



Full wwPDB EM Validation Report ⓘ

Apr 16, 2024 – 06:30 am BST

PDB ID : 8OIS
EMDB ID : EMD-16898
Title : 28S human mitochondrial small ribosomal subunit with mtRF1 and P-site tRNA
Authors : Saurer, M.; Leibundgut, M.; Scaiola, A.; Schoenhut, T.; Ban, N.
Deposited on : 2023-03-23
Resolution : 3.00 Å (reported)
Based on initial models : ., 7QI4

This is a Full wwPDB EM Validation Report for a publicly released PDB entry.

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

A user guide is available at

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

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:

EMDB validation analysis : 0.0.1.dev92
Mogul : 1.8.4, CSD as541be (2020)
MolProbity : 4.02b-467
buster-report : 1.1.7 (2018)
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
MapQ : **FAILED**
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.36

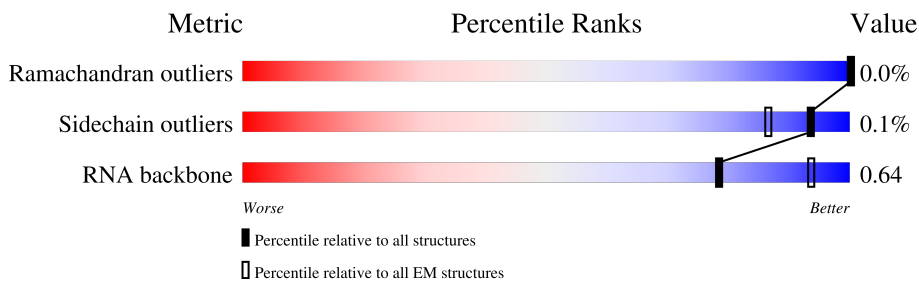
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

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)	EM structures (#Entries)
Ramachandran outliers	154571	4023
Sidechain outliers	154315	3826
RNA backbone	4643	859

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 $\leq 5\%$.

Mol	Chain	Length	Quality of chain
1	BX	292	5% 95%
2	Bd	128	20% 80%
3	AA	955	87% 13%
4	AB	323	86% 14%
5	AC	167	79% 21%
6	AD	199	35% 65%
7	AE	125	97% ..
8	AF	242	86% 14%
9	AG	71	80% 20%


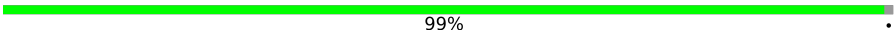
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Mol	Chain	Length	Quality of chain	
10	AH	201	69%	30%
11	AI	33	97%	.
12	AJ	138	78%	22%
13	AK	128	79%	21%
14	AL	257	67%	32%
15	AM	137	87%	13%
16	AN	130	85%	15%
17	AO	258	75%	25%
18	AP	142	68%	32%
19	AQ	87	99%	.
20	AR	360	82%	18%
21	AS	190	71%	29%
22	AT	173	97%	.
23	AU	205	86%	14%
24	AV	414	87%	13%
25	AW	187	53%	47%
26	AX	398	88%	12%
27	AY	395	38%	62%
28	AZ	106	94%	6%
29	Aa	484	79%	21%
30	Ab	296	76%	24%
31	Ac	118	99%	.
32	Ad	430	80%	20%
33	Ae	689	85%	15%
34	Ag	396	82%	17%

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Mol	Chain	Length	Quality of chain
35	Ai	194	 70% 29%
36	Aj	218	 99%

2 Entry composition [i](#)

There are 44 unique types of molecules in this entry. The entry contains 72671 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 39S ribosomal protein L19, mitochondrial.

Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
1	BX	14	113	74	22	17	0	0

- Molecule 2 is a protein called 39S ribosomal protein L55, mitochondrial.

Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
2	Bd	26	241	150	45	46	0	0

- Molecule 3 is a RNA chain called 12S rRNA.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	P		
3	AA	955	20283	9098	3652	6578	955	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
AA	62	G	A	variant	GB OM714795.1

- Molecule 4 is a protein called 28S ribosomal protein S35, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
4	AB	279	2265	1435	387	432	11	0	0

- Molecule 5 is a protein called 28S ribosomal protein S24, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
5	AC	132	1083	699	195	185	4	0	0

- Molecule 6 is a protein called Aurora kinase A-interacting protein.

Mol	Chain	Residues	Atoms					AltConf	Trace
6	AD	70	Total	C	N	O	S	0	0
			625	401	134	89	1		

- Molecule 7 is a protein called 28S ribosomal protein S6, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
7	AE	122	Total	C	N	O	S	0	0
			972	614	177	177	4		

- Molecule 8 is a protein called 28S ribosomal protein S7, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
8	AF	208	Total	C	N	O	S	0	0
			1725	1104	312	298	11		

- Molecule 9 is a RNA chain called P-site Met-tRNA(Met).

Mol	Chain	Residues	Atoms					AltConf	Trace
9	AG	71	Total	C	N	O	P	0	0
			1504	674	264	495	71		

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
AG	69	C	-	insertion	GB NC_012920.1
AG	70	C	-	insertion	GB NC_012920.1

- Molecule 10 is a protein called 28S ribosomal protein S10, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
10	AH	140	Total	C	N	O	S	0	0
			1152	745	194	210	3		

- Molecule 11 is a RNA chain called mRNA.

Mol	Chain	Residues	Atoms					AltConf	Trace
11	AI	33	Total	C	N	O	P	0	0
			463	198	29	203	33		

- Molecule 12 is a protein called 28S ribosomal protein S12, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
12	AJ	108	839	521	169	143	6	0	0

- Molecule 13 is a protein called 28S ribosomal protein S14, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
13	AK	101	862	537	179	141	5	0	0

- Molecule 14 is a protein called 28S ribosomal protein S15, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
14	AL	174	1453	925	270	251	7	0	0

- Molecule 15 is a protein called 28S ribosomal protein S16, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
15	AM	119	942	594	185	157	6	0	0

- Molecule 16 is a protein called 28S ribosomal protein S17, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
16	AN	110	868	562	156	147	3	0	0

- Molecule 17 is a protein called 28S ribosomal protein S18b, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
17	AO	193	1592	1014	294	277	7	0	0

- Molecule 18 is a protein called 28S ribosomal protein S18c, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
18	AP	97	781	501	134	138	8	0	0

- Molecule 19 is a protein called 28S ribosomal protein S21, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
19	AQ	86	Total	C	N	O	S	0	0
			744	460	150	126	8		

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
AQ	50	ARG	CYS	variant	UNP P82921

- Molecule 20 is a protein called 28S ribosomal protein S22, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
20	AR	295	Total	C	N	O	S	0	0
			2409	1533	413	455	8		

