WORLDWIDE wwPDB PROTEIN DATA BANK

wwPDB X-ray Structure Validation Summary Report ⓘ

Jun 24, 2024 – 10:35 AM EDT

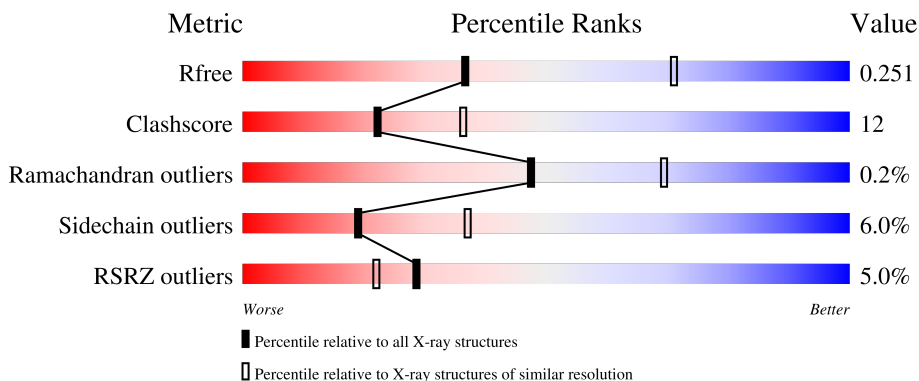|		
PDB ID	:	6QD6
Title	:	Molecular scaffolds expand the nanobody toolkit for cryo-EM applications: crystal structure of Mb-cHopQ-Nb207
Authors	:	Uchanski, T.; Masiulis, S.; Fischer, B.; Kalichuk, V.; Wohlkonig, A.; Zogg, T.; Remaut, H.; Vranken, W.; Aricescu, A.R.; Pardon, E.; Steyaert, J.
Deposited on	:	2018-12-31
Resolution	:	2.84 Å(reported)

1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.84 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)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	1031 (2.86-2.82)
Clashscore	141614	1078 (2.86-2.82)
Ramachandran outliers	138981	1050 (2.86-2.82)
Sidechain outliers	138945	1051 (2.86-2.82)
RSRZ outliers	127900	1019 (2.86-2.82)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower 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 electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	542	2% 69% 13% • 17%
1	B	542	5% 68% 13% • 18%
1	C	542	3% 59% 19% • 20%
1	D	542	2% 68% 13% • 18%
1	E	542	4% 64% 17% • 17%

Continued on next page...

Continued from previous page...

Mol	Chain	Length	Quality of chain
1	F	542	3% 65% 18% · 16%
1	G	542	5% 65% 20% · 13%
1	H	542	7% 61% 12% · 26%
1	I	542	4% 64% 12% · 23%
1	J	542	5% 52% 15% · 30%

2 Entry composition ⓘ

There are 3 unique types of molecules in this entry. The entry contains 33077 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, 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 Mb-cHopQ-Nb207,Outer membrane protein,Mb-cHopQ-Nb207,Outer membrane protein,Mb-cHopQ-Nb207.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	448	Total	C	N	O	S	0	0	0
			3409	2107	603	686	13			
1	B	446	Total	C	N	O	S	0	0	0
			3372	2081	594	682	15			
1	C	431	Total	C	N	O	S	0	0	0
			3263	2015	573	660	15			
1	D	446	Total	C	N	O	S	0	0	0
			3384	2090	598	683	13			
1	E	451	Total	C	N	O	S	0	0	0
			3406	2103	599	689	15			
1	F	457	Total	C	N	O	S	0	0	0
			3465	2144	606	702	13			
1	G	469	Total	C	N	O	S	0	0	0
			3561	2197	626	723	15			
1	H	399	Total	C	N	O	S	0	0	0
			3015	1868	525	609	13			
1	I	419	Total	C	N	O	S	0	0	0
			3187	1976	558	640	13			
1	J	380	Total	C	N	O	S	0	0	0
			2900	1795	508	584	13			

- Molecule 2 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Cl	0	0
			1	1		

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	18	Total	O	0	0
			18	18		

Continued on next page...

Continued from previous page...

