



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 9, 2026 – 10:47 PM UTC

PDB ID : 1MFC / pdb_00001mfc
Title : HIGH RESOLUTION STRUCTURES OF ANTIBODY FAB FRAGMENT COMPLEXED WITH CELL-SURFACE OLIGOSACCHARIDE OF PATHOGENIC SALMONELLA
Authors : Zdanov, A.; Cygler, M.
Deposited on : 1993-10-25
Resolution : 2.10 Å(reported)

This is a wwPDB X-ray Structure 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/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
Mogul : 2022.3.0, CSD as543be (2022)
Xtrriage (Phenix) : **NOT EXECUTED**
EDS : **NOT EXECUTED**
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

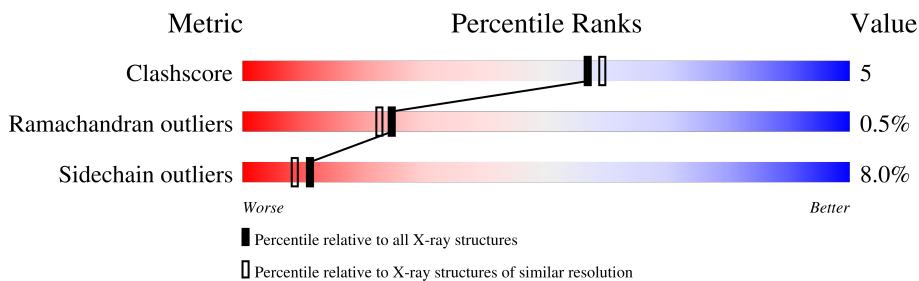
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.10 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))
Clashscore	190562	7164 (2.10-2.10)
Ramachandran outliers	187476	7099 (2.10-2.10)
Sidechain outliers	187428	7100 (2.10-2.10)

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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	L	215	
2	H	219	
3	A	4	

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 3412 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 IGG1-LAMBDA SE155-4 FAB (LIGHT CHAIN).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	L	212	1580	985	268	320	7	0	0	0

There are 9 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
L	28	THR	ALA	conflict	GB 387376
L	31	SER	THR	conflict	GB 387376
L	32	GLY	SER	conflict	GB 387376
L	34	HIS	TYR	conflict	GB 387376
L	52	ASP	GLY	conflict	GB 387376
L	82	PRO	THR	conflict	GB 387376
L	94	CYS	TYR	conflict	GB 387376
L	95	ASN	SER	conflict	GB 387376
L	99	ILE	VAL	conflict	GB 387376

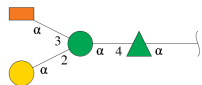
- Molecule 2 is a protein called IGG1-LAMBDA SE155-4 FAB (HEAVY CHAIN).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	H	212	1595	1018	266	303	8	0	0	1

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
H	?	-	ALA	deletion	GB 208365
H	468	ARG	ASP	conflict	GB 208365

- Molecule 3 is an oligosaccharide called alpha-D-galactopyranose-(1-2)-[alpha-D-Abequopyranose-(1-3)]alpha-D-mannopyranose-(1-4)-alpha-L-rhamnopyranose.



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf	Trace
3	A	4	Total	C	O	0	0	0
			42	24	18			

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	L	106	Total	O	0	0
			106	106		
4	H	89	Total	O	0	0
			89	89		

4 Data and refinement statistics

Xtrriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	47.20Å 128.70Å 80.10Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	(Not available) – 2.10	Depositor
% Data completeness (in resolution range)	(Not available) ((Not available)-2.10)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	X-PLOR	Depositor
R, R_{free}	0.163 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	3412	wwPDB-VP
Average B, all atoms (Å ²)	31.0	wwPDB-VP

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: MAN, GLA, RAM, ABE

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	L	0.90	6/1618 (0.4%)	1.64	30/2211 (1.4%)
2	H	0.93	7/1642 (0.4%)	1.71	24/2246 (1.1%)
All	All	0.91	13/3260 (0.4%)	1.67	54/4457 (1.2%)