- Molecule 21 is a protein called 28S ribosomal protein S23, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
21	AS	135	Total	C	N	O	S	0	0
			1111	716	198	196	1		

- Molecule 22 is a protein called 28S ribosomal protein S25, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
22	AT	168	Total	C	N	O	S	0	0
			1371	877	239	244	11		

- Molecule 23 is a protein called 28S ribosomal protein S26, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
23	AU	176	Total	C	N	O	S	0	0
			1488	916	301	267	4		

- Molecule 24 is a protein called 28S ribosomal protein S27, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
24	AV	362	Total	C	N	O	S	0	0
			2969	1904	495	558	12		

- Molecule 25 is a protein called 28S ribosomal protein S28, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
25	AW	100	789	498	141	146	4	0	0

- Molecule 26 is a protein called 28S ribosomal protein S29, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
26	AX	352	2849	1822	499	517	11	0	0

- Molecule 27 is a protein called 28S ribosomal protein S31, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
27	AY	149	1246	801	207	234	4	0	0

- Molecule 28 is a protein called 28S ribosomal protein S33, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
28	AZ	100	839	534	153	148	4	0	0

- Molecule 29 is a protein called Peptide chain release factor 1, mitochondrial,mtRF1(AAQ).

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
29	Aa	381	3114	1940	569	592	13	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
Aa	311	ALA	GLY	engineered mutation	UNP O75570
Aa	312	ALA	GLY	engineered mutation	UNP O75570

- Molecule 30 is a protein called 28S ribosomal protein S2, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
30	Ab	225	1828	1164	331	323	10	0	0

- Molecule 31 is a protein called Coiled-coil-helix-coiled-coil-helix domain-containing protein 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
31	Ac	117	935	579	182	166	8	0	0

- Molecule 32 is a protein called 28S ribosomal protein S5, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
32	Ad	343	2731	1713	518	487	13	0	0

- Molecule 33 is a protein called Pentatricopeptide repeat domain-containing protein 3, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
33	Ae	588	4768	3053	808	879	28	0	0

- Molecule 34 is a protein called 28S ribosomal protein S9, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
34	Ag	327	2688	1710	477	487	14	0	0

- Molecule 35 is a protein called 28S ribosomal protein S11, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
35	Ai	137	1020	642	192	182	4	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
Ai	184	5F0	ASN	variant	UNP P82912

- Molecule 36 is a protein called 28S ribosomal protein S34, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
36	Aj	215	1787	1130	339	313	5	0	0

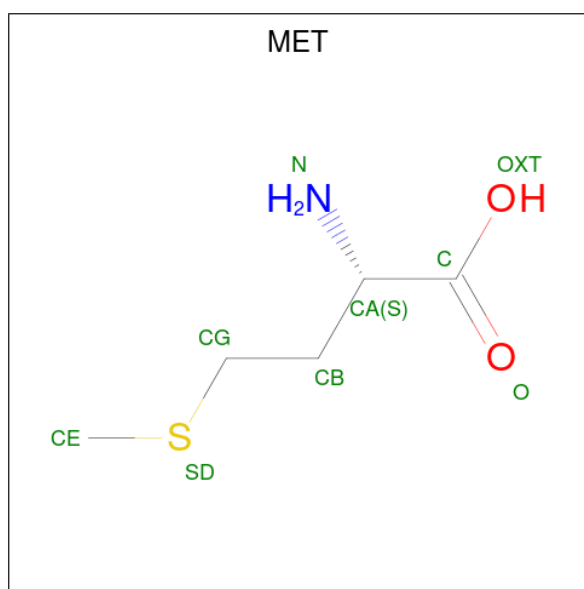
- Molecule 37 is POTASSIUM ION (three-letter code: K) (formula: K).

Mol	Chain	Residues	Atoms	AltConf
37	AA	16	Total K 16 16	0
37	Ae	1	Total K 1 1	0

- Molecule 38 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms	AltConf
38	AA	120	Total Mg 120 120	0
38	AD	1	Total Mg 1 1	0
38	AG	1	Total Mg 1 1	0
38	AU	1	Total Mg 1 1	0
38	AX	1	Total Mg 1 1	0
38	Ab	1	Total Mg 1 1	0
38	Ad	1	Total Mg 1 1	0

- Molecule 39 is METHIONINE (three-letter code: MET) (formula: C₅H₁₁NO₂S).

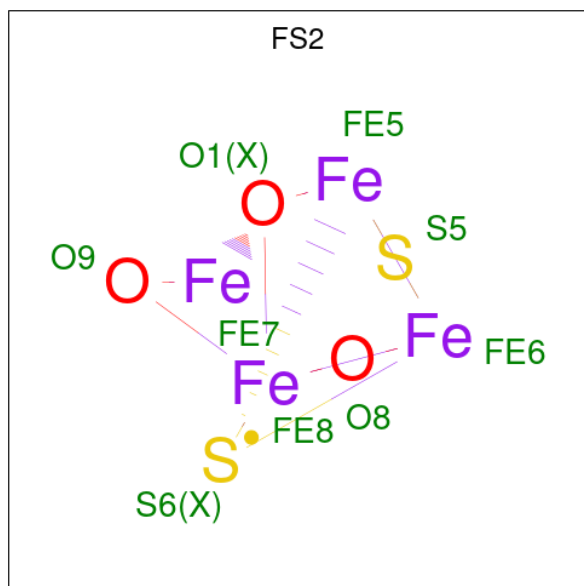


Mol	Chain	Residues	Atoms	AltConf
39	AG	1	Total C N O S 8 5 1 1 1	0

- Molecule 40 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		AltConf
			Total	Zn	
40	AO	1	1	1	0

- Molecule 41 is FE-S-O HYBRID CLUSTER (three-letter code: FS2) (formula: Fe₄O₃S₂).



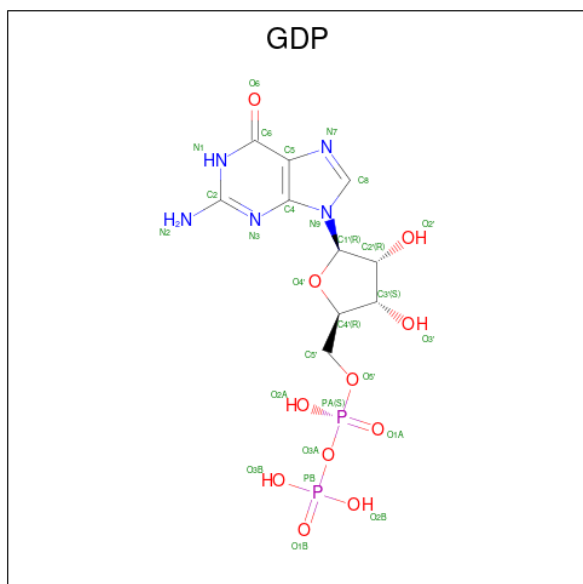
Mol	Chain	Residues	Atoms			AltConf
			Total	Fe	S	
41	AP	1	4	2	2	0
41	AT	1	4	2	2	0

- Molecule 42 is ADENOSINE-5'-TRIPHOSPHATE (three-letter code: ATP) (formula: C₁₀H₁₆N₅O₁₃P₃).



