

wwPDB EM Validation Summary Report (i)

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PDB ID	:	7017
EMDB ID	:	EMD-12920
Title	:	Cryo-EM structure of late human 39S mitoribosome assembly intermediates,
		state 2
Authors	:	Cheng, J.; Berninghausen, O.; Beckmann, R.
Deposited on	:	2021-05-11
Resolution	:	3.50 Å(reported)

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

We welcome your comments at *validation@mail.wwpdb.org* A user guide is available at https://www.wwpdb.org/validation/2017/EMValidationReportHelp with specific help available everywhere you see the (i) 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 (1)) were used in the production of this report:

EMDB validation analysis	:	0.0.1. dev 92
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	:	1.9.13
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.37.1

1 Overall quality at a glance (i)

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

The reported resolution of this entry is 3.50 Å.

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



Metric	$egin{array}{c} { m Whole \ archive} \ (\#{ m Entries}) \end{array}$	${f EM\ structures}\ (\#{ m Entries})$
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 $\geq=3, 2, 1$ and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq=5\%$ The upper red bar (where present) indicates the fraction of residues that have poor fit to the EM map (all-atom inclusion < 40%). The numeric value is given above the bar.

Mol	Chain	Length	Quality of cha	in		
1	D	305	8%	• 28%		
2	Е	348	• 82%	18%		
3	F	311	• 79%	• 20%		
4	Н	267	• 35% •	64%		
5	Ι	261	52% 60%	39%		
6	J	192	73%	• 27%		
7	K	178	99%			
8	L	145	10%	• 21%		



Mol	Chain	Length	Quality of chain	
0	М	206	•	
9	101	290	96%	••
10	Ν	251	81%	18%
11	О	175	86%	• 13%
12	Р	180	78%	22%
13	Q	292	74%	26%
14	R	149	94%	6%
15	S	205	75% .	24%
16	Т	206	77%	23%
17	U	153	90%	• 9%
18	V	216	88%	11%
19	W	148	74%	26%
20	Х	256	94%	• 5%
21	Y	250	70%	30%
22	Ζ	161	75%	25%
23	0	188	57% 43	3%
24	1	65	42%	• 20%
25	2	92	47% 53%	
26	3	188	5 1% 49%	
27	5	423	91%	• 9%
28	6	380	84%	• 15%
29	7	338	84%	• 15%
30	8	206	43% 48% 52%	
31	9	137	85%	• 15%
32	a	142	58% 4	2%
33	b	215	69%	31%

Continued from previous page...



Mol	Chain	Length	Quality of chain							
		0	• · · ·							
34	С	332	83%	17%						
35	d	306	68% • 31%							
			77%							
36	е	279	77%	22%						
37	f	212	50% 54%	45%						
38	g	166	78%	22%						
39	h	158	• 62% •	37%						
40	i	128	76%	24%						
41	j	123	69%	31%						
42	k	112	70% 71%	29%						
43	1	138	17% 83%							
44	m	128	35% 6	5%						
45	0	102	•	23%						
46	р	206	61%	38%						
47	q	222	10% 54% ·	44%						
48	r	196	12%	• 26%						
49	S	439	84%	16%						
50	u	234	21%	53%						
50		70	70%	-						
-01	V	70	51%	•						
52	W	156	50% ·	49%						
53	А	1559	49% 17%	• 32%						
54	В	69	46%	20% · 19%						

Continued from previous page...



2 Entry composition (i)

There are 57 unique types of molecules in this entry. The entry contains 89747 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 L2, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	D	220	Total 1706	C 1059	N 339	O 299	S 9	0	0

• Molecule 2 is a protein called 39S ribosomal protein L3, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	Е	285	Total 2258	C 1457	N 384	O 406	S 11	0	0

• Molecule 3 is a protein called 39S ribosomal protein L4, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	F	250	Total 2013	C 1294	N 365	0 348	S 6	0	0

• Molecule 4 is a protein called 39S ribosomal protein L9, mitochondrial.

Mol	Chain	Residues	Atoms				AltConf	Trace
4	Н	95	Total 784	C 498	N 152	0 134	0	0

• Molecule 5 is a protein called 39S ribosomal protein L10, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
5	Ι	158	Total 1283	C 828	N 235	0 210	S 10	0	0

• Molecule 6 is a protein called 39S ribosomal protein L11, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
6	J	140	Total 1061	C 680	N 192	0 187	$\begin{array}{c} \mathrm{S} \\ \mathrm{2} \end{array}$	0	0



• Molecule 7 is a protein called 39S ribosomal protein L13, mitochondrial.

Mol	Chain	Residues		At	oms			AltConf	Trace
7	K	177	Total 1451	C 934	N 259	0 251	${ m S} 7$	0	0

• Molecule 8 is a protein called 39S ribosomal protein L14, mitochondrial.

Mol	Chain	Residues		At	oms			AltConf	Trace
8	L	115	Total 889	C 559	N 171	0 154	${f S}{5}$	0	0

• Molecule 9 is a protein called 39S ribosomal protein L15, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
9	М	287	Total 2305	C 1472	N 425	O 402	S 6	0	0

• Molecule 10 is a protein called 39S ribosomal protein L16, mitochondrial.

Mol	Chain	Residues		At	oms			AltConf	Trace
10	Ν	205	Total 1654	C 1056	N 308	O 280	S 10	0	0

• Molecule 11 is a protein called 39S ribosomal protein L17, mitochondrial.

Mol	Chain	Residues		At	oms			AltConf	Trace
11	Ο	152	Total 1245	C 784	N 239	0 215	${f S}{7}$	0	0

• Molecule 12 is a protein called 39S ribosomal protein L18, mitochondrial.

Mol	Chain	Residues		At	oms			AltConf	Trace
12	Р	141	Total	С	Ν	Ο	S	0	0
12	1	1.11	1148	719	221	203	5	0	0

• Molecule 13 is a protein called 39S ribosomal protein L19, mitochondrial.

Mol	Chain	Residues		Ate	oms		AltConf	Trace	
13	Q	217	Total 1805	C 1159	N 317	O 320	S 9	0	0

• Molecule 14 is a protein called 39S ribosomal protein L20, mitochondrial.



Mol	Chain	Residues		At	oms			AltConf	Trace
14	R	140	Total 1153	C 732	N 231	O 186	$\frac{S}{4}$	0	0

• Molecule 15 is a protein called 39S ribosomal protein L21, mitochondrial.

Mol	Chain	Residues		At	oms	AltConf	Trace		
15	S	156	Total 1251	C 806	N 222	0 219	$\frac{S}{4}$	0	0

• Molecule 16 is a protein called 39S ribosomal protein L22, mitochondrial.

Mol	Chain	Residues		At	oms			AltConf	Trace
16	Т	159	Total 1305	C 835	N 239	0 224	S 7	0	0

• Molecule 17 is a protein called 39S ribosomal protein L23, mitochondrial.

Mol	Chain	Residues		At	\mathbf{oms}			AltConf	Trace
17	U	139	Total	С	N	0	S	0	0
	-		1154	734	220	197	3		, i i i i i i i i i i i i i i i i i i i

• Molecule 18 is a protein called 39S ribosomal protein L24, mitochondrial.

Mol	Chain	Residues		At	oms			AltConf	Trace
18	V	192	Total 1575	C 1003	N 281	0 283	S 8	0	0

• Molecule 19 is a protein called 39S ribosomal protein L27, mitochondrial.

Mol	Chain	Residues		At	oms		AltConf	Trace	
19	W	109	Total 859	C 552	N 162	0 142	${ m S} { m 3}$	0	0

• Molecule 20 is a protein called 39S ribosomal protein L28, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
20	Х	243	Total 2035	C 1317	N 351	O 362	${S \atop 5}$	0	0

• Molecule 21 is a protein called 39S ribosomal protein L47, mitochondrial.



Mol	Chain	Residues		At	oms			AltConf	Trace
21	Y	176	Total 1517	C 970	N 291	O 252	$\frac{S}{4}$	0	0

• Molecule 22 is a protein called 39S ribosomal protein L30, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
22	Ζ	120	Total 978	C 626	N 183	O 166	${ m S} { m 3}$	0	0

• Molecule 23 is a protein called 39S ribosomal protein L32, mitochondrial.

