Full wwPDB X-ray Structure Validation Report (i)

Sep 12, 2023 – 12:10 AM EDT

PDB ID	:	4MCK
Title	:	Crystal structure of Family GH19, Class IV chitinase from Zea mays
Authors	:	Chaudet, M.M.; Rose, D.R.
Deposited on	:	2013-08-21
Resolution	:	1.50 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 (i) 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 (1)) were used in the production of this report:

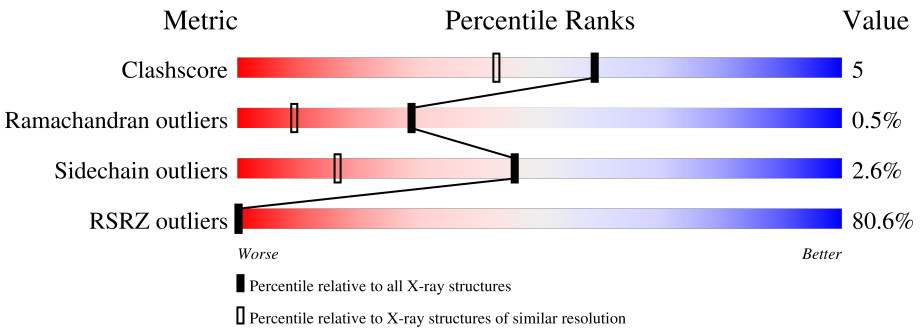
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.35.1
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.35.1

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

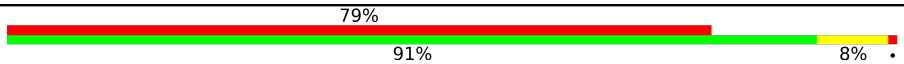
The reported resolution of this entry is 1.50 Å.

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	141614	3144 (1.50-1.50)
Ramachandran outliers	138981	3066 (1.50-1.50)
Sidechain outliers	138945	3064 (1.50-1.50)
RSRZ outliers	127900	2884 (1.50-1.50)

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	201	

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 1866 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 Chitinase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	201	1563	990	281	282	10	0	0	0

There are 9 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-4	UNK	-	expression tag	UNP Q6JBL3
A	-3	UNK	-	expression tag	UNP Q6JBL3
A	-2	UNK	-	expression tag	UNP Q6JBL3
A	-1	UNK	-	expression tag	UNP Q6JBL3
A	0	UNK	-	expression tag	UNP Q6JBL3
A	3	SER	THR	SEE REMARK 999	UNP Q6JBL3
A	62	GLN	GLU	engineered mutation	UNP Q6JBL3
A	?	-	GLN	deletion	UNP Q6JBL3
A	?	-	ALA	deletion	UNP Q6JBL3

- Molecule 2 is water.

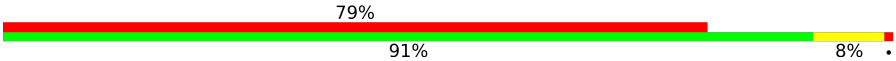
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
2	A	303	303	303	0	0

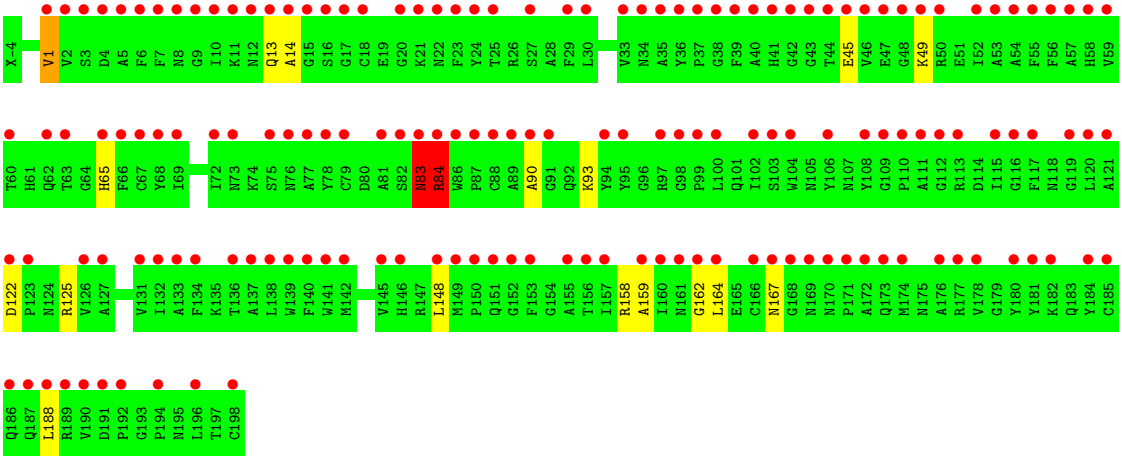
3 Residue-property plots (i)

