wwPDB EM Validation Summary Report ⓘ

Apr 15, 2025 – 10:22 am BST

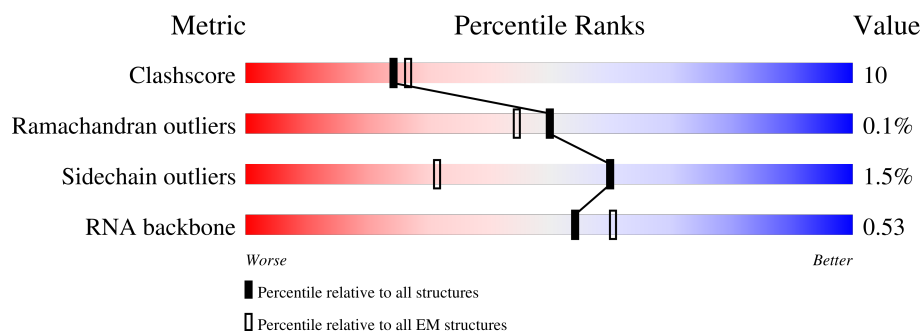|		
PDB ID	:	8RR3 / pdb_00008rr3
EMDB ID	:	EMD-19455
Title	:	Human mitochondrial RNase Z complex with ELAC2-D550N catalytic mutant and tRNA-Gln precursor (Composite model)
Authors	:	Bhatta, A.; Yu, R.D.; Kuhle, B.; Hillen, H.S.
Deposited on	:	2024-01-22
Resolution	:	3.40 Å(reported)
Based on initial models	:	., 7ONU

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1   Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:
ELECTRON MICROSCOPY

The reported resolution of this entry is 3.40 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	Percentile Ranks	Value
Clashscore		10
Ramachandran outliers		0.1%
Sidechain outliers		1.5%
RNA backbone		0.53

Worse   *Better*

▮ Percentile relative to all structures

▯ Percentile relative to all EM structures

Metric	Whole archive (#Entries)	EM structures (#Entries)
Clashscore	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415
RNA backbone	6643	2191

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the 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%

Mol	Chain	Length	Quality of chain
1	A	261	83% · · · · 14% · ·
1	B	261	70% · · · 17% · · · 13%
1	C	261	78% · · · · 20% · · · · ·
1	D	261	66% · · · 21% · · 11%
2	E	798	58% · · · 26% · · 16%
3	F	315	67% · · · 19% · · 13%
4	T	96	31% · · · 41% · · · 12% · · 16%

2   Entry composition ⓘ

There are 6 unique types of molecules in this entry. The entry contains 16294 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, 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 3-hydroxyacyl-CoA dehydrogenase type-2.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	255	Total	C	N	O	S	0	0
			1848	1164	325	351	8		
1	B	226	Total	C	N	O	S	0	0
			1622	1017	287	312	6		
1	C	255	Total	C	N	O	S	0	0
			1848	1164	325	351	8		
1	D	231	Total	C	N	O	S	0	0
			1663	1047	294	316	6		

- Molecule 2 is a protein called Zinc phosphodiesterase ELAC protein 2.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	E	672	Total	C	N	O	S	0	0
			5265	3346	922	960	37		

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
E	29	SER	-	expression tag	UNP Q9BQ52
E	30	ASN	-	expression tag	UNP Q9BQ52
E	31	ALA	-	expression tag	UNP Q9BQ52
E	550	ASN	ASP	engineered mutation	UNP Q9BQ52

- Molecule 3 is a protein called tRNA methyltransferase 10 homolog C.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	F	275	Total	C	N	O	S	0	0
			2278	1464	396	403	15		

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
F	89	SER	-	expression tag	UNP Q7L0Y3

