



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 28, 2026 – 09:46 PM UTC

PDB ID : 5WO1 / pdb_00005wo1
Title : Chaperone Spy H96L bound to Im7 L18A L19A L37A (Im7 un-modeled)
Authors : Horowitz, S.; Koldewey, P.; Martin, R.; Bardwell, J.C.A.
Deposited on : 2017-08-01
Resolution : 1.87 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	:	FAILED
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

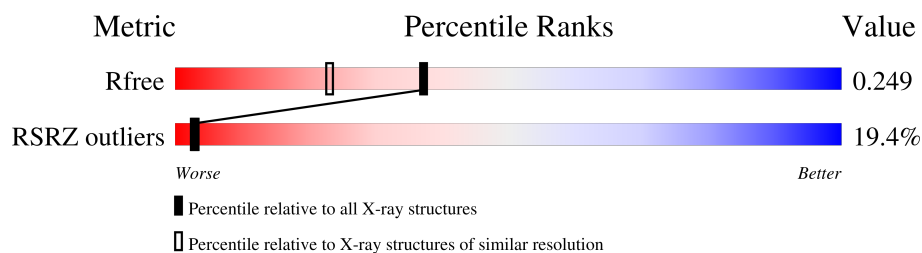
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.87 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}	180053	1220 (1.88-1.88)
RSRZ outliers	180081	1220 (1.88-1.88)

MolProbity failed to run properly - the sequence quality summary graphics cannot be shown.

2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 3275 atoms, of which 1569 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.

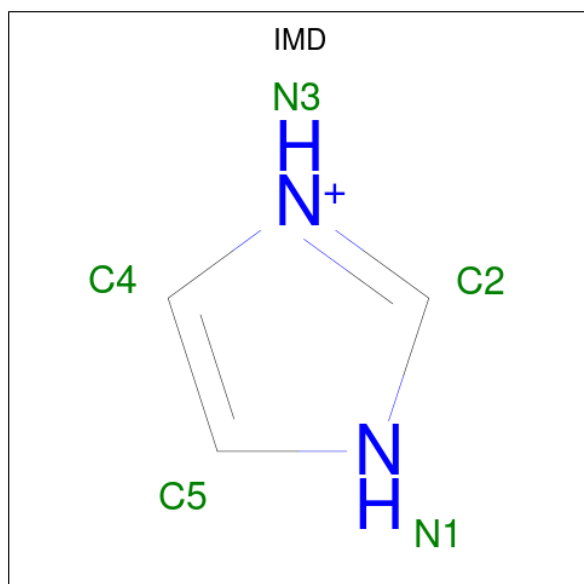
- Molecule 1 is a protein called Periplasmic chaperone Spy.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	87	Total	C	H	N	O	S	0	9	0
			1581	487	794	141	152	7			
1	B	88	Total	C	H	N	O	S	0	18	0
			1478	459	742	132	139	6			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	28	SER	-	expression tag	UNP P77754
A	96	LEU	HIS	engineered mutation	UNP P77754
B	28	SER	-	expression tag	UNP P77754
B	96	LEU	HIS	engineered mutation	UNP P77754

- Molecule 2 is IMIDAZOLE (CCD ID: IMD) (formula: $C_3H_5N_2$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total C H N 10 3 5 2	0	0
2	B	1	Total C H N 10 3 5 2	0	0
2	B	1	Total C H N 10 3 5 2	0	1
2	B	1	Total C H N 10 3 5 2	0	1
2	B	1	Total C H N 10 3 5 2	0	0

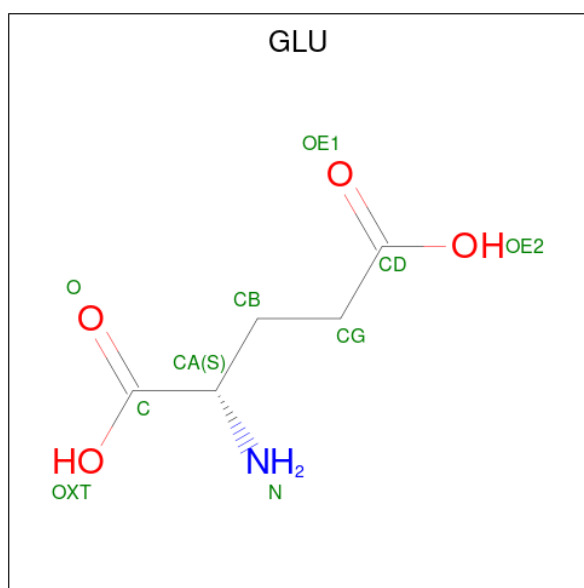
- Molecule 3 is ZINC ION (CCD ID: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	11	Total Zn 12 12	0	11
3	B	16	Total Zn 20 20	0	16

