



Full wwPDB X-ray Structure Validation Report ⓘ

May 24, 2020 – 01:58 am BST

PDB ID : 3IWR
Title : Crystal structure of class I chitinase from *Oryza sativa* L. japonica
Authors : Kezuka, Y.; Watanabe, T.; Nonaka, T.
Deposited on : 2009-09-03
Resolution : 2.57 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 following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.11
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) : 2.11

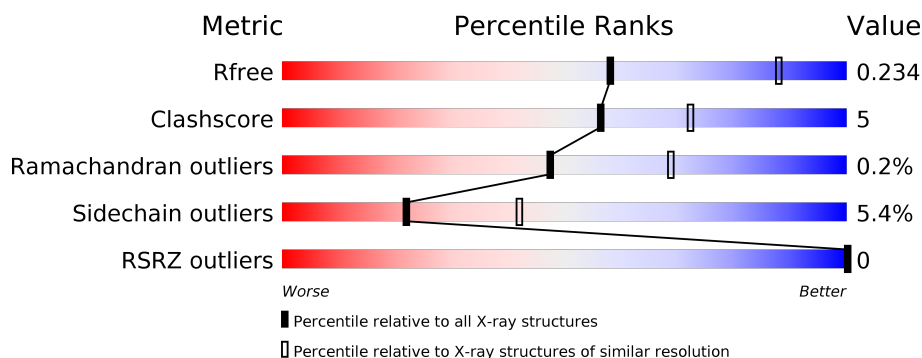
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION



The reported resolution of this entry is 2.57 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}	130704	3676 (2.60-2.56)
Clashscore	141614	4049 (2.60-2.56)
Ramachandran outliers	138981	3979 (2.60-2.56)
Sidechain outliers	138945	3979 (2.60-2.56)
RSRZ outliers	127900	3614 (2.60-2.56)

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 on 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	309	
1	B	309	

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 3925 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.

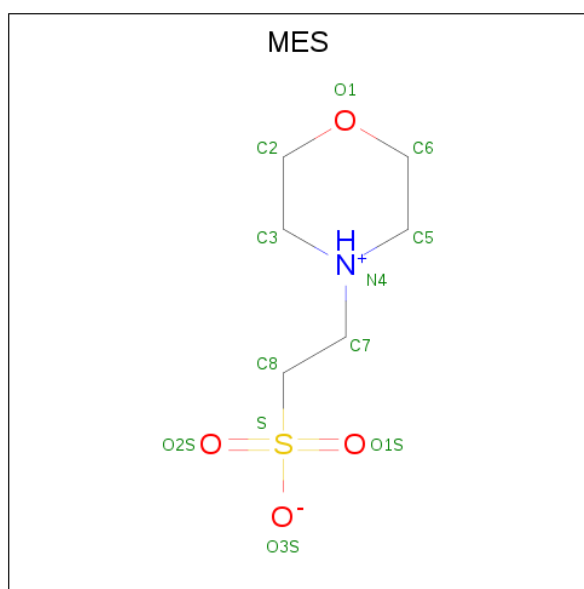
- Molecule 1 is a protein called Chitinase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	244	Total	C	N	O	S	0	1	0
			1866	1182	332	344	8			
1	B	246	Total	C	N	O	S	0	4	0
			1898	1205	336	349	8			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	32	MET	-	INITIATING METHIONINE	UNP Q7DNA1
B	32	MET	-	INITIATING METHIONINE	UNP Q7DNA1

- Molecule 2 is 2-(N-MORPHOLINO)-ETHANESULFONIC ACID (three-letter code: MES) (formula: C₆H₁₃NO₄S).



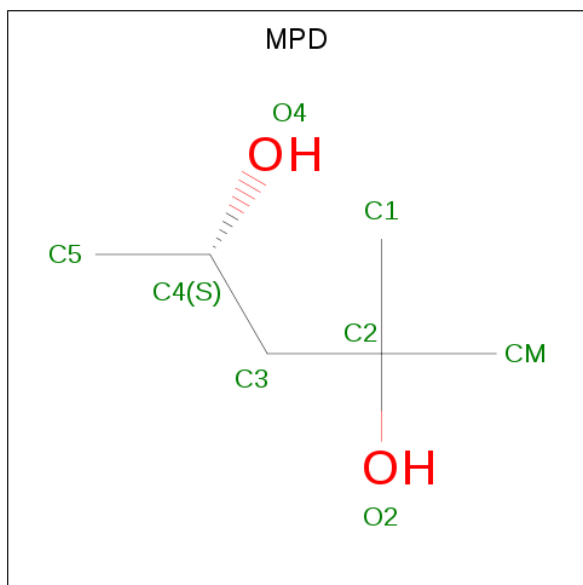
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	S	0	0
			12	6	1	4	1		

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	B	1	Total	C	N	O	S	0	0
			12	6	1	4	1		