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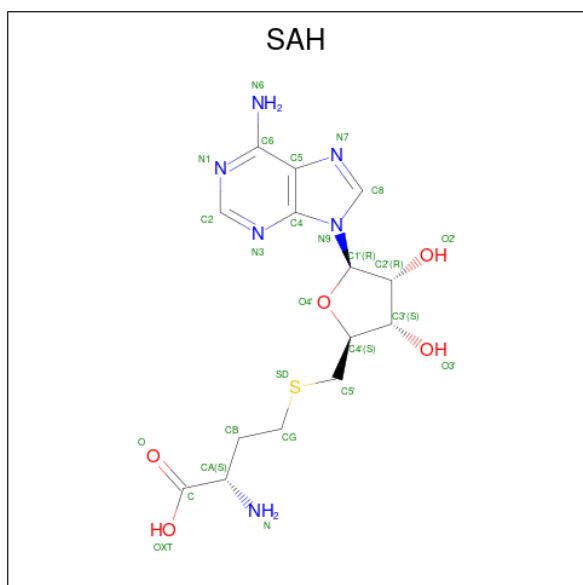| Chain	Residue	Modelled	Actual	Comment	Reference
F	90	ASN	-	expression tag	UNP Q7L0Y3
F	91	ALA	-	expression tag	UNP Q7L0Y3

- Molecule 4 is a RNA chain called Human mitochondrial tRNA-Gln precursor with 3' trailer RNA.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	P		
4	T	81	1742	775	314	572	81	0	0

- Molecule 5 is ZINC ION (CCD ID: ZN) (formula: Zn) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		AltConf
			Total	Zn	
5	E	2	2	2	0

- Molecule 6 is S-ADENOSYL-L-HOMOCYSTEINE (CCD ID: SAH) (formula: $C_{14}H_{20}N_6O_5S$) (labeled as "Ligand of Interest" by depositor).
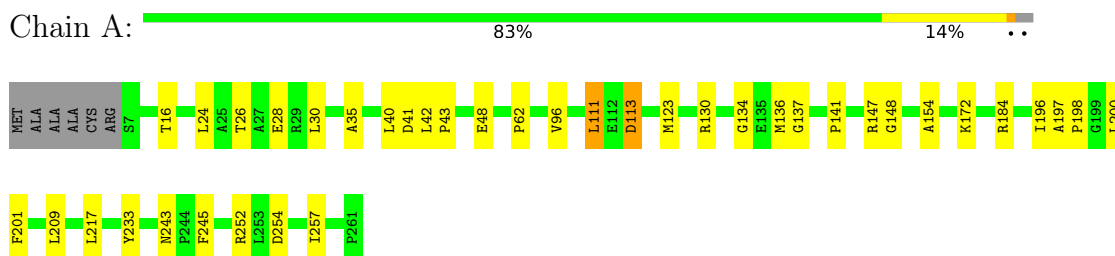

Mol	Chain	Residues	Atoms					AltConf
			Total	C	N	O	S	
6	F	1	26	14	6	5	1	0

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. 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. 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: 3-hydroxyacyl-CoA dehydrogenase type-2

Chain A:

• Molecule 1: 3-hydroxyacyl-CoA dehydrogenase type-2

Chain B:

• Molecule 1: 3-hydroxyacyl-CoA dehydrogenase type-2

Chain C:

• Molecule 1: 3-hydroxyacyl-CoA dehydrogenase type-2

Chain D:

