of atoms	11099	wwPDB-VP
Average B, all atoms (Å^2)	45.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.03% of the height of the origin peak. No significant pseudotranslation is detected.*

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[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: LFA, NA, RET, OLC

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	0.29	0/2209	0.43	0/3007
1	B	0.30	0/2197	0.44	0/2994
1	C	0.29	0/2214	0.43	0/3015
1	D	0.34	1/2211 (0.0%)	0.47	1/3009 (0.0%)
1	E	0.29	0/2205	0.43	0/3002
All	All	0.30	1/11036 (0.0%)	0.44	1/15027 (0.0%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand.A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	C	0	1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	176	ALA	C-N	8.61	1.53	1.34

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(º)	Ideal(º)
1	D	176	ALA	O-C-N	6.07	132.41	122.70

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	C	228	THR	Peptide

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	2152	0	2105	62	0
1	B	2140	0	2081	72	1
1	C	2157	0	2114	68	0
1	D	2154	0	2115	86	0
1	E	2149	0	2096	79	1
2	A	2	0	0	0	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0
2	D	1	0	0	0	0
3	A	12	0	13	0	0
3	B	12	0	13	1	0
3	C	13	0	15	0	0
3	D	12	0	13	2	0
3	E	12	0	13	0	0
4	A	15	0	29	3	0
4	B	44	0	85	3	0
4	C	26	0	47	0	0
4	D	28	0	54	0	0
4	E	27	0	49	1	0
5	A	20	0	27	6	0
5	B	20	0	27	8	0
5	C	20	0	27	6	0
5	D	20	0	27	8	0
5	E	20	0	27	8	0
6	A	9	0	0	1	0
6	B	6	0	0	2	0
6	C	10	0	0	1	0
6	D	9	0	0	2	0
6	E	7	0	0	2	0
All	All	11099	0	10977	325	1

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 15.

The worst 5 of 325 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:115:ILE:HD11	1:E:34:LEU:HD12	1.29	1.12
1:E:63:LEU:HD22	1:E:119:MET:HE2	1.25	1.09
1:A:111:LEU:HD23	1:E:30:HIS:HB3	1.37	1.03
1:C:34:LEU:HD12	1:D:115:ILE:HD11	1.43	0.99
1:D:30:HIS:HB3	1:E:111:LEU:HD23	1.41	0.98

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:197:SER:OG	1:E:131:THR:O[8_545]	1.71	0.49

5.3　Torsion angles ⓘ

5.3.1　Protein backbone ⓘ

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	270/288 (94%)	263 (97%)	7 (3%)	0	100	100
1	B	271/288 (94%)	264 (97%)	7 (3%)	0	100	100
1	C	273/288 (95%)	262 (96%)	10 (4%)	1 (0%)	34	72
1	D	270/288 (94%)	263 (97%)	7 (3%)	0	100	100
1	E	270/288 (94%)	264 (98%)	6 (2%)	0	100	100
All	All	1354/1440 (94%)	1316 (97%)	37 (3%)	1 (0%)	51	85

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	230	VAL

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	224/248 (90%)	211 (94%)	13 (6%)	20	55
1	B	220/248 (89%)	210 (96%)	10 (4%)	27	64
1	C	224/248 (90%)	210 (94%)	14 (6%)	18	51
1	D	224/248 (90%)	208 (93%)	16 (7%)	14	46
1	E	224/248 (90%)	208 (93%)	16 (7%)	14	46
All	All	1116/1240 (90%)	1047 (94%)	69 (6%)	18	52

5 of 69 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	E	81	ASN
1	E	111	LEU
1	E	189	ILE
1	C	56	LYS
1	C	10	PHE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 15 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	89	ASN
1	E	81	ASN
1	C	112	ASN
1	E	112	ASN
1	D	264	ASN

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 monosaccharides in this entry.

5.6 Ligand geometry (i)

Of 25 ligands modelled in this entry, 5 are monoatomic - leaving 20 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	$\#|Z| > 2$
4	LFA	E	303	-	12,12,19	0.38	0	11,11,18	0.32	0
4	LFA	C	304	-	13,13,19	0.31	0	12,12,18	0.45	0
4	LFA	B	305	-	15,15,19	0.31	0	14,14,18	0.44	0
4	LFA	B	303	-	13,13,19	0.36	0	12,12,18	0.38	0
4	LFA	D	304	-	13,13,19	0.36	0	12,12,18	0.35	0
5	RET	B	306	1	20,20,21	0.68	0	27,27,28	1.75	6 (22%)
3	OLC	B	304	-	11,11,24	1.31	1 (9%)	12,12,25	1.30	2 (16%)
4	LFA	A	303	-	14,14,19	0.30	0	13,13,18	0.45	0
4	LFA	D	302	-	13,13,19	0.34	0	12,12,18	0.36	0
5	RET	A	305	1	20,20,21	0.65	0	27,27,28	1.79	7 (25%)
5	RET	C	305	1	20,20,21	0.68	0	27,27,28	1.79	7 (25%)
5	RET	D	305	1	20,20,21	0.73	0	27,27,28	1.76	6 (22%)
3	OLC	C	303	-	12,12,24	1.37	1 (8%)	13,13,25	1.10	2 (15%)
3	OLC	E	302	-	11,11,24	1.44	1 (9%)	12,12,25	1.32	2 (16%)
4	LFA	C	302	-	11,11,19	0.33	0	10,10,18	0.39	0
5	RET	E	304	1	20,20,21	0.74	0	27,27,28	1.84	8 (29%)
3	OLC	D	303	-	11,11,24	1.35	1 (9%)	12,12,25	1.09	1 (8%)
4	LFA	B	302	-	13,13,19	0.30	0	12,12,18	0.45	0
3	OLC	A	302	-	11,11,24	1.48	1 (9%)	12,12,25	1.38	2 (16%)
4	LFA	E	301	-	13,13,19	0.37	0	12,12,18	0.39	0

