



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 1, 2026 – 02:21 AM UTC

PDB ID : 7U8J / pdb_00007u8j
Title : Crystal structure of chimeric hemagglutinin cH4/3 in complex with broad protective antibody 31.a.83
Authors : Zhu, X.; Wilson, I.A.
Deposited on : 2022-03-08
Resolution : 4.90 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

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

A user guide is available at

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

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity	:	4-5-2 with Phenix2.0
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

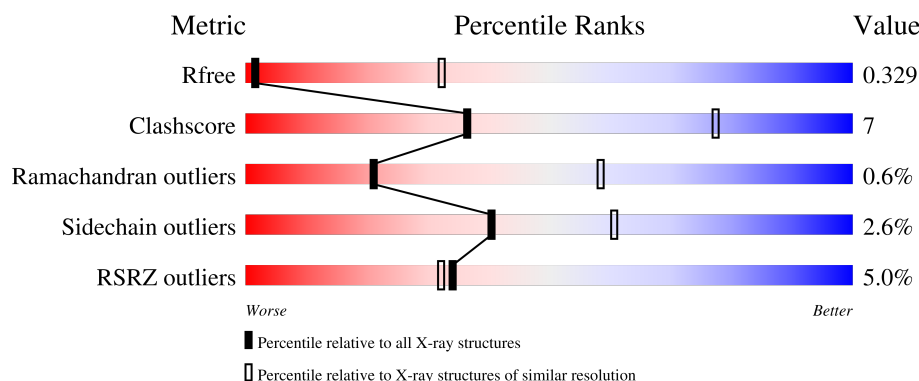
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 4.90 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}	180053	1007 (5.82-3.96)
Clashscore	190562	1020 (5.82-3.98)
Ramachandran outliers	187476	1123 (5.90-3.90)
Sidechain outliers	187428	1103 (5.90-3.90)
RSRZ outliers	180081	1002 (5.82-3.96)

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 $\leq 5\%$. 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	324	8% 85% 10% ..
2	B	179	9% 92% ..
3	L	214	79% 19% .
4	H	234	% 75% 19% ..

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 7121 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 Hemagglutinin HA1 subunit.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	311	Total	C	N	O	S	0	0	0
			2391	1501	424	456	10			

- Molecule 2 is a protein called Hemagglutinin HA2 subunit.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	173	Total	C	N	O	S	0	0	0
			1393	868	246	273	6			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	177	SER	GLU	conflict	UNP A0A3B1ELE4
B	178	GLY	LEU	conflict	UNP A0A3B1ELE4

- Molecule 3 is a protein called Antibody Fab light chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	L	213	Total	C	N	O	S	0	0	0
			1643	1025	281	331	6			

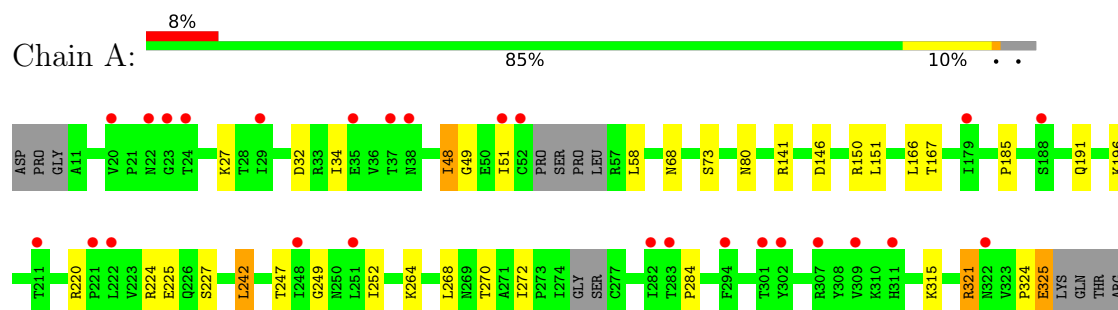
- Molecule 4 is a protein called antibody Fab heavy chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	H	225	Total	C	N	O	S	0	0	0
			1694	1071	279	337	7			

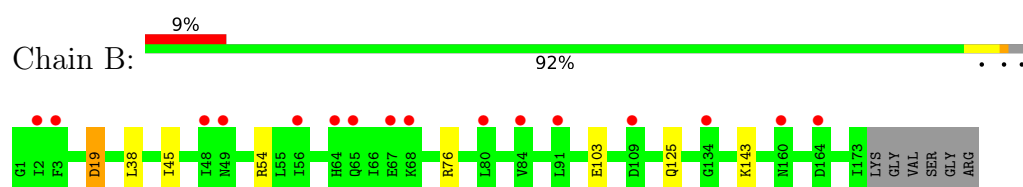
3 Residue-property plots [i](#)

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 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.

