



# Full wwPDB X-ray Structure Validation Report ⓘ

May 29, 2024 – 03:24 PM EDT

PDB ID : 1PAL  
Title : IONIC INTERACTIONS WITH PARVALBUMINS. CRYSTAL STRUCTURE DETERMINATION OF PIKE 4.10 PARVALBUMIN IN FOUR DIFFERENT IONIC ENVIRONMENTS  
Authors : Declercq, J.P.; Tinant, B.; Parello, J.; Rambaud, J.  
Deposited on : 1990-11-08  
Resolution : 1.65 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](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 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	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36.2
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)	:	2.36.2

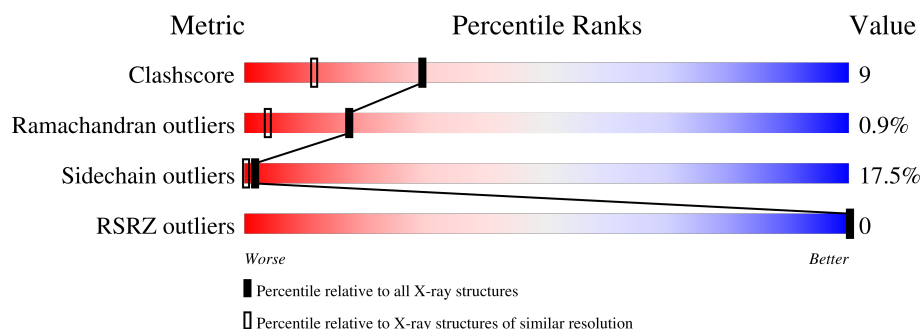
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.65 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	1931 (1.66-1.66)
Ramachandran outliers	138981	1891 (1.66-1.66)
Sidechain outliers	138945	1891 (1.66-1.66)
RSRZ outliers	127900	1791 (1.66-1.66)

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  $\geq 3$ , 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	108	

## 2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 872 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.

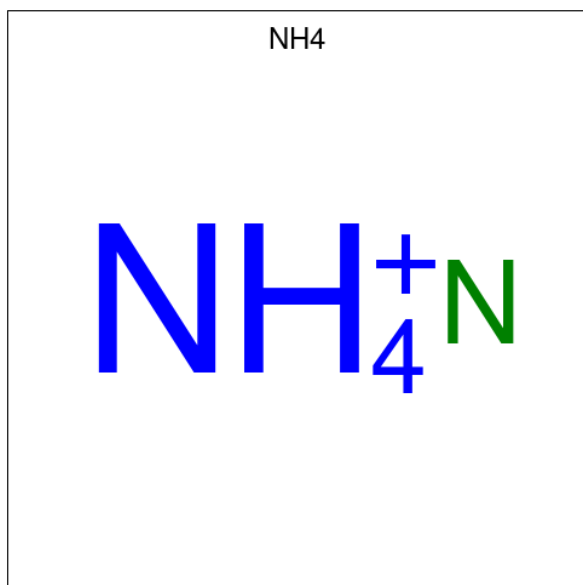
- Molecule 1 is a protein called PARVALBUMIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	108	Total	C	N	O	S	5	0	0
			805	512	127	163	3			

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

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	2	Total	Ca	0	0
			2	2		

- Molecule 3 is AMMONIUM ION (three-letter code: NH4) (formula: H<sub>4</sub>N).



Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	N	0	0
			1	1		

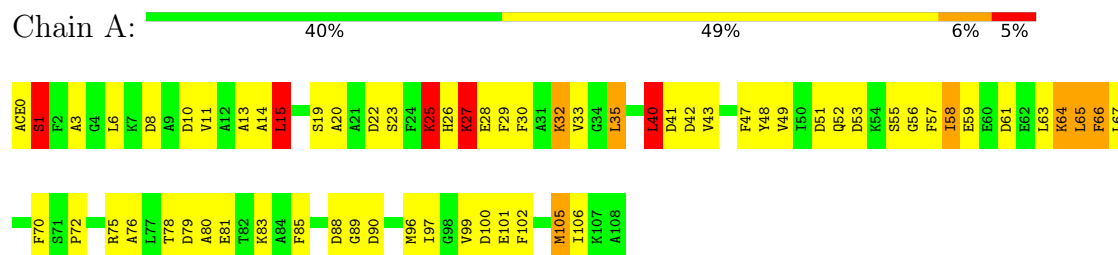
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	64	Total 64	O 64	0	0

### 3 Residue-property plots

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: PARVALBUMIN



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	59.50Å 59.63Å 26.24Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	(Not available) – 1.65 26.62 – 1.65	Depositor EDS
% Data completeness (in resolution range)	(Not available) ((Not available)-1.65) 75.1 (26.62-1.65)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$	-	Xtriage
Refinement program	PROLSQ	Depositor
R, $R_{free}$	0.197 , (Not available) 0.203 , (Not available)	Depositor DCC
$R_{free}$ test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	6.7	Xtriage
Anisotropy	0.876	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 47.0	EDS
L-test for twinning <sup>1</sup>	$\langle  L  \rangle = 0.35$ , $\langle L^2 \rangle = 0.18$	Xtriage
Estimated twinning fraction	0.065 for k,h,-l	Xtriage
$F_o, F_c$ correlation	0.93	EDS
Total number of atoms	872	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	15.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 10.38% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</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 ⓘ

### 5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: CA, NH4, ACE

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	1.29	3/815 (0.4%)	3.01	93/1091 (8.5%)

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	56	GLY	N-CA	-6.13	1.36	1.46
1	A	81	GLU	CD-OE1	-5.60	1.19	1.25
1	A	48	TYR	CG-CD1	5.21	1.46	1.39

All (93) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	101	GLU	OE1-CD-OE2	-18.69	100.87	123.30
1	A	90	ASP	CB-CG-OD2	-13.74	105.93	118.30
1	A	48	TYR	CB-CG-CD1	-13.08	113.15	121.00
1	A	101	GLU	CG-CD-OE2	12.97	144.24	118.30
1	A	78	THR	CA-CB-CG2	11.38	128.33	112.40
1	A	8	ASP	CB-CG-OD1	11.18	128.36	118.30
1	A	55	SER	O-C-N	-10.86	104.73	123.20
1	A	70	PHE	CB-CG-CD2	-10.39	113.53	120.80
1	A	22	ASP	CB-CG-OD2	-10.10	109.21	118.30
1	A	57	PHE	CB-CG-CD1	10.10	127.87	120.80
1	A	41	ASP	CB-CG-OD1	9.75	127.08	118.30
1	A	40	LEU	CB-CA-C	9.42	128.10	110.20
1	A	0	ACE	O-C-N	-9.14	108.08	122.70
1	A	75	ARG	NE-CZ-NH2	-9.09	115.76	120.30
1	A	99	VAL	CA-CB-CG2	9.09	124.53	110.90
1	A	15	LEU	O-C-N	9.08	137.23	122.70
1	A	81	GLU	O-C-N	9.01	137.11	122.70
1	A	57	PHE	CB-CG-CD2	-8.80	114.64	120.80