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	B	15	Total 15	O 15	0	0
3	C	11	Total 11	O 11	0	0
3	D	12	Total 12	O 12	0	0
3	E	8	Total 8	O 8	0	0
3	F	14	Total 14	O 14	0	0
3	G	14	Total 14	O 14	0	0
3	H	5	Total 5	O 5	0	0
3	I	12	Total 12	O 12	0	0
3	J	5	Total 5	O 5	0	0

3 Residue-property plots ⓘ

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron 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 dot above a residue indicates a poor fit to the electron density (RSRZ > 2). 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: Mb-cHopQ-Nb207,Outer membrane protein,Mb-cHopQ-Nb207,Outer membrane protein,Mb-cHopQ-Nb207

- Molecule 1: Mb-cHopQ-Nb207,Outer membrane protein,Mb-cHopQ-Nb207,Outer membrane protein,Mb-cHopQ-Nb207

• Molecule 1: Mb-cHopQ-Nb207,Outer membrane protein,Mb-cHopQ-Nb207,Outer membrane pr
otein,Mb-cHopQ-Nb207

Chain C:

• Molecule 1: Mb-cHopQ-Nb207,Outer membrane protein,Mb-cHopQ-Nb207,Outer membrane pr
otein,Mb-cHopQ-Nb207

Chain D:

S532 HIS HIS HIS HIS HIS GLU PRO GLU ALA

• Molecule 1: Mb-cHopQ-Nb207,Outer membrane protein,Mb-cHopQ-Nb207,Outer membrane protein,Mb-cHopQ-Nb207

Chain E:

4%

64%　　　　17%　　17%

GLN V2 Q3 L4 L11 V12 T17 T18 S19 D26 L30 A34 Q35 I47 L48 I49 A50 LYS SER SER SER ASN GLY GLY THR ASN ASN A62 P65 K74 N75 S76 C77 A78 G81 I91 Q95 N107 N111 I112 THR GLN HIS ASN L118

N119 L120 N121 S122 P123 S124 S125 L126 L144 V150 E151 G160 K163 D164 Y165 K168 C169 D170 A171 S172 A173 I174 S175 S176 M181 Q182 N183 Q184 K185 N186 G189 N190 G194 L201 L202 K203 T204 I216 L222 A223 N224 T225 L226 I227 GLN GLU LEU GLY ASN