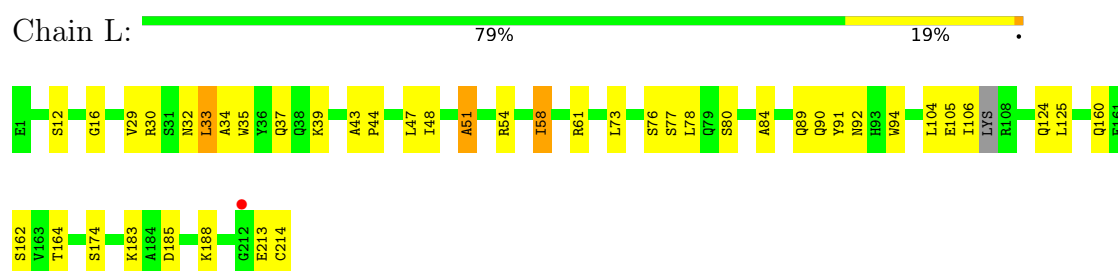
- Molecule 1: Hemagglutinin HA1 subunit



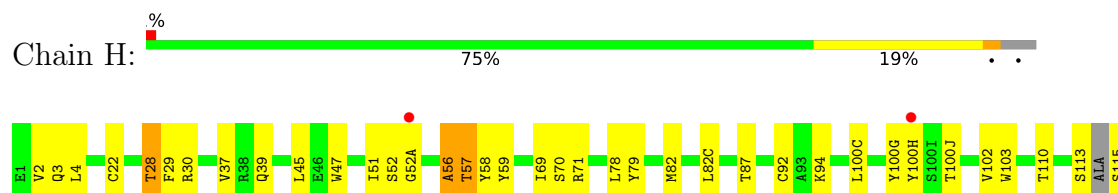
- Molecule 2: Hemagglutinin HA2 subunit



- Molecule 3: Antibody Fab light chain



- Molecule 4: antibody Fab heavy chain





4 Data and refinement statistics

Property	Value	Source
Space group	P 3 2 1	Depositor
Cell constants a, b, c, α , β , γ	158.12Å 158.12Å 127.01Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	49.51 – 4.90 49.51 – 4.90	Depositor EDS
% Data completeness (in resolution range)	97.8 (49.51-4.90) 99.0 (49.51-4.90)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.18	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.64 (at 4.86Å)	Xtriage
Refinement program	PHENIX 1.19.2_4158	Depositor
R, R_{free}	0.324 , 0.340 0.327 , 0.329	Depositor DCC
R_{free} test set	474 reflections (5.41%)	wwPDB-VP
Wilson B-factor (Å ²)	205.1	Xtriage
Anisotropy	0.649	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.26 , 350.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.39$, $\langle L^2 \rangle = 0.22$	Xtriage
Estimated twinning fraction	0.090 for -h,-k,l	Xtriage
F_o, F_c correlation	0.85	EDS
Total number of atoms	7121	wwPDB-VP
Average B, all atoms (Å ²)	336.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.51% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ 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](#)

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	0.38	0/2442	0.76	0/3328
2	B	0.34	0/1417	0.68	1/1902 (0.1%)
3	L	0.45	0/1677	0.59	0/2277
4	H	0.38	0/1735	0.60	2/2366 (0.1%)
All	All	0.39	0/7271	0.67	3/9873 (0.0%)

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	H	56	ALA	CA-C-N	5.53	131.65	121.70
4	H	56	ALA	C-N-CA	5.53	131.65	121.70
2	B	76	ARG	N-CA-C	5.26	117.44	111.02

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	2391	0	2319	29	0
2	B	1393	0	1326	4	0
3	L	1643	0	1592	42	0
4	H	1694	0	1644	48	0
All	All	7121	0	6881	101	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 7.

