



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 11:07 AM UTC

PDB ID : 6VET / pdb_00006vet
Title : Human insulin analog: [GluB10,HisA8,ArgA9,TyrB20]-DOI
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Deposited on : 2020-01-02
Resolution : 1.46 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	:	4-5-2 with Phenix2.0
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

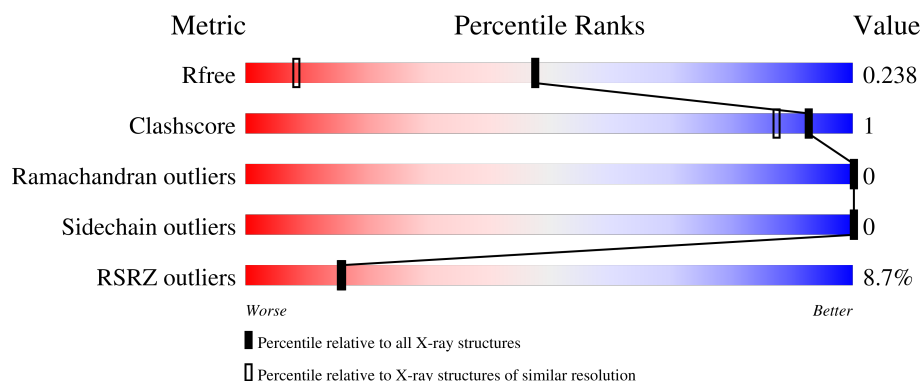
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.46 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	1756 (1.46-1.46)
Clashscore	190562	1795 (1.46-1.46)
Ramachandran outliers	187476	1776 (1.46-1.46)
Sidechain outliers	187428	1776 (1.46-1.46)
RSRZ outliers	180081	1756 (1.46-1.46)

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 $\leq 5\%$. 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	A	21	95% 5%
1	C	21	95% 5%
1	E	21	14% 90% 5% 5%
2	B	22	18% 95% 5%
2	D	22	95% 5%

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Mol	Chain	Length	Quality of chain
2	F	22	18% 95% 5%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 2072 atoms, of which 903 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 A chain.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	20	Total	C	H	N	O	S	0	0	0
			309	100	147	28	30	4			
1	C	20	Total	C	H	N	O	S	0	0	0
			310	100	148	28	30	4			
1	E	20	Total	C	H	N	O	S	0	0	0
			311	100	149	28	30	4			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	8	HIS	THR	engineered mutation	UNP P01308
A	9	ARG	SER	engineered mutation	UNP P01308
C	8	HIS	THR	engineered mutation	UNP P01308
C	9	ARG	SER	engineered mutation	UNP P01308
E	8	HIS	THR	engineered mutation	UNP P01308
E	9	ARG	SER	engineered mutation	UNP P01308

- Molecule 2 is a protein called Insulin B chain.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
2	B	22	Total	C	H	N	O	S	0	1	0
			359	121	171	30	35	2			
2	D	22	Total	C	H	N	O	S	0	0	0
			334	116	153	29	34	2			
2	F	22	Total	C	H	N	O	S	0	2	0
			330	123	135	32	38	2			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	10	GLU	HIS	engineered mutation	UNP P01308
B	20	TYR	GLY	engineered mutation	UNP P01308

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Chain	Residue	Modelled	Actual	Comment	Reference
D	10	GLU	HIS	engineered mutation	UNP P01308
D	20	TYR	GLY	engineered mutation	UNP P01308
F	10	GLU	HIS	engineered mutation	UNP P01308
F	20	TYR	GLY	engineered mutation	UNP P01308

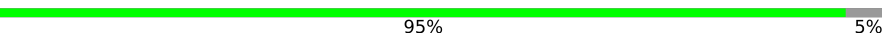
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	20	Total	O	0	0
			20	20		
3	B	21	Total	O	0	0
			21	21		
3	C	15	Total	O	0	0
			15	15		
3	D	31	Total	O	0	0
			31	31		
3	E	14	Total	O	0	0
			14	14		
3	F	18	Total	O	0	0
			18	18		

3 Residue-property plots [i](#)

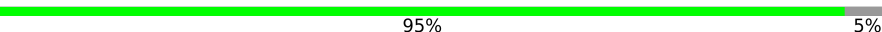
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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: Insulin A chain

Chain A: 



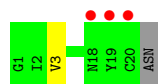
- Molecule 1: Insulin A chain

Chain C: 

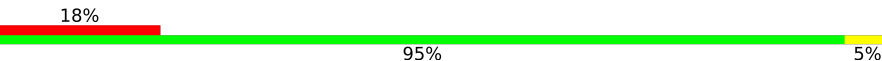


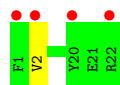
- Molecule 1: Insulin A chain

Chain E: 

