



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 18, 2024 – 07:43 PM EST

PDB ID : 4HH3  
Title : Structure of the AppA-PpsR2 core complex from *Rb. sphaeroides*  
Authors : Winkler, A.; Heintz, U.; Lindner, R.; Reinstein, J.; Shoeman, R.; Schlichting, I.  
Deposited on : 2012-10-09  
Resolution : 1.75 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>.

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The following versions of software and data (see [references ⓘ](#)) 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

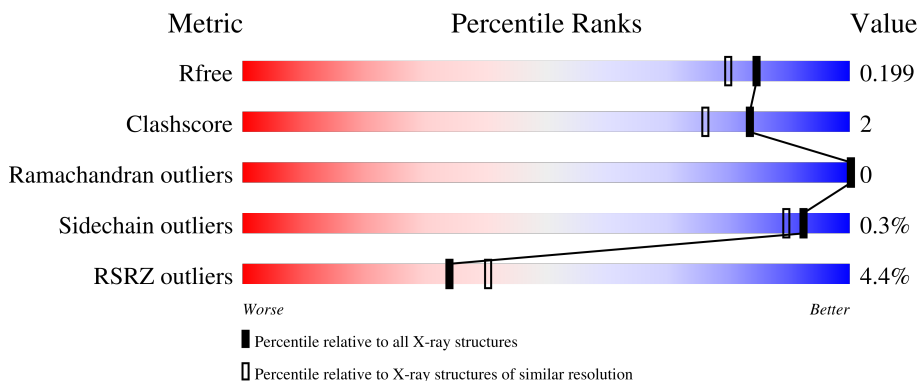
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.75 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	2340 (1.76-1.76)
Clashscore	141614	2466 (1.76-1.76)
Ramachandran outliers	138981	2437 (1.76-1.76)
Sidechain outliers	138945	2437 (1.76-1.76)
RSRZ outliers	127900	2298 (1.76-1.76)

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	262	 6% 90% 5%
1	B	262	 3% 87% 6% 7%
2	C	240	 2% 83% 7% 10%

## 2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 6221 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 Transcriptional regulator, PpsR.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	251	Total	C	N	O	S	0	3	0
			1970	1234	361	366	9			
1	B	243	Total	C	N	O	S	0	8	0
			1921	1201	351	360	9			

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-4	GLY	-	expression tag	UNP Q3J179
A	-3	ALA	-	expression tag	UNP Q3J179
A	-2	MET	-	expression tag	UNP Q3J179
A	-1	GLY	-	expression tag	UNP Q3J179
A	0	MET	-	expression tag	UNP Q3J179
A	1	GLY	-	expression tag	UNP Q3J179
B	-4	GLY	-	expression tag	UNP Q3J179
B	-3	ALA	-	expression tag	UNP Q3J179
B	-2	MET	-	expression tag	UNP Q3J179
B	-1	GLY	-	expression tag	UNP Q3J179
B	0	MET	-	expression tag	UNP Q3J179
B	1	GLY	-	expression tag	UNP Q3J179

- Molecule 2 is a protein called AppA protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	C	217	Total	C	N	O	S	0	9	0
			1647	1041	304	298	4			

There are 9 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	399	SER	CYS	engineered mutation	UNP Q53119
C	400	SER	-	expression tag	UNP Q53119

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Chain	Residue	Modelled	Actual	Comment	Reference
C	401	ALA	-	expression tag	UNP Q53119
C	402	HIS	-	expression tag	UNP Q53119
C	403	HIS	-	expression tag	UNP Q53119
C	404	HIS	-	expression tag	UNP Q53119
C	405	HIS	-	expression tag	UNP Q53119
C	406	HIS	-	expression tag	UNP Q53119
C	407	HIS	-	expression tag	UNP Q53119

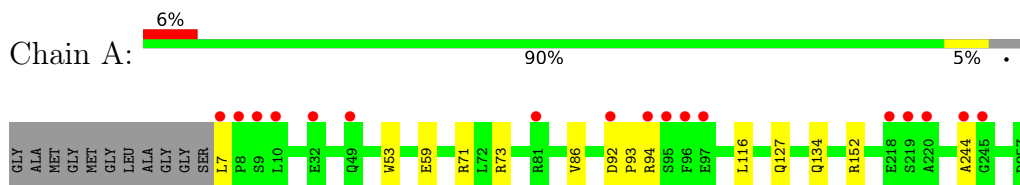
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	228	Total 228	O 228	0	0
3	B	232	Total 232	O 232	0	0
3	C	223	Total 223	O 223	0	0