- Molecule 3 is (4S)-2-METHYL-2,4-PENTANEDIOL (three-letter code: MPD) (formula: $C_6H_{14}O_2$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			8	6	2		
3	B	1	Total	C	O	0	0
			8	6	2		

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	49	Total	O	0	0
			49	49		
4	B	72	Total	O	0	0
			72	72		

- Molecule 1: Chitinase

GLY	LEU	ALA	GLU	GLN	MET
					GLU
					GLN
					CYS
					GLY
					ALA
					GLN
					ALA
					GLY
					GLY
					ALA
					ARG
					CYS
					PRO
					ASN
					CYS
					LEU
					CYS
					CYS
					SER
					ARG
					TRP
					GLY
					TRP
					CYS
					GLY
					THR
					THR
					SER
					ASP
					PHE
					CYS
					GLY
					ASP
					GLY
					CYS
					GLN
					GLN
					CYS
					SER
					GLY
					CYS
					GLY
					PRO
					THR
					PRO
					THR
					PRO
					THR
					PRO
					PRO
					SER
					PRO
					SER
					PRO
					SER
					GLY
					D87
					988
					V89
					T03

- Molecule 1: Chitinase

L97	L101	E138	Q150	E176	S181	P186	G200	Q205	R217	L224	D228	N251	N286	R302	N330	GLY	SER	SER	SER	VAL	GLN	LEU	GLY	ALA	GLU	GLN																													
MET	GLU	GLN	CYS	GLY	ALA	GLN	ALA	GLY	GLY	ALA	ARG	CYS	CYS	PRO	ASN	CYS	LEU	CYS	CYS	SER	ARG	TRP	GLY	TRP	CYS	GLY	THR	SER	ASP	PHE	CYS	GLY	ASP	CYS	GLN	SER	GLN	GLN	CYS	SER	GLY	CYS	GLY	PRO	THR	PRO	THR	PRO	PRO	SER	P85	S86	V89	I92	T93

4 Data and refinement statistics

Property	Value	Source
Space group	P 65	Depositor
Cell constants a, b, c, α , β , γ	117.08 Å 117.08 Å 77.97 Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	101.53 – 2.57 101.40 – 2.57	Depositor EDS
% Data completeness (in resolution range)	100.0 (101.53-2.57) 97.0 (101.40-2.57)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	0.06	Depositor
$\langle I/\sigma(I) \rangle$ ¹	5.14 (at 2.58 Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.179 , 0.236 0.181 , 0.234	Depositor DCC
R_{free} test set	967 reflections (5.11%)	wwPDB-VP
Wilson B-factor (Å ²)	25.9	Xtriage
Anisotropy	0.263	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 39.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.042 for h,-h-k,-l	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	3925	wwPDB-VP
Average B, all atoms (Å ²)	22.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.30% 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: MPD, MES

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	0.67	0/1932	0.67	0/2636
1	B	0.74	1/1975 (0.1%)	0.73	0/2695
All	All	0.71	1/3907 (0.0%)	0.70	0/5331

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
1	B	0	1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	138	GLU	CG-CD	5.31	1.59	1.51

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	85	PRO	Peptide

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	1866	0	1738	24	0
1	B	1898	0	1774	12	0
2	A	12	0	13	1	0
2	B	12	0	13	0	0
3	A	8	0	14	0	0
3	B	8	0	14	1	0
4	A	49	0	0	1	0
4	B	72	0	0	1	0
All	All	3925	0	3566	37	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.

