Full wwPDB X-ray Structure Validation Report ⓘ

Oct 16, 2023 – 01:09 PM EDT

PDB ID	:	2D4K
Title	:	Monoclinic hen egg-white lysozyme crystallized at 313K
Authors	:	Harata, K.; Akiba, T.
Deposited on	:	2005-10-20
Resolution	:	1.15 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:

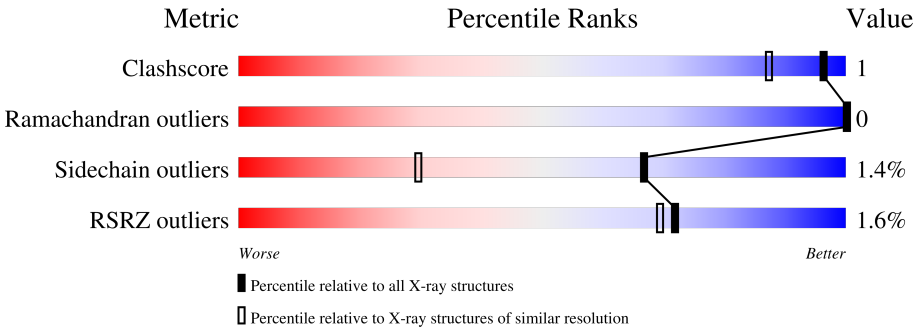
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.36
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

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 1.15 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	1537 (1.18-1.10)
Ramachandran outliers	138981	1483 (1.18-1.10)
Sidechain outliers	138945	1480 (1.18-1.10)
RSRZ outliers	127900	1464 (1.18-1.10)

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	129	3%, 87%, 13%
1	N	129	90%, 9%, ·

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 2293 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 Lysozyme C.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	129	Total	C	N	O	S	0	4	0
			1019	626	196	187	10			
1	N	129	Total	C	N	O	S	0	4	0
			1019	624	198	187	10			

- Molecule 2 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Na	0	0
			1	1		
2	N	1	Total	Na	0	0
			1	1		

- Molecule 3 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Cl	0	1
			1	1		
3	N	3	Total	Cl	0	0
			3	3		

- Molecule 4 is water.

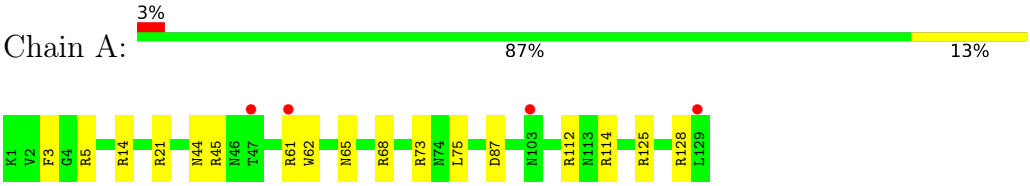
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	103	Total	O	0	6
			103	103		
4	N	146	Total	O	0	10
			146	146		

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.

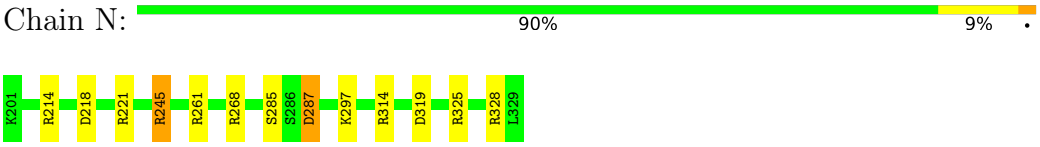
• Molecule 1: Lysozyme C

Chain A:



• Molecule 1: Lysozyme C

Chain N:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	27.22Å 63.48Å 59.19Å 90.00° 92.93° 90.00°	Depositor
Resolution (Å)	19.70 – 1.15 19.73 – 1.15	Depositor EDS
% Data completeness (in resolution range)	(Not available) (19.70-1.15) 93.8 (19.73-1.15)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.12 (at 1.15Å)	Xtriage
Refinement program	SHELXL-97	Depositor
R, R_{free}	0.132 , 0.164 0.133 , (Not available)	Depositor DCC
R_{free} test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å^2)	13.1	Xtriage
Anisotropy	0.331	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 78.8	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	0.039 for h,-k,-l	Xtriage
F_o,F_c correlation	0.98	EDS
Total number of atoms	2293	wwPDB-VP
Average B, all atoms (Å^2)	24.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 76.22 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 1.0855e-06. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

[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)

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

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	0.68	0/1055	1.64	22/1425 (1.5%)
1	N	0.80	0/1055	1.63	16/1423 (1.1%)
All	All	0.74	0/2110	1.63	38/2848 (1.3%)

There are no bond length outliers.

