wwPDB X-ray Structure Validation Summary Report (i)

Sep 28, 2024 – 08:30 PM EDT

PDB ID	:	1LWT
Title	:	Crystal structure of the intein homing endonuclease PI-SceI bound to its substrate DNA (Ca2+ free)
Authors	:	Moure, C.M.; Gimble, F.S.; Quiocho, F.A.
Deposited on	:	2002-06-03
Resolution	:	3.20 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*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the (i) 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 (i)) were used in the production of this report:

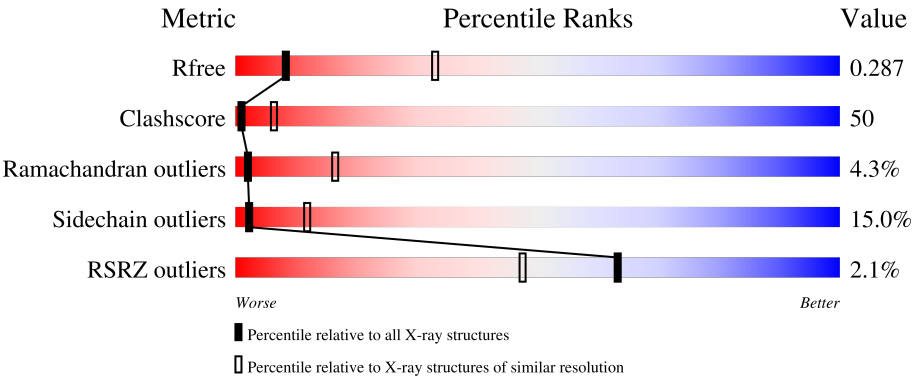
MolProbity	:	4.02b-467
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	1.20.1
EDS	:	3.0
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.003 (Gargrove)
Density-Fitness	:	1.0.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.39

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 3.20 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}	164625	1370 (3.20-3.20)
Clashscore	180529	1497 (3.20-3.20)
Ramachandran outliers	177936	1479 (3.20-3.20)
Sidechain outliers	177891	1478 (3.20-3.20)
RSRZ outliers	164620	1371 (3.20-3.20)

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	B	37	3% 95%
2	C	37	11% 86%
3	A	454	2% 36% 51% 11%

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 5065 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 DNA chain called PI-SceI DNA substrate top strand.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	B	37	Total	C	N	O	P	0	0	0
			772	366	153	217	36			

- Molecule 2 is a DNA chain called PI-SceI DNA substrate bottom strand.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	C	37	Total	C	N	O	P	0	0	0
			739	356	124	223	36			

- Molecule 3 is a protein called ENDONUCLEASE PI-SCEI.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
3	A	448	Total	C	N	O	S	Se	0	0	0
			3539	2234	620	671	6	8			

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	10	MSE	MET	modified residue	UNP P17255
A	28	MSE	MET	modified residue	UNP P17255
A	47	MSE	MET	modified residue	UNP P17255
A	109	MSE	MET	modified residue	UNP P17255
A	193	MSE	MET	modified residue	UNP P17255
A	236	MSE	MET	modified residue	UNP P17255
A	372	MSE	MET	modified residue	UNP P17255
A	385	MSE	MET	modified residue	UNP P17255

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	3	Total	O	0	0
			3	3		

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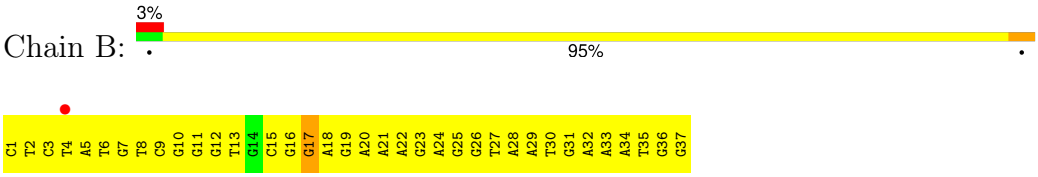
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	C	4	Total O 4 4	0	0
4	A	8	Total O 8 8	0	0

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 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.

