wwPDB EM Validation Summary Report (i)

Nov 24, 2025 – 12:51 pm GMT

PDB ID	:	9HHL / pdb_00009hhl
EMDB ID	:	EMD-52171
Title	:	Structure of Dynein-Dynactin-NuMA-LIS1
Authors	:	d'Amico, E.A.; Carter, A.P.
Deposited on	:	2024-11-21
Resolution	:	6.53 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:

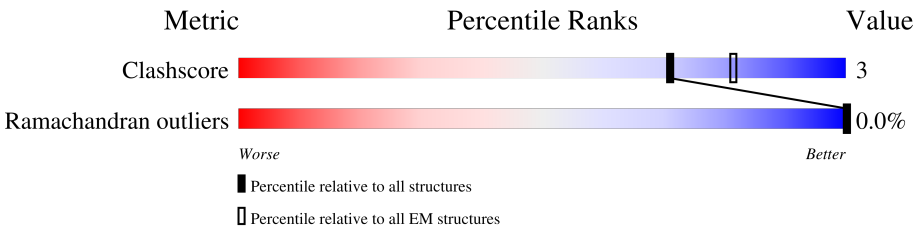
EMDB validation analysis	:	0.0.1.dev129
Mogul	:	1.8.4, CSD as541be (2020)
MolProbity	:	4-5-2 with Phenix2.0
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
EM percentile statistics	:	202505.v01 (Using data in the EMDB archive up until May 2025)
MapQ	:	1.9.13
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.46

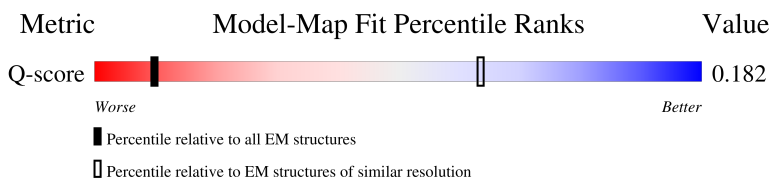
1 Overall quality at a glance (i)

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

The reported resolution of this entry is 6.53 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)	Similar EM resolution (#Entries, resolution range(Å))
Clashscore	210492	15764	-
Ramachandran outliers	207382	16835	-
Q-score	-	25397	500 (6.03 - 7.02)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions <=5% 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 chain
1	g	612	16% 59% 5% 36%
1	h	612	6% 61% • 35%
1	o	612	15% 58% 6% 36%
1	p	612	40% 65% • 34%
2	1	889	• 22% • 77%

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Mol	Chain	Length	Quality of chain
2	2	889	21% 78%
3	A	376	93% 5%
3	B	376	90% 9%
3	C	376	99%
3	D	376	94% 5%
3	E	376	95%
3	F	376	94% 5%
3	G	376	95%
3	I	376	95%
4	H	375	93% 6%
5	J	417	87% 9%
6	K	286	93%
7	L	272	96%
8	M	405	5% 64% 35%
8	N	405	5% 67% 31%
8	P	405	6% 80% 5% 15%
8	Q	405	74% 6% 20%
8	V	405	18% 81%
9	O	186	86% 5% 9%
9	R	186	94%
10	U	190	80% 9% 11%
11	W	182	88% 10%
12	Y	467	5% 72% 9% 20%
13	e	4646	17% 83%
13	f	4646	21% 78%

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Mol	Chain	Length	Quality of chain
13	m	4646	17% 83%
13	n	4646	6% 16% 84%
14	j	492	22% 60% 40%
14	q	492	97%
14	u	492	96%
15	s	96	57% 93%
15	t	96	39% 93%
15	w	96	29% 85% 11%
15	z	96	41% 84% 12%
16	S	1281	10% 90%
16	T	1281	15% 85%

2 Entry composition (i)

There are 19 unique types of molecules in this entry. The entry contains 64583 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 Cytoplasmic dynein 1 intermediate chain 2.

Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
1	p	401	1980	1178	401	401	0	0
1	g	394	1946	1158	394	394	0	0
1	h	396	1955	1163	396	396	0	0
1	o	394	1946	1158	394	394	0	0

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
p	484	SER	THR	conflict	UNP Q13409
p	499	GLY	ASP	conflict	UNP Q13409
g	510	SER	THR	conflict	UNP Q13409
g	525	GLY	ASP	conflict	UNP Q13409
h	510	SER	THR	conflict	UNP Q13409
h	525	GLY	ASP	conflict	UNP Q13409
o	510	SER	THR	conflict	UNP Q13409
o	525	GLY	ASP	conflict	UNP Q13409

- Molecule 2 is a protein called Nuclear mitotic apparatus protein 1,Methylated-DNA--protei n-cysteine methyltransferase.

Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
2	1	205	1021	611	205	205	0	0
2	2	193	962	576	193	193	0	0

There are 44 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
1	706	GLY	-	linker	UNP Q14980
1	707	SER	-	linker	UNP Q14980
1	737	ARG	GLU	engineered mutation	UNP P16455
1	739	ILE	LYS	engineered mutation	UNP P16455
1	740	PHE	LEU	engineered mutation	UNP P16455
1	769	ALA	CYS	engineered mutation	UNP P16455
1	822	SER	GLN	engineered mutation	UNP P16455
1	823	HIS	GLN	engineered mutation	UNP P16455
1	832	ALA	LYS	engineered mutation	UNP P16455
1	834	THR	ALA	engineered mutation	UNP P16455
1	835	ALA	ARG	engineered mutation	UNP P16455
1	838	LYS	GLY	engineered mutation	UNP P16455
1	839	THR	GLY	engineered mutation	UNP P16455
1	841	LEU	MET	engineered mutation	UNP P16455
1	842	SER	ARG	engineered mutation	UNP P16455
1	857	GLN	CYS	engineered mutation	UNP P16455
1	858	GLY	SER	engineered mutation	UNP P16455
1	859	ASP	SER	engineered mutation	UNP P16455
1	860	LEU	GLY	engineered mutation	UNP P16455
1	861	ASP	ALA	engineered mutation	UNP P16455
1	864	GLY	ASN	engineered mutation	UNP P16455
1	866	GLU	SER	engineered mutation	UNP P16455
2	706	GLY	-	linker	UNP Q14980
2	707	SER	-	linker	UNP Q14980
2	737	ARG	GLU	engineered mutation	UNP P16455
2	739	ILE	LYS	engineered mutation	UNP P16455
2	740	PHE	LEU	engineered mutation	UNP P16455
2	769	ALA	CYS	engineered mutation	UNP P16455
2	822	SER	GLN	engineered mutation	UNP P16455
2	823	HIS	GLN	engineered mutation	UNP P16455
2	832	ALA	LYS	engineered mutation	UNP P16455
2	834	THR	ALA	engineered mutation	UNP P16455
2	835	ALA	ARG	engineered mutation	UNP P16455
2	838	LYS	GLY	engineered mutation	UNP P16455
2	839	THR	GLY	engineered mutation	UNP P16455
2	841	LEU	MET	engineered mutation	UNP P16455
2	842	SER	ARG	engineered mutation	UNP P16455
2	857	GLN	CYS	engineered mutation	UNP P16455
2	858	GLY	SER	engineered mutation	UNP P16455
2	859	ASP	SER	engineered mutation	UNP P16455
2	860	LEU	GLY	engineered mutation	UNP P16455
2	861	ASP	ALA	engineered mutation	UNP P16455
2	864	GLY	ASN	engineered mutation	UNP P16455

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Chain	Residue	Modelled	Actual	Comment	Reference
2	866	GLU	SER	engineered mutation	UNP P16455

- Molecule 3 is a protein called ARP1 actin related protein 1 homolog A.

Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
3	A	370	1822	1082	370	370	0	0
3	B	370	1822	1082	370	370	0	0
3	D	370	1822	1082	370	370	0	0
3	E	370	1822	1082	370	370	0	0
3	F	370	1822	1082	370	370	0	0
3	G	370	1822	1082	370	370	0	0
3	I	370	1822	1082	370	370	0	0
3	C	375	1847	1097	375	375	0	0

- Molecule 4 is a protein called Actin, cytoplasmic 1.

Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
4	H	370	1822	1082	370	370	0	0

- Molecule 5 is a protein called Arp11.

Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
5	J	379	1868	1110	379	379	0	0

- Molecule 6 is a protein called Capping protein (Actin filament) muscle Z-line, alpha 1.

Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
6	K	278	1378	822	278	278	0	0

- Molecule 7 is a protein called F-actin-capping protein subunit beta.

Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
7	L	269	1327	789	269	269	0	0

- Molecule 8 is a protein called Dynactin subunit 2.

Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
8	M	265	1320	790	265	265	0	0
8	N	280	1394	834	280	280	0	0
8	P	343	1707	1021	343	343	0	0
8	Q	325	1612	962	325	325	0	0
8	V	75	369	219	75	75	0	0

- Molecule 9 is a protein called Dynactin subunit 3.

Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
9	O	170	844	504	170	170	0	0
9	R	179	888	530	179	179	0	0

- Molecule 10 is a protein called Dynactin 6.

Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
10	U	169	832	494	169	169	0	0

- Molecule 11 is a protein called Dynactin subunit 5.

Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
11	W	179	881	523	179	179	0	0

- Molecule 12 is a protein called Dynactin subunit 4.

Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
12	Y	375	1863	1113	375	375	0	0

- Molecule 13 is a protein called Cytoplasmic dynein 1 heavy chain 1.

Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
13	e	807	4004	2390	807	807	0	0
13	f	1017	5046	3012	1017	1017	0	0
13	m	795	3946	2356	795	795	0	0
13	n	744	3693	2205	744	744	0	0

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
e	1567	GLU	ARG	engineered mutation	UNP Q14204
e	1610	GLU	LYS	engineered mutation	UNP Q14204
f	1567	GLU	ARG	engineered mutation	UNP Q14204
f	1610	GLU	LYS	engineered mutation	UNP Q14204
m	1567	GLU	ARG	engineered mutation	UNP Q14204
m	1610	GLU	LYS	engineered mutation	UNP Q14204
n	1567	GLU	ARG	engineered mutation	UNP Q14204
n	1610	GLU	LYS	engineered mutation	UNP Q14204

- Molecule 14 is a protein called Cytoplasmic dynein 1 light intermediate chain 2.

Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
14	j	296	1465	873	296	296	0	0
14	q	15	75	45	15	15	0	0
14	u	18	90	54	18	18	0	0

- Molecule 15 is a protein called Dynein light chain roadblock-type 1.

Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
15	s	93	462	276	93	93	0	0
15	t	93	462	276	93	93	0	0
15	w	93	462	276	93	93	0	0

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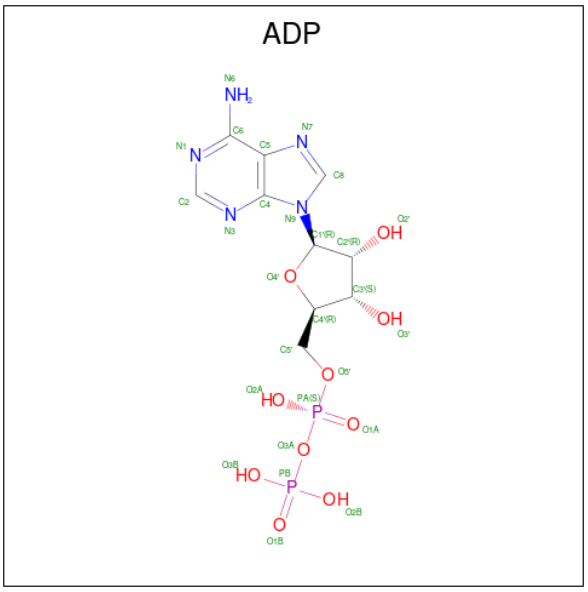
Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
15	z	93	462	276	93	93	0	0

- Molecule 16 is a protein called Dynactin subunit 1.

Mol	Chain	Residues	Atoms				AltConf	Trace
			Total	C	N	O		
16	S	134	667	399	134	134	0	0
			Total	C	N	O		
16	T	192	952	568	192	192	0	0

- Molecule 17 is ADENOSINE-5'-DIPHOSPHATE (CCD ID: ADP) (formula: $C_{10}H_{15}N_5O_{10}P_2$).



Mol	Chain	Residues	Atoms					AltConf
			Total	C	N	O	P	
17	A	1	27	10	5	10	2	0
			Total	C	N	O	P	
17	B	1	27	10	5	10	2	0
			Total	C	N	O	P	
17	D	1	27	10	5	10	2	0
			Total	C	N	O	P	
17	E	1	27	10	5	10	2	0
			Total	C	N	O	P	
17	F	1	27	10	5	10	2	0
			Total	C	N	O	P	
17	G	1	27	10	5	10	2	0

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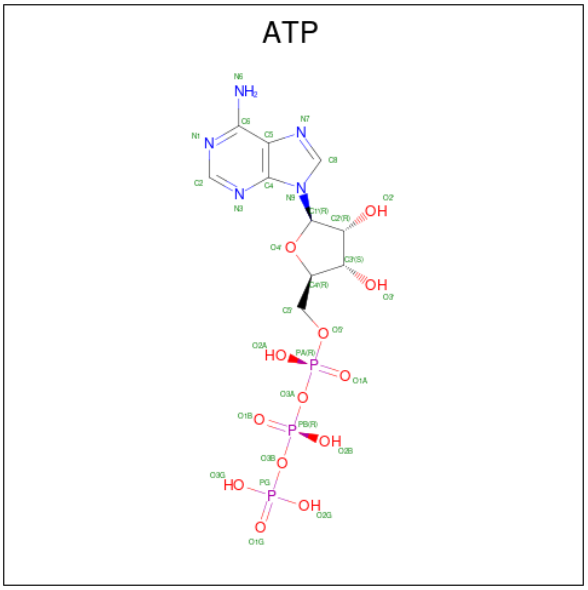
Mol	Chain	Residues	Atoms					AltConf
			Total	C	N	O	P	
17	I	1	27	10	5	10	2	0
			Total	C	N	O	P	
17	C	1	27	10	5	10	2	0

- Molecule 18 is ADENOSINE-5'-TRIPHOSPHATE (CCD ID: ATP) (formula: $C_{10}H_{16}N_5O_{13}P_3$).



Mol	Chain	Residues	Atoms					AltConf
			Total	C	N	O	P	
18	H	1	31	10	5	13	3	0
			Total	C	N	O	P	
18	J	1	31	10	5	13	3	0

- Molecule 19 is ZINC ION (CCD ID: ZN) (formula: Zn).

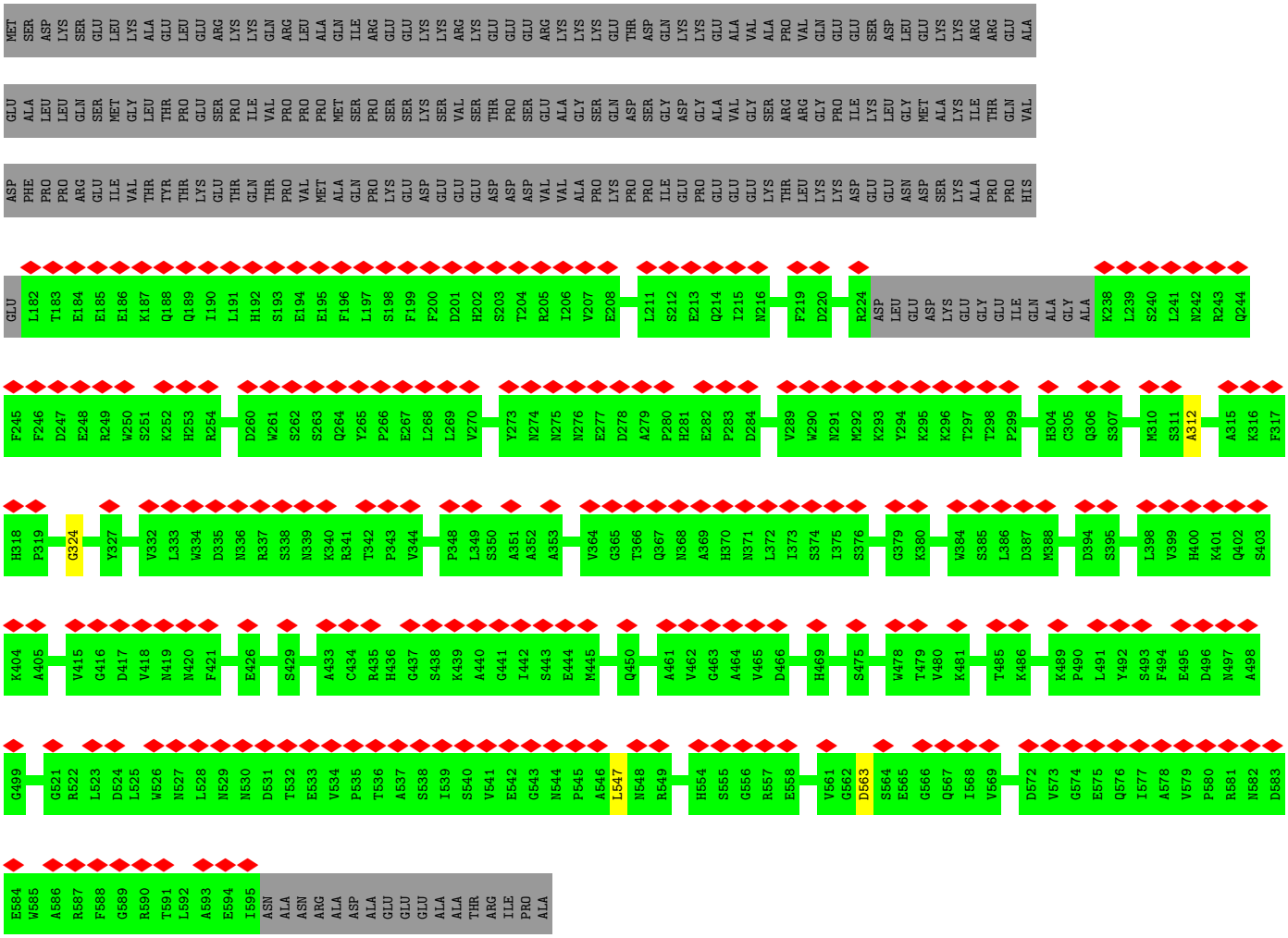
Mol	Chain	Residues	Atoms		AltConf
			Total	Zn	
19	Y	3	3	3	0

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.

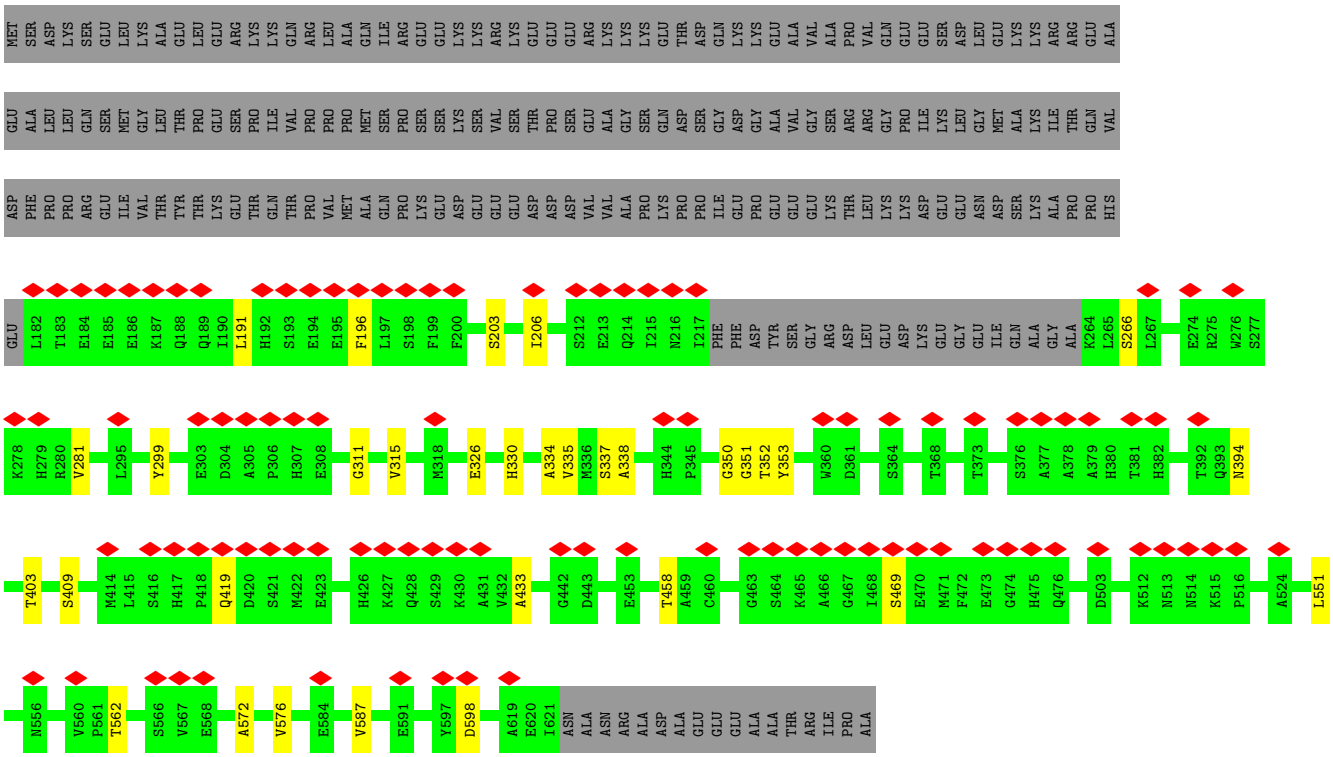
• Molecule 1: Cytoplasmic dynein 1 intermediate chain 2

Chain p:

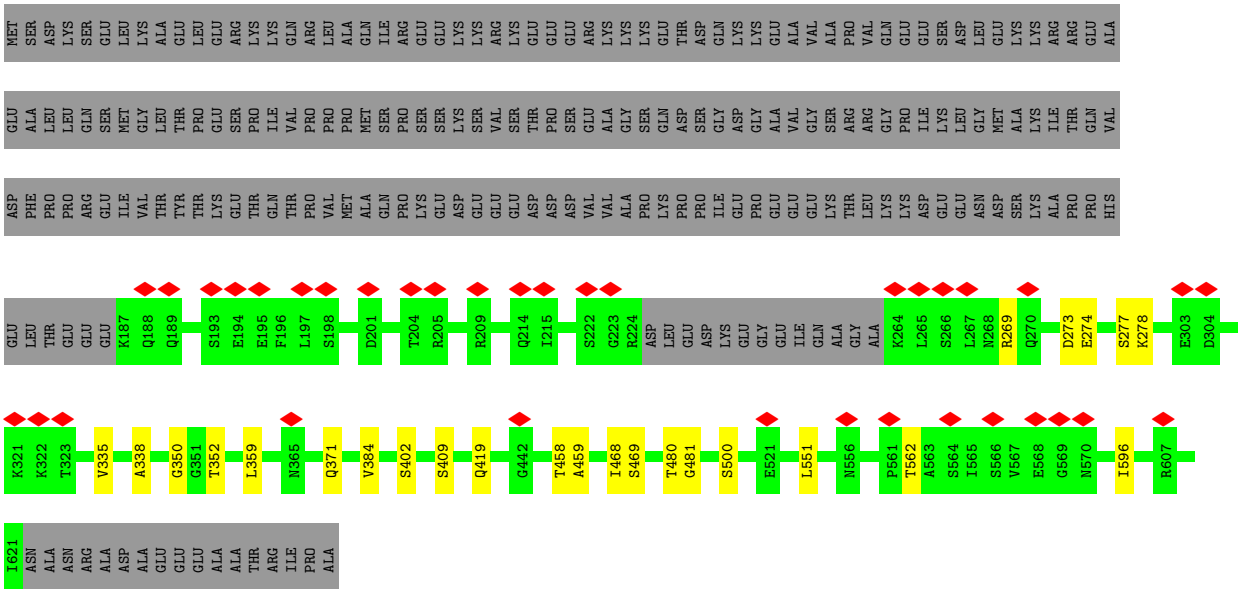


• Molecule 1: Cytoplasmic dynein 1 intermediate chain 2

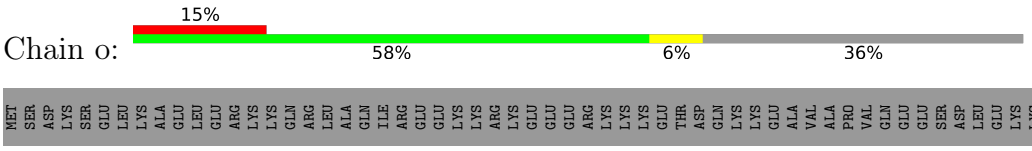
Chain g:

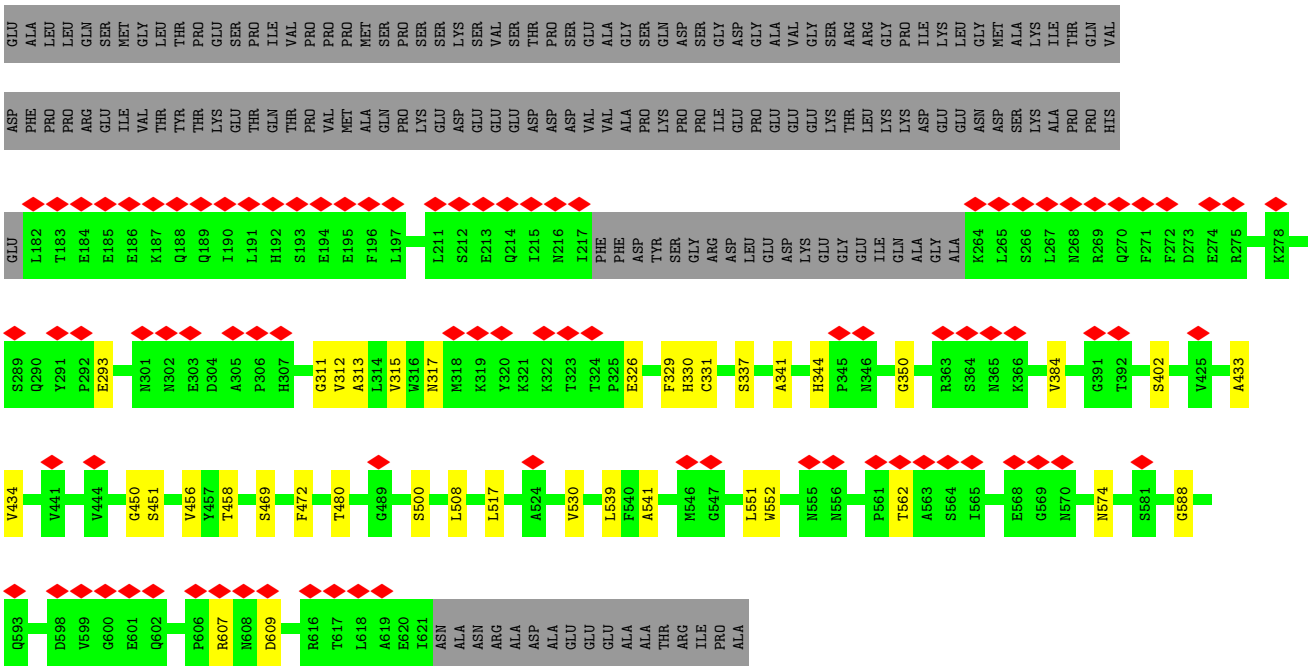


• Molecule 1: Cytoplasmic dynein 1 intermediate chain 2



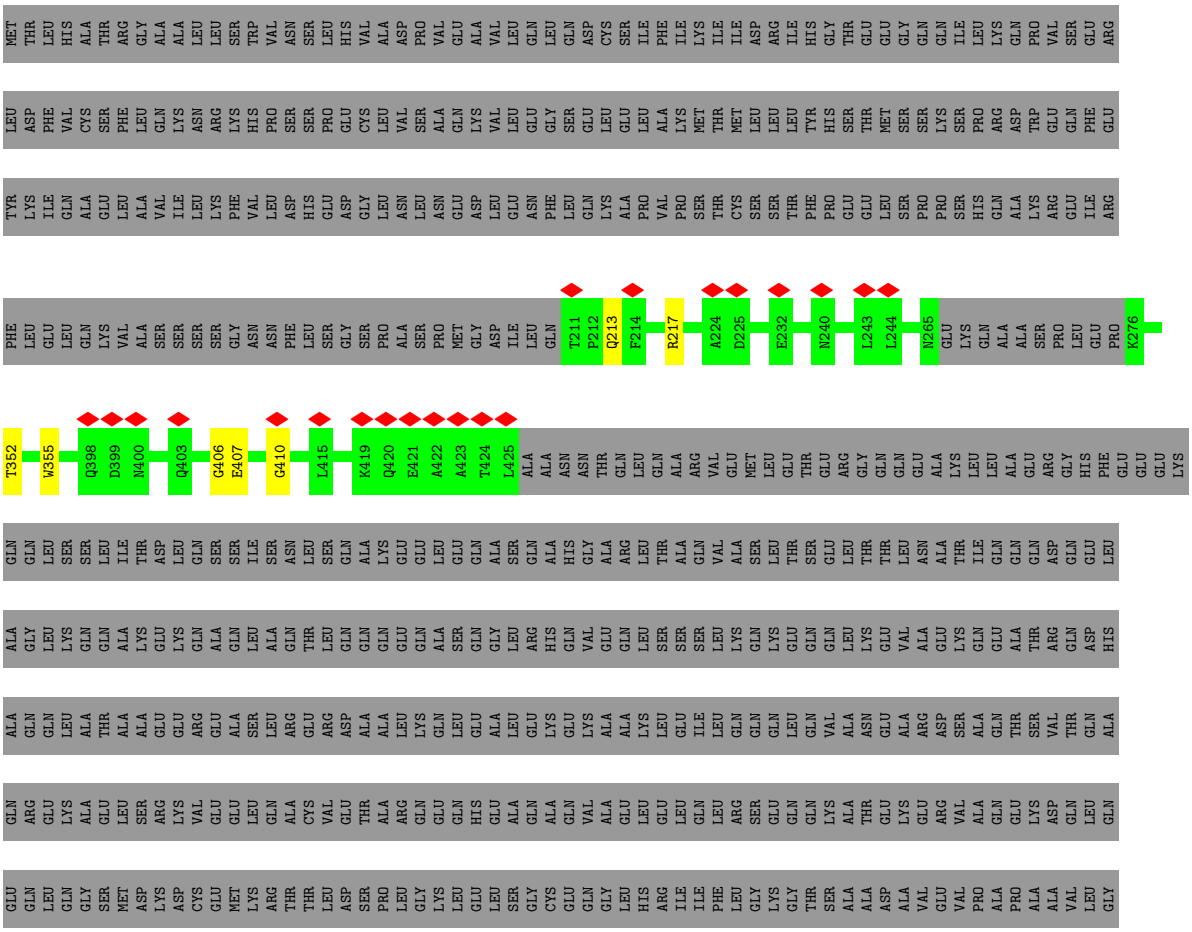
• Molecule 1: Cytoplasmic dynein 1 intermediate chain 2

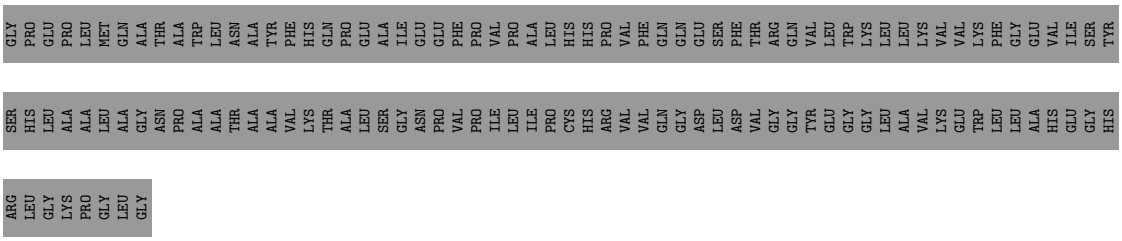




• Molecule 2: Nuclear mitotic apparatus protein 1,Methylated-DNA--protein-cysteine methyltransferase