All (37) 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:330:ASN:C	1:A:330:ASN:HD22	1.65	0.99
1:A:283:ASN:HD22	1:A:326:GLN:HE21	1.34	0.74
3:B:341:MPD:HM3	4:B:9:HOH:O	1.90	0.70
1:B:200:GLY:HA3	1:B:205[B]:GLN:NE2	2.07	0.68
1:A:330:ASN:ND2	1:A:330:ASN:C	2.38	0.68
1:A:283:ASN:HD22	1:A:326:GLN:NE2	1.96	0.64
1:A:136:ASN:C	1:A:136:ASN:HD22	2.03	0.62
1:A:136:ASN:ND2	1:A:139:THR:H	2.00	0.59
1:A:193:ALA:HB3	1:A:196:ARG:HG3	1.85	0.57
1:B:150:GLN:NE2	1:B:302:ARG:HH11	2.04	0.55
1:A:272:ALA:HB1	1:A:327:ARG:HB3	1.88	0.54
1:B:176:GLU:HB2	1:B:205[B]:GLN:HE22	1.76	0.51
1:A:136:ASN:HD21	1:A:139:THR:H	1.61	0.49
1:A:101:LEU:HD22	1:A:309:TYR:CD1	2.48	0.48
1:A:275:ALA:HB3	1:A:320:ASN:HD22	1.78	0.48
1:B:89:VAL:HG13	1:B:93:VAL:CG1	2.45	0.47
1:A:206:LEU:HA	2:A:1:MES:O1S	2.15	0.47
1:B:97:LEU:HD22	1:B:101:LEU:HG	1.96	0.47
1:A:215:ALA:O	1:A:219:ILE:HG12	2.16	0.46
1:A:235:THR:O	1:A:239:LYS:HG3	2.16	0.45
1:A:275:ALA:HB3	1:A:320:ASN:ND2	2.32	0.45
1:A:207:SER:O	1:A:208:PHE:HB2	2.16	0.45
1:B:251:ASN:H	1:B:251:ASN:HD22	1.64	0.44
1:B:150:GLN:NE2	1:B:302:ARG:NH1	2.65	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:153:HIS:ND1	1:A:301:ASN:OD1	2.29	0.44
1:B:251:ASN:N	1:B:251:ASN:HD22	2.15	0.44
1:A:97:LEU:HD22	1:A:101:LEU:HG	1.99	0.44
1:A:92:ILE:HD13	1:A:140:ARG:HB3	1.99	0.44
1:A:106:ASN:O	1:A:113:ARG:NH1	2.50	0.43
1:B:150:GLN:HE22	1:B:302:ARG:HD3	1.83	0.42
1:A:226:ASN:HB3	4:A:344:HOH:O	2.19	0.42
1:B:92:ILE:HD13	1:B:92:ILE:HG21	1.70	0.42
1:B:330:ASN:OD1	1:B:330:ASN:C	2.59	0.41
1:A:204:ILE:HD12	1:A:204:ILE:HA	1.96	0.41
1:A:259:ILE:HA	1:A:259:ILE:HD12	1.96	0.40
1:B:93:VAL:HG22	1:B:93:VAL:O	2.21	0.40
1:A:193:ALA:HB3	1:A:196:ARG:CG	2.49	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	243/309 (79%)	234 (96%)	8 (3%)	1 (0%)	34	55
1	B	248/309 (80%)	241 (97%)	7 (3%)	0	100	100
All	All	491/618 (79%)	475 (97%)	15 (3%)	1 (0%)	47	69

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	208	PHE

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	186/235 (79%)	178 (96%)	8 (4%)	29	52
1	B	191/235 (81%)	179 (94%)	12 (6%)	18	35
All	All	377/470 (80%)	357 (95%)	20 (5%)	22	43

All (20) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	87	ASP
1	A	89	VAL
1	A	97	LEU
1	A	107	ASP
1	A	113	ARG
1	A	136	ASN
1	A	320	ASN
1	A	330	ASN
1	B	86	SER
1	B	92	ILE
1	B	93	VAL
1	B	97	LEU
1	B	138	GLU
1	B	181	SER
1	B	186	PRO
1	B	217	ARG
1	B	224	LEU
1	B	228	ASP
1	B	251	ASN
1	B	286	ASN

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (9) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	136	ASN
1	A	211	ASN

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Mol	Chain	Res	Type
1	A	249	GLN
1	A	286	ASN
1	A	326	GLN
1	A	330	ASN
1	B	150	GLN
1	B	251	ASN
1	B	286	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 carbohydrates in this entry.

5.6 Ligand geometry [i](#)

4 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	$\# Z > 2$
3	MPD	B	341	-	7,7,7	0.37	0	9,10,10	0.58	0
2	MES	B	2	-	12,12,12	2.05	1 (8%)	14,16,16	0.73	0
3	MPD	A	341	-	7,7,7	0.35	0	9,10,10	0.59	0
2	MES	A	1	-	12,12,12	1.99	1 (8%)	14,16,16	0.70	0

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	MPD	B	341	-	-	1/5/5/5	-
2	MES	B	2	-	-	1/6/14/14	0/1/1/1
3	MPD	A	341	-	-	0/5/5/5	-
2	MES	A	1	-	-	4/6/14/14	0/1/1/1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	2	MES	C8-S	-6.62	1.68	1.77
2	A	1	MES	C8-S	-6.43	1.68	1.77

There are no bond angle outliers.

There are no chirality outliers.

All (6) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	2	MES	N4-C7-C8-S
2	A	1	MES	N4-C7-C8-S
2	A	1	MES	C7-C8-S-O1S
2	A	1	MES	C7-C8-S-O3S
2	A	1	MES	C7-C8-S-O2S
3	B	341	MPD	C2-C3-C4-C5

There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	341	MPD	1	0
2	A	1	MES	1	0

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 [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	244/309 (78%)	-0.11	0 100 100	13, 24, 40, 47	0
1	B	246/309 (79%)	-0.15	0 100 100	9, 18, 35, 43	0
All	All	490/618 (79%)	-0.13	0 100 100	9, 22, 38, 47	0

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 carbohydrates 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
3	MPD	B	341	8/8	0.89	0.21	38,41,42,42	0
2	MES	A	1	12/12	0.89	0.22	60,61,64,65	0
2	MES	B	2	12/12	0.95	0.20	53,53,54,55	0
3	MPD	A	341	8/8	0.96	0.14	33,35,35,36	0

6.5 Other polymers [i](#)

There are no such residues in this entry.