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: Chitinase

Chain A:





4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	37.15Å 65.17Å 72.33Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	25.91 – 1.50 25.92 – 1.50	Depositor EDS
% Data completeness (in resolution range)	(Not available) (25.91-1.50) 93.8 (25.92-1.50)	Depositor EDS
R_{merge}	0.04	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.96 (at 1.50Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.8_1069)	Depositor
R, R_{free}	0.178 , 0.203 0.179 , (Not available)	Depositor DCC
R_{free} test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å^2)	15.7	Xtriage
Anisotropy	0.302	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 55.7	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	1866	wwPDB-VP
Average B, all atoms (Å^2)	39.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 9.56% of the height of the origin peak. No significant pseudotranslation is detected.*

[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	0.38	0/1566	0.59	2/2124 (0.1%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	83	ASN	N-CA-C	7.01	129.94	111.00
1	A	84	ARG	CB-CA-C	-5.23	99.93	110.40

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	1563	0	1438	14	3
2	A	303	0	0	6	3
All	All	1866	0	1438	14	3

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.

All (14) 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:84:ARG:CZ	1:A:84:ARG:HB3	1.96	0.94
1:A:93:LYS:NZ	2:A:468:HOH:O	2.09	0.84
1:A:162:GLY:O	2:A:473:HOH:O	2.00	0.77
1:A:162:GLY:O	2:A:459:HOH:O	2.04	0.75
1:A:90:ALA:O	2:A:340:HOH:O	2.04	0.75
1:A:158:ARG:HH22	1:A:167:ASN:HD21	1.37	0.73
1:A:84:ARG:HB3	1:A:84:ARG:NH2	2.14	0.62
1:A:148:LEU:HD13	1:A:159:ALA:HB2	1.86	0.56
1:A:65:HIS:HE1	2:A:465:HOH:O	1.93	0.51
1:A:45:GLU:HG2	1:A:49:LYS:HE3	1.93	0.51
1:A:164:LEU:HA	2:A:459:HOH:O	2.12	0.48
1:A:158:ARG:HH22	1:A:167:ASN:ND2	2.10	0.42
1:A:1:VAL:HG23	1:A:188:LEU:HD22	2.01	0.41
1:A:122:ASP:HB3	1:A:125:ARG:HG3	2.02	0.40

All (3) 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)
1:A:83:ASN:O	2:A:270:HOH:O[4_455]	1.64	0.56
1:A:83:ASN:OD1	2:A:240:HOH:O[4_455]	2.06	0.14
1:A:83:ASN:ND2	2:A:240:HOH:O[4_455]	2.14	0.06

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	195/201 (97%)	184 (94%)	10 (5%)	1 (0%)	29 9

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	14	ALA

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	151/151 (100%)	147 (97%)	4 (3%)	46 16

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1	VAL
1	A	13	GLN
1	A	83	ASN
1	A	84	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	167	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 monosaccharides in this entry.

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)

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	196/201 (97%)	3.35	158 (80%)	0	0	31, 36, 49, 58	0

All (158) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	14	ALA	11.6
1	A	162	GLY	10.7
1	A	164	LEU	9.3
1	A	90	ALA	8.6
1	A	91	GLY	7.9
1	A	16	SER	7.8
1	A	43	GLY	7.6
1	A	160	ILE	7.3
1	A	83	ASN	6.5
1	A	2	VAL	6.0
1	A	100	LEU	5.8
1	A	1	VAL	5.8
1	A	15	GLY	5.7
1	A	13	GLN	5.6
1	A	69	ILE	5.6
1	A	17	GLY	5.5
1	A	42	GLY	5.3
1	A	104	TRP	5.2
1	A	8	ASN	5.1
1	A	84	ARG	5.1
1	A	141	TRP	5.0
1	A	190	VAL	5.0
1	A	139	TRP	4.9
1	A	191	ASP	4.9
1	A	18	CYS	4.9
1	A	115	ILE	4.9
1	A	133	ALA	4.8