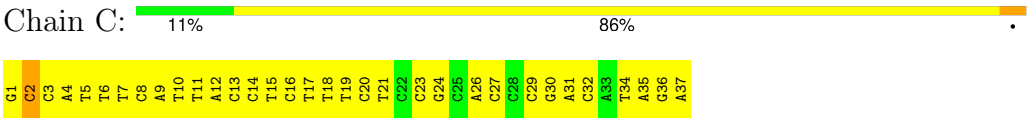
• Molecule 1: PI-SceI DNA substrate top strand

Chain B:



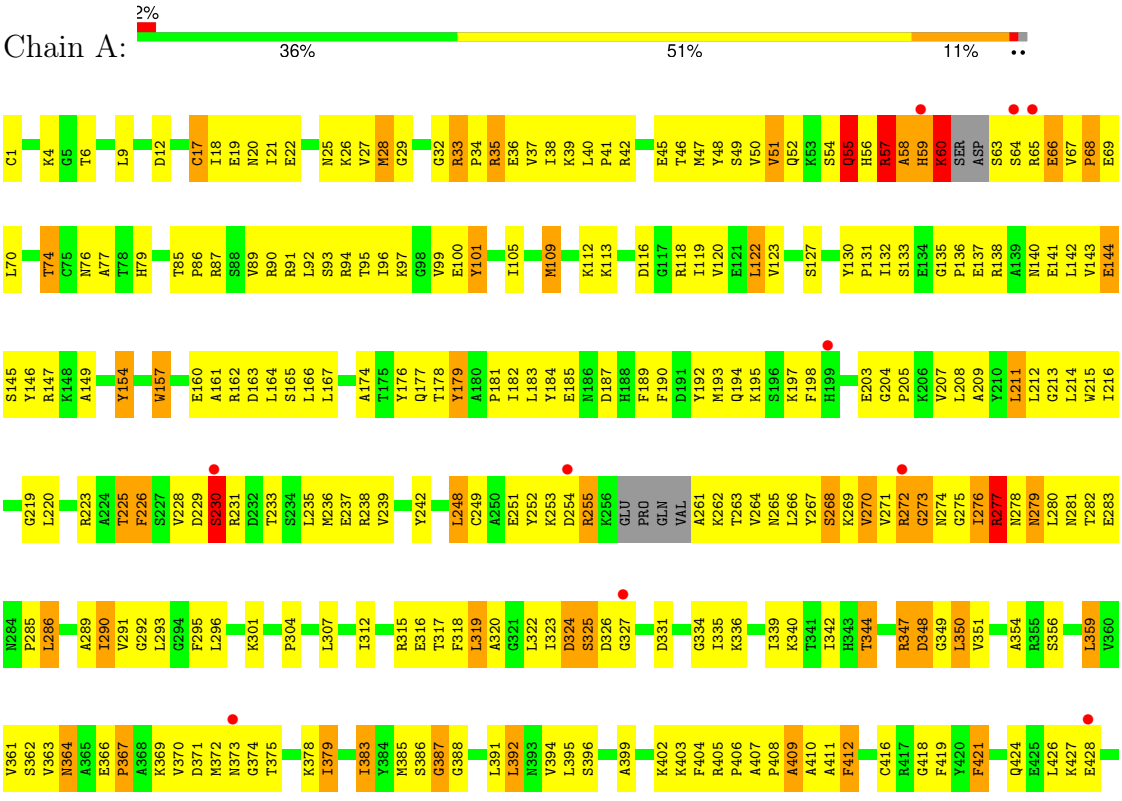
• Molecule 2: PI-SceI DNA substrate bottom strand

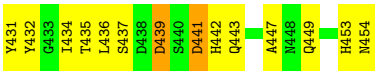
Chain C:



• Molecule 3: ENDONUCLEASE PI-SCEI

Chain A:




Y431
Y432
G433
I434
T435
L436
S437
D438
D439
S440
D441
H442
Q443
A447
N448
Q449
H453
M454

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	45.20Å 87.40Å 214.80Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	24.49 – 3.20 24.49 – 3.20	Depositor EDS
% Data completeness (in resolution range)	82.4 (24.49-3.20) 83.4 (24.49-3.20)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	0.08	Depositor
$< I/\sigma(I) >$ [1]	6.17 (at 3.18Å)	Xtriage
Refinement program	CNS	Depositor
R, R_{free}	0.242 , 0.287 0.240 , 0.287	Depositor DCC
R_{free} test set	546 reflections (4.43%)	wwPDB-VP
Wilson B-factor (Å^2)	52.7	Xtriage
Anisotropy	0.332	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.22 , 25.9	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.90	EDS
Total number of atoms	5065	wwPDB-VP
Average B, all atoms (Å^2)	36.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.79% of the height of the origin peak. No significant pseudotranslation is detected.*

[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

5.1 Standard geometry

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	B	0.82	0/870	0.96	1/1345 (0.1%)
2	C	0.84	1/824 (0.1%)	0.99	1/1266 (0.1%)
3	A	0.63	3/3595 (0.1%)	0.87	5/4833 (0.1%)
All	All	0.70	4/5289 (0.1%)	0.91	7/7444 (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
3	A	0	1

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	165	SER	CB-OG	-6.64	1.33	1.42
3	A	273	GLY	CA-C	5.68	1.60	1.51
2	C	2	DC	N1-C2	5.06	1.45	1.40
3	A	55	GLN	CA-CB	-5.03	1.42	1.53

The worst 5 of 7 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	A	60	LYS	N-CA-C	7.42	131.03	111.00
3	A	273	GLY	N-CA-C	-6.50	96.84	113.10
1	B	17	DG	OP1-P-OP2	-5.65	111.12	119.60
3	A	59	HIS	N-CA-C	5.65	126.25	111.00
3	A	277	ARG	N-CA-C	-5.38	96.46	111.00

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
3	A	179	TYR	Sidechain

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	B	772	0	417	72	0
2	C	739	0	420	51	0
3	A	3539	0	3548	373	0
4	A	8	0	0	0	0
4	B	3	0	0	0	0
4	C	4	0	0	0	0
All	All	5065	0	4385	476	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 50.

The worst 5 of 476 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)
3:A:113:LYS:NZ	3:A:119:ILE:HG12	1.57	1.19
3:A:219:GLY:HA2	3:A:226:PHE:HB3	1.21	1.12
3:A:65:ARG:HH21	3:A:367:PRO:HG2	1.08	1.12
1:B:12:DG:H2"	1:B:13:DT:H71	1.38	1.05
3:A:270:VAL:CG1	3:A:271:VAL:H	1.73	1.02

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
3	A	442/454 (97%)	345 (78%)	78 (18%)	19 (4%)	2 16

5 of 19 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
3	A	58	ALA
3	A	270	VAL
3	A	230	SER
3	A	348	ASP
3	A	349	GLY

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
3	A	386/384 (100%)	328 (85%)	58 (15%)	2 12

5 of 58 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	A	230	SER
3	A	421	PHE
3	A	276	ILE
3	A	412	PHE
3	A	379	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 6 such sidechains are listed below:

Mol	Chain	Res	Type
3	A	56	HIS
3	A	79	HIS
3	A	278	ASN
3	A	20	ASN
3	A	7	ASN

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

There are no ligands in this entry.

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

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	B	37/37 (100%)	0.16	1 (2%) 56 40	21, 41, 52, 57	0
2	C	37/37 (100%)	0.23	0 100 100	11, 47, 61, 62	0
3	A	440/454 (96%)	0.02	10 (2%) 61 44	5, 33, 63, 84	0
All	All	514/528 (97%)	0.05	11 (2%) 63 47	5, 34, 63, 84	0

The worst 5 of 11 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	A	373	ASN	3.0
3	A	327	GLY	2.9
3	A	230	SER	2.6
3	A	65	ARG	2.5
3	A	64	SER	2.5

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

There are no ligands in this entry.

6.5 Other polymers (i)

There are no such residues in this entry.