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
4	LFA	E	303	-	-	7/10/10/17	-
4	LFA	C	304	-	-	5/11/11/17	-
4	LFA	B	305	-	-	8/13/13/17	-
4	LFA	B	303	-	-	6/11/11/17	-
4	LFA	D	304	-	-	5/11/11/17	-
5	RET	B	306	1	-	0/13/30/31	0/1/1/1
3	OLC	B	304	-	-	4/11/11/24	-
4	LFA	A	303	-	-	8/12/12/17	-
4	LFA	D	302	-	-	9/11/11/17	-
5	RET	A	305	1	-	0/13/30/31	0/1/1/1
5	RET	C	305	1	-	0/13/30/31	0/1/1/1
5	RET	D	305	1	-	0/13/30/31	0/1/1/1
3	OLC	C	303	-	-	5/12/12/24	-
3	OLC	E	302	-	-	4/11/11/24	-
4	LFA	C	302	-	-	5/9/9/17	-
5	RET	E	304	1	-	0/13/30/31	0/1/1/1
3	OLC	D	303	-	-	5/11/11/24	-
4	LFA	B	302	-	-	4/11/11/17	-
3	OLC	A	302	-	-	5/11/11/24	-
4	LFA	E	301	-	-	6/11/11/17	-

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	302	OLC	O20-C1	4.70	1.47	1.33
3	E	302	OLC	O20-C1	4.55	1.46	1.33
3	C	303	OLC	O20-C1	4.54	1.46	1.33
3	D	303	OLC	O20-C1	4.29	1.45	1.33
3	B	304	OLC	O20-C1	4.12	1.45	1.33

The worst 5 of 43 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	C	305	RET	C18-C5-C6	-5.09	118.81	124.53
5	E	304	RET	C18-C5-C6	-5.03	118.88	124.53

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
5	D	305	RET	C18-C5-C6	-4.86	119.07	124.53
5	A	305	RET	C18-C5-C6	-4.84	119.09	124.53
5	B	306	RET	C18-C5-C6	-4.39	119.60	124.53

There are no chirality outliers.

5 of 86 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	302	OLC	C21-C22-C24-O25
3	A	302	OLC	C2-C1-O20-C21
3	A	302	OLC	O19-C1-O20-C21
3	B	304	OLC	C2-C1-O20-C21
3	B	304	OLC	O19-C1-O20-C21

There are no ring outliers.

12 monomers are involved in 45 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	B	305	LFA	1	0
4	B	303	LFA	1	0
5	B	306	RET	8	0
3	B	304	OLC	1	0
4	A	303	LFA	3	0
5	A	305	RET	6	0
5	C	305	RET	6	0
5	D	305	RET	8	0
5	E	304	RET	8	0
3	D	303	OLC	2	0
4	B	302	LFA	1	0
4	E	301	LFA	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 then 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 LFA E 303

Bond lengths

Bond angles

Torsions

Rings

Ligand LFA C 304

Bond lengths

Bond angles

Torsions

Rings

Ligand LFA B 305

Bond lengths

Bond angles

Torsions

Rings

Ligand LFA B 303

Bond lengths

Bond angles

Torsions

Rings

Ligand LFA D 304

Bond lengths

Bond angles

Torsions

Rings

Ligand RET B 306

Bond lengths

Bond angles

Torsions

Rings

Ligand OLC B 304

Bond lengths

Bond angles

Torsions

Rings

Ligand LFA A 303

Bond lengths

Bond angles

Torsions

Rings

Ligand LFA D 302

Bond lengths

Bond angles

Torsions

Rings

Ligand RET A 305

Bond lengths

Bond angles

Torsions

Rings

Ligand RET C 305

Bond lengths

Bond angles

Torsions

Rings

Ligand RET D 305

Bond lengths

Bond angles

Torsions

Rings

Ligand OLC C 303

Bond lengths

Bond angles

Torsions

Rings

Ligand OLC E 302

Bond lengths

Bond angles

Torsions

Rings

Ligand LFA C 302

Bond lengths

Bond angles

Torsions

Rings

Ligand RET E 304

Bond lengths

Bond angles

Torsions

Rings

Ligand OLC D 303

Bond lengths

Bond angles

Torsions

Rings

Ligand LFA B 302

Bond lengths

Bond angles

Torsions

Rings

Ligand OLC A 302

Bond lengths

Bond angles

Torsions

Rings

Ligand LFA E 301

Bond lengths

Bond angles

Torsions

Rings

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, 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(Å²)	Q<0.9
1	A	273/288 (94%)	0.02	4 (1%)	73	46	27, 43, 64, 101	0
1	B	274/288 (95%)	0.06	9 (3%)	46	20	30, 46, 68, 99	0
1	C	275/288 (95%)	0.07	10 (3%)	42	17	27, 44, 73, 96	0
1	D	274/288 (95%)	0.04	9 (3%)	46	20	27, 42, 64, 90	0
1	E	274/288 (95%)	0.06	9 (3%)	46	20	25, 42, 65, 83	0
All	All	1370/1440 (95%)	0.05	41 (2%)	50	22	25, 44, 67, 101	0

The worst 5 of 41 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	132	THR	3.3
1	B	132	THR	3.2
1	B	236	SER	3.1
1	E	3	GLN	3.0
1	E	190	ASN	3.0

6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

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

6.3 Carbohydrates ⓘ

There are no monosaccharides in this entry.

