



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 02:18 PM UTC

PDB ID : 4MJX / pdb_00004mjx
Title : Crystal structure of the double mutant (S112A, H303A) of B.anthraxis mycrocine immunity protein (MccF)
Authors : Nocek, B.; Joachimiak, A.; Center for Structural Genomics of Infectious Diseases (CSGID)
Deposited on : 2013-09-04
Resolution : 1.40 Å(reported)

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

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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)
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

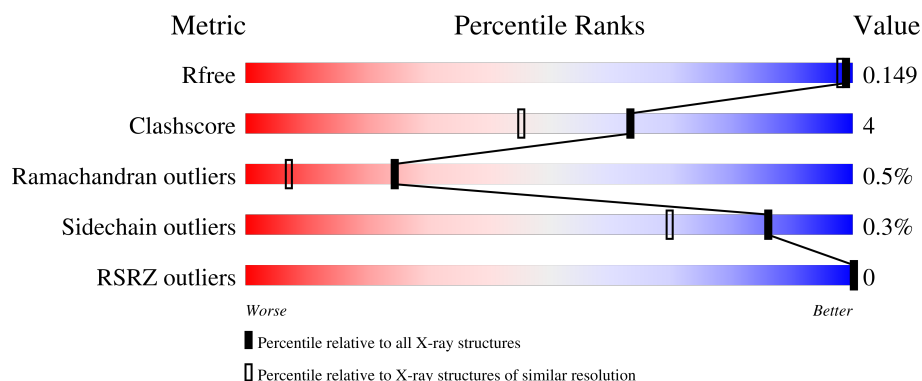
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.40 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	2563 (1.40-1.40)
Clashscore	190562	2660 (1.40-1.40)
Ramachandran outliers	187476	2611 (1.40-1.40)
Sidechain outliers	187428	2610 (1.40-1.40)
RSRZ outliers	180081	2561 (1.40-1.40)

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	336	
1	B	336	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	EDO	A	602	-	-	X	-

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 6306 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 Microcin immunity protein MccF.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	333	Total	C	N	O	S	0	4	0
			2660	1718	430	498	14			
1	B	336	Total	C	N	O	S	0	6	0
			2702	1745	439	504	14			

There are 10 discrepancies between the modelled and reference sequences:

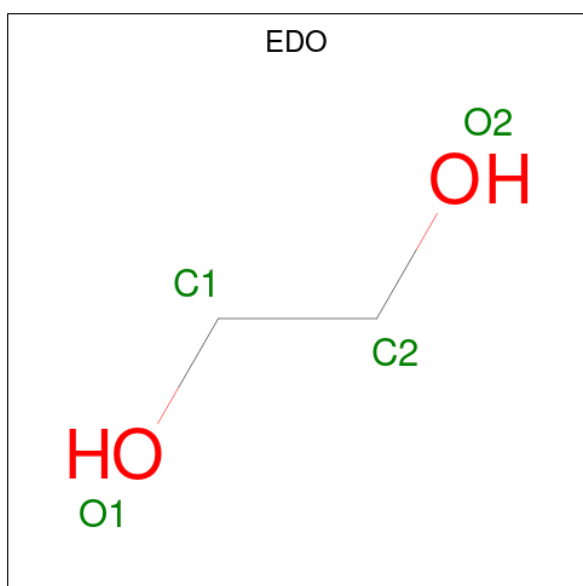
Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	SER	-	expression tag	UNP Q81RT8
A	-1	ASN	-	expression tag	UNP Q81RT8
A	0	ALA	-	expression tag	UNP Q81RT8
A	112	ALA	SER	engineered mutation	UNP Q81RT8
A	303	ALA	HIS	engineered mutation	UNP Q81RT8
B	-2	SER	-	expression tag	UNP Q81RT8
B	-1	ASN	-	expression tag	UNP Q81RT8
B	0	ALA	-	expression tag	UNP Q81RT8
B	112	ALA	SER	engineered mutation	UNP Q81RT8
B	303	ALA	HIS	engineered mutation	UNP Q81RT8

- Molecule 2 is GLYCEROL (CCD ID: GOL) (formula: C₃H₈O₃).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	C	O	0	0
			6	3	3		
2	B	1	Total	C	O	0	0
			6	3	3		

- Molecule 3 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: $C_2H_6O_2$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			4	2	2		

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	451	Total 451	O 451	0	0
4	B	477	Total 477	O 477	0	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 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: Microcin immunity protein MccF

Chain A:  90% 9% .