Mol	Chain	Residues	Atoms					AltConf
			Total	C	N	O	P	
42	AX	1	31	10	5	13	3	0

- Molecule 43 is GUANOSINE-5'-DIPHOSPHATE (three-letter code: GDP) (formula: $C_{10}H_{15}N_5O_{11}P_2$).



Mol	Chain	Residues	Atoms					AltConf
			Total	C	N	O	P	
43	AX	1	28	10	5	11	2	0

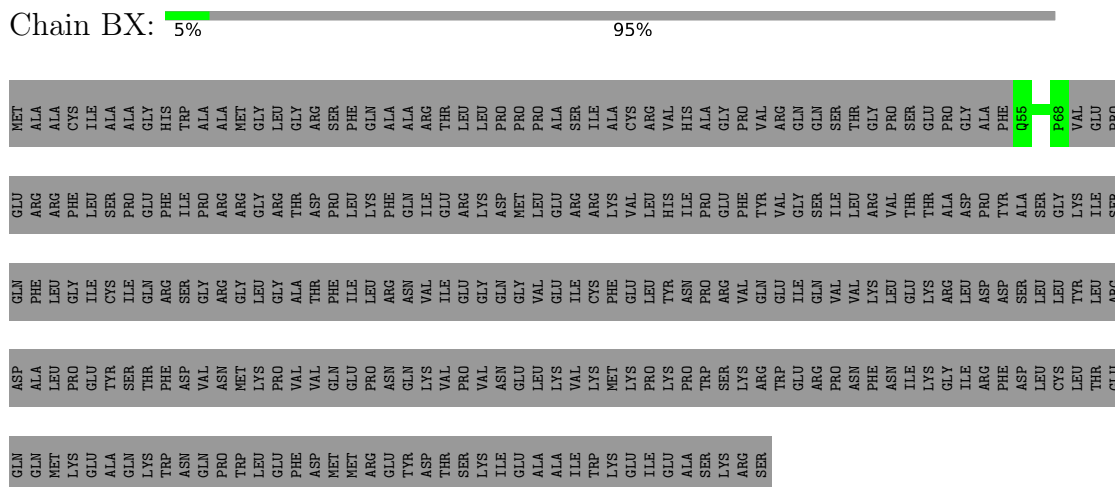
- Molecule 44 is water.

Mol	Chain	Residues	Atoms		AltConf
44	AX	3	Total	O	0
			3	3	

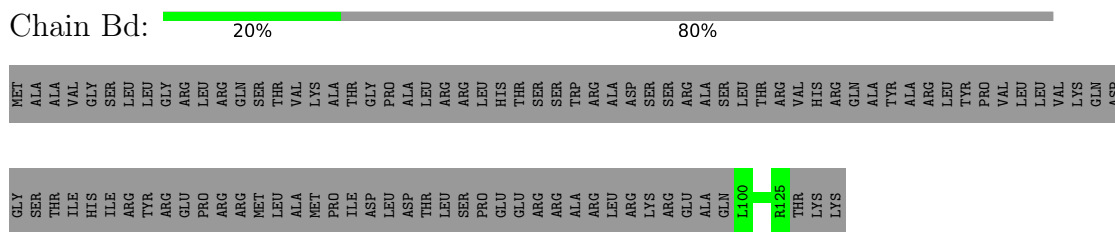
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. 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.

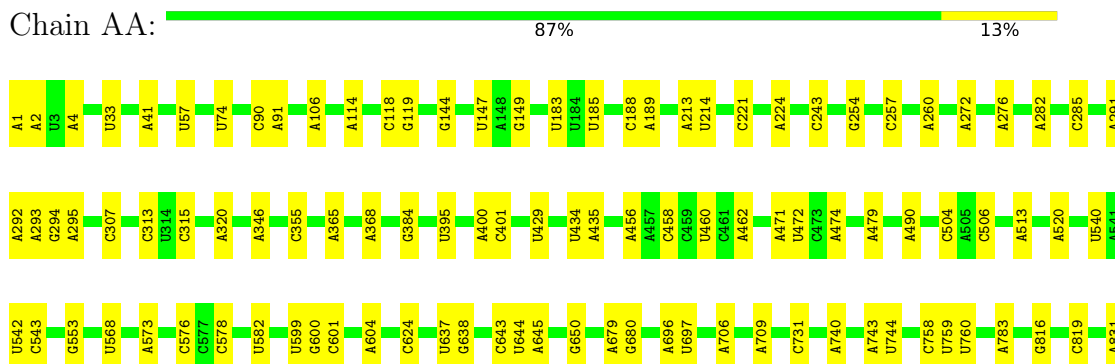
- Molecule 1: 39S ribosomal protein L19, mitochondrial

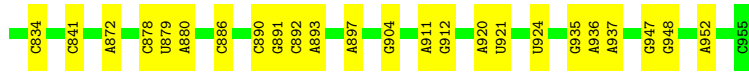


- Molecule 2: 39S ribosomal protein L55, mitochondrial

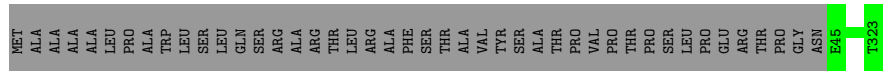
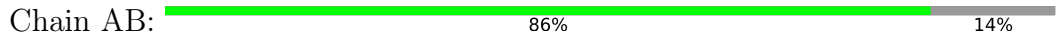


- Molecule 3: 12S rRNA

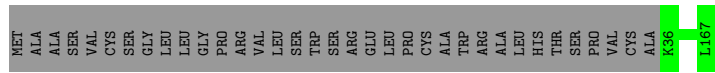
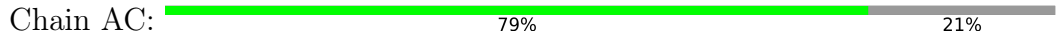