All (38) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	N	214	ARG	CD-NE-CZ	20.45	152.24	123.60
1	N	245	ARG	CD-NE-CZ	18.99	150.19	123.60
1	A	45	ARG	CD-NE-CZ	18.16	149.02	123.60
1	A	45	ARG	NE-CZ-NH2	14.52	127.56	120.30
1	A	73	ARG	NE-CZ-NH2	14.49	127.54	120.30
1	A	73	ARG	CD-NE-CZ	13.78	142.89	123.60
1	N	268	ARG	CD-NE-CZ	11.37	139.52	123.60
1	N	221[A]	ARG	CD-NE-CZ	11.10	139.14	123.60
1	N	221[B]	ARG	CD-NE-CZ	11.10	139.14	123.60
1	A	114	ARG	NE-CZ-NH1	-9.63	115.48	120.30
1	A	125	ARG	CD-NE-CZ	9.45	136.83	123.60
1	N	328	ARG	NE-CZ-NH1	-8.41	116.10	120.30
1	A	125	ARG	NE-CZ-NH1	8.31	124.46	120.30
1	N	218	ASP	CB-CG-OD2	7.77	125.29	118.30
1	N	261	ARG	NE-CZ-NH2	-7.48	116.56	120.30
1	N	319	ASP	CB-CG-OD1	7.07	124.66	118.30
1	A	14[A]	ARG	NE-CZ-NH2	7.00	123.80	120.30
1	A	14[B]	ARG	NE-CZ-NH2	7.00	123.80	120.30
1	N	214	ARG	NE-CZ-NH2	6.86	123.73	120.30
1	N	314	ARG	NE-CZ-NH1	-6.84	116.88	120.30
1	A	128	ARG	C-N-CA	6.60	138.21	121.70
1	N	325	ARG	NE-CZ-NH2	6.42	123.51	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	N	245	ARG	NE-CZ-NH2	6.37	123.48	120.30
1	A	68	ARG	NE-CZ-NH2	-6.33	117.13	120.30
1	A	45	ARG	NH1-CZ-NH2	-6.08	112.71	119.40
1	A	73	ARG	NH1-CZ-NH2	-5.97	112.83	119.40
1	A	5	ARG	NE-CZ-NH2	-5.85	117.38	120.30
1	A	87[A]	ASP	CB-CG-OD1	5.79	123.51	118.30
1	A	87[B]	ASP	CB-CG-OD1	5.79	123.51	118.30
1	A	21	ARG	NE-CZ-NH2	5.73	123.17	120.30
1	N	287	ASP	CA-CB-CG	5.71	125.95	113.40
1	A	112	ARG	CD-NE-CZ	5.56	131.38	123.60
1	A	3	PHE	CB-CG-CD1	-5.34	117.06	120.80
1	A	61	ARG	NE-CZ-NH2	5.20	122.90	120.30
1	A	112	ARG	CA-CB-CG	5.17	124.77	113.40
1	N	325	ARG	NE-CZ-NH1	-5.10	117.75	120.30
1	A	68	ARG	NE-CZ-NH1	5.08	122.84	120.30
1	N	328	ARG	NE-CZ-NH2	5.06	122.83	120.30

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	1019	0	979	3	0
1	N	1019	0	976	1	0
2	A	1	0	0	0	0
2	N	1	0	0	0	0
3	A	1	0	0	1	0
3	N	3	0	0	0	0
4	A	103	0	0	1	0
4	N	146	0	0	1	0
All	All	2293	0	1955	4	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 1.

All (4) 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:44:ASN:HB2	4:A:576:HOH:O	2.07	0.54
1:A:62:TRP:O	1:A:75[B]:LEU:HD13	2.14	0.47
1:A:65:ASN:OD1	3:A:405[B]:CL:CL	2.70	0.47
1:N:297[B]:LYS:NZ	4:N:534:HOH:O	2.49	0.45

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	131/129 (102%)	129 (98%)	2 (2%)	0	100	100
1	N	131/129 (102%)	129 (98%)	2 (2%)	0	100	100
All	All	262/258 (102%)	258 (98%)	4 (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	109/105 (104%)	109 (100%)	0	100	100
1	N	109/105 (104%)	106 (97%)	3 (3%)	43	7
All	All	218/210 (104%)	215 (99%)	3 (1%)	67	29

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

Mol	Chain	Res	Type
1	N	245	ARG
1	N	285	SER
1	N	287	ASP

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

Mol	Chain	Res	Type
1	A	15	HIS
1	N	244	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)

Of 6 ligands modelled in this entry, 6 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 (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, 95^{th} 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	129/129 (100%)	0.04	4 (3%) 49 48	13, 24, 48, 61	0
1	N	129/129 (100%)	-0.22	0 100 100	11, 18, 31, 60	0
All	All	258/258 (100%)	-0.09	4 (1%) 72 69	11, 20, 44, 61	0

All (4) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	129	LEU	5.3
1	A	47	THR	2.9
1	A	103	ASN	2.4
1	A	61	ARG	2.1

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 monosaccharides in this entry.

6.4 Ligands

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, 95^{th} 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	CL	A	405[B]	1/1	0.94	0.08	38,38,38,38	1

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	NA	N	406	1/1	0.99	0.03	16,16,16,16	0
2	NA	A	401	1/1	0.99	0.07	21,21,21,21	0
3	CL	N	410	1/1	0.99	0.06	29,29,29,29	0
3	CL	N	409	1/1	1.00	0.15	29,29,29,29	0
3	CL	N	411	1/1	1.00	0.30	17,17,17,17	0

6.5 Other polymers

There are no such residues in this entry.