Mol	Chain	Residues		At	oms	AltConf	Trace		
23	0	108	Total 880	С 545	N 172	0 157	S 6	0	0

• Molecule 24 is a protein called 39S ribosomal protein L33, mitochondrial.

Mol	Chain	Residues		Ato	\mathbf{ms}	AltConf	Trace		
24	1	52	Total 433	C 278	N 83	O 70	${ m S} { m 2}$	0	0

• Molecule 25 is a protein called 39S ribosomal protein L34, mitochondrial.

Mol	Chain	Residues		Atc	\mathbf{ms}	AltConf	Trace		
25	2	43	Total 351	C 218	N 76	O 56	S 1	0	0

• Molecule 26 is a protein called 39S ribosomal protein L35, mitochondrial.

Mol	Chain	Residues		At	\mathbf{oms}			AltConf	Trace
26	3	95	Total 831	C 539	N 162	0 127	${ m S} { m 3}$	0	0

• Molecule 27 is a protein called 39S ribosomal protein L37, mitochondrial.

Mol	Chain	Residues		At	AltConf	Trace			
27	5	387	Total 3156	C 2039	N 548	O 558	S 11	0	0

• Molecule 28 is a protein called 39S ribosomal protein L38, mitochondrial.



Mol	Chain	Residues		At	oms			AltConf	Trace
28	6	324	Total 2640	C 1694	N 470	O 468	S 8	0	0

• Molecule 29 is a protein called 39S ribosomal protein L39, mitochondrial.

Mol	Chain	Residues		At	AltConf	Trace			
29	7	287	Total 2334	C 1495	N 397	0 425	S 17	0	0

• Molecule 30 is a protein called 39S ribosomal protein L40, mitochondrial.

Mol	Chain	Residues		At	oms	AltConf	Trace		
30	8	99	Total 836	$\begin{array}{c} \mathrm{C} \\ 535 \end{array}$	N 144	0 155	${S \over 2}$	0	0

• Molecule 31 is a protein called 39S ribosomal protein L41, mitochondrial.

Mol	Chain	Residues		At	oms			AltConf	Trace
31	9	117	Total 947	C 614	N 163	0 168	${ m S} { m 2}$	0	0

• Molecule 32 is a protein called 39S ribosomal protein L42, mitochondrial.

Mol	Chain	Residues		At	oms			AltConf	Trace
32	a	82	Total 686	C 434	N 124	0 123	${ m S}{ m 5}$	0	0

• Molecule 33 is a protein called 39S ribosomal protein L43, mitochondrial.

Mol	Chain	Residues		At	oms			AltConf	Trace
33	b	148	Total 1178	C 733	N 229	0 213	${ m S} { m 3}$	0	0

• Molecule 34 is a protein called 39S ribosomal protein L44, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
34	с	275	Total 2217	C 1415	N 383	0 410	S 9	0	0

• Molecule 35 is a protein called 39S ribosomal protein L45, mitochondrial.



Mol	Chain	Residues		At	oms			AltConf	Trace
35	d	211	Total 1741	C 1123	N 299	O 309	S 10	0	0

• Molecule 36 is a protein called 39S ribosomal protein L46, mitochondrial.

Mol	Chain	Residues		Ate	AltConf	Trace			
36	е	217	Total 1762	C 1124	N 310	O 323	${ m S}{ m 5}$	0	0

• Molecule 37 is a protein called 39S ribosomal protein L48, mitochondrial.

Mol	Chain	Residues		At	oms			AltConf	Trace
37	f	116	Total 915	C 585	N 152	0 175	${ m S} { m 3}$	0	0

• Molecule 38 is a protein called 39S ribosomal protein L49, mitochondrial.

Mol	Chain	Residues		At	oms			AltConf	Trace
38	g	129	Total 1067	C 690	N 185	O 190	${ m S} { m 2}$	0	0

• Molecule 39 is a protein called 39S ribosomal protein L50, mitochondrial.

Mol	Chain	Residues		At	oms			AltConf	Trace
39	h	100	Total 827	С 524	N 146	0 155	$\begin{array}{c} \mathrm{S} \\ \mathrm{2} \end{array}$	0	0

• Molecule 40 is a protein called 39S ribosomal protein L51, mitochondrial.

Mol	Chain	Residues		At	oms			AltConf	Trace
40	i	97	Total 827	C 532	N 165	O 126	${f S}$ 4	0	0

• Molecule 41 is a protein called 39S ribosomal protein L52, mitochondrial.

Mol	Chain	Residues		At	oms	AltConf	Trace		
41	j	85	Total 684	C 423	N 133	0 126	${S \over 2}$	0	0

• Molecule 42 is a protein called 39S ribosomal protein L53, mitochondrial.



Mol	Chain	Residues		At	oms	AltConf	Trace		
42	k	80	Total 627	C 392	N 116	0 114	${ m S}{ m 5}$	0	0

• Molecule 43 is a protein called 39S ribosomal protein L54, mitochondrial.

Mol	Chain	Residues		Aton	ıs	AltConf	Trace	
43	1	23	Total 221	C 137	N 52	O 32	0	0

• Molecule 44 is a protein called 39S ribosomal protein L55, mitochondrial.

Mol	Chain	Residues		Ato	\mathbf{ms}	AltConf	Trace		
44	m	45	Total 372	C 232	N 76	O 62	$\begin{array}{c} \mathrm{S} \\ \mathrm{2} \end{array}$	0	0

• Molecule 45 is a protein called Ribosomal protein 63, mitochondrial.

Mol	Chain	Residues		At	oms	AltConf	Trace		
45	О	79	Total 665	C 420	N 130	0 112	${ m S} { m 3}$	0	0

• Molecule 46 is a protein called Peptidyl-tRNA hydrolase ICT1, mitochondrial.

Mol	Chain	Residues		At	oms	AltConf	Trace		
46	р	127	Total 1058	C 661	N 201	0 192	S 4	0	0

• Molecule 47 is a protein called Growth arrest and DNA damage-inducible proteins-interacting protein 1.

Mol	Chain	Residues		At	AltConf	Trace			
47	q	124	Total 1039	C 650	N 200	0 184	${S \atop 5}$	0	0

• Molecule 48 is a protein called 39S ribosomal protein S18a, mitochondrial.

Mol	Chain	Residues		At	oms	AltConf	Trace		
48	r	146	Total 1203	С 764	N 232	O 199	S 8	0	0

• Molecule 49 is a protein called 39S ribosomal protein S30, mitochondrial.



Mol	Chain	Residues		At	AltConf	Trace			
49	s	370	Total 3036	C 1946	N 542	O 534	S 14	0	0

• Molecule 50 is a protein called Mitochondrial assembly of ribosomal large subunit protein 1.

Mol	Chain	Residues		A	AltConf	Trace			
50	u	111	Total 927	C 595	N 155	0 167	S 10	0	0

• Molecule 51 is a protein called MIEF1 upstream open reading frame protein.

Mol	Chain	Residues		Ato	\mathbf{ms}	AltConf	Trace	
51	V	69	Total 588	C 372	N 116	O 100	0	0

• Molecule 52 is a protein called Acyl carrier protein, mitochondrial.

Mol	Chain	Residues		Ate	oms	AltConf	Trace		
52	W	79	Total 638	C 410	N 05	0 128	S 5	0	0
			000	410	95	120	\mathbf{O}		

• Molecule 53 is a RNA chain called 16S rRNA.

Mol	Chain	Residues		A	AltConf	Trace			
53	А	1054	Total 22369	C 10046	N 4050	O 7219	Р 1054	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
А	1437	U	UNK	conflict	GB 1025814679

• Molecule 54 is a RNA chain called mitochondrial Val tRNA.

Mol	Chain	Residues		A	toms			AltConf	Trace
54	В	56	Total 1191	C 534	N 214	0 387	Р 56	0	0

• Molecule 55 is ZINC ION (three-letter code: ZN) (formula: Zn).



