



wwPDB EM Validation Summary Report ⓘ

Feb 19, 2025 – 12:30 pm GMT

PDB ID : 8P8W
EMDB ID : EMD-17145
Title : Mycoplasma pneumoniae di-ribosome in chloramphenicol-treated cells (following 70S)
Authors : Schacherl, M.; Xue, L.; Spahn, C.M.T.; Mahamid, J.
Deposited on : 2023-06-02
Resolution : 8.70 Å (reported)
Based on initial models : 7OOC, 7OOD

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 ⓘ 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 : **FAILED**
Mogul : 1.8.4, CSD as541be (2020)
MolProbity : 4.02b-467
buster-report : 1.1.7 (2018)
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ : **FAILED**
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.41

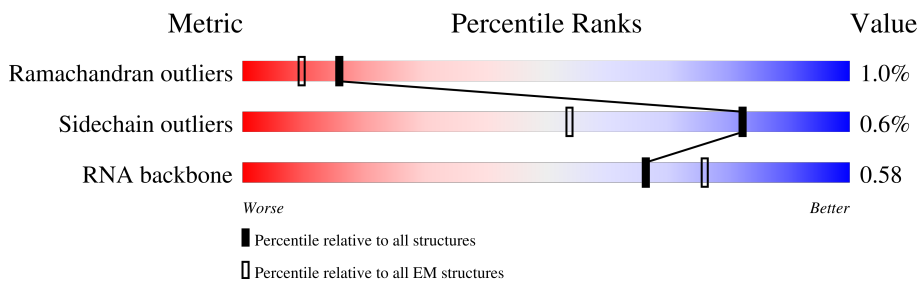
1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 8.70 Å.

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



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

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$.

Mol	Chain	Length	Quality of chain
1	0	48	98%
2	1	59	100%
3	2	37	100%
4	3	2907	81% 19%
5	4	108	73% 27%
6	5	1520	82% 17%
7	6	76	67% 28% 5%
8	7	75	69% 31%
9	A	294	88% 9%

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Mol	Chain	Length	Quality of chain
10	B	273	81% 18%
11	C	205	96%
11	U	205	91% 8%
12	D	219	76% 21%
13	E	215	75% 22%
14	F	155	95% 5%
15	G	142	98%
16	H	132	97% ..
17	I	108	94% . .
18	J	121	94% 6%
19	K	139	93% . .
20	L	124	97% ..
21	M	61	98% .
22	N	86	99% .
23	O	94	90% . 7%
24	P	85	99% .
25	Q	104	73% 25%
26	R	87	98% ..
27	S	87	90% . 9%
28	T	60	97% ..
29	X	444	7% 93%
30	Y	29	45% 55%
31	Z	36	100%
32	a	287	99% .
33	b	287	79% 20%

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Mol	Chain	Length	Quality of chain
34	c	212	100%
35	d	180	99%
36	e	184	95%
37	f	149	99%
38	g	161	76% 22%
39	h	137	93% 7%
40	i	146	98%
41	j	122	98%
42	k	151	99%
43	l	139	97%
44	m	124	95%
45	n	116	100%
46	o	119	99%
47	p	127	93% 7%
48	q	100	99%
49	r	159	87% 11%
50	s	237	40% 60%
51	t	111	99%
52	u	104	93%
53	v	65	97%
54	w	111	99%
55	x	97	90% 8%
56	y	57	95%
57	z	53	94% 6%

2 Entry composition

There are 61 unique types of molecules in this entry. The entry contains 151559 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 50S ribosomal protein L34.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	0	47	380	236	81	61	2	0	0

- Molecule 2 is a protein called 50S ribosomal protein L35.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
2	1	59	477	300	99	77	1	0	0

- Molecule 3 is a protein called 50S ribosomal protein L36.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
3	2	37	304	189	65	46	4	0	0

- Molecule 4 is a RNA chain called 23S ribosomal RNA.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	P		
4	3	2893	61995	27704	11293	20105	2893	0	0

- Molecule 5 is a RNA chain called 5S ribosomal RNA.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	P		
5	4	108	2305	1030	415	752	108	0	0

- Molecule 6 is a RNA chain called 16S ribosomal RNA.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	P		
6	5	1507	32258	14420	5847	10484	1507	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
5	1003	A	G	conflict	GB 26117688

- Molecule 7 is a RNA chain called tRNA-Ala (E-site).

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	P		
7	6	76	1620	723	287	534	76	0	0

- Molecule 8 is a RNA chain called tRNA-Asp (P-site).

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	P		
8	7	75	1599	712	279	533	75	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
7	17	G	-	insertion	GB 26117688
7	55	C	U	conflict	GB 26117688

- Molecule 9 is a protein called 30S ribosomal protein S2.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
9	A	268	2152	1368	379	396	9	0	0

- Molecule 10 is a protein called 30S ribosomal protein S3.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
10	B	225	1773	1121	328	319	5	0	0

- Molecule 11 is a protein called 30S ribosomal protein S4.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
11	C	204	1669	1057	316	292	4	0	0
11	U	204	1669	1057	316	292	4	0	0

- Molecule 12 is a protein called 30S ribosomal protein S5.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
12	D	173	1346	846	265	232	3	0	0

- Molecule 13 is a protein called 30S ribosomal protein S6.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
13	E	167	1362	857	240	263	2	0	0

- Molecule 14 is a protein called 30S ribosomal protein S7.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
14	F	155	1254	790	240	217	7	0	0

- Molecule 15 is a protein called 30S ribosomal protein S8.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
15	G	142	1118	728	194	193	3	0	0

- Molecule 16 is a protein called 30S ribosomal protein S9.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
16	H	129	1040	661	195	183	1	0	0

- Molecule 17 is a protein called 30S ribosomal protein S10.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
17	I	104	832	536	147	148	1	0	0

- Molecule 18 is a protein called 30S ribosomal protein S11.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
18	J	114	829	514	153	156	6	0	0

- Molecule 19 is a protein called 30S ribosomal protein S12.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
19	K	135	1071	677	212	180	2	0	0

- Molecule 20 is a protein called 30S ribosomal protein S13.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
20	L	121	975	609	197	169		0	0

- Molecule 21 is a protein called 30S ribosomal protein S14 type Z.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
21	M	60	474	302	96	72	4	0	0

- Molecule 22 is a protein called 30S ribosomal protein S15.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
22	N	86	697	441	131	124	1	0	0