ASN PRO PHE ARG ALA SER GLY GLY GLY SER GLY GLY GLY SER GLY LYS LEU SER ASP THR TYR GLU GLN LEU SER ARG LEU THR ASN ASP ASN GLY THR ASN SER LYS THR S272 A273 Q274 A275 I276 N277 V280 L283 K288 A302 T303 A306 L307 R308 S309 V310
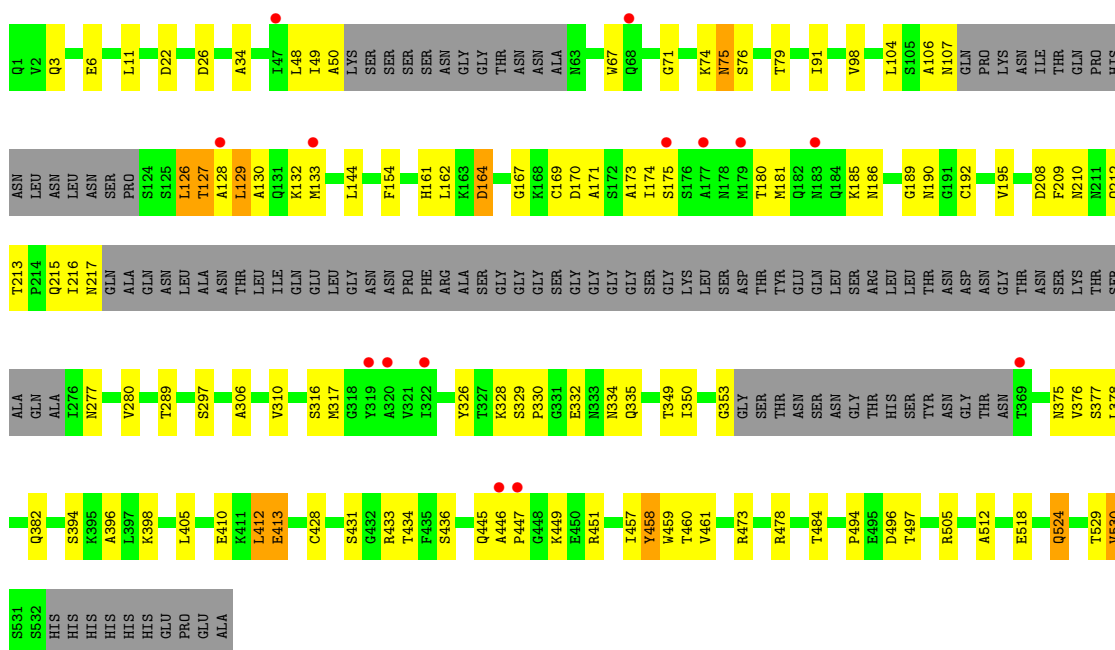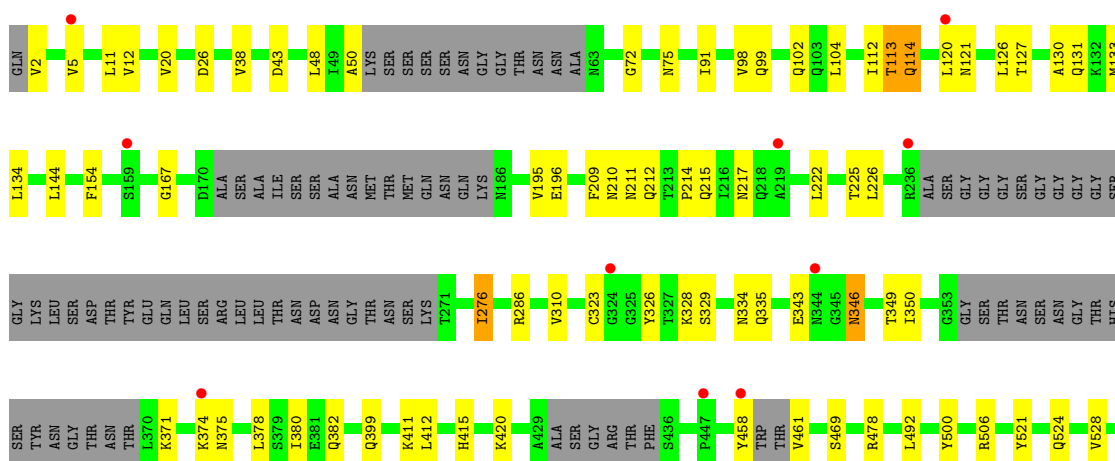
Y319 Y326 S329 P330 G331 E332 Q335 K336 D337 G347 T348 T349 I350 N351 C352 GLY SER THR ASN SER ASN GLY THR HIS SER TYR ASN GLY THR ASN T369 L378 Q382 K398 Q399 L402 L405 L412 T418 G432 ARG THR PHE SER T437

M440 G441 W442 A446 K449 Y458 W459 T460 V461 K471 G472 R473 R478 I476 S477 N483 S491 L492 K493 P494 T497 Y500 A504 R505 R506 N517 E518 Y519 D520 Y521 Q524 G525 V528 T529 V530 S531 S532 HIS HIS HIS HIS HIS GLU PRO GLU ALA

• Molecule 1: Mb-cHopQ-Nb207,Outer membrane protein,Mb-cHopQ-Nb207,Outer membrane protein,Mb-cHopQ-Nb207

Chain F:

3%

65%　　　　18%　　16%

GLN V2 Q3 L11 T17 T23 D26 A27 Q28 A34 C45 P46 I47 L48 I49 A50 LYS SER SER SER ASN GLY GLY THR ASN ASN ALA ASN T64 P65 S66 W67 Q68 T69 A70 N75 S76 C77 G81 F84 S85 A86 I91 V98 Q102 S105

Q108 P109 K110 P115 H116 N117 L118 N119 T127 K132 L144 A147 V150 F154 N155 K156 L157 H161 L162 K163 D164 C169 D170 ALA SER ALA ILE SER SER ALA ASN MET THR MET GLN ASN GLN LYS ASN W188 C192 A193 G194 V195 E196 E197 S200

L201 F209 T213 P214 Q215 I216 N217 Q218 L222 T225 L226 I227 Q228 E229 L230 G231 ASN ASN PRO PHE ARG ALA SER GLY GLY SER GLY GLY GLY SER GLY LYS L250 T253 Y254 L257 L260 L261 T262 ASN ASP ASN GLY THR ASN SER LYS T271 R286

N296 A302 A306 V310 Y319 Y326 N333 D337 T341 G347 T348 T349 I350 G353 GLY SER THR ASN SER ASN GLY THR HIS SER TYR ASN GLY THR ASN T369 L370 K371 A372 D373 V376 I392 A396 Q399 L412 G432 ARG THR PHE S436