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	88	ASP	CB-CG-OD1	8.78	126.20	118.30
1	A	41	ASP	CB-CG-OD2	-7.92	111.17	118.30
1	A	89	GLY	O-C-N	7.88	135.31	122.70
1	A	48	TYR	CD1-CE1-CZ	-7.86	112.73	119.80
1	A	20	ALA	O-C-N	7.77	135.13	122.70
1	A	59	GLU	O-C-N	7.69	135.01	122.70
1	A	100	ASP	O-C-N	7.68	134.98	122.70
1	A	57	PHE	O-C-N	7.67	134.97	122.70
1	A	70	PHE	CD1-CG-CD2	7.58	128.16	118.30
1	A	75	ARG	CD-NE-CZ	7.42	133.98	123.60
1	A	27	LYS	CB-CA-C	7.28	124.96	110.40
1	A	64	LYS	CB-CA-C	7.12	124.63	110.40
1	A	102	PHE	CG-CD1-CE1	7.08	128.59	120.80
1	A	8	ASP	O-C-N	-7.03	111.45	122.70
1	A	10	ASP	CB-CG-OD2	7.01	124.61	118.30
1	A	55	SER	C-N-CA	6.98	136.96	122.30
1	A	8	ASP	CA-C-O	6.88	134.54	120.10
1	A	81	GLU	OE1-CD-OE2	6.87	131.54	123.30
1	A	76	ALA	N-CA-CB	6.82	119.65	110.10
1	A	52	GLN	O-C-N	6.82	133.61	122.70
1	A	30	PHE	CB-CG-CD1	-6.80	116.04	120.80
1	A	1	SER	O-C-N	6.74	133.49	122.70
1	A	59	GLU	N-CA-CB	6.71	122.67	110.60
1	A	30	PHE	CZ-CE2-CD2	-6.70	112.06	120.10
1	A	23	SER	CB-CA-C	-6.61	97.53	110.10
1	A	29	PHE	CB-CG-CD2	-6.59	116.19	120.80
1	A	25	LYS	O-C-N	6.54	133.17	122.70
1	A	35	LEU	CB-CA-C	6.52	122.58	110.20
1	A	66	PHE	CZ-CE2-CD2	6.48	127.88	120.10
1	A	58	ILE	C-N-CA	6.46	137.85	121.70
1	A	106	ILE	CA-CB-CG1	-6.37	98.90	111.00
1	A	43	VAL	CB-CA-C	6.28	123.34	111.40
1	A	8	ASP	CB-CG-OD2	-6.22	112.70	118.30
1	A	51	ASP	O-C-N	-6.17	112.84	122.70
1	A	29	PHE	O-C-N	6.07	132.40	122.70
1	A	80	ALA	N-CA-CB	-5.99	101.71	110.10
1	A	14	ALA	N-CA-CB	-5.99	101.72	110.10
1	A	23	SER	N-CA-CB	5.98	119.47	110.50
1	A	48	TYR	CE1-CZ-CE2	5.97	129.36	119.80
1	A	61	ASP	CB-CG-OD1	5.96	123.66	118.30
1	A	67	LEU	CA-CB-CG	5.92	128.91	115.30
1	A	66	PHE	CG-CD2-CE2	-5.91	114.30	120.80

*Continued on next page...*



*Continued from previous page...*

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	25	LYS	N-CA-CB	-5.88	100.01	110.60
1	A	19	SER	N-CA-CB	-5.87	101.70	110.50
1	A	61	ASP	CB-CG-OD2	-5.86	113.03	118.30
1	A	66	PHE	CA-C-O	5.77	132.22	120.10
1	A	70	PHE	CG-CD1-CE1	-5.74	114.49	120.80
1	A	55	SER	CA-C-N	5.68	127.56	116.20
1	A	89	GLY	CA-C-O	-5.64	110.44	120.60
1	A	75	ARG	NH1-CZ-NH2	5.58	125.54	119.40
1	A	81	GLU	CG-CD-OE2	-5.58	107.15	118.30
1	A	102	PHE	CD1-CE1-CZ	-5.55	113.44	120.10
1	A	48	TYR	CD1-CG-CD2	5.53	123.99	117.90
1	A	66	PHE	O-C-N	-5.52	113.88	122.70
1	A	102	PHE	O-C-N	-5.50	113.89	122.70
1	A	6	LEU	N-CA-CB	-5.47	99.45	110.40
1	A	13	ALA	O-C-N	-5.47	113.95	122.70
1	A	53	ASP	CA-C-O	-5.41	108.74	120.10
1	A	58	ILE	O-C-N	-5.29	114.24	122.70
1	A	96	MET	CB-CG-SD	-5.28	96.56	112.40
1	A	41	ASP	CA-C-O	5.26	131.15	120.10
1	A	30	PHE	CG-CD1-CE1	-5.25	115.02	120.80
1	A	102	PHE	CG-CD2-CE2	-5.25	115.03	120.80
1	A	56	GLY	O-C-N	5.24	131.09	122.70
1	A	97	ILE	C-N-CA	-5.24	111.31	122.30
1	A	19	SER	O-C-N	-5.22	114.34	122.70
1	A	8	ASP	C-N-CA	5.18	134.66	121.70
1	A	30	PHE	CA-C-O	5.14	130.91	120.10
1	A	102	PHE	CA-C-O	5.14	130.90	120.10
1	A	49	VAL	N-CA-CB	-5.13	100.21	111.50
1	A	35	LEU	C-N-CA	5.08	134.39	121.70
1	A	61	ASP	O-C-N	-5.06	114.61	122.70
1	A	100	ASP	CA-C-O	-5.06	109.48	120.10
1	A	26	HIS	CA-CB-CG	-5.04	105.04	113.60
1	A	51	ASP	CA-C-O	5.03	130.66	120.10