6.4 Ligands ⓘ

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
2	NA	D	301	1/1	0.73	0.17	40,40,40,40	0
4	LFA	C	302	12/20	0.78	0.85	43,50,59,60	0
4	LFA	B	302	14/20	0.81	0.95	48,65,81,81	0
4	LFA	E	301	14/20	0.81	0.99	36,55,88,88	0
4	LFA	D	302	14/20	0.83	0.91	42,69,85,86	0
3	OLC	A	302	12/25	0.83	0.29	34,55,64,64	0
2	NA	A	304	1/1	0.84	0.19	35,35,35,35	0
4	LFA	A	303	15/20	0.85	0.35	48,57,60,61	0
3	OLC	E	302	12/25	0.86	0.29	42,58,78,85	0
4	LFA	E	303	13/20	0.86	0.42	39,53,66,68	0
4	LFA	B	303	14/20	0.87	0.86	36,58,70,72	0
5	RET	B	306	20/21	0.88	0.31	50,57,67,68	0
3	OLC	C	303	13/25	0.89	0.36	40,54,63,63	0
5	RET	E	304	20/21	0.89	0.26	38,50,61,72	0
4	LFA	C	304	14/20	0.90	0.37	32,41,47,49	0
5	RET	A	305	20/21	0.90	0.30	46,58,74,76	0
4	LFA	B	305	16/20	0.90	0.36	44,54,61,65	0
3	OLC	B	304	12/25	0.90	0.28	42,48,56,65	0
3	OLC	D	303	12/25	0.91	0.31	46,51,76,77	0
5	RET	C	305	20/21	0.91	0.25	38,46,55,55	0
2	NA	A	301	1/1	0.91	0.10	40,40,40,40	0
4	LFA	D	304	14/20	0.93	0.30	33,44,50,51	0
2	NA	B	301	1/1	0.94	0.10	25,25,25,25	0
5	RET	D	305	20/21	0.94	0.25	36,45,51,64	0
