



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 02:20 PM UTC

PDB ID : 7R9X / pdb_00007r9x
Title : Crystal structure of a dehydrating condensation domain, AmbE-CmodAA, involved in nonribosomal peptide synthesis
Authors : Fortinez, C.M.; Schmeing, T.M.
Deposited on : 2021-06-29
Resolution : 2.14 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

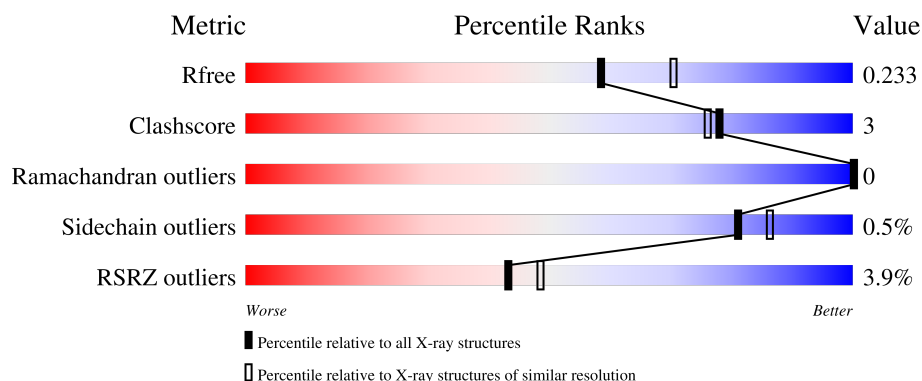
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.14 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	3689 (2.16-2.12)
Clashscore	190562	3812 (2.16-2.12)
Ramachandran outliers	187476	3773 (2.16-2.12)
Sidechain outliers	187428	3772 (2.16-2.12)
RSRZ outliers	180081	3691 (2.16-2.12)

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	438	
1	B	438	

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 13149 atoms, of which 6277 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 AmbE.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	418	Total	C	H	N	O	S	0	0	0
			6450	2045	3208	603	588	6			
1	B	403	Total	C	H	N	O	S	0	0	0
			6175	1962	3069	571	567	6			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1350	GLN	-	expression tag	UNP Q9I1H3
A	1351	SER	-	expression tag	UNP Q9I1H3
A	1352	ASN	-	expression tag	UNP Q9I1H3
B	1350	GLN	-	expression tag	UNP Q9I1H3
B	1351	SER	-	expression tag	UNP Q9I1H3
B	1352	ASN	-	expression tag	UNP Q9I1H3

- Molecule 2 is IODIDE ION (CCD ID: IOD) (formula: I).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	3	Total	I	0	0
			3	3		
2	B	2	Total	I	0	0
			2	2		

- Molecule 3 is SODIUM ION (CCD ID: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	6	Total	Na	0	0
			6	6		
3	B	6	Total	Na	0	0
			6	6		

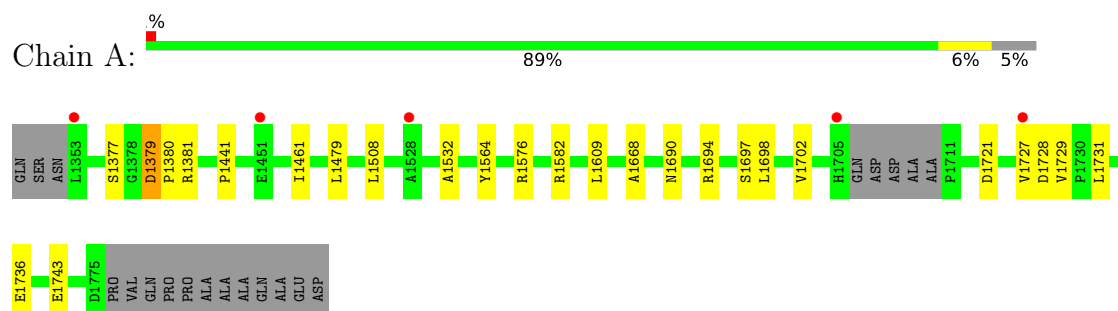
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	302	Total 302	O 302	0	0
4	B	205	Total 205	O 205	0	0

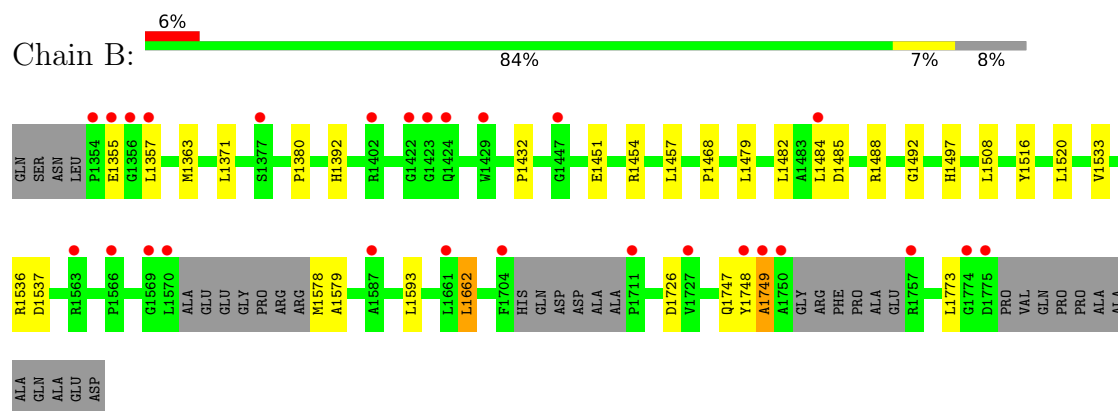
3 Residue-property plots [i](#)