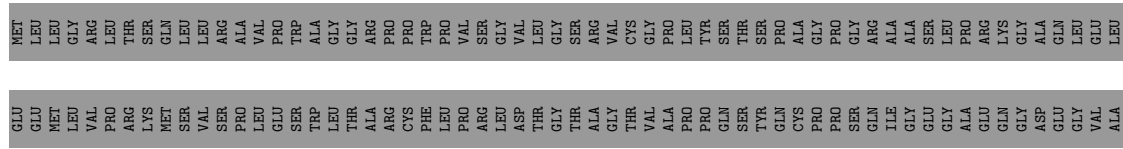
- Molecule 4: 28S ribosomal protein S35, mitochondrial



- Molecule 5: 28S ribosomal protein S24, mitochondrial



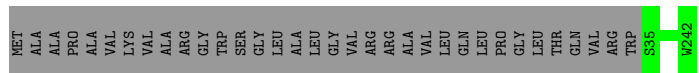
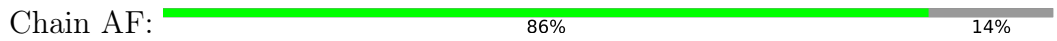
- Molecule 6: Aurora kinase A-interacting protein



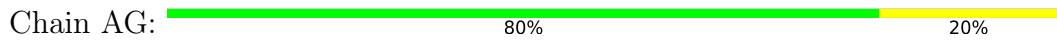
- Molecule 7: 28S ribosomal protein S6, mitochondrial

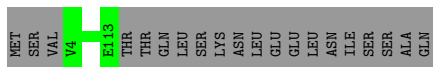


- Molecule 8: 28S ribosomal protein S7, mitochondrial

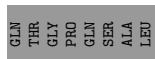
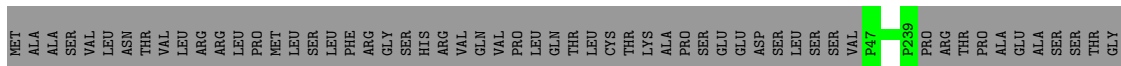
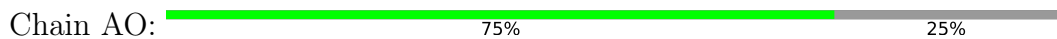


- Molecule 9: P-site Met-tRNA(Met)

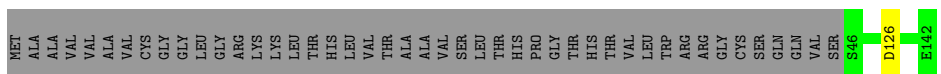
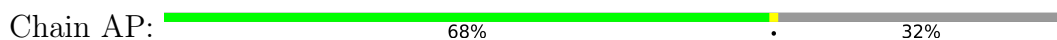




- Molecule 17: 28S ribosomal protein S18b, mitochondrial



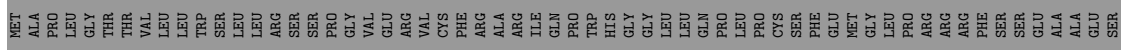
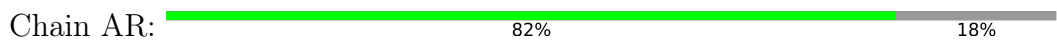
- Molecule 18: 28S ribosomal protein S18c, mitochondrial



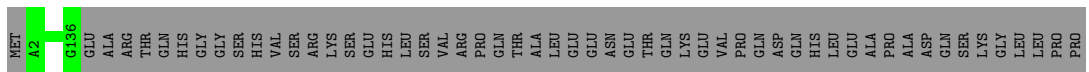
- Molecule 19: 28S ribosomal protein S21, mitochondrial



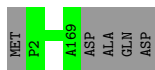
- Molecule 20: 28S ribosomal protein S22, mitochondrial



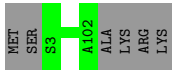
- Molecule 21: 28S ribosomal protein S23, mitochondrial




- Molecule 22: 28S ribosomal protein S25, mitochondrial

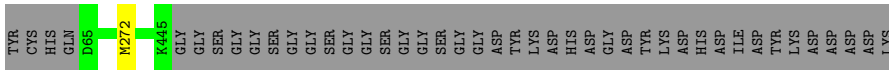


Chain AZ:  94% 6%




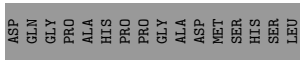
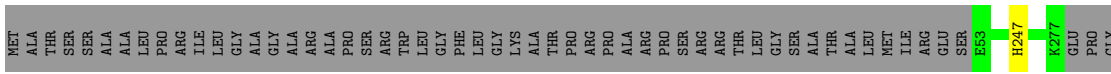
- Molecule 29: Peptide chain release factor 1, mitochondrial, mtRF1(AAQ)

Chain Aa:  79% 21%



- Molecule 30: 28S ribosomal protein S2, mitochondrial

Chain Ab:  76% 24%




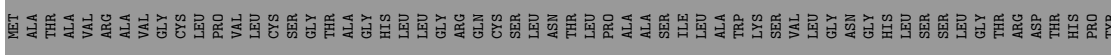
- Molecule 31: Coiled-coil-helix-coiled-coil-helix domain-containing protein 1

Chain Ac:  99% .




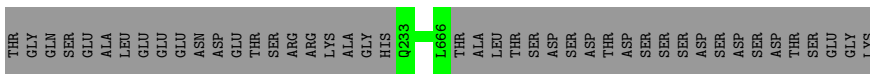
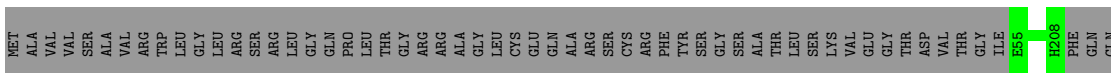
- Molecule 32: 28S ribosomal protein S5, mitochondrial

Chain Ad:  80% 20%




- Molecule 33: Pentatricopeptide repeat domain-containing protein 3, mitochondrial

Chain Ae:  85% 15%



- Molecule 34: 28S ribosomal protein S9, mitochondrial

Chain Ag:  82% 17%

MET ALA ALA PRO CYS VAL SER TYR GLY GLY ALA ALA VAL SER TYR ARG ARG LEU LEU TRP GLY ARG GLY SER SER LEU ALA ARG LYS LYS THR ALA ALA PRO PRO LEU LEU LYS THR ALA ALA GLU LEU LEU GLN THR ASN VAL ARG SER GLN ILE LEU ARG ARG LEU HIS HIS THR A63 G176 SER HIS LEU GLN ALA