2	NA	C	301	1/1	0.94	0.08	32,32,32,32	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 LFA C 302:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
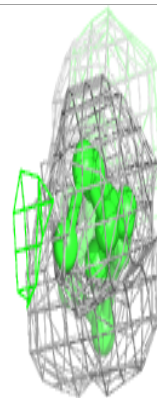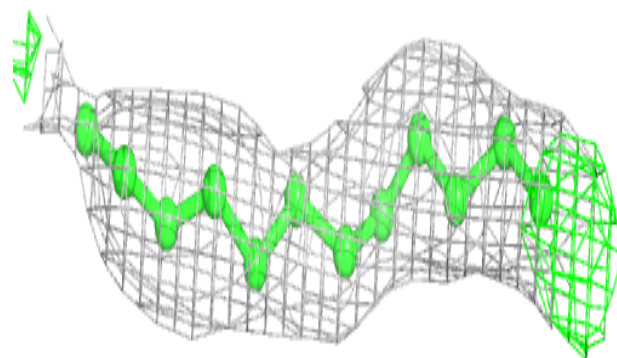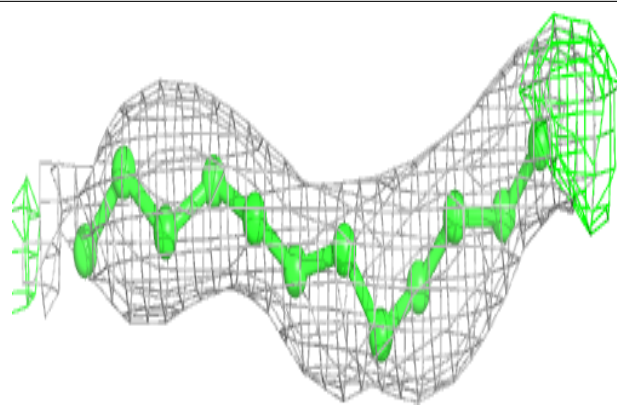
Electron density around LFA B 302:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
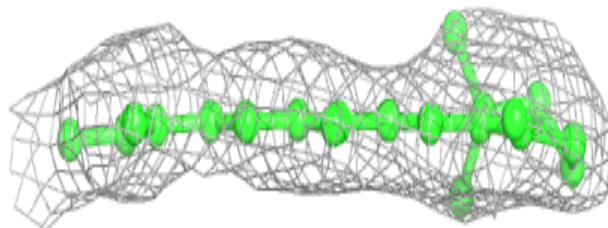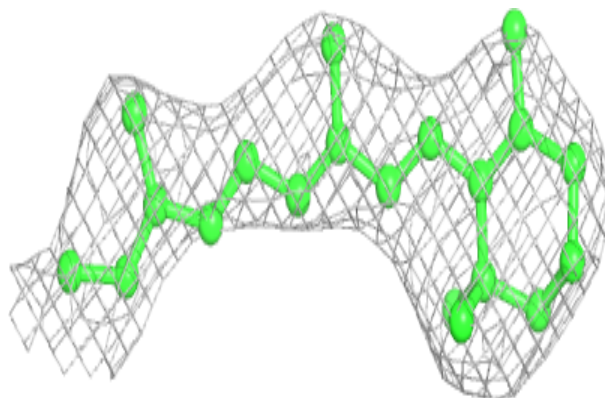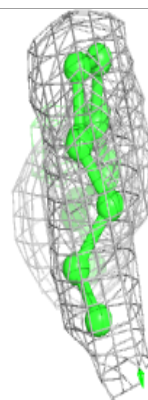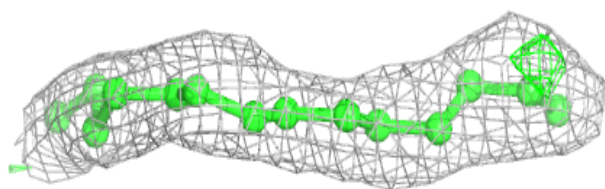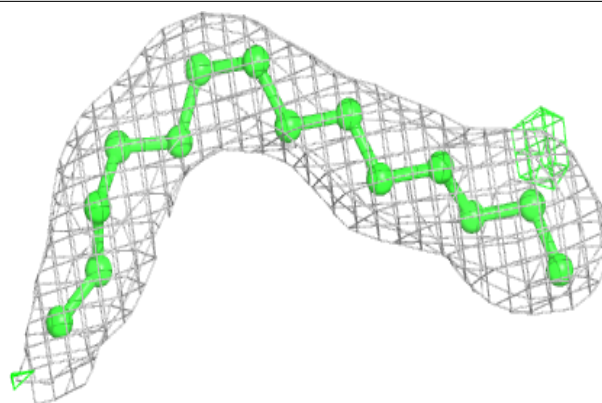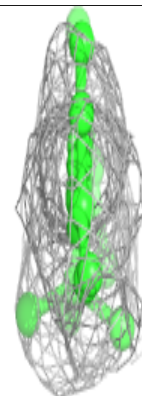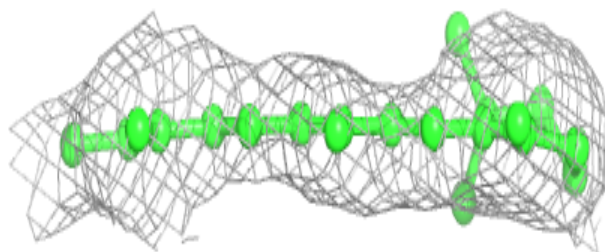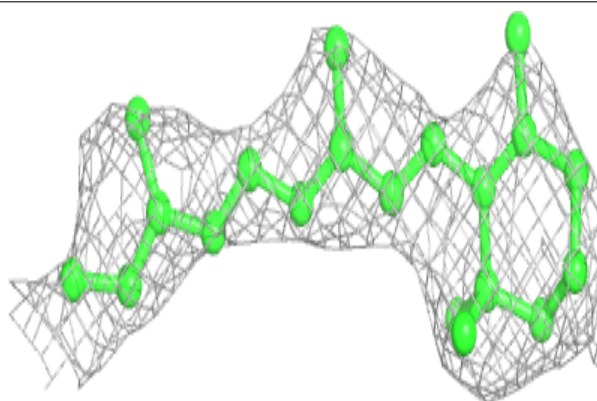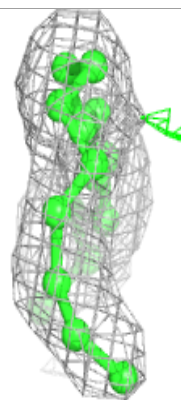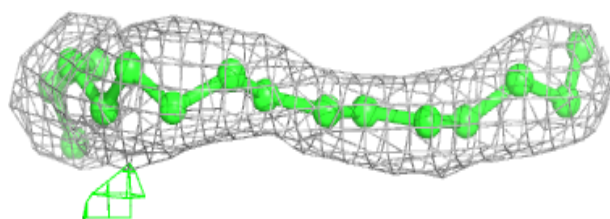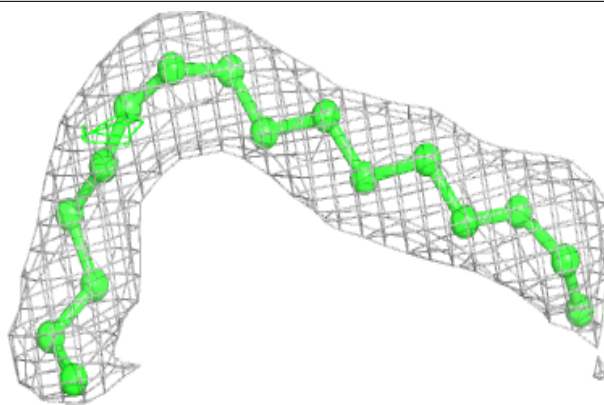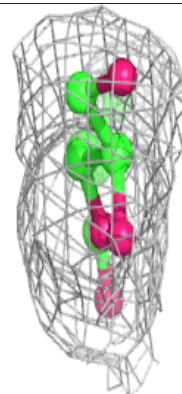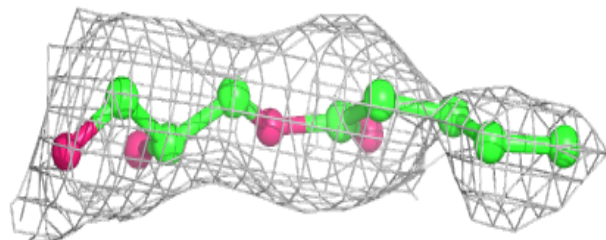$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
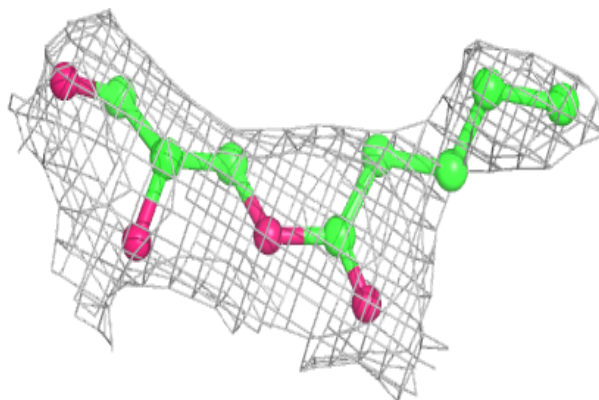and green (positive)
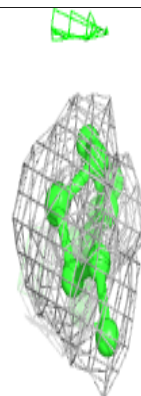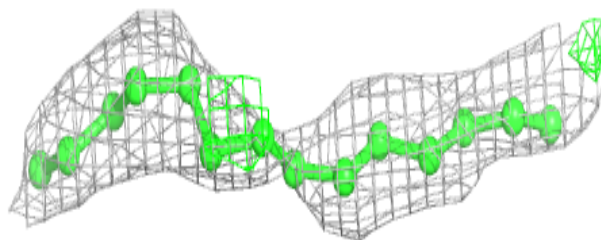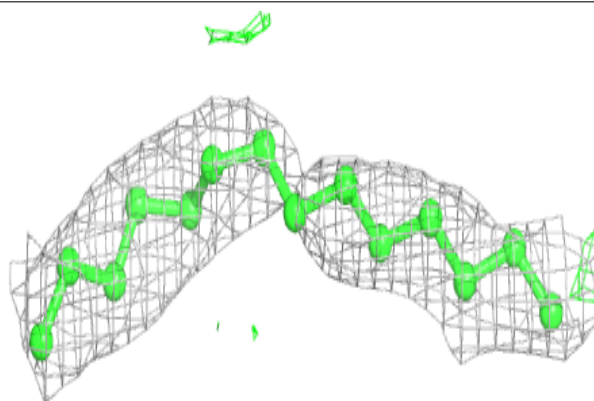
Electron density around LFA E 301:

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mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
and green (positive)
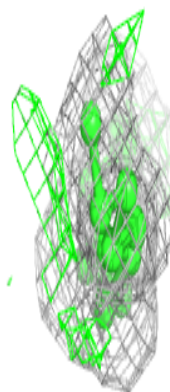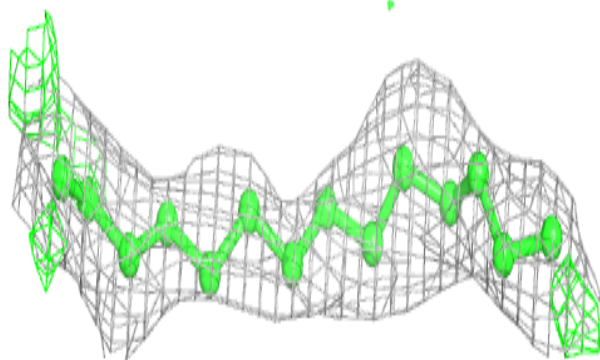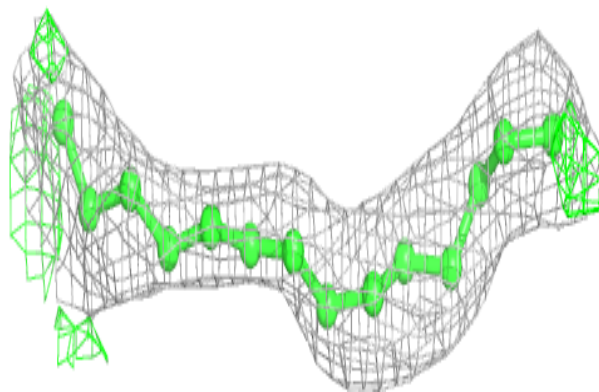
Electron density around LFA D 302:

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mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
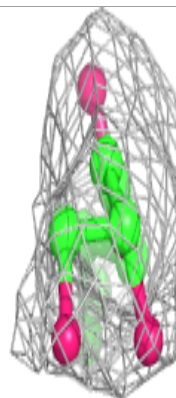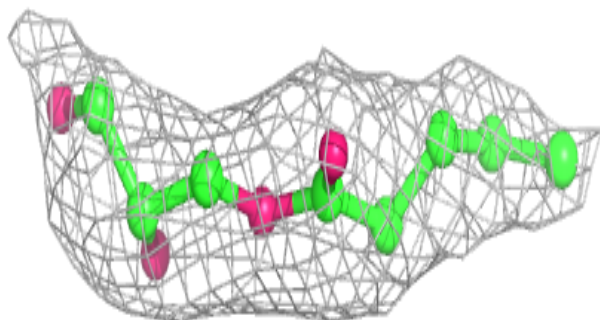and green (positive)
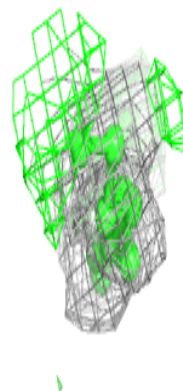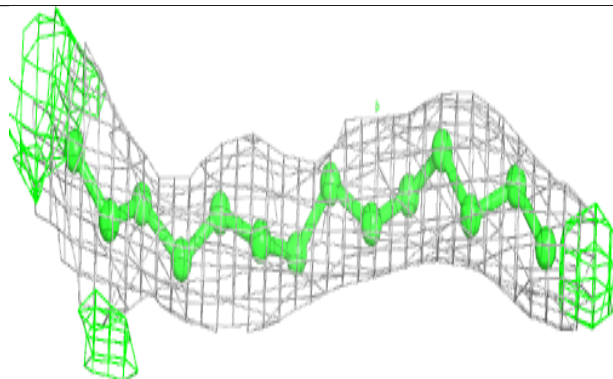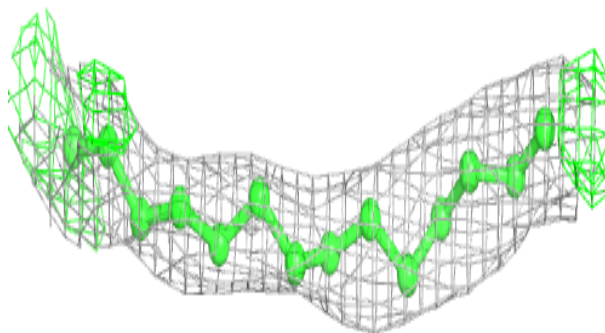
Electron density around OLC A 302:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
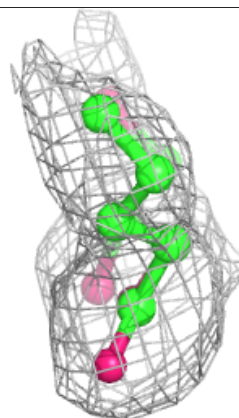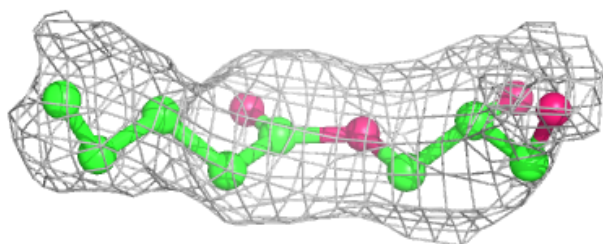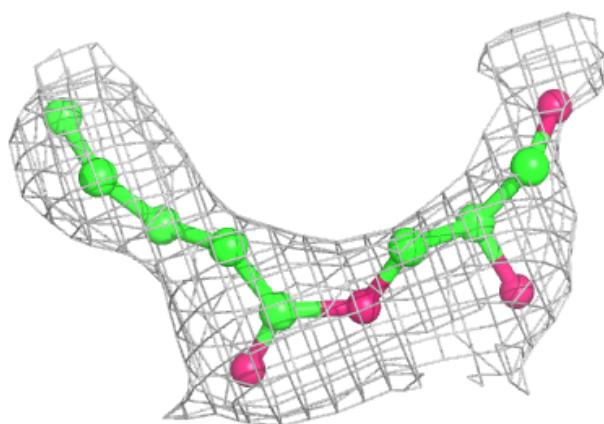
Electron density around LFA A 303:

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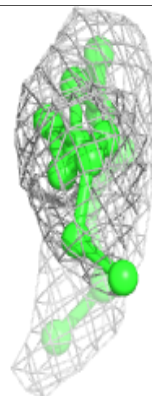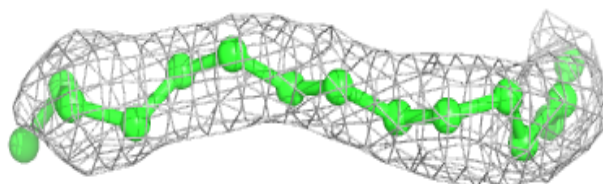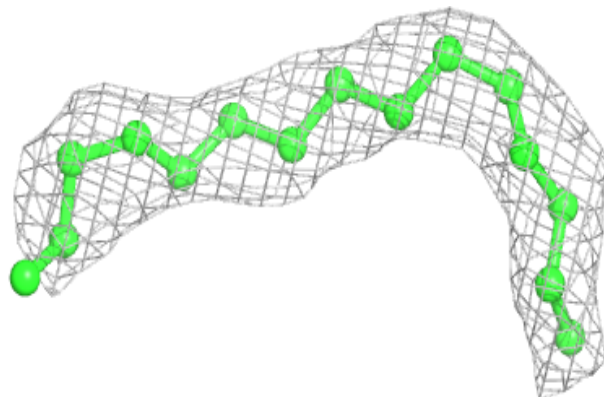
Electron density around OLC E 302:

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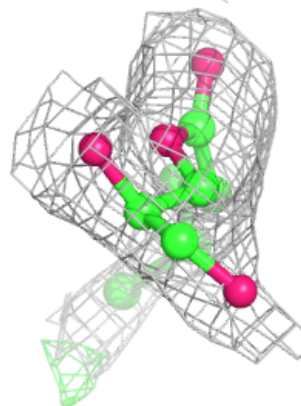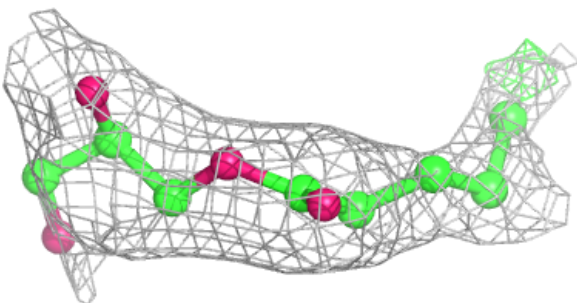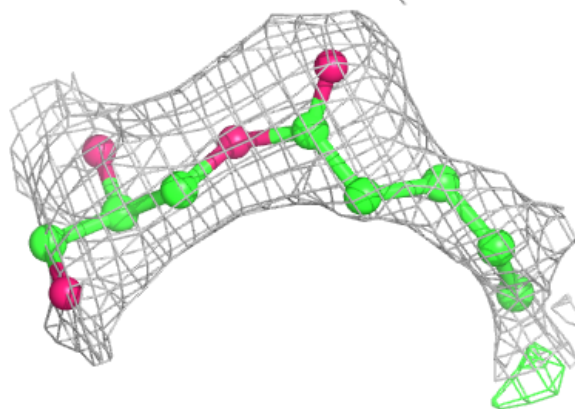
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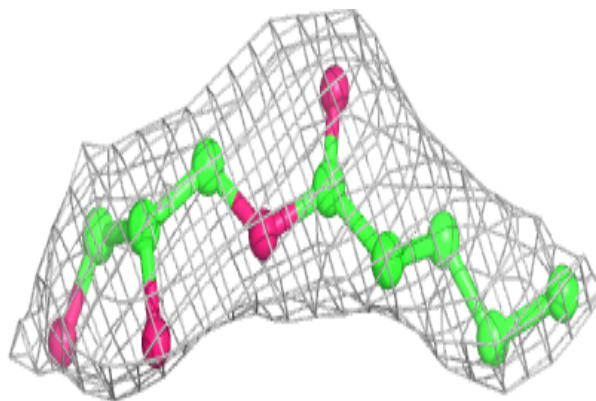$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
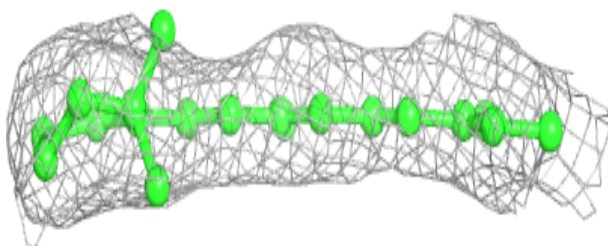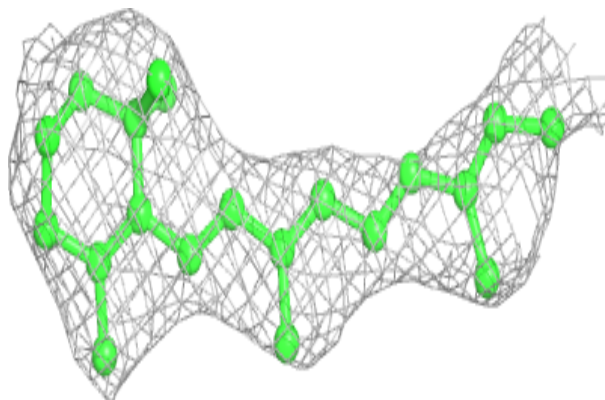and green (positive)
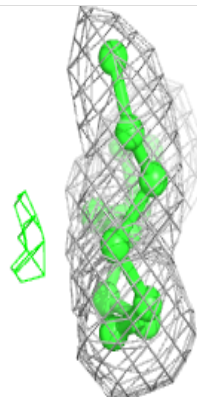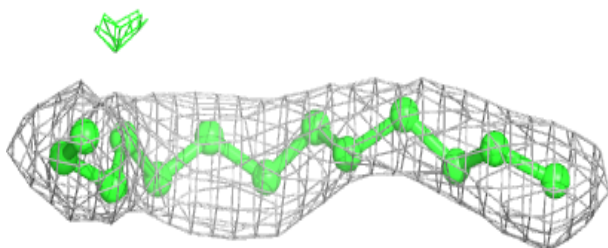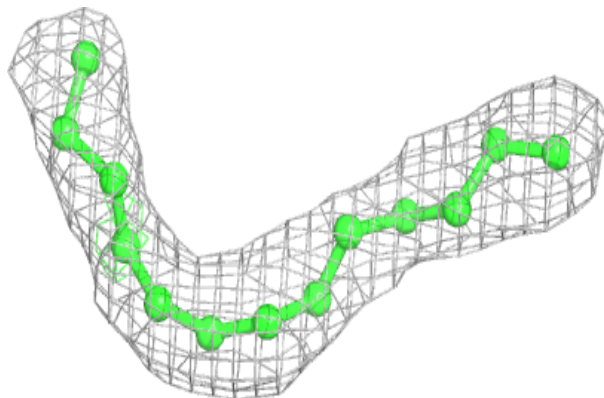
Electron density around LFA B 303:

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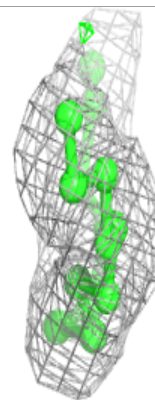and green (positive)
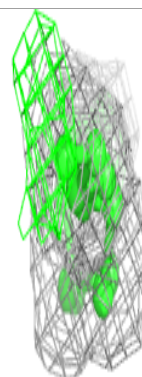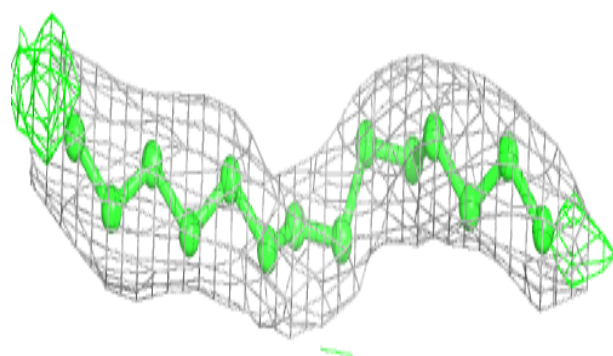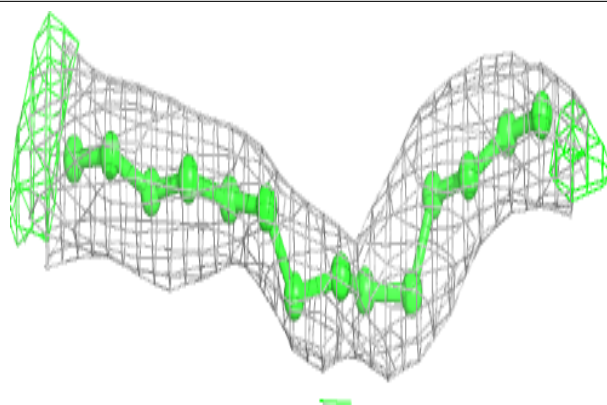
Electron density around RET B 306:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
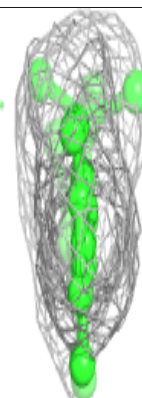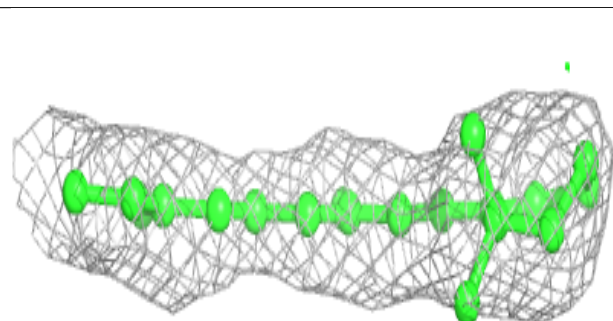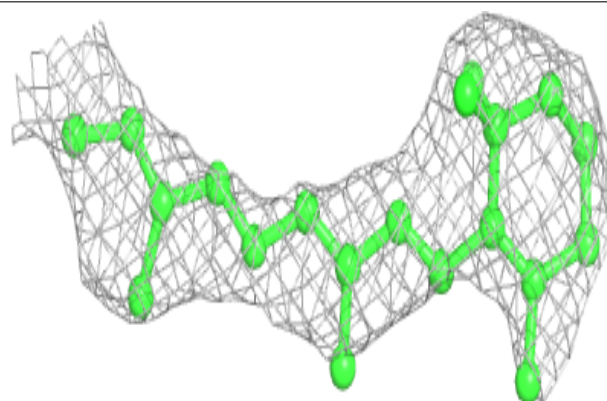
Electron density around OLC C 303:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
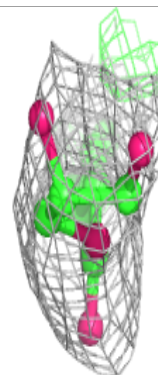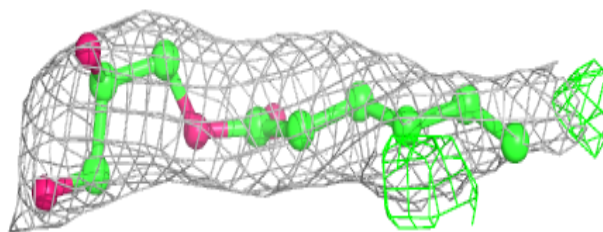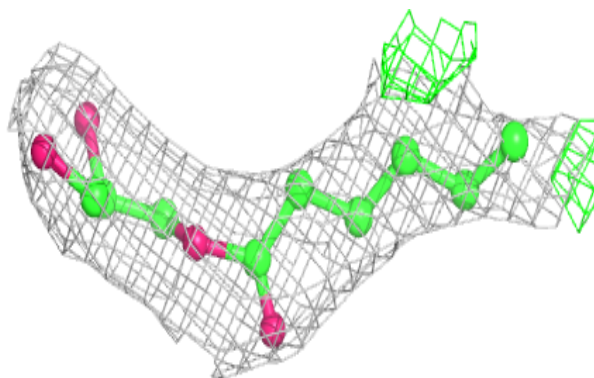
Electron density around RET E 304:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
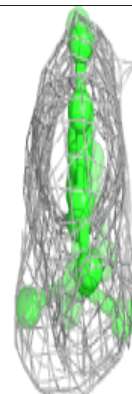
Electron density around LFA C 304:

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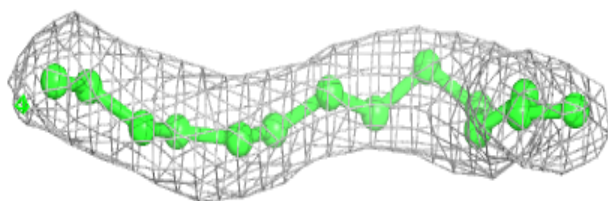and green (positive)

Electron density around RET A 305:

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

Electron density around LFA B 305:

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

Electron density around OLC B 304:

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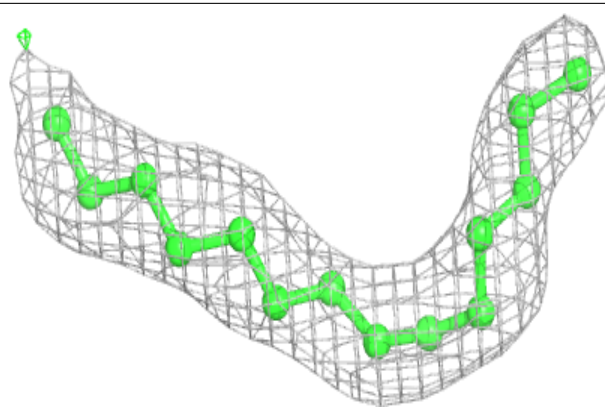and green (positive)

Electron density around OLC D 303:

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

Electron density around RET C 305:

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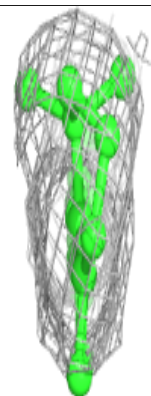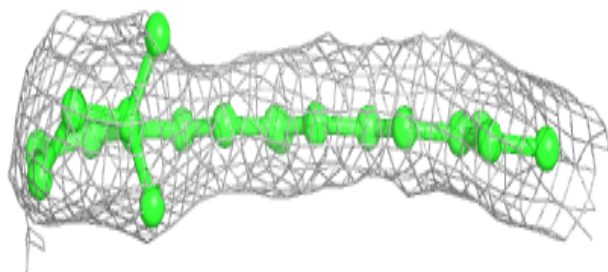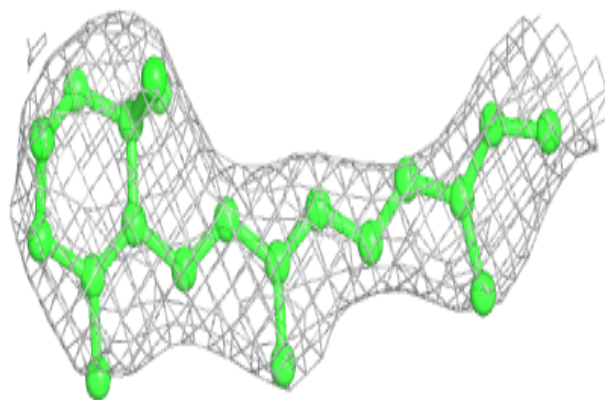$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative) and green (positive)

Electron density around LFA D 304:

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

Electron density around RET D 305:

$2mF_o$-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.