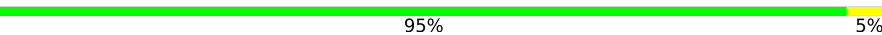


- Molecule 2: Insulin B chain

Chain B: 

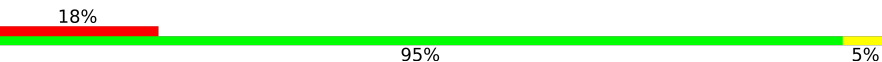


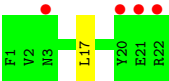
- Molecule 2: Insulin B chain

Chain D: 



- Molecule 2: Insulin B chain

Chain F: 



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	28.37Å 52.12Å 80.50Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	43.75 – 1.46 43.75 – 1.46	Depositor EDS
% Data completeness (in resolution range)	99.1 (43.75-1.46) 99.2 (43.75-1.46)	Depositor EDS
R_{merge}	0.14	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.10 (at 1.46Å)	Xtriage
Refinement program	PHENIX (1.13-2998_1692)	Depositor
R, R_{free}	0.201 , 0.238 0.203 , 0.238	Depositor DCC
R_{free} test set	2000 reflections (9.30%)	wwPDB-VP
Wilson B-factor (Å ²)	20.2	Xtriage
Anisotropy	0.418	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.41 , 45.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	2072	wwPDB-VP
Average B, all atoms (Å ²)	32.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 11.32% 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.

5 Model quality [i](#)

5.1 Standard geometry [i](#)

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	0.23	0/164	0.34	0/220
1	C	0.26	0/164	0.40	0/220
1	E	0.26	0/164	0.36	0/220
2	B	0.23	0/191	0.34	0/257
2	D	0.24	0/184	0.32	0/247
2	F	0.24	0/198	0.38	0/266
All	All	0.24	0/1065	0.36	0/1430

There are no bond length outliers.

There are no bond angle outliers.

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	162	147	151	0	0
1	C	162	148	151	0	0
1	E	162	149	151	1	0
2	B	188	171	181	1	0
2	D	181	153	173	1	0
2	F	195	135	182	1	0
3	A	20	0	0	0	0
3	B	21	0	0	1	0
3	C	15	0	0	0	0
3	D	31	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	E	14	0	0	0	0
3	F	18	0	0	0	0
All	All	1169	903	989	3	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 1.

All (3) 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:2:VAL:HG23	3:B:108:HOH:O	2.00	0.60
2:D:20:TYR:CZ	1:E:3:VAL:HG11	2.53	0.44
2:F:17:LEU:HD23	2:F:17:LEU:C	2.44	0.43

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	18/21 (86%)	18 (100%)	0	0	100	100
1	C	18/21 (86%)	17 (94%)	1 (6%)	0	100	100
1	E	18/21 (86%)	18 (100%)	0	0	100	100
2	B	21/22 (96%)	21 (100%)	0	0	100	100
2	D	20/22 (91%)	20 (100%)	0	0	100	100
2	F	22/22 (100%)	20 (91%)	2 (9%)	0	100	100
All	All	117/129 (91%)	114 (97%)	3 (3%)	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	19/20 (95%)	19 (100%)	0	100	100
1	C	19/20 (95%)	19 (100%)	0	100	100
1	E	19/20 (95%)	19 (100%)	0	100	100
2	B	21/20 (105%)	21 (100%)	0	100	100
2	D	20/20 (100%)	20 (100%)	0	100	100
2	F	22/20 (110%)	22 (100%)	0	100	100
All	All	120/120 (100%)	120 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

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

Mol	Chain	Res	Type
1	A	8	HIS
2	B	5	HIS
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 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 [i](#)

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

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	20/21 (95%)	0.42	0 100 100	21, 29, 44, 45	0
1	C	20/21 (95%)	0.09	0 100 100	19, 26, 36, 38	0
1	E	20/21 (95%)	0.99	3 (15%) 5 6	22, 32, 57, 77	0
2	B	22/22 (100%)	1.10	4 (18%) 3 3	15, 30, 59, 68	1 (4%)
2	D	22/22 (100%)	0.05	0 100 100	19, 25, 36, 39	0
2	F	22/22 (100%)	0.74	4 (18%) 3 3	12, 26, 47, 82	2 (9%)
All	All	126/129 (97%)	0.57	11 (8%) 16 16	12, 28, 55, 82	3 (2%)

All (11) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	2	VAL	4.9
2	B	1	PHE	4.8
2	F	22	ARG	4.1
2	F	20	TYR	3.7
1	E	18	ASN	3.6
1	E	19	TYR	3.0
1	E	20	CYS	2.6
2	B	22	ARG	2.5
2	B	20	TYR	2.3
2	F	21	GLU	2.3
2	F	3[A]	ASN	2.2

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

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

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.