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: AmbE



• Molecule 1: AmbE



4 Data and refinement statistics

Property	Value	Source
Space group	I 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	89.94Å 106.87Å 108.91Å 90.00° 96.25° 90.00°	Depositor
Resolution (Å)	44.70 – 2.14 44.70 – 2.14	Depositor EDS
% Data completeness (in resolution range)	99.1 (44.70-2.14) 99.1 (44.70-2.14)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.62 (at 2.14Å)	Xtriage
Refinement program	PHENIX 1.15.2_3472	Depositor
R, R_{free}	0.190 , 0.232 0.191 , 0.233	Depositor DCC
R_{free} test set	2000 reflections (3.55%)	wwPDB-VP
Wilson B-factor (Å ²)	27.5	Xtriage
Anisotropy	0.316	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 50.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	13149	wwPDB-VP
Average B, all atoms (Å ²)	37.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.38% 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: NA, IOD

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	0.58	0/3312	0.69	5/4502 (0.1%)
1	B	0.53	0/3169	0.66	4/4308 (0.1%)
All	All	0.56	0/6481	0.68	9/8810 (0.1%)

There are no bond length outliers.

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	1377	SER	CA-C-N	-6.87	110.46	122.83
1	A	1377	SER	C-N-CA	-6.87	110.46	122.83
1	A	1690	ASN	N-CA-C	-6.68	96.08	107.23
1	B	1355	GLU	CB-CA-C	5.93	120.30	111.17
1	A	1379	ASP	N-CA-C	5.69	117.14	109.24
1	B	1749	ALA	N-CA-C	5.59	117.07	110.97
1	B	1484	LEU	CB-CA-C	-5.31	101.11	109.34
1	B	1484	LEU	N-CA-C	5.20	120.10	113.55
1	A	1379	ASP	N-CA-CB	-5.09	103.56	110.23

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	3242	3208	3207	15	0
1	B	3106	3069	3072	20	0
2	A	3	0	0	0	0
2	B	2	0	0	1	0
3	A	6	0	0	0	0
3	B	6	0	0	0	0
4	A	302	0	0	1	1
4	B	205	0	0	1	0
All	All	6872	6277	6279	35	1

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 3.

All (35) 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:1564:TYR:O	1:A:1694:ARG:NH2	2.19	0.73
1:B:1593:LEU:HD23	1:B:1773:LEU:HD21	1.79	0.65
1:A:1702:VAL:HB	1:A:1736:GLU:HG2	1.78	0.65
1:B:1363:MET:HE1	1:B:1371:LEU:HD12	1.79	0.64
1:A:1609:LEU:HD23	1:A:1668:ALA:HB1	1.82	0.62
1:B:1578:MET:HG3	1:B:1726:ASP:HA	1.82	0.60
1:B:1485:ASP:OD2	1:B:1488:ARG:NH1	2.37	0.57
1:A:1379:ASP:OD1	1:A:1381:ARG:NH2	2.38	0.55
1:A:1698:LEU:HG	1:A:1729:VAL:HG21	1.89	0.55
1:B:1578:MET:SD	1:B:1749:ALA:HA	2.47	0.54
1:B:1392:HIS:CE1	1:B:1488:ARG:HD2	2.44	0.53
1:A:1582:ARG:HH22	1:A:1743:GLU:HB3	1.73	0.53
1:A:1727:VAL:HG12	1:A:1728:ASP:H	1.74	0.52
1:A:1461:ILE:HD11	1:A:1721:ASP:HB3	1.93	0.51
1:A:1508:LEU:C	1:A:1508:LEU:HD23	2.37	0.50
1:B:1380:PRO:HB3	1:B:1468:PRO:HB3	1.93	0.50
1:A:1727:VAL:HG12	1:A:1728:ASP:N	2.27	0.49
1:B:1457:LEU:HD23	1:B:1482:LEU:HD22	1.95	0.48
1:A:1697:SER:HA	1:A:1731:LEU:O	2.14	0.47
1:A:1532:ALA:HB1	4:A:2076:HOH:O	2.14	0.46
1:B:1726:ASP:OD1	1:B:1726:ASP:N	2.51	0.44
1:A:1576:ARG:NH1	1:A:1728:ASP:OD1	2.40	0.44
1:B:1479:LEU:HA	1:B:1492:GLY:O	2.18	0.43
1:B:1451:GLU:OE1	1:B:1454:ARG:NH2	2.51	0.43
1:B:1579:ALA:HB3	1:B:1748:TYR:CZ	2.53	0.43
1:B:1748:TYR:CD1	1:B:1748:TYR:N	2.86	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:1516:TYR:CE2	1:B:1520:LEU:HD11	2.54	0.43
1:A:1379:ASP:HA	1:A:1380:PRO:HD2	1.95	0.42
1:B:1357:LEU:HA	1:B:1432:PRO:HD3	2.01	0.42
1:B:1747:GLN:NE2	4:B:1921:HOH:O	2.52	0.41
1:B:1508:LEU:HD23	1:B:1508:LEU:C	2.46	0.41
1:A:1441:PRO:HD2	1:A:1479:LEU:O	2.20	0.41
1:B:1662:LEU:HD21	2:B:1802:IOD:I	2.90	0.41
1:B:1579:ALA:HB3	1:B:1748:TYR:CE1	2.56	0.40
1:B:1533:VAL:HB	1:B:1537:ASP:OD2	2.21	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:A:1989:HOH:O	4:A:2011:HOH:O[2_555]	2.11	0.09