Mol	Chain	Residues	Atoms	AltConf
55	Ι	1	Total Zn 1 1	0
55	0	1	Total Zn 1 1	0

• Molecule 56 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms	AltConf
56	W	1	Total Mg 1 1	0
56	g	1	Total Mg 1 1	0
56	А	47	TotalMg4747	0

• Molecule 57 is 4'-PHOSPHOPANTETHEINE (three-letter code: PNS) (formula: $C_{11}H_{23}N_2O_7PS$).



Mol	Chain	Residues		Α	tom	IS			AltConf
57		1	Total	С	Ν	0	Р	S	0
57	V	T	21	11	2	6	1	1	0



3 Residue-property plots (i)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and atom inclusion in map 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 diamond above a residue indicates a poor fit to the EM map for this residue (all-atom inclusion < 40%). 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 L2, mitochondrial



MET ALA ALA ALA ALA ALA THR THR THR ALA ALA ALA ALA	LEU LEU LEU LEU ALA ALA ALA ALA ALA ALA CLY CLY CLY CLN CLN CLN	LUL LEU LEU ARG ARG ARG CLU CLU ASN ASN ASN ASN ASN ASN CLU	ALA ALA ASN ASN ASN ASN ASN ASN ASN ASN ASN AS	194 E103 V105	
D110 L118 A129 E141 E142 E142 E143 E143 K144	R147 R147 GLU GLU GLU GLU CLU CLU CLU GLU THR ALA ALA ALA ALA	ALU THR VAL LYS LYS LEU LYS SER ARG CYS SER ARG CVS VAL	MET MET LYS ASN ASN ASN LYS LYS TRP GLU GLU ASN ASN ASN ASN ASN GLU	ULE VAL ALA ARG HIS PHE LYS	
ASN LEU GLY VAL VAL VAL ALA PRO HIS THR LEU	LEU PRO GLU CLU CLU PRO GLU TRP GLU TRP CLU TRP CLU	VAL VAL VAL ASN GLY GLY CLEU ASP ASP VAL VAL VAL VAL VAL SER	VAL VAL VAL ASIN PHE GLU CYS PRO LYS THR LYS TYR LYS	TYR TRP LEU ALA GLN GLN	
ALA ALA LYS LYS ALA ALA AET PRO PRO GLN GLN	1				
• Molecule 5: 3	9S ribosomal protein 1 52%	L10, mitochondrial			
Chain I:	60%		39%		
MET ALA ALA ALA ALA ALA ALA CLY MET MET ARG GLY GLY	LEU LEU LEU LEU ALA ALA ALA ALA ALA ALA CLU LEU LEU CLN THR THR THR THR THR THR THR	11K GLY S30 K31 A32 V33 N33 R35 R35 R35 R35 R37 R37 R37	P58 A59 H61 P62 S63 S63 C64 C64 C65 S53 S5R	PRO PRO PRO GLU GLU GLU CLU CLU CLU CLU	
179 180 181 182 182 183 185 186 186 186	A88 V89 F90 P91 P92 N93 N93 A97 V98 V98 C99 C99	q100 N101 V102 A103 S105 A104 A104 A106 E107 K109 K108	L111 M112 R113 H114 Q115 C116 K116 K118 K118 K118 K120	1121 L122 M123 K124 F126 F126 P127 M128 Q129 V130 V130 V130 K132	P133 F134 L135 E136 D137 S138
K139 Y140 Q141 L142 L143 L144 P145 L146 F147	V148 0149 M150 M151 M151 M152 L153 L153 V155 E157 E157 E157 E158	K160 V161 K162 E163 M164 N164 R166 L167 L167 R169 R169 R169	V171 P172 F173 L174 D175 L176 L177 C177 G178 G178 C180	1181 D182 D183 T184 T185 L186 S187 R186 R188 R188 G190 F191 F191	N193 Y194 S195 K196 K196 L197 PR0
SER LEU PRO LEU VAL GLV GLV CLEU VAL CLY GLY	LEU THR CYS CYS CYS LEU LEU ALA ALA ALA ALA CLA HIS GLA GLA GLA	PRU GLN THR LEU THR LEU LEU ASP GLN TYR TYR ARG GLU	GLN GLU LYS ASP SER VAL MET SER ALA ASN GLY LYS	PRIO ASP ASP THR VAL	
PRO ASP SER					
• Molecule 6: 39	9S ribosomal protein 1	L11, mitochondrial			
Chain J:	73%		• 27%		
MET SER LYS LLYS LEU LEU ARG ALA ALA ALA ALA ALA ALA ALA	LIYS PR0 PR0 GLU VAL C18 C18 C18 C18 C18 C120 R21 R21 R21 R21 R21 R21 R25	A26 G27 G27 L28 M300 M300 P31 P31 P33 P33 P33 P33 P33 C35 C35 C35 C35 C35 C35 C35 C35 C35 C	P37 V38 L39 C40 C41 C41 P42 C43 V44 V44 S45 S45 S45	N47 048 149 149 149 150 153 153 155 155 155 157 157	D59
K61 E62 G63 C63 F64 F65 F65 F65 F65 F65 F65 F65 K69	170 L71 V72 F74 F74 D75 R76 F77 F78 E79 E79 E79 K81	182 683 684 985 985 788 888 789 790 F90 F90 F90 K92	A93 A94 A95 A95 G96 E98 K99 G100 A101 A102	q103 T104 G105 K106 E107 V108 A109 G110 C111 V112 T113 T114	K115 H116 V117 Y118 E119 I120
	0 H N M 4 D 0 H 00 0 H	••••••••••••••••	<mark>₩4₩0₩</mark>		
A12 R12 R12 A12 A12 D12 D12 D12 D12 D12 D12	F13 A13 L13 Q13 Q13 D13 D13 D13 C13 S13 S13 S13 S13 V14 V14	ан ан ан ан ан ан ан ан ан ан ан ан ан а	115 R15 V15 V15 V15 V15 C15 C10 G10	LEU ALA ALA ALA CLN CLN CLN CLN CLN CLN CLN CLN CLN	GLU
A S S S S S S S S S S S S S S S S S S S	2				

ALI ASI ALI ALI ALI ALI ALI ALI CY?

• Molecule 7: 39S ribosomal protein L13, mitochondrial



Chain K:	99%	••	
MET S2 D156 E162 E162 W170 P172 P172 P173 E174 P173 E174 P173 E174 C175			
• Molecule 8: 39S riboso	mal protein L14, mitochondrial		
Chain L:	78% .	21%	
MET PHE PHE THR THR THR THR THR PHC THR THR THR THR THR THR THR THR THR THR	HIS HIS PHE PHE PHE PHE PHE PHE PHE PHE PHE PHE	1106 E109 D110 N111 K129 K130 E131	E133
• Molecule 9: 39S riboso	mal protein L15, mitochondrial		
Chain M:	96%	•••	
MET ALA ALA ALA CLY PRO CLN CLN CLN CLN CLY CLN CLY CLY CLY CLY CLY CLY CLY CLY CLY CLY	660 4 € 111 111 111 111 111 111 111 111 111		
• Molecule 10: 39S ribose	omal protein L16, mitochondrial		
Chain N:	51% 81%	18%	
MET TRP TRP ARG LEU LEU LEU ALA ALA ALA PRO PRO ARG VAL LEU LEU LEU LEU LEU SER	SER TRP LEU LEU LEU LEU LEU LEU ALA SER CLY CLY FRO FRO FRO FRO FRO FRO FRO FRO FRO FRO	K47 P48 K49 L50 R51 F52 I53	E55 A56 L58 V59 P60
•••••	·····	******	•••••
K61 V62 R63 R64 E65 E65 E65 E65 P66 R67 R67 E77 E77 E78 T77	E81 F82 F82 E84 F85 F87 F87 F87 F87 A91 188 A91 L90 C94 C94 C94 C94 C94 C94 C94 C94 C94 C94	M104 M105 R106 L107 T108 T108 T109 N110	R111 8112 9115 9115 7119 7115 8116 7119 7120 7121 9122 7123 7126 7126 7126 7126 7126 7126 7126 7126
P127 1131 1132 7132 8133 8133 6137 6137 8138 8138 8138 8138 6131 1138 6141 8138 8142 8142 8142 8142 8142 8142 8142 814	Ci 43 Ki 44 Ki 44 Mi 45 Di 45 Mi 45 Mi 45 Mi 49 Mi 50 Mi 50 Mi 65 Mi 75 Mi	E170 E171 V172 F175 L176	41.76 A180 A180 F1183 F1183 F1183 A189 V190 S191 C195 C195 C195 C195
E196 H H 99 H H 90 H 100 H			
• Molecule 11: 39S ribose	omal protein L17, mitochondrial		
Chain O:	86%	• 13%	
MET ARG LEU SER ALA ALA ALA ALA ALA ALA ALA ALA ALA AL	SER ASN ASN ASN HIS THR THR THR PRO CLN TILE		
• Molecule 12: 39S ribose	omal protein L18, mitochondrial		
Chain P:	78% .	22%	
	WORLDWIDE PROTEIN DATA BANK		