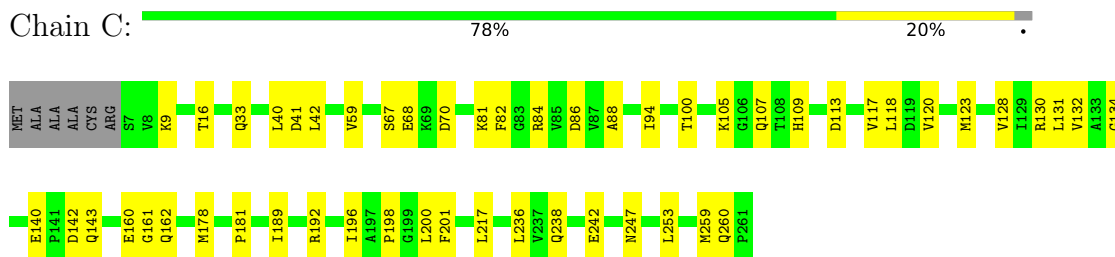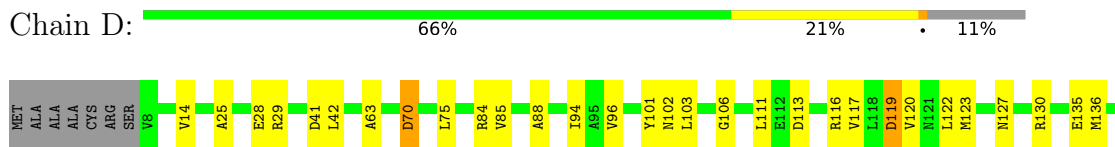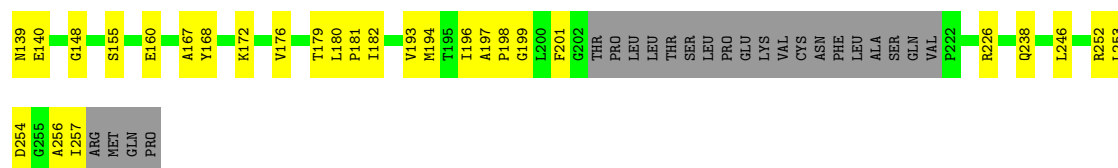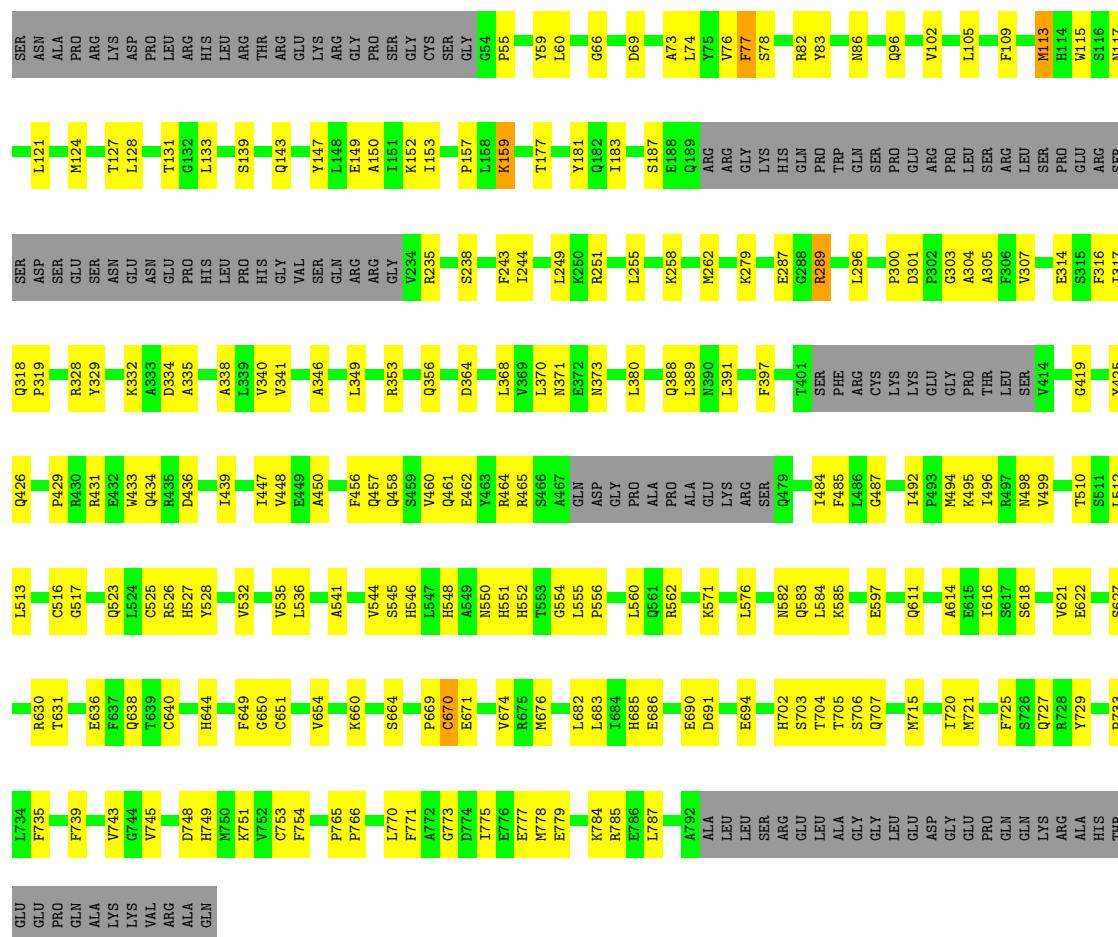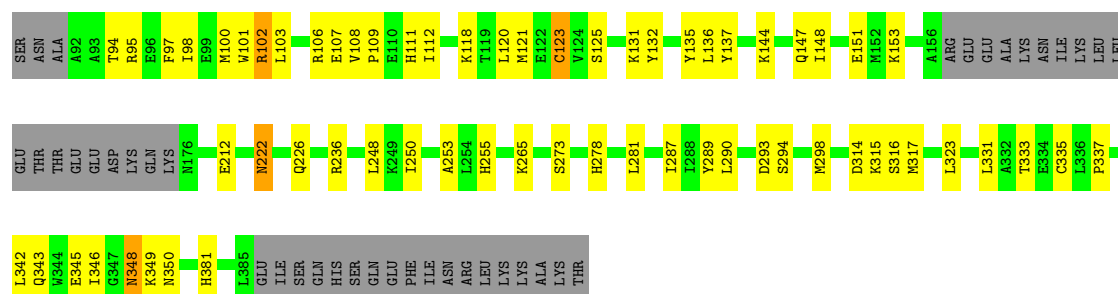N139 E140 G148 S155 E160 A167 Y168 K172 V176 T179 L180 P181 I182 V193 M194 T195 I196 A197 P198 G199 L200 F201 G202 THR PRO LEU LEU THR SER LEU PRO GLU LYS VAL CYS ASN PHE LEU ALA SER GLN VAL P222 R226 Q238 L246 R252 L253