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	805	0	783	15	0
2	A	2	0	0	0	0
3	A	1	0	0	0	0
4	A	64	0	0	3	0
All	All	872	0	783	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)
1:A:3:ALA:HB1	4:A:231:HOH:O	1.76	0.83
1:A:42:ASP:HB3	4:A:231:HOH:O	1.80	0.81
1:A:64:LYS:NZ	1:A:65:LEU:HD21	2.05	0.72
1:A:40:LEU:O	1:A:40:LEU:HD13	1.94	0.67
1:A:72:PRO:HD3	4:A:200:HOH:O	1.97	0.65
1:A:40:LEU:HD13	1:A:40:LEU:C	2.29	0.52
1:A:64:LYS:CE	1:A:65:LEU:HD21	2.40	0.51
1:A:64:LYS:HZ3	1:A:65:LEU:HD21	1.77	0.49
1:A:47:PHE:CE1	1:A:58:ILE:HG13	2.49	0.47
1:A:25:LYS:HZ2	1:A:25:LYS:HG3	1.31	0.46
1:A:105:MET:HE2	1:A:105:MET:HB2	1.73	0.44
1:A:11:VAL:HG12	1:A:15:LEU:HD22	1.98	0.44
1:A:63:LEU:O	1:A:66:PHE:HB2	2.18	0.43
1:A:27:LYS:HE3	1:A:27:LYS:HB2	1.77	0.41
1:A:32:LYS:HA	1:A:32:LYS:HD2	1.69	0.41

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	106/108 (98%)	102 (96%)	3 (3%)	1 (1%)	17 4

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	1	SER

### 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	80/80 (100%)	66 (82%)	14 (18%)	2 0

All (14) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1	SER
1	A	15	LEU
1	A	25	LYS
1	A	27	LYS
1	A	28	GLU
1	A	32	LYS
1	A	33	VAL
1	A	35	LEU
1	A	40	LEU
1	A	65	LEU
1	A	79	ASP
1	A	83	LYS
1	A	85	PHE
1	A	105	MET

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	52	GLN
1	A	69	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 3 ligands modelled in this entry, 2 are monoatomic and 1 is modelled with single atom - 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](#)

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	107/108 (99%)	-0.20	0 <a href="#">100</a> <a href="#">100</a>	4, 12, 28, 53	1 (0%)

There are no RSRZ outliers to report.

### 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 monosaccharides 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(Å <sup>2</sup> )	Q<0.9
3	NH4	A	223	1/1	0.98	0.07	7,7,7,7	0
2	CA	A	111	1/1	0.99	0.04	6,6,6,6	0
2	CA	A	110	1/1	0.99	0.03	7,7,7,7	0

### 6.5 Other polymers [i](#)

There are no such residues in this entry.