• Molecule 18: 3	39S ribosomal protein L24, mitochondria	hl
Chain V:	88%	11%
MET MET LEU LEU SER ALA ALA ALA SER SER LEU LEU LLEU LLEU SER	VAL THR LI5 D53 M102 P125 M102 M126 M126 M126 M126 M126 M126 M126 M12	E158 PHE PHE PRO ALA ASP ALA ASP ALA ASP ASC CLY TLE TLU CLU CLU CLU CLU CLU
• Molecule 19: 3	39S ribosomal protein L27, mitochondria	hl
Chain W:	~ 74%	26%
MET ALA SER SER VAL LEU LEU LEU ARC ARC THR THR	ALA VAL THR SER LEU LEU LEU PRO SER ALA ALA ALA ALA ALA ALA ALA ALA ALA AL	L42 L42 C44 C44 C44 C44 C48 C48 C48 C48 C48 C48
R119 L120 G123 A124 L148		
• Molecule 20: 3	39S ribosomal protein L28, mitochondria	hl
Chain X:	94%	• 5%
MET P2 R23 R23 R23 R23 R23 B64 B64 B64 B64	E193 A242 A242 CLU PRO PRO PRO PRO ALA VAL VAL VAL VAL VAL VAL CLY GLN GLN GLN	
• Molecule 21: 3	39S ribosomal protein L47, mitochondria	al
Chain Y:	70%	30%
MET ALA ALA ALA ALA GLY LEU LEU LEU CYS ARG ARG	VAL SER SER SER ALA ALA ALA SER SER SER SER SER ALA ALA ALA ALA ALA CYS SER CYS SER CYS SER CYS SER SER SER SER SER SER SER SER SER SE	THR PRO ASN VAL THR THR PHE HIS CLN THR TTR HIS THR THR THR THR SER THR SER
ARC LYS GG3 GG3 H198 F238 F10 H1S LEU ALLA GLU GLU	ALA GIN LYS SER SER LEU VAL	
• Molecule 22: 3	39S ribosomal protein L30, mitochondria	ıl
Chain Z:	75%	25%
MET ALA ALA GLY ILEU LEU LEU VAL VAL CLN TRP PRO	PR0 GLY ARG ARG CLN THR THR THR UAL CLU CLU CLU CLU CLU CLU CLU CLU CLU CL	GLU GLN ALA ALA HIS HIS GLU SER
• Molecule 23: 3	39S ribosomal protein L32, mitochondria	al
Chain 0:	57%	43%
MET ALA LEU LEU MET MET MET LEU VAL LEU VAL SER SER PRO	TRP ALLA ALLA ALLA ALLA ALCA ALCA CLU CLEU CLEU CLU CLU CLU CLU CLU CLU CLU CLU CLU CL	PR0 GLY PR0 PR0 LLEU ALA ALA ALA CLU CLU PRC GLV PHE THR PR0 GLU PR0 GLU PR0 ALA ALA ALA



ASP THR SER SER CLY CLY CLY CLU CLU CLU CLU CLU CLU CLU CLU CLU CLU	PILE TRP MET MET 1966 GLN ASN		
• Molecule 24: 39S	ribosomal protein L33, m	itochondrial	
Chain 1:	42%	·	20%
MET PHE LEU LEU SER ALA PHE ALA LI'S SER SER SER SER SER	N15 + 116 + L17 + M20 + M20 + M21 + 132 + K33 + K36 + L37 +	R38 E39 K40 L41 L41 L43 L44 H45 Y46 P48 P48 P48 K51	452 R53 F58 F58 F63 S64 L65 S64
• Molecule 25: 39S	ribosomal protein L34, m	itochondrial	
Chain 2:	47%	53%	
MET ALA ALA VAL LEU LEU LEU LEU LEU LEU FRO FRO SER SER SER	ALA ALA ALA ALA ALA CLEU CLEU CLEU PRO PRO PRO PRO PRO	ASP ALA TTRP GLY GLY FPRO FPRO GLN GLN ALA ALA ALA ALA ALA ALA ALA	
• Molecule 26: 39S	ribosomal protein L35, m	itochondrial	
Chain 3:	51%	49%	
MET MET ALA ALA SER SER ALA ALA ALA ALA ALA ALA ALA SER	LLP LLE LEU LEU PRO PRO PRO PRO PRO ASY LLEU ASY ASY VAL ASY VAL VAL VAL	ASN ALA SER LLEU TLEU TLEU SER CLEU CLEU CLEU CLEU SER TTR CLEU SER TTR R TLEU TLEU TLEU TTR R TLEU TLEU TLEU TLEU TLEU TLEU TLEU TLEU	THR PRO VAL VAL SER SER PRO ARG ARG LEU
THR THR SER SER ARC ARC ASN ASN ASN CYS CYS CYS CYS SER THR THR THR THR	LLE LEU ASN ARG ARG ARG PRO VAL LEU VAL LEU VAL LEU VAL CEU VAL SER SER	L94 K135 D174 K187 V188	
• Molecule 27: 39S	ribosomal protein L37, m	itochondrial	
Chain 5:	91%		• 9%
MET ALLA ALLA ALLA ALLA SER SER ALLA ALLA ALLA ALLA ALLA ALLA ALLA AL	SER CLY CLY CLY CLY CLY CLY CLY FLZ ARG CLY FLZ ARG CLY FLZ CLZ CLZ	N1 49 N1 49 E2 16 E2 16 E2 E2 16 E2 E2 E2 E2 E2 E2 E2	VAL VAL V388 A22 ALA ALA
• Molecule 28: 39S	ribosomal protein L38, m	itochondrial	
Chain 6:	84%		15%
MET ALLA ALLA ALLA PRO PRO TRP TRP ALLA ALLA ALLA CVS GLU CVS	ARG TRP ARG GLY PHE SER SER SER SER SER ALA ALA ALA ALA ALA ALA ALA T29 CL7 R27 R27 R27 R27 R27 R27 R27 R27 R27 R2	C33 P34 P34 M35 S38 S38 D39 D41 L42 C42 C42 S43 S43 S43 S43 S43 S43 S43 S43 S43 S43	R47 L48 B49 B53 B53 F54 F55 F55 F60 A61 A61
G <mark>79</mark> G79 G179 G179 A57 FR0 C175 C175 C175 C175 C175 C175 C175 C175	PR0 PR0 PR0 PR0 PR0 PR0 PR0 PR0 PR0 PR0	E112 E113 A115 A115 A115 E119 E119 E119 E119 E120 A123 A123 A123 A123	L125 R126 T127 A128 S129 P131 L132 D133 A134 V135 R136 R136 R136 R136
E153 + E159 + E162 + H163 - C164 + A165 + P169 -	K170 V171 P173 L173 H174 V175 A176 A176 V177 A176 C180 C180 C180 C180 C180 C180 C180 C180 C180 C180 C180 C180 C180 C180 C181 C181 C182 C183 C182 C183	Y188 C189 C189 C189 E192 E197 A199 A201 P202 P202 E203 E203	T205 T205 E207 E207 A208 E209 CLU CLU CLU CLU CLU CLU CLU CLU