D254 G255 A256 I257 ARG MET GLN PRO

• Molecule 2: Zinc phosphodiesterase ELAC protein 2

Chain E: 58% 26% • 16%

SER ASN ALA PRO ARG LYS ASP PRO LEU ARG HIS LEU ARG THR ARG GLU LYS ARG PRO SER GLY CYS SER GLY G54 P55 Y59 L60 G66 D69 A73 L74 Y75 V76 F77 S78 R82 Y83 N86 Q96 V102 L105 F109 M113 H114 W115 S116 N117

L121 M124 T127 L128 T131 G132 L133 S139 Q143 Y147 L148 E149 A150 I151 K152 I153 P157 L158 K159 T177 Y181 Q182 I183 S187 E188 Q189 ARG ARG GLY LYS HIS GLN PRO TRP GLN SER GLU ARG LEU SER ARG LEU SER PRO GLU ARG SER

SER ASP SER GLU SER ASN GLU ASN GLU PRO HIS LEU PRO HIS GLY VAL SER GLN ARG GLY V234 R235 S238 F243 I244 L249 K250 R251 L255 K258 M262 K279 E287 G288 R289 L296 P300 D301 P302 G303 A304 A305 F306 V307 E314 S315 F316 I317

Q318 P319 R328 Y329 K332 A333 D334 A335 A338 L339 V340 V341 A346 L349 R353 Q356 D364 L368 V369 L370 N371 E372 N373 L380 Q388 L389 N390 L391 F397 T401 SER PHE ARG CYS LYS GLU GLY PRO THR LEU SER V414 G419 Y425

Q426 P429 R430 R431 E432 W433 Q434 R435 D436 I439 I447 V448 E449 A450 F456 Q457 Q458 S459 V460 Q461 E462 Y463 R464 R465 S466 A467 GLN ASP GLY PRO ALA PRO ALA GLU LYS ARG SER Q479 I484 F485 L486 G487 I492 P493 M494 K495 I496 R497 N498 V499 T510 S511 L512

L513 C516 G517 Q523 L524 C525 R526 H527 Y528 V532 V535 L536 A541 V544 S545 H546 L547 H548 A549 N550 H551 H552 T553 G554 L555 P556 L560 Q561 R562 K571 L576 N582 Q583 L584 K585 E597 Q611 A614 E615 I616 S617 S618 V621 E622 S627

