



# wwPDB X-ray Structure Validation Summary Report

Feb 27, 2014 – 11:19 PM GMT

PDB ID : 1HC0  
Title : structure of lysozyme with periodate  
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Deposited on : 2001-04-25  
Resolution : 1.82 Å(reported)

This is a wwPDB validation summary report for a publicly released PDB entry.

We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)

A user guide is available at <http://wwpdb.org/ValidationPDFNotes.html>

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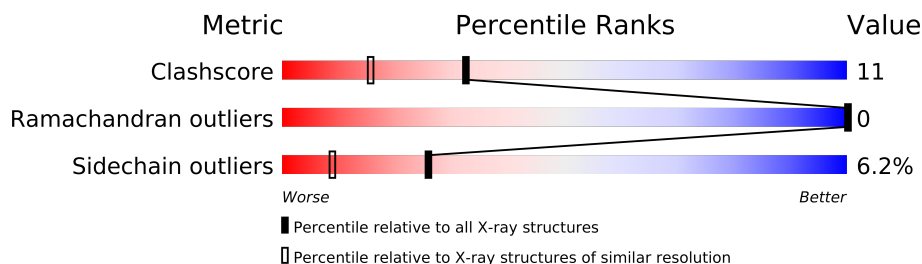
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity	:	4.02b-467
Mogul	:	1.15 2013
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	21963
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et. al. (1996)
Validation Pipeline (wwPDB-VP)	:	stable22683

# 1 Overall quality at a glance

The reported resolution of this entry is 1.82 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	79885	5140 (1.84-1.80)
Ramachandran outliers	78287	5077 (1.84-1.80)
Sidechain outliers	78261	5077 (1.84-1.80)

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  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	1-A	129	
1	10-A	129	
1	2-A	129	
1	3-A	129	
1	4-A	129	
1	5-A	129	
1	6-A	129	
1	7-A	129	
1	8-A	129	
1	9-A	129	

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 12267 atoms, of which 0 are hydrogen and 0 are deuterium.

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	1-A	129	Total	C	N	O	S	0	3	0
			1004	618	192	184	10			
1	2-A	129	Total	C	N	O	S	0	3	0
			1004	618	192	184	10			
1	3-A	129	Total	C	N	O	S	0	3	0
			1004	618	192	184	10			
1	4-A	129	Total	C	N	O	S	0	3	0
			1004	618	192	184	10			
1	5-A	129	Total	C	N	O	S	0	3	0
			1004	618	192	184	10			
1	6-A	129	Total	C	N	O	S	0	3	0
			1004	618	192	184	10			
1	7-A	129	Total	C	N	O	S	0	3	0
			1004	618	192	184	10			
1	8-A	129	Total	C	N	O	S	0	3	0
			1004	618	192	184	10			
1	9-A	129	Total	C	N	O	S	0	3	0
			1004	618	192	184	10			
1	10-A	129	Total	C	N	O	S	0	3	0
			1004	618	192	184	10			

- Molecule 2 is IODIDE ION (three-letter code: IOD) (formula: I).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	3-A	10	Total	I	0	0
			10	10		
2	4-A	10	Total	I	0	0
			10	10		
2	5-A	10	Total	I	0	0
			10	10		
2	8-A	10	Total	I	0	0
			10	10		

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Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	1-A	10	Total I 10 10	0	0
2	6-A	10	Total I 10 10	0	0
2	2-A	10	Total I 10 10	0	0
2	10-A	10	Total I 10 10	0	0
2	9-A	10	Total I 10 10	0	0
2	7-A	10	Total I 10 10	0	0

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

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	3-A	1	Total Cl 1 1	0	0
3	4-A	1	Total Cl 1 1	0	0
3	5-A	1	Total Cl 1 1	0	0
3	8-A	1	Total Cl 1 1	0	0
3	1-A	1	Total Cl 1 1	0	0
3	6-A	1	Total Cl 1 1	0	0
3	2-A	1	Total Cl 1 1	0	0
3	10-A	1	Total Cl 1 1	0	0
3	9-A	1	Total Cl 1 1	0	0
3	7-A	1	Total Cl 1 1	0	0

- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	1-A	220	Total O 220 220	0	0

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	2-A	211	Total 211	O 211	0	0
4	3-A	211	Total 211	O 211	0	0
4	4-A	220	Total 220	O 220	0	0
4	5-A	208	Total 208	O 208	0	0
4	6-A	206	Total 206	O 206	0	0
4	7-A	205	Total 205	O 205	0	0
4	8-A	210	Total 210	O 210	0	0
4	9-A	213	Total 213	O 213	0	0
4	10-A	213	Total 213	O 213	0	0

### 3 Residue-property plots

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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.