- Molecule 23 is a protein called 30S ribosomal protein S16.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
23	O	87	705	453	130	118	4	0	0

- Molecule 24 is a protein called 30S ribosomal protein S17.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
24	P	85	693	436	138	118	1	0	0

- Molecule 25 is a protein called 30S ribosomal protein S18.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
25	Q	78	651	417	129	100	5	0	0

- Molecule 26 is a protein called 30S ribosomal protein S19.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
26	R	86	700	444	132	122	2	0	0

- Molecule 27 is a protein called 30S ribosomal protein S20.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
27	S	79	643	391	138	114		0	0

- Molecule 28 is a protein called 30S ribosomal protein S21.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
28	T	59	519	326	111	80	2	0	0

- Molecule 29 is a protein called Trigger factor.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
29	X	30	242	155	43	43	1	0	0

- Molecule 30 is a RNA chain called mRNA.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	P		
30	Y	29	623	280	120	194	29	0	0

- Molecule 31 is a protein called Nascent chain.

Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
31	Z	36	187	112	37	38	0	0

- Molecule 32 is a protein called 50S ribosomal protein L2.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
32	a	285	2225	1385	437	397	6	0	0

- Molecule 33 is a protein called 50S ribosomal protein L3.

Mol	Chain	Residues	Atoms					AltConf	Trace
33	b	231	Total	C	N	O	S	0	0
			1778	1129	320	322	7		

- Molecule 34 is a protein called 50S ribosomal protein L4.

Mol	Chain	Residues	Atoms					AltConf	Trace
34	c	211	Total	C	N	O	S	0	0
			1654	1053	299	299	3		

- Molecule 35 is a protein called 50S ribosomal protein L5.

Mol	Chain	Residues	Atoms					AltConf	Trace
35	d	179	Total	C	N	O	S	0	0
			1416	910	251	251	4		

- Molecule 36 is a protein called 50S ribosomal protein L6.

Mol	Chain	Residues	Atoms				AltConf	Trace
36	e	176	Total	C	N	O	0	0
			1396	899	247	250		

- Molecule 37 is a protein called 50S ribosomal protein L9.

Mol	Chain	Residues	Atoms					AltConf	Trace
37	f	149	Total	C	N	O	S	0	0
			1210	780	212	215	3		

- Molecule 38 is a protein called 50S ribosomal protein L10.

Mol	Chain	Residues	Atoms					AltConf	Trace
38	g	125	Total	C	N	O	S	0	0
			951	606	165	177	3		

- Molecule 39 is a protein called 50S ribosomal protein L11.

Mol	Chain	Residues	Atoms					AltConf	Trace
39	h	128	Total	C	N	O	S	0	0
			959	616	160	177	6		

- Molecule 40 is a protein called 50S ribosomal protein L13.

Mol	Chain	Residues	Atoms					AltConf	Trace
40	i	144	Total	C	N	O	S	0	0
			1164	737	213	209	5		

- Molecule 41 is a protein called 50S ribosomal protein L14.

Mol	Chain	Residues	Atoms					AltConf	Trace
41	j	122	Total	C	N	O	S	0	0
			944	595	178	167	4		

- Molecule 42 is a protein called 50S ribosomal protein L15.

Mol	Chain	Residues	Atoms					AltConf	Trace
42	k	150	Total	C	N	O	S	0	0
			1170	741	228	200	1		

- Molecule 43 is a protein called 50S ribosomal protein L16.

Mol	Chain	Residues	Atoms					AltConf	Trace
43	l	136	Total	C	N	O	S	0	0
			1079	694	196	182	7		

- Molecule 44 is a protein called 50S ribosomal protein L17.

Mol	Chain	Residues	Atoms					AltConf	Trace
44	m	119	Total	C	N	O	S	0	0
			958	609	175	171	3		

- Molecule 45 is a protein called 50S ribosomal protein L18.

Mol	Chain	Residues	Atoms					AltConf	Trace
45	n	116	Total	C	N	O	S	0	0
			918	573	181	162	2		

- Molecule 46 is a protein called 50S ribosomal protein L19.

Mol	Chain	Residues	Atoms					AltConf	Trace
46	o	118	Total	C	N	O	S	0	0
			966	609	186	170	1		

- Molecule 47 is a protein called 50S ribosomal protein L20.

Mol	Chain	Residues	Atoms					AltConf	Trace
47	p	118	Total	C	N	O	S	0	0
			981	624	194	161	2		

- Molecule 48 is a protein called 50S ribosomal protein L21.

Mol	Chain	Residues	Atoms					AltConf	Trace
48	q	99	Total	C	N	O	S	0	0
			811	525	148	134	4		

- Molecule 49 is a protein called 50S ribosomal protein L22.

Mol	Chain	Residues	Atoms					AltConf	Trace
49	r	142	Total	C	N	O	S	0	0
			1091	677	212	195	7		

- Molecule 50 is a protein called 50S ribosomal protein L23.

Mol	Chain	Residues	Atoms					AltConf	Trace
50	s	95	Total	C	N	O	S	0	0
			740	486	125	128	1		

- Molecule 51 is a protein called 50S ribosomal protein L24.

Mol	Chain	Residues	Atoms					AltConf	Trace
51	t	111	Total	C	N	O	S	0	0
			871	550	166	152	3		

- Molecule 52 is a protein called 50S ribosomal protein L27.

Mol	Chain	Residues	Atoms					AltConf	Trace
52	u	101	Total	C	N	O	S	0	0
			786	498	148	139	1		

- Molecule 53 is a protein called 50S ribosomal protein L28.

Mol	Chain	Residues	Atoms					AltConf	Trace
53	v	64	Total	C	N	O	S	0	0
			520	320	109	90	1		

- Molecule 54 is a protein called 50S ribosomal protein L29.

Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
54	w	110	906	576	168	162	0	0

- Molecule 55 is a protein called 50S ribosomal protein L31.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
55	x	89	708	449	124	131	4	0	0

- Molecule 56 is a protein called 50S ribosomal protein L32.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
56	y	56	452	274	98	75	5	0	0

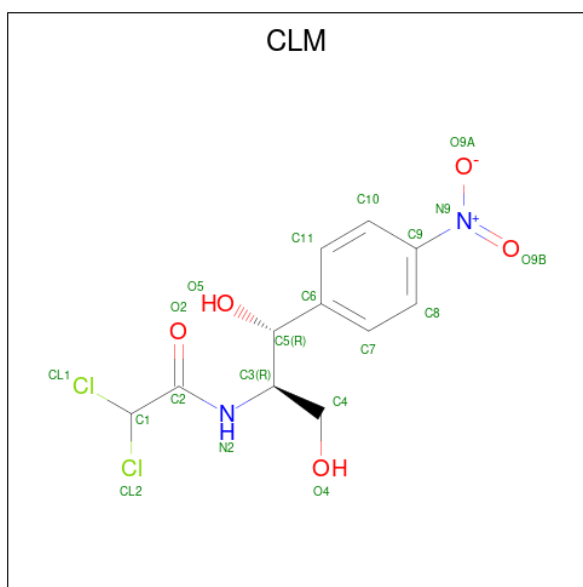
- Molecule 57 is a protein called 50S ribosomal protein L33 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
57	z	50	408	255	81	68	4	0	0

- Molecule 58 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		AltConf
58	2	1	Total	Zn	0
			1	1	
58	M	1	Total	Zn	0
			1	1	
58	Q	1	Total	Zn	0
			1	1	
58	x	1	Total	Zn	0
			1	1	
58	y	1	Total	Zn	0
			1	1	
58	z	1	Total	Zn	0
			1	1	

- Molecule 59 is CHLORAMPHENICOL (three-letter code: CLM) (formula: C₁₁H₁₂Cl₂N₂O₅) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				AltConf	
			Total	C	Cl	N		O
59	3	1	20	11	2	2	5	0

- Molecule 60 is POTASSIUM ION (three-letter code: K) (formula: K).

Mol	Chain	Residues	Atoms		AltConf
			Total	K	
60	3	1	1	1	0

- Molecule 61 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		AltConf
			Total	Mg	
61	3	206	206	206	0
61	4	1	1	1	0
61	5	90	90	90	0
61	6	1	1	1	0
61	K	1	1	1	0
61	P	1	1	1	0
61	Y	1	1	1	0

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Mol	Chain	Residues	Atoms		AltConf
61	b	2	Total 2	Mg 2	0
61	i	1	Total 1	Mg 1	0
61	k	2	Total 2	Mg 2	0
61	y	2	Total 2	Mg 2	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. 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: 50S ribosomal protein L34

Chain 0:  98%



- Molecule 2: 50S ribosomal protein L35

Chain 1:  100%


There are no outlier residues recorded for this chain.

