



# wwPDB X-ray Structure Validation Summary Report ⓘ

May 21, 2020 – 09:03 pm BST

PDB ID : 3HVQ  
Title : Crystal structure of a complex between Protein Phosphatase 1 alpha (PP1) and the PP1 binding and PDZ domains of Neurabin  
Authors : Critton, D.A.; Ragusa, M.J.; Page, R.; Peti, W.  
Deposited on : 2009-06-16  
Resolution : 2.20 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](mailto: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 following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.11
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)	:	2.11

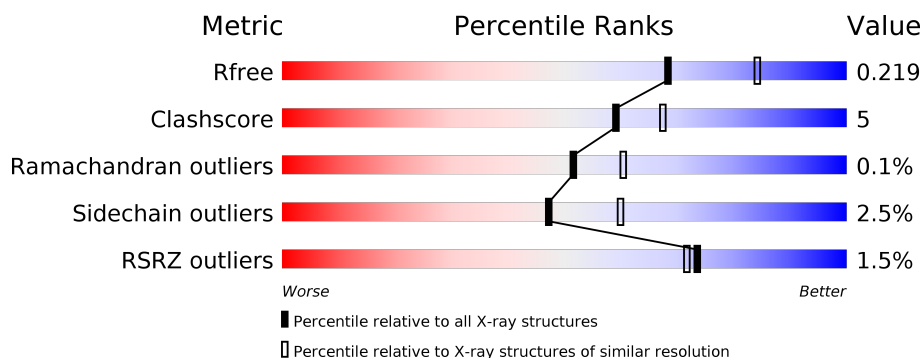
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.20 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))
$R_{free}$	130704	4898 (2.20-2.20)
Clashscore	141614	5594 (2.20-2.20)
Ramachandran outliers	138981	5503 (2.20-2.20)
Sidechain outliers	138945	5504 (2.20-2.20)
RSRZ outliers	127900	4800 (2.20-2.20)

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 on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 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	329	<div> <div style="width: 100%; height: 10px; background: linear-gradient(to right, red 1%, orange 1%, yellow 9%, green 80%, grey 11%);"></div> <div style="display: flex; justify-content: space-between; width: 100%;"> <span>%</span> <span>80%</span> <span>9%</span> <span>11%</span> </div> </div>
1	B	329	<div> <div style="width: 100%; height: 10px; background: linear-gradient(to right, green 78%, yellow 11%, grey 11%);"></div> <div style="display: flex; justify-content: space-between; width: 100%;"> <span>78%</span> <span>11%</span> <span>11%</span> </div> </div>
2	C	170	<div> <div style="width: 100%; height: 10px; background: linear-gradient(to right, red 2%, orange 1%, yellow 9%, green 82%, grey 8%);"></div> <div style="display: flex; justify-content: space-between; width: 100%;"> <span>2%</span> <span>82%</span> <span>9%</span> <span>8%</span> </div> </div>
2	D	170	<div> <div style="width: 100%; height: 10px; background: linear-gradient(to right, red 3%, orange 1%, yellow 1%, green 35%, grey 62%);"></div> <div style="display: flex; justify-content: space-between; width: 100%;"> <span>3%</span> <span>35%</span> <span>62%</span> </div> </div>

## 2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 7048 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 Serine/threonine-protein phosphatase PP1-alpha catalytic subunit.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	294	Total	C	N	O	S	0	11	0
			2381	1526	395	440	20			
1	B	294	Total	C	N	O	S	0	5	0
			2356	1509	394	433	20			

There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	2	GLY	-	EXPRESSION TAG	UNP P62136
A	3	HIS	-	EXPRESSION TAG	UNP P62136
A	4	MET	-	EXPRESSION TAG	UNP P62136
A	5	GLY	-	EXPRESSION TAG	UNP P62136
A	6	SER	-	EXPRESSION TAG	UNP P62136
B	2	GLY	-	EXPRESSION TAG	UNP P62136
B	3	HIS	-	EXPRESSION TAG	UNP P62136
B	4	MET	-	EXPRESSION TAG	UNP P62136
B	5	GLY	-	EXPRESSION TAG	UNP P62136
B	6	SER	-	EXPRESSION TAG	UNP P62136

- Molecule 2 is a protein called Neurabin-1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	C	157	Total	C	N	O	S	0	2	0
			1199	753	205	238	3			
2	D	65	Total	C	N	O	S	0	1	0
			520	324	88	106	2			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	423	GLY	-	EXPRESSION TAG	UNP O35867

