



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 08:07 AM UTC

PDB ID : 4MT0 / pdb_00004mt0
Title : Crystal Structure of the Open State of the Neisseria gonorrhoeae MtrE Outer Membrane Channel
Authors : Su, C.-C.; Bolla, J.R.; Yu, E.W.
Deposited on : 2013-09-18
Resolution : 3.29 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
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

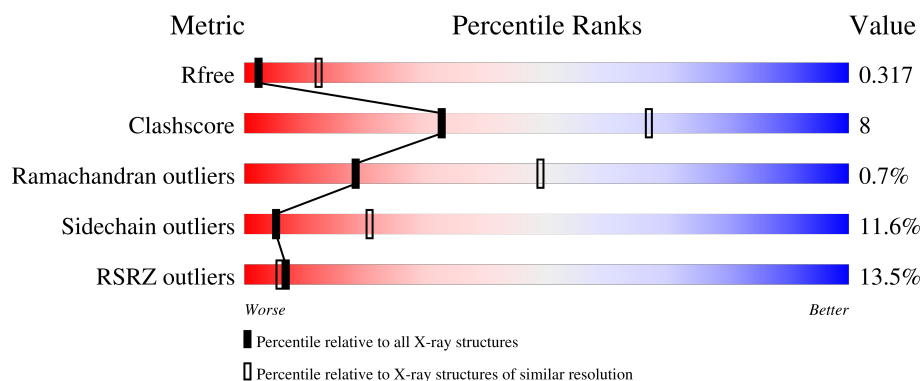
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.29 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	1169 (3.32-3.28)
Clashscore	190562	1209 (3.32-3.28)
Ramachandran outliers	187476	1188 (3.32-3.28)
Sidechain outliers	187428	1187 (3.32-3.28)
RSRZ outliers	180081	1169 (3.32-3.28)

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	447	13% 76% 20% .

2 Entry composition [i](#)

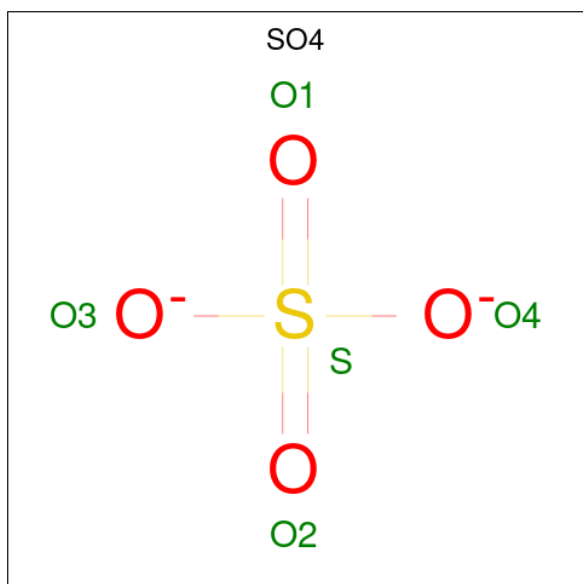
There are 3 unique types of molecules in this entry. The entry contains 3418 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 MtrE protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	445	Total	C	N	O	S	0	0	0
			3406	2126	622	654	4			

- Molecule 2 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	O	S	0	0
			5	4	1		

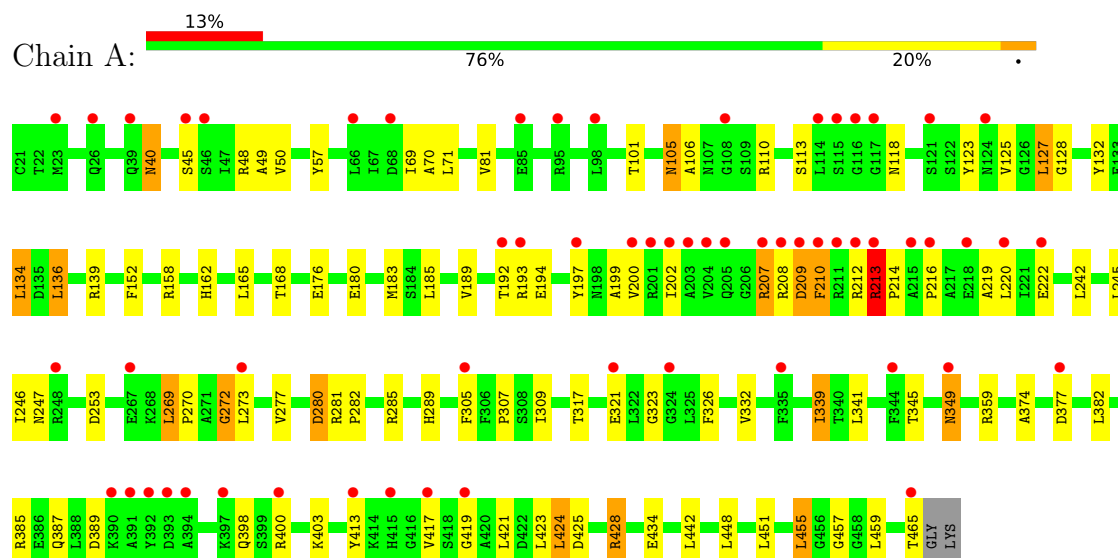
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	7	Total	O	0	0
			7	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: MtrE protein