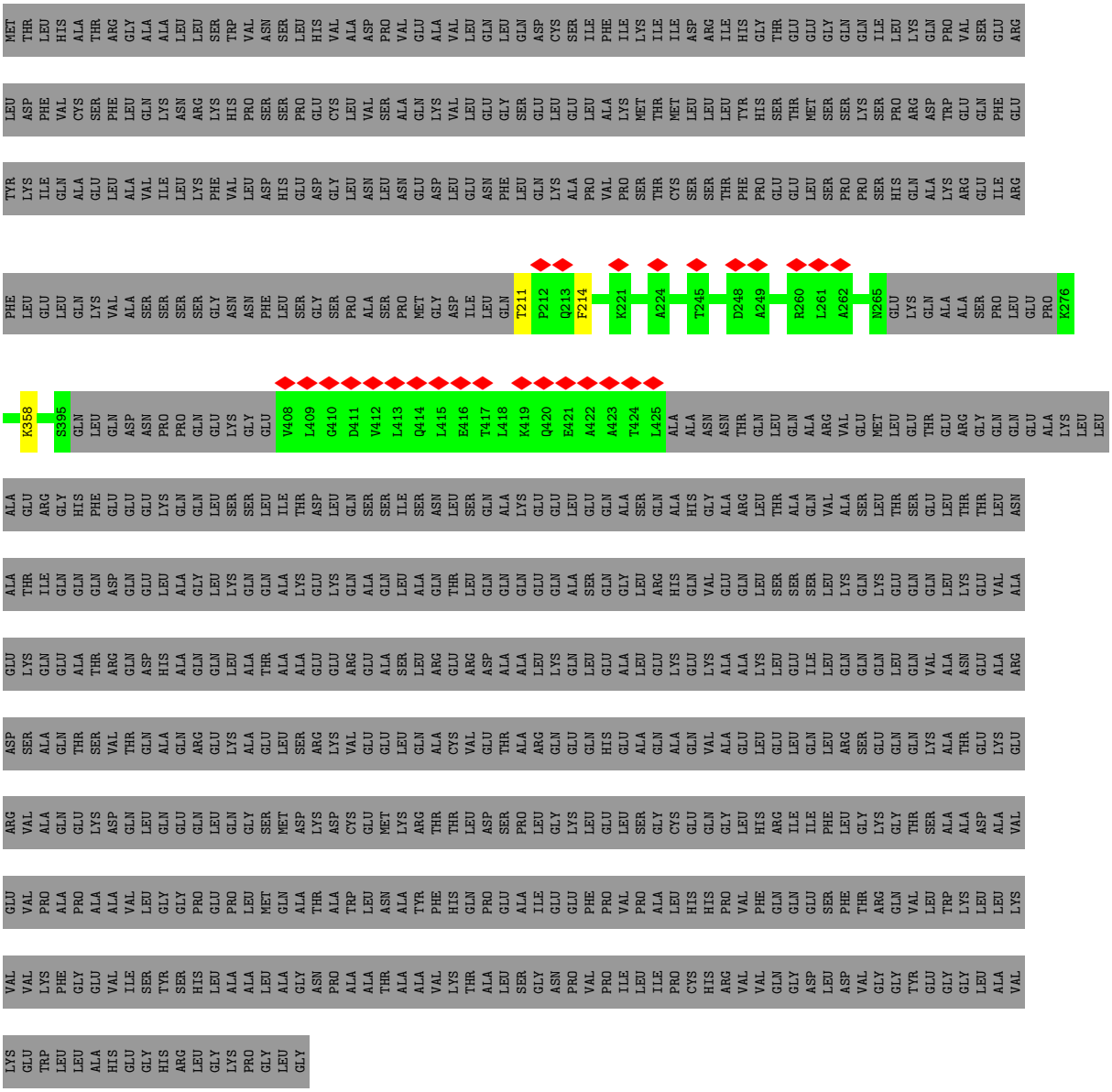
Chain 1:





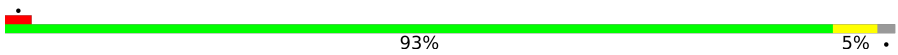
• Molecule 2: Nuclear mitotic apparatus protein 1,Methylated-DNA--protein-cysteine methyltransferase

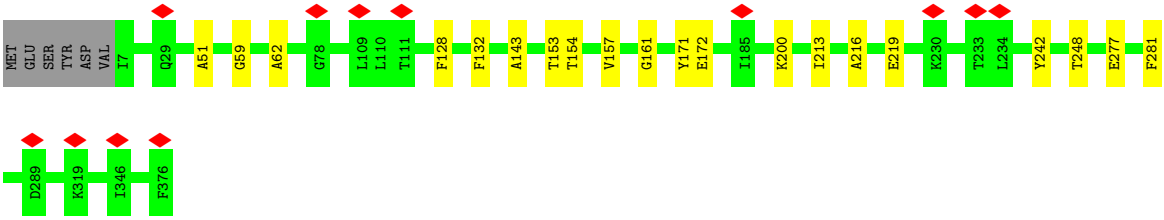
Chain 2:



• Molecule 3: ARP1 actin related protein 1 homolog A

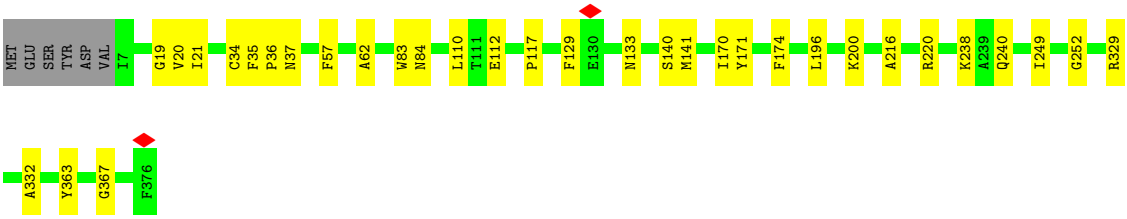
Chain A:





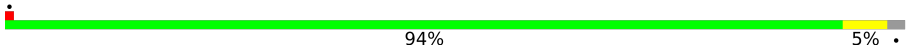
• Molecule 3: ARP1 actin related protein 1 homolog A

Chain B:



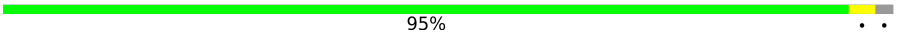
• Molecule 3: ARP1 actin related protein 1 homolog A

Chain D:



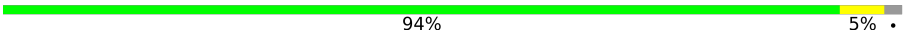
• Molecule 3: ARP1 actin related protein 1 homolog A

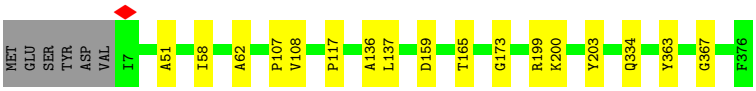
Chain E:



• Molecule 3: ARP1 actin related protein 1 homolog A

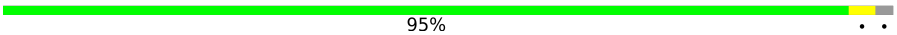
Chain F:

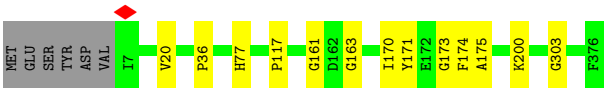




• Molecule 3: ARP1 actin related protein 1 homolog A

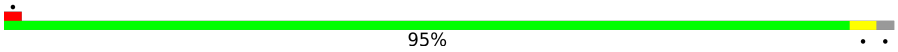
Chain G:

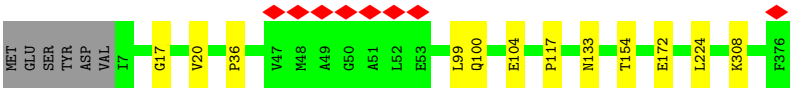




• Molecule 3: ARP1 actin related protein 1 homolog A

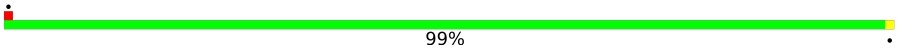
Chain I:

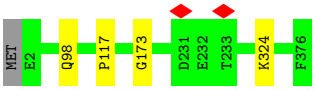




• Molecule 3: ARP1 actin related protein 1 homolog A

Chain C:





• Molecule 4: Actin, cytoplasmic 1

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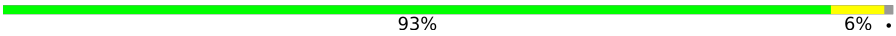
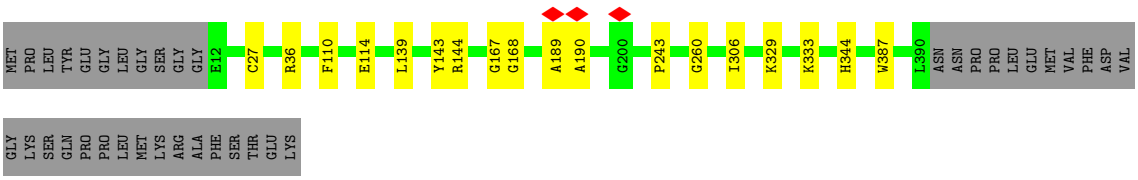


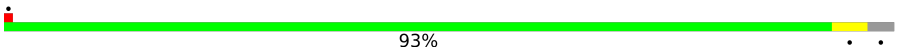
• Molecule 5: Arp11

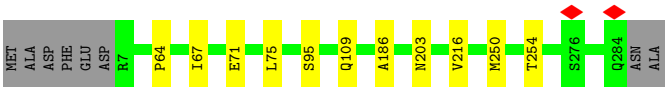
Chain J:



• Molecule 6: Capping protein (Actin filament) muscle Z-line, alpha 1

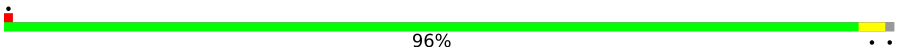
Chain K:





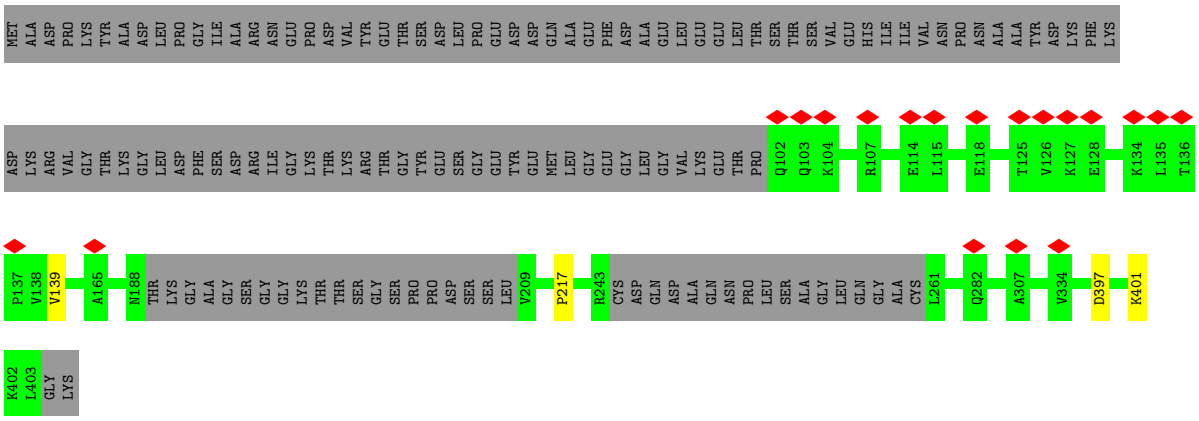
• Molecule 7: F-actin-capping protein subunit beta

Chain L:



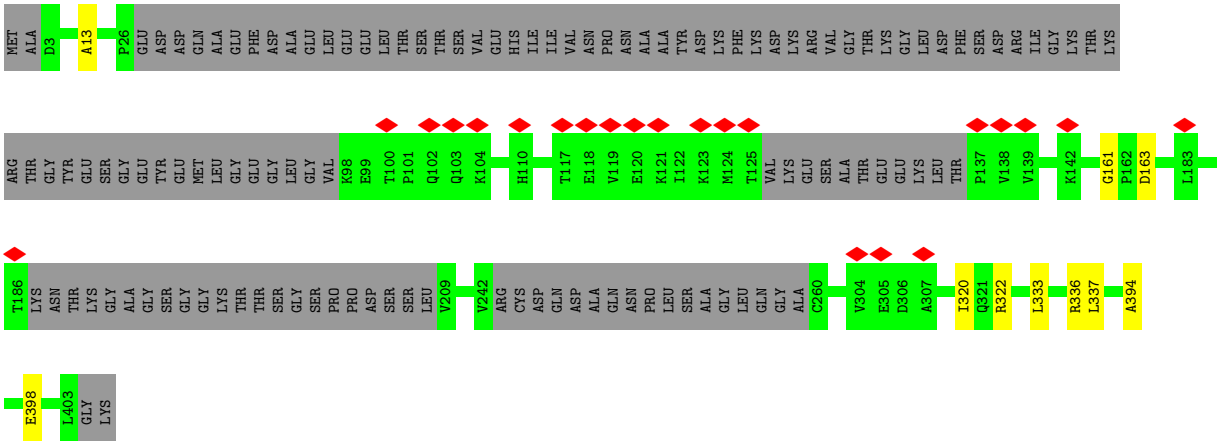
• Molecule 8: Dynactin subunit 2

Chain M:



• Molecule 8: Dynactin subunit 2

Chain N:



• Molecule 8: Dynactin subunit 2

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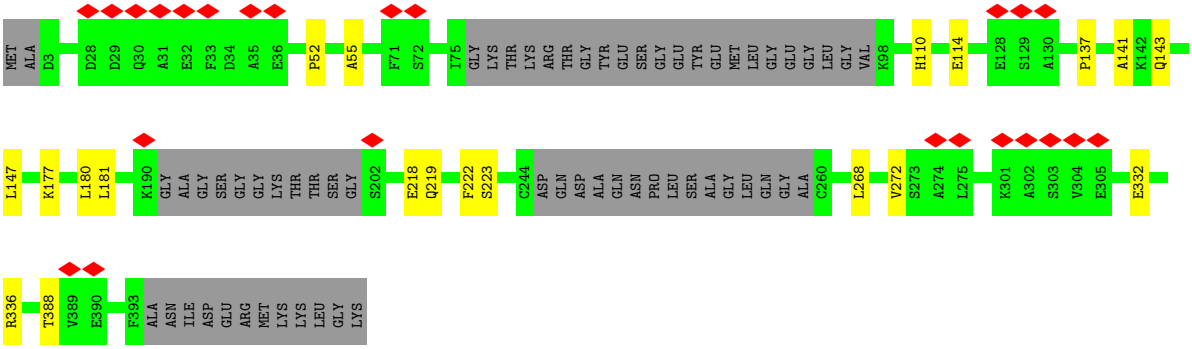
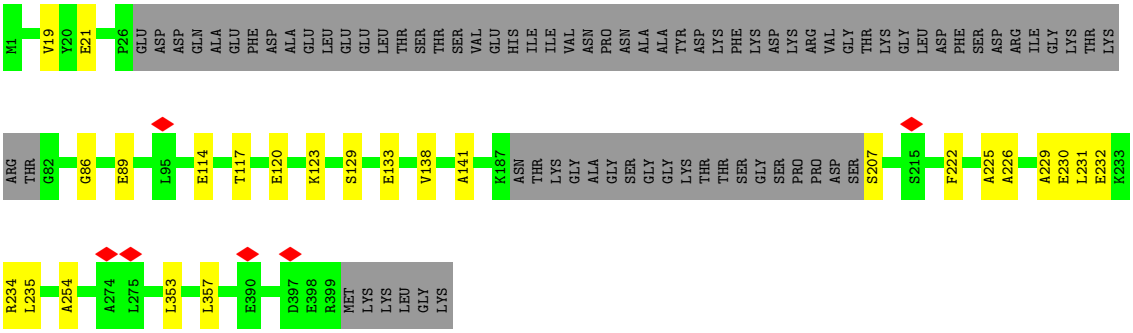


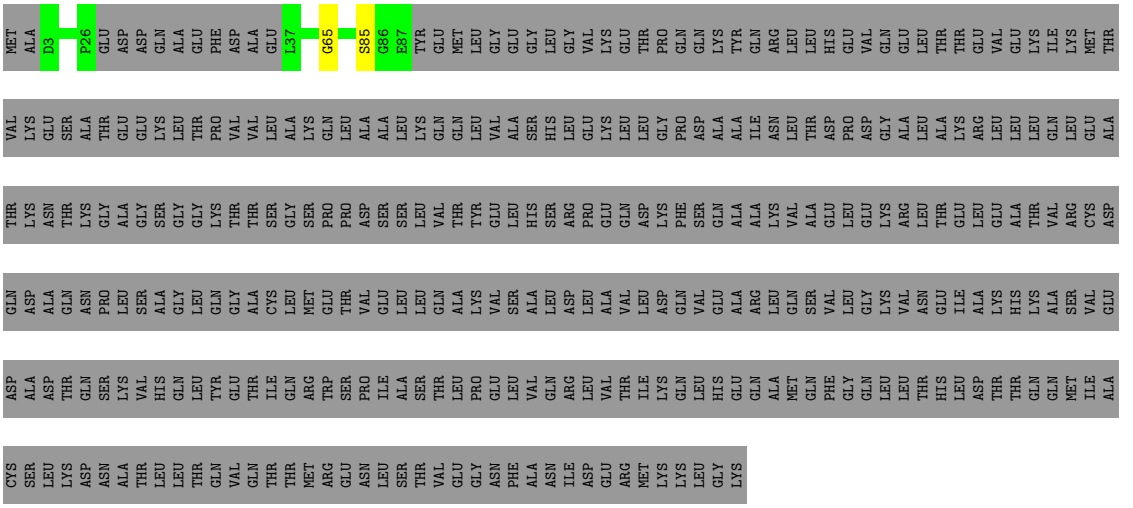
• Molecule 8: Dynactin subunit 2

Chain Q:



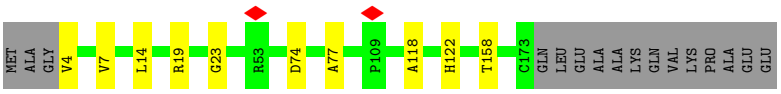
- Molecule 8: Dynactin subunit 2

Chain V:



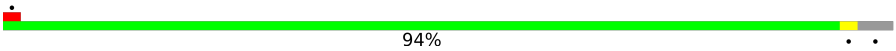
- Molecule 9: Dynactin subunit 3

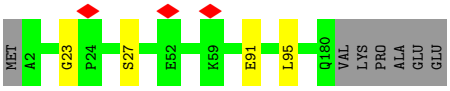
Chain O:



- Molecule 9: Dynactin subunit 3

Chain R:



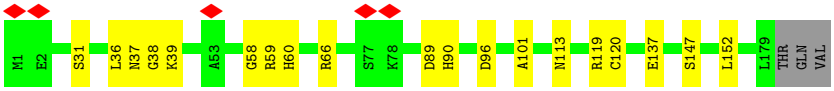


- Molecule 10: Dynactin 6

Chain U:

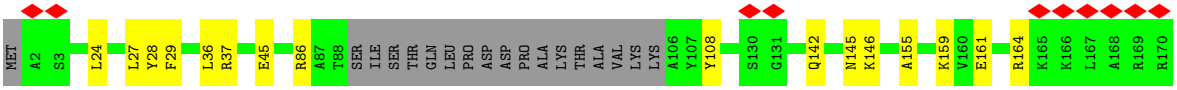
• Molecule 11: Dynactin subunit 5

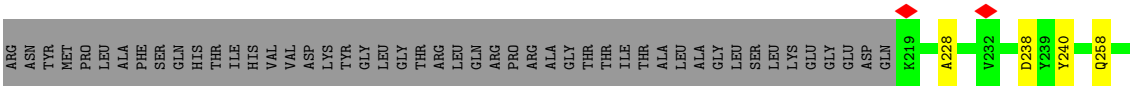
Chain W:

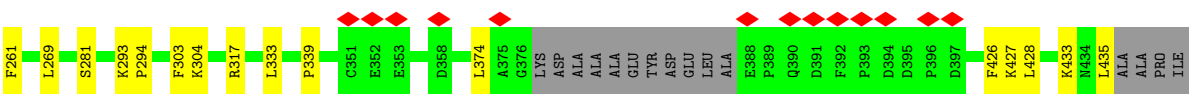


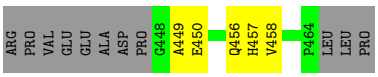
• Molecule 12: Dynactin subunit 4

Chain Y:



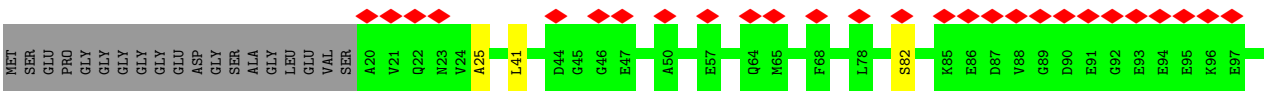


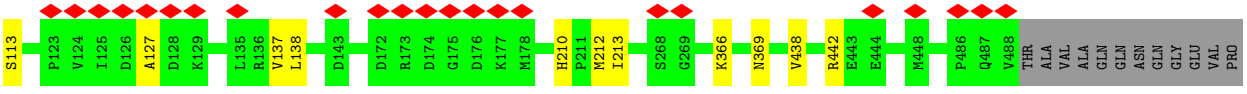


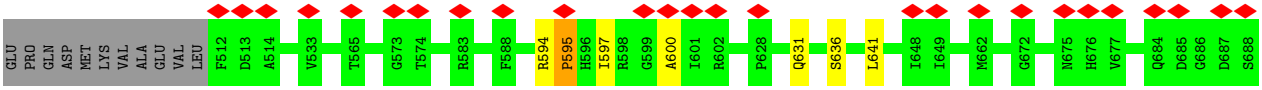


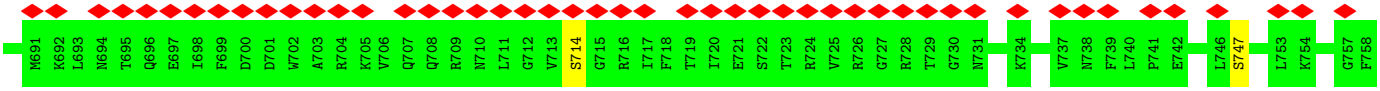
• Molecule 13: Cytoplasmic dynein 1 heavy chain 1

Chain e:









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Q844 E845 K846 V847 D848 D849 LEU LEU ILE ILE GLU GLU LYS ILE ASP LEU GLU VAL ARG SER LEU GLU THR CYS MET TYR ASP HIS LYS THR PHE SER GLU ILE LEU ASN LEU ASP LEU HIS SER TYR SER ASN LEU PRO LYS ILE LEU
ASP MET GLU ILE GLU ARG ILE LEU GLY VAL ARG LEU GLN ALA GLY LEU ARG ALA TRP THR GLN VAL LEU LEU GLY GLN ALA GLU ASP LYS ALA GLU VAL ASP MET ASP THR ASP ALA PRO GLN VAL SER HIS LYS PRO GLY GLY GLU PRO LYS ILE LYS ASN VAL HIS GLU ARG
ILE THR ASN GLN VAL ILE TYR LEU ASN PRO PRO ILE GLU GLU CYS ARG TYR LYS LEU TYR GLN GLU MET PHE ALA TRP LYS MET VAL VAL LEU SER LEU PRO ARG ILE GLN SER GLN ARG TYR GLN VAL GLY VAL HIS TYR GLU LEU THR GLU GLU GLU LYS PHE TYR ARG ASN LEU
THR ARG MET PRO ASP GLY PRO VAL ALA LEU GLU GLU SER TYR SER ALA VAL MET GLY ILE VAL SER GLU VAL GLU GLN TYR VAL LYS VAL TRP LEU GLN TYR GLN CYS LEU TRP ASP MET GLN ALA GLU ASN ILE TYR ASN ARG LEU GLY GLU ASP LEU ASN LYS TRP GLN ALA LEU LEU
VAL GLN ILE ARG LYS ALA ARG GLY THR PHE ASP ASN ALA GLU THR LYS LYS GLU PHE GLY PRO VAL VAL ILE ASP TYR GLY LYS VAL GLN SER LYS VAL ASN LEU LYS TYR ASP SER TRP HIS LYS GLU VAL LEU SER LYS PHE GLY GLN MET LEU GLY SER ASN MET THR GLU PHE HIS
SER GLN ILE SER LYS SER ARG GLN GLU LEU GLU GLN HIS SER VAL ASP THR ALA SER THR SER ASP ALA VAL THR PHE ILE THR TYR VAL GLN SER LEU LYS ARG LYS ILE LYS GLN PHE GLU LYS GLN VAL GLU LEU TYR ARG ASN GLY GLN ARG LEU LEU GLU GLN ARG PHE GLN
PHE PRO PRO SER TRP LEU TYR ILE ASP ASN ILE GLU GLY GLU TRP GLY ALA PHE ASN ASP ILE MET ARG ARG LYS ASP SER ALA ILE GLN GLN GLN VAL ALA ASN LEU GLN MET LYS ILE VAL GLN GLU ASP ARG ALA VAL GLU SER ARG THR THR ASP LEU LEU LEU THR ASP TRP GLU LYS
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VAL MET PHE LYS THR PRO VAL SER ILE THR GLU HIS PRO LYS ILE ASN GLU TRP LEU THR LEU VAL GLU LYS GLU MET ARG VAL THR LEU ALA LYS ILE VAL LYS LEU LEU ALA GLU SER VAL THR GLU VAL GLU ILE PHE GLY LYS ALA THR SER ILE ASP PRO ASN VAL SER ILE ASP PRO LYS
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ARG ARG ARG LYS LEU GLU HIS LEU VAL THR ARG SER LYS ILE ASP ASN ALA LYS SER PHE GLU TRP LEU SER GLN MET ARG PHE TYR PHE ASP PRO LYS GLN THR ASP VAL LEU GLN GLN GLU VAL LEU GLN GLN VAL ALA ARG
ALA LYS PHE ASN TYR GLY PHE GLU TYR CYS TYR LEU THR MET THR GLN ALA LEU GLU ARG PRO PHE GLY PRO ALA GLY THR GLY LYS THR SER VAL GLU GLN GLN LEU
GLY ARG PHE VAL LEU VAL PHE ASN CYS ASP GLU THR PHE PHE ASP GLN ALA MET LEU CYS GLN VAL GLY ALA TRP GLY CYS PHE ASP GLU PHE ASN ARG LEU GLU GLU ARG MET LEU SER ALA VAL SER GLN GLN VAL GLN CYS ILE GLN GLU ALA LEU ARG

GLU HIS SER ASN PRO ASN TYR ASP LYS THR SER ALA PRO ILE THR CYS GLU LEU LEU ASN LYS GLN VAL LYS VAL SER PRO ASP MET ALA ILE PHE ILE THR MET ASN PRO GLY TYR ALA GLY ARG SER ASN LEU PRO ASP ASN LEU LYS LYS LEU PHE ARG SER LEU ALA MET THR LYS

PRO ASP ARG GLN LEU ILE ALA GLN VAL MET LEU TYR SER GLN GLY PHE ARG THR ALA GLU VAL LEU ALA ASN LYS ILE VAL PRO PHE PHE LYS LEU CYS ASP GLU GLN LEU SER SER GLN SER HIS TYR ASP PHE GLY LEU ARG ALA LEU LYS SER VAL LEU VAL SER ALA GLY ASN VAL

LYS ARG GLU ARG ILE GLN LYS ILE LYS ARG GLU LYS GLU GLU ARG GLY GLU ALA VAL ASP GLU GLY GLU ILE ALA GLU ASN LEU PRO GLU GLN GLU ILE LEU ILE GLN SER VAL CYS GLU THR MET VAL PRO LYS LEU VAL ALA GLU ASP ILE PRO LEU LEU PHE SER LEU LEU SER ASP

VAL PHE PRO GLY VAL GLN TYR HIS ARG GLY GLU MET THR ALA LEU ARG GLU GLU LEU LYS LYS VAL CYS GLN GLU MET TYR LEU THR TYR GLY ASP GLY GLU GLU VAL GLY GLY MET TRP VAL GLU LYS VAL LEU GLN LEU TYR GLN ILE THR GLN ILE ASN HIS GLY LEU MET MET VAL

GLY PRO SER GLY SER GLY LYS SER MET ALA TRP ARG VAL LEU LEU LYS ALA LEU GLU ARG LEU GLU GLY VAL GLU GLY VAL ALA HIS ILE ILE ASP PRO LYS ALA ILE SER LYS ASP HIS LEU TYR GLY THR LEU ASP PRO ASN THR ARG GLU TRP THR ASP GLY LEU PHE THR HIS VAL

LEU ARG LYS ILE ILE ASP SER VAL ARG GLY GLU LEU GLN LYS ARG GLN TRP ILE VAL PHE ASP GLY ASP VAL ASP PRO GLU TRP VAL GLU ASN LEU ASN SER VAL LEU ASP ASP ASN LYS LEU LEU THR LEU PRO ASN GLY GLU ARG LEU SER LEU PRO PRO ASN VAL ARG ILE MET PHE

GLU VAL GLN ASP LEU LYS TYR ALA THR LEU ALA THR VAL SER ARG CYS GLY MET VAL TRP PHE SER GLU ASP VAL LEU SER THR ASP MET ILE PHE ASN ASN PHE LEU ALA ARG LEU ARG SER ILE PRO LEU ASP GLU GLY GLU ASP GLU ALA GLN ARG ARG ARG LYS GLY LYS GLU ASP

GLU GLY GLU GLU ALA ALA SER PRO MET LEU GLN ILE GLN ARG ASP ALA ALA THR ILE MET GLN PRO TYR PHE THR SER ASN GLY LEU VAL THR LYS ALA LEU GLU HIS ALA PHE GLN LEU GLU HIS ILE MET ASP LEU THR ARG LEU ARG CYS LEU GLY SER LEU PHE SER MET LEU HIS

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

VAL PRO LEU PRO THR ALA PRO ASN ILE PRO ILE ILE ASP TYR GLU VAL SER ILE SER GLY GLU TRP SER PRO TRP GLN ALA LYS VAL PRO GLN ILE GLU GLU VAL GLU THR HIS LYS VAL ALA ALA PRO ASP VAL VAL VAL PRO THR LEU ASP THR VAL ARG HIS GLU ALA LEU LEU TYR THR

TRP LEU ALA GLU HIS LYS PRO LEU VAL LEU CYS GLY PRO PRO GLY SER GLY LYS THR MET THR LEU PHE SER ALA LEU ARG ALA LEU PRO ASP MET GLU VAL VAL GLY LEU ASN PHE SER SER ALA THR THR PRO GLU LEU LEU LEU LYS THR PHE ASP HIS TYR CYS GLU TYR ARG ARG