R630 T631 E636 F637 Q638 T639 C640 H644 F649 G650 C651 V654 K660 S664 P669 C670 E671 V674 R675 M676 L682 L683 I684 H685 E686 E690 D691 E694 H702 S703 T704 T705 S706 Q707 M715 I720 M721 F725 S726 Q727 R728 Y729 P733

L734 F735 F739 V743 G744 V745 D748 H749 K751 V752 C753 F754 P765 P766 L770 F771 A772 D774 I775 E776 E777 M778 E779 K784 R785 E786 L787 A792 ALA LEU LEU SER ARG GLU LEU ALA GLY GLY LEU GLU ASP GLY GLU PRO GLN GLN LYS ARG ALA HIS THR

GLU GLU PRO GLN ALA LYS LYS VAL ARG ALA GLN

• Molecule 3: tRNA methyltransferase 10 homolog C

Chain F: 67% 19% • 13%

SER ASN ALA A92 A93 T94 R95 E96 F97 I98 E99 M100 W101 R102 L103 R106 E107 V108 P109 E110 H111 I112 K118 T119 L120 M121 E122 C123 V124 S125 K131 Y132 Y135 L136 Y137 K144 Q147 I148 E151 M152 K153 A156 ARG GLU GLU ALA LYS ASN ILE LYS LEU LEU

GLU THR THR GLU GLU ASP LYS GLN LYS N176 E212 M222 Q226 R236 L248 K249 I250 A253 L254 H255 K265 S273 H278 L281 I287 I288 Y289 L290 D293 S294 M298 D314 K315 S316 M317 L323 L331 A332 T333 E334 C335 L336 P337

L342 Q343 W344 E345 I346 G347 N348 K349 N350 H381 L385 GLU ILE SER GLN HIS SER GLN GLU PHE ILE ASN ARG LEU LYS LYS ALA LYS THR

• Molecule 4: Human mitochondrial tRNA-Gln precursor with 3' trailer RNA

Chain T:

31% 41% 12% 16%

U1 A2 G3 G4 A5 U6 G7 G8 G9 U13 G14 A15 U16 A17 G18 G19 U20 G21 G22 C23 A24 G27 A28 G29 U32 U U U G36 G37 A38 U39 C43 A44 G45 G46 G47 A48 U49 G50 G51 G52 G56 A57 U58 U59 C60 U61 C62 A63 U67 C68 G72

G73 C74 U75 C76 C77 G78 A79 G80 G U G A U U U C A A G C93 G96

4　Experimental information　ⓘ

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	75812	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose $(e^-/\text{Å}^2)$	40	Depositor
Minimum defocus (nm)	500	Depositor
Maximum defocus (nm)	2500	Depositor
Magnification	105000	Depositor
Image detector	GATAN K3 (6k x 4k)	Depositor

5   Model quality ⓘ

5.1   Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: SAH, 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	0.29	0/1874	0.65	2/2541 (0.1%)
1	B	0.27	0/1639	0.58	0/2219
1	C	0.27	0/1874	0.55	0/2541
1	D	0.28	0/1684	0.59	0/2280
2	E	0.26	0/5380	0.61	0/7293
3	F	0.30	0/2326	0.60	1/3127 (0.0%)
4	T	0.21	0/1947	0.82	0/3032
All	All	0.27	0/16724	0.63	3/23033 (0.0%)

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	111	LEU	CB-CG-CD1	-6.07	100.69	111.00
3	F	121	MET	CA-CB-CG	5.41	122.50	113.30
1	A	113	ASP	CB-CG-OD1	5.21	122.99	118.30

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	1848	0	1896	27	0

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WORLDWIDE
wwPDB
PROTEIN DATA BANK

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	B	1622	0	1653	33	0
1	C	1848	0	1896	37	0
1	D	1663	0	1702	41	0
2	E	5265	0	5289	145	0
3	F	2278	0	2322	46	0
4	T	1742	0	873	33	0
5	E	2	0	0	0	0
6	F	26	0	19	5	0
All	All	16294	0	15650	335	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 10.

The worst 5 of 335 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:111:LEU:HD11	1:B:123:MET:SD	2.02	0.99
2:E:73:ALA:HA	2:E:86:ASN:HD22	1.38	0.88
2:E:183:ILE:HD11	2:E:244:ILE:HG12	1.56	0.88
2:E:494:MET:SD	2:E:496:ILE:N	2.50	0.85
2:E:332:LYS:HG3	2:E:334:ASP:H	1.44	0.83

There are no symmetry-related clashes.