*Continued on next page...*

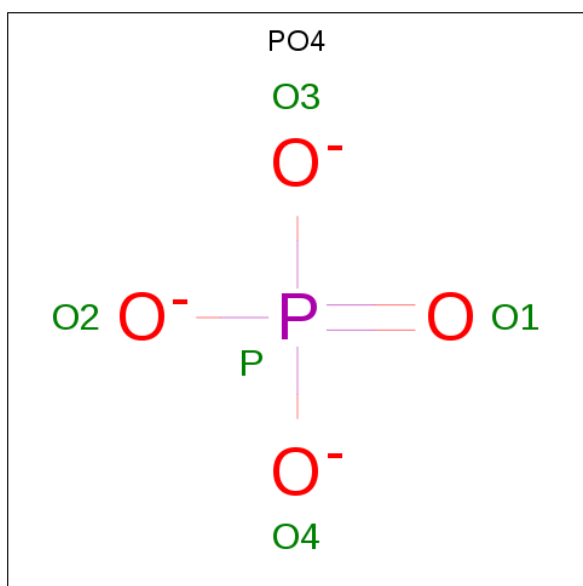
Continued from previous page...

Chain	Residue	Modelled	Actual	Comment	Reference
C	424	HIS	-	EXPRESSION TAG	UNP O35867
C	425	MET	-	EXPRESSION TAG	UNP O35867
D	423	GLY	-	EXPRESSION TAG	UNP O35867
D	424	HIS	-	EXPRESSION TAG	UNP O35867
D	425	MET	-	EXPRESSION TAG	UNP O35867

- Molecule 3 is MANGANESE (II) ION (three-letter code: MN) (formula: Mn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	B	2	Total	Mn	0	0
			2	2		
3	A	2	Total	Mn	0	0
			2	2		

- Molecule 4 is PHOSPHATE ION (three-letter code: PO4) (formula: O<sub>4</sub>P).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	O	P	0	0
			5	4	1		
4	B	1	Total	O	P	0	0
			5	4	1		

- Molecule 5 is GLYCEROL (three-letter code: GOL) (formula: C<sub>3</sub>H<sub>8</sub>O<sub>3</sub>).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	B	1	Total	C	O	0	0
			6	3	3		
5	B	1	Total	C	O	0	0
			6	3	3		
5	B	1	Total	C	O	0	0
			6	3	3		

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	231	Total	O	0	0
			231	231		
6	B	195	Total	O	0	0
			195	195		
6	C	93	Total	O	0	0
			93	93		
6	D	41	Total	O	0	0
			41	41		



ARG  
GLU

## 4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	120.86Å 83.66Å 108.80Å 90.00° 93.59° 90.00°	Depositor
Resolution (Å)	20.00 – 2.20 19.81 – 2.20	Depositor EDS
% Data completeness (in resolution range)	97.9 (20.00-2.20) 97.9 (19.81-2.20)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.10	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	4.76 (at 2.21Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, $R_{free}$	0.161 , 0.221 0.161 , 0.219	Depositor DCC
$R_{free}$ test set	2704 reflections (5.03%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	21.7	Xtriage
Anisotropy	0.067	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 44.7	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	7048	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	23.0	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 40.04 % 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 2.9023e-04. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

<sup>1</sup> Intensities estimated from amplitudes.

<sup>2</sup> Theoretical 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](#)

Bond lengths and bond angles in the following residue types are not validated in this section: GOL, PO4, MN

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	0.66	0/2495	0.67	0/3373
1	B	0.64	0/2441	0.65	0/3298
2	C	0.56	0/1224	0.64	0/1654
2	D	0.56	0/538	0.58	0/728
All	All	0.63	0/6698	0.65	0/9053

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	2381	0	2318	25	0
1	B	2356	0	2299	26	0
2	C	1199	0	1184	13	0
2	D	520	0	483	4	0
3	A	2	0	0	0	0
3	B	2	0	0	0	0
4	A	5	0	0	0	0
4	B	5	0	0	0	0
5	B	18	0	24	4	0

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	A	231	0	0	5	0
6	B	195	0	0	6	0
6	C	93	0	0	2	0
6	D	41	0	0	2	0
All	All	7048	0	6308	60	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 5.