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

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THR TYR ALA GLU PRO LEU THR ALA ALA MET VAL GLU PHE TYR THR MET SER GLN GLU ARG PHE THR GLN ASP THR GLN PRO HIS TYR ILE TYR SER PRO ARG GLU MET THR ARG TRP VAL ARG GLY ILE PHE GLU ALA LEU ARG PRO LEU GLU THR LEU PRO VAL GLU GLY LEU ILE ARG

ILE TRP ALA HIS GLU ALA LEU ARG LEU PHE GLN ASP ARG LEU VAL GLU ASP GLU GLU ARG ARG TRP THR ASP GLU ASN ILE ASP THR VAL ALA LEU LYS HIS PHE PRO ASN ILE ASP ARG GLU LYS ALA MET SER ARG PRO ILE LEU TYR SER ASN TRP LEU SER LYS ASP TYR ILE PRO

VAL ASP GLN GLU GLU LEU ARG ASP TYR VAL LYS ALA ARG LEU LYS VAL PHE TYR GLU GLU GLU LEU ASP VAL PRO LEU VAL LEU PHE ASN GLU VAL LEU ASP HIS VAL LEU ARG ILE ASP ARG ILE PHE ARG GLN PRO GLN GLY HIS LEU LEU LEU ILE GLY VAL SER GLY ALA GLY LYS

THR THR LEU SER ARG PHE VAL ALA TRP MET ASN GLY LEU SER VAL TYR GLN ILE LYS VAL HIS ARG LYS TYR THR GLY GLU ASP PHE ASP GLU ASP LEU ARG THR VAL LEU ARG ARG SER GLY CYS LYS ASN GLU LYS ILE ALA PHE ILE MET ASP GLU SER ASN VAL LEU ASP SER GLY

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

VAL VAL PHE THR MET ASN PRO SER SER GLU GLY LEU LYS ASP ARG ALA ALA THR SER PRO ALA LEU PHE ASN ARG CYS VAL LEU ASN TRP PHE GLY ASP TRP SER THR GLU ALA LEU TYR GLN VAL GLY LYS GLU PHE THR SER LYS MET ASP LEU GLU LYS PRO ASN TYR ILE VAL PRO

ASP TYR MET PRO VAL VAL TYR ASP LYS LEU PRO GLN PRO PRO SER HIS ARG GLU ALA ILE VAL ASN SER CYS VAL PHE VAL HIS GLN THR LEU HIS GLN ALA ASN ALA ARG LEU ALA LYS ARG GLY GLY ARG THR MET ALA ILE THR PRO ARG HIS TYR LEU ASP PHE ILE ASN HIS TYR

ALA ASN LEU PHE HIS GLU LYS ARG SER GLU LEU GLU GLU GLN GLN MET HIS LEU ASN VAL GLY LEU ARG LYS ILE LYS GLU THR VAL ASP GLN VAL GLU GLU LEU ARG ARG ASP LEU ARG ILE LYS SER GLN GLU LEU GLU VAL LYS ASN ALA ALA ASN ASP LYS LEU LYS LYS MET

VAL LYS ASP GLN GLN GLU ALA GLU LYS LYS LYS VAL MET SER GLN GLU ILE GLN GLU GLN LEU HIS LYS GLN GLN GLU VAL ILE ALA ASP LYS GLN MET SER VAL LYS GLU ASP LEU ASP LYS VAL GLU PRO ALA VAL ILE GLU ALA GLN ASN ALA VAL LYS SER ILE LYS LYS GLN HIS

LEU VAL GLU VAL ARG SER MET ALA ASN PRO PRO ALA ALA VAL LYS LEU ALA LEU GLU SER ILE CYS LEU LEU LEU GLY GLU SER THR THR ASP TRP LYS GLN ILE ARG SER ILE ILE MET ARG GLU ASN PHE ILE PRO THR ILE VAL ASN PHE SER ALA GLU GLU ILE SER ASP ALA ILE

ARG GLU LYS MET LYS LYS ASN TYR MET SER ASN PRO SER TYR ASN TYR GLU ILE VAL ASN ARG ALA SER LEU ALA CYS GLY PRO MET VAL LYS TRP ALA ILE ALA GLN LEU ASN TYR ALA ASP MET LEU LYS ARG VAL GLU PRO LEU ARG ASN GLU LEU GLN LYS LEU GLU ASP ASP ALA

LYS ASP ASN GLN GLN LYS ALA ASN GLU VAL GLU GLN MET ILE ARG ASP LEU GLU ALA SER ILE ALA ARG TYR LYS GLU GLU TYR ALA VAL LEU ILE SER GLU ALA GLN ALA ILE LYS ALA ASP LEU ALA ALA VAL GLU ALA LYS VAL ASN ARG SER THR ALA LEU LEU LYS SER LEU SER

ALA GLU ARG GLU ARG TRP GLU LYS THR SER GLU THR PHE LYS ASN GLN MET SER THR ILE ALA GLY ASP CYS LEU LEU SER ALA ALA PHE ILE ALA TYR ALA GLY TYR PHE ASP GLN GLN MET ARG GLN ASN LEU PHE THR THR TRP SER HIS HIS LEU GLN GLN ALA ASN ILE GLN PHE

ARG THR ASP ILE ALA ARG THR GLU TYR LEU SER ASN ALA ASP GLU ARG LEU ARG TRP GLN ALA SER SER LEU PRO ALA ASP ASP LEU CYS THR GLU ASN ALA ILE MET LEU LYS ARG PHE ASN ARG TYR PRO LEU ILE ILE ASP PRO SER GLY GLN ALA THR GLU PHE ILE MET ASN GLU

TYR LYS ASP ARG LYS ILE THR ARG THR SER PHE LEU ASP ASP ALA PHE ARG LYS ASN LEU GLU SER ALA LEU ARG PHE GLY ASN PRO LEU LEU VAL GLN ASP VAL GLU SER TYR ASP PRO VAL LEU ASN PRO VAL LEU ASN ARG GLU VAL ARG ARG THR GLY GLY ARG VAL LEU ILE THR

LEU GLY ASP GLN ASP ILE ASP LEU SER PRO SER PHE VAL ILE PHE LEU SER THR ARG ASP PRO THR VAL GLU PHE PRO PRO ASP LEU CYS SER ARG VAL THR PHE VAL ASN PHE THR VAL THR ARG SER SER LEU GLN SER GLN CYS LEU ASN GLU VAL LEU LYS ALA GLU ARG PRO ASP

VAL ASP GLU LYS ARG SER ASP LEU LEU LYS LEU GLN GLY GLU PHE GLN LEU ARG LEU ARG GLN LEU GLU LYS SER LEU LEU GLN ALA LEU ASN GLU VAL LYS GLY ARG ILE LEU ASP ASP THR ILE ILE THR THR LEU GLU ASN LEU LYS ARG GLU ALA ALA GLU VAL THR ARG LYS

VAL GLU GLU THR ASP ILE VAL MET GLN GLU VAL GLU THR VAL SER GLN GLN TYR LEU PRO LEU SER THR ALA CYS SER SER ILE TYR PHE THR MET GLU SER LEU LYS GLN ILE HIS PHE LEU TYR GLN TYR SER LEU GLN PHE PHE LEU ASP ILE TYR HIS ASN VAL LEU TYR GLU ASN

PRO ASN LEU LYS GLY VAL THR ASP HIS THR GLN ARG LEU SER ILE ILE THR LYS ASP LEU PHE GLN VAL ALA PHE ASN ARG VAL ALA ARG GLY MET LEU HIS GLN ASP HIS ILE THR PHE ALA MET LEU LEU ALA ARG ILE LYS LEU LYS GLY THR VAL GLY GLU PRO THR TYR ASP ALA

GLU PHE GLN HIS PHE LEU ARG GLY ASN GLU ILE VAL LEU SER ALA GLY SER THR PRO ARG ILE GLN GLY LEU THR VAL GLU GLN ALA GLU ALA VAL VAL ARG LEU SER CYS LEU PRO ALA PHE LYS ASP LEU ILE ALA LYS VAL GLN ALA ASP GLU GLN PHE GLY ILE TRP LEU ASP SER

SER SER PRO GLU GLN THR VAL PRO TYR LEU TRP SER GLU GLU THR PRO ALA THR PRO ILE GLY GLN ALA ILE HIS ARG LEU LEU LEU ILE GLN ALA PHE ARG PRO ASP ARG LEU LEU ALA MET ALA HIS MET PHE VAL SER THR ASN LEU GLY GLU SER PHE MET SER ILE MET GLU GLN

PRO LEU ASP LEU THR HIS ILE VAL GLY THR GLU VAL LYS PRO ASN THR PRO VAL LEU MET CYS SER VAL PRO GLY TYR ASP ALA SER GLY HIS VAL GLU ASP LEU ALA ALA GLU GLN ASN THR GLN ILE THR SER ILE ALA ILE GLY SER ALA GLU GLY PHE ASN GLN ALA ASP LYS ALA

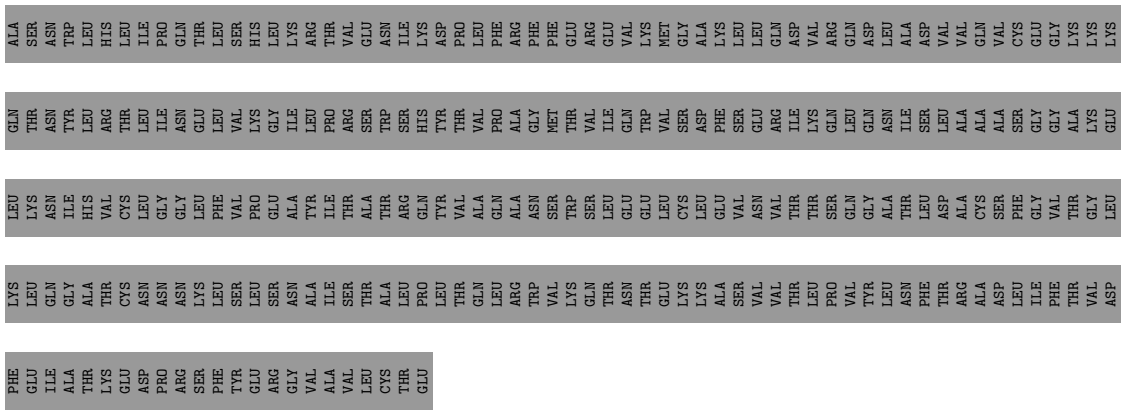
ILE ASN THR ALA VAL LYS SER GLY ARG TRP VAL MET LEU LYS ASN VAL HIS LEU ALA PRO GLY TRP LEU MET GLN LEU GLU LYS LYS LEU HIS SER LEU GLN PRO HIS ALA CYS PHE ARG LEU PHE LEU THR MET GLU ILE ASN PRO LYS VAL PRO VAL ASN LEU LEU ARG ALA GLY ARG

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

LYS TYR GLU PHE GLY GLU SER ASP LEU ARG SER ALA CYS ASP THR VAL ASP THR TRP LEU ASP ASP THR ALA LYS GLY ARG GLN ASN ILE SER PRO ASP LYS ILE PRO TRP SER ALA LEU LYS THR LEU MET ALA GLN SER ILE TYR GLY GLY ARG VAL ASP ASN GLU PHE ASP GLN ARG

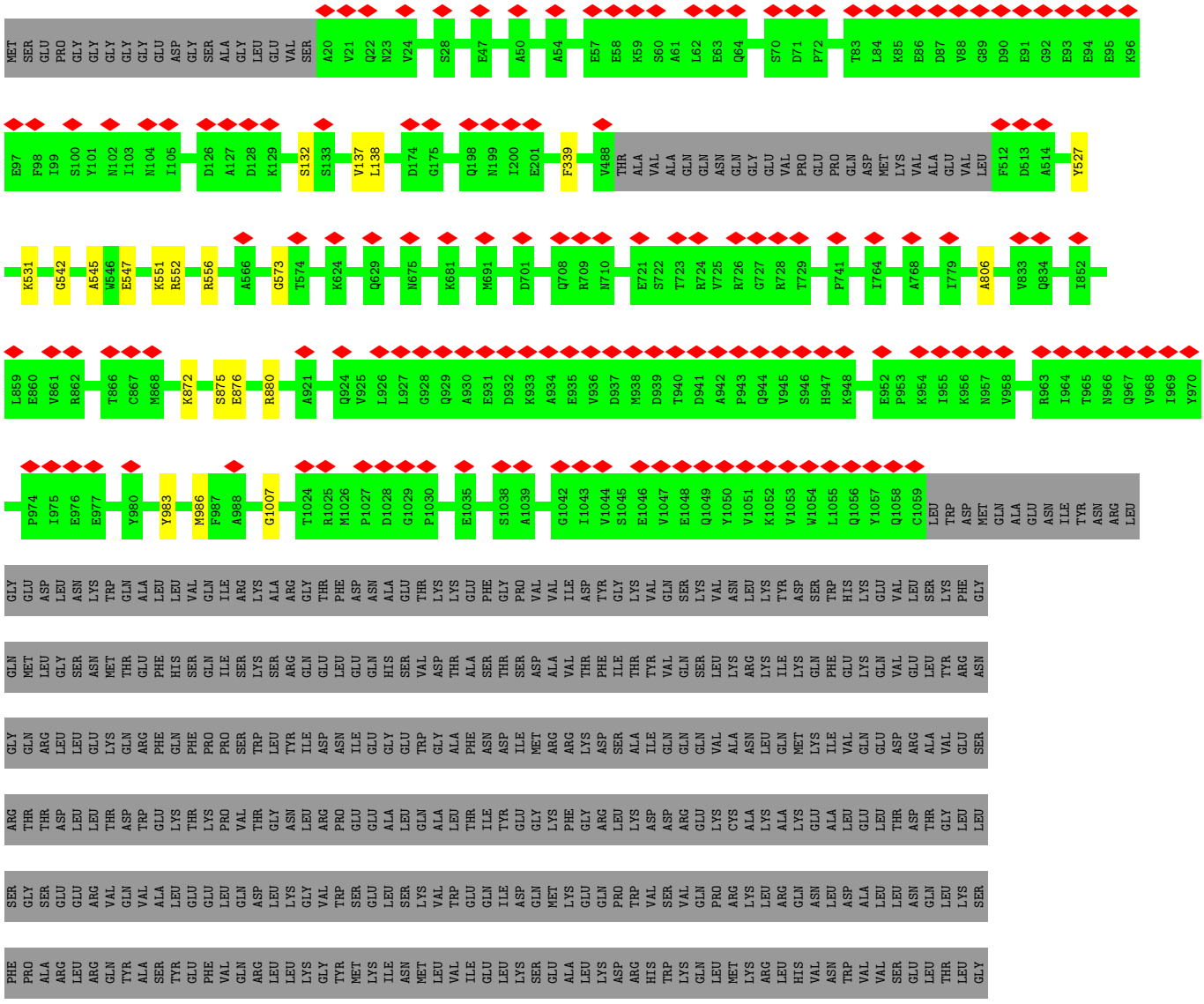
LEU LEU ASN THR PHE LEU GLU ARG LEU PHE THR THR ARG SER PHE ASP SER GLU PHE LYS LEU ALA CYS LYS VAL ASP GLY HIS LYS ASP ILE GLN MET PRO ASP GLY ILE ARG ARG GLU GLU PHE VAL GLN TRP VAL GLU LEU LEU PRO ASP THR GLN THR PRO SER TRP LEU GLY LEU

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



• Molecule 13: Cytoplasmic dynein 1 heavy chain 1

Chain f:



GLN ILE TRP ASP VAL ASP LEU GLN LYS ASN GLU ALA ILE VAL LYS ASP VAL LEU LEU VAL ALA GLN GLY GLU MET ALA LEU GLU GLU PHE LEU LYS GLN ILE ARG GLU VAL TRP ASN THR TYR GLU LEU ASP LEU VAL ASN TYR GLN ASN LYS CYS ARG LEU ILE ARG GLY TRP ASP ASP

LEU PHE ASN LYS VAL LYS GLU HIS ILE ASN SER VAL SER ALA MET LYS LEU SER PRO TYR TYR LYS VAL PHE GLU GLU ASP ALA LEU SER TRP GLU ASP LYS LEU ASN ARG ILE MET ALA LEU PHE ASP VAL TRP ILE ASP VAL GLN ARG ARG TRP VAL TYR LEU GLU GLY ILE PHE THR

GLY SER ALA ASP ILE LYS HIS LEU LEU PRO VAL GLU THR GLN GLU PHE GLN SER ILE SER THR GLU PHE LEU ALA LEU MET LYS LYS VAL SER LYS SER PRO LEU VAL MET ASP VAL LEU ASN ILE GLN GLY VAL GLN ARG SER LEU GLU ARG LEU ALA ASP LEU LEU GLY GLU ILE GLN

LYS ALA LEU GLY GLU TYR LEU GLU ARG GLU ARG SER SER PHE PRO ARG PHE TYR PHE VAL GLY ASP GLU ASP LEU LEU GLU ILE ILE GLY ASN SER LYS ASN VAL ALA LYS LEU GLN LYS HIS PHE LYS LYS MET PHE ALA GLY VAL SER SER ILE ILE LEU ASN GLU ASP ASN SER VAL

VAL LEU GLY ILE SER SER ARG GLU GLY GLU GLU VAL MET PHE LYS THR PRO VAL SER ILE THR GLU HIS PRO LYS ILE ASN GLU TRP LEU THR LEU VAL GLU LYS GLU MET ARG VAL THR LEU ALA LYS LEU LEU ALA GLU SER VAL THR GLU VAL GLU ILE PHE GLY LYS ALA THR SER

ILE ASP PRO ASN THR TYR ILE THR TRP ILE ASP LYS TYR GLN ALA GLN LEU VAL VAL LEU SER ALA GLN ILE ALA TRP SER GLU ASN VAL GLU THR ALA LEU SER SER MET GLY GLY GLY GLY ASP ALA ALA PRO LEU HIS SER VAL LEU SER ASN VAL GLU VAL THR LEU ASN VAL LEU

ALA ASP SER VAL LEU MET GLU GLN PRO PRO LEU ARG ARG LYS LEU GLU HIS LEU ILE THR GLU LEU VAL HIS GLN ARG ASP VAL THR ARG SER LEU ILE LYS SER LYS ILE ASP ASN ALA LYS SER PHE GLU TRP LEU SER GLN MET ARG PHE TYR PHE ASP PRO LYS GLN THR ASP

VAL LEU GLN GLN LEU SER ILE GLN MET ALA ASN ALA LYS PHE ASN TYR GLY PHE GLU TYR LEU GLY VAL GLN ASP LYS LEU VAL GLN THR PRO LEU THR ASP ARG CYS TYR LEU THR MET THR GLN ALA LEU GLU ALA ARG LEU GLY GLY SER PRO PHE GLY PRO ALA GLY THR GLY LYS

THR GLU SER VAL LYS ALA LEU GLY HIS GLN LEU GLY ARG PHE VAL LEU VAL PHE ASN CYS ASP GLU THR PHE ASP PHE GLN ALA MET GLY ARG ILE PHE VAL GLY LEU CYS GLN VAL GLY ALA TRP GLY CYS PHE ASP GLU PHE ASN ARG LEU GLU GLU ARG MET LEU SER ALA VAL SER

GLN GLN VAL GLN CYS ILE GLN GLU ALA LEU ARG GLU HIS SER ASN PRO ASN TYR ASP LYS THR SER ALA PRO ILE THR CYS GLU LEU LEU ASN LYS GLN VAL LYS VAL SER PRO ASP MET ALA ILE PHE ILE THR MET ASN PRO GLY TYR ALA GLY ARG SER ASN LEU PRO ASP ASN LEU

LYS LYS LEU PHE ARG SER LEU ALA MET THR LYS PRO ASP ARG GLN LEU ILE ALA GLN VAL MET LEU TYR SER GLN GLY PHE ARG THR ALA GLU VAL LEU ALA ASN LYS ILE VAL PRO PHE PHE LYS LEU CYS ASP GLU GLN LEU SER SER GLN SER HIS TYR ASP PHE GLY LEU ARG ALA

LEU LYS SER VAL LEU VAL SER ALA GLY ASN VAL LYS ARG GLU ARG ILE GLN LYS ILE LYS ARG GLU LYS GLU GLU ARG GLY GLU ALA VAL ASP GLU GLY GLU ILE ALA GLU ASN LEU PRO GLU GLN GLU ILE LEU ILE GLN SER VAL CYS GLU THR MET VAL PRO LYS LEU VAL ALA GLU

ASP ILE PRO LEU LEU PHE SER LEU LEU SER ASP VAL PHE PRO GLY VAL GLN TYR HIS ARG GLY GLU MET THR ALA LEU ARG GLU GLU LEU LYS LYS VAL CYS GLN GLU MET TYR LEU THR TYR GLY ASP GLY GLU GLU VAL GLY GLY MET TRP VAL GLU LYS VAL LEU GLN LEU TYR GLN

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

ARG GLU TRP THR ASP GLY LEU PHE THR HIS VAL LEU ARG LYS ILE ILE ASP SER VAL ARG GLY GLU LEU GLN LYS ARG GLN TRP ILE VAL PHE ASP GLY ASP VAL ASP PRO GLU TRP VAL GLU ASN LEU ASN SER VAL LEU ASP ASP ASN LYS LEU LEU THR LEU PRO ASN GLY GLU ARG

LEU SER LEU PRO PRO ASN VAL ARG ILE MET PHE GLU VAL GLN ASP LEU LYS TYR ALA THR LEU ALA THR VAL SER ARG CYS GLY MET VAL TRP PHE SER GLU ASP VAL LEU SER THR ASP MET ILE PHE ASN ASN PHE LEU ALA ARG LEU ARG SER ILE PRO LEU ASP GLU GLY GLU ASP

GLU ALA GLN ARG ARG ARG LYS GLY LYS GLU ASP GLU GLY GLU GLU ALA ALA SER PRO MET LEU GLN ILE GLN ARG ASP ALA ALA THR ILE MET GLN PRO TYR PHE THR SER ASN GLY LEU VAL THR LYS ALA LEU GLU HIS ALA PHE GLN LEU GLU HIS ILE MET ASP LEU THR ARG LEU

ARG CYS LEU GLY SER LEU PHE SER MET LEU HIS GLN ALA CYS ARG ASN VAL ALA GLN TYR ASN ALA ASN HIS PRO ASP PHE PRO MET GLN ILE GLU GLN LEU GLU ARG TYR ILE GLN ARG TYR LEU VAL TYR ALA ILE LEU TRP SER LEU SER GLY ASP SER ARG LEU LYS MET ARG ALA

GLU LEU GLY GLU TYR ILE ARG ARG ILE THR THR VAL PRO LEU PRO THR ALA PRO ASN ILE PRO ILE ILE ASP TYR GLU VAL SER ILE SER GLY GLU TRP SER PRO TRP GLN ALA LYS VAL PRO GLN ILE GLU VAL VAL GLU THR HIS LYS VAL ALA ALA PRO ASP VAL VAL VAL PRO THR LEU

ASP THR VAL ARG HIS GLU ALA LEU LEU TYR THR TRP LEU ALA ALA GLU HIS LYS PRO LEU VAL LEU CYS GLY PRO PRO GLY SER GLY LYS THR MET THR LEU PHE SER ALA LEU ARG ALA LEU PRO ASP MET GLU VAL VAL GLY LEU ASN PHE SER SER ALA THR THR PRO GLU LEU LEU LEU

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

TYR ARG THR SER ASP GLN THR TRP VAL LYS LEU GLU ARG ILE GLN PHE VAL GLY ALA CYS ASN PRO PRO THR ASP PRO GLY ARG LYS PRO LEU SER HIS ARG PHE LEU ARG HIS VAL PRO VAL VAL TYR VAL ASP TYR PRO GLY PRO ALA SER LEU THR GLN ILE TYR GLY THR PHE ASN

ARG ALA MET LEU ARG LEU ILE PRO SER LEU ARG THR TYR ALA GLU PRO LEU THR ALA ALA MET VAL GLU PHE TYR THR MET SER GLN GLU ARG PHE THR GLN ASP THR GLN PRO HIS TYR ILE TYR SER PRO ARG GLU MET THR ARG TRP VAL ARG GLY ILE PHE GLU ALA LEU ARG PRO

LEU GLU THR LEU PRO VAL GLU GLY LEU ILE ARG ILE TRP ALA HIS GLU ALA LEU ARG LEU PHE GLN ASP ARG LEU VAL GLU ASP GLU GLU ARG ARG TRP THR ASP GLU ASN ILE ASP THR VAL ALA LEU LYS HIS PHE PRO ASN ILE ASP ARG GLU LYS ALA MET SER ARG PRO ILE LEU

TYR SER ASN TRP LEU SER LYS ASP TYR ILE PRO VAL ASP GLN GLU GLU LEU ARG ASP TYR VAL LYS ALA ARG LEU LYS VAL PHE TYR GLU GLU GLU LEU ASP VAL PRO LEU VAL LEU PHE ASN GLU VAL LEU ASP HIS VAL LEU ARG ILE ASP ARG ILE PHE ARG GLN PRO GLN GLY HIS

LEU LEU LEU ILE GLY VAL SER GLY ALA GLY LYS THR THR LEU SER ARG PHE VAL ALA TRP MET ASN GLY LEU SER VAL TYR GLN ILE LYS VAL HIS ARG LYS TYR THR GLY GLU ASP PHE ASP GLU ASP LEU ARG THR VAL LEU ARG ARG SER GLY CYS LYS ASN GLU LYS ILE ALA PHE

ILE MET ASP GLU SER ASN VAL LEU ASP SER GLY PHE LEU GLU ARG MET ASN THR LEU LEU ALA ASN GLY GLU VAL PRO GLY LEU PHE GLU GLY ASP GLU TYR ALA THR LEU MET THR GLN CYS LYS GLU GLY ALA GLN LYS GLU GLY LEU MET LEU ASP SER HIS GLU GLU LEU TYR LYS

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

MET ASP LEU GLU LYS PRO ASN TYR ILE VAL PRO ASP TYR MET PRO VAL VAL TYR ASP LYS LEU PRO GLN PRO PRO SER HIS ARG GLU ALA ILE VAL ASN SER CYS VAL PHE VAL HIS GLN THR LEU HIS GLN ALA ASN ALA ARG LEU ALA LYS ARG GLY GLY ARG THR MET ALA ILE THR

PRO ARG HIS TYR LEU ASP PHE ILE ASN HIS TYR ALA ASN LEU PHE HIS GLU LYS ARG SER GLU LEU GLU GLU GLN GLN MET HIS LEU ASN VAL GLY LEU ARG LYS ILE LYS GLU THR VAL ASP GLN VAL GLU GLU LEU ARG ARG ASP LEU ARG ILE LYS SER GLN GLU LEU GLU VAL LYS

ASN ALA ALA ALA ASN ASP LYS LEU LYS LYS MET VAL LYS ASP GLN GLN GLU ALA GLU LYS LYS LYS VAL MET SER GLN GLU ILE GLN GLU GLN LEU HIS LYS GLN GLN GLU VAL ILE ALA ASP LYS GLN MET SER VAL LYS GLU ASP LEU ASP LYS VAL GLU PRO ALA VAL ILE GLU ALA

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

ASN PHE SER ALA GLU GLU ILE SER ASP ALA ILE ARG GLU LYS MET LYS LYS ASN TYR MET SER ASN PRO SER TYR ASN TYR GLU ILE VAL ASN ARG ALA SER LEU ALA CYS GLY PRO MET VAL LYS TRP ALA ILE ALA GLN LEU ASN TYR ALA ASP MET LEU LYS ARG VAL GLU PRO LEU

ARG ASN GLU LEU GLN LYS LEU GLU ASP ASP ALA LYS ASP ASN GLN GLN LYS ALA ASN GLU VAL GLU GLN MET ILE ARG ASP LEU GLU ALA SER ILE ALA ARG TYR LYS GLU GLU TYR ALA VAL LEU ILE SER GLU ALA GLN ALA ILE LYS ALA ASP LEU ALA ALA VAL GLU ALA LYS VAL

ASN ARG SER THR ALA LEU LEU LYS SER LEU SER ALA GLU ARG GLU ARG TRP GLU LYS THR SER GLU THR PHE LYS ASN GLN MET SER THR ILE ALA GLY ASP CYS LEU LEU SER ALA ALA PHE ILE ALA TYR ALA GLY TYR PHE ASP GLN GLN MET ARG GLN ASN LEU PHE THR THR TRP

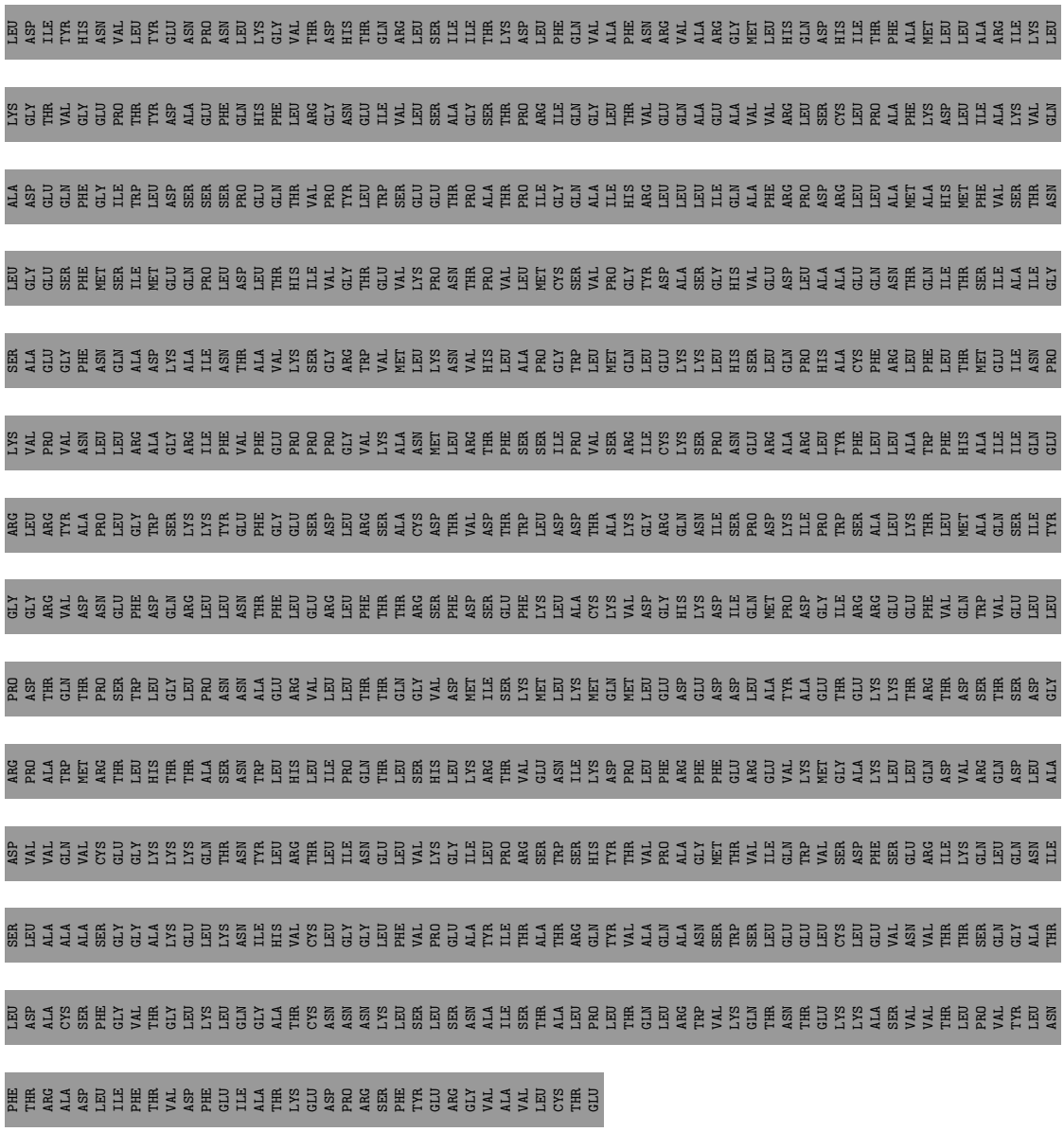
SER HIS HIS LEU GLN GLN ALA ASN ILE GLN PHE ARG THR ASP ILE ALA ARG THR GLU TYR LEU SER ASN ALA ASP GLU ARG LEU ARG TRP GLN ALA SER SER LEU PRO ALA ASP ASP LEU CYS THR GLU ASN ALA ILE MET LEU LYS ARG PHE ASN ARG TYR PRO LEU ILE ILE ASP PRO