LYS SER LEU LEU PRO CYS LYS THR VAL THR ARG ASP V194 F315 F396

- Molecule 35: 28S ribosomal protein S11, mitochondrial

Chain Ai:  70% 29%

MET GLN ALA VAL ARG ASN ALA GLY SER ARG PHE ARG LEU ARG SER TRP TRP PRO PRO GLN THR ALA GLY ARG VAL VAL ALA ARG THR PRO GLY THR THR CYS THR GLY ALA ARG GLN LEU GLN ASP ALA ALA LYS GLN LYS VAL GLU GLN ASN ALA ALA PRO SER HIS T58 5F0184

L194

- Molecule 36: 28S ribosomal protein S34, mitochondrial

Chain Aj:  99%

MET ALA ARG R4 V218

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	41288	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 ($e^-/\text{\AA}^2$)	60	Depositor
Minimum defocus (nm)	600	Depositor
Maximum defocus (nm)	3000	Depositor
Magnification	81000	Depositor
Image detector	GATAN K3 (6k x 4k)	Depositor

5 Model quality [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: MA6, 5F0, 5MU, ZN, ATP, FS2, GDP, AYA, B8T, MG, Y5P, 5MC, RSQ, PSU, K

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	BX	0.23	0/118	0.47	0/162
2	Bd	0.22	0/246	0.52	0/329
3	AA	0.21	1/22563 (0.0%)	0.67	1/35124 (0.0%)
4	AB	0.24	0/2313	0.43	0/3129
5	AC	0.24	0/1113	0.46	0/1505
6	AD	0.23	0/636	0.52	0/839
7	AE	0.25	0/989	0.49	0/1335
8	AF	0.24	0/1767	0.44	0/2373
9	AG	0.30	1/1588 (0.1%)	0.69	0/2466
10	AH	0.24	0/1178	0.45	0/1598
11	AI	0.16	0/149	0.65	0/231
12	AJ	0.25	0/855	0.53	0/1148
13	AK	0.23	0/880	0.53	0/1182
14	AL	0.23	0/1477	0.45	0/1974
15	AM	0.24	0/963	0.50	0/1295
16	AN	0.25	0/886	0.47	0/1199
17	AO	0.24	0/1648	0.46	0/2243
18	AP	0.24	0/798	0.43	0/1070
19	AQ	0.25	0/748	0.53	0/994
20	AR	0.24	0/2456	0.43	0/3317
21	AS	0.25	0/1138	0.47	0/1533
22	AT	0.25	0/1402	0.44	0/1883
23	AU	0.23	0/1510	0.50	0/2025
24	AV	0.23	0/3030	0.38	0/4093
25	AW	0.25	0/801	0.50	0/1079
26	AX	0.24	0/2921	0.42	0/3954
27	AY	0.24	0/1280	0.38	0/1725
28	AZ	0.24	0/857	0.45	0/1141
29	Aa	0.23	0/3162	0.46	0/4253
30	Ab	0.25	0/1871	0.46	0/2531
31	Ac	0.23	0/941	0.49	0/1257
32	Ad	0.24	0/2783	0.49	0/3724

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z >5	RMSZ	# Z >5
33	Ae	0.23	0/4877	0.40	0/6598
34	Ag	0.24	0/2746	0.46	0/3681
35	Ai	0.25	0/1030	0.48	0/1386
36	Aj	0.23	0/1834	0.51	0/2484
All	All	0.23	2/75554 (0.0%)	0.54	1/106860 (0.0%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	AA	1	A	OP3-P	-10.59	1.48	1.61
9	AG	1	A	OP3-P	-10.53	1.48	1.61

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	AA	118	C	C2-N1-C1'	5.73	125.11	118.80

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [i](#)

Due to software issues we are unable to calculate clashes - this section is therefore empty.

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 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	BX	12/292 (4%)	12 (100%)	0	0	100	100
2	Bd	24/128 (19%)	23 (96%)	1 (4%)	0	100	100
4	AB	277/323 (86%)	275 (99%)	2 (1%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
5	AC	130/167 (78%)	128 (98%)	2 (2%)	0	100	100
6	AD	68/199 (34%)	67 (98%)	1 (2%)	0	100	100
7	AE	120/125 (96%)	118 (98%)	2 (2%)	0	100	100
8	AF	206/242 (85%)	206 (100%)	0	0	100	100
10	AH	138/201 (69%)	133 (96%)	4 (3%)	1 (1%)	22	60
12	AJ	106/138 (77%)	105 (99%)	1 (1%)	0	100	100
13	AK	99/128 (77%)	98 (99%)	1 (1%)	0	100	100
14	AL	172/257 (67%)	172 (100%)	0	0	100	100
15	AM	117/137 (85%)	117 (100%)	0	0	100	100
16	AN	108/130 (83%)	106 (98%)	2 (2%)	0	100	100
17	AO	191/258 (74%)	189 (99%)	2 (1%)	0	100	100
18	AP	95/142 (67%)	95 (100%)	0	0	100	100
19	AQ	84/87 (97%)	82 (98%)	2 (2%)	0	100	100
20	AR	293/360 (81%)	288 (98%)	5 (2%)	0	100	100
21	AS	133/190 (70%)	132 (99%)	1 (1%)	0	100	100
22	AT	166/173 (96%)	164 (99%)	2 (1%)	0	100	100
23	AU	174/205 (85%)	174 (100%)	0	0	100	100
24	AV	358/414 (86%)	354 (99%)	4 (1%)	0	100	100
25	AW	98/187 (52%)	95 (97%)	3 (3%)	0	100	100
26	AX	350/398 (88%)	345 (99%)	5 (1%)	0	100	100
27	AY	147/395 (37%)	146 (99%)	1 (1%)	0	100	100
28	AZ	98/106 (92%)	97 (99%)	1 (1%)	0	100	100
29	Aa	379/484 (78%)	376 (99%)	3 (1%)	0	100	100
30	Ab	223/296 (75%)	222 (100%)	1 (0%)	0	100	100
31	Ac	115/118 (98%)	113 (98%)	2 (2%)	0	100	100
32	Ad	341/430 (79%)	333 (98%)	8 (2%)	0	100	100
33	Ae	584/689 (85%)	580 (99%)	4 (1%)	0	100	100
34	Ag	323/396 (82%)	318 (98%)	5 (2%)	0	100	100
35	Ai	134/194 (69%)	132 (98%)	2 (2%)	0	100	100
36	Aj	213/218 (98%)	211 (99%)	2 (1%)	0	100	100
All	All	6076/8207 (74%)	6006 (99%)	69 (1%)	1 (0%)	100	100

