wwPDB X-ray Structure Validation Summary Report (i)

Oct 22, 2023 – 07:25 AM EDT

PDB ID	:	3HLH
Title	:	Diisopropyl fluorophosphatase (DFPase), active site mutants
Authors	:	Chen, J.C.-H.; Blum, M.-M.
Deposited on	:	2009-05-27
Resolution	:	1.80 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:

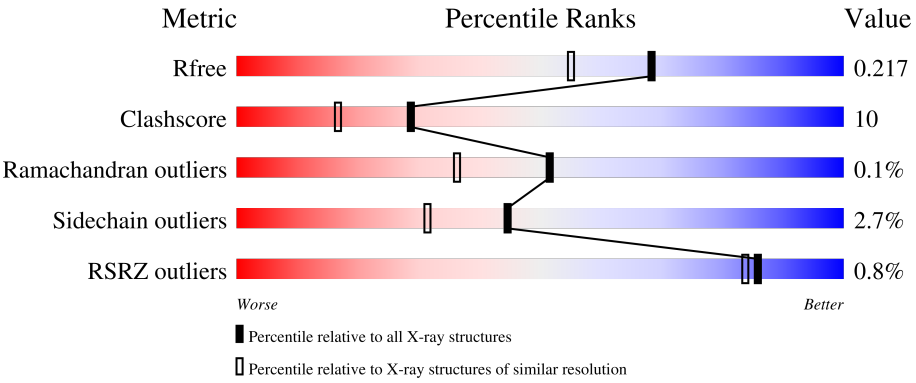
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.36
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

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 1.80 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}	130704	5950 (1.80-1.80)
Clashscore	141614	6793 (1.80-1.80)
Ramachandran outliers	138981	6697 (1.80-1.80)
Sidechain outliers	138945	6696 (1.80-1.80)
RSRZ outliers	127900	5850 (1.80-1.80)

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	A	314	80% 19%
1	B	314	76% 23%
1	C	314	79% 20%
1	D	314	83% 16%

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 10655 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 Diisopropyl-fluorophosphatase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	312	Total	C	N	O	S	0	0	0
			2435	1547	413	459	16			
1	B	312	Total	C	N	O	S	0	0	0
			2435	1547	413	459	16			
1	C	312	Total	C	N	O	S	0	0	0
			2435	1547	413	459	16			
1	D	312	Total	C	N	O	S	0	0	0
			2435	1547	413	459	16			

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	37	ALA	GLU	engineered mutation	UNP Q7SIG4
A	144	ALA	TYR	engineered mutation	UNP Q7SIG4
A	146	ALA	ARG	engineered mutation	UNP Q7SIG4
A	195	MET	THR	engineered mutation	UNP Q7SIG4
B	37	ALA	GLU	engineered mutation	UNP Q7SIG4
B	144	ALA	TYR	engineered mutation	UNP Q7SIG4
B	146	ALA	ARG	engineered mutation	UNP Q7SIG4
B	195	MET	THR	engineered mutation	UNP Q7SIG4
C	37	ALA	GLU	engineered mutation	UNP Q7SIG4
C	144	ALA	TYR	engineered mutation	UNP Q7SIG4
C	146	ALA	ARG	engineered mutation	UNP Q7SIG4
C	195	MET	THR	engineered mutation	UNP Q7SIG4
D	37	ALA	GLU	engineered mutation	UNP Q7SIG4
D	144	ALA	TYR	engineered mutation	UNP Q7SIG4
D	146	ALA	ARG	engineered mutation	UNP Q7SIG4
D	195	MET	THR	engineered mutation	UNP Q7SIG4

- Molecule 2 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	2	Total Ca 2 2	0	0
2	B	2	Total Ca 2 2	0	0
2	C	2	Total Ca 2 2	0	0
2	D	2	Total Ca 2 2	0	0

- Molecule 3 is water.

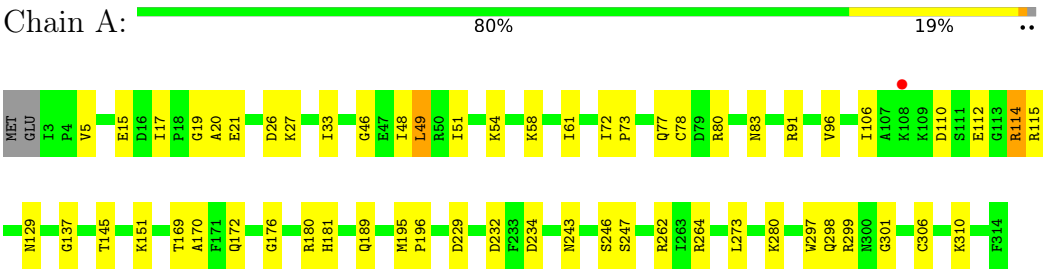
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	208	Total O 208 208	0	0
3	B	244	Total O 244 244	0	0
3	C	231	Total O 231 231	0	0
3	D	224	Total O 224 224	0	0

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.