SER GLY GLN ALA THR GLU PHE ILE MET ASN GLU TYR LYS ASP ARG LYS ILE THR ARG THR SER PHE LEU ASP ASP ALA PHE ARG LYS ASN LEU GLU SER ALA LEU ARG PHE GLY ASN PRO LEU LEU VAL GLN ASP VAL GLU SER TYR ASP PRO VAL LEU ASN PRO VAL LEU ASN ARG GLU

VAL ARG ARG THR GLY GLY ARG VAL LEU ILE THR LEU GLY ASP GLN ASP ILE ASP LEU SER PRO SER PHE VAL ILE PHE LEU SER THR ARG ASP PRO THR VAL GLU PHE PRO PRO ASP LEU CYS SER ARG VAL THR PHE VAL ASN PHE THR VAL THR ARG SER SER LEU GLN SER GLN CYS

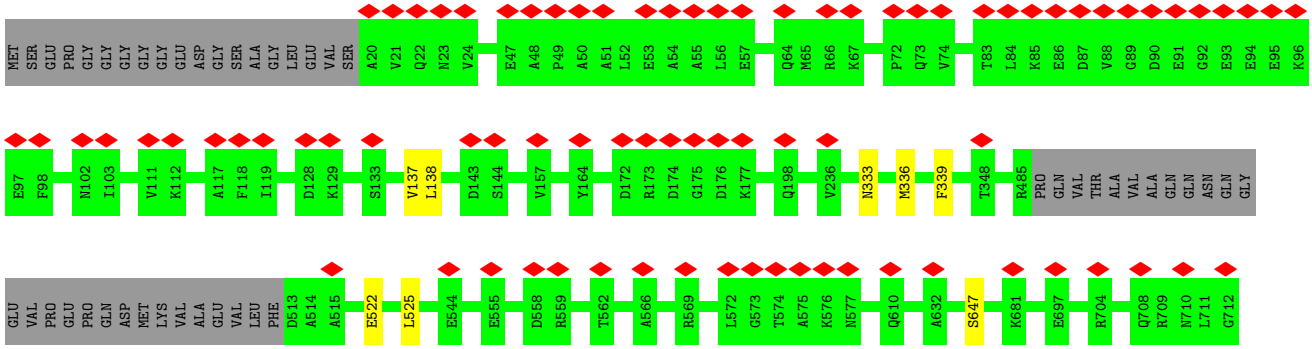
LEU ASN GLU VAL LEU LYS ALA GLU ARG PRO ASP VAL ASP GLU LYS ARG SER ASP LEU LEU LYS LEU GLN GLY GLU PHE GLN LEU ARG LEU ARG GLN LEU GLU LYS SER LEU LEU GLN ALA LEU ASN GLU VAL LYS GLY ARG ILE LEU ASP ASP ASP THR ILE ILE THR THR LEU GLU ASN

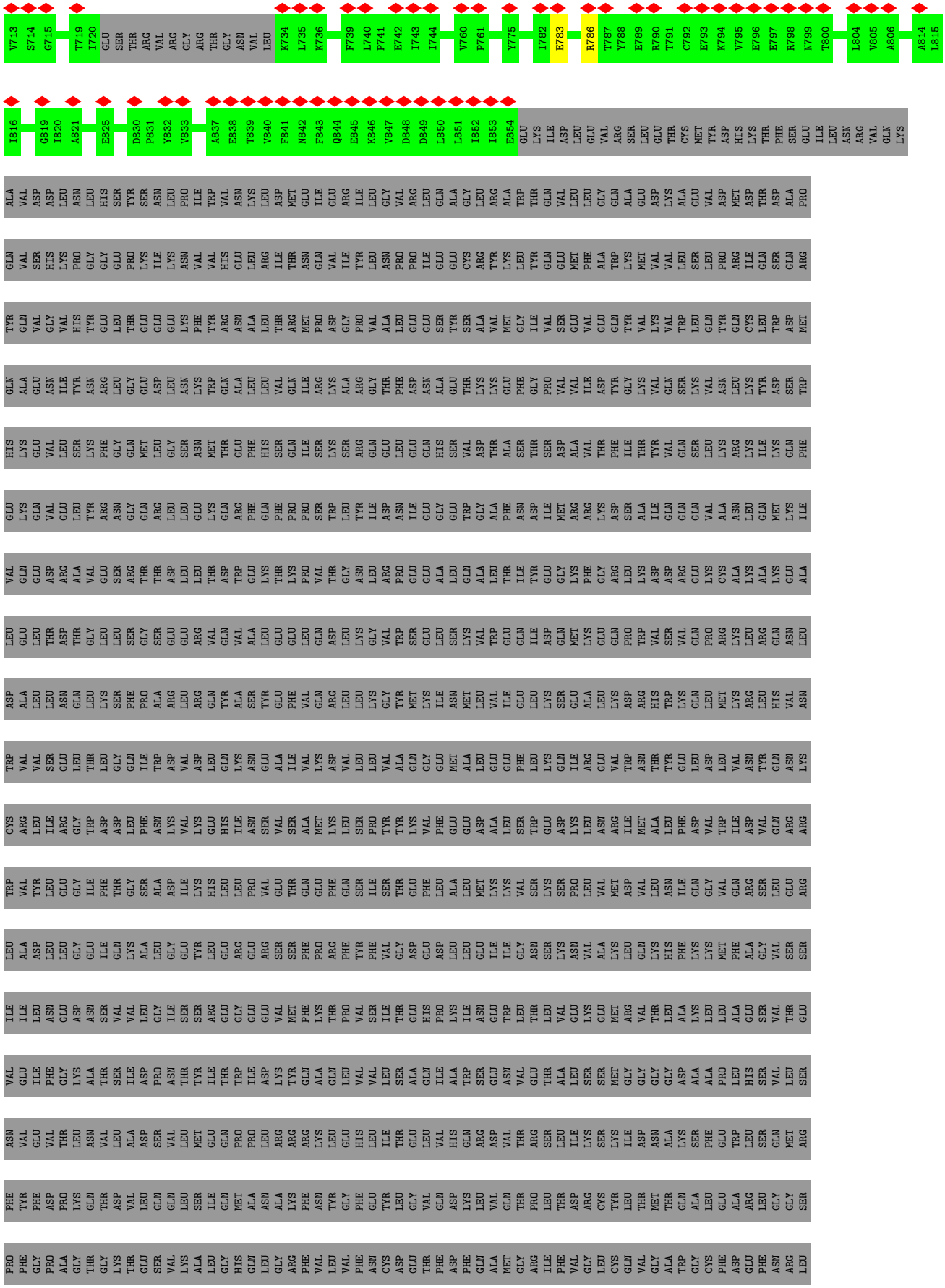
LEU LYS ARG GLU ALA ALA GLU VAL THR ARG LYS VAL GLU GLU THR ASP ILE VAL MET GLN GLU VAL GLU THR VAL SER GLN GLN TYR LEU PRO LEU SER THR ALA CYS SER SER ILE TYR PHE THR MET GLU SER LEU LYS GLN ILE HIS PHE LEU TYR GLN TYR SER LEU GLN PHE PHE



- Molecule 13: Cytoplasmic dynein 1 heavy chain 1

Chain m:




V713 S714 G715 T719 I720 GLU SER THR ARG VAL ARG GLY ARG THR GLY ASN VAL LEU K734 L735 K736 F739 L740 P741 E742 I743 I744 V760 P761 Y775 I782 E783 R786 T787 Y788 E789 R790 T791 C792 E793 K794 V795 E796 E797 R798 N799 T800 L804 V805 A806 A814 L815
I816 G819 I820 A821 E825 D830 P831 Y832 V833 A837 E838 T839 V840 F841 N842 F843 Q844 E845 K846 V847 D848 D849 L850 L851 I852 I853 E854 GLU LYS ILE ASP LEU GLU VAL ARG SER LEU GLU THR CYS MET TYR ASP HIS LYS THR PHE SER GLU ILE LEU ASN ARG VAL GLN LYS
ALA VAL ASP ASP LEU ASN LEU HIS SER TYR SER ASN LEU PRO ILE TRP VAL ASN LYS LEU ASP MET GLU ILE GLU ARG ILE LEU GLY VAL ALA LEU ARG LEU GLN ALA GLY LEU ARG ALA TRP THR GLN VAL LEU LEU GLY GLN ALA GLU ASP LYS ALA GLU VAL ASP MET ASP THR ASP ALA PRO
GLN VAL SER HIS LYS PRO GLY GLY GLU PRO LYS ILE LYS ASN VAL VAL HIS GLU LEU ARG ILE THR ASN GLN VAL ILE TYR LEU ASN PRO PRO ILE GLU GLU CYS ARG TYR LYS LEU TYR GLN GLU MET PHE ALA TRP LYS MET VAL LEU SER LEU PRO ARG ILE GLN SER GLN ARG
TYR GLN VAL GLY VAL HIS TYR GLU GLU LEU THR GLU GLU GLU LYS PHE TYR ARG ASN ALA LEU THR ARG MET PRO ASP GLY PRO VAL ALA LEU GLU GLU SER TYR SER ALA VAL MET GLY ILE VAL SER GLU VAL GLU GLN TYR VAL LYS VAL TRP LEU GLN TYR GLN CYS LEU TRP ASP MET
GLN ALA GLU ASN ILE TYR ASN ARG LEU GLY GLU ASP LEU ASN LYS TRP GLN ALA LEU LEU VAL GLN ILE ARG LYS ALA ARG GLY THR PHE ASP ASN ALA GLU THR LYS LYS GLU PHE GLY PRO VAL VAL ILE ASP TYR GLY LYS VAL GLN SER LYS VAL ASN LEU LYS TYR ASP SER TRP
HIS LYS GLU VAL LEU SER LYS PHE GLY GLN MET LEU GLY SER ASN MET THR GLU PHE HIS SER GLN ILE SER LYS SER ARG GLN GLU LEU GLU GLN HIS SER VAL ASP THR ALA SER THR SER ASP ALA VAL THR PHE ILE THR TYR VAL GLN SER LEU LYS ARG LYS ILE LYS GLN PHE
GLU LYS GLN VAL GLU LEU TYR ARG ASN GLY GLN ARG LEU GLU LYS ARG PHE GLN PHE PRO PRO SER TRP LEU TYR ILE ASP ASN ILE GLU GLY GLU TRP GLY ALA PHE ASN ASP ILE MET ARG ARG LYS ASP SER ALA ILE GLN GLN GLN VAL ALA ASN LEU GLN MET LYS ILE
VAL GLN GLU ASP ARG ALA VAL GLU SER ARG THR THR ASP LEU LEU THR ASP TRP GLU LYS THR LYS PRO VAL THR GLY ASN LEU ARG PRO GLU GLU ALA LEU GLN ALA LEU THR ILE TYR GLU GLU GLY LYS PHE GLY ARG LEU LYS ASP PRO GLU LYS CYS ALA LYS ALA ALA LYS GLU ALA
LEU GLU LEU THR ASP THR GLY LEU LEU SER SER GLY SER GLU GLU ARG VAL GLN VAL ALA LEU GLU GLU LEU GLN ASP LEU LYS GLY VAL TRP SER GLU LEU SER LYS VAL TRP GLU ILE ASP GLN MET LYS GLU GLN PRO TRP VAL SER VAL GLN PRO ARG LYS LEU ARG GLN ASN LEU
ASP ALA LEU LEU ASN GLN LEU LYS SER PHE PRO ALA ARG LEU LEU SER TYR ALA SER TYR GLU PHE VAL GLN ARG LEU LEU LYS GLY GLY TYR MET LYS ILE ASN MET LEU VAL ILE GLU LEU LYS SER GLU ALA LEU LYS ASP ARG HIS TRP LYS GLN GLN LEU MET LYS ARG LEU HIS VAL ASN
TRP VAL VAL SER GLU LEU THR LEU GLY GLN ILE TRP ASP VAL ASP LEU LEU VAL ALA GLN GLY GLU MET ALA LEU GLU GLU PHE LEU LYS GLN ILE ARG GLU VAL TRP ASN THR TYR GLU LEU ASP LEU VAL ASN TYR GLN ASN LYS
CYS ARG LEU ILE ARG GLY TRP ASP ASP LEU PHE ASN LYS VAL LYS GLU HIS ILE ASN SER VAL SER ALA MET LYS LEU SER PRO TYR TYR LYS VAL PHE GLU GLU ASP ALA LEU SER TRP GLU ASP LYS LEU ASN ARG ILE ARG GLU ARG ARG
TRP VAL TYR LEU GLU GLY ILE PHE THR GLY SER ALA ASP ILE LYS HIS LEU LEU PRO VAL GLU THR GLN GLU PHE GLN SER ILE SER THR GLU PHE LEU ALA LEU LYS SER PRO LEU VAL MET ASP VAL ASN THR GLN GLY GLN ILE GLN GLY VAL LEU GLU
LEU ALA ASP LEU LEU GLY GLU ILE GLN LYS ALA LEU GLY GLU ARG GLU ARG SER SER PHE PRO ARG PHE TYR PHE VAL GLY ASP GLU ASP LEU GLU MET LYS ILE ILE GLY ASN SER LYS ASN VAL ALA LYS LEU GLN LYS HIS PHE LYS LYS MET PHE ALA GLY VAL SER ARG
ILE ILE LEU ASN GLU ASP ASN SER VAL VAL LEU GLY ILE SER SER ARG GLU GLU GLY ILE PHE THR PRO VAL MET PHE LYS THR PRO VAL SER ILE THR GLU HIS PRO LYS LEU THR LEU LEU VAL GLU LYS GLU MET ARG VAL THR LEU ALA LEU LYS VAL THR GLU
VAL GLU ILE PHE GLY LYS ALA THR SER ILE ASP PRO ASN THR TYR ILE ILE THR TRP SER GLU ASN VAL VAL LEU SER ALA GLN ILE ALA TRP SER GLU THR ALA LEU SER SER MET GLY GLY GLY GLY ASP ALA ALA PRO LEU HIS SER VAL LEU SER
ASN VAL GLU VAL THR LEU ALA ASP SER VAL LEU MET GLU GLN PRO LEU LYS LEU GLU LEU VAL HIS GLN ARG GLU LEU VAL THR ARG SER LEU ILE SER LYS SER LYS ILE ASP VAL ASN ALA LYS SER PHE GLU TRP GLN MET ARG
PHE TYR PHE ASP PRO LYS GLN THR GLY LYS TYR ASP VAL LEU GLN GLN MET ALA ASN ALA LYS PHE ASN TYR GLY PHE GLU TYR LEU GLY VAL GLN LYS LEU THR LEU GLN ILE SER LEU LEU THR ASP ARG CYS TYR LEU THR MET ARG GLY GLY ASP ALA GLU GLU ALA GLU LEU ASP SER
PRO PHE GLY PRO ALA GLY THR GLY LYS THR GLU SER VAL LYS ALA LEU GLY ARG PHE VAL LEU VAL PHE ASN CYS ASP PHE GLU THR PHE ASP PHE GLN ALA MET GLY ARG ILE PHE VAL GLY LEU CYS GLN VAL GLY ALA TRP GLY CYS PHE ASP GLU PHE ARG GLN LEU ARG ARG

GLU GLU ARG MET LEU SER ALA VAL SER GLN GLN VAL GLN CYS ILE GLN GLU ALA LEU ARG GLU HIS SER ASN PRO ASN TYR ASP LYS THR SER ALA PRO ILE THR CYS GLU LEU LEU ASN LYS GLN VAL LYS VAL SER PRO ASP MET ALA ILE PHE ILE THR MET ASN PRO GLY TYR ALA

GLY ARG SER ASN LEU PRO ASP ASN LEU LYS LYS LEU PHE ARG SER LEU ALA MET THR LYS PRO ASP ARG GLN LEU ILE ALA GLN VAL MET LEU TYR SER GLN GLY PHE ARG THR ALA GLU VAL LEU ALA ASN LYS ILE VAL PRO PHE PHE LYS LEU CYS ASP GLU GLN LEU SER SER GLN

SER HIS TYR ASP PHE GLY LEU ARG ALA LEU LYS SER VAL LEU VAL SER ALA GLY ASN VAL LYS ARG GLU ARG ILE GLN LYS ILE LYS ARG GLU LYS GLU GLU ARG GLY GLU ALA VAL ASP GLU GLY GLU ILE ALA GLU ASN LEU PRO GLU GLN GLU ILE LEU ILE GLN SER VAL CYS GLU

THR MET VAL PRO LYS LEU VAL ALA GLU ASP ILE PRO LEU LEU PHE SER LEU LEU SER ASP VAL PHE PRO GLY VAL GLN TYR HIS ARG GLY GLU MET THR ALA LEU ARG GLU GLU LEU LYS LYS VAL CYS GLN GLU MET TYR LEU THR TYR GLY ASP GLY GLU GLU VAL GLY MET TRP

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

LEU TYR GLY THR LEU ASP PRO ASN THR ARG GLU TRP THR ASP GLY LEU PHE THR HIS VAL LEU ARG LYS ILE ILE ASP SER VAL ARG GLY GLU LEU GLN LYS ARG GLN TRP ILE VAL PHE ASP GLY ASP VAL ASP PRO GLU TRP VAL GLU ASN LEU ASN SER VAL LEU ASP ASP ASN LYS

LEU LEU THR LEU PRO ASN GLY GLU ARG LEU SER LEU PRO PRO ASN VAL ARG ILE MET PHE GLU VAL GLN ASP LEU LYS TYR ALA THR LEU ALA THR VAL SER ARG CYS GLY MET VAL TRP PHE SER GLU ASP VAL LEU SER THR ASP MET ILE PHE ASN ASN PHE LEU ALA ARG LEU ARG

SER ILE PRO LEU ASP GLU GLY GLU ASP GLU ALA GLN ARG ARG ARG LYS GLY LYS GLU ASP GLU GLY GLU ALA ALA SER PRO MET LEU GLN ILE GLN ARG ASP ALA ALA THR ILE MET GLN PRO TYR PHE THR SER ASN GLY LEU VAL THR LYS ALA LEU GLU HIS ALA PHE GLN LEU

GLU HIS ILE MET ASP LEU THR ARG LEU ARG CYS LEU GLY SER LEU PHE SER MET LEU HIS GLN ALA CYS ARG ASN VAL ALA GLN TYR ASN ALA ASN HIS PRO ASP PHE PRO MET GLN ILE GLU GLN LEU GLU ARG TYR ILE GLN ARG TYR LEU VAL TYR ALA ILE LEU TRP SER LEU SER

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

ALA PRO ASP VAL VAL VAL PRO THR LEU ASP THR VAL ARG HIS GLU ALA LEU LEU TYR THR TRP LEU ALA GLU HIS LYS PRO LEU VAL LEU CYS GLY PRO PRO GLY SER GLY LYS THR MET THR LEU PHE SER ALA LEU ARG ALA LEU PRO ASP MET GLU VAL VAL GLY LEU ASN PHE SER

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

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

LEU THR GLN ILE TYR GLY THR PHE ASN ARG ALA MET LEU ARG LEU ILE PRO SER LEU ARG THR TYR ALA GLU PRO LEU THR ALA ALA MET VAL GLU PHE TYR THR MET SER GLN GLU ARG PHE THR GLN ASP THR GLN PRO HIS TYR ILE TYR SER PRO ARG GLU MET THR ARG TRP VAL

ARG GLY ILE PHE GLU ALA LEU ARG PRO LEU GLU THR LEU PRO VAL GLU GLY LEU ILE ARG ILE TRP ALA HIS GLU ALA LEU ARG LEU PHE GLN ASP ARG LEU VAL GLU ASP GLU GLU ARG ARG TRP THR ASP GLU ASN ILE ASP THR VAL ALA LEU LYS HIS PHE PRO ASN ILE ASP ARG

GLU LYS ALA MET SER ARG PRO ILE LEU TYR SER ASN TRP LEU SER LYS ASP TYR ILE PRO VAL ASP GLN GLU GLU LEU ARG ASP TYR VAL LYS ALA ARG LEU LYS VAL PHE TYR GLU GLU GLU LEU ASP VAL PRO LEU VAL LEU PHE ASN GLU VAL LEU ASP HIS VAL LEU ARG ILE ASP

ARG ILE PHE ARG GLN PRO GLN GLY HIS LEU LEU LEU ILE GLY VAL SER GLY ALA GLY LYS THR THR LEU SER ARG PHE VAL ALA TRP MET ASN GLY LEU SER VAL TYR GLN ILE LYS VAL HIS ARG LYS TYR THR GLY GLU ASP PHE ASP GLU ASP LEU ARG THR VAL LEU ARG ARG SER

GLY CYS LYS ASN GLU LYS ILE ALA PHE ILE MET ASP GLU SER ASN VAL LEU ASP SER GLY PHE LEU GLU ARG MET ASN THR LEU LEU ALA ASN GLY GLU VAL PRO GLY LEU PHE GLU GLY ASP GLU TYR ALA THR LEU MET THR GLN CYS LYS GLU GLY ALA GLN LYS GLU GLY LEU MET

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

GLN VAL GLY LYS GLU PHE THR SER LYS MET ASP LEU GLU LYS PRO ASN TYR ILE VAL PRO ASP TYR MET PRO VAL VAL TYR ASP LYS LEU PRO GLN PRO PRO SER HIS ARG GLU ALA ILE VAL ASN SER CYS VAL PHE VAL HIS GLN THR LEU HIS GLN ALA ASN ALA ARG LEU ALA LYS

ARG GLY GLY ARG THR MET ALA ILE THR PRO ARG HIS TYR LEU ASP PHE ILE ASN HIS TYR ALA ASN LEU PHE HIS GLU LYS ARG SER GLU LEU GLU GLU GLN GLN MET HIS LEU ASN VAL GLY LEU ARG LYS ILE LYS GLU THR VAL ASP GLN VAL GLU GLU LEU ARG ARG ASP LEU ARG

ILE LYS SER GLN GLU LEU GLU VAL LYS ASN ALA ALA ALA ASN ASP LYS LEU LYS LYS MET VAL LYS ASP GLN GLN GLU ALA GLU LYS LYS LYS VAL MET SER GLN GLU ILE GLN GLU GLN LEU HIS LYS GLN GLN GLU VAL ILE ALA ASP LYS GLN MET SER VAL LYS GLU ASP LEU ASP

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

ARG GLU ASN PHE ILE PRO THR ILE VAL ASN PHE SER ALA GLU GLU ILE SER ASP ALA ILE ARG GLU LYS MET LYS LYS ASN TYR MET SER ASN PRO SER TYR ASN TYR GLU ILE VAL ASN ARG ALA SER LEU ALA CYS GLY PRO MET VAL LYS TRP ALA ILE ALA GLN LEU ASN TYR ALA

ASP MET LEU LYS ARG VAL GLU PRO LEU ARG ASN GLU LEU GLN LYS LEU GLU ASP ASP ALA LYS ASP ASN GLN GLN LYS ALA ASN GLU VAL GLU GLN MET ILE ARG ASP LEU GLU ALA SER ILE ALA ARG TYR LYS GLU GLU TYR ALA VAL LEU ILE SER GLU ALA GLN ALA ILE LYS ALA

ASP LEU ALA ALA VAL GLU ALA LYS VAL ASN ARG SER THR ALA LEU LEU LYS SER LEU SER ALA GLU ARG GLU ARG TRP GLU LYS THR SER GLU THR PHE LYS ASN GLN MET SER THR ILE ALA GLY ASP CYS LEU LEU SER ALA ALA PHE ILE ALA TYR ALA GLY TYR PHE ASP GLN GLN

MET ARG GLN ASN LEU PHE THR THR TRP SER HIS HIS LEU GLN GLN ALA ASN ILE GLN PHE ARG THR ASP ILE ALA ARG THR GLU TYR LEU SER ASN ALA ASP GLU ARG LEU ARG TRP GLN ALA SER SER LEU PRO ALA ASP ASP LEU CYS THR GLU ASN ALA ILE MET LEU LYS ARG PHE

ASN ARG TYR PRO LEU ILE ILE ASP PRO SER GLY GLN ALA THR GLU PHE ILE MET ASN GLU TYR LYS ASP ARG LYS ILE THR ARG THR SER PHE LEU ASP ASP ALA PHE ARG LYS ASN LEU GLU SER ALA LEU ARG PHE GLY ASN PRO LEU LEU VAL GLN ASP VAL GLU SER TYR ASP PRO

VAL LEU ASN PRO VAL LEU ASN ARG GLU VAL ARG ARG THR GLY GLY ARG VAL LEU ILE THR LEU GLY ASP GLN ASP ILE ASP LEU SER PRO SER PHE VAL ILE PHE LEU SER THR ARG ASP PRO THR VAL GLU PHE PRO PRO ASP LEU CYS SER ARG VAL THR PHE VAL ASN PHE THR VAL

THR ARG SER SER LEU GLN SER GLN CYS LEU ASN GLU VAL LEU LYS ALA GLU ARG PRO ASP VAL ASP GLU LYS ARG SER ASP LEU LEU LYS LEU GLN GLY GLU PHE GLN LEU ARG LEU ARG GLN LEU GLU LYS SER LEU LEU GLN ALA LEU ASN GLU VAL LYS GLY ARG ILE LEU ASP ASP

ASP THR ILE ILE THR THR LEU GLU ASN LEU LYS ARG GLU ALA ALA GLU VAL THR ARG LYS VAL GLU GLU THR ASP ILE VAL MET GLN GLU VAL GLU THR VAL SER GLN GLN TYR LEU PRO LEU SER THR ALA CYS SER SER ILE TYR PHE THR MET GLU SER LEU LYS GLN ILE HIS PHE

LEU TYR GLN TYR SER LEU GLN PHE PHE LEU ASP ILE TYR HIS ASN VAL LEU TYR GLU ASN PRO ASN LEU LYS GLY VAL THR ASP HIS THR GLN ARG LEU SER ILE ILE THR LYS ASP LEU PHE GLN VAL ALA PHE ASN ARG VAL ALA ARG GLY MET LEU HIS GLN ASP HIS ILE THR PHE

ALA MET LEU LEU ALA ARG ILE LYS LEU LYS GLY THR VAL GLY GLU PRO THR TYR ASP ALA GLU PHE GLN HIS PHE LEU ARG GLY ASN GLU ILE VAL LEU SER ALA GLY SER THR PRO ARG ILE GLN GLY LEU THR VAL GLU GLN ALA GLU ALA VAL VAL ARG LEU SER CYS LEU PRO ALA

PHE LYS ASP LEU ILE ALA LYS VAL GLN ALA ASP GLU GLN PHE GLY ILE TRP LEU ASP SER SER PRO GLU GLN THR VAL PRO TYR LEU TRP SER GLU GLU THR PRO ALA THR PRO ILE GLY GLN ALA ILE HIS ARG LEU LEU ILE GLN ALA PHE ARG PRO ASP ARG LEU LEU ALA

MET ALA HIS MET PHE VAL SER THR ASN LEU GLY GLU SER PHE MET SER ILE MET GLU GLN PRO LEU ASP LEU THR HIS ILE VAL GLY THR GLU VAL LYS PRO ASN THR PRO VAL LEU MET CYS SER VAL PRO GLY TYR ASP ALA SER GLY HIS VAL GLU ASP LEU ALA ALA GLU GLN ASN

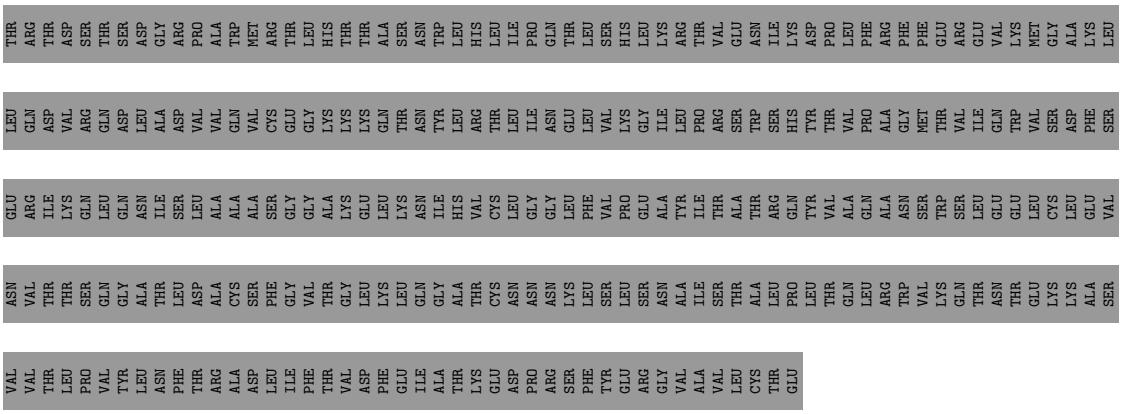
THR GLN ILE THR SER ILE ALA ILE GLY SER ALA GLU GLY PHE ASN GLN ALA ASP LYS ALA ILE ASN THR ALA VAL LYS SER GLY ARG TRP VAL MET LEU LYS ASN VAL HIS LEU ALA PRO GLY TRP LEU MET GLN LEU GLU LYS LYS LEU HIS SER LEU GLN PRO HIS ALA CYS PHE ARG

LEU PHE LEU THR MET GLU ILE ASN PRO LYS VAL PRO VAL ASN LEU LEU ARG ALA GLY ARG ILE PHE VAL PHE GLU PRO PRO PRO GLY VAL LYS ALA ASN MET LEU ARG THR PHE SER SER ILE PRO VAL SER ARG ILE CYS LYS SER PRO ASN GLU ARG ALA ARG LEU TYR PHE LEU LEU

ALA TRP PHE HIS ALA ILE ILE GLN GLU ARG LEU ARG TYR ALA PRO LEU GLY TRP SER LYS LYS TYR GLU PHE GLY GLU SER ASP LEU ARG SER ALA CYS ASP THR VAL ASP THR TRP LEU ASP ASP THR ALA LYS GLY ARG GLN ASN ILE SER PRO ASP LYS ILE PRO TRP SER ALA LEU