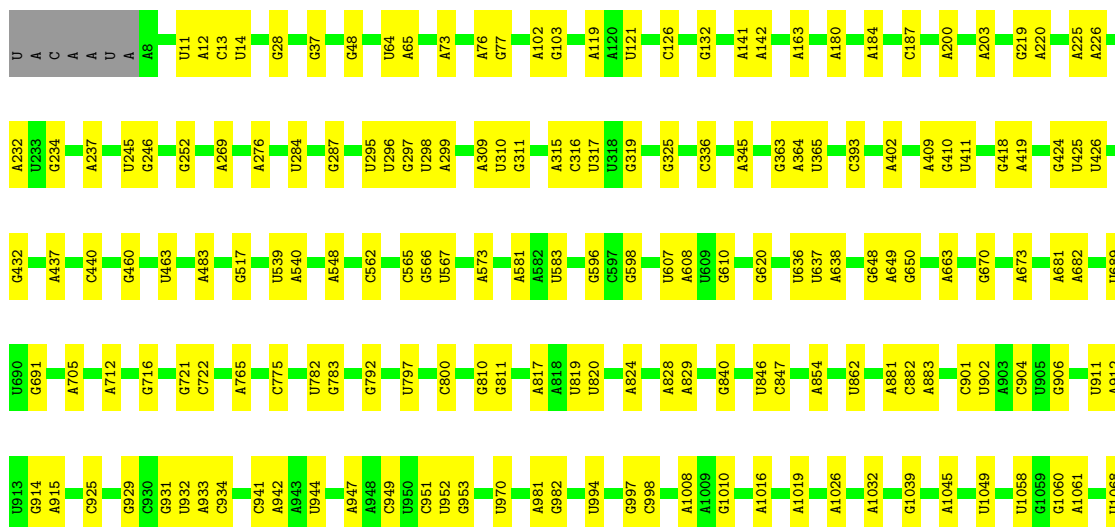
- Molecule 3: 50S ribosomal protein L36

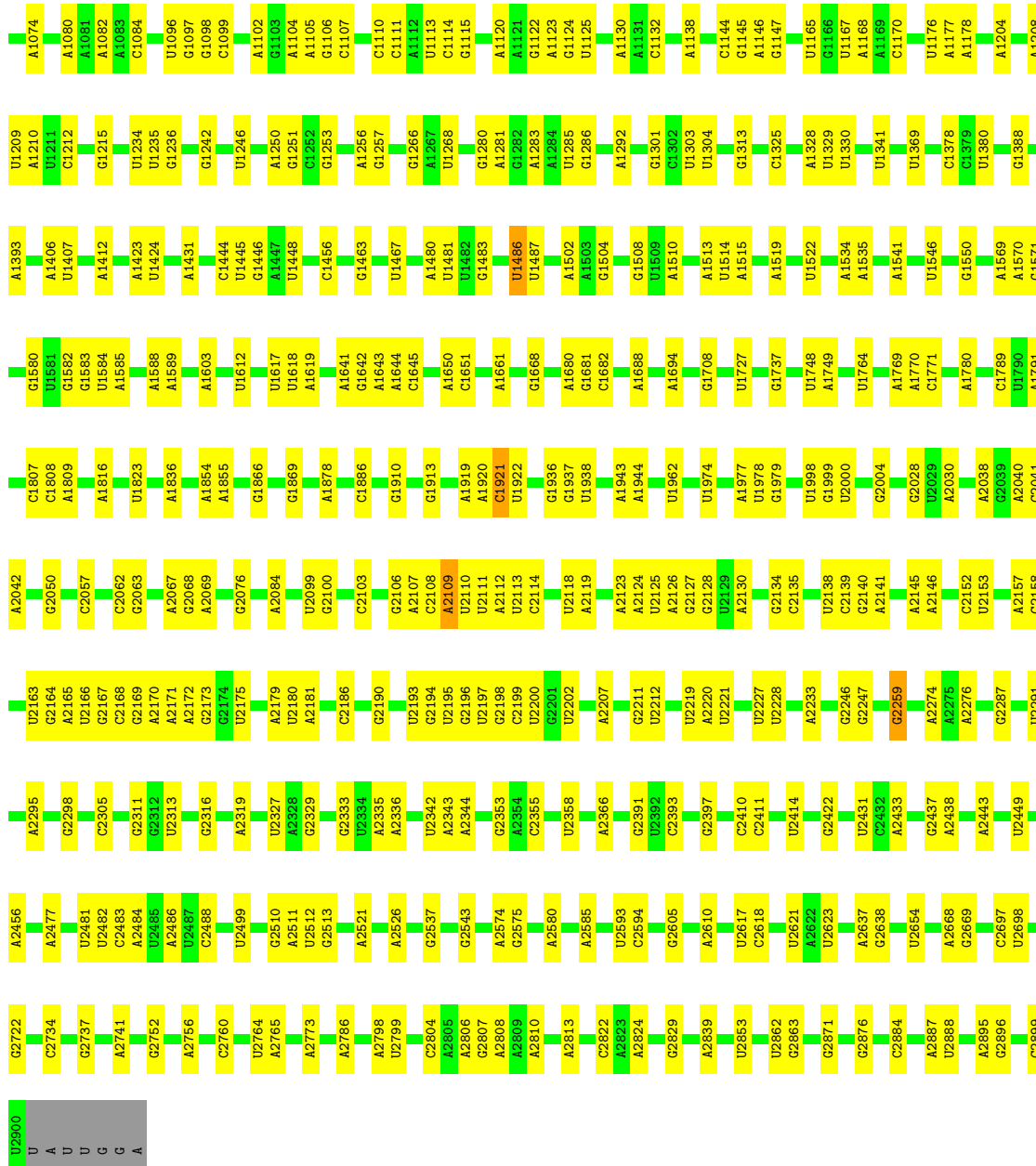
Chain 2:  100%

There are no outlier residues recorded for this chain.

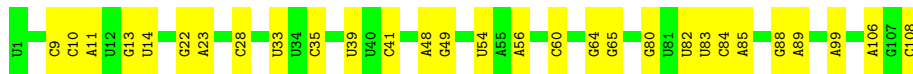
- Molecule 4: 23S ribosomal RNA

Chain 3:  81% 19%

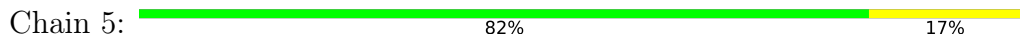


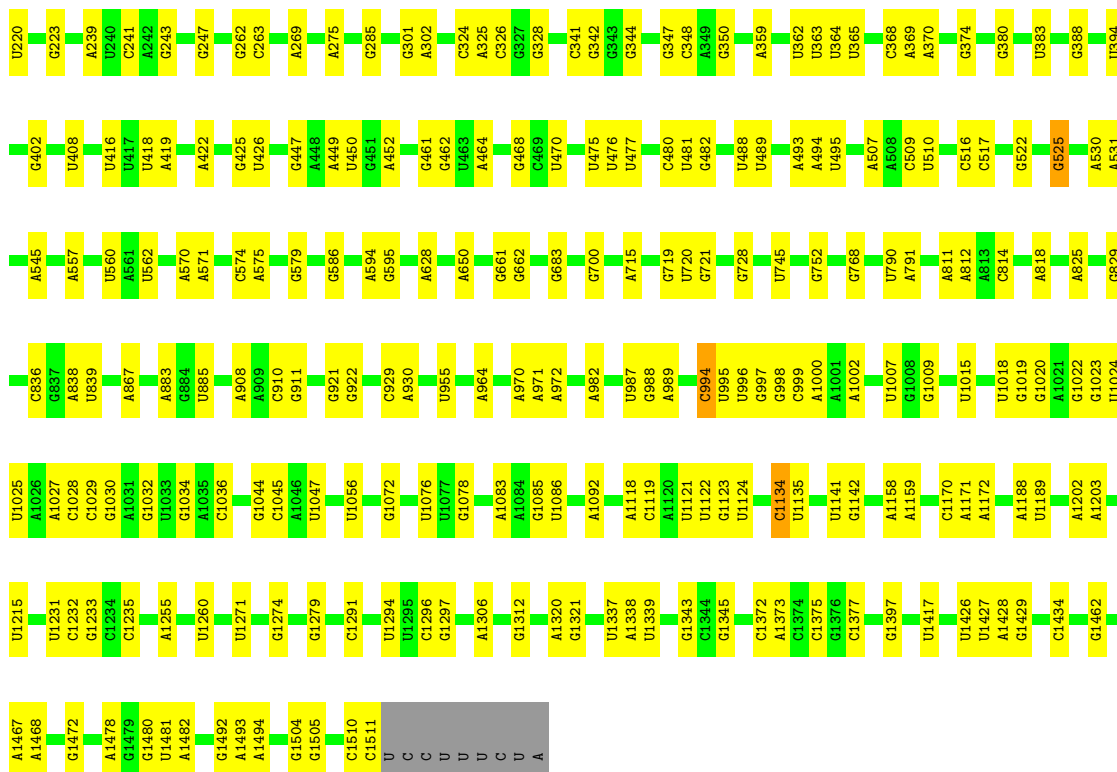


• Molecule 5: 5S ribosomal RNA



• Molecule 6: 16S ribosomal RNA





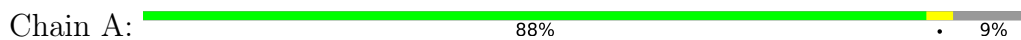
• Molecule 7: tRNA-Ala (E-site)



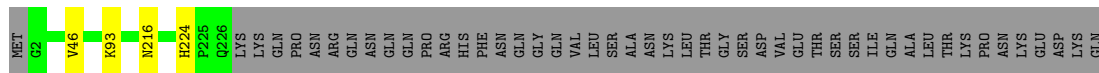
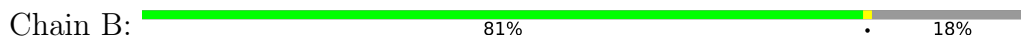
• Molecule 8: tRNA-Asp (P-site)



• Molecule 9: 30S ribosomal protein S2



• Molecule 10: 30S ribosomal protein S3



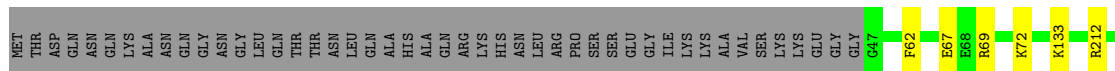
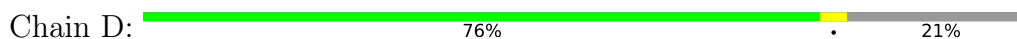
• Molecule 11: 30S ribosomal protein S4