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
10	AH	126	ILE

5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all 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	BX	14/256 (6%)	14 (100%)	0	100	100
2	Bd	26/113 (23%)	26 (100%)	0	100	100
4	AB	257/291 (88%)	257 (100%)	0	100	100
5	AC	115/143 (80%)	115 (100%)	0	100	100
6	AD	65/166 (39%)	64 (98%)	1 (2%)	65	87
7	AE	104/107 (97%)	103 (99%)	1 (1%)	76	91
8	AF	185/209 (88%)	185 (100%)	0	100	100
10	AH	130/180 (72%)	130 (100%)	0	100	100
12	AJ	93/118 (79%)	93 (100%)	0	100	100
13	AK	91/113 (80%)	91 (100%)	0	100	100
14	AL	158/226 (70%)	157 (99%)	1 (1%)	86	95
15	AM	97/113 (86%)	97 (100%)	0	100	100
16	AN	96/115 (84%)	96 (100%)	0	100	100
17	AO	174/230 (76%)	174 (100%)	0	100	100
18	AP	88/123 (72%)	87 (99%)	1 (1%)	73	90
19	AQ	78/79 (99%)	78 (100%)	0	100	100
20	AR	264/318 (83%)	264 (100%)	0	100	100
21	AS	116/164 (71%)	116 (100%)	0	100	100
22	AT	153/157 (98%)	153 (100%)	0	100	100
23	AU	152/174 (87%)	152 (100%)	0	100	100
24	AV	325/364 (89%)	325 (100%)	0	100	100
25	AW	87/158 (55%)	87 (100%)	0	100	100

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
26	AX	311/351 (89%)	311 (100%)	0	100	100
27	AY	137/357 (38%)	137 (100%)	0	100	100
28	AZ	90/95 (95%)	90 (100%)	0	100	100
29	Aa	338/427 (79%)	337 (100%)	1 (0%)	92	97
30	Ab	198/249 (80%)	197 (100%)	1 (0%)	88	96
31	Ac	100/101 (99%)	100 (100%)	0	100	100
32	Ad	286/357 (80%)	286 (100%)	0	100	100
33	Ae	526/609 (86%)	526 (100%)	0	100	100
34	Ag	285/342 (83%)	284 (100%)	1 (0%)	91	97
35	Ai	104/146 (71%)	104 (100%)	0	100	100
36	Aj	188/190 (99%)	188 (100%)	0	100	100
All	All	5431/7141 (76%)	5424 (100%)	7 (0%)	93	98

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
6	AD	155	ARG
7	AE	109	VAL
14	AL	209	LEU
18	AP	126	ASP
29	Aa	272	MET
30	Ab	247	HIS
34	Ag	315	PHE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (39) such sidechains are listed below:

Mol	Chain	Res	Type
4	AB	268	GLN
7	AE	58	HIS
7	AE	92	ASN
8	AF	127	HIS
8	AF	147	GLN
8	AF	151	ASN
10	AH	125	HIS
12	AJ	105	HIS
14	AL	162	GLN
15	AM	50	GLN

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Mol	Chain	Res	Type
17	AO	169	GLN
20	AR	224	HIS
20	AR	288	GLN
22	AT	14	GLN
22	AT	33	ASN
22	AT	51	ASN
22	AT	56	GLN
24	AV	380	GLN
26	AX	170	GLN
26	AX	211	ASN
28	AZ	56	HIS
28	AZ	76	GLN
28	AZ	82	GLN
29	Aa	124	GLN
29	Aa	258	HIS
29	Aa	368	GLN
30	Ab	134	HIS
30	Ab	265	GLN
30	Ab	276	GLN
32	Ad	155	GLN
32	Ad	415	GLN
33	Ae	257	HIS
33	Ae	306	ASN
33	Ae	453	HIS
33	Ae	491	GLN
33	Ae	562	GLN
34	Ag	77	GLN
34	Ag	176	GLN
35	Ai	129	GLN

5.3.3 RNA [i](#)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
11	AI	5/33 (15%)	1 (20%)	0
3	AA	951/955 (99%)	120 (12%)	0
9	AG	69/71 (97%)	10 (14%)	0
All	All	1025/1059 (96%)	131 (12%)	0

All (131) RNA backbone outliers are listed below:

Mol	Chain	Res	Type
3	AA	2	A
3	AA	4	A
3	AA	33	U
3	AA	41	A
3	AA	57	U
3	AA	74	U
3	AA	90	C
3	AA	91	A
3	AA	106	A
3	AA	114	A
3	AA	119	G
3	AA	144	G
3	AA	147	U
3	AA	149	G
3	AA	183	U
3	AA	185	U
3	AA	188	C
3	AA	189	A
3	AA	213	A
3	AA	214	U
3	AA	221	C
3	AA	224	A
3	AA	243	C
3	AA	254	G
3	AA	257	C
3	AA	260	A
3	AA	272	A
3	AA	276	A
3	AA	282	A
3	AA	285	C
3	AA	291	A
3	AA	292	A
3	AA	293	A
3	AA	294	G
3	AA	295	A
3	AA	307	C
3	AA	313	C
3	AA	315	C
3	AA	320	A
3	AA	346	A
3	AA	355	C
3	AA	365	A
3	AA	368	A

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Mol	Chain	Res	Type
3	AA	384	G
3	AA	395	U
3	AA	400	A
3	AA	401	C
3	AA	434	U
3	AA	435	A
3	AA	456	A
3	AA	458	C
3	AA	460	U
3	AA	462	A
3	AA	471	A
3	AA	472	U
3	AA	474	A
3	AA	479	A
3	AA	490	A
3	AA	504	C
3	AA	506	C
3	AA	513	A
3	AA	520	A
3	AA	540	U
3	AA	542	U
3	AA	543	C
3	AA	553	G
3	AA	568	U
3	AA	573	A
3	AA	576	C
3	AA	578	C
3	AA	582	U
3	AA	599	U
3	AA	600	G
3	AA	601	C
3	AA	604	A
3	AA	624	C
3	AA	637	U
3	AA	638	G
3	AA	643	C
3	AA	644	U
3	AA	645	A
3	AA	650	G
3	AA	679	A
3	AA	680	G
3	AA	696	A

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Mol	Chain	Res	Type
3	AA	697	U
3	AA	706	A
3	AA	709	A
3	AA	731	C
3	AA	740	A
3	AA	743	A
3	AA	744	U
3	AA	758	C
3	AA	759	U
3	AA	760	U
3	AA	783	A
3	AA	816	G
3	AA	819	C
3	AA	831	A
3	AA	834	C
3	AA	872	A
3	AA	878	C
3	AA	879	U
3	AA	880	A
3	AA	886	C
3	AA	890	C
3	AA	891	G
3	AA	892	C
3	AA	893	A
3	AA	897	A
3	AA	904	G
3	AA	911	A
3	AA	912	G
3	AA	920	A
3	AA	921	U
3	AA	924	U
3	AA	935	G
3	AA	947	G
3	AA	948	G
3	AA	952	A
9	AG	7	G
9	AG	8	U
9	AG	10	A
9	AG	11	G
9	AG	17	U
9	AG	18	A
9	AG	45	G

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Mol	Chain	Res	Type
9	AG	52	A
9	AG	53	U
9	AG	55	C
11	AI	2	G

There are no RNA pucker outliers to report.