• Molecule 33: 39S ribosomal protein L43, mitochondrial



Chain b:	69%	31%	
MET T2 Q149 ASP PRO ALA	ARO ARO GLIA GLIA GLIA GLIA LEU LEU LEU LEU LEU LEU LEU CLIA CLEU PRO GLIA PRO PRO PRO PRO PRO PRO PRO PRO PRO PRO	THR SER SER PRO PRO PRO PRO PRO PRO PRO SER SER SER SER SER SER SER SER	LIE
VAL PRO ALA LEU THR THR VAL	SCYS ALA ALA		
• Molecul	e 34: 39S ribosomal protein L44, mitochondrial		
Chain c:	83%	17%	
MET ALA SER GLY LEU VAL ARG	LEU LEU GLN GLN GLN GLN GLN GLY ARG PRO PRO PRO PRO PRO PRO PRO PRO PRO PRO	LI19 L119 X316 SER LVS LVS CLU CLU ALA ALA ALA ALA ALA ALV CLVS	TLE
THR ALA SER			
• Molecul	e 35: 39S ribosomal protein L45, mitochondrial		
Chain d:	68% •	31%	
MET ALA ALA PRO TLE PRO GLN	GLY PHE SER SER SER SER SER SER PHE FHE CYS CYS CYS CYS CYS CYS CYS CYS CYS CYS	PRU TYR GLM PRO LYR F50 K51 F53 K54 E53 K54	MG7 056 AG0
R61 K62 A63 G64 L65 V65	LIEU LIEV PEG PEG PEG PET PET ABT ABT ABT ABT ABT ABT ABT AB	THR MICT A117 A117 B136 V136 D136 V186	L 189 C 199 SER SER
MET MET ASN GLN GLY N207	L252 L252 L255 ASN P255 CUU CUU ALA CUU ALA CUU ALA CUV CUV CUV CUV CUV CUV CUV CUV ALA ALA ALA ALA ALA		
• Molecul	e 36: 39S ribosomal protein L46, mitochondrial		
Chain e:	77%	22%	
MET ALA ALA PRO VAL ARG ARG	THR LEU CLY VAL VAL ARA ARA ARA ARA ARA ARA ARA ARA ARA A	P44 W45 R46 L47 L47 L48 A50 A50 C49 L51 L51 C52 C52 C52 C52 C52 C52 C52 C52 C52 C52	P56 V58 S60
****	** *** ****************		↓ ↓ ↓ ↓ ↓
K61 P62 L63 T64 P65	000 000 000 001 001 001 001 001	N95 0966 897 1987 1987 1996 1997 1997 1997 1997 1997 1997 199	GLU GLU GLU GLU GLU GLU GLU GLU CLI LLU CLI LLU GLI CLI LLU CLI LLU CLI LLU CLI LLU CLI LLU CLI CLI CLI CLI CLI CLI CLI CLI CLI CLI
E121 D122 M123 W124 E125	 R1.25 F1.28 F1.28 F1.29 F1.31 F1.31 F1.33 F1.33 F1.35 F1.35 F1.35 F1.35 F1.35 F1.35 F1.45 <	R1155 N156 L157 V158 V158 L159 L160 V161 R162 E163 E163 F165	C166 D167 D167 D168 V170 W171 V170 W171 D169 M172 D173 D175 A176 A176 A176 A176 A176 D175 D175 D175 D175 D175 D175 D167 D167 D167 D167 D167 D167 D167 D167
	о N ю о о н N о т ю ю N ю о о н N о т и ю N о о о н N о т о т о т о т о т о т о т о т о т о		
G18 E185 T186 L186 R186	414 8 118 8 119	721 F21 K21, K21, K21, F20 F1 F21 F21 F1 F1 F1 F1 F1 F1 F1 F1 F1 F1 F1 F1 F1	622 223 723 723 723 723 723 723 723 1233 7243



622 622 622 622 622 722 622 722 622 722 622 722 7	
• Molecule 37: 39S ribosomal protein L48, mitochondrial	
50% Chain f: 54% 45%	
• • • • • • • • • • • • • • • • • • • •	
MET THR THR THR CLEU CLEU CLEU CLEU CLEU CLEU CCYS CCYS CCYS CCYS CCYS CCYS CCYS CCY	
E66 CLU PRO CLU PRO LYS LAS L91 N92 R83 R84 L91 L93 R84 L94 N92 R83 R84 L94 N92 R84 L94 N92 R93 R100 M100 M111 N112 L113 L114 L115 L114 L115 <	V121 E122 E123 S124 Y125
A126 A126 A128 A128 A128 A129 A133 A133 A133 A133 A133 A133 A133 A13	R183 L184 S185
V186 K137 E188 H190 CLU CLU CLU CLU CLU CLU CLU CLU CLU CLU	
• Molecule 38: 39S ribosomal protein L49, mitochondrial	
Chain g: 78% 22%	
MET ALA ALA ALA ALA ALA ARG CLU CLU ARG C C C C C C C C C C C C C C C C C C C	
• Molecule 39: 39S ribosomal protein L50, mitochondrial	
Chain h: 62% . 37%	
MET ALA ALA ALA ALA ALA ARG SER THR THR THR THR THR THR THR THR THR TH	
SER	
\bullet Molecule 40: 39S ribosomal protein L51, mitochondrial	
Chain i: 76% 24%	
MET ASN CLA ASN CLEU CLEU CLEU ASS ASS ASS ASS ASS ASS ASS ASS ASS AS	
• Molecule 41: 39S ribosomal protein L52, mitochondrial	
Chain j: 69% 31%	

 Molecule 42: 39S ribosomal protein L53, mitochondrial Chain k: 70% Chain k: 70% Molecule 43: 39S ribosomal protein L54, mitochondrial Chain 1: 17% R3% Signa Signa Sign
70% Chain k: 71% 29% ####################################
Image:
 Molecule 43: 39S ribosomal protein L54, mitochondrial Chain 1: 17% 83% 845 255 255 255 255 255 255 255 255 255 2
 Molecule 43: 39S ribosomal protein L54, mitochondrial Chain I: 17% B3% B # # # # # # # # # # # # # # # # # # #
Chain l: 17% 83% W W W W W W W W W W W W W W W W W W W
Image:
Image: Second
Image:
 Molecule 44: 39S ribosomal protein L55, mitochondrial 35% Chain m: 35% 65%
35% Chain m: 35% 65%
••••••••••••••••••••••••••••••••••••••
MET MET ALA ALA ALA ALA ALA ALA ALA ALA CLY SER CLY CLEU CLY ARG ARG ARG ARG ARG ARG ARG ARG ARG ARG
del le l
GLA TTRP TTRP TTRR TTRR LLYS LVS
• Molecule 45: Ribosomal protein 63, mitochondrial
Chain o: 77% 23%