Note EDS was not executed.

- Molecule 1: LYSOZYME C

Chain 1-A: 



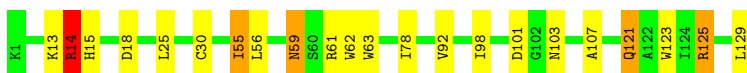
- Molecule 1: LYSOZYME C

Chain 2-A: 



- Molecule 1: LYSOZYME C

Chain 3-A: 



- Molecule 1: LYSOZYME C

Chain 4-A: 



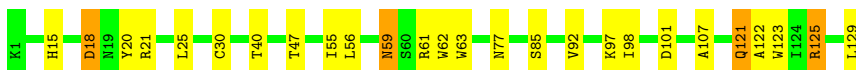
- Molecule 1: LYSOZYME C

Chain 5-A: 

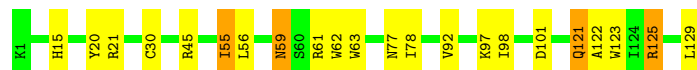


- Molecule 1: LYSOZYME C

Chain 6-A: 



## • Molecule 1: LYSOZYME C

Chain 7-A: 

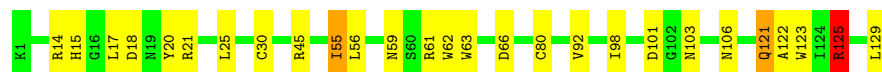
## • Molecule 1: LYSOZYME C

Chain 8-A: 

## • Molecule 1: LYSOZYME C

Chain 9-A: 

## • Molecule 1: LYSOZYME C

Chain 10-A: 

## 4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section will therefore be incomplete.

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	77.77Å 77.77Å 37.55Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	8.00 – 1.82	Depositor
% Data completeness (in resolution range)	99.7 (8.00-1.82)	Depositor
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.06	Depositor
Refinement program	SHELXL-97	Depositor
R, $R_{free}$	0.160 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	12267	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	22.0	wwPDB-VP



## 5 Model quality

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: IOD, 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	1-A	0.39	0/1039	1.03	0/1405
1	2-A	0.39	0/1039	1.03	2/1405 (0.1%)
1	3-A	0.39	0/1039	1.02	1/1405 (0.1%)
1	4-A	0.39	0/1039	1.04	2/1405 (0.1%)
1	5-A	0.39	0/1039	1.06	3/1405 (0.2%)
1	6-A	0.39	0/1039	1.02	0/1405
1	7-A	0.38	0/1039	1.01	0/1405
1	8-A	0.39	0/1039	1.04	1/1405 (0.1%)
1	9-A	0.38	0/1039	1.03	2/1405 (0.1%)
1	10-A	0.38	0/1039	1.01	1/1405 (0.1%)
All	All	0.39	0/10390	1.03	12/14050 (0.1%)

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	5-A	0	1
1	6-A	0	1
All	All	0	2

There are no bond length outliers.

The worst 5 of 12 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	4-A	14	ARG	NE-CZ-NH2	-8.74	115.93	120.30
1	2-A	125	ARG	CD-NE-CZ	8.18	135.05	123.60
1	5-A	21	ARG	CD-NE-CZ	6.46	132.65	123.60
1	5-A	21	ARG	NE-CZ-NH1	6.43	123.52	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	8-A	125	ARG	CD-NE-CZ	6.07	132.10	123.60

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	5-A	18	ASP	Sidechain
1	6-A	18	ASP	Sidechain

## 5.2 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 hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	1-A	1004	0	968	19	0
1	2-A	1004	0	968	20	0
1	3-A	1004	0	968	17	0
1	4-A	1004	0	968	19	1
1	5-A	1004	0	968	17	0
1	6-A	1004	0	968	21	0
1	7-A	1004	0	968	15	1
1	8-A	1004	0	968	22	1
1	9-A	1004	0	968	25	1
1	10-A	1004	0	968	22	1
2	1-A	10	0	0	2	0
2	2-A	10	0	0	2	0
2	3-A	10	0	0	0	0
2	4-A	10	0	0	2	0
2	5-A	10	0	0	2	0
2	6-A	10	0	0	3	0
2	7-A	10	0	0	4	0
2	8-A	10	0	0	4	0
2	9-A	10	0	0	3	0
2	10-A	10	0	0	2	0
3	1-A	1	0	0	0	0
3	2-A	1	0	0	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	3-A	1	0	0	1	0
3	4-A	1	0	0	1	0
3	5-A	1	0	0	1	0
3	6-A	1	0	0	0	0
3	7-A	1	0	0	0	0
3	8-A	1	0	0	0	0
3	9-A	1	0	0	0	0
3	10-A	1	0	0	0	0
4	1-A	220	0	0	7	3
4	2-A	211	0	0	9	1
4	3-A	211	0	0	4	1
4	4-A	220	0	0	7	2
4	5-A	208	0	0	5	1
4	6-A	206	0	0	9	1
4	7-A	205	0	0	7	2
4	8-A	210	0	0	9	2
4	9-A	213	0	0	9	1
4	10-A	213	0	0	5	2
All	All	12267	0	9680	225	16

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 11.

