Full wwPDB X-ray Structure Validation Report (i)

May 29, 2020 – 05:05 am BST

PDB ID	:	4INS
Title	:	THE STRUCTURE OF 2ZN PIG INSULIN CRYSTALS AT 1.5 ANGSTROMS RESOLUTION
Authors	:	Dodson, G.G.; Dodson, E.J.; Hodgkin, D.C.; Isaacs, N.W.; Vijayan, M.
Deposited on	:	1989-07-10
Resolution	:	1.50 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 (i) symbol.

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

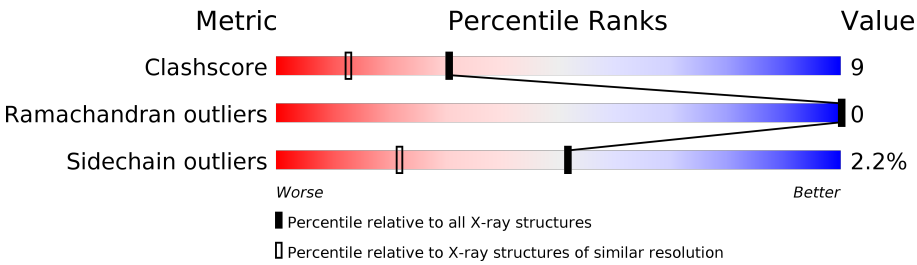
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

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 1.50 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	3144 (1.50-1.50)
Ramachandran outliers	138981	3066 (1.50-1.50)
Sidechain outliers	138945	3064 (1.50-1.50)

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 >=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%

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	21	67% 29% 5%
1	C	21	71% 29%
2	B	30	63% 27% 10%
2	D	30	67% 23% 10%

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 1182 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 INSULIN (CHAIN A).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	21	163	99	25	35	4	0	0	0
1	C	21	163	99	25	35	4	0	0	0

- Molecule 2 is a protein called INSULIN (CHAIN B).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	30	256	165	44	45	2	0	5	0
2	D	30	248	161	44	41	2	0	2	0

- Molecule 3 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Zn		
3	B	1	1	1	0	0
3	D	1	1	1	0	0

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
4	A	31	31	31	0	0
4	B	49	49	49	0	0
4	C	7	7	7	0	0
4	D	263	263	263	0	0

3 Residue-property plots (i)

These plots are drawn for all protein, RNA and DNA 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: INSULIN (CHAIN A)

Chain A:

- Molecule 1: INSULIN (CHAIN A)

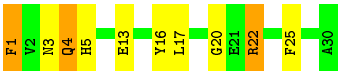
Chain C:

- Molecule 2: INSULIN (CHAIN B)

Chain B:

- Molecule 2: INSULIN (CHAIN B)

Chain D:



4 Data and refinement statistics (i)

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

Property	Value	Source
Space group	H 3	Depositor
Cell constants a, b, c, α, β, γ	82.50Å 82.50Å 34.00Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	(Not available) – 1.50	Depositor
% Data completeness (in resolution range)	(Not available) ((Not available)-1.50)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	PROLSQ	Depositor
R, R_{free}	0.153 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	1182	wwPDB-VP
Average B, all atoms ($Å^2$)	30.0	wwPDB-VP

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: ZN

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	1.27	0/164	2.12	8/220 (3.6%)
1	C	1.29	1/164 (0.6%)	1.93	4/220 (1.8%)
2	B	1.37	0/290	2.18	11/391 (2.8%)
2	D	1.29	1/267 (0.4%)	2.17	7/357 (2.0%)
All	All	1.31	2/885 (0.2%)	2.12	30/1188 (2.5%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	17	GLU	CD-OE1	-7.23	1.17	1.25
2	D	13	GLU	CD-OE1	-5.70	1.19	1.25

All (30) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	D	22[A]	ARG	NE-CZ-NH1	13.27	126.94	120.30
2	D	22[B]	ARG	NE-CZ-NH1	13.27	126.94	120.30
2	B	22[A]	ARG	NE-CZ-NH1	11.33	125.97	120.30
2	B	22[B]	ARG	NE-CZ-NH1	11.33	125.97	120.30
1	A	14	TYR	CB-CG-CD1	-9.51	115.30	121.00
2	B	22[A]	ARG	NE-CZ-NH2	-8.18	116.21	120.30
2	B	22[B]	ARG	NE-CZ-NH2	-8.18	116.21	120.30
2	D	16	TYR	CB-CG-CD2	-8.12	116.12	121.00
2	D	1	PHE	CB-CG-CD1	-8.05	115.17	120.80
1	C	14	TYR	CB-CG-CD1	-7.52	116.49	121.00
1	A	14	TYR	CB-CG-CD2	7.19	125.31	121.00
2	B	25	PHE	CB-CG-CD2	-6.89	115.98	120.80
1	A	19	TYR	CB-CG-CD2	6.74	125.04	121.00
2	B	26	TYR	CG-CD1-CE1	-6.44	116.15	121.30
1	A	21	ASN	CA-CB-CG	6.31	127.28	113.40