 \bullet Molecule 46: Peptidyl-tRNA hydrolase ICT1, mitochondrial



Chain p:	61%	38%	
MET ALA ALA ALA ARG CYS CYS CYS CYS CITRP GLT SER SER	ALA VAL TRP TEU TEU TEU PRO PRO PRO ARG ARG ARG ARG ARG ARG CYS CYS CYS CYS CYS CYS CYS CYS CYS CYS	LYS GLY GLY THR THR FRO FRO GLY ALA ALA ALA ALA ALA ALA GLY C FRO FRO	GCLY GCLN ASN VAL
ASN LYS V95 A108 1111 1121	q152 ♦ D156 ♦ E160 ♦ q163 ♦ Q103 ↓ PR0 C1U PR0 C1U PR0 C1U PR0 C1U ASP	H176 H176 L177 L186 L188 H182 H188 H188 R187 R185 R187 R199 Q190 Q190 R193 R193 R193 R193 R193 R193 R193 R193	ALA VAL LYS LYS SER SER ARG ARG ARC ASP MET
ASP			
• Molecule 47: G	rowth arrest and DNA dam	age-inducible proteins-interacti	ng protein 1
Chain q:	54%	• 44%	
		• •••••	****
MET ALA ALA ALA SER VAL ALA ALA ALA SER LEU LEU CLY	VAL ALA ALA ALA ALA ALA ALA ALA CLA CLA C	E123 K127 N128 P129 P129 P129 P138 P138 P138 P138 P138 P138 P138 P138	E144 K145 A146 Q147 Q147 A148 ASP LYS GLU ARG
ARG ALA ARG ARG LEU GLN GLN GLU GLU CEU LEU CEU CEV CEV	TYR VAL VAL ASP ASP ASP PRO PRO CLU CLU CLU CLU CLU CLU CLU CLU CLU CLU	GLU GLU LYS CLYS CLYS CLYS CLY CLYS CLU CLYS CLY CLYS CLY CLYS CLY CLYS CLU ALA ALA ALA ALA ALA	ALA VAL ALA GLN
ASP PRO ALA ALA ALA CLY GLY ALA PRO SER SER			
• Molecule 48: 39	S ribosomal protein S18a, r	nitochondrial	
Chain r:	72%	• 26%	
0110111 11	7270	2070	
		• • • • • • • • • • • • • • • • • • • •	***
MET ALA ALA LEU LEU LEU LEU VAL SER GLY GLY ARG	LEU LEU ARS GLY GLY CEU LEU ALA ALA ALA SER SER SER ARG ARG ARG ARG ARG	GLY F35 E37 V38 V38 V38 V38 F40 E40 GLU GLV GLV GLV GLV GLY T48 I48 I48 C49 E50 G51	153 A55 P57 K58 K58 P64
M65 MET P66 ALA S67 ALA ALA S67 ALA LEV UVAL D84 VAL VAL VAL CVS G1Y G1Y G1Y AAAAAAAAAAAAAAAAAAAAAAAAAAA	Q109 LEU E110 LEU E117 LEU E117 LEU E117 LEU E117 LEU E117 LEU R134 LEU R134 LEU R134 LEU R134 LEU R134 A.I.A R10 A.I.A C1V A.I.A C1V A.I.A C1V A.I.A C1V A.I.A C1V S.R.R VAL S.R.R VAL S.R.R PAO A.I.A C1V S.R.R PAO A.I.A PAO A.I.A PAO A.I.A PAO A.I.A	L180 F35 F35 F36 F37 F38 F38 F33 F33 F33 F33 F33 F33 F33 F34 F41 F141 F1	
Image: Section of the section of t	B B B C <td>itochondrial</td> <td></td>	itochondrial	
Image: Section of the section of t	BAR	16%	
Image: Second	B B	8 8	PR0 EU PR0 ALA ALA ALA
Image: Second	Image: Second	No No <td< td=""><td>PRO CIU PRO ALA ALA ALA PRO P64</td></td<>	PRO CIU PRO ALA ALA ALA PRO P64
Image: Second	Image: Second system Image: Second system <td< td=""><td> </td><td>PRO CLU PRO ALA ALA PEG</td></td<>	 	PRO CLU PRO ALA ALA PEG
Image: Second	B B	 	PRO GLU PRO ALA ALA P57 P57 P64







• Molecule 54: mitochondrial Val tRNA







4 Experimental information (i)

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	76339	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	NONE	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose $(e^-/\text{\AA}^2)$	28	Depositor
Minimum defocus (nm)	Not provided	
Maximum defocus (nm)	Not provided	
Magnification	Not provided	
Image detector	FEI FALCON II (4k x 4k)	Depositor
Maximum map value	0.910	Depositor
Minimum map value	-0.487	Depositor
Average map value	0.001	Depositor
Map value standard deviation	0.018	Depositor
Recommended contour level	0.05	Depositor
Map size (Å)	390.24, 390.24, 390.24	wwPDB
Map dimensions	360, 360, 360	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.084, 1.084, 1.084	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: ZN, PNS, MG

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with |Z| > 5 is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mal	Chain	Bo	nd lengths	E	Bond angles
MOI	Unam	RMSZ	# Z > 5	RMSZ	# Z > 5
1	D	0.31	0/1736	0.68	0/2335
2	Ε	0.35	0/2322	0.61	1/3148~(0.0%)
3	F	0.43	0/2071	0.65	0/2817
4	Н	0.36	0/798	0.83	2/1073~(0.2%)
5	Ι	0.28	0/1308	0.60	0/1761
6	J	0.26	0/1077	0.56	0/1452
7	Κ	0.38	0/1495	0.64	1/2029~(0.0%)
8	L	0.28	0/904	0.68	1/1218~(0.1%)
9	М	0.38	0/2359	0.66	1/3185~(0.0%)
10	Ν	0.30	0/1697	0.63	0/2281
11	0	0.39	0/1269	0.69	1/1708~(0.1%)
12	Р	0.31	0/1173	0.68	0/1588
13	Q	0.33	0/1846	0.63	0/2487
14	R	0.44	0/1174	0.65	0/1572
15	S	0.37	0/1276	0.67	0/1729
16	Т	0.43	0/1335	0.62	0/1796
17	U	0.40	0/1183	0.66	1/1600~(0.1%)
18	V	0.31	0/1616	0.61	0/2189
19	W	0.31	0/881	0.64	0/1188
20	Х	0.35	0/2090	0.68	1/2825~(0.0%)
21	Y	0.37	0/1552	0.63	0/2079
22	Ζ	0.31	0/1003	0.60	0/1354
23	0	0.41	0/895	0.66	0/1201
24	1	0.26	0/438	0.71	0/583
25	2	0.44	0/357	0.70	0/475
26	3	0.34	0/852	0.64	0/1136
27	5	0.35	0/3250	0.65	2/4429~(0.0%)
28	6	0.30	0/2726	0.66	1/3715~(0.0%)
29	7	0.35	0/2391	0.64	1/3234~(0.0%)
30	8	0.28	0/855	0.64	0/1152
31	9	0.38	$0/\overline{972}$	0.69	$1/1306\ \overline{(0.1\%)}$
32	a	0.34	0/709	0.60	0/963



Mal	Chain	Bo	nd lengths	I	Bond angles
	Unain	RMSZ	# Z > 5	RMSZ	# Z > 5
33	b	0.40	0/1202	0.67	0/1626
34	с	0.35	0/2264	0.60	0/3059
35	d	0.31	0/1790	0.63	1/2423~(0.0%)
36	е	0.25	0/1797	0.56	0/2422
37	f	0.27	0/931	0.58	0/1259
38	g	0.38	0/1102	0.64	0/1503
39	h	0.34	0/847	0.71	2/1150~(0.2%)
40	i	0.44	0/849	0.66	0/1135
41	j	0.30	0/698	0.54	0/940
42	k	0.27	0/635	0.60	0/855
43	1	0.22	0/226	0.59	0/299
44	m	0.26	0/379	0.74	0/510
45	0	0.32	0/682	0.67	0/916
46	р	0.32	0/1071	0.70	1/1433~(0.1%)
47	q	0.33	0/1070	0.72	1/1450~(0.1%)
48	r	0.34	0/1238	0.74	4/1676~(0.2%)
49	S	0.38	0/3114	0.62	1/4225~(0.0%)
50	u	0.33	0/949	0.80	2/1281~(0.2%)
51	V	0.29	0/597	0.78	0/796
52	W	0.28	0/647	0.66	1/871~(0.1%)
53	A	0.54	$2/2\overline{5013}~(0.0\%)$	1.03	$113\overline{/38878}\ (0.3\%)$
54	В	0.26	0/1328	0.96	4/2056~(0.2%)
All	All	0.40	$2/9\overline{4039}\ (0.0\%)$	0.79	$144\overline{/132371~(0.1\%)}$

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
3	F	0	1
28	6	0	2
29	7	0	1
31	9	0	1
35	d	0	1
47	q	0	1
All	All	0	7

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
53	А	340	U	N3-C4	-6.10	1.32	1.38



Continued from previous page...

Mol	Chain	Res	Type	Atoms	\mathbf{Z}	Observed(Å)	$\mathrm{Ideal}(\mathrm{\AA})$
53	А	239	A	C6-N1	-5.21	1.31	1.35

The worst 5 of 144 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	$Observed(^{o})$	$Ideal(^{o})$
53	А	340	U	C5-C4-O4	21.26	138.66	125.90
53	А	340	U	N3-C4-O4	-17.17	107.38	119.40
53	А	239	А	N1-C6-N6	-14.13	110.12	118.60
53	А	23	С	N1-C2-O2	11.66	125.89	118.90
53	А	23	С	C2-N1-C1'	10.63	130.50	118.80

There are no chirality outliers.