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

13 non-standard protein/DNA/RNA residues are modelled in this entry.

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$
9	PSU	AG	46	9	18,21,22	1.32	2 (11%)	22,30,33	1.86	3 (13%)
3	B8T	AA	839	37,3	19,22,23	0.43	0	26,31,34	0.37	0
9	RSQ	AG	31	9,11	20,23,24	0.48	0	26,33,36	0.56	0
19	AYA	AQ	2	19	6,7,8	0.76	0	5,8,10	0.22	0
3	MA6	AA	937	3	18,26,27	1.10	2 (11%)	19,38,41	1.97	3 (15%)
3	5MU	AA	429	3	19,22,23	1.39	6 (31%)	28,32,35	2.06	6 (21%)
31	AYA	Ac	2	31	6,7,8	0.79	0	5,8,10	0.38	0
9	PSU	AG	24	9	18,21,22	1.33	2 (11%)	22,30,33	1.85	3 (13%)
3	5MC	AA	841	3	18,22,23	0.93	2 (11%)	26,32,35	1.08	2 (7%)
3	MA6	AA	936	3	18,26,27	1.10	2 (11%)	19,38,41	1.97	3 (15%)
9	PSU	AG	51	9	18,21,22	1.35	2 (11%)	22,30,33	1.80	3 (13%)
35	5F0	Ai	184	35	8,8,9	1.46	2 (25%)	7,9,11	1.66	1 (14%)
11	Y5P	AI	4	11	14,19,20	0.49	0	18,26,29	0.54	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
9	PSU	AG	46	9	-	0/7/25/26	0/2/2/2
3	B8T	AA	839	37,3	-	0/7/27/28	0/2/2/2
9	RSQ	AG	31	9,11	-	1/9/27/28	0/2/2/2
19	AYA	AQ	2	19	-	0/4/6/8	-
3	MA6	AA	937	3	-	2/7/29/30	0/3/3/3
3	5MU	AA	429	3	-	0/7/25/26	0/2/2/2
31	AYA	Ac	2	31	-	2/4/6/8	-
9	PSU	AG	24	9	-	0/7/25/26	0/2/2/2
3	5MC	AA	841	3	-	0/7/25/26	0/2/2/2
3	MA6	AA	936	3	-	0/7/29/30	0/3/3/3
9	PSU	AG	51	9	-	2/7/25/26	0/2/2/2
35	5F0	Ai	184	35	-	4/9/9/10	-
11	Y5P	AI	4	11	-	5/7/33/34	0/2/2/2

All (20) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	AA	937	MA6	C5-N7	3.35	1.51	1.39
3	AA	936	MA6	C5-N7	3.33	1.51	1.39
9	AG	51	PSU	C6-C5	3.23	1.39	1.35
9	AG	46	PSU	C6-C5	3.21	1.39	1.35
9	AG	24	PSU	C6-C5	3.13	1.39	1.35
35	Ai	184	5F0	OD1-C1	2.86	1.40	1.33
3	AA	429	5MU	C4-N3	-2.65	1.33	1.38
9	AG	24	PSU	C4-N3	-2.64	1.33	1.38
3	AA	429	5MU	C6-C5	2.63	1.38	1.34
3	AA	841	5MC	C6-C5	2.61	1.38	1.34
9	AG	46	PSU	C4-N3	-2.56	1.34	1.38
9	AG	51	PSU	C4-N3	-2.54	1.34	1.38
3	AA	429	5MU	C6-N1	-2.32	1.34	1.38
3	AA	841	5MC	C6-N1	-2.26	1.34	1.38
3	AA	429	5MU	C4-C5	2.22	1.48	1.44
3	AA	936	MA6	C4-N3	-2.18	1.32	1.35
3	AA	937	MA6	C4-N3	-2.16	1.32	1.35
35	Ai	184	5F0	OD1-CXT	-2.12	1.40	1.45
3	AA	429	5MU	C2-N3	-2.06	1.34	1.38
3	AA	429	5MU	C2-N1	2.06	1.41	1.38

All (24) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
9	AG	46	PSU	N1-C2-N3	5.88	121.79	115.13

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
9	AG	24	PSU	N1-C2-N3	5.87	121.78	115.13
3	AA	937	MA6	C4-C5-N7	-5.74	103.42	109.40
9	AG	51	PSU	N1-C2-N3	5.70	121.58	115.13
3	AA	936	MA6	C4-C5-N7	-5.67	103.49	109.40
3	AA	429	5MU	C4-N3-C2	-5.15	120.68	127.35
3	AA	429	5MU	N3-C2-N1	4.84	121.31	114.89
3	AA	429	5MU	C5-C4-N3	4.50	119.15	115.31
3	AA	937	MA6	C1'-N9-C4	-4.39	118.92	126.64
3	AA	936	MA6	C1'-N9-C4	-4.36	118.98	126.64
3	AA	936	MA6	N3-C2-N1	-4.28	121.99	128.68
3	AA	937	MA6	N3-C2-N1	-4.16	122.18	128.68
3	AA	429	5MU	O4-C4-C5	-4.05	120.20	124.90
9	AG	24	PSU	C4-N3-C2	-3.86	120.78	126.34
9	AG	46	PSU	C4-N3-C2	-3.86	120.78	126.34
3	AA	429	5MU	C5-C6-N1	-3.67	119.56	123.34
9	AG	51	PSU	C4-N3-C2	-3.58	121.19	126.34
3	AA	841	5MC	C5-C6-N1	-3.40	119.84	123.34
9	AG	51	PSU	O2-C2-N1	-3.30	119.16	122.79
9	AG	46	PSU	O2-C2-N1	-3.29	119.17	122.79
35	Ai	184	5F0	OD1-C1-CA	3.28	119.91	111.52
9	AG	24	PSU	O2-C2-N1	-3.27	119.19	122.79
3	AA	841	5MC	C5-C4-N3	-2.46	119.03	121.67
3	AA	429	5MU	O2-C2-N1	-2.45	119.53	122.79

There are no chirality outliers.