- Molecule 1: Microcin immunity protein MccF

Chain B:  92% 8%



4 Data and refinement statistics

Property	Value	Source
Space group	P 43	Depositor
Cell constants a, b, c, α , β , γ	118.38Å 118.38Å 56.25Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	28.73 – 1.40 28.73 – 1.40	Depositor EDS
% Data completeness (in resolution range)	99.7 (28.73-1.40) 99.7 (28.73-1.40)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.94 (at 1.40Å)	Xtriage
Refinement program	REFMAC 5.7.0029	Depositor
R, R_{free}	0.110 , 0.148 0.111 , 0.149	Depositor DCC
R_{free} test set	7690 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å ²)	15.6	Xtriage
Anisotropy	0.000	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 45.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.021 for h,-k,-l	Xtriage
F_o, F_c correlation	0.98	EDS
Total number of atoms	6306	wwPDB-VP
Average B, all atoms (Å ²)	21.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.14% 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: GOL, EDO

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	1.23	9/2740 (0.3%)	1.08	0/3718
1	B	1.24	6/2789 (0.2%)	1.05	3/3784 (0.1%)
All	All	1.23	15/5529 (0.3%)	1.06	3/7502 (0.0%)

All (15) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	318	MET	SD-CE	-11.83	1.50	1.79
1	A	310	MET	C-O	-8.55	1.14	1.24
1	B	310	MET	C-O	-6.47	1.17	1.24
1	A	81	MET	CG-SD	6.09	1.96	1.80
1	A	311	PRO	N-CD	5.92	1.56	1.47
1	A	312	ILE	C-O	-5.87	1.18	1.24
1	B	311	PRO	C-O	-5.64	1.17	1.23
1	A	311	PRO	C-O	-5.57	1.17	1.23
1	A	225[A]	CYS	C-O	-5.49	1.17	1.23
1	A	225[B]	CYS	C-O	-5.49	1.17	1.23
1	B	199	ASN	CG-ND2	-5.35	1.22	1.33
1	A	223	MET	CG-SD	5.30	1.94	1.80
1	A	296	LEU	C-O	-5.26	1.17	1.24
1	B	310	MET	C-N	5.13	1.40	1.33
1	B	1	MET	SD-CE	-5.01	1.67	1.79

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	310	MET	CA-C-N	-6.76	113.02	119.85
1	B	310	MET	C-N-CA	-6.76	113.02	119.85
1	B	323	LYS	CG-CD-CE	5.28	123.45	111.30

There are no chirality outliers.

There are no planarity outliers.

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	2660	0	2648	22	0
1	B	2702	0	2698	18	0
2	A	6	0	8	0	0
2	B	6	0	7	3	0
3	A	4	0	6	6	0
4	A	451	0	0	4	0
4	B	477	0	0	12	0
All	All	6306	0	5367	43	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.

All (43) 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:A:1:MET:HE2	4:A:922:HOH:O	1.62	0.95
1:B:160:ASP:HB3	4:B:1060:HOH:O	1.64	0.95
1:A:104:ASN:HB2	4:A:1044:HOH:O	1.79	0.81
1:A:111:TYR:OH	3:A:602:EDO:H22	1.79	0.81
1:A:137:PRO:HB2	3:A:602:EDO:H22	1.60	0.81
1:A:305:HIS:CE1	3:A:602:EDO:H12	2.19	0.78
1:B:152[A]:TYR:HD1	4:B:921:HOH:O	1.70	0.75
1:A:1:MET:HE1	1:A:313:GLY:O	1.88	0.74
1:B:151:LYS:HE3	4:B:1012:HOH:O	1.86	0.74
1:B:239:LYS:HE2	2:B:601:GOL:O1	1.89	0.72
1:B:105:PRO:HB3	1:B:127[B]:ILE:HD13	1.73	0.69
1:B:66:LYS:HG3	4:B:1009:HOH:O	1.94	0.67
2:B:601:GOL:H12	4:B:1020:HOH:O	1.94	0.67
1:B:152[A]:TYR:CD1	4:B:921:HOH:O	2.46	0.65
1:B:185:LYS:HE3	4:B:869:HOH:O	1.97	0.64
2:B:601:GOL:H32	4:B:734:HOH:O	2.02	0.59