- Molecule 4 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	2	Total Cl 2 2	0	0

- Molecule 5 is GLUTAMIC ACID (CCD ID: GLU) (formula: C₅H₉NO₄).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
5	A	1	Total	C	H	N	O	0	0
			18	5	8	1	4		

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	70	Total	O	0	0
			70	70		
6	B	44	Total	O	0	0
			44	44		

MolProbity failed to run properly - this section is therefore empty.

3 Data and refinement statistics

Property	Value	Source
Space group	P 41 2 2	Depositor
Cell constants a, b, c, α , β , γ	43.09Å 43.09Å 258.67Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	30.47 – 1.87 30.47 – 1.87	Depositor EDS
% Data completeness (in resolution range)	99.9 (30.47-1.87) 99.9 (30.47-1.87)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.70 (at 1.87Å)	Xtriage
Refinement program	PHENIX (1.12_2829: ???)	Depositor
R, R_{free}	0.207 , 0.248 0.208 , 0.249	Depositor DCC
R_{free} test set	2000 reflections (9.33%)	wwPDB-VP
Wilson B-factor (Å ²)	31.4	Xtriage
Anisotropy	0.112	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.39 , 59.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	3275	wwPDB-VP
Average B, all atoms (Å ²)	51.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.92% 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.

4 Model quality [i](#)

4.1 Standard geometry [i](#)

MolProbity failed to run properly - this section is therefore empty.

4.2 Too-close contacts [i](#)

MolProbity failed to run properly - this section is therefore empty.

4.3 Torsion angles [i](#)

4.3.1 Protein backbone [i](#)

MolProbity failed to run properly - this section is therefore empty.

4.3.2 Protein sidechains [i](#)

MolProbity failed to run properly - this section is therefore empty.

4.3.3 RNA [i](#)

MolProbity failed to run properly - this section is therefore empty.

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

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

4.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

4.6 Ligand geometry [i](#)

Of 40 ligands modelled in this entry, 34 are monoatomic - leaving 6 for Mogul analysis.

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
2	IMD	B	202	3	5,5,5	0.64	0	5,5,5	1.06	0
2	IMD	A	201	3	5,5,5	0.63	0	5,5,5	0.74	0
5	GLU	A	214	3	8,9,9	1.12	1 (12%)	8,11,11	1.43	1 (12%)
2	IMD	B	205	-	5,5,5	0.64	0	5,5,5	0.42	0
2	IMD	B	203[A]	-	5,5,5	0.58	0	5,5,5	0.43	0
2	IMD	B	204[B]	-	5,5,5	0.63	0	5,5,5	0.54	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
2	IMD	B	202	3	-	-	0/1/1/1
2	IMD	A	201	3	-	-	0/1/1/1
5	GLU	A	214	3	-	0/9/9/9	-
2	IMD	B	205	-	-	-	0/1/1/1
2	IMD	B	203[A]	-	-	-	0/1/1/1
2	IMD	B	204[B]	-	-	-	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	A	214	GLU	OXT-C	-2.25	1.23	1.30

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	A	214	GLU	OXT-C-O	-3.29	116.61	124.08

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

4.7 Other polymers [i](#)

There are no such residues in this entry.

4.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

5 Fit of model and data

5.1 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, 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	87/97 (89%)	0.54	14 (16%)	4 5	11, 38, 95, 130	8 (9%)
1	B	88/97 (90%)	0.97	20 (22%)	2 2	16, 47, 116, 133	4 (4%)
All	All	175/194 (90%)	0.76	34 (19%)	3 3	11, 43, 106, 133	12 (6%)

All (34) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	29	PHE	5.6
1	A	57	PRO	5.5
1	A	124	LEU	5.5
1	A	29	PHE	5.4
1	B	56	PRO	4.6
1	A	28	SER	4.4
1	B	30	LYS	4.3
1	B	31	ASP	4.3
1	A	58	LEU	4.2
1	B	123	LEU	4.2
1	B	110[A]	GLU	4.1
1	B	54	LYS	3.8
1	B	36[A]	ASP	3.6
1	B	37[A]	ALA	3.5
1	B	57	PRO	3.5
1	B	35[A]	THR	3.1
1	B	40	GLN	3.0
1	B	34[A]	LEU	3.0
1	B	58	LEU	2.8
1	B	59	GLU	2.7
1	B	55	ARG	2.6
1	B	33	ASN	2.6
1	A	122	ARG	2.6
1	A	114	GLN	2.4