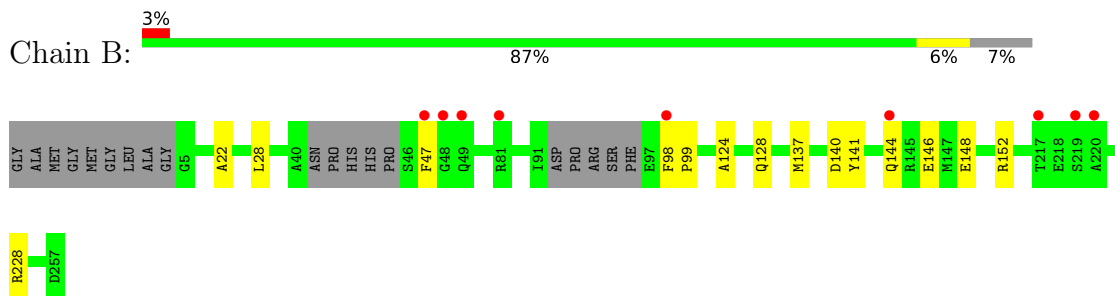
### 3 Residue-property plots [i](#)

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.

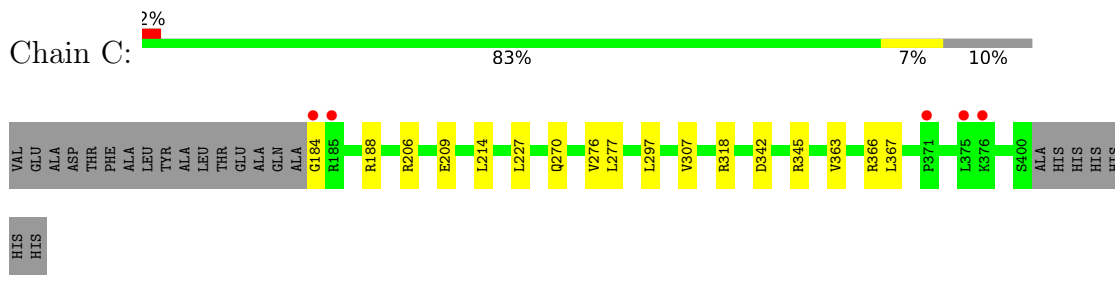
- Molecule 1: Transcriptional regulator, PpsR



- Molecule 1: Transcriptional regulator, PpsR



- Molecule 2: AppA protein



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	89.78Å 188.30Å 51.86Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	44.91 – 1.75 44.91 – 1.75	Depositor EDS
% Data completeness (in resolution range)	99.9 (44.91-1.75) 99.9 (44.91-1.75)	Depositor EDS
$R_{merge}$	0.01	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.68 (at 1.75Å)	Xtrriage
Refinement program	PHENIX (phenix.refine: 1.8_1069)	Depositor
R, $R_{free}$	0.170 , 0.198 0.171 , 0.199	Depositor DCC
$R_{free}$ test set	4489 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	28.1	Xtrriage
Anisotropy	0.379	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.33 , 44.6	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.97	EDS
Total number of atoms	6221	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	31.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.91% of the height of the origin peak. No significant pseudotranslation is detected.*

<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](#)

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	0.32	0/2008	0.51	0/2719
1	B	0.33	0/1966	0.52	0/2653
2	C	0.34	0/1698	0.50	0/2306
All	All	0.33	0/5672	0.51	0/7678

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	1970	0	2021	10	0
1	B	1921	0	1991	10	0
2	C	1647	0	1760	12	0
3	A	228	0	0	1	0
3	B	232	0	0	2	0
3	C	223	0	0	2	0
All	All	6221	0	5772	27	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 2.