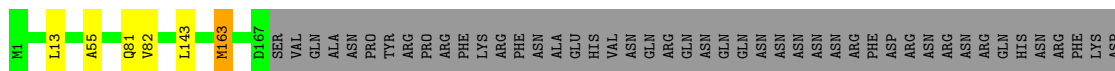
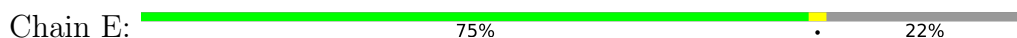
• Molecule 11: 30S ribosomal protein S4



• Molecule 12: 30S ribosomal protein S5



• Molecule 13: 30S ribosomal protein S6



• Molecule 14: 30S ribosomal protein S7

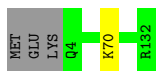


• Molecule 15: 30S ribosomal protein S8



• Molecule 16: 30S ribosomal protein S9

Chain H:  97% ..



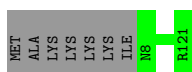
- Molecule 17: 30S ribosomal protein S10

Chain I:  94% ..



- Molecule 18: 30S ribosomal protein S11

Chain J:  94% 6%



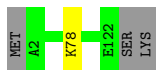
- Molecule 19: 30S ribosomal protein S12

Chain K:  93% ..



- Molecule 20: 30S ribosomal protein S13

Chain L:  97% ..



- Molecule 21: 30S ribosomal protein S14 type Z

Chain M:  98% .



- Molecule 22: 30S ribosomal protein S15

Chain N:  99% .



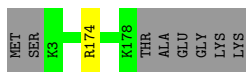
- Molecule 23: 30S ribosomal protein S16

Chain d:  99%



- Molecule 36: 50S ribosomal protein L6

Chain e:  95%




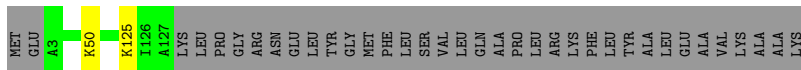
- Molecule 37: 50S ribosomal protein L9

Chain f:  99%



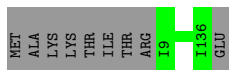
- Molecule 38: 50S ribosomal protein L10

Chain g:  76%



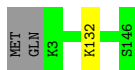
- Molecule 39: 50S ribosomal protein L11

Chain h:  93%



- Molecule 40: 50S ribosomal protein L13

Chain i:  98%



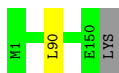
- Molecule 41: 50S ribosomal protein L14

Chain j:  98%



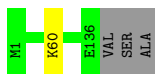
- Molecule 42: 50S ribosomal protein L15

Chain k:  99%



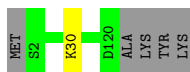
- Molecule 43: 50S ribosomal protein L16

Chain l:  97%



- Molecule 44: 50S ribosomal protein L17

Chain m:  95%



- Molecule 45: 50S ribosomal protein L18

Chain n:  100%

There are no outlier residues recorded for this chain.

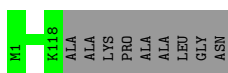
- Molecule 46: 50S ribosomal protein L19

Chain o:  99%



- Molecule 47: 50S ribosomal protein L20

Chain p:  93% 7%




- Molecule 48: 50S ribosomal protein L21

Chain q:  99%

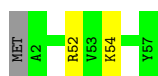


- Molecule 49: 50S ribosomal protein L22

Chain r:  87% 11%

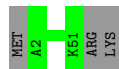
- Molecule 56: 50S ribosomal protein L32

Chain y:  95% ..



- Molecule 57: 50S ribosomal protein L33 1

Chain z:  94% 6%



4 Experimental information

Property	Value	Source
EM reconstruction method	SUBTOMOGRAM AVERAGING	Depositor
Imposed symmetry	POINT, C1	Depositor
Number of subtomograms used	963	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION; CTF estimation and 3D CTF correction are done in Warp	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	137	Depositor
Minimum defocus (nm)	1000	Depositor
Maximum defocus (nm)	3250	Depositor
Magnification	64000	Depositor
Image detector	GATAN K3 BIOQUANTUM (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: 5MC, B8T, CLM, 1MG, OMG, 7MG, ZN, 2MA, K, MG, MA6

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	0	0.25	0/383	0.61	0/504
2	1	0.25	0/484	0.53	0/637
3	2	0.27	0/306	0.68	0/401
4	3	0.18	0/69363	0.73	9/108161 (0.0%)
5	4	0.15	0/2578	0.72	0/4016
6	5	0.18	0/35992	0.72	5/56111 (0.0%)
7	6	0.34	1/1810 (0.1%)	0.86	3/2817 (0.1%)
8	7	0.40	2/1785 (0.1%)	0.77	0/2779
9	A	0.31	0/2186	0.67	4/2952 (0.1%)
10	B	0.28	0/1800	0.62	1/2433 (0.0%)
11	C	0.34	0/1700	0.72	0/2278
11	U	0.34	0/1700	0.78	0/2278
12	D	0.30	0/1365	0.66	0/1827
13	E	0.28	0/1384	0.71	2/1867 (0.1%)
14	F	0.29	0/1274	0.66	0/1710
15	G	0.31	0/1134	0.69	1/1527 (0.1%)
16	H	0.28	0/1056	0.65	0/1409
17	I	0.30	0/843	0.69	2/1132 (0.2%)
18	J	0.27	0/844	0.57	0/1136
19	K	0.26	0/1089	0.63	0/1461
20	L	0.28	0/986	0.67	0/1321
21	M	0.35	0/483	0.69	0/643
22	N	0.24	0/703	0.61	0/936
23	O	0.32	0/718	0.76	0/962
24	P	0.25	0/702	0.62	0/934
25	Q	0.27	0/663	0.69	0/883
26	R	0.30	0/716	0.61	1/958 (0.1%)
27	S	0.26	0/645	0.55	0/857
28	T	0.30	0/524	0.79	1/685 (0.1%)
29	X	0.28	0/245	0.72	0/325
30	Y	0.29	0/699	0.90	0/1087
31	Z	0.74	0/26	1.33	0/33