4 Data and refinement statistics

Property	Value	Source
Space group	P 63 2 2	Depositor
Cell constants a, b, c, α , β , γ	94.10Å 94.10Å 392.37Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	46.18 – 3.29 46.18 – 3.29	Depositor EDS
% Data completeness (in resolution range)	92.4 (46.18-3.29) 92.6 (46.18-3.29)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.56 (at 3.32Å)	Xtriage
Refinement program	PHENIX 1.8.1_1168	Depositor
R, R_{free}	0.281 , 0.317 0.285 , 0.317	Depositor DCC
R_{free} test set	767 reflections (2.61%)	wwPDB-VP
Wilson B-factor (Å ²)	64.2	Xtriage
Anisotropy	0.880	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.29 , 41.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.30$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.88	EDS
Total number of atoms	3418	wwPDB-VP
Average B, all atoms (Å ²)	57.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 9.31% 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](#)

Bond lengths and bond angles in the following residue types are not validated in this section: SO4

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	0.28	0/3461	0.72	1/4686 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	210	PHE	N-CA-C	-5.48	105.86	112.54

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	3406	0	3404	54	0
2	A	5	0	0	0	0
3	A	7	0	0	0	0
All	All	3418	0	3404	54	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 8.

All (54) 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:48:ARG:HH12	1:A:277:VAL:HG12	1.50	0.75
1:A:280:ASP:OD1	1:A:280:ASP:N	2.24	0.71
1:A:216:PRO:O	1:A:428:ARG:NH2	2.30	0.65
1:A:70:ALA:HB2	1:A:246:ILE:HG22	1.80	0.63
1:A:209:ASP:OD2	1:A:209:ASP:N	2.29	0.61
1:A:199:ALA:HA	1:A:202:ILE:HG12	1.82	0.60
1:A:132:TYR:HE2	1:A:134:LEU:HD22	1.67	0.59
1:A:189:VAL:HA	1:A:192:THR:HG22	1.88	0.55
1:A:105:ASN:OD1	1:A:105:ASN:N	2.36	0.55
1:A:210:PHE:HA	1:A:213:ARG:HD3	1.90	0.52
1:A:309:ILE:HG22	1:A:339:ILE:HB	1.90	0.52
1:A:110:ARG:NH2	1:A:123:TYR:OH	2.38	0.52
1:A:180:GLU:HA	1:A:183:MET:HE2	1.92	0.52
1:A:40:ASN:HB3	1:A:382:LEU:HB3	1.92	0.51
1:A:210:PHE:O	1:A:213:ARG:HB2	2.10	0.51
1:A:413:TYR:HA	1:A:417:VAL:HB	1.94	0.50
1:A:307:PRO:HD3	1:A:341:LEU:HD12	1.94	0.49
1:A:71:LEU:HD12	1:A:165:LEU:HD23	1.94	0.49
1:A:194:GLU:HA	1:A:197:TYR:CE2	2.48	0.48
1:A:451:LEU:O	1:A:455:LEU:HB2	2.14	0.48
1:A:400:ARG:HH21	1:A:403:LYS:HD3	1.79	0.48
1:A:307:PRO:HB3	1:A:341:LEU:HB2	1.96	0.48
1:A:81:VAL:HA	1:A:158:ARG:HG3	1.96	0.47
1:A:50:VAL:HA	1:A:457:GLY:HA2	1.96	0.47
1:A:176:GLU:O	1:A:180:GLU:HG2	2.14	0.47
1:A:207:ARG:NE	1:A:209:ASP:OD2	2.45	0.47
1:A:321:GLU:HG3	1:A:323:GLY:H	1.79	0.47
1:A:305:PHE:CE1	1:A:349:ASN:HB3	2.50	0.46
1:A:168:THR:HG22	1:A:245:LEU:HD21	1.97	0.46
1:A:134:LEU:HD12	1:A:136:LEU:HD12	1.98	0.45
1:A:193:ARG:HD3	1:A:424:LEU:HD21	1.97	0.45
1:A:127:LEU:HD22	1:A:128:GLY:N	2.32	0.44
1:A:49:ALA:HB3	1:A:455:LEU:HB3	2.00	0.43
1:A:197:TYR:O	1:A:200:VAL:HG12	2.18	0.43
1:A:57:TYR:CE1	1:A:269:LEU:HD21	2.54	0.43
1:A:106:ALA:HB1	1:A:125:VAL:HG22	2.00	0.43
1:A:305:PHE:HE1	1:A:349:ASN:HB3	1.83	0.43
1:A:213:ARG:H	1:A:214:PRO:HD2	1.84	0.43
1:A:213:ARG:NH2	1:A:419:GLY:HA2	2.35	0.42
1:A:455:LEU:HD22	1:A:455:LEU:HA	1.86	0.42
1:A:281:ARG:HD3	1:A:374:ALA:HB1	2.02	0.42
1:A:220:LEU:HB2	1:A:428:ARG:HH21	1.84	0.42

