Full wwPDB X-ray Structure Validation Report (i)

Aug 23, 2023 – 08:04 PM EDT

PDB ID	:	1G4C
Title	:	CRYSTAL STRUCTURE OF A COMPLEX OF HPPK(R92A) FROM E.COLI WITH MG2+ AT 1.65 ANGSTROM RESOLUTION
Authors	:	Blaszczyk, J.; Ji, X.
Deposited on	:	2000-10-26
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*
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 (1)) were used in the production of this report:

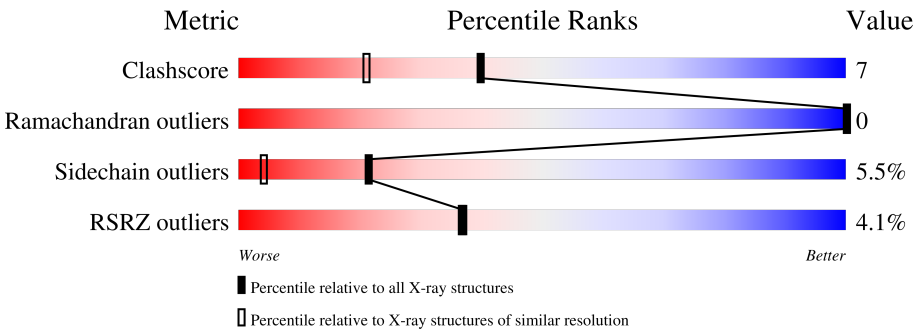
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.35
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.35

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 1.65 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 >=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	158	4% 82% 14% • •
1	B	158	4% 82% 15% • •

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 2963 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 6-HYDROXYMETHYL-7,8-DIHYDROPTERIN PYROPHOSPHOKINASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	158	1265	810	216	235	4	0	1	0
1	B	158	1267	811	218	234	4	0	2	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	92	ALA	ARG	engineered mutation	UNP P26281
B	292	ALA	ARG	engineered mutation	UNP P26281

- Molecule 2 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Mg		
2	A	1	1	1	0	0
2	B	2	2	2	0	0

- Molecule 3 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Cl		
3	A	2	2	2	0	0
3	B	1	1	1	0	0

- Molecule 4 is water.

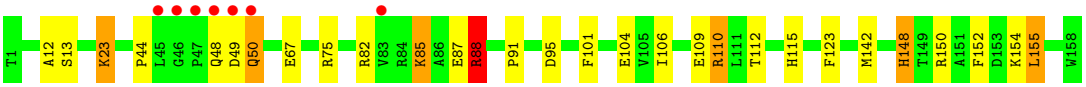
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
4	A	225	225	225	0	0
			Total	O		
4	B	199	200	200	0	1

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.

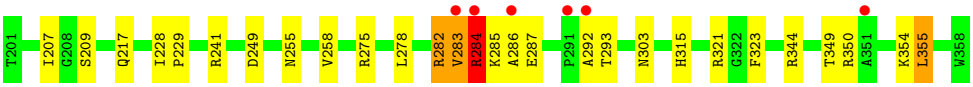
- Molecule 1: 6-HYDROXYMETHYL-7,8-DIHYDROPTERIN PYROPHOSPHOKINASE

Chain A:



- Molecule 1: 6-HYDROXYMETHYL-7,8-DIHYDROPTERIN PYROPHOSPHOKINASE

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	42.35Å 47.21Å 71.31Å 90.00° 105.61° 90.00°	Depositor
Resolution (Å)	30.00 – 1.65 20.49 – 1.65	Depositor EDS
% Data completeness (in resolution range)	93.6 (30.00-1.65) 79.2 (20.49-1.65)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.87 (at 1.65Å)	Xtriage
Refinement program	SHELXL-97	Depositor
R, R_{free}	0.172 , 0.236 0.165 , (Not available)	Depositor DCC
R_{free} test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å^2)	11.8	Xtriage
Anisotropy	0.247	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 79.8	EDS
L-test for twinning[2]	$< \|L\| > = 0.47$, $< L^2 > = 0.30$	Xtriage
Estimated twinning fraction	0.007 for h,-k,-h-l	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	2963	wwPDB-VP
Average B, all atoms (Å^2)	21.0	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 55.12 % 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 3.3129e-05. 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 (i)

5.1 Standard geometry (i)

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

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	0.49	0/1301	1.18	7/1772 (0.4%)
1	B	0.43	0/1309	1.24	10/1782 (0.6%)
All	All	0.46	0/2610	1.21	17/3554 (0.5%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand.A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	B	0	1

There are no bond length outliers.