5 of 7 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
28	6	187	VAL	Peptide
28	6	49	GLU	Peptide
29	7	93	MET	Peptide
31	9	71	LYS	Peptide
3	F	108	ARG	Sidechain

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	Perce	ntiles
1	D	216/305~(71%)	201~(93%)	14 (6%)	1 (0%)	29	68
2	Е	281/348~(81%)	274 (98%)	7 (2%)	0	100	100



α \cdot \cdot \cdot	C		
Continued	trom	previous	page
	9	1	1 0

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Perce	ntiles
3	F	248/311~(80%)	239 (96%)	9 (4%)	0	100	100
4	Н	93/267~(35%)	89~(96%)	4 (4%)	0	100	100
5	Ι	154/261~(59%)	142 (92%)	12 (8%)	0	100	100
6	J	138/192~(72%)	127~(92%)	11 (8%)	0	100	100
7	Κ	175/178~(98%)	167~(95%)	8 (5%)	0	100	100
8	L	113/145~(78%)	108 (96%)	5 (4%)	0	100	100
9	М	285/296~(96%)	271 (95%)	14 (5%)	0	100	100
10	Ν	203/251~(81%)	198 (98%)	5 (2%)	0	100	100
11	Ο	150/175~(86%)	145 (97%)	5 (3%)	0	100	100
12	Р	139/180~(77%)	134 (96%)	5 (4%)	0	100	100
13	Q	215/292~(74%)	206 (96%)	9 (4%)	0	100	100
14	R	138/149~(93%)	133 (96%)	5 (4%)	0	100	100
15	S	154/205~(75%)	149 (97%)	5 (3%)	0	100	100
16	Т	155/206~(75%)	152 (98%)	3 (2%)	0	100	100
17	U	135/153~(88%)	127 (94%)	8 (6%)	0	100	100
18	V	188/216~(87%)	180 (96%)	8 (4%)	0	100	100
19	W	107/148~(72%)	102 (95%)	5 (5%)	0	100	100
20	Х	241/256~(94%)	237~(98%)	4 (2%)	0	100	100
21	Y	174/250~(70%)	168 (97%)	6 (3%)	0	100	100
22	Ζ	118/161~(73%)	110 (93%)	8 (7%)	0	100	100
23	0	106/188~(56%)	102 (96%)	4 (4%)	0	100	100
24	1	50/65~(77%)	49 (98%)	1 (2%)	0	100	100
25	2	41/92~(45%)	41 (100%)	0	0	100	100
26	3	93/188~(50%)	91~(98%)	2 (2%)	0	100	100
27	5	383/423~(90%)	366 (96%)	16 (4%)	1 (0%)	41	75
28	6	316/380~(83%)	299~(95%)	17 (5%)	0	100	100
29	7	285/338~(84%)	265~(93%)	20 (7%)	0	100	100
30	8	97/206~(47%)	90(93%)	7(7%)	0	100	100
31	9	$\overline{113/137}$ (82%)	105 (93%)	8 (7%)	0	100	100
32	a	78/142~(55%)	76 (97%)	2(3%)	0	100	100
33	b	$146/\overline{215}~(68\%)$	138 (94%)	8 (6%)	0	100	100



Mol	Chain	Analysed	Favoured	Allowed	Outliers	Perce	ntiles
34	с	271/332~(82%)	262~(97%)	9~(3%)	0	100	100
35	d	203/306~(66%)	197~(97%)	6 (3%)	0	100	100
36	е	211/279~(76%)	196~(93%)	15 (7%)	0	100	100
37	f	110/212~(52%)	103 (94%)	7 (6%)	0	100	100
38	g	127/166~(76%)	119 (94%)	8 (6%)	0	100	100
39	h	96/158~(61%)	93~(97%)	3 (3%)	0	100	100
40	i	95/128~(74%)	91~(96%)	4 (4%)	0	100	100
41	j	83/123~(68%)	83 (100%)	0	0	100	100
42	k	76/112~(68%)	73~(96%)	3 (4%)	0	100	100
43	1	21/138~(15%)	21 (100%)	0	0	100	100
44	m	43/128 (34%)	38~(88%)	5 (12%)	0	100	100
45	О	77/102~(76%)	75~(97%)	2(3%)	0	100	100
46	р	119/206~(58%)	118 (99%)	1 (1%)	0	100	100
47	q	122/222~(55%)	121 (99%)	1 (1%)	0	100	100
48	r	140/196~(71%)	134 (96%)	6 (4%)	0	100	100
49	s	366/439~(83%)	355~(97%)	11 (3%)	0	100	100
50	u	109/234~(47%)	100 (92%)	9 (8%)	0	100	100
51	V	67/70~(96%)	65~(97%)	2 (3%)	0	100	100
52	W	77/156~(49%)	73~(95%)	4 (5%)	0	100	100
All	All	7941/11026~(72%)	7598~(96%)	341 (4%)	2(0%)	100	100

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All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
27	5	216	GLU
1	D	207	ILE

5.3.2 Protein sidechains (i)

In the following table, the Percentiles column shows the percent side chain 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		Outliers	Perce	ntiles
1	D	179/245~(73%)	177~(99%)	2(1%)	73	88
2	Ε	246/290~(85%)	246 (100%)	0	100	100
3	F	217/262~(83%)	215 (99%)	2 (1%)	78	90
4	Н	86/228~(38%)	86 (100%)	0	100	100
5	Ι	145/232~(62%)	144 (99%)	1 (1%)	84	93
6	J	113/150~(75%)	111 (98%)	2(2%)	59	81
7	К	155/156~(99%)	155 (100%)	0	100	100
8	L	98/124 (79%)	97~(99%)	1 (1%)	76	88
9	М	245/249~(98%)	242 (99%)	3 (1%)	71	87
10	Ν	172/211 (82%)	171 (99%)	1 (1%)	86	94
11	О	133/150~(89%)	133 (100%)	0	100	100
12	Р	123/155~(79%)	122 (99%)	1 (1%)	81	91
13	Q	199/256~(78%)	199 (100%)	0	100	100
14	R	118/126~(94%)	118 (100%)	0	100	100
15	S	141/180 (78%)	139 (99%)	2 (1%)	67	85
16	Т	141/176~(80%)	141 (100%)	0	100	100
17	U	124/135~(92%)	124 (100%)	0	100	100
18	V	172/191~(90%)	171 (99%)	1 (1%)	86	94
19	W	89/119~(75%)	89 (100%)	0	100	100
20	Х	219/229~(96%)	217 (99%)	2 (1%)	78	90
21	Y	159/223~(71%)	158 (99%)	1 (1%)	86	94
22	Ζ	111/147 (76%)	111 (100%)	0	100	100
23	0	97/164~(59%)	97 (100%)	0	100	100
24	1	49/60~(82%)	48 (98%)	1 (2%)	55	79
25	2	38/72~(53%)	38 (100%)	0	100	100
26	3	88/166~(53%)	88 (100%)	0	100	100
27	5	348/368~(95%)	348 (100%)	0	100	100
28	6	265/332~(80%)	264 (100%)	1 (0%)	91	96
29	7	263/303~(87%)	261 (99%)	2 (1%)	81	91
30	8	91/190 (48%)	90 (99%)	1 (1%)	73	88
31	9	99/112~(88%)	99 (100%)	0	100	100
32	a	78/133~(59%)	78 (100%)	0	100	100



Mol	Chain	Analysed	Rotameric	Outliers	Perce	ntiles
33	b	130/186~(70%)	130 (100%)	0	100	100
34	с	241/288~(84%)	241 (100%)	0	100	100
35	d	193/274 (70%)	192 (100%)	1 (0%)	88	94
36	е	188/236~(80%)	187 (100%)	1 (0%)	88	94
37	f	101/188 (54%)	100 (99%)	1 (1%)	76	88
38	g	119/148 (80%)	119 (100%)	0	100	100
39	h	95/148~(64%)	95 (100%)	0	100	100
40	i	86/110 (78%)	86 (100%)	0	100	100
41	j	68/97~(70%)	68 (100%)	0	100	100
42	k	71/90~(79%)	71 (100%)	0	100	100
43	1	23/116~(20%)	23 (100%)	0	100	100
44	m	40/113~(35%)	40 (100%)	0	100	100
45	0	68/87~(78%)	68 (100%)	0	100	100
46	р	117/181~(65%)	117 (100%)	0	100	100
47	q	106/178~(60%)	104 (98%)	2 (2%)	57	80
48	r	133/169~(79%)	131 (98%)	2 (2%)	65	84
49	S	326/381~(86%)	326 (100%)	0	100	100
50	u	105/200~(52%)	105 (100%)	0	100	100
51	V	59/60~(98%)	59 (100%)	0	100	100
52	W	73/136 (54%)	73 (100%)	0	100	100
All	All	7143/9520 (75%)	7112 (100%)	31 (0%)	91	96