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	A	121	LYS	2.4
1	A	77	LYS	2.3
1	A	31	ASP	2.2
1	A	93[A]	MET	2.2
1	B	46[A]	MET	2.2
1	A	59	GLU	2.2
1	A	88	GLN	2.2
1	A	62[B]	ARG	2.2
1	B	63	ALA	2.2
1	B	60	GLU	2.1

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

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

5.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.4 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	ZN	A	210[A]	1/1	-0.05	0.21	309,309,309,309	1
3	ZN	B	201[A]	1/1	0.34	0.36	58,58,58,58	1
3	ZN	B	201[B]	1/1	0.34	0.36	55,55,55,55	1
3	ZN	B	201[C]	1/1	0.34	0.36	20,20,20,20	1
3	ZN	B	220[A]	1/1	0.42	0.40	178,178,178,178	1
3	ZN	B	217[A]	1/1	0.48	0.14	155,155,155,155	1
3	ZN	A	209[A]	1/1	0.49	0.23	131,131,131,131	1
3	ZN	B	211[A]	1/1	0.55	0.24	198,198,198,198	0
3	ZN	A	208[A]	1/1	0.56	0.19	154,154,154,154	1
3	ZN	B	210[A]	1/1	0.59	0.14	156,156,156,156	0
3	ZN	A	213[A]	1/1	0.66	0.14	150,150,150,150	1
5	GLU	A	214	10/10	0.77	0.25	112,127,155,155	0
3	ZN	B	208[A]	1/1	0.81	0.32	221,221,221,221	1

Continued on next page...

Continued from previous page...

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
3	ZN	B	219[A]	1/1	0.81	0.20	40,40,40,40	1
3	ZN	B	208[B]	1/1	0.81	0.32	70,70,70,70	1
3	ZN	B	214[A]	1/1	0.81	0.29	215,215,215,215	0
3	ZN	B	215[A]	1/1	0.84	0.17	64,64,64,64	1
3	ZN	B	216[A]	1/1	0.84	0.10	113,113,113,113	1
3	ZN	B	212[A]	1/1	0.86	0.18	66,66,66,66	1
2	IMD	B	205	5/5	0.88	0.35	147,158,185,190	0
3	ZN	A	211[A]	1/1	0.91	0.11	56,56,56,56	1
3	ZN	A	212[A]	1/1	0.91	0.31	57,57,57,57	1
3	ZN	A	204[B]	1/1	0.94	0.11	58,58,58,58	1
2	IMD	B	203[A]	5/5	0.94	0.17	17,24,38,43	10
2	IMD	A	201	5/5	0.94	0.11	32,38,51,61	0
3	ZN	B	209[A]	1/1	0.94	0.19	103,103,103,103	1
3	ZN	B	209[B]	1/1	0.94	0.19	40,40,40,40	1
2	IMD	B	202	5/5	0.95	0.10	23,30,38,45	0
4	CL	A	206	1/1	0.96	0.11	39,39,39,39	0
3	ZN	B	207[A]	1/1	0.96	0.05	40,40,40,40	1
3	ZN	B	218[A]	1/1	0.97	0.05	37,37,37,37	1
3	ZN	A	207[B]	1/1	0.97	0.20	53,53,53,53	1
2	IMD	B	204[B]	5/5	0.97	0.08	19,35,42,47	10
3	ZN	A	207[A]	1/1	0.97	0.20	63,63,63,63	1
3	ZN	B	213[A]	1/1	0.97	0.06	56,56,56,56	1
3	ZN	A	203[A]	1/1	0.98	0.10	29,29,29,29	1
4	CL	A	205	1/1	0.98	0.06	31,31,31,31	0
3	ZN	B	206[A]	1/1	0.99	0.02	31,31,31,31	0
3	ZN	A	202[A]	1/1	0.99	0.02	30,30,30,30	0
3	ZN	A	215[A]	1/1	1.00	0.01	27,27,27,27	0

5.5 Other polymers

There are no such residues in this entry.