A439 F453 G456 I457 Y458 R473 I476 K493 P494 E495 D496 T497 R505 R506 F509 T514 T529 V530 S531 S532 HIS HIS HIS HIS HIS GLU PRO GLU ALA

• Molecule 1: Mb-cHopQ-Nb207,Outer membrane protein,Mb-cHopQ-Nb207,Outer membrane protein,Mb-cHopQ-Nb207

Chain G:

• Molecule 1: Mb-cHopQ-Nb207,Outer membrane protein,Mb-cHopQ-Nb207,Outer membrane pr
otein,Mb-cHopQ-Nb207

Chain H:

• Molecule 1: Mb-cHopQ-Nb207,Outer membrane protein,Mb-cHopQ-Nb207,Outer membrane pr
otein,Mb-cHopQ-Nb207

Chain I:

• Molecule 1: Mb-cHopQ-Nb207,Outer membrane protein,Mb-cHopQ-Nb207,Outer membrane protein,Mb-cHopQ-Nb207

4   Data and refinement statistics   ⓘ

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α, β, γ	71.17Å 92.92Å 244.22Å 92.05° 96.93° 112.15°	Depositor
Resolution (Å)	41.45 – 2.84 44.77 – 2.84	Depositor EDS
% Data completeness (in resolution range)	95.5 (41.45-2.84) 95.4 (44.77-2.84)	Depositor EDS
R_{merge}	0.04	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.86 (at 2.86Å)	Xtriage
Refinement program	BUSTER 2.10.3	Depositor
R, R_{free}	0.204 , 0.239 0.225 , 0.251	Depositor DCC
R_{free} test set	6538 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å^2)	82.3	Xtriage
Anisotropy	0.101	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.31 , 72.5	EDS
L-test for twinning[2]	$< |L| > = 0.49, < L^2 > = 0.33$	Xtriage
Estimated twinning fraction	0.039 for h,-h-k,-h-l	Xtriage
F_o,F_c correlation	0.93	EDS
Total number of atoms	33077	wwPDB-VP
Average B, all atoms (Å^2)	99.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.40% of the height of the origin peak. No significant pseudotranslation is detected.*

---

[1]Intensities estimated from amplitudes.

[2]Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

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: CL

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

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	#$|Z|$ >5	RMSZ	#$|Z|$ >5
1	A	0.50	0/3461	0.73	0/4690
1	B	0.56	0/3419	0.74	0/4625
1	C	0.55	0/3310	0.77	0/4479
1	D	0.51	0/3432	0.74	0/4647
1	E	0.50	0/3453	0.73	0/4676
1	F	0.55	0/3514	0.74	0/4760
1	G	0.52	0/3610	0.74	0/4887
1	H	0.48	0/3051	0.72	0/4124
1	I	0.48	0/3229	0.72	0/4369
1	J	0.53	0/2939	0.73	0/3971
All	All	0.52	0/33418	0.74	0/45228

There are no bond length outliers.

There are no bond angle outliers.

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	A	3409	0	3318	64	0
1	B	3372	0	3291	62	0
1	C	3263	0	3181	77	0

Continued on next page...

Continued from previous page...

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	D	3384	0	3298	48	0
1	E	3406	0	3329	96	0
1	F	3465	0	3388	85	0
1	G	3561	0	3477	122	0
1	H	3015	0	2948	57	0
1	I	3187	0	3118	56	0
1	J	2900	0	2817	104	0
2	A	1	0	0	0	0
3	A	18	0	0	0	0
3	B	15	0	0	0	0
3	C	11	0	0	0	0
3	D	12	0	0	1	0
3	E	8	0	0	3	0
3	F	14	0	0	0	0
3	G	14	0	0	0	0
3	H	5	0	0	0	0
3	I	12	0	0	2	0
3	J	5	0	0	0	0
All	All	33077	0	32165	761	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 12.

The worst 5 of 761 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:J:326:TYR:CD1	1:J:329:SER:HB3	1.50	1.46
1:F:45:CYS:SG	1:F:77:CYS:CB	2.23	1.27
1:J:326:TYR:CG	1:J:329:SER:HB3	1.70	1.26
1:A:45:CYS:SG	1:A:77:CYS:SG	1.45	1.24
1:F:45:CYS:CB	1:F:77:CYS:SG	2.25	1.23

There are no symmetry-related clashes.