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Mol	Chain	Res	Type	RSRZ
1	A	172	ALA	4.8
1	A	47	GLU	4.8
1	A	189	ARG	4.7
1	A	159	ALA	4.7
1	A	178	VAL	4.7
1	A	126	VAL	4.6
1	A	46	VAL	4.6
1	A	168	GLY	4.6
1	A	44	THR	4.6
1	A	121	ALA	4.6
1	A	72	ILE	4.5
1	A	150	PRO	4.5
1	A	59	VAL	4.4
1	A	134	PHE	4.4
1	A	157	ILE	4.4
1	A	145	VAL	4.3
1	A	52	ILE	4.3
1	A	33	VAL	4.3
1	A	12	ASN	4.3
1	A	82	SER	4.3
1	A	5	ALA	4.2
1	A	95	TYR	4.2
1	A	155	ALA	4.1
1	A	36	TYR	4.1
1	A	55	PHE	4.1
1	A	131	VAL	4.1
1	A	24	TYR	4.0
1	A	37	PRO	4.0
1	A	185	CYS	4.0
1	A	68	TYR	4.0
1	A	10	ILE	4.0
1	A	6	PHE	4.0
1	A	7	PHE	4.0
1	A	188	LEU	3.9
1	A	39	PHE	3.9
1	A	138	LEU	3.8
1	A	29	PHE	3.8
1	A	153	PHE	3.8
1	A	66	PHE	3.8
1	A	117	PHE	3.8
1	A	78	TYR	3.8
1	A	86	TRP	3.8

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Mol	Chain	Res	Type	RSRZ
1	A	186	GLN	3.7
1	A	156	THR	3.7
1	A	161	ASN	3.7
1	A	75	SER	3.7
1	A	127	ALA	3.6
1	A	180	TYR	3.6
1	A	87	PRO	3.5
1	A	81	ALA	3.5
1	A	27	SER	3.5
1	A	35	ALA	3.5
1	A	54	ALA	3.5
1	A	88	CYS	3.5
1	A	30	LEU	3.5
1	A	77	ALA	3.4
1	A	23	PHE	3.4
1	A	3	SER	3.4
1	A	132	ILE	3.4
1	A	20	GLY	3.3
1	A	34	ASN	3.3
1	A	79	CYS	3.3
1	A	198	CYS	3.3
1	A	94	TYR	3.3
1	A	110	PRO	3.3
1	A	140	PHE	3.3
1	A	111	ALA	3.3
1	A	63	THR	3.2
1	A	148	LEU	3.2
1	A	169	ASN	3.2
1	A	21	LYS	3.2
1	A	53	ALA	3.1
1	A	171	PRO	3.1
1	A	102	ILE	3.1
1	A	106	TYR	3.1
1	A	136	THR	3.1
1	A	120	LEU	3.1
1	A	196	LEU	3.1
1	A	49	LYS	3.0
1	A	45	GLU	3.0
1	A	9	GLY	3.0
1	A	152	GLY	3.0
1	A	108	TYR	2.9
1	A	119	GLY	2.9

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Mol	Chain	Res	Type	RSRZ
1	A	181	TYR	2.9
1	A	4	ASP	2.9
1	A	56	PHE	2.8
1	A	57	ALA	2.8
1	A	65	HIS	2.8
1	A	40	ALA	2.7
1	A	137	ALA	2.7
1	A	73	ASN	2.7
1	A	41	HIS	2.7
1	A	50	ARG	2.6
1	A	187	GLN	2.6
1	A	60	THR	2.6
1	A	176	ALA	2.6
1	A	166	CYS	2.6
1	A	194	PRO	2.6
1	A	89	ALA	2.5
1	A	103	SER	2.5
1	A	167	ASN	2.5
1	A	174	MET	2.5
1	A	76	ASN	2.4
1	A	146	HIS	2.4
1	A	184	TYR	2.4
1	A	48	GLY	2.4
1	A	149	MET	2.4
1	A	67	CYS	2.4
1	A	38	GLY	2.4
1	A	142	MET	2.4
1	A	62	GLN	2.3
1	A	123	PRO	2.3
1	A	109	GLY	2.3
1	A	122	ASP	2.3
1	A	22	ASN	2.3
1	A	170	ASN	2.3
1	A	58	HIS	2.2
1	A	25	THR	2.2
1	A	11	LYS	2.2
1	A	99	PRO	2.2
1	A	112	GLY	2.1
1	A	116	GLY	2.1
1	A	177	ARG	2.1
1	A	192	PRO	2.1
1	A	98	GLY	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	113	ARG	2.0
1	A	182	LYS	2.0
1	A	151	GLN	2.0
1	A	97	ARG	2.0
1	A	173	GLN	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 monosaccharides in this entry.

6.4 Ligands (i)

There are no ligands in this entry.

6.5 Other polymers (i)

There are no such residues in this entry.