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z >5	RMSZ	# Z >5
32	a	0.26	0/2267	0.61	1/3044 (0.0%)
33	b	0.29	0/1812	0.63	1/2436 (0.0%)
34	c	0.27	0/1681	0.57	0/2257
35	d	0.27	0/1437	0.61	0/1931
36	e	0.30	0/1420	0.60	0/1912
37	f	0.27	0/1233	0.59	0/1653
38	g	0.28	0/960	0.56	0/1284
39	h	0.25	0/968	0.54	0/1298
40	i	0.26	0/1186	0.58	0/1592
41	j	0.29	0/953	0.68	0/1275
42	k	0.26	0/1187	0.62	1/1581 (0.1%)
43	l	0.30	0/1104	0.61	0/1481
44	m	0.27	0/973	0.58	0/1309
45	n	0.25	0/927	0.61	0/1239
46	o	0.29	0/976	0.65	0/1296
47	p	0.25	0/996	0.55	0/1325
48	q	0.30	0/828	0.64	0/1111
49	r	0.27	0/1100	0.67	3/1471 (0.2%)
50	s	0.26	0/752	0.53	0/1015
51	t	0.30	0/878	0.69	1/1165 (0.1%)
52	u	0.25	0/798	0.58	0/1063
53	v	0.30	0/526	0.82	1/703 (0.1%)
54	w	0.23	0/916	0.50	0/1222
55	x	0.30	0/722	0.71	2/959 (0.2%)
56	y	0.27	0/457	0.74	1/601 (0.2%)
57	z	0.26	0/412	0.59	0/547
All	All	0.22	3/163655 (0.0%)	0.71	40/243830 (0.0%)

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

Mol	Chain	#Chirality outliers	#Planarity outliers
11	U	0	2

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
7	6	1	G	OP3-P	-10.58	1.48	1.61
8	7	1	G	OP3-P	-10.54	1.48	1.61
8	7	72	G	O3'-P	-8.01	1.51	1.61

The worst 5 of 40 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	3	2109	A	O5'-P-OP2	-10.18	96.54	105.70
6	5	1434	C	P-O3'-C3'	-9.93	107.79	119.70
53	v	58	LEU	CA-CB-CG	8.88	135.72	115.30
55	x	94	LEU	CA-CB-CG	7.74	133.10	115.30
4	3	393	C	C6-N1-C2	-7.29	117.38	120.30

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
11	U	121	HIS	Peptide
11	U	153	ILE	Peptide

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	0	45/48 (94%)	45 (100%)	0	0	100	100
2	1	57/59 (97%)	57 (100%)	0	0	100	100
3	2	35/37 (95%)	35 (100%)	0	0	100	100
9	A	264/294 (90%)	233 (88%)	25 (10%)	6 (2%)	5	28
10	B	223/273 (82%)	197 (88%)	24 (11%)	2 (1%)	14	52
11	C	202/205 (98%)	166 (82%)	33 (16%)	3 (2%)	8	40
11	U	202/205 (98%)	148 (73%)	41 (20%)	13 (6%)	1	13
12	D	171/219 (78%)	141 (82%)	25 (15%)	5 (3%)	3	23

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
13	E	165/215 (77%)	142 (86%)	18 (11%)	5 (3%)	3	23
14	F	153/155 (99%)	132 (86%)	15 (10%)	6 (4%)	2	19
15	G	140/142 (99%)	132 (94%)	8 (6%)	0	100	100
16	H	127/132 (96%)	115 (91%)	12 (9%)	0	100	100
17	I	102/108 (94%)	88 (86%)	13 (13%)	1 (1%)	13	49
18	J	112/121 (93%)	105 (94%)	7 (6%)	0	100	100
19	K	133/139 (96%)	113 (85%)	15 (11%)	5 (4%)	2	19
20	L	119/124 (96%)	112 (94%)	7 (6%)	0	100	100
21	M	58/61 (95%)	56 (97%)	2 (3%)	0	100	100
22	N	84/86 (98%)	77 (92%)	6 (7%)	1 (1%)	11	44
23	O	85/94 (90%)	78 (92%)	5 (6%)	2 (2%)	5	27
24	P	83/85 (98%)	71 (86%)	11 (13%)	1 (1%)	11	44
25	Q	76/104 (73%)	65 (86%)	9 (12%)	2 (3%)	4	26
26	R	84/87 (97%)	79 (94%)	5 (6%)	0	100	100
27	S	77/87 (88%)	74 (96%)	2 (3%)	1 (1%)	10	43
28	T	57/60 (95%)	55 (96%)	2 (4%)	0	100	100
29	X	28/444 (6%)	24 (86%)	4 (14%)	0	100	100
31	Z	3/36 (8%)	3 (100%)	0	0	100	100
32	a	283/287 (99%)	267 (94%)	15 (5%)	1 (0%)	30	68
33	b	229/287 (80%)	219 (96%)	9 (4%)	1 (0%)	30	68
34	c	209/212 (99%)	198 (95%)	11 (5%)	0	100	100
35	d	177/180 (98%)	169 (96%)	8 (4%)	0	100	100
36	e	174/184 (95%)	162 (93%)	12 (7%)	0	100	100
37	f	147/149 (99%)	131 (89%)	15 (10%)	1 (1%)	19	57
38	g	123/161 (76%)	117 (95%)	6 (5%)	0	100	100
39	h	126/137 (92%)	121 (96%)	5 (4%)	0	100	100
40	i	142/146 (97%)	133 (94%)	9 (6%)	0	100	100
41	j	120/122 (98%)	115 (96%)	5 (4%)	0	100	100
42	k	148/151 (98%)	138 (93%)	10 (7%)	0	100	100
43	l	134/139 (96%)	132 (98%)	2 (2%)	0	100	100
44	m	117/124 (94%)	112 (96%)	5 (4%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
45	n	114/116 (98%)	109 (96%)	5 (4%)	0	100	100
46	o	116/119 (98%)	108 (93%)	8 (7%)	0	100	100
47	p	116/127 (91%)	114 (98%)	2 (2%)	0	100	100
48	q	97/100 (97%)	92 (95%)	5 (5%)	0	100	100
49	r	140/159 (88%)	137 (98%)	3 (2%)	0	100	100
50	s	93/237 (39%)	89 (96%)	4 (4%)	0	100	100
51	t	109/111 (98%)	102 (94%)	7 (6%)	0	100	100
52	u	99/104 (95%)	86 (87%)	9 (9%)	4 (4%)	2	18
53	v	62/65 (95%)	57 (92%)	5 (8%)	0	100	100
54	w	108/111 (97%)	102 (94%)	6 (6%)	0	100	100
55	x	85/97 (88%)	64 (75%)	21 (25%)	0	100	100
56	y	54/57 (95%)	53 (98%)	1 (2%)	0	100	100
57	z	48/53 (91%)	47 (98%)	1 (2%)	0	100	100
All	All	6255/7355 (85%)	5717 (91%)	478 (8%)	60 (1%)	16	49