All (101) 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)
3:L:164:THR:HG23	4:H:174:PHE:CD2	1.79	1.18
3:L:162:SER:HB3	4:H:177:VAL:CG1	1.80	1.09
1:A:49:GLY:O	1:A:272:ILE:HG21	1.66	0.93
1:A:51:ILE:HG22	1:A:58:LEU:HD11	1.53	0.90
1:A:247:THR:HG22	1:A:249:GLY:H	1.36	0.87
1:A:51:ILE:CD1	1:A:268:LEU:HD13	2.07	0.85
3:L:164:THR:CG2	4:H:174:PHE:CD2	2.60	0.84
3:L:164:THR:HG23	4:H:174:PHE:HD2	1.39	0.82
3:L:162:SER:HB3	4:H:177:VAL:HG12	1.64	0.78
1:A:51:ILE:HD11	1:A:268:LEU:HD13	1.68	0.74
4:H:52:SER:HB3	4:H:100(H):TYR:HD1	1.52	0.74
3:L:32:ASN:HB3	3:L:91:TYR:HB3	1.69	0.73
3:L:162:SER:HB3	4:H:177:VAL:HG13	1.69	0.72
1:A:51:ILE:HD11	1:A:268:LEU:CD1	2.19	0.72
1:A:27:LYS:NZ	1:A:32:ASP:OD1	2.23	0.71
2:B:54:ARG:NH2	2:B:103:GLU:OE2	2.24	0.71
4:H:56:ALA:HA	4:H:57:THR:HG22	1.74	0.69
4:H:28:THR:HG21	4:H:94:LYS:HZ1	1.59	0.66
3:L:160:GLN:HE22	4:H:179:GLN:HA	1.60	0.66
3:L:78:LEU:HD11	3:L:104:LEU:HD21	1.78	0.66
3:L:164:THR:HG23	4:H:174:PHE:CE2	2.31	0.65
3:L:125:LEU:O	3:L:183:LYS:HD2	1.97	0.64
4:H:28:THR:HG21	4:H:94:LYS:NZ	2.13	0.64
2:B:45:ILE:HG23	4:H:100(C):LEU:HD12	1.79	0.63
2:B:38:LEU:HA	4:H:100(G):TYR:OH	1.99	0.63
3:L:37:GLN:HB2	3:L:47:LEU:HD11	1.81	0.61
1:A:51:ILE:HD13	1:A:268:LEU:HD13	1.81	0.61
1:A:268:LEU:HD23	1:A:270:THR:HG22	1.84	0.59
1:A:151:LEU:HD12	1:A:252:ILE:HG22	1.84	0.59
2:B:19:ASP:OD1	2:B:19:ASP:N	2.35	0.59
3:L:44:PRO:O	4:H:103:TRP:CD1	2.55	0.59
1:A:268:LEU:CD2	1:A:270:THR:CG2	2.81	0.58
4:H:70:SER:HB3	4:H:79:TYR:HB2	1.86	0.58
4:H:100(H):TYR:CE2	4:H:100(J):THR:HA	2.40	0.57
3:L:162:SER:CB	4:H:177:VAL:CG1	2.71	0.55
3:L:174:SER:HB2	4:H:174:PHE:CE2	2.41	0.55
1:A:49:GLY:O	1:A:272:ILE:CG2	2.50	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:H:4:LEU:HD23	4:H:94:LYS:HE2	1.89	0.53
4:H:187:LEU:C	4:H:187:LEU:HD12	2.34	0.53
3:L:162:SER:CB	4:H:177:VAL:HG13	2.39	0.53
3:L:48:ILE:HA	3:L:54:ARG:HA	1.91	0.53
3:L:44:PRO:HD2	4:H:103:TRP:CE3	2.44	0.52
4:H:87:THR:HG23	4:H:110:THR:HA	1.90	0.52
3:L:174:SER:HB2	4:H:174:PHE:HE2	1.75	0.52
3:L:39:LYS:HG3	3:L:84:ALA:HB2	1.92	0.52
4:H:51:ILE:HG23	4:H:71:ARG:HH21	1.74	0.51
1:A:80:ASN:OD1	1:A:150:ARG:NH2	2.39	0.51
4:H:100(H):TYR:HE2	4:H:100(J):THR:HA	1.75	0.51
3:L:30:ARG:H	3:L:91:TYR:HE1	1.57	0.51