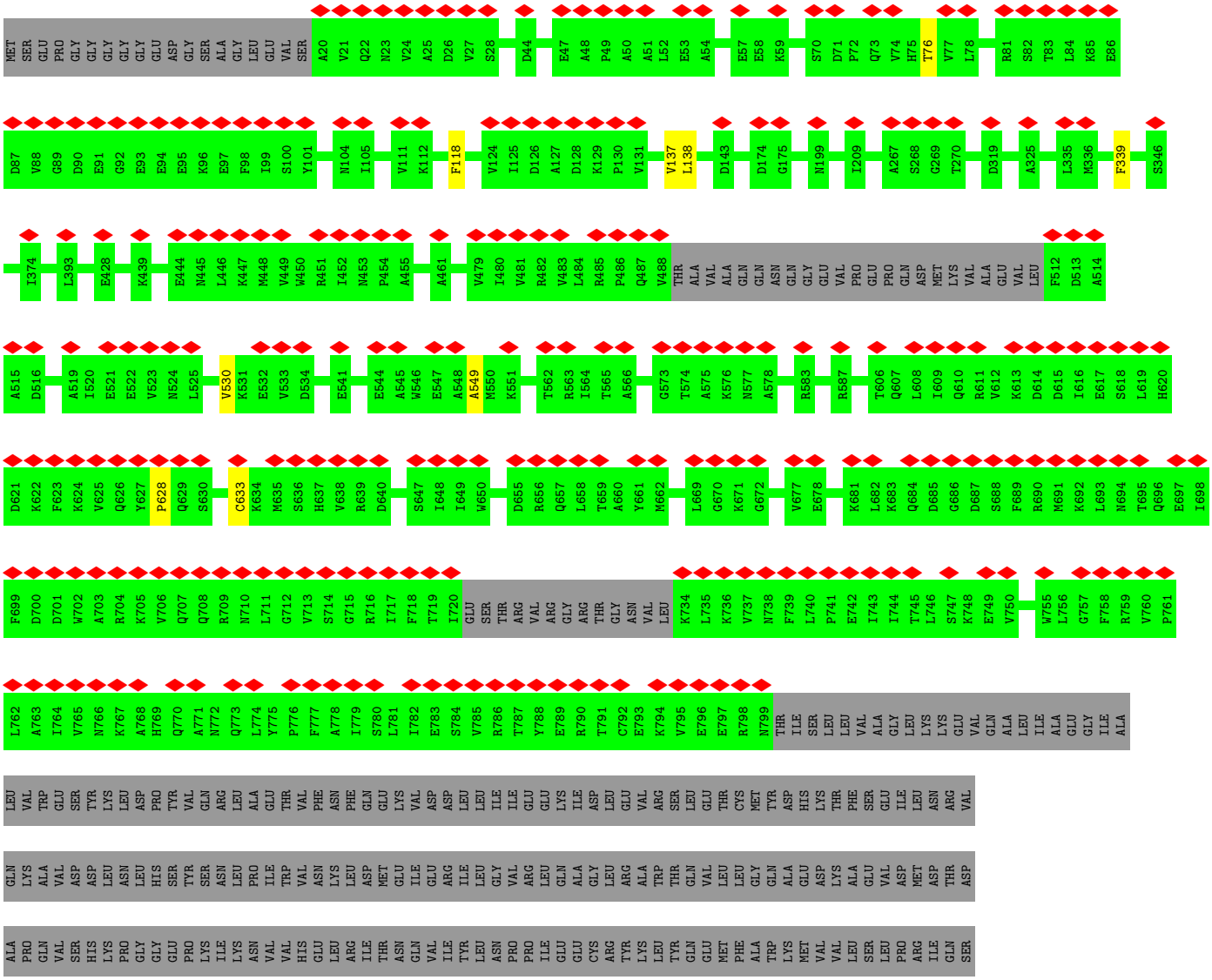
LYS THR LEU MET ALA GLN SER ILE TYR GLY GLY ARG VAL ASP ASN GLU PHE ASP GLN ARG LEU LEU ASN THR PHE LEU GLU ARG LEU PHE THR THR ARG SER PHE ASP SER GLU PHE LYS LEU ALA CYS LYS VAL ASP GLY HIS LYS ASP ILE GLN MET PRO ASP GLY ILE ARG ARG GLU

GLU PHE VAL GLN TRP VAL GLU LEU LEU PRO ASP THR GLN THR PRO SER TRP LEU GLY LEU PRO ASN ASN ALA GLU ARG VAL LEU LEU THR THR GLN GLY VAL ASP MET ILE SER LYS MET LEU LYS MET GLN MET LEU GLU ASP GLU ASP ASP LEU ALA TYR ALA GLU THR GLU LYS LYS



- Molecule 13: Cytoplasmic dynein 1 heavy chain 1

Chain n: 6% 16% 84%



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

ASP MET GLN ALA GLU ASN ILE TYR ASN ARG LEU GLY GLU ASP LEU ASN LYS TRP GLN ALA LEU LEU VAL GLN ILE ARG LYS ALA ARG GLY THR PHE ASP ASN ALA GLU THR LYS LYS GLU PHE GLY PRO VAL VAL ILE ASP TYR GLY LYS VAL GLN SER LYS VAL ASN LEU LYS TYR ASP

SER TRP HIS LYS GLU VAL LEU SER LYS PHE GLY GLN MET LEU GLY SER ASN MET THR GLU PHE HIS SER GLN ILE SER LYS SER ARG GLN GLU LEU GLU GLN HIS SER VAL ASP THR ALA SER THR SER ASP ALA VAL THR PHE ILE THR TYR VAL GLN SER LEU LYS ARG LYS ILE LYS

GLN PHE GLU LYS GLN VAL GLU LEU TYR ARG ASN GLY GLN ARG LEU LEU GLU LYS GLN ARG PHE GLN PHE PRO PRO SER TRP LEU TYR ILE ASP ASN ILE GLU GLY GLU TRP GLY ALA PHE ASN ASP ILE MET ARG ARG LYS ASP SER ALA ILE GLN GLN GLN VAL ALA ASN LEU GLN MET

LYS ILE VAL GLN GLU ASP ARG ALA VAL GLU SER ARG THR THR ASP LEU LEU THR ASP TRP GLU LYS THR LYS PRO VAL THR GLY ASN LEU ARG PRO GLU GLU ALA LEU GLN ALA LEU THR ILE TYR GLU GLY LYS PHE GLY ARG LEU LYS ASP ASP ARG GLU LYS CYS ALA LYS ALA LYS

GLU ALA LEU GLU LEU THR ASP THR GLY LEU LEU SER GLY SER GLU GLU ARG VAL GLN VAL ALA LEU GLU GLU LEU GLN ASP LEU LYS GLY VAL TRP SER GLU LEU SER LYS VAL TRP GLU GLN ILE ASP GLN MET LYS GLU GLN PRO TRP VAL SER VAL GLN PRO ARG LYS LEU ARG GLN

ASN LEU ASP ALA LEU LEU ASN GLN LEU LYS SER PHE PRO ALA ARG LEU ARG GLN TYR ALA SER TYR GLU PHE VAL GLN ARG LEU LEU LYS GLY TYR MET LYS ILE ASN MET LEU VAL ILE GLU LEU LYS SER GLU ALA LEU LYS ASP ARG HIS TRP LYS GLN LEU MET LYS ARG LEU HIS

VAL ASN TRP VAL VAL SER GLU LEU THR LEU GLY GLN ILE TRP ASP VAL ASP LEU GLN LYS ASN GLU ALA ILE VAL LYS ASP VAL LEU LEU VAL ALA GLN GLY GLU MET ALA LEU GLU GLU PHE LEU LYS GLN ILE ARG GLU VAL TRP ASN THR TYR GLU LEU ASP LEU VAL ASN TYR GLN

ASN LYS CYS ARG LEU ILE ARG GLY TRP ASP ASP LEU PHE ASN LYS VAL LYS GLU HIS ILE ASN SER VAL SER ALA MET LYS LEU SER PRO TYR TYR LYS VAL PHE GLU GLU ASP ALA LEU SER TRP GLU ASP LYS LEU ASN ARG ILE MET ALA LEU PHE ASP VAL TRP ILE ASP VAL GLN

ARG ARG TRP VAL TYR LEU GLU GLY ILE PHE THR GLY SER ALA ASP ILE LYS HIS LEU LEU PRO VAL GLU THR GLN GLU PHE GLN SER ILE SER THR GLU PHE LEU ALA LEU MET LYS LYS VAL SER LYS SER PRO LEU VAL MET ASP VAL LEU ASN ILE GLN GLY VAL GLN ARG SER LEU

GLU ARG LEU ALA ASP LEU LEU GLY GLU ILE GLN LYS ALA LEU GLY GLU TYR LEU GLU ARG GLU ARG SER SER PHE PRO ARG PHE TYR PHE VAL GLY ASP GLU ASP LEU LEU GLU ILE ILE GLY ASN SER LYS ASN VAL ALA LYS LEU GLN LYS HIS PHE LYS LYS MET PHE ALA GLY VAL

SER SER ILE ILE LEU ASN GLU ASP ASN SER VAL VAL LEU GLY ILE SER SER ARG GLU GLY GLU GLU VAL MET PHE LYS THR PRO VAL SER ILE THR GLU HIS PRO LYS ILE ASN GLU TRP LEU THR LEU VAL GLU LYS GLU MET ARG VAL THR LEU ALA LYS LEU LEU ALA GLU SER VAL

THR GLU VAL GLU ILE PHE GLY LYS ALA THR SER ILE ASP PRO ASN THR TYR ILE THR TRP ILE ASP LYS TYR GLN ALA GLN LEU VAL VAL LEU SER ALA GLN ILE ALA TRP SER GLU ASN VAL GLU THR ALA LEU SER SER MET GLY GLY GLY GLY ASP ALA ALA PRO LEU HIS SER VAL

LEU SER ASN VAL GLU VAL THR LEU ASN VAL LEU ALA ASP SER VAL LEU MET GLU GLN PRO PRO LEU ARG ARG ARG LYS LEU GLU HIS LEU ILE THR GLU LEU VAL HIS GLN ARG ASP VAL THR ARG SER LEU ILE LYS SER LYS ILE ASP ASN ALA LYS SER PHE GLU TRP LEU SER GLN

MET ARG PHE TYR PHE ASP PRO LYS GLN THR ASP VAL LEU GLN GLN LEU SER ILE GLN MET ALA ASN ALA LYS PHE ASN TYR GLY PHE GLU TYR LEU GLY VAL GLN ASP LYS LEU VAL GLN THR PRO LEU THR ASP ARG CYS TYR LEU THR MET THR GLN ALA LEU GLU ALA ARG LEU GLY

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

ARG LEU GLU GLU ARG MET LEU SER ALA VAL SER GLN GLN VAL GLN CYS ILE GLN GLU ALA LEU ARG GLU HIS SER ASN PRO ASN TYR ASP LYS THR SER ALA PRO ILE THR CYS GLU LEU LEU ASN LYS GLN VAL LYS VAL SER PRO ASP MET ALA ILE PHE ILE THR MET ASN PRO GLY

TYR ALA GLY ARG SER ASN LEU PRO ASP ASN LEU LYS LYS LEU PHE ARG SER LEU ALA MET THR LYS PRO ASP ARG GLN LEU ILE ALA GLN VAL MET LEU TYR SER GLN GLY PHE ARG THR ALA GLU VAL LEU ALA ASN LYS ILE VAL PRO PHE PHE LYS LEU CYS ASP GLU GLN LEU SER

SER GLN SER HIS TYR ASP PHE GLY LEU ARG ALA LEU LYS SER VAL LEU VAL SER ALA GLY ASN VAL LYS ARG GLU ARG ILE GLN LYS ILE LYS ARG GLU LYS GLU GLU ARG GLY GLU ALA VAL ASP GLU GLY GLU ILE ALA GLU ASN LEU PRO GLU GLN GLU ILE LEU ILE GLN SER VAL

CYS GLU THR MET VAL PRO LYS LEU VAL ALA GLU ASP ILE PRO LEU LEU PHE SER LEU LEU SER ASP VAL PHE PRO GLY VAL GLN TYR HIS ARG GLY GLU MET THR ALA LEU ARG GLU GLU LEU LYS LYS VAL CYS GLN GLU MET TYR LEU THR TYR GLY ASP GLY GLU GLU VAL GLY GLY

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

ASP HIS LEU TYR GLY THR LEU ASP PRO ASN THR ARG GLU TRP THR ASP GLY LEU PHE THR HIS VAL LEU ARG LYS ILE ILE ASP SER VAL ARG GLY GLU LEU GLN LYS ARG GLN TRP ILE VAL PHE ASP GLY ASP VAL ASP PRO GLU TRP VAL GLU ASN LEU ASN SER VAL LEU ASP ASP

ASN LYS LEU LEU THR LEU PRO ASN GLY GLU ARG LEU SER LEU PRO PRO ASN VAL ARG ILE MET PHE GLU VAL GLN ASP LEU LYS TYR ALA THR LEU ALA THR VAL SER ARG CYS GLY MET VAL TRP PHE SER GLU ASP VAL LEU SER THR ASP MET ILE PHE ASN ASN PHE LEU ALA ARG

LEU ARG SER ILE PRO LEU ASP GLU GLY GLU ASP GLU ALA GLN ARG ARG ARG LYS GLY LYS GLU ASP GLU GLY GLU GLU ALA ALA SER PRO MET LEU GLN ILE GLN ARG ASP ALA ALA THR ILE MET GLN PRO TYR PHE THR SER ASN GLY LEU VAL THR LYS ALA LEU GLU HIS ALA PHE

GLN LEU GLU HIS ILE MET ASP LEU THR ARG LEU ARG CYS LEU GLY SER LEU PHE SER MET LEU HIS GLN ALA CYS ARG ASN VAL ALA GLN TYR ASN ALA ASN HIS PRO ASP PHE PRO MET GLN ILE GLU GLN LEU GLU ARG TYR ILE GLN ARG TYR LEU VAL TYR ALA ILE LEU TRP SER

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

VAL ALA ALA PRO ASP VAL VAL VAL PRO THR LEU ASP THR VAL ARG HIS GLU ALA LEU LEU TYR THR TRP LEU ALA GLU HIS LYS PRO LEU VAL LEU CYS GLY PRO PRO GLY SER GLY LYS THR MET THR LEU PHE SER ALA LEU ARG ALA LEU PRO ASP MET GLU VAL VAL GLY LEU ASN

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

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

ALA SER LEU THR GLN ILE TYR GLY THR PHE ASN ARG ALA MET LEU ARG LEU ILE PRO SER LEU ARG THR TYR ALA GLU PRO LEU THR ALA ALA MET VAL GLU PHE TYR THR MET SER GLN GLU ARG PHE THR GLN ASP THR GLN PRO HIS TYR ILE TYR SER PRO ARG GLU MET THR ARG

TRP VAL ARG GLY ILE PHE GLU ALA LEU ARG PRO LEU GLU THR LEU PRO VAL GLU GLY LEU ILE ARG ILE TRP ALA HIS GLU ALA LEU ARG LEU PHE GLN ASP ARG LEU VAL GLU ASP GLU GLU ARG ARG TRP THR ASP GLU ASN ILE ASP THR VAL ALA LEU LYS HIS PHE PRO ASN ILE

ASP ARG GLU LYS ALA MET SER ARG PRO ILE LEU TYR SER ASN TRP LEU SER LYS ASP TYR ILE PRO VAL ASP GLN GLU GLU LEU ARG ASP TYR VAL LYS ALA ARG LEU LYS VAL PHE TYR GLU GLU GLU LEU ASP VAL PRO LEU VAL LEU PHE ASN GLU VAL LEU ASP HIS VAL LEU ARG

ILE ASP ARG ILE PHE ARG GLN PRO GLN GLY HIS LEU LEU LEU ILE GLY VAL SER GLY ALA GLY LYS THR THR LEU SER ARG PHE VAL ALA TRP MET ASN GLY LEU SER VAL TYR GLN ILE LYS VAL HIS ARG LYS TYR THR GLY GLU ASP PHE ASP GLU ASP LEU ARG THR VAL LEU ARG

ARG SER GLY CYS LYS ASN GLU LYS ILE ALA PHE ILE MET ASP GLU SER ASN VAL LEU ASP SER GLY PHE LEU GLU ARG MET ASN THR LEU LEU ALA ASN GLY GLU VAL PRO GLY LEU PHE GLU GLY ASP GLU TYR ALA THR LEU MET THR GLN CYS LYS GLU GLY ALA GLN LYS GLU GLY

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

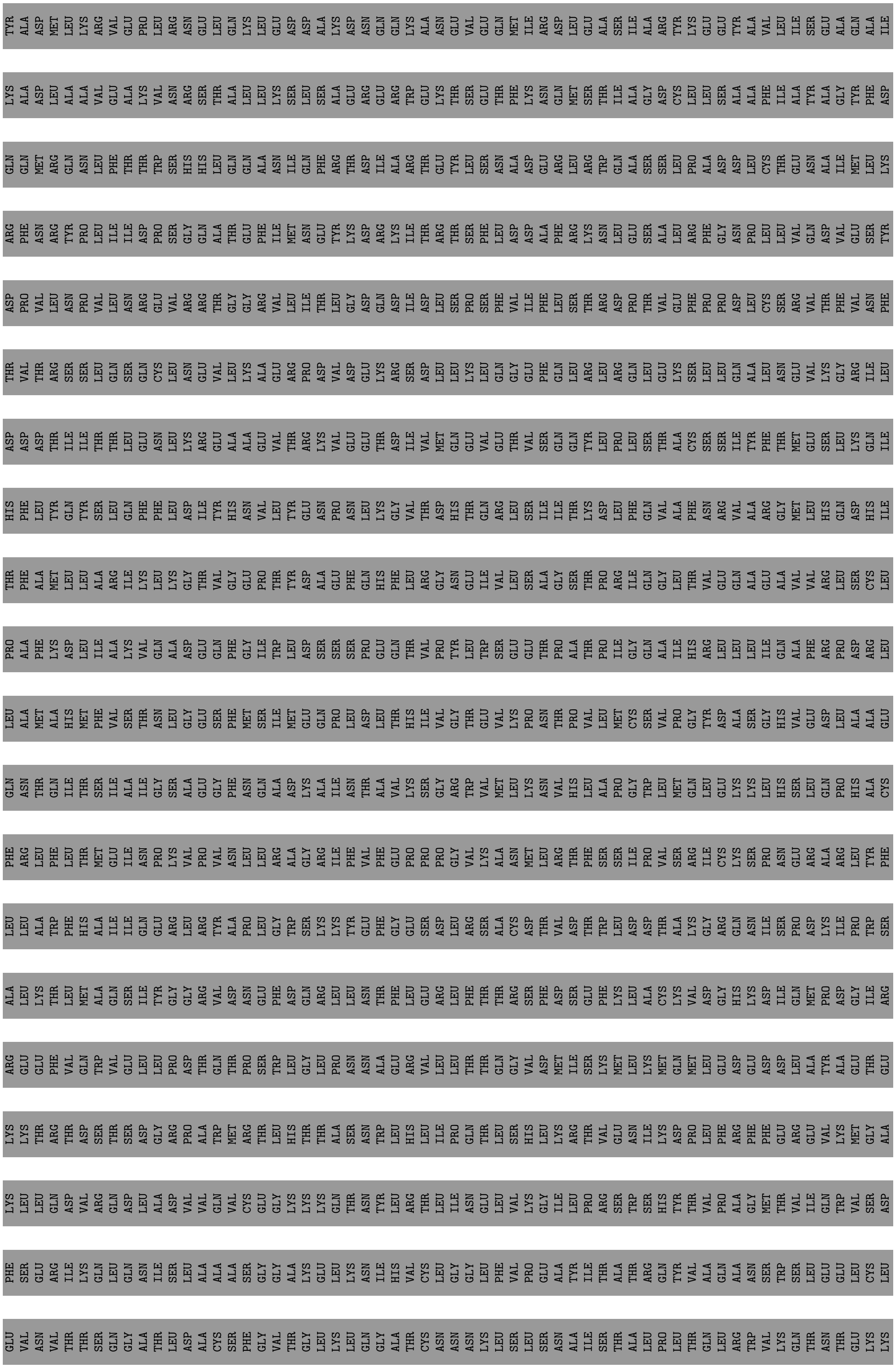
LEU TYR GLN VAL GLY LYS GLU PHE THR SER LYS MET ASP LEU GLU LYS PRO ASN TYR ILE VAL PRO ASP TYR MET PRO VAL VAL TYR ASP LYS LEU PRO GLN PRO PRO SER HIS ARG GLU ALA ILE VAL ASN SER CYS VAL PHE VAL HIS GLN THR LEU HIS GLN ALA ASN ALA ARG LEU

ALA LYS ARG GLY GLY ARG THR MET ALA ILE THR PRO ARG HIS TYR LEU ASP PHE ILE ASN HIS TYR ALA ASN LEU PHE HIS GLU LYS ARG SER GLU LEU GLU GLU GLN GLN MET HIS LEU ASN VAL GLY LEU ARG LYS ILE LYS GLU THR VAL ASP GLN VAL GLU GLU LEU ARG ARG ASP

LEU ARG ILE LYS SER GLN GLU LEU GLU VAL LYS ASN ALA ALA ALA ASN ASP LYS LEU LYS LYS MET VAL LYS ASP GLN GLN GLU ALA GLU LYS LYS LYS VAL MET SER GLN GLU ILE GLN GLU GLN LEU HIS LYS GLN GLN GLU VAL ILE ALA ASP LYS GLN MET SER VAL LYS GLU ASP

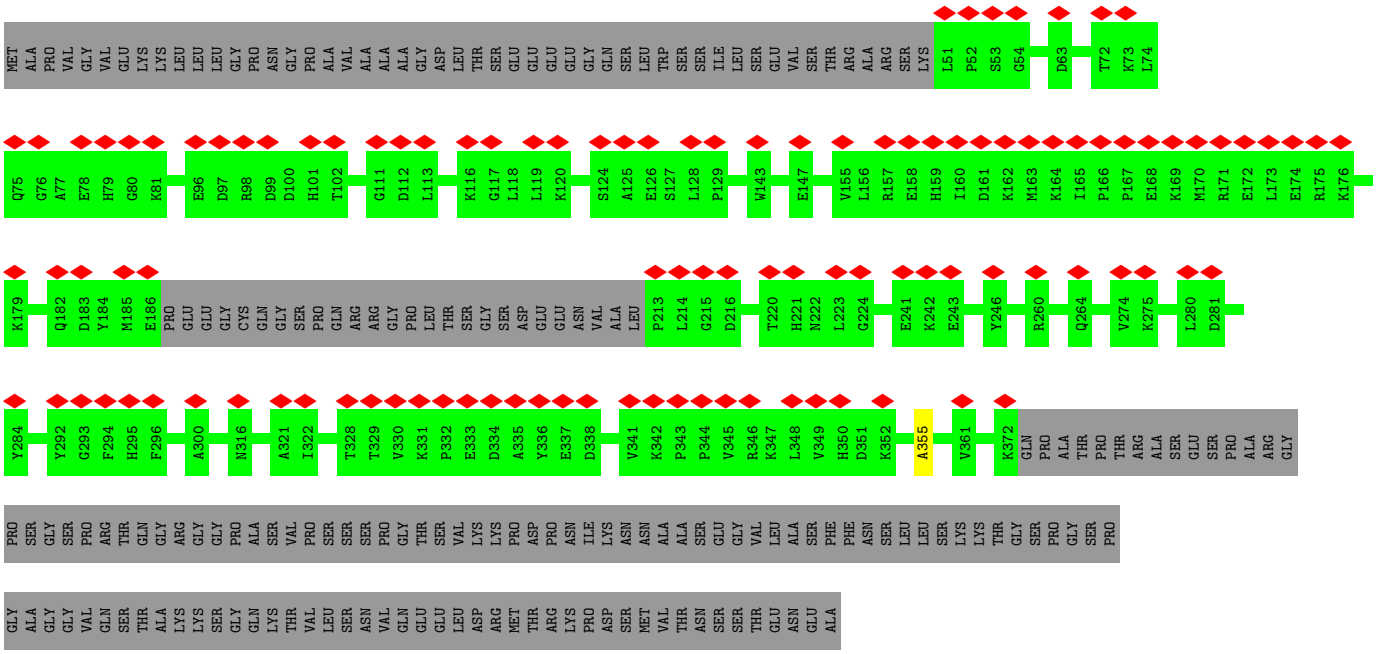
LEU ASP LYS VAL GLU PRO ALA VAL ILE GLU ALA GLN ASN ALA VAL LYS SER ILE LYS LYS GLN HIS LEU VAL GLU VAL ARG SER MET ALA ASN PRO PRO ALA ALA VAL LYS LEU ALA LEU GLU SER ILE CYS LEU LEU LEU GLY GLU SER THR THR ASP TRP LYS GLN ILE ARG SER ILE

ILE MET ARG GLU ASN PHE ILE PRO THR ILE VAL ASN PHE SER ALA GLU GLU ILE SER ASP ALA ILE ARG GLU LYS MET LYS LYS ASN TYR MET SER ASN PRO SER TYR ASN TYR GLU ILE VAL ASN ARG ALA SER LEU ALA CYS GLY PRO MET VAL LYS TRP ALA ILE ALA GLN LEU ASN


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

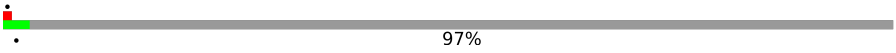
• Molecule 14: Cytoplasmic dynein 1 light intermediate chain 2

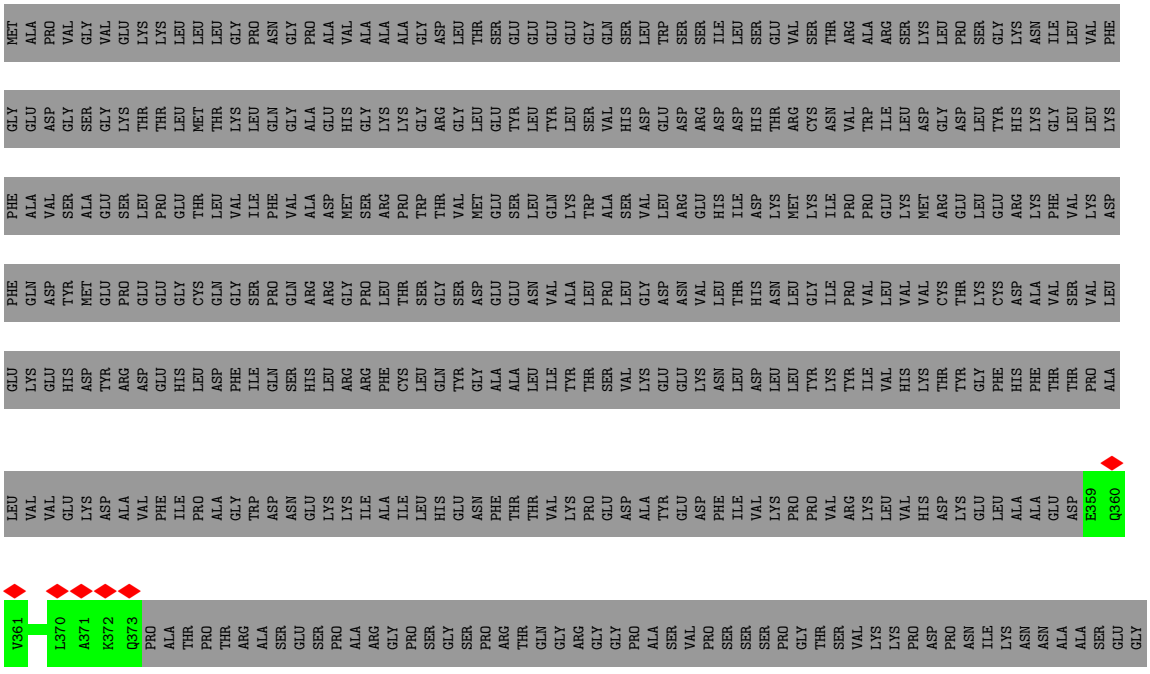
Chain j:



• Molecule 14: Cytoplasmic dynein 1 light intermediate chain 2

Chain q:



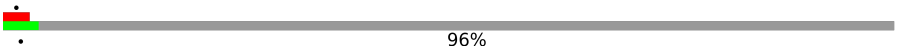


VAL LEU ALA SER PHE PHE ASN SER LEU LEU SER LYS LYS THR GLY SER PRO GLY SER PRO GLY ALA GLY GLY VAL GLN SER THR ALA LYS LYS SER GLY GLN LYS THR VAL LEU SER ASN VAL GLN GLU GLU LEU ASP ARG MET THR ARG LYS PRO ASP SER MET VAL THR ASN SER SER

THR GLU ASN GLU ALA

- Molecule 14: Cytoplasmic dynein 1 light intermediate chain 2

Chain u:



MET ALA PRO VAL GLY VAL GLU LYS LYS LEU LEU LEU GLY PRO ASN GLY PRO ALA VAL ALA ALA ALA GLY ASP LEU THR SER GLU GLU GLU GLU GLY GLN SER LEU TRP SER SER ILE LEU SER GLU VAL SER THR ARG ALA ARG SER LYS LEU PRO SER GLY LYS ASN ILE LEU VAL PHE

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

PHE ALA VAL SER ALA GLU SER LEU PRO GLU THR LEU VAL ILE PHE VAL ALA ASP MET SER ARG PRO TRP THR VAL MET GLU SER LEU GLN LYS TRP ALA SER VAL LEU ARG GLU HIS ILE ASP LYS MET LYS ILE PRO PRO GLU LYS MET ARG GLU LEU GLU ARG LYS PHE VAL LYS ASP

PHE GLN ASP TYR MET GLU PRO GLU GLU GLY CYS GLN GLY SER PRO GLN ARG ARG GLY PRO LEU THR SER GLY SER ASP GLU GLU ASN VAL ALA LEU PRO LEU GLY ASP ASN VAL LEU THR HIS ASN LEU GLY ILE PRO VAL LEU VAL VAL CYS THR LYS CYS ASP ALA VAL SER VAL LEU

GLU LYS GLU HIS ASP TYR ARG ASP GLU HIS LEU ASP PHE ILE GLN SER HIS LEU ARG ARG PHE CYS LEU GLN TYR GLY ALA ALA LEU ILE TYR THR SER VAL LYS GLU GLU LYS ASN LEU ASP LEU LEU TYR LYS TYR ILE VAL HIS LYS THR TYR GLY PHE HIS PHE THR THR PRO ALA

LEU VAL VAL GLU LYS ASP ALA VAL PHE ILE PRO ALA GLY TRP ASP ASN GLU LYS LYS ILE ALA ILE LEU HIS GLU ASN PHE THR THR VAL LYS PRO GLU ASP ALA TYR GLU ASP PHE ILE VAL LYS PRO PRO VAL ARG LYS LEU VAL HIS ASP LYS GLU LEU ALA A356 E357 Q360 V361

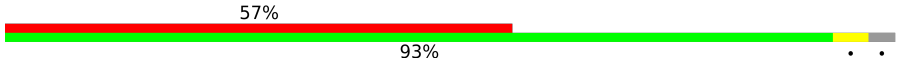
F362 L363 M364 K365 Q366 Q367 S368 L369 L370 A371 K372 Q373 PRO ALA THR PRO THR ARG ALA SER GLU SER PRO ALA ARG GLY PRO SER GLY SER PRO ARG THR GLN GLY ARG GLY GLY PRO ALA SER VAL PRO SER SER SER PRO GLY THR SER VAL LYS LYS PRO ASP PRO ASN ILE LYS ASN

ASN ALA ALA SER GLU GLY VAL LEU ALA SER PHE PHE ASN SER LEU LEU SER LYS LYS THR GLY SER PRO GLY SER PRO GLY ALA ALA GLY GLY VAL GLN SER THR ALA LYS LYS SER GLY GLN LYS THR VAL LEU SER ASN VAL GLN GLU GLU LEU ASP ARG MET THR ARG LYS PRO ASP SER

MET VAL THR ASN SER SER THR GLU ASN GLU ALA

- Molecule 15: Dynein light chain roadblock-type 1

Chain s:



MET ALA E3 V4 E5 E6 T7 L8 K9 R10 L11 Q12 S13 Q14 K15 G16 V17 Q18 G19 I20 I21 V22 V23 N24 T25 E26 G27 I28 P29 I30 K31 S32 T33 M34 D35 N36 T40 S44 K52 S55 T56 V57 R58 D59 I60 D61 F62 Q63 N64 D65 L66 T67 F68 A81 F82

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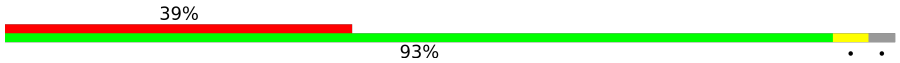
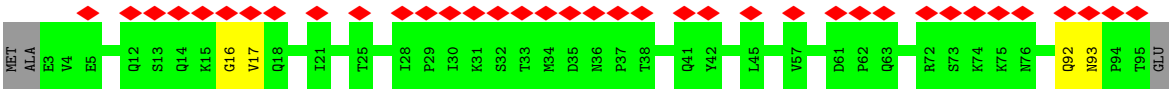
- Molecule 15: Dynein light chain roadblock-type 1

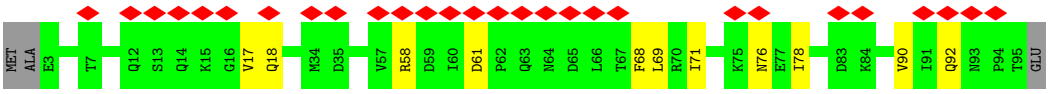
Chain t:





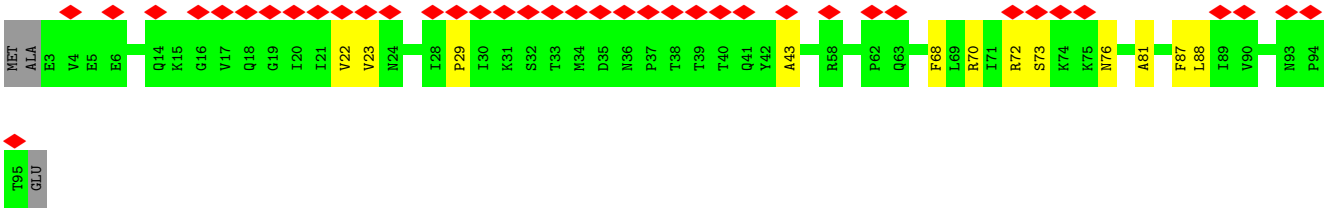
• Molecule 15: Dynein light chain roadblock-type 1

Chain w:



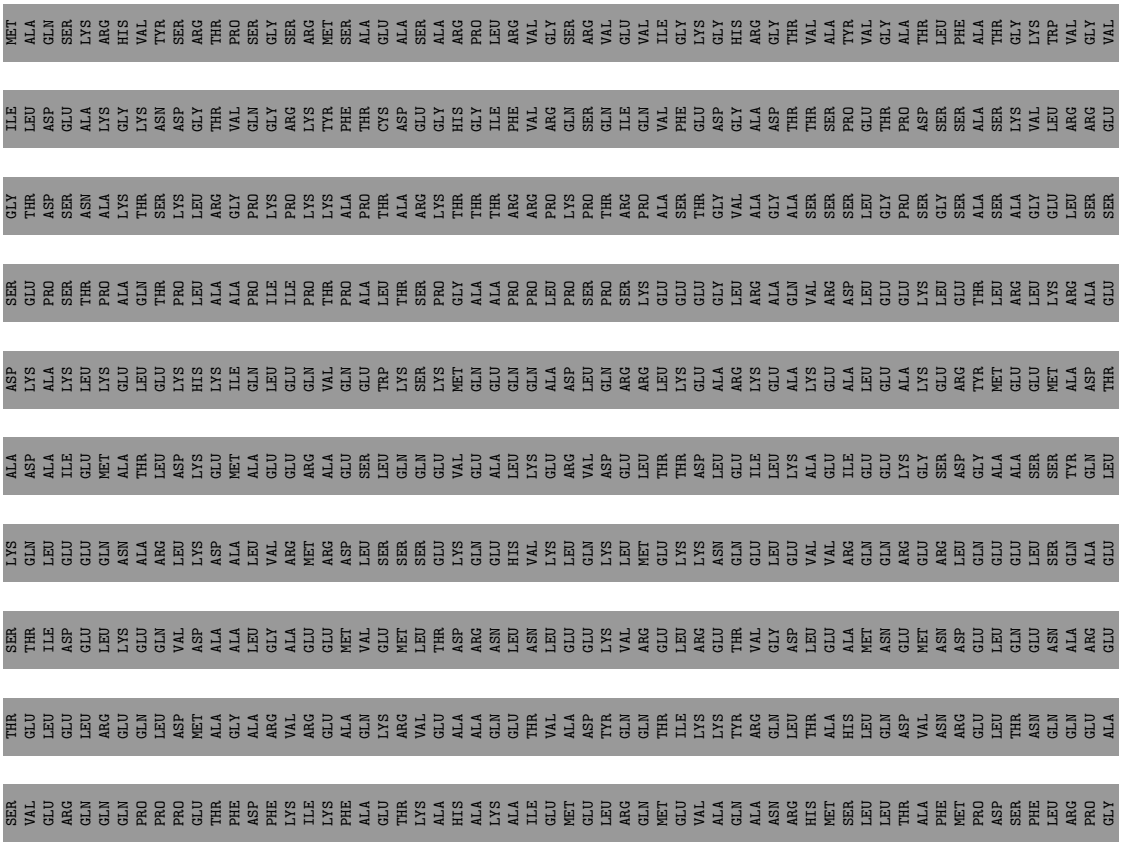
• Molecule 15: Dynein light chain roadblock-type 1

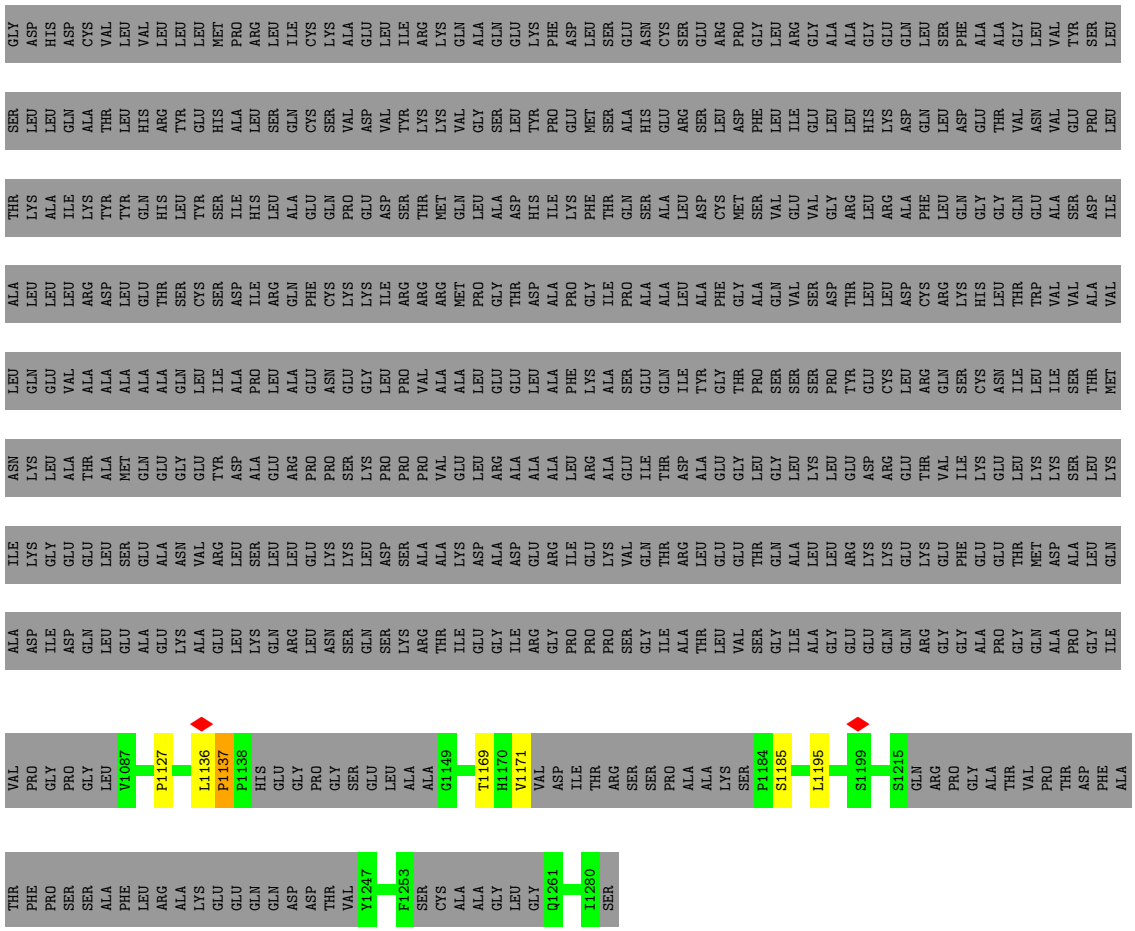
Chain z:



• Molecule 16: Dynactin subunit 1

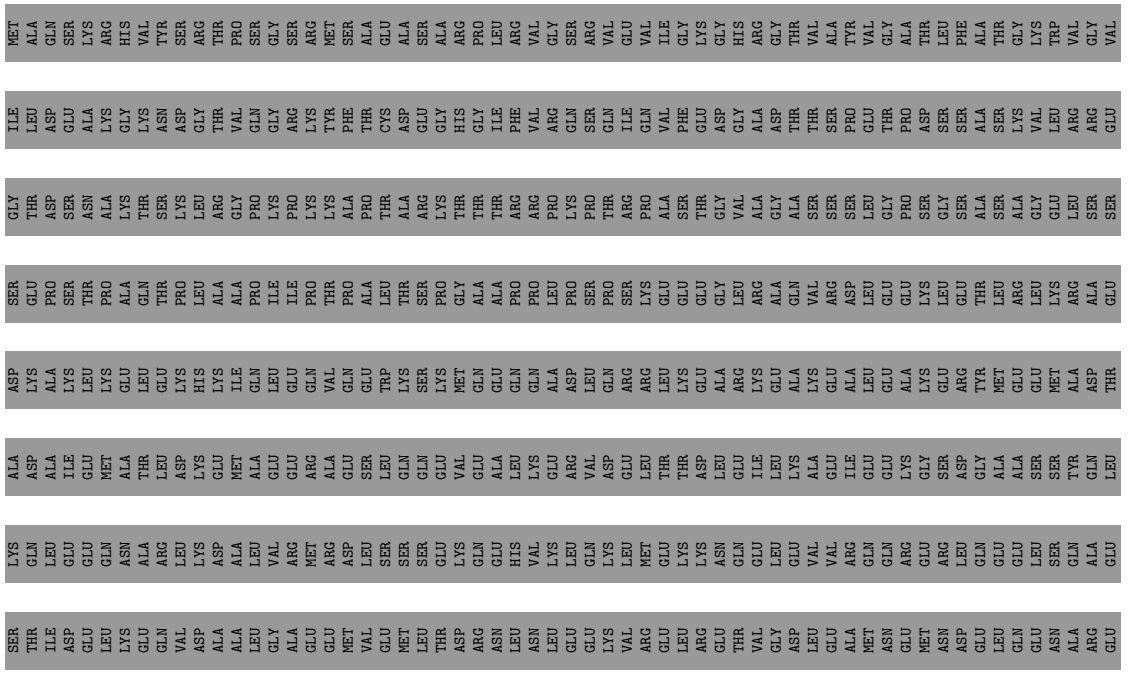
Chain S:

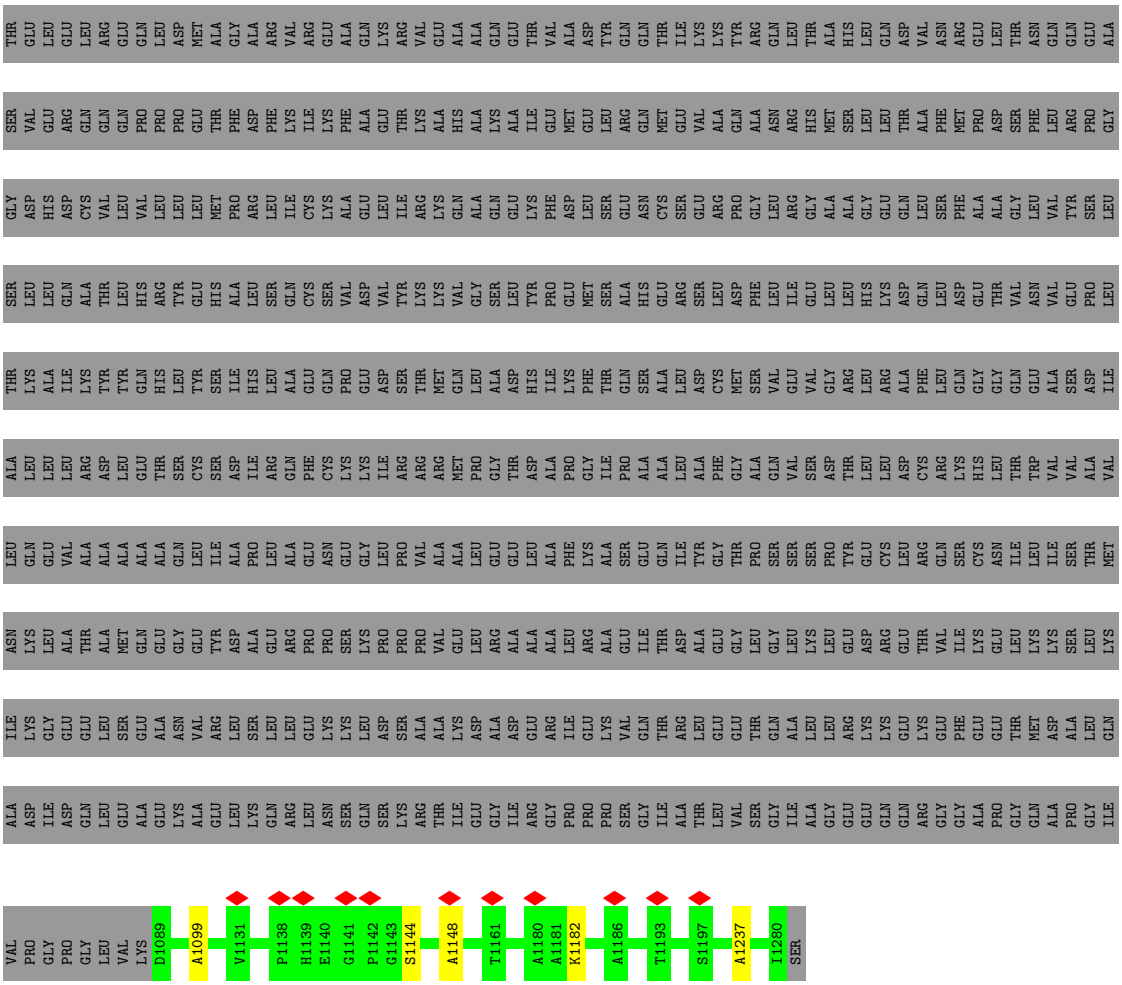




- Molecule 16: Dynactin subunit 1

Chain T:




VAL PRO GLY PRO GLY LEU VAL LYS D1089 A1099 V1131 P1138 H1139 E1140 G1141 P1142 G1143 S1144 A1148 T1161 A1180 A1181 K1182 A1186 T1193 S1197 A1237 I1280 SER

4 Experimental information (i)

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	8092	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	TFS KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/Å^2$)	40	Depositor
Minimum defocus (nm)	1200	Depositor
Maximum defocus (nm)	2200	Depositor
Magnification	Not provided	
Image detector	GATAN K3 BIOQUANTUM (6k x 4k)	Depositor
Maximum map value	2.195	Depositor
Minimum map value	-0.758	Depositor
Average map value	0.001	Depositor
Map value standard deviation	0.072	Depositor
Recommended contour level	0.4	Depositor
Map size (Å)	878.39996, 878.39996, 878.39996	wwPDB
Map dimensions	488, 488, 488	wwPDB
Map angles (°)	90.0, 90.0, 90.0	wwPDB
Pixel spacing (Å)	1.8, 1.8, 1.8	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: ATP, ZN, ADP

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	g	0.12	0/1944	0.34	0/2704
1	h	0.12	0/1953	0.37	0/2716
1	o	0.12	0/1944	0.36	0/2704
1	p	0.30	0/1978	0.70	0/2751
2	1	0.29	0/1019	0.66	0/1421
2	2	0.25	0/959	0.64	1/1336 (0.1%)
3	A	0.19	0/1821	0.66	0/2531
3	B	0.21	0/1821	0.67	0/2531
3	C	0.35	0/1846	0.80	4/2566 (0.2%)
3	D	0.19	0/1821	0.60	0/2531
3	E	0.47	1/1821 (0.1%)	0.68	3/2531 (0.1%)
3	F	0.19	0/1821	0.62	0/2531
3	G	0.16	0/1821	0.56	0/2531
3	I	0.16	0/1821	0.56	0/2531
4	H	0.16	0/1821	0.55	0/2531
5	J	0.15	0/1867	0.53	0/2596
6	K	0.15	0/1377	0.51	0/1919
7	L	0.24	0/1326	0.59	0/1844
8	M	0.12	0/1317	0.42	0/1836
8	N	0.11	0/1389	0.40	0/1933
8	P	0.16	0/1703	0.53	0/2373
8	Q	0.33	1/1609 (0.1%)	0.61	0/2240
8	V	0.15	0/367	0.52	0/507
9	O	0.19	0/843	0.60	2/1175 (0.2%)
9	R	0.20	0/887	0.59	0/1236
10	U	0.16	0/830	0.45	0/1151
11	W	0.12	0/880	0.35	0/1222
12	Y	0.17	0/1858	0.51	2/2586 (0.1%)
13	e	0.15	0/4002	0.46	1/5581 (0.0%)
13	f	0.18	1/5044 (0.0%)	0.46	0/7035
13	m	0.19	1/3943 (0.0%)	0.51	0/5498
13	n	0.16	1/3690 (0.0%)	0.45	0/5145

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	#|Z| >5	RMSZ	#|Z| >5
14	j	0.14	0/1463	0.39	0/2036
14	q	0.10	0/74	0.34	0/102
14	u	0.15	0/89	0.48	0/123
15	s	0.16	0/461	0.50	0/642
15	t	0.15	0/461	0.39	0/642
15	w	0.13	0/461	0.34	0/642
15	z	0.17	0/461	0.38	0/642
16	S	0.68	0/662	1.36	6/917 (0.7%)
16	T	0.31	0/951	0.76	0/1325
All	All	0.22	5/64226 (0.0%)	0.55	19/89394 (0.0%)

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	E	41	ARG	C-N	17.63	1.51	1.33
8	Q	207	SER	C-N	-9.07	1.21	1.33
13	f	339	PHE	C-N	6.93	1.39	1.33
13	m	339	PHE	C-N	5.20	1.37	1.33
13	n	339	PHE	C-N	5.12	1.45	1.33

The worst 5 of 19 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
16	S	1127	PRO	CA-C-N	8.64	128.27	118.85
16	S	1127	PRO	C-N-CA	8.64	128.27	118.85
3	E	41	ARG	O-C-N	-7.70	114.10	121.57
16	S	1136	LEU	CA-C-N	7.03	127.62	120.38
16	S	1136	LEU	C-N-CA	7.03	127.62	120.38

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts (i)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	g	1946	0	874	18	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	h	1955	0	879	13	0
1	o	1946	0	874	19	0
1	p	1980	0	889	2	0
2	1	1021	0	448	7	0
2	2	962	0	424	1	0
3	A	1822	0	820	14	0
3	B	1822	0	820	23	0
3	C	1847	0	830	2	0
3	D	1822	0	820	15	0
3	E	1822	0	820	7	0
3	F	1822	0	820	12	0
3	G	1822	0	820	9	0
3	I	1822	0	820	8	0
4	H	1822	0	835	15	0
5	J	1868	0	823	12	0
6	K	1378	0	611	7	0
7	L	1327	0	585	4	0
8	M	1320	0	604	2	0
8	N	1394	0	632	6	0
8	P	1707	0	769	12	0
8	Q	1612	0	747	15	0
8	V	369	0	161	1	0
9	O	844	0	385	5	0
9	R	888	0	413	2	0
10	U	832	0	371	10	0
11	W	881	0	379	14	0
12	Y	1863	0	794	23	0
13	e	4004	0	1786	15	0
13	f	5046	0	2235	13	0
13	m	3946	0	1760	6	0
13	n	3693	0	1641	5	0
14	j	1465	0	642	1	0
14	q	75	0	32	0	0
14	u	90	0	41	0	0
15	s	462	0	192	2	0
15	t	462	0	192	4	0
15	w	462	0	192	8	0
15	z	462	0	192	10	0
16	S	667	0	285	4	0
16	T	952	0	434	3	0
17	A	27	0	12	2	0
17	B	27	0	12	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
17	C	27	0	12	0	0
17	D	27	0	12	5	0
17	E	27	0	12	0	0
17	F	27	0	12	0	0
17	G	27	0	12	2	0
17	I	27	0	12	1	0
18	H	31	0	12	2	0
18	J	31	0	12	1	0
19	Y	3	0	0	0	0
All	All	64583	0	28811	304	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 3.

The worst 5 of 304 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:1:406:GLY:HA2	11:W:37:ASN:HA	1.48	0.96
8:P:388:THR:CB	16:S:1171:VAL:CB	2.48	0.90
3:A:154:THR:HA	3:A:171:TYR:HA	1.55	0.89
3:A:153:THR:CB	3:A:172:GLU:HA	2.03	0.87
2:1:213:GLN:O	2:1:217:ARG:N	2.12	0.82

There are no symmetry-related clashes.

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	g	390/612 (64%)	386 (99%)	4 (1%)	0	100 100
1	h	392/612 (64%)	388 (99%)	4 (1%)	0	100 100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	o	390/612 (64%)	380 (97%)	10 (3%)	0	100	100
1	p	397/612 (65%)	383 (96%)	14 (4%)	0	100	100
2	1	201/889 (23%)	195 (97%)	6 (3%)	0	100	100
2	2	187/889 (21%)	187 (100%)	0	0	100	100
3	A	368/376 (98%)	359 (98%)	9 (2%)	0	100	100
3	B	368/376 (98%)	354 (96%)	14 (4%)	0	100	100
3	C	373/376 (99%)	358 (96%)	15 (4%)	0	100	100
3	D	368/376 (98%)	360 (98%)	8 (2%)	0	100	100
3	E	368/376 (98%)	350 (95%)	18 (5%)	0	100	100
3	F	368/376 (98%)	353 (96%)	15 (4%)	0	100	100
3	G	368/376 (98%)	357 (97%)	11 (3%)	0	100	100
3	I	368/376 (98%)	351 (95%)	17 (5%)	0	100	100
4	H	368/375 (98%)	354 (96%)	14 (4%)	0	100	100
5	J	377/417 (90%)	364 (97%)	13 (3%)	0	100	100
6	K	276/286 (96%)	266 (96%)	10 (4%)	0	100	100
7	L	267/272 (98%)	265 (99%)	2 (1%)	0	100	100
8	M	259/405 (64%)	253 (98%)	5 (2%)	1 (0%)	30	68
8	N	270/405 (67%)	262 (97%)	7 (3%)	1 (0%)	30	68
8	P	335/405 (83%)	320 (96%)	15 (4%)	0	100	100
8	Q	319/405 (79%)	310 (97%)	9 (3%)	0	100	100
8	V	71/405 (18%)	69 (97%)	2 (3%)	0	100	100
9	O	168/186 (90%)	159 (95%)	9 (5%)	0	100	100
9	R	177/186 (95%)	164 (93%)	13 (7%)	0	100	100
10	U	165/190 (87%)	154 (93%)	11 (7%)	0	100	100
11	W	177/182 (97%)	172 (97%)	5 (3%)	0	100	100
12	Y	365/467 (78%)	343 (94%)	22 (6%)	0	100	100
13	e	803/4646 (17%)	779 (97%)	23 (3%)	1 (0%)	48	83
13	f	1013/4646 (22%)	989 (98%)	24 (2%)	0	100	100
13	m	789/4646 (17%)	782 (99%)	7 (1%)	0	100	100
13	n	738/4646 (16%)	724 (98%)	14 (2%)	0	100	100
14	j	292/492 (59%)	286 (98%)	6 (2%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
14	q	13/492 (3%)	13 (100%)	0	0	100	100
14	u	16/492 (3%)	16 (100%)	0	0	100	100
15	s	91/96 (95%)	85 (93%)	6 (7%)	0	100	100
15	t	91/96 (95%)	86 (94%)	5 (6%)	0	100	100
15	w	91/96 (95%)	85 (93%)	6 (7%)	0	100	100
15	z	91/96 (95%)	82 (90%)	9 (10%)	0	100	100
16	S	124/1281 (10%)	117 (94%)	6 (5%)	1 (1%)	16	55
16	T	190/1281 (15%)	180 (95%)	9 (5%)	1 (0%)	25	64
All	All	12842/34826 (37%)	12440 (97%)	397 (3%)	5 (0%)	100	100

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
8	M	217	PRO
16	S	1137	PRO
8	N	163	ASP
16	T	1182	LYS
13	e	595	PRO

5.3.2 Protein sidechains (i)

There are no protein residues with a non-rotameric sidechain to report in this entry.

5.3.3 RNA (i)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates (i)

There are no oligosaccharides in this entry.

5.6 Ligand geometry (i)

Of 13 ligands modelled in this entry, 3 are monoatomic - leaving 10 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	$\#\|Z\| > 2$
17	ADP	C	800	-	24,29,29	0.96	1 (4%)	29,45,45	1.45	4 (13%)
18	ATP	H	401	-	26,33,33	0.60	0	31,52,52	0.73	2 (6%)
17	ADP	G	800	-	24,29,29	0.97	1 (4%)	29,45,45	1.41	4 (13%)
17	ADP	F	800	-	24,29,29	0.97	1 (4%)	29,45,45	1.37	4 (13%)
17	ADP	A	800	-	24,29,29	0.96	1 (4%)	29,45,45	1.43	4 (13%)
17	ADP	I	800	-	24,29,29	0.96	1 (4%)	29,45,45	1.45	4 (13%)
17	ADP	D	800	-	24,29,29	0.96	1 (4%)	29,45,45	1.41	4 (13%)
18	ATP	J	800	-	26,33,33	0.59	0	31,52,52	0.76	2 (6%)
17	ADP	E	800	-	24,29,29	0.97	1 (4%)	29,45,45	1.40	4 (13%)
17	ADP	B	800	-	24,29,29	0.96	1 (4%)	29,45,45	1.44	4 (13%)

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
17	ADP	C	800	-	-	2/12/32/32	0/3/3/3
18	ATP	H	401	-	-	10/18/38/38	0/3/3/3
17	ADP	G	800	-	-	6/12/32/32	0/3/3/3
17	ADP	F	800	-	-	2/12/32/32	0/3/3/3
17	ADP	A	800	-	-	1/12/32/32	0/3/3/3
17	ADP	I	800	-	-	4/12/32/32	0/3/3/3
17	ADP	D	800	-	-	7/12/32/32	0/3/3/3
18	ATP	J	800	-	-	7/18/38/38	0/3/3/3
17	ADP	E	800	-	-	4/12/32/32	0/3/3/3
17	ADP	B	800	-	-	1/12/32/32	0/3/3/3

The worst 5 of 8 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
17	C	800	ADP	C5-C4	2.57	1.47	1.40
17	G	800	ADP	C5-C4	2.55	1.47	1.40
17	I	800	ADP	C5-C4	2.54	1.47	1.40
17	B	800	ADP	C5-C4	2.52	1.47	1.40
17	E	800	ADP	C5-C4	2.52	1.47	1.40

The worst 5 of 36 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
17	B	800	ADP	PA-O3A-PB	-3.72	120.07	132.83
17	I	800	ADP	PA-O3A-PB	-3.52	120.73	132.83
17	A	800	ADP	PA-O3A-PB	-3.51	120.78	132.83
17	C	800	ADP	C3'-C2'-C1'	3.41	106.11	100.98
17	E	800	ADP	PA-O3A-PB	-3.37	121.25	132.83

There are no chirality outliers.

5 of 44 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
17	D	800	ADP	C5'-O5'-PA-O1A
17	D	800	ADP	C5'-O5'-PA-O2A
17	D	800	ADP	C5'-O5'-PA-O3A
17	E	800	ADP	C5'-O5'-PA-O2A
17	E	800	ADP	C5'-O5'-PA-O3A

There are no ring outliers.

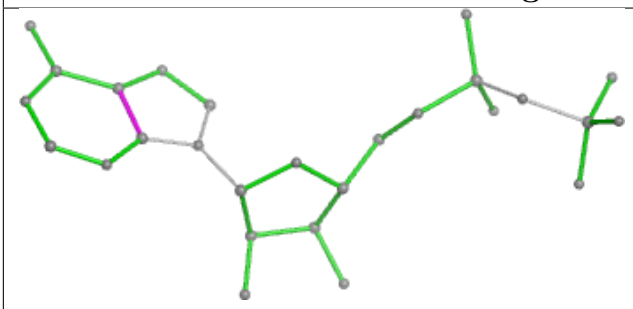
6 monomers are involved in 13 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
18	H	401	ATP	2	0
17	G	800	ADP	2	0
17	A	800	ADP	2	0
17	I	800	ADP	1	0
17	D	800	ADP	5	0
18	J	800	ATP	1	0

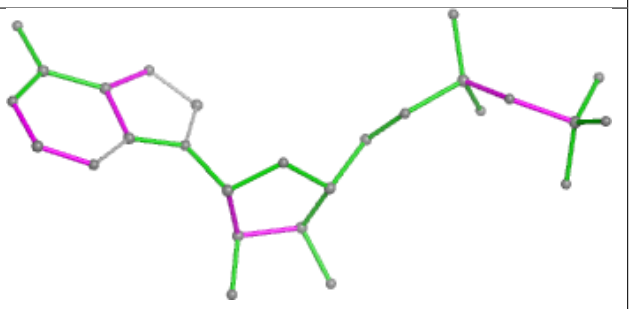
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier.

Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

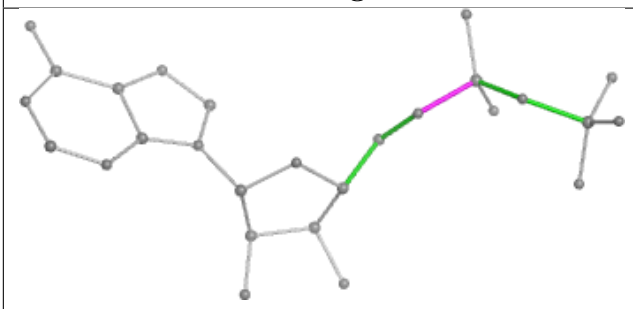
Ligand ADP C 800



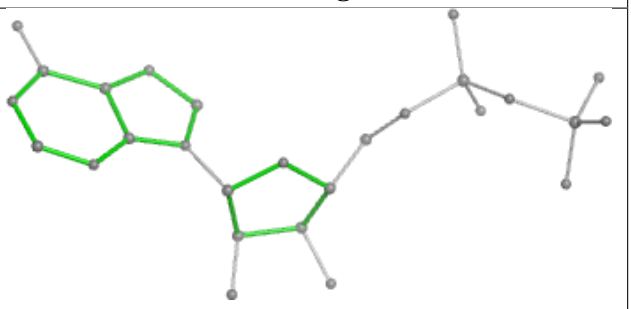
Bond lengths



Bond angles

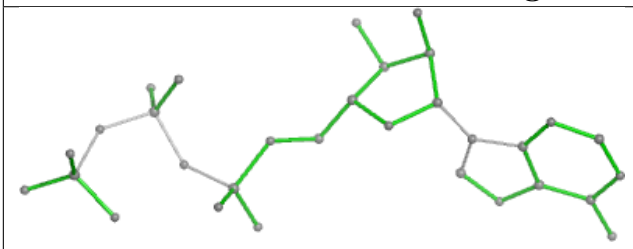


Torsions

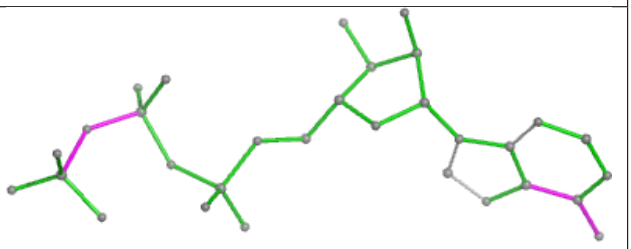


Rings

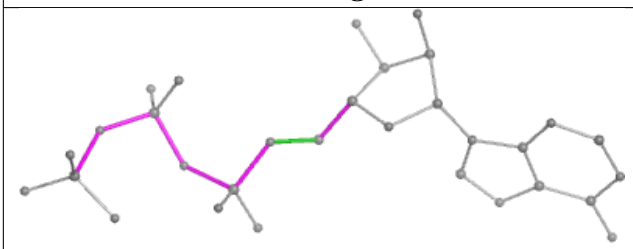
Ligand ATP H 401



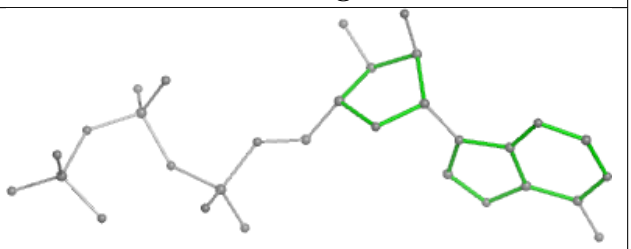
Bond lengths



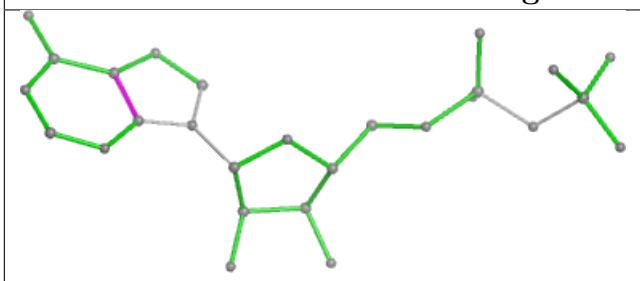
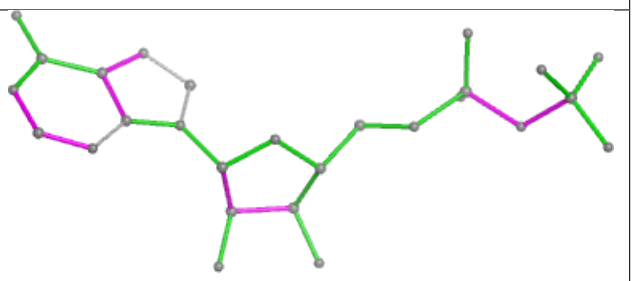
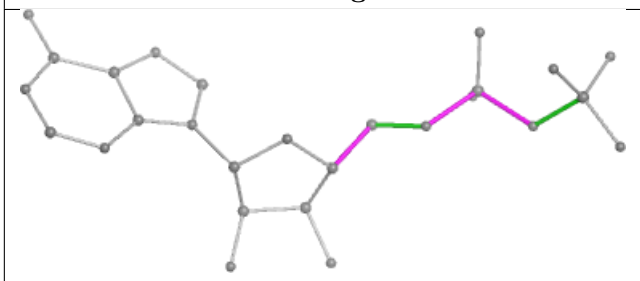
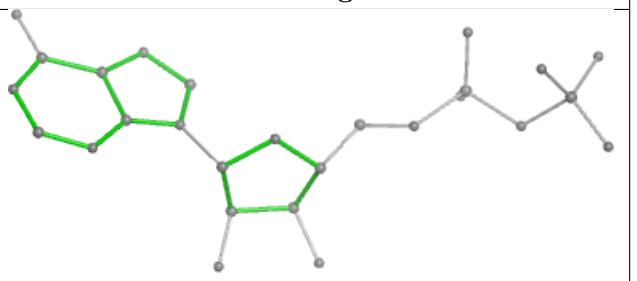
Bond angles

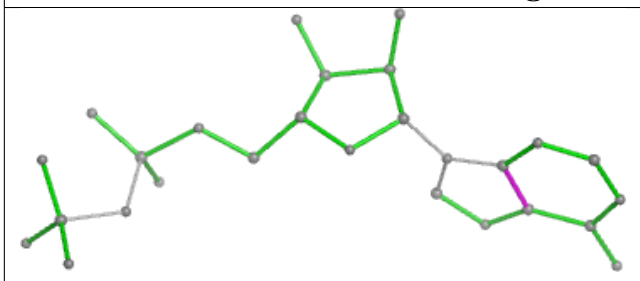
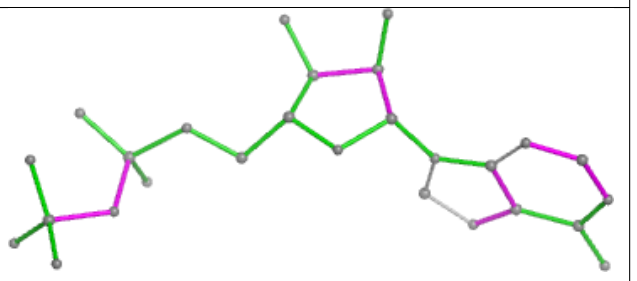
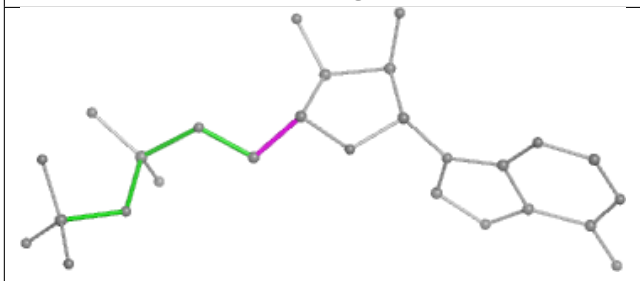
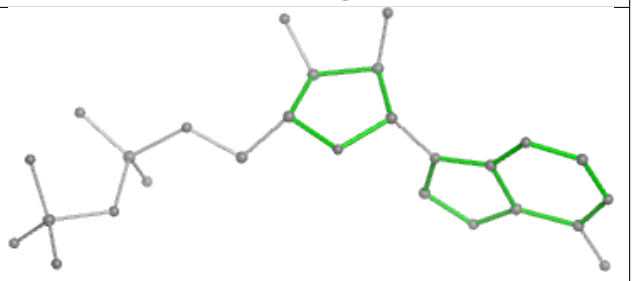


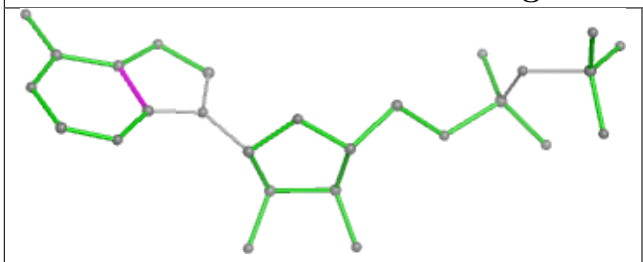
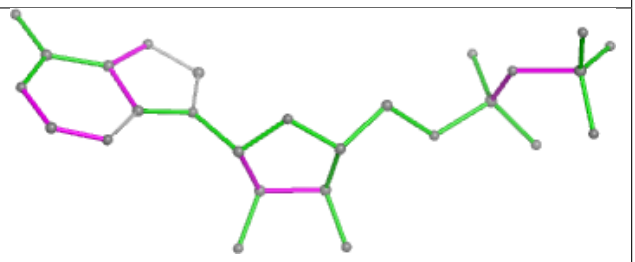
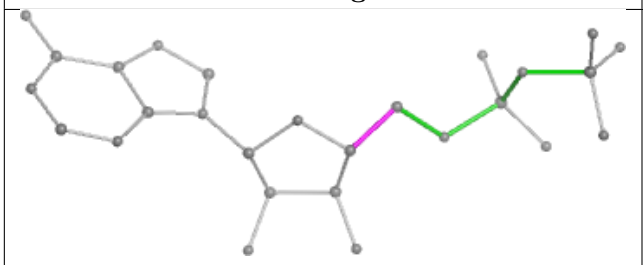
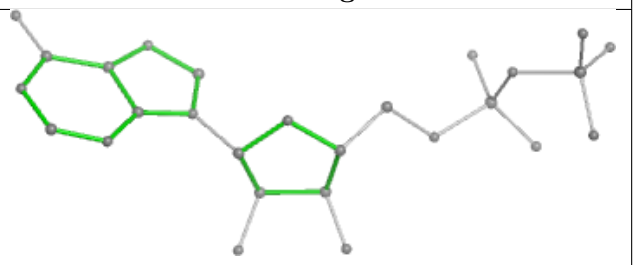
Torsions

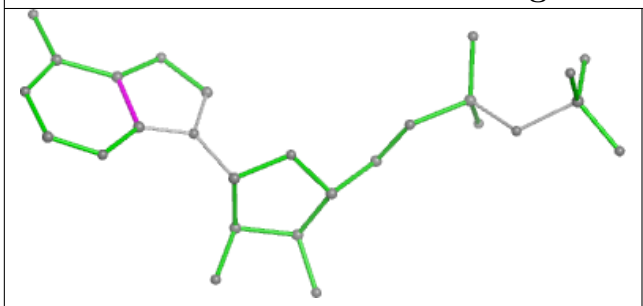
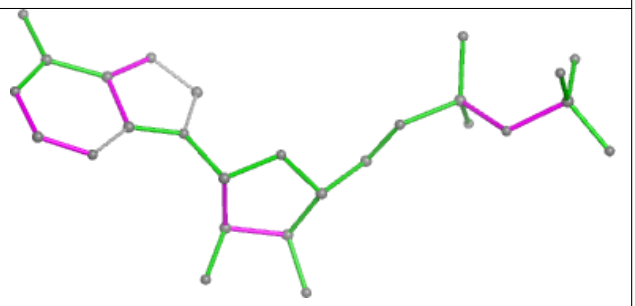
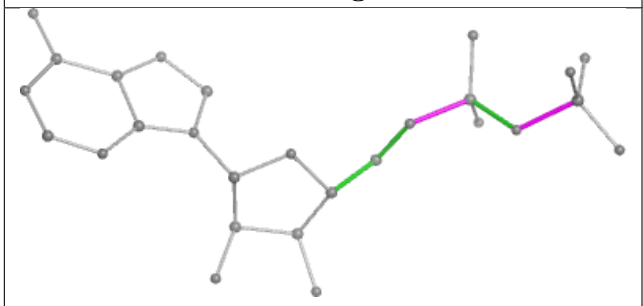
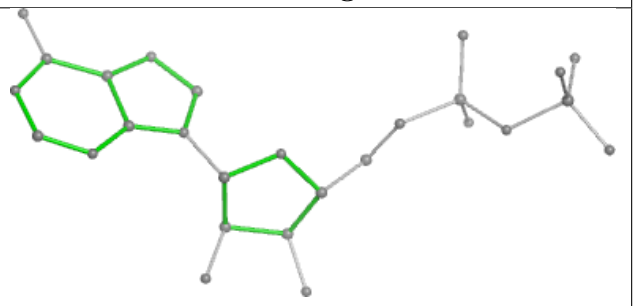


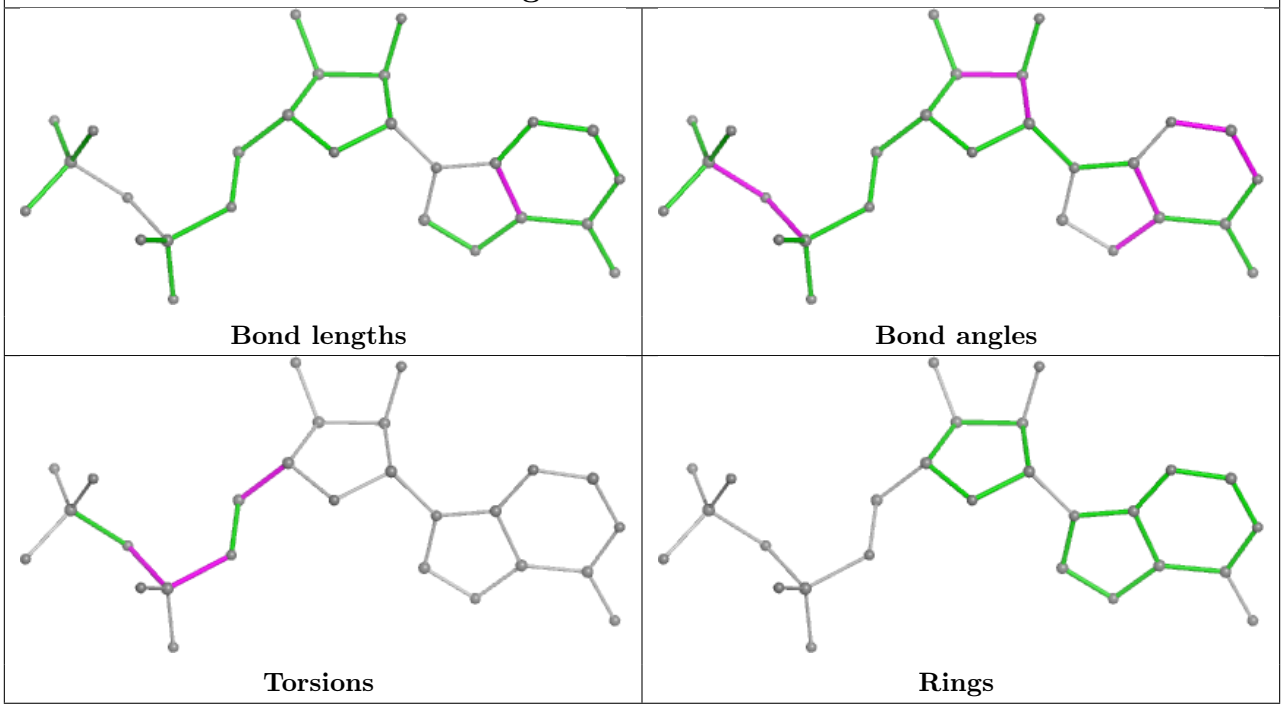
Rings

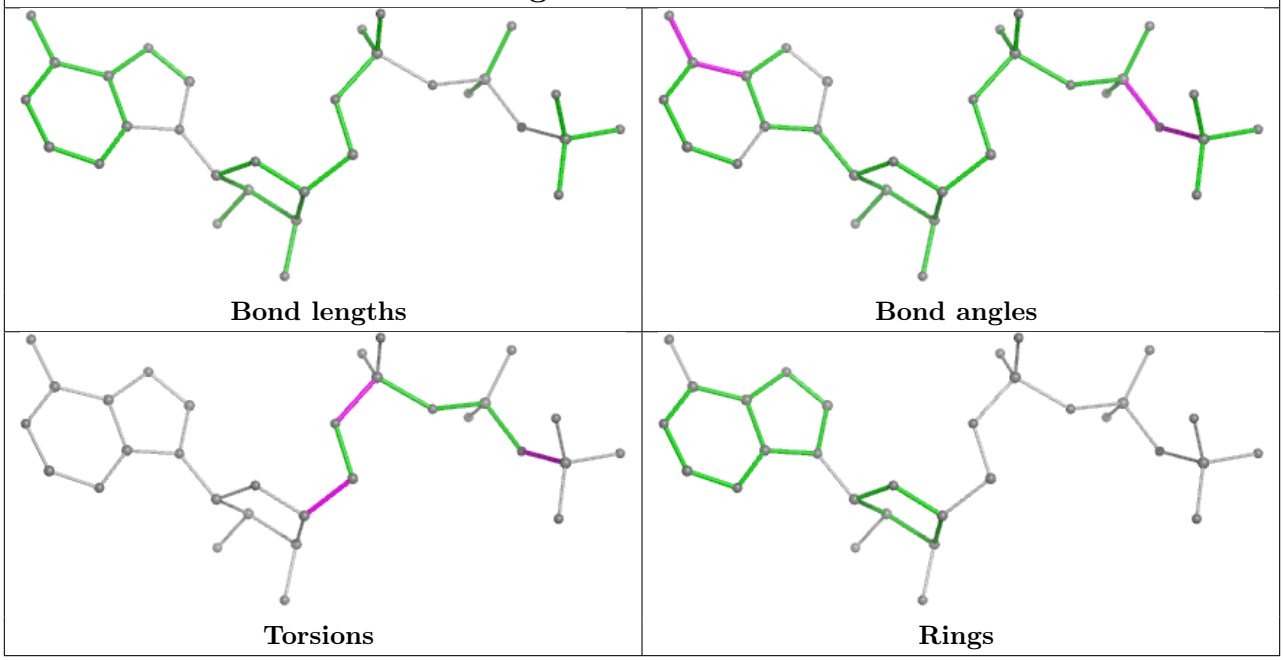
Ligand ADP G 800	
 Bond lengths	 Bond angles
 Torsions	 Rings

Ligand ADP F 800	
 Bond lengths	 Bond angles
 Torsions	 Rings

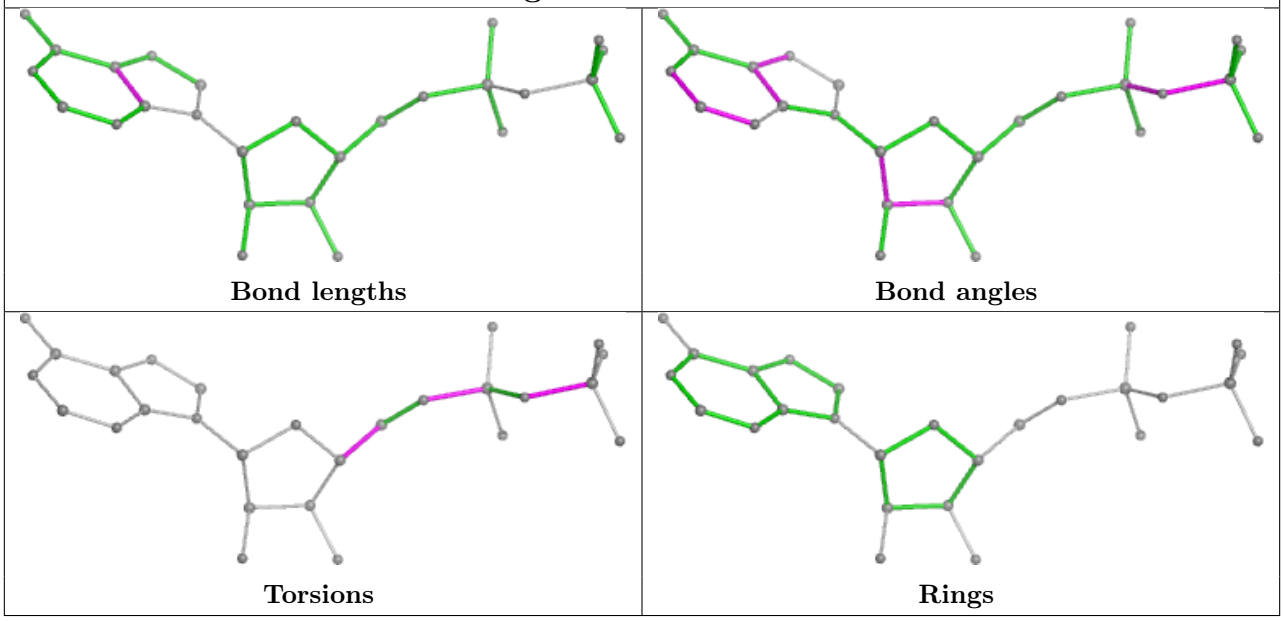
Ligand ADP A 800	
 Bond lengths	 Bond angles
 Torsions	 Rings

Ligand ADP I 800	
 Bond lengths	 Bond angles
 Torsions	 Rings

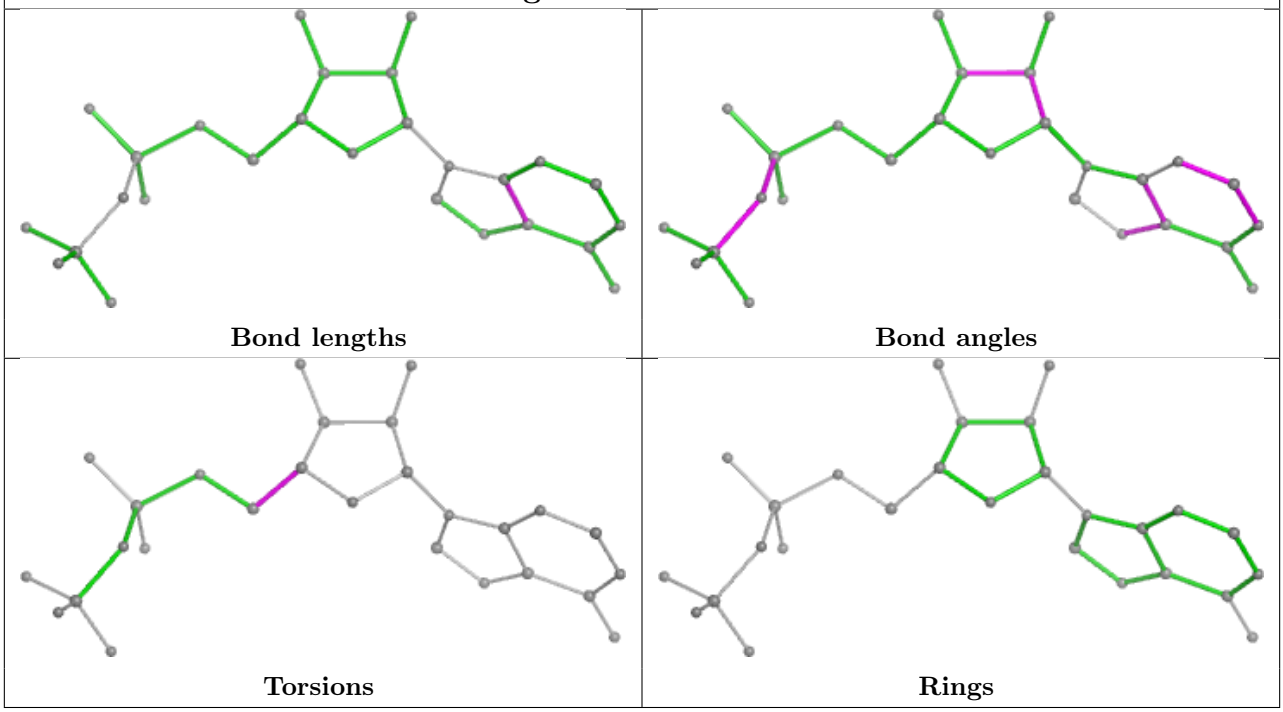
Ligand ADP D 800	
 Bond lengths	Bond angles
Torsions	Rings

Ligand ATP J 800	
 Bond lengths	Bond angles
Torsions	Rings

Ligand ADP E 800



Ligand ADP B 800



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.

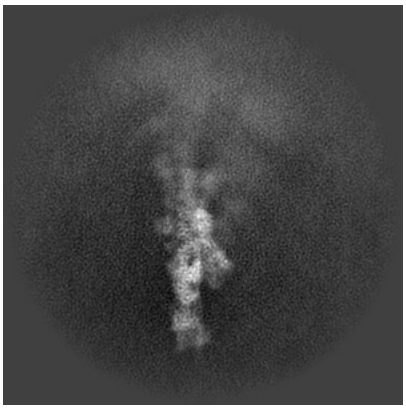
6 Map visualisation (i)

This section contains visualisations of the EMDB entry EMD-52171. These allow visual inspection of the internal detail of the map and identification of artifacts.

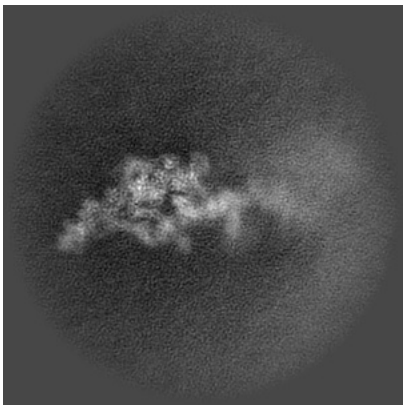
Images derived from a raw map, generated by summing the deposited half-maps, are presented below the corresponding image components of the primary map to allow further visual inspection and comparison with those of the primary map.

6.1 Orthogonal projections (i)

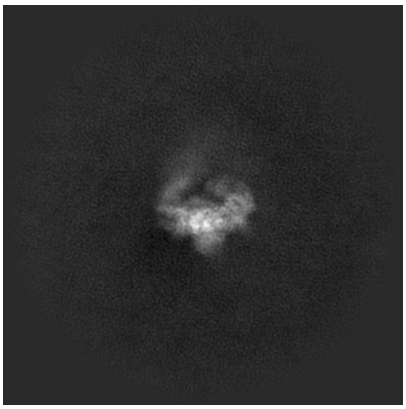
6.1.1 Primary map



X

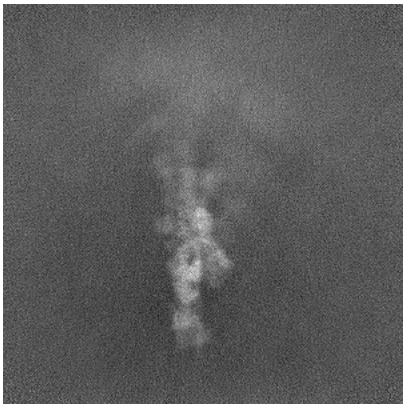


Y

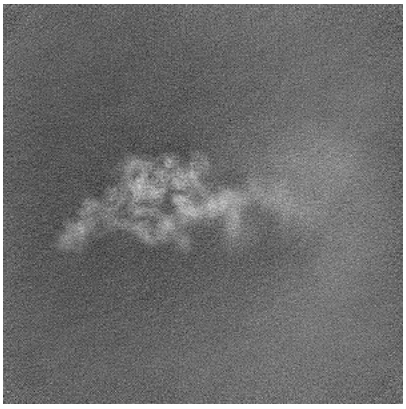


Z

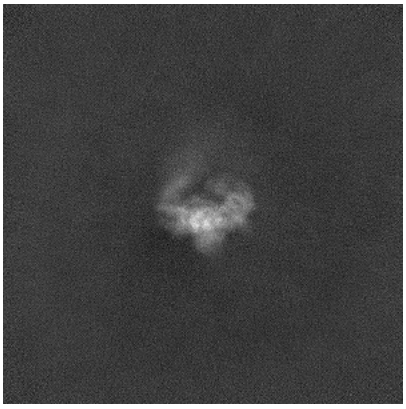
6.1.2 Raw map



X



Y



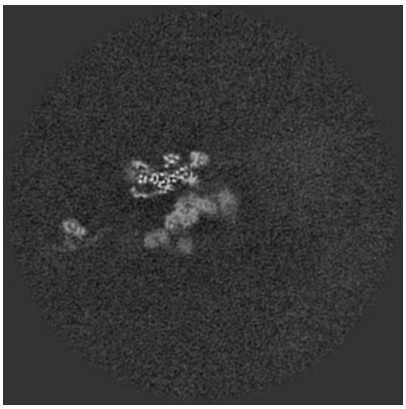
Z

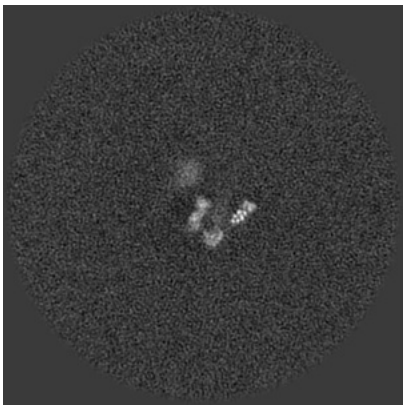
The images above show the map projected in three orthogonal directions.

6.2 Central slices (i)

6.2.1 Primary map

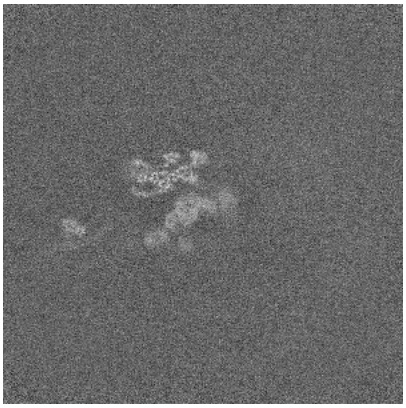
X Index: 244

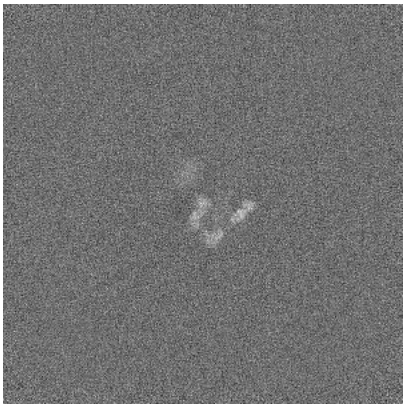

Y Index: 244


Z Index: 244

6.2.2 Raw map

X Index: 244


Y Index: 244

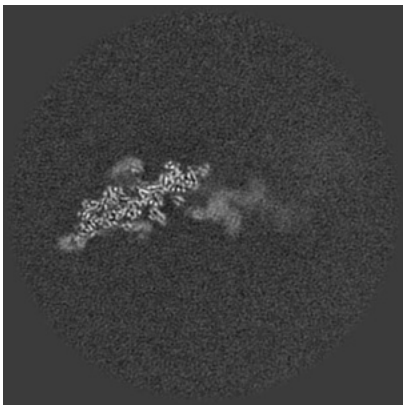

Z Index: 244

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

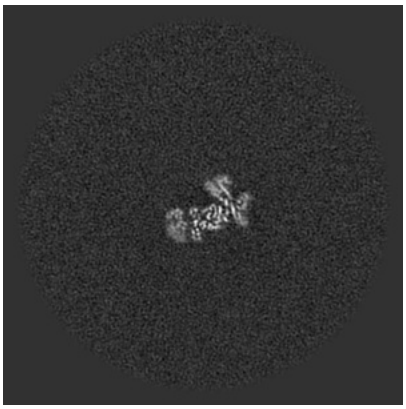
6.3 Largest variance slices (i)

6.3.1 Primary map

X Index: 251

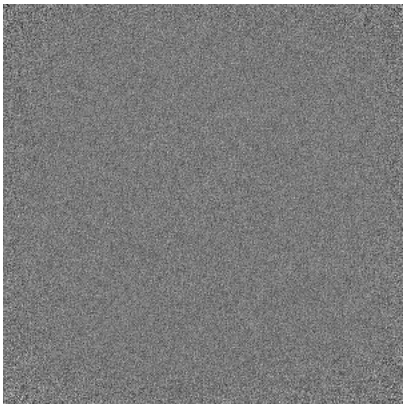


Y Index: 223

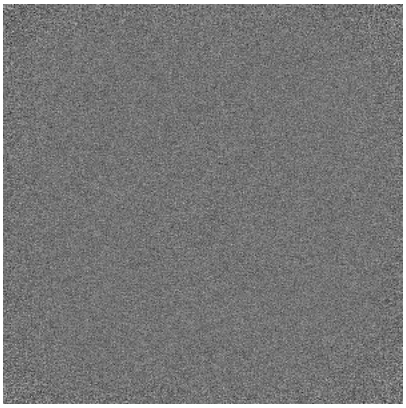


Z Index: 166

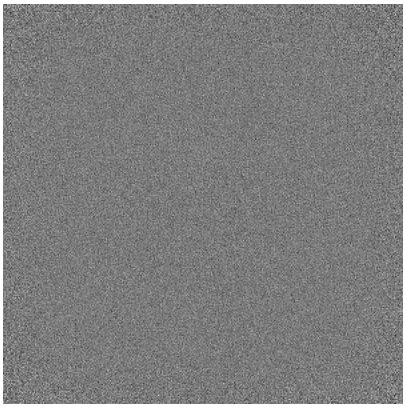
6.3.2 Raw map



X Index: 0



Y Index: 0

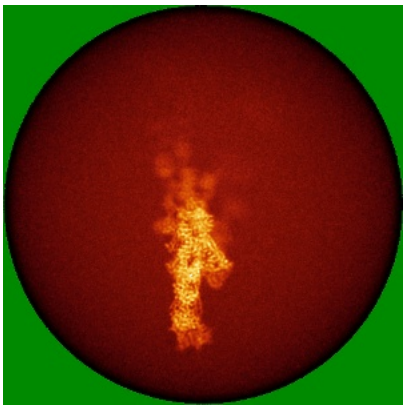


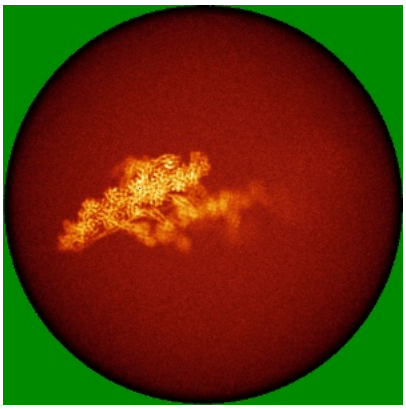
Z Index: 0

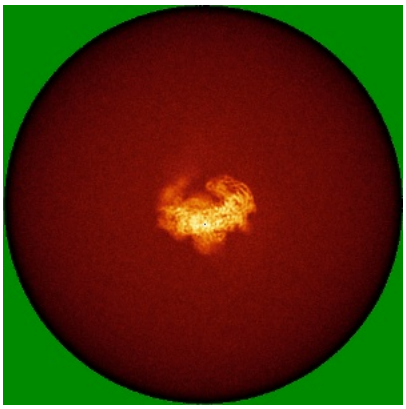
The images above show the largest variance slices of the map in three orthogonal directions.