5.3   Torsion angles ⓘ

5.3.1   Protein backbone ⓘ

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	436/542 (80%)	417 (96%)	19 (4%)	0	100	100
1	B	432/542 (80%)	412 (95%)	19 (4%)	1 (0%)	47	69
1	C	421/542 (78%)	398 (94%)	21 (5%)	2 (0%)	29	51
1	D	432/542 (80%)	417 (96%)	15 (4%)	0	100	100
1	E	439/542 (81%)	422 (96%)	17 (4%)	0	100	100
1	F	443/542 (82%)	424 (96%)	18 (4%)	1 (0%)	47	69
1	G	457/542 (84%)	441 (96%)	15 (3%)	1 (0%)	47	69
1	H	377/542 (70%)	364 (97%)	12 (3%)	1 (0%)	41	61
1	I	401/542 (74%)	388 (97%)	12 (3%)	1 (0%)	47	69
1	J	364/542 (67%)	350 (96%)	14 (4%)	0	100	100
All	All	4202/5420 (78%)	4033 (96%)	162 (4%)	7 (0%)	47	69

5 of 7 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	H	161	HIS
1	I	47	ILE
1	C	75	ASN
1	F	333	ASN
1	G	507	ARG

5.3.2 Protein sidechains ⓘ

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	366/438 (84%)	351 (96%)	15 (4%)	30	56
1	B	361/438 (82%)	342 (95%)	19 (5%)	22	43
1	C	349/438 (80%)	325 (93%)	24 (7%)	15	31
1	D	364/438 (83%)	342 (94%)	22 (6%)	19	37

Continued on next page...

Continued from previous page...

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	E	365/438 (83%)	346 (95%)	19 (5%)	23	44
1	F	373/438 (85%)	354 (95%)	19 (5%)	24	45
1	G	384/438 (88%)	359 (94%)	25 (6%)	17	33
1	H	325/438 (74%)	305 (94%)	20 (6%)	18	35
1	I	342/438 (78%)	318 (93%)	24 (7%)	15	30
1	J	309/438 (70%)	284 (92%)	25 (8%)	11	24
All	All	3538/4380 (81%)	3326 (94%)	212 (6%)	19	37

5 of 212 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	F	373	ASP
1	H	11	LEU
1	J	346	ASN
1	G	26	ASP
1	G	228	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 109 such sidechains are listed below:

Mol	Chain	Res	Type
1	E	103	GLN
1	F	108	GLN
1	J	28	GLN
1	E	186	ASN
1	E	375	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates ⓘ

There are no monosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 1 ligands modelled in this entry, 1 is monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled 'Q< 0.9' lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2			OWAB(Å^2)	Q<0.9
1	A	448/542 (82%)	0.27	13 (2%)	51	45	56, 89, 132, 163	0
1	B	446/542 (82%)	0.30	29 (6%)	18	13	47, 89, 149, 197	0
1	C	431/542 (79%)	0.19	14 (3%)	47	41	46, 88, 138, 187	0
1	D	446/542 (82%)	0.28	10 (2%)	62	57	54, 89, 135, 160	0
1	E	451/542 (83%)	0.26	24 (5%)	26	20	61, 103, 160, 179	0
1	F	457/542 (84%)	0.18	14 (3%)	49	42	55, 88, 130, 157	0
1	G	469/542 (86%)	0.27	26 (5%)	25	18	59, 95, 144, 178	0
1	H	399/542 (73%)	0.45	38 (9%)	8	4	76, 110, 152, 175	0
1	I	419/542 (77%)	0.35	23 (5%)	25	18	63, 107, 151, 183	0
1	J	380/542 (70%)	0.35	26 (6%)	17	11	69, 110, 152, 184	0
All	All	4346/5420 (80%)	0.29	217 (4%)	28	22	46, 97, 146, 197	0

The worst 5 of 217 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	225	THR	6.3
1	B	185	LYS	6.1
1	H	272	SER	6.1
1	G	176	SER	6.0
1	B	184	GLN	5.4

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

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

6.3 Carbohydrates ⓘ

There are no monosaccharides in this entry.

6.4 Ligands ⓘ

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	CL	A	601	1/1	0.84	0.25	91,91,91,91	0

6.5 Other polymers ⓘ

There are no such residues in this entry.