3:L:162:SER:HB3	4:H:177:VAL:HG11	1.87	0.50
3:L:43:ALA:HB1	4:H:103:TRP:HB3	1.94	0.50
3:L:213:GLU:O	3:L:214:CYS:SG	2.70	0.50
3:L:54:ARG:HB2	3:L:58:ILE:HD11	1.93	0.50
4:H:59:TYR:CE1	4:H:69:ILE:HD13	2.47	0.50
3:L:33:LEU:HD12	3:L:51:ALA:HA	1.95	0.49
1:A:51:ILE:HG22	1:A:58:LEU:CD1	2.37	0.49
1:A:324:PRO:O	1:A:325:GLU:HB2	2.13	0.49
4:H:213:LYS:N	4:H:214:PRO:CD	2.76	0.48
1:A:268:LEU:HD23	1:A:270:THR:CG2	2.43	0.47
4:H:37:VAL:HG22	4:H:47:TRP:HA	1.96	0.47
4:H:147:TYR:CE2	4:H:152:VAL:HG13	2.49	0.47
3:L:160:GLN:NE2	4:H:179:GLN:HA	2.29	0.47
1:A:268:LEU:CD2	1:A:270:THR:HG21	2.45	0.47
1:A:220:ARG:HB2	1:A:227:SER:O	2.15	0.47
1:A:51:ILE:O	1:A:58:LEU:HD11	2.15	0.46
4:H:39:GLN:HB2	4:H:45:LEU:HD13	1.98	0.45
3:L:91:TYR:HB2	3:L:92:ASN:HB3	1.98	0.45
1:A:185:PRO:HG2	1:A:191:GLN:OE1	2.16	0.45
1:A:268:LEU:HD11	1:A:284:PRO:HA	1.99	0.45
1:A:51:ILE:CG2	1:A:58:LEU:HD11	2.36	0.45
1:A:141:ARG:NE	1:A:146:ASP:OD2	2.45	0.45
4:H:145:LYS:HE3	4:H:179:GLN:OE1	2.16	0.44
1:A:268:LEU:CD2	1:A:270:THR:HG22	2.43	0.44
1:A:68:ASN:HB3	1:A:73:SER:OG	2.18	0.44
4:H:4:LEU:HD11	4:H:92:CYS:O	2.18	0.44
3:L:12:SER:HA	3:L:105:GLU:HB2	1.99	0.44
4:H:30:ARG:NH2	4:H:71:ARG:HG3	2.32	0.44
3:L:124:GLN:HG3	4:H:122:PHE:CZ	2.53	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:167:THR:HG23	1:A:242:LEU:HD23	1.99	0.43
3:L:91:TYR:HA	3:L:92:ASN:HA	1.80	0.43
3:L:16:GLY:H	3:L:78:LEU:HB3	1.84	0.43
3:L:47:LEU:HB3	3:L:48:ILE:HD12	2.01	0.43
3:L:174:SER:CB	4:H:174:PHE:CE2	3.02	0.42
3:L:80:SER:HA	3:L:106:ILE:HG12	2.01	0.42
4:H:94:LYS:HG3	4:H:102:VAL:HB	2.01	0.42
3:L:61:ARG:HD2	3:L:77:SER:O	2.20	0.42
3:L:34:ALA:HB3	3:L:89:GLN:HG2	2.02	0.42
4:H:58:TYR:HE2	4:H:100(H):TYR:CG	2.38	0.42
3:L:185:ASP:HA	3:L:188:LYS:HD3	2.02	0.42
1:A:48:ILE:H	1:A:48:ILE:HG13	1.55	0.41
4:H:215:SER:O	4:H:217:THR:HG23	2.20	0.41
3:L:92:ASN:N	3:L:92:ASN:OD1	2.52	0.41
3:L:174:SER:CB	4:H:174:PHE:HE2	2.32	0.41
4:H:51:ILE:HG21	4:H:78:LEU:HD13	2.02	0.41
3:L:35:TRP:CE3	3:L:73:LEU:HD22	2.56	0.41
3:L:30:ARG:N	3:L:91:TYR:HE1	2.18	0.41
1:A:224:ARG:O	1:A:225:GLU:CB	2.68	0.40
4:H:113:SER:C	4:H:115:SER:N	2.79	0.40
1:A:34:ILE:HD11	1:A:321:ARG:NE	2.37	0.40
4:H:4:LEU:HD13	4:H:22:CYS:SG	2.62	0.40
4:H:82:MET:HB3	4:H:82(C):LEU:HD21	2.04	0.40