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:137:PRO:HB2	3:A:602:EDO:C2	2.32	0.59
1:A:69:ASN:HD21	1:A:97:ASP:H	1.52	0.55
1:B:108:MET:HE2	1:B:121:ILE:HD12	1.90	0.53
1:A:108:MET:HE2	1:A:121:ILE:HD12	1.91	0.53
1:B:317:LYS:HD3	4:B:1048:HOH:O	2.09	0.52
1:A:202:ALA:O	1:A:317:LYS:HD2	2.10	0.52
3:A:602:EDO:H11	4:A:1122:HOH:O	2.09	0.51
1:A:69:ASN:ND2	1:A:97:ASP:H	2.08	0.50
1:A:111:TYR:OH	3:A:602:EDO:C2	2.55	0.50
1:A:201:GLN:HB3	1:A:317:LYS:HE3	1.94	0.50
1:A:317:LYS:CE	1:A:318:MET:O	2.61	0.48
1:B:284:LEU:HD23	1:B:295:LEU:HD11	1.95	0.47
1:B:160:ASP:CB	4:B:1060:HOH:O	2.42	0.47
1:A:208:GLY:HA3	1:A:233:PHE:O	2.14	0.47
1:B:34:LYS:NZ	4:B:1169:HOH:O	2.49	0.46
1:A:39:GLN:HG3	4:A:707:HOH:O	2.15	0.46
1:B:208:GLY:HA3	1:B:233:PHE:O	2.17	0.45
1:A:69:ASN:HD21	1:A:96:ILE:HA	1.81	0.44
1:B:10:GLY:O	1:B:43:HIS:HD2	2.00	0.43
1:A:317:LYS:HE3	1:A:318:MET:O	2.19	0.43
1:B:279:LYS:NZ	4:B:1065:HOH:O	2.51	0.43
1:A:317:LYS:HE2	1:A:318:MET:O	2.19	0.42
1:B:108:MET:HE2	1:B:121:ILE:CD1	2.49	0.42
1:A:1:MET:HE3	1:A:329:GLU:OE1	2.20	0.41
1:A:108:MET:HE2	1:A:121:ILE:CD1	2.50	0.41
1:A:74:ASN:O	1:A:106:LYS:NZ	2.52	0.41
1:B:295:LEU:C	1:B:295:LEU:HD23	2.46	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	335/336 (100%)	325 (97%)	9 (3%)	1 (0%)	36	16
1	B	340/336 (101%)	328 (96%)	10 (3%)	2 (1%)	21	5
All	All	675/672 (100%)	653 (97%)	19 (3%)	3 (0%)	24	10

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	55	TYR
1	B	55	TYR
1	B	84	ILE

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	295/294 (100%)	293 (99%)	2 (1%)	76	52
1	B	300/294 (102%)	300 (100%)	0	100	100
All	All	595/588 (101%)	593 (100%)	2 (0%)	86	70

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	182	GLU
1	A	330	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	69	ASN
1	A	193	ASN
1	A	277	ASN
1	A	290	ASN
1	A	291	GLN
1	B	43	HIS

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Mol	Chain	Res	Type
1	B	62	GLN
1	B	88	ASN
1	B	166	ASN
1	B	199	ASN
1	B	315	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](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

3 ligands 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	$\# Z > 2$
2	GOL	A	601	-	5,5,5	1.00	0	5,5,5	1.62	1 (20%)
3	EDO	A	602	-	3,3,3	0.74	0	2,2,2	1.41	0
2	GOL	B	601	-	5,5,5	1.42	1 (20%)	5,5,5	2.52	2 (40%)

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
2	GOL	A	601	-	-	2/4/4/4	-
3	EDO	A	602	-	-	1/1/1/1	-
2	GOL	B	601	-	-	1/4/4/4	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	601	GOL	C1-C2	-2.31	1.43	1.51

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	601	GOL	O3-C3-C2	-4.43	90.45	110.38
2	A	601	GOL	O3-C3-C2	2.96	123.70	110.38
2	B	601	GOL	O1-C1-C2	-2.64	98.49	110.38

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	601	GOL	C1-C2-C3-O3
3	A	602	EDO	O1-C1-C2-O2
2	A	601	GOL	O2-C2-C3-O3
2	B	601	GOL	O2-C2-C3-O3

There are no ring outliers.

2 monomers are involved in 9 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	602	EDO	6	0
2	B	601	GOL	3	0

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](#)

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	333/336 (99%)	-0.52	0 100 100	11, 16, 31, 70	4 (1%)
1	B	336/336 (100%)	-0.54	0 100 100	9, 16, 29, 54	7 (2%)
All	All	669/672 (99%)	-0.53	0 100 100	9, 16, 31, 70	11 (1%)

There are no RSRZ outliers to report.

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](#)

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	GOL	B	601	6/6	0.85	0.14	26,31,38,46	6
3	EDO	A	602	4/4	0.90	0.10	22,23,30,30	4
2	GOL	A	601	6/6	0.91	0.10	31,38,43,48	0

6.5 Other polymers [i](#)

There are no such residues in this entry.