All (27) 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:228[B]:ARG:NH1	3:B:441:HOH:O	2.23	0.69
1:A:152:ARG:HG2	2:C:270:GLN:OE1	1.92	0.69
1:B:148:GLU:O	1:B:152:ARG:HG2	1.95	0.66
2:C:277[A]:LEU:HD21	2:C:307[A]:VAL:HG12	1.78	0.65
2:C:277[B]:LEU:HD11	2:C:307[B]:VAL:HG23	1.78	0.63
2:C:307[B]:VAL:HG21	2:C:318:ARG:HG2	1.81	0.63
1:A:134:GLN:HG2	1:B:137:MET:SD	2.38	0.63
1:A:244:ALA:HB2	1:B:146:GLU:HB3	1.81	0.62
1:A:127:GLN:NE2	3:A:469:HOH:O	2.26	0.58
1:A:7:LEU:HD12	1:B:28:LEU:HD22	1.87	0.56
1:B:144:GLN:HG2	3:B:508:HOH:O	2.05	0.56
2:C:366:ARG:NH1	3:C:533:HOH:O	2.40	0.54
2:C:214:LEU:HD23	2:C:227[B]:LEU:HD23	1.90	0.52
1:B:141:TYR:O	1:B:144:GLN:HG3	2.10	0.52
1:A:92:ASP:OD2	1:A:94:ARG:NH1	2.47	0.47
1:B:124:ALA:O	1:B:128:GLN:HG2	2.15	0.47
2:C:363:VAL:HG21	2:C:367[B]:LEU:HD23	1.98	0.46
2:C:227[A]:LEU:HG	3:C:651:HOH:O	2.16	0.46
1:A:73:ARG:HG3	1:A:86[B]:VAL:HG11	1.99	0.45
2:C:206:ARG:NH1	2:C:209:GLU:OE2	2.43	0.45
1:A:59:GLU:CD	1:A:71:ARG:HH21	2.23	0.42
1:A:53:TRP:HE1	1:A:93:PRO:HD3	1.84	0.41
2:C:184:GLY:O	2:C:188:ARG:HG3	2.20	0.41
2:C:276:VAL:HG11	2:C:297:LEU:HD13	2.03	0.41
1:B:98:PHE:HA	1:B:99:PRO:HD3	1.97	0.40
1:A:116:LEU:HD13	1:B:22:ALA:HB2	2.02	0.40
2:C:342:ASP:OD1	2:C:345[A]:ARG:NH2	2.52	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	252/262 (96%)	246 (98%)	6 (2%)	0	100	100
1	B	245/262 (94%)	241 (98%)	4 (2%)	0	100	100
2	C	224/240 (93%)	222 (99%)	2 (1%)	0	100	100
All	All	721/764 (94%)	709 (98%)	12 (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	213/214 (100%)	213 (100%)	0	100	100
1	B	209/214 (98%)	207 (99%)	2 (1%)	76	63
2	C	174/182 (96%)	174 (100%)	0	100	100
All	All	596/610 (98%)	594 (100%)	2 (0%)	92	89

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

Mol	Chain	Res	Type
1	B	47	PHE
1	B	140	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

### 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](#)

There are no ligands in this entry.

## 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<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	251/262 (95%)	-0.01	17 (6%) <span style="border: 1px solid red; padding: 2px;">17</span> <span style="border: 1px solid red; padding: 2px;">22</span>	13, 30, 65, 87	0
1	B	243/262 (92%)	-0.07	9 (3%) <span style="border: 1px solid gray; padding: 2px;">41</span> <span style="border: 1px solid gray; padding: 2px;">48</span>	15, 27, 59, 98	0
2	C	217/240 (90%)	0.16	5 (2%) <span style="border: 1px solid blue; padding: 2px;">60</span> <span style="border: 1px solid blue; padding: 2px;">67</span>	11, 23, 54, 83	0
All	All	711/764 (93%)	0.02	31 (4%) <span style="border: 1px solid red; padding: 2px;">34</span> <span style="border: 1px solid red; padding: 2px;">40</span>	11, 26, 60, 98	0

All (31) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	96	PHE	6.0
1	A	8	PRO	5.7
1	A	9	SER	5.1
1	B	49	GLN	5.0
1	B	220	ALA	4.4
1	B	47	PHE	4.2
1	A	219	SER	3.9
1	A	245	GLY	3.5
2	C	371	PRO	3.3
2	C	375	LEU	3.2
1	A	94	ARG	3.2
1	B	81	ARG	2.9
1	B	219	SER	2.9
1	A	218	GLU	2.7
1	B	48	GLY	2.7
1	A	81	ARG	2.6
1	A	95	SER	2.4
2	C	185	ARG	2.4
1	A	244	ALA	2.4
1	A	7	LEU	2.3
1	A	49	GLN	2.3
1	B	144	GLN	2.2
2	C	376	LYS	2.2

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Mol	Chain	Res	Type	RSRZ
1	A	32	GLU	2.2
1	A	10	LEU	2.1
1	B	217	THR	2.1
1	A	97	GLU	2.0
1	A	220	ALA	2.0
2	C	184	GLY	2.0
1	B	98	PHE	2.0
1	A	92	ASP	2.0

## 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](#)

There are no ligands in this entry.

## 6.5 Other polymers [i](#)

There are no such residues in this entry.