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 PDB entries followed by that with respect to all EM entries.

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	253/261 (97%)	248 (98%)	5 (2%)	0	100	100
1	B	220/261 (84%)	217 (99%)	3 (1%)	0	100	100
1	C	253/261 (97%)	247 (98%)	6 (2%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	D	227/261 (87%)	224 (99%)	3 (1%)	0	100	100
2	E	664/798 (83%)	637 (96%)	26 (4%)	1 (0%)	44	72
3	F	271/315 (86%)	257 (95%)	13 (5%)	1 (0%)	30	60
All	All	1888/2157 (88%)	1830 (97%)	56 (3%)	2 (0%)	50	78

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
3	F	345	GLU
2	E	429	PRO

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 PDB entries followed by that with respect to all EM entries.

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	192/195 (98%)	192 (100%)	0	100	100
1	B	165/195 (85%)	164 (99%)	1 (1%)	84	90
1	C	192/195 (98%)	192 (100%)	0	100	100
1	D	169/195 (87%)	167 (99%)	2 (1%)	67	80
2	E	579/686 (84%)	566 (98%)	13 (2%)	47	68
3	F	247/284 (87%)	240 (97%)	7 (3%)	38	62
All	All	1544/1750 (88%)	1521 (98%)	23 (2%)	60	76

5 of 23 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	E	670	CYS
3	F	111	HIS
3	F	102	ARG
3	F	123	CYS
2	E	159	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 8 such sidechains are listed below:

Mol	Chain	Res	Type
2	E	550	ASN
2	E	248	HIS
2	E	96	GLN
2	E	86	ASN
2	E	107	ASN

5.3.3 RNA ⓘ

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
4	T	80/96 (83%)	23 (28%)	4 (5%)

5 of 23 RNA backbone outliers are listed below:

Mol	Chain	Res	Type
4	T	2	A
4	T	3	G
4	T	4	G
4	T	8	G
4	T	13	U

All (4) RNA pucker outliers are listed below:

Mol	Chain	Res	Type
4	T	1	U
4	T	2	A
4	T	15	A
4	T	36	G

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

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

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 3 ligands modelled in this entry, 2 are monoatomic - leaving 1 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	SAH	F	501	-	24,28,28	1.21	3 (12%)	25,40,40	1.82	7 (28%)

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	SAH	F	501	-	-	4/11/31/31	0/3/3/3

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	F	501	SAH	C2-N3	3.95	1.38	1.32
6	F	501	SAH	C2-N1	2.40	1.38	1.33
6	F	501	SAH	OXT-C	-2.12	1.23	1.30

The worst 5 of 7 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	F	501	SAH	N3-C2-N1	-5.31	120.38	128.68
6	F	501	SAH	C3'-C2'-C1'	3.22	105.83	100.98
6	F	501	SAH	C5'-SD-CG	-3.04	93.14	102.27
6	F	501	SAH	OXT-C-O	-2.62	118.14	124.09
6	F	501	SAH	O4'-C4'-C5'	2.48	115.22	108.83