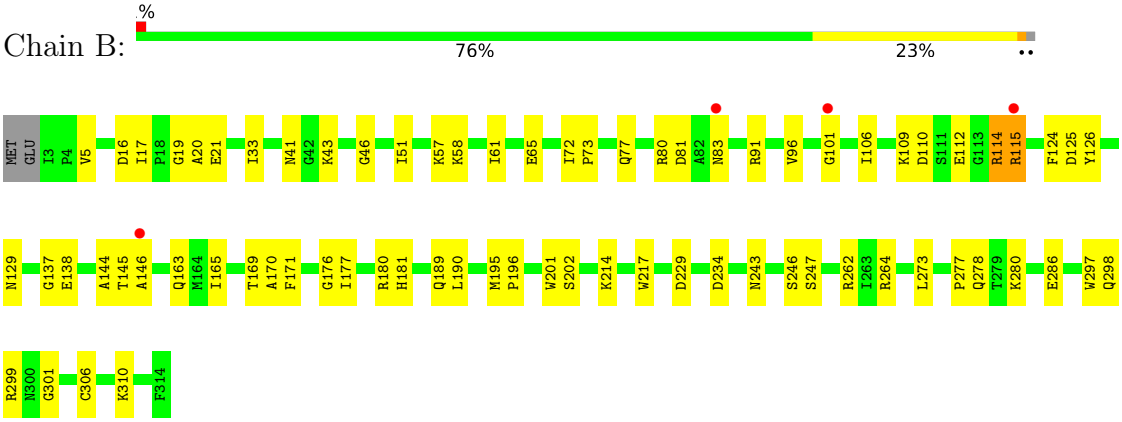
• Molecule 1: Diisopropyl-fluorophosphatase

Chain A:



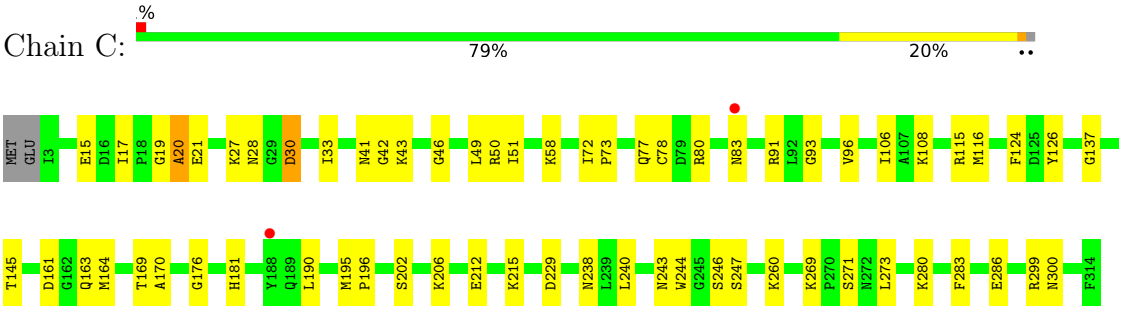
• Molecule 1: Diisopropyl-fluorophosphatase

Chain B:



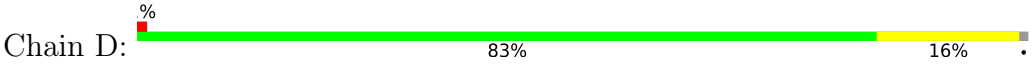
• Molecule 1: Diisopropyl-fluorophosphatase

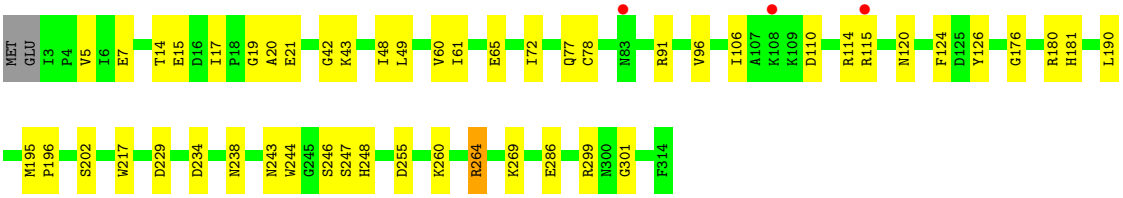
Chain C:



• Molecule 1: Diisopropyl-fluorophosphatase

Chain D:




MET
GLU
I3
P4
V5
I6
E7
T14
E15
D16
I17
P18
G19
A20
E21
G42
K43
I48
L49
V60
I61
E65
I72
Q77
C78
N83
R91
V96
I106
A107
K108
K109
D110
R114
R115
N120
F124
D125
Y126
G176
R180
H181
L190