5 of 60 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
12	D	67	GLU
12	D	69	ARG
12	D	212	ARG
12	D	216	LEU
13	E	81	GLN

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	0	40/41 (98%)	40 (100%)	0	100	100
2	1	51/51 (100%)	51 (100%)	0	100	100
3	2	35/35 (100%)	35 (100%)	0	100	100

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
9	A	239/262 (91%)	238 (100%)	1 (0%)	89	91
10	B	188/232 (81%)	187 (100%)	1 (0%)	86	89
11	C	182/183 (100%)	178 (98%)	4 (2%)	47	65
11	U	182/183 (100%)	180 (99%)	2 (1%)	70	80
12	D	141/178 (79%)	139 (99%)	2 (1%)	62	75
13	E	150/196 (76%)	150 (100%)	0	100	100
14	F	132/132 (100%)	131 (99%)	1 (1%)	79	85
15	G	124/124 (100%)	122 (98%)	2 (2%)	58	73
16	H	112/115 (97%)	111 (99%)	1 (1%)	75	83
17	I	97/99 (98%)	96 (99%)	1 (1%)	73	82
18	J	91/97 (94%)	91 (100%)	0	100	100
19	K	117/120 (98%)	116 (99%)	1 (1%)	75	83
20	L	102/105 (97%)	101 (99%)	1 (1%)	73	82
21	M	47/48 (98%)	47 (100%)	0	100	100
22	N	78/78 (100%)	78 (100%)	0	100	100
23	O	76/82 (93%)	76 (100%)	0	100	100
24	P	75/75 (100%)	75 (100%)	0	100	100
25	Q	69/94 (73%)	69 (100%)	0	100	100
26	R	76/77 (99%)	76 (100%)	0	100	100
27	S	71/77 (92%)	71 (100%)	0	100	100
28	T	55/56 (98%)	55 (100%)	0	100	100
29	X	27/406 (7%)	26 (96%)	1 (4%)	29	49
31	Z	2/2 (100%)	2 (100%)	0	100	100
32	a	241/243 (99%)	240 (100%)	1 (0%)	89	91
33	b	188/233 (81%)	187 (100%)	1 (0%)	86	89
34	c	183/184 (100%)	183 (100%)	0	100	100
35	d	153/154 (99%)	152 (99%)	1 (1%)	81	87
36	e	153/159 (96%)	152 (99%)	1 (1%)	81	87
37	f	134/134 (100%)	134 (100%)	0	100	100
38	g	100/129 (78%)	98 (98%)	2 (2%)	50	68
39	h	102/110 (93%)	102 (100%)	0	100	100

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
40	i	126/128 (98%)	125 (99%)	1 (1%)	79	85
41	j	103/103 (100%)	101 (98%)	2 (2%)	52	69
42	k	125/126 (99%)	125 (100%)	0	100	100
43	l	113/115 (98%)	112 (99%)	1 (1%)	75	83
44	m	105/109 (96%)	104 (99%)	1 (1%)	73	82
45	n	99/99 (100%)	99 (100%)	0	100	100
46	o	104/105 (99%)	104 (100%)	0	100	100
47	p	104/108 (96%)	104 (100%)	0	100	100
48	q	90/91 (99%)	90 (100%)	0	100	100
49	r	118/132 (89%)	118 (100%)	0	100	100
50	s	84/208 (40%)	84 (100%)	0	100	100
51	t	96/96 (100%)	96 (100%)	0	100	100
52	u	82/85 (96%)	82 (100%)	0	100	100
53	v	59/60 (98%)	59 (100%)	0	100	100
54	w	97/98 (99%)	97 (100%)	0	100	100
55	x	79/86 (92%)	78 (99%)	1 (1%)	65	77
56	y	48/49 (98%)	47 (98%)	1 (2%)	48	66
57	z	47/50 (94%)	47 (100%)	0	100	100
All	All	5492/6342 (87%)	5461 (99%)	31 (1%)	82	88

5 of 31 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
20	L	78	LYS
43	l	60	LYS
29	X	36	LYS
55	x	32	LYS
40	i	132	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 44 such sidechains are listed below:

Mol	Chain	Res	Type
35	d	63	GLN
43	l	99	GLN
36	e	33	GLN

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Mol	Chain	Res	Type
41	j	18	GLN
45	n	49	ASN

5.3.3 RNA [i](#)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
30	Y	28/29 (96%)	16 (57%)	4 (14%)
4	3	2891/2907 (99%)	537 (18%)	18 (0%)
5	4	107/108 (99%)	29 (27%)	0
6	5	1503/1520 (98%)	257 (17%)	10 (0%)
7	6	76/76 (100%)	23 (30%)	5 (6%)
8	7	74/75 (98%)	20 (27%)	2 (2%)
All	All	4679/4715 (99%)	882 (18%)	39 (0%)

5 of 882 RNA backbone outliers are listed below:

Mol	Chain	Res	Type
4	3	11	U
4	3	12	A
4	3	13	C
4	3	14	U
4	3	28	G

5 of 39 RNA pucker outliers are listed below:

Mol	Chain	Res	Type
7	6	1	G
30	Y	34	A
7	6	15	A
7	6	74	C
30	Y	49	U

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

8 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$
4	OMG	3	2259	8,4	18,26,27	0.99	2 (11%)	19,38,41	0.71	0
4	2MA	3	2511	61,4	17,25,26	6.17	10 (58%)	17,37,40	1.54	3 (17%)
6	7MG	5	525	6	22,26,27	3.89	10 (45%)	29,39,42	2.03	9 (31%)
6	MA6	5	1493	6	18,26,27	1.06	2 (11%)	19,38,41	3.31	3 (15%)
4	1MG	3	783	4	18,26,27	0.94	1 (5%)	19,39,42	0.81	0
6	MA6	5	1494	6	18,26,27	1.06	2 (11%)	19,38,41	3.37	3 (15%)
6	5MC	5	1375	6	18,22,23	0.34	0	26,32,35	0.69	2 (7%)
6	B8T	5	1377	6	19,22,23	4.71	13 (68%)	26,31,34	0.97	1 (3%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	OMG	3	2259	8,4	-	3/5/27/28	0/3/3/3
4	2MA	3	2511	61,4	-	2/3/25/26	0/3/3/3
6	7MG	5	525	6	-	2/7/37/38	0/3/3/3
6	MA6	5	1493	6	-	0/7/29/30	0/3/3/3
4	1MG	3	783	4	-	0/3/25/26	0/3/3/3
6	MA6	5	1494	6	-	2/7/29/30	0/3/3/3
6	5MC	5	1375	6	-	0/7/25/26	0/2/2/2
6	B8T	5	1377	6	-	0/7/27/28	0/2/2/2

