



# wwPDB X-ray Structure Validation Summary Report ⓘ

Nov 9, 2024 – 10:28 am GMT

PDB ID : 1HC0  
Title : structure of lysozyme with periodate  
Authors : Ondracek, J.; Jursik, F.; Brynda, J.; Rezacova, P.; Sedlacek, J.  
Deposited on : 2001-04-25  
Resolution : 1.82 Å(reported)

This is a wwPDB X-ray Structure 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

<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>.

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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  
Xtriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.39

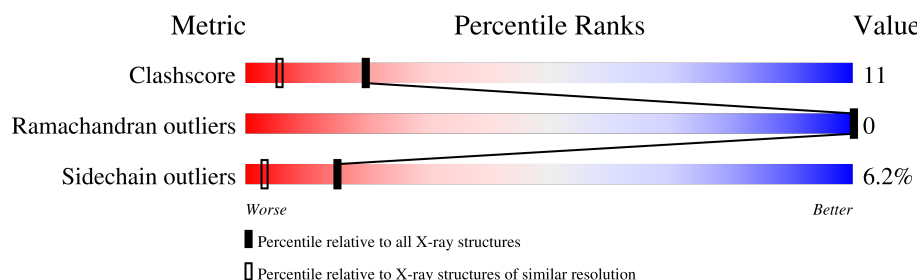
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 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	180529	1080 (1.82-1.82)
Ramachandran outliers	177936	1073 (1.82-1.82)
Sidechain outliers	177891	1073 (1.82-1.82)



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  $\geq 3$ , 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  $\leq 5\%$ .

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	1-A	129	81% 17% .
1	10-A	129	80% 18% ..
1	2-A	129	83% 14% ..
1	3-A	129	83% 13% ..
1	4-A	129	83% 13% ..
1	5-A	129	83% 13% .
1	6-A	129	80% 17% .
1	7-A	129	84% 13% .

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Mol	Chain	Length	Quality of chain
1	8-A	129	 80% 18% ..
1	9-A	129	 78% 19% ..

## 2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 12267 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	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	1-A	10	Total	I	0	0
			10	10		
2	2-A	10	Total	I	0	0
			10	10		
2	3-A	10	Total	I	0	0
			10	10		
2	4-A	10	Total	I	0	0
			10	10		

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Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	5-A	10	Total I 10 10	0	0
2	6-A	10	Total I 10 10	0	0
2	7-A	10	Total I 10 10	0	0
2	8-A	10	Total I 10 10	0	0
2	9-A	10	Total I 10 10	0	0
2	10-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	1-A	1	Total Cl 1 1	0	0
3	2-A	1	Total Cl 1 1	0	0
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	6-A	1	Total Cl 1 1	0	0
3	7-A	1	Total Cl 1 1	0	0
3	8-A	1	Total Cl 1 1	0	0
3	9-A	1	Total Cl 1 1	0	0
3	10-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 [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. 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. 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:  81% 17% .




- Molecule 1: LYSOZYME C

Chain 2-A:  83% 14% ..




- Molecule 1: LYSOZYME C

Chain 3-A:  83% 13% ..




- Molecule 1: LYSOZYME C

Chain 4-A:  83% 13% ..




- Molecule 1: LYSOZYME C

Chain 5-A:  83% 13% .



- Molecule 1: LYSOZYME C

Chain 6-A:  80% 17% .



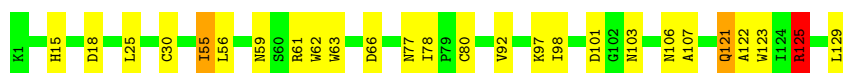
- Molecule 1: LYSOZYME C

Chain 7-A: 84% 13% .



- Molecule 1: LYSOZYME C

Chain 8-A: 80% 18% ..



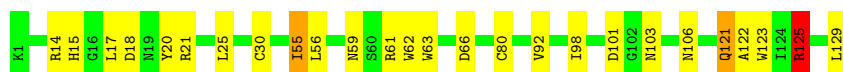
- Molecule 1: LYSOZYME C

Chain 9-A: 78% 19% ..



- Molecule 1: LYSOZYME C

Chain 10-A: 80% 18% ..





## 4 Data and refinement statistics

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

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	77.77 Å 77.77 Å 37.55 Å 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: CL, 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	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 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	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	0
1	5-A	1004	0	968	17	0
1	6-A	1004	0	968	21	0
1	7-A	1004	0	968	15	0
1	8-A	1004	0	968	22	0
1	9-A	1004	0	968	25	0
1	10-A	1004	0	968	22	0
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
3	3-A	1	0	0	1	0
3	4-A	1	0	0	1	0

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

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 11.

The worst 5 of 225 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)
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 9 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: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
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
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%)	9	1
1	2-A	107/105 (102%)	100 (94%)	7 (6%)	14	3
1	3-A	107/105 (102%)	98 (92%)	9 (8%)	9	1
1	4-A	107/105 (102%)	98 (92%)	9 (8%)	9	1

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	5-A	107/105 (102%)	102 (95%)	5 (5%)	22	7
1	6-A	107/105 (102%)	100 (94%)	7 (6%)	14	3
1	7-A	107/105 (102%)	98 (92%)	9 (8%)	9	1
1	8-A	107/105 (102%)	101 (94%)	6 (6%)	17	4
1	9-A	107/105 (102%)	99 (92%)	8 (8%)	11	1
1	10-A	107/105 (102%)	102 (95%)	5 (5%)	22	7
All	All	1070/1050 (102%)	996 (93%)	74 (7%)	15	2

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

Mol	Chain	Res	Type
1	8-A	78	ILE
1	10-A	121	GLN
1	8-A	125	ARG
1	9-A	85	SER
1	3-A	129	LEU

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

Mol	Chain	Res	Type
1	7-A	121	GLN
1	9-A	93	ASN
1	8-A	59	ASN
1	8-A	121	GLN
1	9-A	121	GLN

### 5.3.3 RNA ⓘ

There are no RNA molecules 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 oligosaccharides 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.

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 [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

EDS was not executed - this section is therefore empty.

### 6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

EDS was not executed - this section is therefore empty.

### 6.3 Carbohydrates [i](#)

EDS was not executed - this section is therefore empty.

### 6.4 Ligands [i](#)

EDS was not executed - this section is therefore empty.

### 6.5 Other polymers [i](#)

EDS was not executed - this section is therefore empty.