There are no chirality outliers.
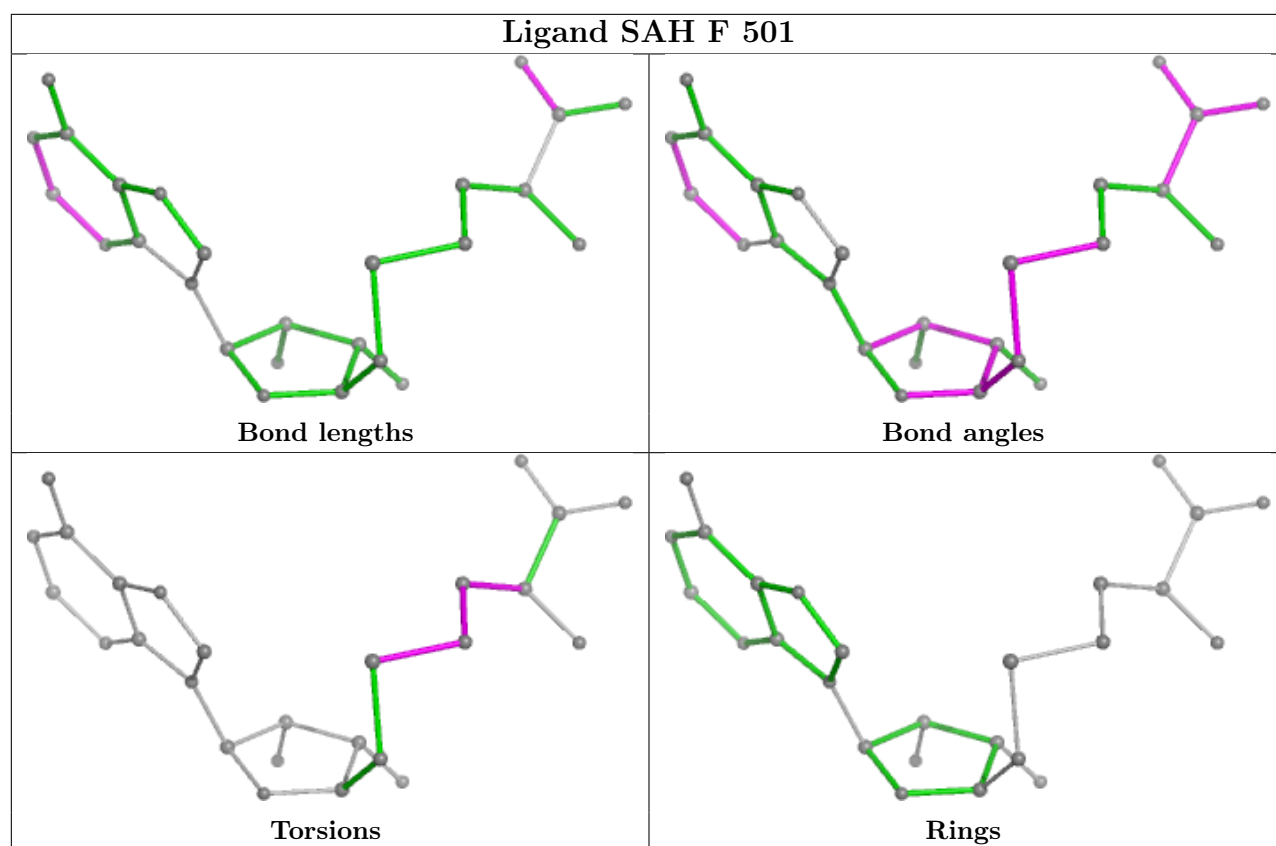
All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	F	501	SAH	N-CA-CB-CG
6	F	501	SAH	C-CA-CB-CG
6	F	501	SAH	CB-CG-SD-C5'
6	F	501	SAH	CA-CB-CG-SD

There are no ring outliers.

1 monomer is involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	F	501	SAH	5	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 SAH F 501

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   Map visualisation ⓘ

This section contains visualisations of the EMDB entry EMD-19455. These allow visual inspection of the internal detail of the map and identification of artifacts.

No raw map or half-maps were deposited for this entry and therefore no images, graphs, etc. pertaining to the raw map can be shown.

6.1   Orthogonal projections ⓘ

This section was not generated.

6.2   Central slices ⓘ

This section was not generated.

6.3   Largest variance slices ⓘ

This section was not generated.

6.4   Orthogonal standard-deviation projections (False-color) ⓘ

This section was not generated.

6.5   Orthogonal surface views ⓘ

This section was not generated.

6.6   Mask visualisation ⓘ

This section was not generated. No masks/segmentation were deposited.

7   Map analysis ⓘ

This section contains the results of statistical analysis of the map.

7.1   Map-value distribution ⓘ

This section was not generated.

7.2   Volume estimate versus contour level ⓘ

This section was not generated.

7.3   Rotationally averaged power spectrum ⓘ

This section was not generated. The rotationally averaged power spectrum had issues being displayed.

8 Fourier-Shell correlation (i)

This section was not generated. No FSC curve or half-maps provided.

9 Map-model fit ⓘ

This section was not generated.