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	19	TYR	CB-CG-CD1	-6.28	117.23	121.00
1	A	9	SER	N-CA-CB	-6.27	101.09	110.50
2	B	29	LYS	C-N-CA	6.12	136.99	121.70
2	D	17	LEU	CB-CG-CD2	-5.93	100.91	111.00
2	B	30	ALA	CB-CA-C	-5.81	101.39	110.10
2	D	1	PHE	CA-CB-CG	-5.60	100.46	113.90
1	A	9	SER	CB-CA-C	5.54	120.62	110.10
2	B	11	LEU	CB-CG-CD1	5.51	120.38	111.00
2	D	5	HIS	N-CA-CB	5.42	120.35	110.60
1	C	21	ASN	CA-CB-CG	5.36	125.19	113.40
1	C	5	GLN	CB-CG-CD	-5.31	97.80	111.60
1	C	16	LEU	CB-CG-CD1	-5.25	102.08	111.00
1	A	17	GLU	OE1-CD-OE2	5.23	129.57	123.30
2	B	30	ALA	N-CA-C	5.19	125.01	111.00
2	B	1	PHE	O-C-N	5.12	130.90	122.70

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	163	0	149	2	0
1	C	163	0	149	1	0
2	B	256	0	244	9	0
2	D	248	0	240	6	0
3	B	1	0	0	0	0
3	D	1	0	0	0	0
4	A	31	0	0	2	0
4	B	49	0	0	1	0
4	C	7	0	0	2	0
4	D	263	0	0	3	0
All	All	1182	0	782	15	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 9.

All (15) 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:B:27[A]:THR:OG1	4:B:207:HOH:O	1.89	0.90
2:B:2:VAL:O	2:B:4[B]:GLN:NE2	2.25	0.68
2:D:1:PHE:HB3	4:D:450:HOH:O	2.07	0.54
1:A:7:CYS:O	2:B:5:HIS:NE2	2.41	0.52
2:B:25:PHE:CE2	2:D:25:PHE:HB3	2.44	0.51
4:A:120:HOH:O	2:B:29:LYS:HE3	2.09	0.51
2:B:27[A]:THR:HG22	4:C:104:HOH:O	2.13	0.48
1:A:2:ILE:HA	1:A:2:ILE:HD12	1.64	0.47
2:D:4:GLN:HB2	2:D:4:GLN:HE21	1.37	0.46
4:A:106:HOH:O	2:B:11:LEU:HD22	2.17	0.44
2:D:20:GLY:N	4:D:241:HOH:O	2.52	0.43
2:B:27[B]:THR:HG23	4:C:104:HOH:O	2.19	0.41
2:D:22[B]:ARG:HD3	4:D:255:HOH:O	2.20	0.41
1:C:12:SER:HB3	2:D:3:ASN:HD21	1.85	0.40

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	19/21 (90%)	18 (95%)	1 (5%)	0	100	100
1	C	19/21 (90%)	18 (95%)	1 (5%)	0	100	100
2	B	33/30 (110%)	33 (100%)	0	0	100	100
2	D	30/30 (100%)	30 (100%)	0	0	100	100
All	All	101/102 (99%)	99 (98%)	2 (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	20/20 (100%)	19 (95%)	1 (5%)	24	4
1	C	20/20 (100%)	20 (100%)	0	100	100
2	B	30/25 (120%)	30 (100%)	0	100	100
2	D	27/25 (108%)	26 (96%)	1 (4%)	34	8
All	All	97/90 (108%)	95 (98%)	2 (2%)	52	23

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	21	ASN
2	D	4	GLN

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	C	18	ASN
2	D	3	ASN
2	D	4	GLN

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 carbohydrates in this entry.

5.6 Ligand geometry (i)

Of 2 ligands modelled in this entry, 2 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 (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.