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
2	H	0	1

The worst 5 of 13 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	H	382	GLY	C-N	-7.50	1.22	1.33
2	H	419	HIS	CD2-NE2	-6.60	1.30	1.37
1	L	203	HIS	CD2-NE2	-6.45	1.30	1.37
1	L	200	HIS	CD2-NE2	-6.22	1.31	1.37
2	H	454	HIS	CD2-NE2	-6.22	1.31	1.37

The worst 5 of 54 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	L	28	THR	N-CA-C	10.68	125.29	110.35
2	H	360	GLN	OE1-CD-NE2	-7.52	115.08	122.60
1	L	173	ASN	OD1-CG-ND2	-6.96	115.64	122.60
2	H	338	ASN	OD1-CG-ND2	-6.83	115.77	122.60
2	H	381	PRO	O-C-N	6.80	129.86	122.17

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	H	354	TYR	Sidechain

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	L	1580	0	1511	14	0
2	H	1595	0	1547	16	0
3	A	42	0	39	0	0
4	H	89	0	0	0	0
4	L	106	0	0	0	0
All	All	3412	0	3097	29	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 5.

The worst 5 of 29 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:382:GLY:HA2	2:H:468:ARG:HB2	1.77	0.67
1:L:23:ARG:HH11	1:L:72:LYS:HD3	1.66	0.60
2:H:318:THR:HG22	2:H:333:LEU:HD23	1.88	0.56
1:L:192:SER:O	1:L:210:SER:HA	2.06	0.56
1:L:28:THR:HG22	1:L:71:ASP:HB2	1.88	0.55

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	L	210/215 (98%)	201 (96%)	8 (4%)	1 (0%)	24	22
2	H	208/219 (95%)	196 (94%)	11 (5%)	1 (0%)	24	22
All	All	418/434 (96%)	397 (95%)	19 (4%)	2 (0%)	24	22

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	H	291	PRO
1	L	109	LEU

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	L	176/183 (96%)	167 (95%)	9 (5%)	21	21
2	H	175/184 (95%)	156 (89%)	19 (11%)	6	4
All	All	351/367 (96%)	323 (92%)	28 (8%)	11	8

5 of 28 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	H	290	ARG
2	H	460	LYS
2	H	348	ARG
2	H	445	SER
2	H	320	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 7 such sidechains are listed below:

Mol	Chain	Res	Type
2	H	256	GLN

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Mol	Chain	Res	Type
2	H	281	ASN
2	H	419	HIS
2	H	289	GLN
1	L	111	GLN

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](#)

4 monosaccharides are modelled in this entry.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# $ Z > 2$	Counts	RMSZ	# $ Z > 2$
3	RAM	A	1	3	11,11,11	1.23	1 (9%)	16,16,16	1.06	2 (12%)
3	MAN	A	2	3	11,11,12	0.58	0	15,15,17	1.51	1 (6%)
3	GLA	A	3	3	11,11,12	1.19	1 (9%)	15,15,17	1.35	1 (6%)
3	ABE	A	4	3	9,9,10	1.08	1 (11%)	11,12,14	1.15	1 (9%)

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
3	RAM	A	1	3	-	-	0/1/1/1
3	MAN	A	2	3	-	1/2/19/22	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	GLA	A	3	3	-	2/2/19/22	0/1/1/1
3	ABE	A	4	3	-	-	0/1/1/1

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	3	GLA	C4-C5	2.42	1.58	1.53
3	A	1	RAM	C4-C3	2.31	1.58	1.52
3	A	4	ABE	C1-C2	2.28	1.53	1.51

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	2	MAN	C1-O5-C5	5.33	119.33	112.19
3	A	3	GLA	C1-O5-C5	4.02	117.57	112.19
3	A	1	RAM	O4-C4-C3	2.43	116.11	110.38
3	A	1	RAM	C6-C5-C4	2.42	117.50	113.08
3	A	4	ABE	C3-C2-C1	2.08	112.18	110.43

There are no chirality outliers.