All (16) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
9	AG	51	PSU	O4'-C1'-C5-C4
9	AG	51	PSU	O4'-C1'-C5-C6
35	Ai	184	5F0	OD1-C1-CA-CB
35	Ai	184	5F0	CA-C1-OD1-CXT
35	Ai	184	5F0	O1-C1-OD1-CXT
11	AI	4	Y5P	C2'-C1'-N1-C2
35	Ai	184	5F0	O1-C1-CA-CB
11	AI	4	Y5P	C2'-C1'-N1-C6
11	AI	4	Y5P	O4'-C4'-C5'-O5'
11	AI	4	Y5P	O4'-C1'-N1-C2
31	Ac	2	AYA	CM-CT-N-CA
3	AA	937	MA6	C4'-C5'-O5'-P
3	AA	937	MA6	C3'-C4'-C5'-O5'
11	AI	4	Y5P	O4'-C1'-N1-C6

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Mol	Chain	Res	Type	Atoms
31	Ac	2	AYA	OT-CT-N-CA
9	AG	31	RSQ	C2'-C1'-N1-C2

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 149 ligands modelled in this entry, 144 are monoatomic - leaving 5 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
41	FS2	AT	201	22,15	0,5,14	-	-	-		
42	ATP	AX	501	38	26,33,33	0.62	0	31,52,52	0.73	2 (6%)
43	GDP	AX	503	-	24,30,30	0.95	1 (4%)	30,47,47	1.30	4 (13%)
39	MET	AG	101	9	6,7,8	0.48	0	2,7,9	0.14	0
41	FS2	AP	201	7,18	0,5,14	-	-	-		

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
41	FS2	AT	201	22,15	-	-	0/2/2/6
42	ATP	AX	501	38	-	0/18/38/38	0/3/3/3
43	GDP	AX	503	-	-	4/12/32/32	0/3/3/3
39	MET	AG	101	9	-	1/5/6/8	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
41	FS2	AP	201	7,18	-	-	0/2/2/6

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
43	AX	503	GDP	C6-N1	-2.39	1.34	1.37

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
43	AX	503	GDP	PA-O3A-PB	-3.46	120.94	132.83
43	AX	503	GDP	C3'-C2'-C1'	3.11	105.65	100.98
43	AX	503	GDP	C8-N7-C5	2.34	107.45	102.99
42	AX	501	ATP	C5-C6-N6	2.30	123.85	120.35
43	AX	503	GDP	C5-C6-N1	2.21	117.85	113.95
42	AX	501	ATP	PB-O3B-PG	2.00	139.70	132.83

There are no chirality outliers.

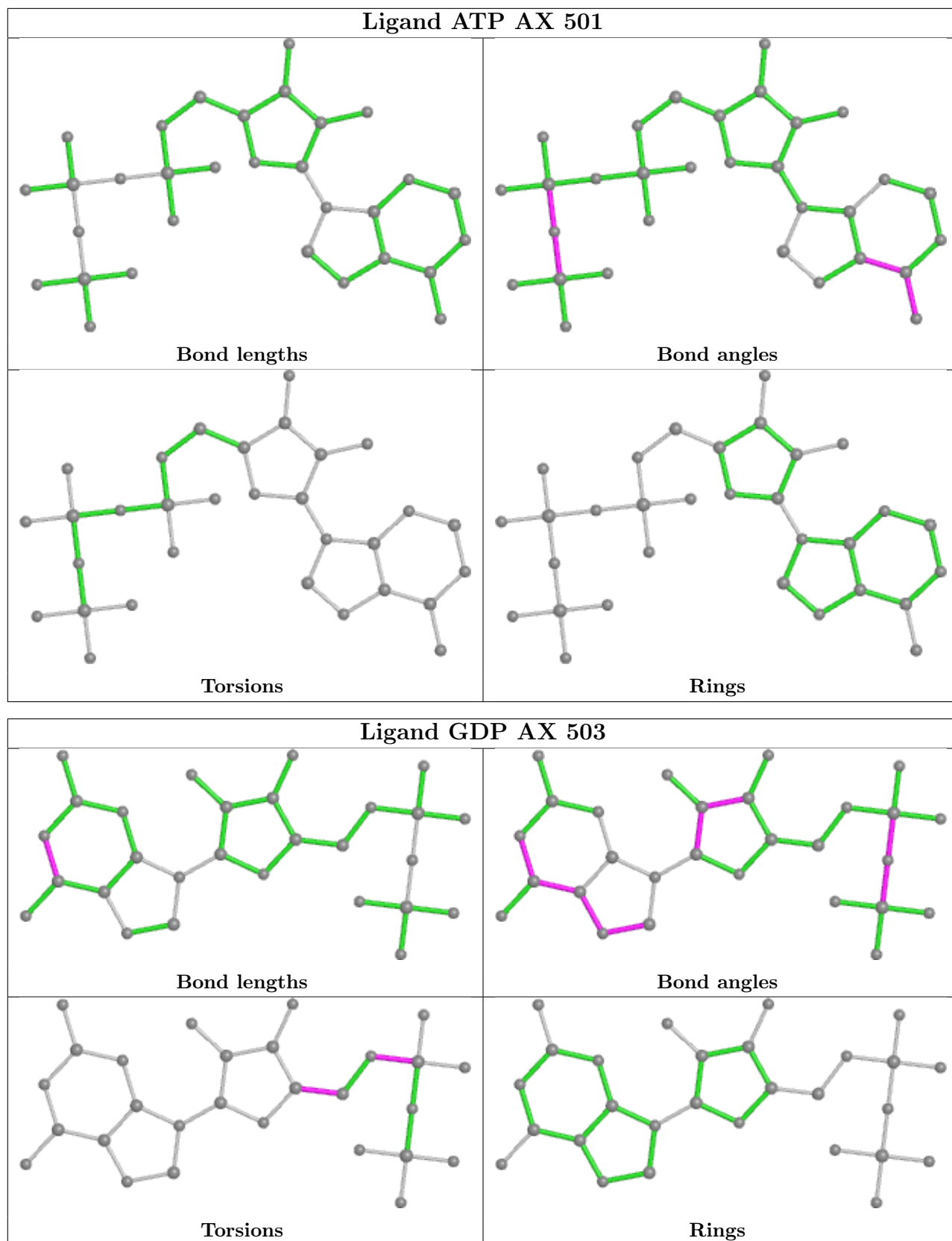
All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
43	AX	503	GDP	C5'-O5'-PA-O3A
43	AX	503	GDP	C5'-O5'-PA-O2A
43	AX	503	GDP	C3'-C4'-C5'-O5'
39	AG	101	MET	N-CA-CB-CG
43	AX	503	GDP	O4'-C4'-C5'-O5'

There are no ring outliers.

No monomer is involved in short contacts.

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



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 Map visualisation

This section contains visualisations of the EMDB entry EMD-16898. These allow visual inspection of the internal detail of the map and identification of artifacts.

Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

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

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

9 Map-model fit

This section was not generated.