The worst 5 of 40 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	3	2511	2MA	C2'-C1'	-15.49	1.30	1.53
4	3	2511	2MA	O4'-C1'	15.36	1.62	1.41
6	5	525	7MG	C8-N9	9.90	1.51	1.46
6	5	1377	B8T	O4'-C1'	8.89	1.63	1.42
4	3	2511	2MA	C2-N3	7.94	1.48	1.31

The worst 5 of 21 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	5	1494	MA6	N1-C6-N6	-12.24	104.18	117.06

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	5	1493	MA6	N1-C6-N6	-11.86	104.57	117.06
6	5	1494	MA6	N3-C2-N1	-5.64	119.86	128.68
6	5	1493	MA6	C1'-N9-C4	5.54	136.38	126.64
6	5	1493	MA6	N3-C2-N1	-5.54	120.02	128.68

There are no chirality outliers.

5 of 9 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	3	2259	OMG	C1'-C2'-O2'-CM2
6	5	525	7MG	O4'-C4'-C5'-O5'
6	5	525	7MG	C3'-C4'-C5'-O5'
6	5	1494	MA6	O4'-C4'-C5'-O5'
6	5	1494	MA6	C3'-C4'-C5'-O5'

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 316 ligands modelled in this entry, 315 are monoatomic - leaving 1 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
59	CLM	3	3001	-	19,20,20	2.08	2 (10%)	23,27,27	0.84	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
59	CLM	3	3001	-	-	2/20/22/22	0/1/1/1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
59	3	3001	CLM	C2-N2	7.25	1.50	1.34
59	3	3001	CLM	O9B-N9	-2.65	1.18	1.22

There are no bond angle outliers.

There are no chirality outliers.

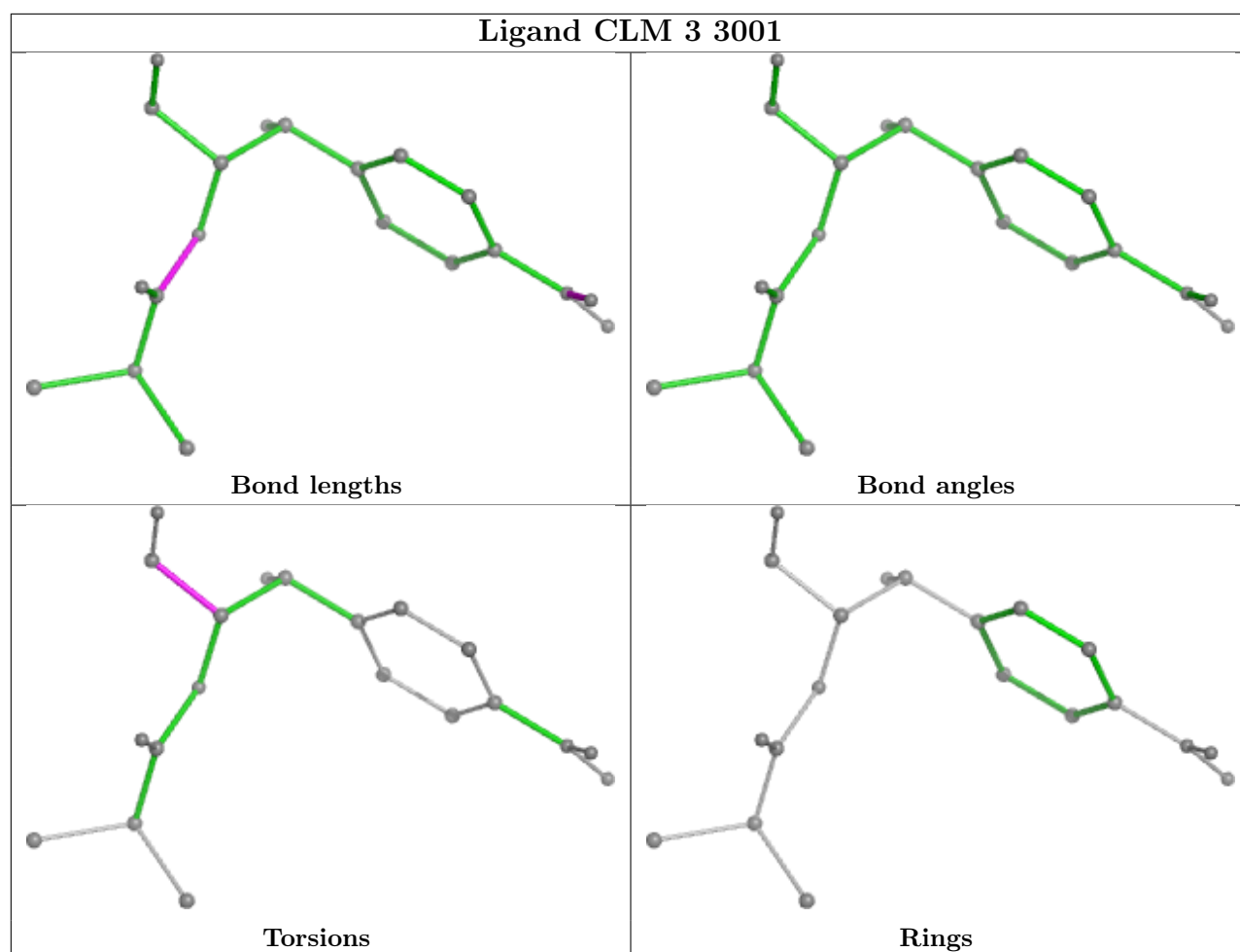
All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
59	3	3001	CLM	C5-C3-C4-O4
59	3	3001	CLM	N2-C3-C4-O4

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.