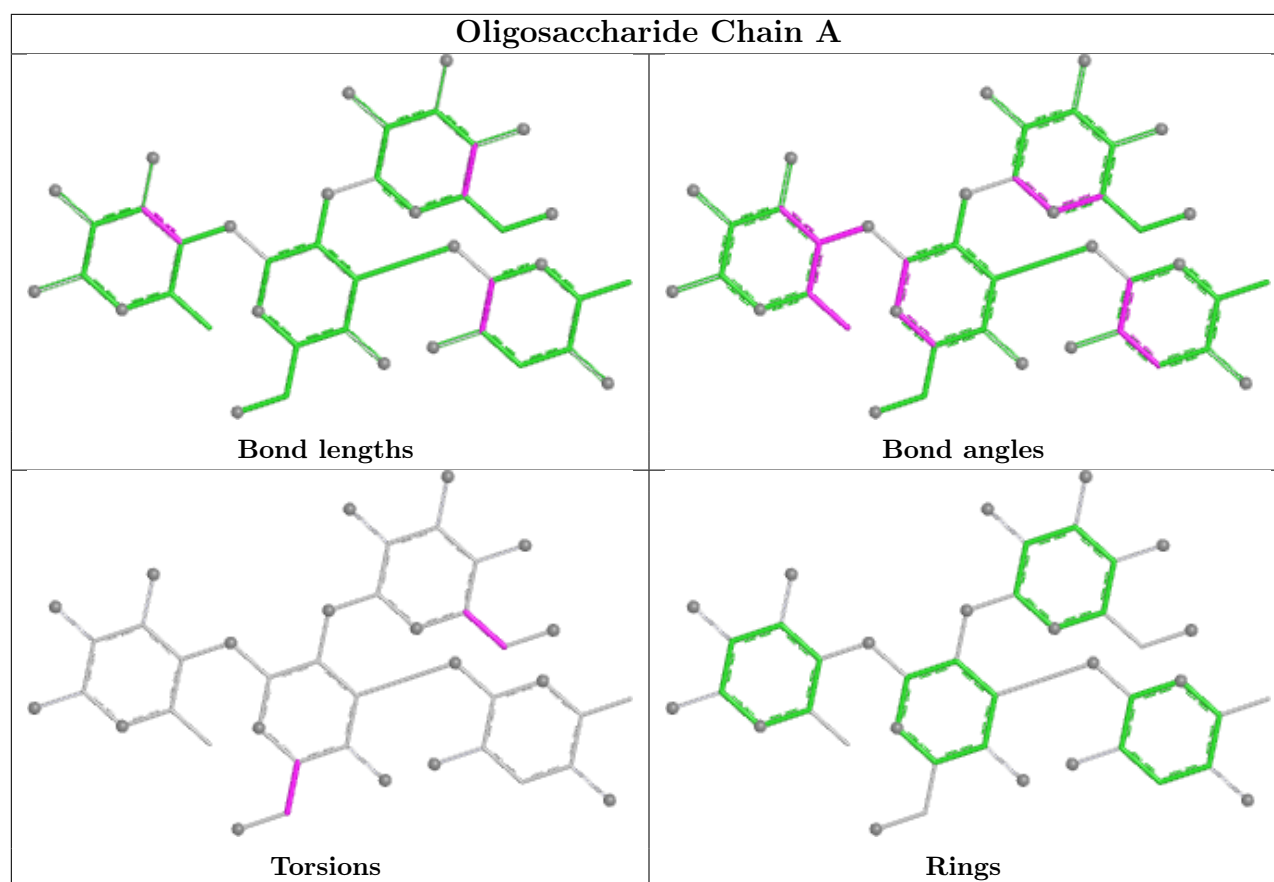
All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	3	GLA	O5-C5-C6-O6
3	A	2	MAN	O5-C5-C6-O6
3	A	3	GLA	C4-C5-C6-O6

There are no ring outliers.

No monomer is involved in short contacts.

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for oligosaccharide.



5.6 Ligand geometry [i](#)

There are no ligands in this entry.

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 Fit of model and data [i](#)

6.1 Protein, DNA and RNA chains [i](#)

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates [i](#)

EDS was not executed - this section is therefore empty.

6.4 Ligands [i](#)

EDS was not executed - this section is therefore empty.

6.5 Other polymers [i](#)

EDS was not executed - this section is therefore empty.