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	414/438 (94%)	407 (98%)	7 (2%)	0	100	100
1	B	395/438 (90%)	390 (99%)	5 (1%)	0	100	100
All	All	809/876 (92%)	797 (98%)	12 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	324/339 (96%)	324 (100%)	0	100	100
1	B	311/339 (92%)	308 (99%)	3 (1%)	68	74
All	All	635/678 (94%)	632 (100%)	3 (0%)	81	86

All (3) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	1497	HIS
1	B	1536	ARG
1	B	1662	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	1421	HIS
1	B	1747	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](#)

Of 17 ligands modelled in this entry, 17 are monoatomic - leaving 0 for Mogul analysis.

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

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	418/438 (95%)	-0.20	5 (1%) 76 80	15, 30, 54, 89	0
1	B	403/438 (92%)	0.40	27 (6%) 24 27	17, 42, 68, 98	0
All	All	821/876 (93%)	0.09	32 (3%) 43 48	15, 35, 63, 98	0

All (32) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	1704	PHE	4.9
1	B	1750	ALA	4.7
1	B	1356	GLY	4.2
1	B	1757	ARG	4.2
1	A	1353	LEU	4.0
1	B	1354	PRO	3.8
1	B	1570	LEU	3.6
1	B	1749	ALA	3.5
1	B	1422	GLY	3.4
1	B	1727	VAL	3.1
1	B	1357	LEU	3.0
1	B	1569	GLY	3.0
1	B	1355	GLU	2.9
1	B	1587	ALA	2.6
1	B	1748	TYR	2.6
1	A	1705	HIS	2.6
1	B	1484	LEU	2.6
1	B	1424	GLN	2.4
1	B	1775	ASP	2.4
1	B	1429	TRP	2.3
1	B	1563	ARG	2.3
1	A	1727	VAL	2.3
1	B	1402	ARG	2.2
1	B	1447	GLY	2.2

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Mol	Chain	Res	Type	RSRZ
1	B	1711	PRO	2.2
1	A	1528	ALA	2.2
1	B	1661	LEU	2.2
1	B	1423	GLY	2.1
1	B	1774	GLY	2.1
1	A	1451	GLU	2.0
1	B	1377	SER	2.1
1	B	1566	PRO	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](#)

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
3	NA	B	1808	1/1	0.80	0.26	33,33,33,33	0
2	IOD	A	1803	1/1	0.81	0.24	156,156,156,156	0
2	IOD	B	1802	1/1	0.84	0.22	159,159,159,159	0
3	NA	A	1805	1/1	0.88	0.14	40,40,40,40	0
3	NA	A	1809	1/1	0.88	0.22	31,31,31,31	0
2	IOD	B	1801	1/1	0.88	0.19	111,111,111,111	0
3	NA	A	1807	1/1	0.89	0.15	31,31,31,31	0
2	IOD	A	1801	1/1	0.92	0.21	111,111,111,111	0
3	NA	B	1803	1/1	0.93	0.26	47,47,47,47	0
3	NA	B	1806	1/1	0.94	0.21	41,41,41,41	0
3	NA	B	1804	1/1	0.94	0.25	22,22,22,22	0
3	NA	B	1807	1/1	0.95	0.47	25,25,25,25	0
3	NA	A	1806	1/1	0.96	0.16	30,30,30,30	0
2	IOD	A	1802	1/1	0.96	0.11	76,76,76,76	0
3	NA	A	1808	1/1	0.98	0.37	25,25,25,25	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
3	NA	A	1804	1/1	0.98	0.17	19,19,19,19	0
3	NA	B	1805	1/1	0.98	0.15	19,19,19,19	0

6.5 Other polymers [i](#)

There are no such residues in this entry.