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 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	305/324 (94%)	294 (96%)	10 (3%)	1 (0%)	36	71
2	B	171/179 (96%)	164 (96%)	7 (4%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
3	L	209/214 (98%)	193 (92%)	13 (6%)	3 (1%)	9	39
4	H	219/234 (94%)	209 (95%)	9 (4%)	1 (0%)	24	63
All	All	904/951 (95%)	860 (95%)	39 (4%)	5 (1%)	21	58

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
3	L	94	TRP
3	L	76	SER
3	L	51	ALA
1	A	196	LYS
4	H	52(A)	GLY

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	263/282 (93%)	256 (97%)	7 (3%)	39	60
2	B	145/150 (97%)	142 (98%)	3 (2%)	47	65
3	L	186/187 (100%)	182 (98%)	4 (2%)	45	64
4	H	189/196 (96%)	183 (97%)	6 (3%)	34	55
All	All	783/815 (96%)	763 (97%)	20 (3%)	40	61

All (20) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	48	ILE
1	A	166	LEU
1	A	242	LEU
1	A	264	LYS
1	A	315	LYS
1	A	321	ARG
1	A	325	GLU

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Mol	Chain	Res	Type
2	B	19	ASP
2	B	125	GLN
2	B	143	LYS
3	L	29	VAL
3	L	33	LEU
3	L	58	ILE
3	L	90	GLN
4	H	2	VAL
4	H	3	GLN
4	H	28	THR
4	H	29	PHE
4	H	57	THR
4	H	187	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
2	B	27	GLN
2	B	53	ASN
2	B	105	GLN
2	B	159	HIS
3	L	37	GLN
3	L	147	GLN
3	L	210	ASN
4	H	216	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 oligosaccharides in this entry.

5.6 Ligand geometry

There are no ligands in this entry.

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	311/324 (95%)	0.63	26 (8%) 17 21	236, 364, 405, 424	0
2	B	173/179 (96%)	0.52	16 (9%) 14 18	264, 303, 352, 384	0
3	L	213/214 (99%)	0.18	1 (0%) 87 75	298, 331, 363, 370	0
4	H	225/234 (96%)	0.42	3 (1%) 75 60	291, 333, 369, 384	0
All	All	922/951 (96%)	0.45	46 (4%) 34 32	236, 333, 388, 424	0

All (46) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	51	ILE	5.9
1	A	20	VAL	4.4
1	A	221	PRO	4.0
1	A	23	GLY	3.9
2	B	80	LEU	3.6
2	B	68	LYS	3.4
1	A	29	ILE	3.3
1	A	294	PHE	3.2
2	B	91	LEU	2.9
2	B	2	ILE	2.9
3	L	212	GLY	2.8
2	B	134	GLY	2.7
1	A	38	ASN	2.7
1	A	211	THR	2.7
4	H	194	PRO	2.6
1	A	35	GLU	2.6
2	B	56	ILE	2.6
1	A	24	THR	2.6
2	B	109	ASP	2.5
2	B	164	ASP	2.5
1	A	22	ASN	2.5

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Mol	Chain	Res	Type	RSRZ
1	A	52	CYS	2.5
1	A	188	SER	2.5
2	B	48	ILE	2.5
1	A	309	VAL	2.5
1	A	222	LEU	2.4
2	B	64	HIS	2.4
1	A	302	TYR	2.4
1	A	248	ILE	2.4
2	B	3	PHE	2.3
1	A	301	THR	2.3
2	B	49	ASN	2.3
1	A	307	ARG	2.3
1	A	37	THR	2.2
1	A	251	LEU	2.2
2	B	84	VAL	2.2
2	B	67	GLU	2.2
4	H	52(A)	GLY	2.1
1	A	311	HIS	2.1
4	H	100(H)	TYR	2.1
1	A	282	ILE	2.1
1	A	322	ASN	2.1
1	A	179	ILE	2.1
2	B	65	GLN	2.1
1	A	283	THR	2.0
2	B	160	ASN	2.0

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

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

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.