The worst 5 of 225 close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
2:A:139:IOD:I	4:A:1029:HOH:O	2.20	1.26
2:A:130:IOD:I	4:A:1161:HOH:O	2.20	1.23
2:A:130:IOD:I	4:A:1186:HOH:O	2.22	1.23
2:A:130:IOD:I	4:A:1158:HOH:O	2.20	1.22
2:A:130:IOD:I	4:A:1160:HOH:O	2.25	1.21

The worst 5 of 16 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	Distance(Å)	Clash(Å)
4:A:1010:HOH:O	4:A:1011:HOH:O[7_556]	2.09	0.11
4:A:1010:HOH:O	4:A:1011:HOH:O[7_556]	2.10	0.10
1:A:45:ARG:NE	4:A:1171:HOH:O[7_556]	2.13	0.07
4:A:1010:HOH:O	4:A:1011:HOH:O[7_556]	2.14	0.06
4:A:1010:HOH:O	4:A:1011:HOH:O[7_556]	2.14	0.06

## 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	1-A	130/129 (101%)	126 (97%)	4 (3%)	0	100	100
1	2-A	130/129 (101%)	126 (97%)	4 (3%)	0	100	100
1	3-A	130/129 (101%)	126 (97%)	4 (3%)	0	100	100
1	4-A	130/129 (101%)	127 (98%)	3 (2%)	0	100	100
1	5-A	130/129 (101%)	125 (96%)	5 (4%)	0	100	100
1	6-A	130/129 (101%)	127 (98%)	3 (2%)	0	100	100
1	7-A	130/129 (101%)	126 (97%)	4 (3%)	0	100	100
1	8-A	130/129 (101%)	126 (97%)	4 (3%)	0	100	100
1	9-A	130/129 (101%)	126 (97%)	4 (3%)	0	100	100
1	10-A	130/129 (101%)	127 (98%)	3 (2%)	0	100	100
All	All	1300/1290 (101%)	1262 (97%)	38 (3%)	0	100	100

There are no Ramachandran outliers to report.

### 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	1-A	107/105 (102%)	98 (92%)	9 (8%)	16	4
1	2-A	107/105 (102%)	100 (94%)	7 (6%)	24	8
1	3-A	107/105 (102%)	98 (92%)	9 (8%)	16	4
1	4-A	107/105 (102%)	98 (92%)	9 (8%)	16	4
1	5-A	107/105 (102%)	102 (95%)	5 (5%)	36	16
1	6-A	107/105 (102%)	100 (94%)	7 (6%)	24	8

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	7-A	107/105 (102%)	98 (92%)	9 (8%)	16 4
1	8-A	107/105 (102%)	101 (94%)	6 (6%)	30 11
1	9-A	107/105 (102%)	99 (92%)	8 (8%)	19 6
1	10-A	107/105 (102%)	102 (95%)	5 (5%)	36 16
All	All	1070/1050 (102%)	996 (93%)	74 (7%)	26 7

5 of 74 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	4-A	129	LEU
1	6-A	77[B]	ASN
1	9-A	129	LEU
1	5-A	59	ASN
1	5-A	125	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 43 such sidechains are listed below:

Mol	Chain	Res	Type
1	5-A	121	GLN
1	6-A	121	GLN
1	10-A	59	ASN
1	6-A	44	ASN
1	6-A	59	ASN

### 5.3.3 RNA ⓘ

There are no RNA chains in this entry.

## 5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

## 5.5 Carbohydrates ⓘ

There are no carbohydrates in this entry.

## 5.6 Ligand geometry ⓘ

Of 110 ligands modelled in this entry, 110 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.

## 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 ⓘ

EDS was not executed - this section will therefore be empty.

### 6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

EDS was not executed - this section will therefore be empty.

### 6.3 Carbohydrates ⓘ

EDS was not executed - this section will therefore be empty.

### 6.4 Ligands ⓘ

EDS was not executed - this section will therefore be empty.

### 6.5 Other polymers ⓘ

EDS was not executed - this section will therefore be empty.