wwPDB X-ray Structure Validation Summary Report (i)

Nov 16, 2023 – 07:25 PM EST

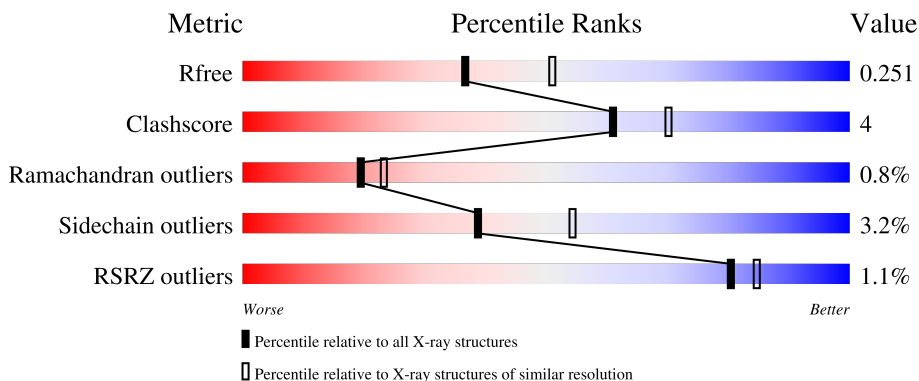|		
PDB ID	:	8TJF
Title	:	monovalent bispecific IgG antibodies through novel electrostatic steering mutations at the CH1-CL interface
Authors	:	Oganesyan, V.Y.; van Dyk, N.; Mazor, Y.; Chiang, C.
Deposited on	:	2023-07-21
Resolution	:	2.30 Å(reported)

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 2.30 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	Percentile Ranks	Value
Rfree		0.251
Clashscore		4
Ramachandran outliers		0.8%
Sidechain outliers		3.2%
RSRZ outliers		1.1%

Worse *Better*

▌ Percentile relative to all X-ray structures
▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	5042 (2.30-2.30)
Clashscore	141614	5643 (2.30-2.30)
Ramachandran outliers	138981	5575 (2.30-2.30)
Sidechain outliers	138945	5575 (2.30-2.30)
RSRZ outliers	127900	4938 (2.30-2.30)

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	213	% 87% · · 10% · ·
1	L	213	86% 10% · ·
2	B	224	2% 83% 14% ·
2	H	224	.% 84% 10% · ·

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 6607 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 Fab Lambda light chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	L	211	Total 1608	C 1011	N 269	O 322	S 6	0	0	0
1	A	210	Total 1599	C 1006	N 268	O 319	S 6	0	0	0

- Molecule 2 is a protein called IgG1 Fab heavy chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	H	215	Total 1620	C 1022	N 275	O 316	S 7	0	0	0
2	B	220	Total 1656	C 1042	N 282	O 325	S 7	0	1	0

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	L	22	Total 22	O 22	0	0
3	H	35	Total 35	O 35	0	0
3	A	34	Total 34	O 34	0	0
3	B	33	Total 33	O 33	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.
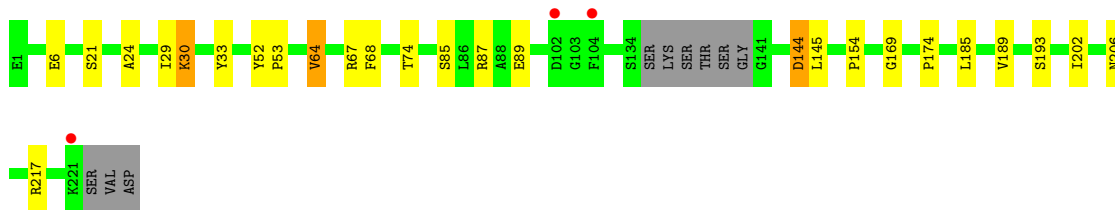
- Molecule 1: Fab Lambda light chain

Chain L:

- Molecule 1: Fab Lambda light chain

Chain A:
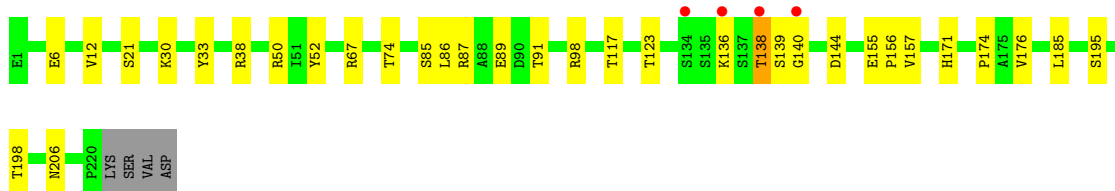

- Molecule 2: IgG1 Fab heavy chain

Chain H:

- Molecule 2: IgG1 Fab heavy chain

Chain B:

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	71.78Å 78.70Å 75.66Å 90.00° 91.84° 90.00°	Depositor
Resolution (Å)	37.84 – 2.30 37.81 – 2.10	Depositor EDS
% Data completeness (in resolution range)	98.8 (37.84-2.30) 98.3 (37.81-2.10)	Depositor EDS
R_{merge}	0.13	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.62 (at 2.10Å)	Xtriage
Refinement program	REFMAC 5.8.0419	Depositor
R, R_{free}	0.208 , 0.251 0.214 , 0.251	Depositor DCC
R_{free} test set	1035 reflections (2.13%)	wwPDB-VP
Wilson B-factor (Å^2)	33.9	Xtriage
Anisotropy	0.353	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 20.4	EDS
L-test for twinning[2]	$< |L| > = 0.49, < L^2 > = 0.32$	Xtriage
Estimated twinning fraction	0.022 for -h,-l,-k 0.000 for -h,l,k 0.169 for h,-k,-l	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	6607	wwPDB-VP
Average B, all atoms (Å^2)	43.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.00% of the height of the origin peak. No significant pseudotranslation is detected.*

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[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)

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	0.48	0/1640	0.83	1/2238 (0.0%)
1	L	0.48	0/1649	0.84	1/2250 (0.0%)
2	B	0.51	1/1701 (0.1%)	0.86	2/2320 (0.1%)
2	H	0.50	0/1660	0.86	0/2263
All	All	0.49	1/6650 (0.0%)	0.85	4/9071 (0.0%)

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

Mol	Chain	#Chirality outliers	#Planarity outliers
1	L	0	1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	155	GLU	CD-OE1	5.40	1.31	1.25

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	L	122	CYS	CB-CA-C	-5.98	98.44	110.40
2	B	98	ARG	NE-CZ-NH2	-5.50	117.55	120.30
2	B	38	ARG	NE-CZ-NH2	-5.39	117.60	120.30
1	A	100	GLN	CB-CA-C	5.10	120.61	110.40

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	L	24	ARG	Sidechain

5.2 Too-close contacts ⓘ

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	1599	0	1561	11	0
1	L	1608	0	1567	19	0
2	B	1656	0	1607	15	0
2	H	1620	0	1574	18	0
3	A	34	0	0	0	0
3	B	33	0	0	0	0
3	H	35	0	0	0	0
3	L	22	0	0	0	0
All	All	6607	0	6309	57	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 4.

The worst 5 of 57 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:H:29:ILE:HG22	2:H:53:PRO:HG2	1.43	1.00
2:B:67:ARG:HG2	2:B:85:SER:HB2	1.70	0.72
2:H:64:VAL:HG13	2:H:68:PHE:HB2	1.71	0.71
1:L:117:ARG:HD2	2:H:144:ASP:OD2	2.00	0.62
1:L:108:GLY:O	1:L:109:GLN:O	2.18	0.61

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	208/213 (98%)	199 (96%)	8 (4%)	1 (0%)	29	35
1	L	209/213 (98%)	199 (95%)	7 (3%)	3 (1%)	11	11
2	B	219/224 (98%)	210 (96%)	7 (3%)	2 (1%)	17	20
2	H	211/224 (94%)	203 (96%)	7 (3%)	1 (0%)	29	35
All	All	847/874 (97%)	811 (96%)	29 (3%)	7 (1%)	19	23

5 of 7 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	L	109	GLN
2	B	139	SER
2	H	30	LYS
2	B	138	THR
1	L	153	SER

5.3.2   Protein sidechains (i)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all 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	181/184 (98%)	175 (97%)	6 (3%)	38	53
1	L	182/184 (99%)	176 (97%)	6 (3%)	38	53
2	B	183/186 (98%)	176 (96%)	7 (4%)	33	47
2	H	178/186 (96%)	173 (97%)	5 (3%)	43	60
All	All	724/740 (98%)	700 (97%)	24 (3%)	39	53

5 of 24 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	111	LYS
2	B	50	ARG
1	A	157	LYS
2	B	136	LYS
2	H	64	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 12 such sidechains are listed below:

Mol	Chain	Res	Type
2	H	211	ASN
1	A	171	ASN
2	B	206	ASN
1	A	198	HIS
1	L	109	GLN

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 ⓘ

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	210/213 (98%)	-0.48	2 (0%)	82	86	22, 38, 73, 100	0
1	L	211/213 (99%)	-0.54	0	100	100	21, 42, 66, 96	0
2	B	220/224 (98%)	-0.52	4 (1%)	68	74	22, 38, 81, 132	0
2	H	215/224 (95%)	-0.54	3 (1%)	75	80	22, 38, 74, 136	0
All	All	856/874 (97%)	-0.52	9 (1%)	80	85	21, 39, 74, 136	0

The worst 5 of 9 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	138	THR	4.0
2	B	140	GLY	3.8
2	H	104	PHE	3.1
2	H	221	LYS	2.7
2	H	102	ASP	2.5

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 ⓘ

There are no ligands in this entry.

WORLDWIDE
wwPDB
PROTEIN DATA BANK

6.5 Other polymers ⓘ

There are no such residues in this entry.