The worst 5 of 60 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:A:214:GLN:O	6:A:393:HOH:O	1.62	1.16
1:A:78[B]:TYR:HE1	2:C:437:ASP:O	1.43	0.98
1:B:214:GLN:O	6:B:385:HOH:O	1.84	0.95
1:A:78[A]:TYR:HE1	1:A:296:LEU:HG	1.35	0.89
1:A:78[B]:TYR:CE1	2:C:437:ASP:O	2.29	0.86

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	303/329 (92%)	290 (96%)	12 (4%)	1 (0%)	41	46
1	B	297/329 (90%)	283 (95%)	14 (5%)	0	100	100
2	C	157/170 (92%)	155 (99%)	2 (1%)	0	100	100
2	D	64/170 (38%)	63 (98%)	1 (2%)	0	100	100
All	All	821/998 (82%)	791 (96%)	29 (4%)	1 (0%)	51	60

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	273	CYS

### 5.3.2 Protein sidechains ⓘ

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	266/285 (93%)	261 (98%)	5 (2%)	57	71
1	B	260/285 (91%)	256 (98%)	4 (2%)	65	78
2	C	127/143 (89%)	122 (96%)	5 (4%)	32	41
2	D	57/143 (40%)	53 (93%)	4 (7%)	15	16
All	All	710/856 (83%)	692 (98%)	18 (2%)	47	60

5 of 18 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	290	MET
2	C	474	GLU
2	D	435	GLN
1	B	240	ASP
1	B	246	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
2	C	448	GLN

### 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 carbohydrates in this entry.

## 5.6 Ligand geometry

Of 9 ligands modelled in this entry, 4 are monoatomic - leaving 5 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	$\# Z  > 2$
5	GOL	B	334	-	5,5,5	0.45	0	5,5,5	0.21	0
4	PO4	B	333	3	4,4,4	0.96	0	6,6,6	0.81	0
5	GOL	B	335	-	5,5,5	0.32	0	5,5,5	0.45	0
4	PO4	A	332	3	4,4,4	1.05	0	6,6,6	0.91	0
5	GOL	B	1	-	5,5,5	0.39	0	5,5,5	0.89	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
5	GOL	B	334	-	-	2/4/4/4	-
5	GOL	B	335	-	-	1/4/4/4	-
5	GOL	B	1	-	-	2/4/4/4	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	B	334	GOL	C1-C2-C3-O3
5	B	1	GOL	O1-C1-C2-C3

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type	Atoms
5	B	334	GOL	O2-C2-C3-O3
5	B	1	GOL	O1-C1-C2-O2
5	B	335	GOL	O1-C1-C2-C3

There are no ring outliers.

3 monomers are involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	B	334	GOL	1	0
5	B	335	GOL	1	0
5	B	1	GOL	2	0

## 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](#)

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<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	294/329 (89%)	-0.64	2 (0%) 87 86	9, 17, 33, 60	0
1	B	294/329 (89%)	-0.64	1 (0%) 94 93	11, 17, 32, 60	0
2	C	157/170 (92%)	-0.05	4 (2%) 57 55	18, 32, 49, 57	0
2	D	65/170 (38%)	0.10	5 (7%) 13 12	19, 32, 51, 57	0
All	All	810/998 (81%)	-0.47	12 (1%) 73 72	9, 20, 42, 60	0

The worst 5 of 12 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	300	ASP	5.4
2	C	436	PRO	4.4
2	D	497	ARG	3.8
1	A	300	ASP	3.6
2	D	437	ASP	2.6

### 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 carbohydrates in this entry.

### 6.4 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, 95<sup>th</sup> 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( $\text{\AA}^2$ )	Q<0.9
5	GOL	B	1	6/6	0.72	0.32	46,47,51,56	0
5	GOL	B	334	6/6	0.86	0.30	49,63,64,65	0
5	GOL	B	335	6/6	0.88	0.23	42,50,52,53	0
4	PO4	B	333	5/5	0.99	0.05	16,17,19,20	0
3	MN	B	331	1/1	0.99	0.08	28,28,28,28	0
3	MN	A	1	1/1	1.00	0.04	24,24,24,24	0
3	MN	A	331	1/1	1.00	0.02	14,14,14,14	0
3	MN	B	332	1/1	1.00	0.01	12,12,12,12	0
4	PO4	A	332	5/5	1.00	0.04	19,21,24,30	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.