M195
P196
S202
W217
D229
D234
N238
N243
W244
G245
S246
S247
H248
D255
K260
R264
K269
E286
R299
N300
G301
F314

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	67.11Å 74.39Å 118.64Å 90.00° 99.90° 90.00°	Depositor
Resolution (Å)	47.77 – 1.80 47.77 – 1.80	Depositor EDS
% Data completeness (in resolution range)	99.2 (47.77-1.80) 99.2 (47.77-1.80)	Depositor EDS
R_{merge}	0.14	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.39 (at 1.79Å)	Xtriage
Refinement program	CNS	Depositor
R, R_{free}	0.195 , 0.218 0.193 , 0.217	Depositor DCC
R_{free} test set	5332 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å^2)	8.7	Xtriage
Anisotropy	0.362	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.39 , 48.4	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	10655	wwPDB-VP
Average B, all atoms (Å^2)	11.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 32.84 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 8.8044e-04. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

[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

Bond lengths and bond angles in the following residue types are not validated in this section: CA

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	0.31	0/2497	0.67	0/3379
1	B	0.31	0/2497	0.66	0/3379
1	C	0.31	0/2497	0.67	0/3379
1	D	0.31	0/2497	0.67	0/3379
All	All	0.31	0/9988	0.67	0/13516

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

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	2435	0	2359	49	0
1	B	2435	0	2359	59	0
1	C	2435	0	2359	44	0
1	D	2435	0	2358	39	0
2	A	2	0	0	0	0
2	B	2	0	0	0	0
2	C	2	0	0	0	0
2	D	2	0	0	0	0
3	A	208	0	0	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	244	0	0	5	0
3	C	231	0	0	5	0
3	D	224	0	0	2	0
All	All	10655	0	9435	186	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 10.

The worst 5 of 186 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)
1:B:17:ILE:HD13	1:B:33:ILE:HD12	1.47	0.97
1:D:264:ARG:HB2	1:D:264:ARG:HH11	1.37	0.89
1:B:17:ILE:HD13	1:B:33:ILE:CD1	2.04	0.86
1:B:126:TYR:H	1:B:181:HIS:CE1	1.92	0.86
1:A:180:ARG:HE	1:A:189:GLN:NE2	1.75	0.84

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	310/314 (99%)	297 (96%)	13 (4%)	0	100	100
1	B	310/314 (99%)	300 (97%)	10 (3%)	0	100	100
1	C	310/314 (99%)	300 (97%)	9 (3%)	1 (0%)	41	27
1	D	310/314 (99%)	298 (96%)	12 (4%)	0	100	100
All	All	1240/1256 (99%)	1195 (96%)	44 (4%)	1 (0%)	51	36

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	20	ALA

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	258/260 (99%)	252 (98%)	6 (2%)	50	37
1	B	258/260 (99%)	251 (97%)	7 (3%)	44	31
1	C	258/260 (99%)	251 (97%)	7 (3%)	44	31
1	D	258/260 (99%)	250 (97%)	8 (3%)	40	25
All	All	1032/1040 (99%)	1004 (97%)	28 (3%)	44	31

5 of 28 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	30	ASP
1	D	286	GLU
1	C	115	ARG
1	D	120	ASN
1	C	78	CYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 42 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	243	ASN
1	D	181	HIS
1	C	258	GLN
1	D	28	ASN
1	D	238	ASN

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 monosaccharides in this entry.

5.6 Ligand geometry (i)

Of 8 ligands modelled in this entry, 8 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

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	A	312/314 (99%)	-0.36	1 (0%)	94	92	2, 9, 21, 30	0
1	B	312/314 (99%)	-0.29	4 (1%)	77	74	2, 9, 24, 33	0
1	C	312/314 (99%)	-0.37	2 (0%)	89	87	2, 8, 21, 27	0
1	D	312/314 (99%)	-0.29	3 (0%)	82	80	2, 9, 22, 30	0
All	All	1248/1256 (99%)	-0.33	10 (0%)	86	84	2, 8, 22, 33	0

The worst 5 of 10 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	115	ARG	3.3
1	A	108	LYS	3.0
1	D	83	ASN	3.0
1	B	101	GLY	2.7
1	C	83	ASN	2.7

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

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, 95^{th} 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
2	CA	A	315	1/1	1.00	0.05	3,3,3,3	0
2	CA	A	316	1/1	1.00	0.07	2,2,2,2	0
2	CA	B	315	1/1	1.00	0.05	3,3,3,3	0
2	CA	B	316	1/1	1.00	0.08	2,2,2,2	0
2	CA	C	315	1/1	1.00	0.05	2,2,2,2	0
2	CA	C	316	1/1	1.00	0.06	2,2,2,2	0
2	CA	D	315	1/1	1.00	0.05	2,2,2,2	0
2	CA	D	316	1/1	1.00	0.06	1,1,1,1	0

6.5 Other polymers (i)

There are no such residues in this entry.