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

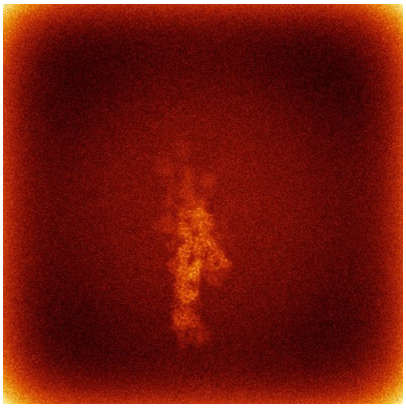
6.4.1 Primary map

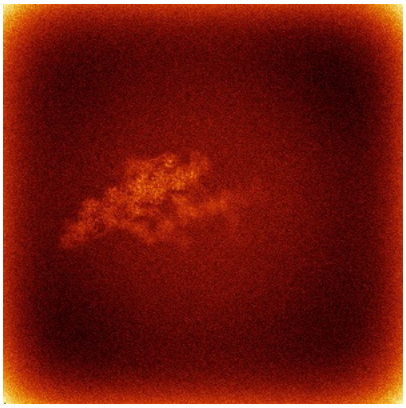

X

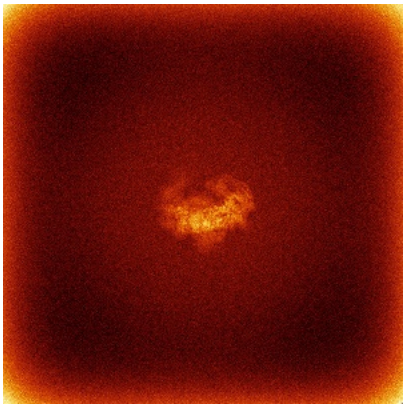

Y


Z

6.4.2 Raw map


X


Y


Z

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

X Y Z

The images above show the 3D surface view of the map at the recommended contour level 0.4. These images, in conjunction with the slice images, may facilitate assessment of whether an appropriate contour level has been provided.

6.5.2 Raw map

X Y Z

These images show the 3D surface of the raw map. The raw map's contour level was selected so that its surface encloses the same volume as the primary map does at its recommended contour level.

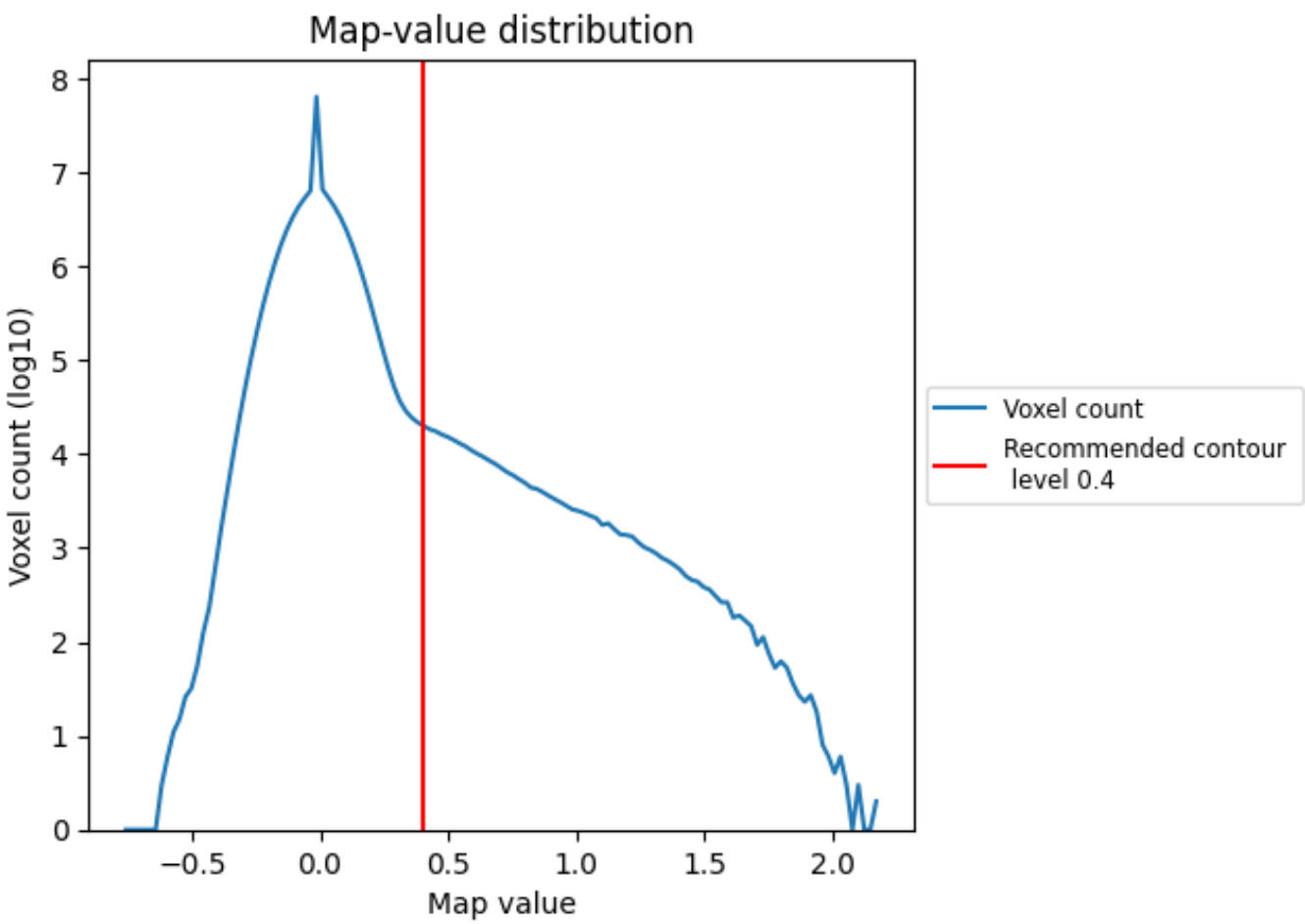
6.6 Mask visualisation (i)

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

7 Map analysis (i)

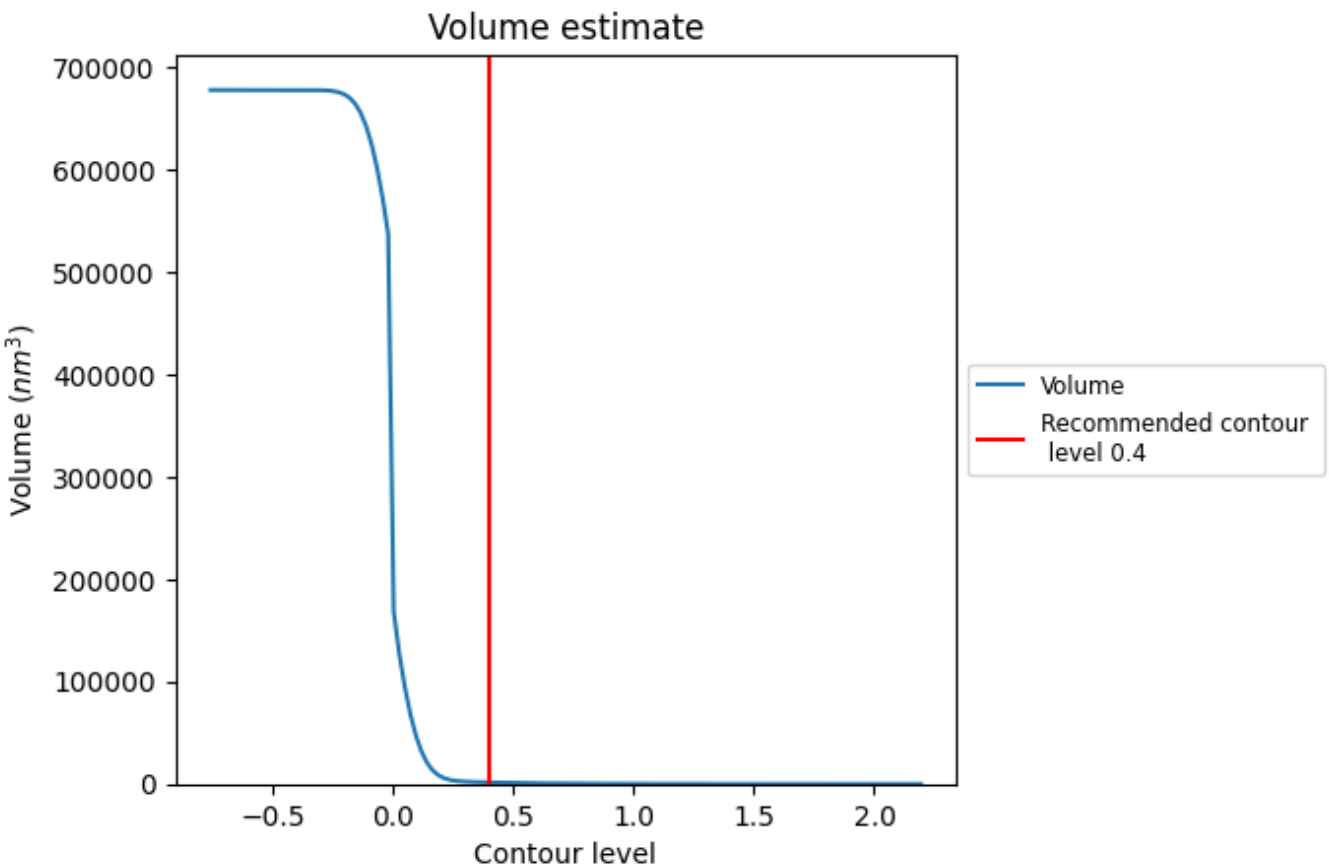
This section contains the results of statistical analysis of the map.

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.

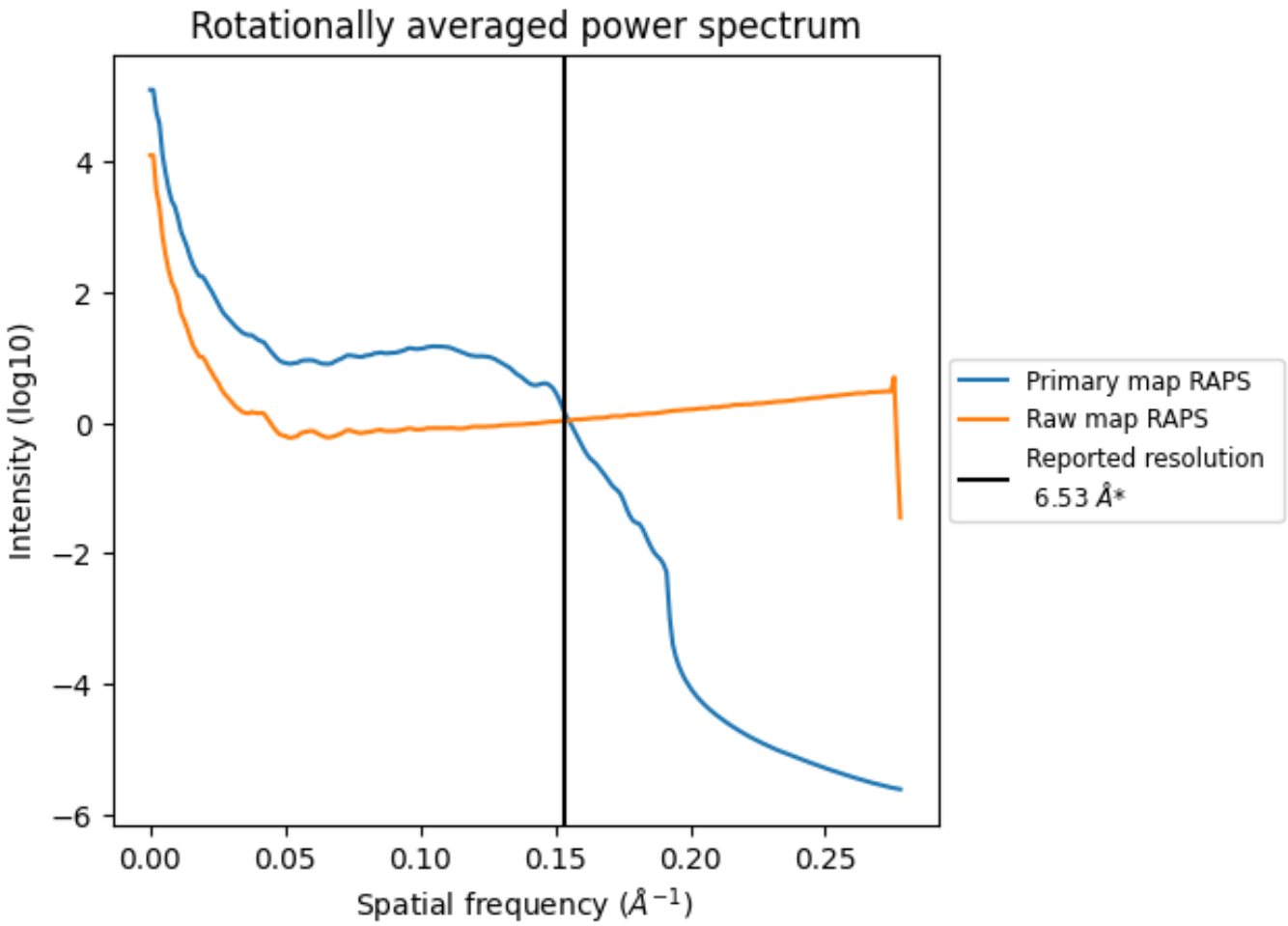
7.2 Volume estimate (i)



The volume at the recommended contour level is 1541 nm^3; this corresponds to an approximate mass of 1392 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)

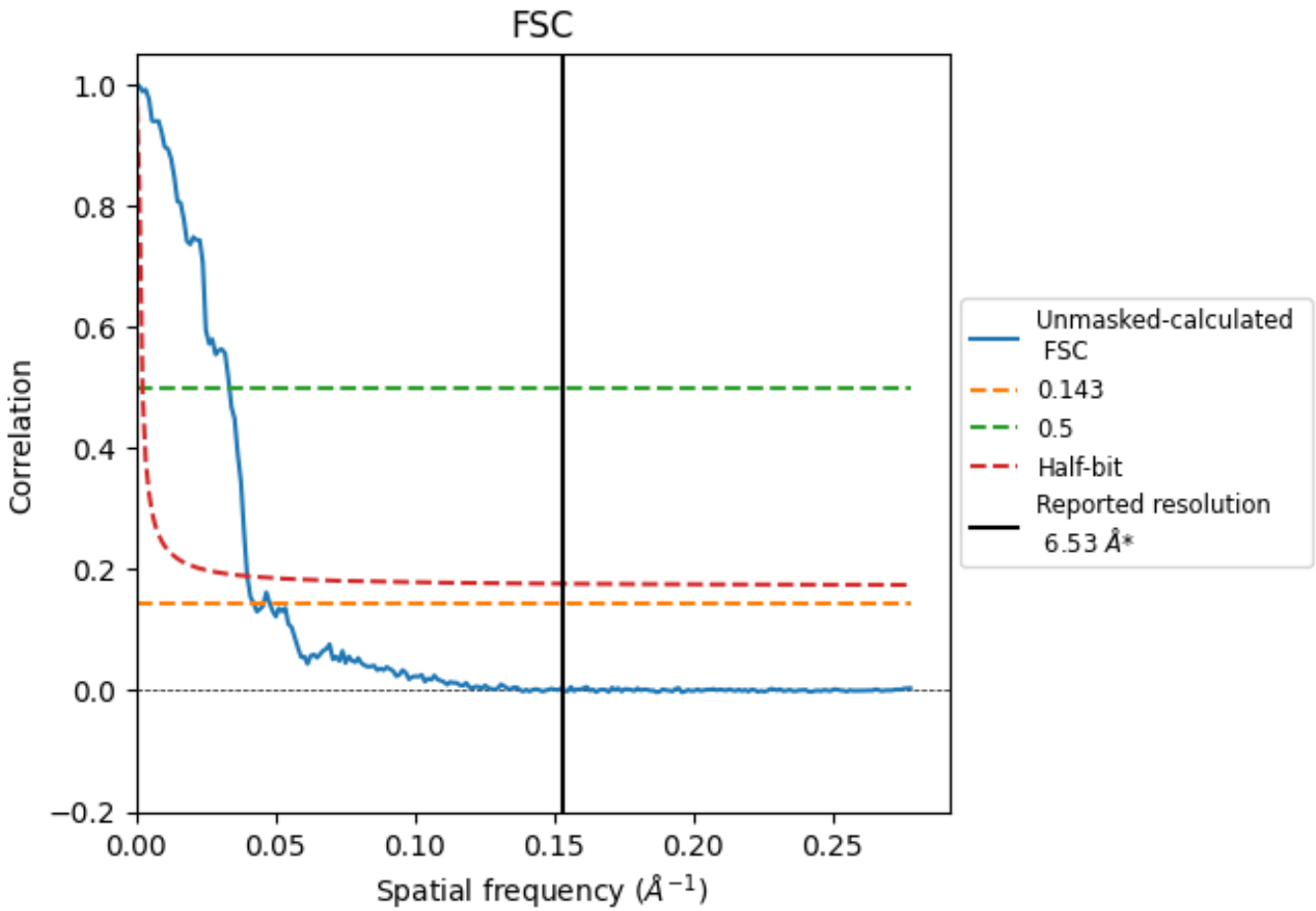


*Reported resolution corresponds to spatial frequency of 0.153 Å^{-1}

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 0.153 Å^{-1}

8.2 Resolution estimates (i)

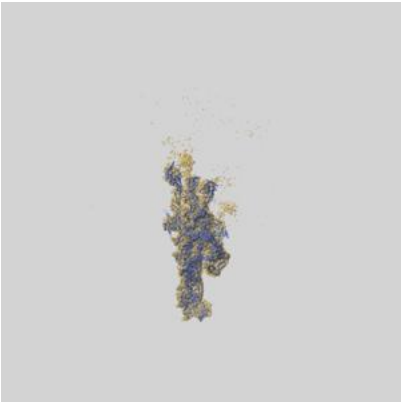
Resolution estimate (Å)	Estimation criterion (FSC cut-off)		
	0.143	0.5	Half-bit
Reported by author	6.53	-	-
Author-provided FSC curve	-	-	-
Unmasked-calculated*	23.70	29.94	25.06

*Resolution estimate based on FSC curve calculated by comparison of deposited half-maps. The value from deposited half-maps intersecting FSC 0.143 CUT-OFF 23.70 differs from the reported value 6.53 by more than 10 %

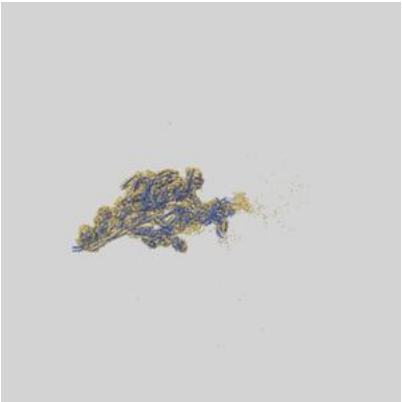
9 Map-model fit (i)

This section contains information regarding the fit between EMDB map EMD-52171 and PDB model 9HHL. Per-residue inclusion information can be found in section 3 on page 12.

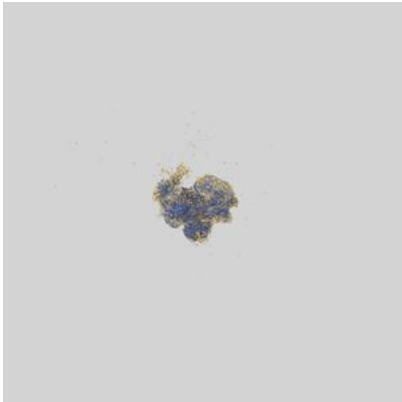
9.1 Map-model overlay (i)



X



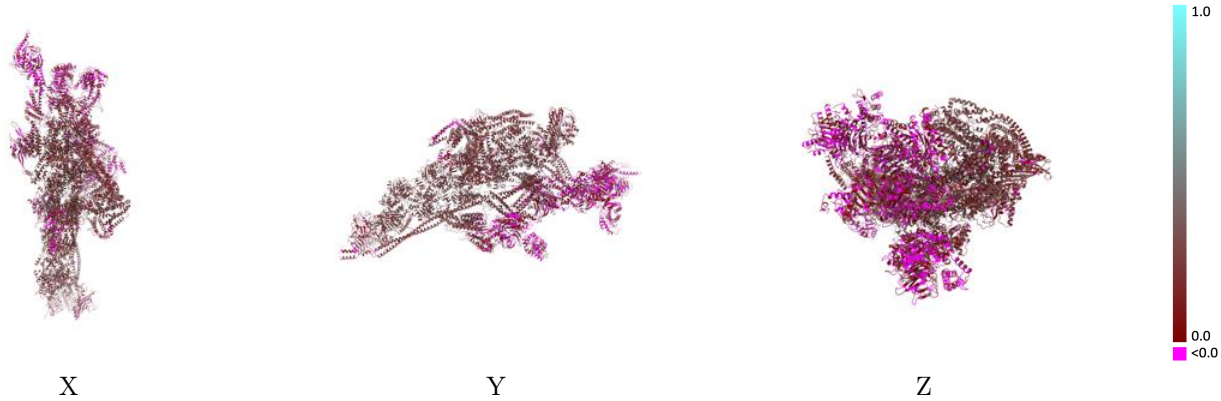
Y



Z

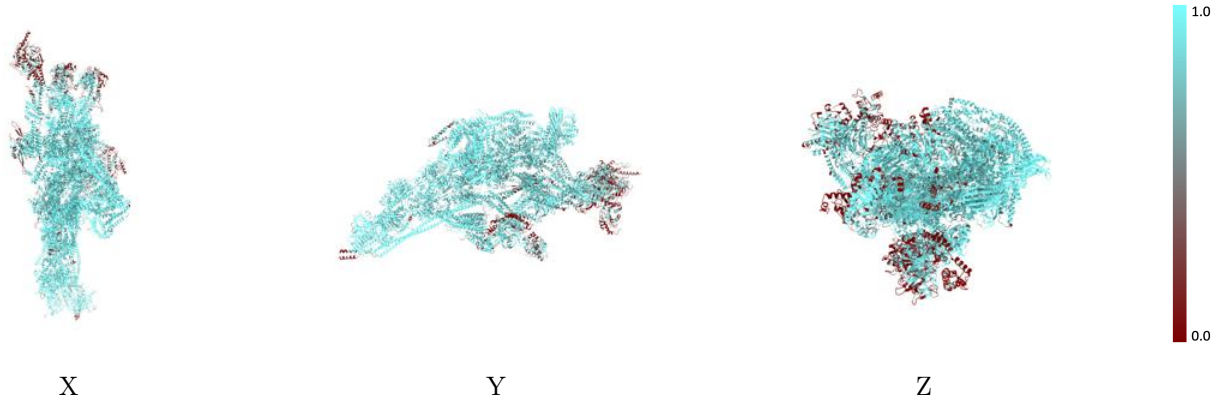
The images above show the 3D surface view of the map at the recommended contour level 0.4 at 50% transparency in yellow overlaid with a ribbon representation of the model coloured in blue. These images allow for the visual assessment of the quality of fit between the atomic model and the map.

9.2 Q-score mapped to coordinate model (i)



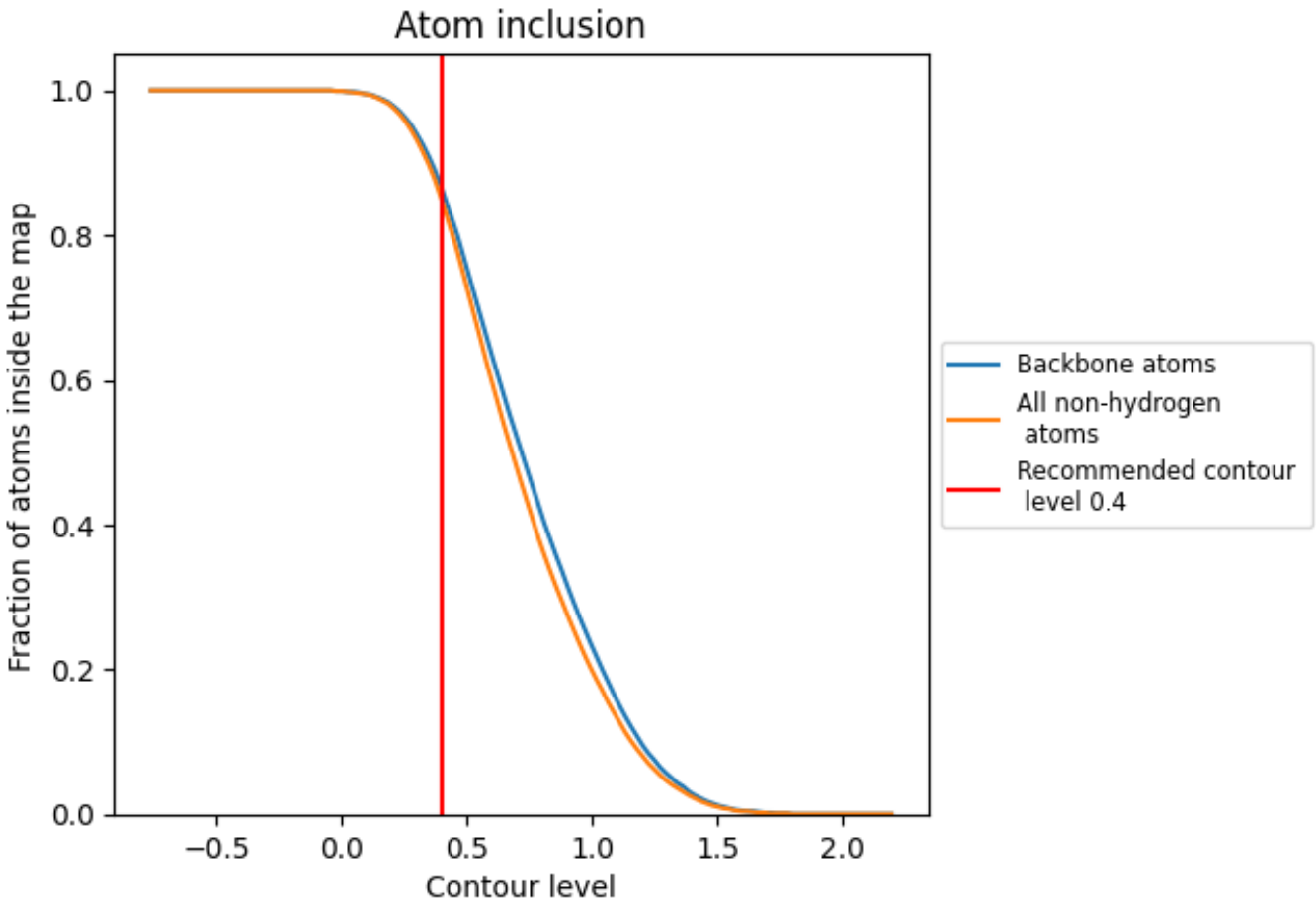
The images above show the model with each residue coloured according its Q-score. This shows their resolvability in the map with higher Q-score values reflecting better resolvability. Please note: Q-score is calculating the resolvability of atoms, and thus high values are only expected at resolutions 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 (0.4).

9.4 Atom inclusion (i)



At the recommended contour level, 87% of all backbone atoms, 85% of all non-hydrogen atoms, are inside the map.

9.5 Map-model fit summary (i)

The table lists the average atom inclusion at the recommended contour level (0.4) and Q-score for the entire model and for each chain.

Chain	Atom inclusion	Q-score
All	0.8500	0.1820
1	0.8750	0.2260
2	0.8470	0.2370
A	0.9350	0.2240
B	0.9600	0.2420
C	0.9620	0.2430
D	0.9780	0.2620
E	0.9850	0.2690
F	0.9870	0.2710
G	0.9860	0.2690
H	0.9830	0.2740
I	0.9660	0.2570
J	0.9750	0.2570
K	0.9640	0.2080
L	0.9550	0.2370
M	0.8950	0.2020
N	0.8970	0.1900
O	0.9680	0.2120
P	0.8930	0.2300
Q	0.9520	0.2480
R	0.9540	0.2080
S	0.9730	0.2140
T	0.9080	0.2190
U	0.9240	0.1740
V	0.9730	0.2950
W	0.9500	0.1840
Y	0.9200	0.2120
e	0.7730	0.1540
f	0.8340	0.1670
g	0.7310	0.0350
h	0.8970	0.1160
j	0.6180	0.0570
m	0.8020	0.1460
n	0.6270	0.1060
o	0.7520	0.0530

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Chain	Atom inclusion	Q-score
p	0.4010	0.0390
q	0.6000	0.1290
s	0.4180	0.0560
t	0.5910	0.0880
u	0.1110	-0.0180
w	0.6930	0.0120
z	0.5430	0.0260