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:216:PRO:HA	1:A:219:ALA:HB3	2.02	0.42
1:A:185:LEU:HD11	1:A:434:GLU:CD	2.45	0.42
1:A:403:LYS:HE2	1:A:403:LYS:HB3	1.88	0.42
1:A:317:THR:HG21	1:A:326:PHE:HA	2.01	0.41
1:A:45:SER:O	1:A:270:PRO:HG3	2.21	0.41
1:A:71:LEU:HD11	1:A:162:HIS:CD2	2.56	0.41
1:A:118:ASN:OD1	1:A:118:ASN:N	2.51	0.41
1:A:385:ARG:HD3	1:A:451:LEU:HD22	2.02	0.41
1:A:48:ARG:HH22	1:A:272:GLY:H	1.69	0.40
1:A:220:LEU:HD13	1:A:428:ARG:HB2	2.03	0.40
1:A:281:ARG:HA	1:A:282:PRO:HD3	1.89	0.40
1:A:152:PHE:HB3	1:A:289:HIS:ND1	2.37	0.40

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	443/447 (99%)	427 (96%)	13 (3%)	3 (1%)	18 49

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	272	GLY
1	A	253	ASP
1	A	213	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	346/347 (100%)	306 (88%)	40 (12%)	5 21

All (40) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	40	ASN
1	A	69	ILE
1	A	101	THR
1	A	105	ASN
1	A	113	SER
1	A	127	LEU
1	A	134	LEU
1	A	136	LEU
1	A	139	ARG
1	A	207	ARG
1	A	208	ARG
1	A	209	ASP
1	A	212	ARG
1	A	213	ARG
1	A	222	GLU
1	A	242	LEU
1	A	247	ASN
1	A	269	LEU
1	A	273	LEU
1	A	280	ASP
1	A	285	ARG
1	A	332	VAL
1	A	339	ILE
1	A	345	THR
1	A	349	ASN
1	A	359	ARG
1	A	377	ASP
1	A	387	GLN
1	A	389	ASP
1	A	398	GLN
1	A	421	LEU
1	A	423	LEU
1	A	424	LEU
1	A	425	ASP

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	A	428	ARG
1	A	442	LEU
1	A	448	LEU
1	A	455	LEU
1	A	459	LEU
1	A	465	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	40	ASN
1	A	107	ASN
1	A	124	ASN
1	A	349	ASN

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](#)

1 ligand is 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	SO4	A	501	-	4,4,4	0.24	0	6,6,6	0.08	0

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 [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 ⓘ

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	445/447 (99%)	0.74	60 (13%) 7 6	12, 45, 136, 283	0

All (60) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	393	ASP	7.5
1	A	204	VAL	5.5
1	A	417	VAL	5.0
1	A	115	SER	4.6
1	A	211	ARG	4.4
1	A	210	PHE	4.4
1	A	209	ASP	4.2
1	A	208	ARG	4.0
1	A	216	PRO	4.0
1	A	212	ARG	3.9
1	A	203	ALA	3.8
1	A	400	ARG	3.7
1	A	215	ALA	3.7
1	A	202	ILE	3.6
1	A	116	GLY	3.6
1	A	197	TYR	3.5
1	A	39	GLN	3.5
1	A	114	LEU	3.4
1	A	392	TYR	3.4
1	A	419	GLY	3.3
1	A	465	THR	3.2
1	A	213	ARG	3.2
1	A	45	SER	3.0
1	A	205	GLN	3.0
1	A	201	ARG	3.0
1	A	349	ASN	2.9
1	A	192	THR	2.9

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	A	324	GLY	2.9
1	A	218	GLU	2.8
1	A	200	VAL	2.7
1	A	377	ASP	2.7
1	A	394	ALA	2.6
1	A	344	PHE	2.6
1	A	397	LYS	2.6
1	A	273	LEU	2.5
1	A	23	MET	2.5
1	A	98	LEU	2.4
1	A	391	ALA	2.4
1	A	321	GLU	2.4
1	A	85	GLU	2.3
1	A	415	HIS	2.3
1	A	46	SER	2.3
1	A	121	SER	2.3
1	A	124	ASN	2.3
1	A	305	PHE	2.2
1	A	66	LEU	2.2
1	A	222	GLU	2.2
1	A	267	GLU	2.2
1	A	108	GLY	2.2
1	A	95	ARG	2.1
1	A	390	LYS	2.1
1	A	207	ARG	2.1
1	A	26	GLN	2.1
1	A	117	GLY	2.1
1	A	335	PHE	2.1
1	A	193	ARG	2.1
1	A	220	LEU	2.1
1	A	413	TYR	2.0
1	A	248	ARG	2.0
1	A	68	ASP	2.0

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 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($\text{\AA}^2$)	Q<0.9
2	SO4	A	501	5/5	0.82	0.10	100,100,100,100	0

6.5 Other polymers [i](#)

There are no such residues in this entry.