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 $5~{\rm of}~31$ residues with a non-rotameric side chain are listed below:

Mol	Chain	Res	Type
15	S	118	ASN
47	q	113	LYS
20	Х	36	ARG
48	r	58	LYS
35	d	142	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 10 such sidechains are listed below:



Mol	Chain	Res	Type
29	7	232	HIS
42	k	15	GLN
49	s	152	GLN
22	Ζ	53	HIS
22	Z	67	HIS

5.3.3 RNA (i)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
53	А	1032/1559~(66%)	250 (24%)	11 (1%)
54	В	51/69~(73%)	14 (27%)	1 (1%)
All	All	1083/1628~(66%)	264~(24%)	12 (1%)

5 of 264 RNA backbone outliers are listed below:

Mol	Chain	\mathbf{Res}	Type
53	А	5	А
53	А	6	А
53	А	7	С
53	А	8	С
53	А	9	U

5 of 12 RNA pucker outliers are listed below:

Mol	Chain	Res	Type
53	А	787	А
53	А	837	А
54	В	1607	U
53	А	1235	А
53	А	360	U

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 52 ligands modelled in this entry, 51 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).

Mal	Tuno	Chain	Dog	Link	Bo	ond leng	\mathbf{ths}	В	ond ang	les
	туре	Ullalli	nes	LINK	Counts	RMSZ	# Z >2	Counts	RMSZ	# Z > 2
57	PNS	V	101	-	13,20,21	2.42	3 (23%)	18,26,29	1.40	3 (16%)

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
57	PNS	v	101	-	-	10/24/26/27	-

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
57	V	101	PNS	C39-N41	5.95	1.46	1.33
57	V	101	PNS	C34-N36	5.46	1.45	1.33
57	V	101	PNS	O35-C34	-2.18	1.19	1.23

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms		$Observed(^{o})$	$Ideal(^{o})$
57	V	101	PNS	C37-C38-C39	-3.75	106.11	112.36
57	V	101	PNS	C42-N41-C39	2.40	127.29	122.84
57	V	101	PNS	C37-N36-C34	-2.13	118.80	122.59

There are no chirality outliers.

5 of 10 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
57	V	101	PNS	O27-C28-C29-C32
57	V	101	PNS	C28-C29-C32-O33



Mol	Chain	Res	Type	Atoms
57	V	101	PNS	O27-C28-C29-C30
57	V	101	PNS	O27-C28-C29-C31
57	V	101	PNS	C30-C29-C32-O33

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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 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 sufficient 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 (i)

This section contains visualisations of the EMDB entry EMD-12920. 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 (i)

6.1.1 Primary map



The images above show the map projected in three orthogonal directions.

6.2 Central slices (i)

6.2.1 Primary map



X Index: 180

Y Index: 180





The images above show central slices of the map in three orthogonal directions.

6.3 Largest variance slices (i)

6.3.1 Primary map



X Index: 191

Y Index: 146

Z Index: 188

The images above show the largest variance slices of the map in three orthogonal directions.

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

6.4.1 Primary map



The images above show the map standard deviation projections with false color in three orthogonal directions. Minimum values are shown in green, max in blue, and dark to light orange shades represent small to large values respectively.



6.5 Orthogonal surface views (i)

6.5.1 Primary map



The images above show the 3D surface view of the map at the recommended contour level 0.05. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

6.6 Mask visualisation (i)

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



7 Map analysis (i)

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

7.1 Map-value distribution (i)



The map-value distribution is plotted in 128 intervals along the x-axis. The y-axis is logarithmic. A spike in this graph at zero usually indicates that the volume has been masked.



7.2 Volume estimate (i)



The volume at the recommended contour level is 728 $\rm nm^3;$ this corresponds to an approximate mass of 657 kDa.

The volume estimate graph shows how the enclosed volume varies with the contour level. The recommended contour level is shown as a vertical line and the intersection between the line and the curve gives the volume of the enclosed surface at the given level.



7.3 Rotationally averaged power spectrum (i)



*Reported resolution corresponds to spatial frequency of 0.286 \AA^{-1}



8 Fourier-Shell correlation (i)

Fourier-Shell Correlation (FSC) is the most commonly used method to estimate the resolution of single-particle and subtomogram-averaged maps. The shape of the curve depends on the imposed symmetry, mask and whether or not the two 3D reconstructions used were processed from a common reference. The reported resolution is shown as a black line. A curve is displayed for the half-bit criterion in addition to lines showing the 0.143 gold standard cut-off and 0.5 cut-off.

8.1 FSC (i)



*Reported resolution corresponds to spatial frequency of 0.286 \AA^{-1}



8.2 Resolution estimates (i)

$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	Estimation criterion (FSC cut-off)		
Resolution estimate (A)	0.143	0.5	Half-bit
Reported by author	3.50	-	-
Author-provided FSC curve	3.52	4.22	3.59
Unmasked-calculated*	-	-	-

*Resolution estimate based on FSC curve calculated by comparison of deposited half-maps.



9 Map-model fit (i)

This section contains information regarding the fit between EMDB map EMD-12920 and PDB model 70I7. Per-residue inclusion information can be found in section 3 on page 14.

9.1 Map-model overlay (i)



The images above show the 3D surface view of the map at the recommended contour level 0.05 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.



9.2 Q-score mapped to coordinate model (i)



The images above show the model with each residue coloured according its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions at which atoms can be resolved. Low Q-score values may therefore be expected for many entries.

9.3 Atom inclusion mapped to coordinate model (i)



The images above show the model with each residue coloured according to its atom inclusion. This shows to what extent they are inside the map at the recommended contour level (0.05).



9.4 Atom inclusion (i)



At the recommended contour level, 79% of all backbone atoms, 73% of all non-hydrogen atoms, are inside the map.



1.0

0.0 <0.0

9.5 Map-model fit summary (i)

The table lists the average atom inclusion at the recommended contour level (0.05) and Q-score for the entire model and for each chain.

\mathbf{Chain}	Atom inclusion	$\mathbf{Q} ext{-score}$
All	0.7340	0.4000
0	0.8910	0.5030
1	0.3760	0.2290
2	0.9790	0.5950
3	0.8780	0.5180
5	0.8650	0.4580
6	0.5450	0.2340
7	0.8280	0.4370
8	0.0810	0.1010
9	0.8600	0.4780
А	0.8260	0.4300
В	0.4080	0.1440
D	0.7700	0.4150
Ε	0.8590	0.4580
\mathbf{F}	0.9180	0.5320
Н	0.7400	0.3860
Ι	0.1190	0.1300
J	0.0000	0.0330
К	0.8690	0.4760
L	0.6840	0.3590
М	0.8720	0.4900
N	0.3240	0.2550
О	0.9130	0.5170
Р	0.5500	0.1990
Q	0.8330	0.4390
R	0.9110	0.5290
S	0.8790	0.4920
Т	0.9250	0.5450
U	0.8780	0.5050
V	0.7540	0.4350
W	0.6730	0.3590
Х	0.8420	0.4540
Y	0.9130	0.5190
Z	0.8240	0.4360
a	0.8900	0.5040



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Chain	Atom inclusion	Q-score
b	0.9270	0.5320
С	0.8800	0.4810
d	0.7090	0.3880
е	0.0120	0.0750
f	0.0800	0.0810
g	0.9240	0.5130
h	0.8660	0.4410
i	0.9300	0.5590
j	0.7930	0.4410
k	0.0200	0.0840
1	0.0340	0.0630
m	0.0000	0.0670
О	0.8830	0.4720
р	0.6840	0.3380
q	0.7050	0.3830
r	0.7420	0.3510
S	0.9040	0.5100
u	0.4420	0.2130
V	0.2290	0.1960
W	0.0160	0.1370