All (17) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	75	ARG	NE-CZ-NH2	9.56	125.08	120.30
1	B	282	ARG	NE-CZ-NH1	8.87	124.73	120.30
1	A	110	ARG	CD-NE-CZ	8.00	134.80	123.60
1	A	82	ARG	NE-CZ-NH2	-7.29	116.66	120.30
1	B	350	ARG	NE-CZ-NH1	7.18	123.89	120.30
1	B	275	ARG	NE-CZ-NH2	6.93	123.76	120.30
1	B	241	ARG	NE-CZ-NH2	-6.28	117.16	120.30
1	B	249	ASP	O-C-N	5.67	131.77	122.70
1	B	283	VAL	CB-CA-C	-5.65	100.66	111.40
1	B	275	ARG	NH1-CZ-NH2	-5.58	113.27	119.40
1	B	282	ARG	NE-CZ-NH2	-5.34	117.63	120.30
1	B	275	ARG	NE-CZ-NH1	5.34	122.97	120.30
1	A	88	ARG	CG-CD-NE	5.31	122.95	111.80
1	A	110	ARG	NE-CZ-NH1	-5.28	117.66	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	282	ARG	CD-NE-CZ	5.25	130.95	123.60
1	A	110	ARG	N-CA-CB	-5.24	101.16	110.60
1	A	75	ARG	NH1-CZ-NH2	-5.11	113.78	119.40

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	284	ARG	Mainchain

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	1265	0	1262	22	0
1	B	1267	0	1264	15	0
2	A	1	0	0	0	0
2	B	2	0	0	0	0
3	A	2	0	0	0	0
3	B	1	0	0	0	0
4	A	225	0	0	8	0
4	B	200	0	0	5	0
All	All	2963	0	2526	37	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 7.

All (37) 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:282:ARG:HD3	4:B:723:HOH:O	1.85	0.77
1:A:23:LYS:HB2	1:A:23:LYS:HZ3	1.50	0.75
1:A:23:LYS:HB2	1:A:23:LYS:NZ	2.03	0.74
1:B:284:ARG:O	1:B:287:GLU:HG3	1.88	0.73
1:A:95:ASP:HB3	4:A:699:HOH:O	1.89	0.71

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:87:GLU:HG2	1:A:91:PRO:O	1.92	0.70
1:A:91:PRO:HD2	4:A:754:HOH:O	1.92	0.68
1:A:85:LYS:O	1:A:88:ARG:HG2	1.94	0.67
1:A:101:PHE:O	1:A:104[A]:GLU:HG3	2.02	0.60
1:A:23:LYS:NZ	4:A:764:HOH:O	2.33	0.57
1:A:48:GLN:O	1:A:49:ASP:HB3	2.02	0.57
1:A:85:LYS:O	1:A:88:ARG:CG	2.56	0.53
1:B:321:ARG:HD3	1:B:323:PHE:CZ	2.44	0.53
1:A:106:ILE:O	1:A:112:THR:HA	2.09	0.52
1:B:283:VAL:O	1:B:284:ARG:C	2.47	0.49
1:B:315:HIS:HE1	4:B:431:HOH:O	1.94	0.49
1:A:142:MET:HE2	4:A:746:HOH:O	2.13	0.48
1:A:23:LYS:NZ	1:A:23:LYS:CB	2.67	0.48
1:B:285:LYS:HE2	4:B:698:HOH:O	2.14	0.47
1:A:67:GLU:HG3	4:A:603:HOH:O	2.13	0.47
1:A:123:PHE:HA	1:A:155:LEU:CD2	2.46	0.46
1:B:207:ILE:HD11	1:B:258:VAL:CG2	2.46	0.46
1:A:49:ASP:N	1:A:50:GLN:OE1	2.49	0.45
1:B:209:SER:OG	1:B:217:GLN:NE2	2.50	0.45
1:B:209:SER:HA	1:B:293:THR:O	2.18	0.44
1:A:12:ALA:O	1:A:13:SER:HB2	2.18	0.44
1:B:284:ARG:N	1:B:284:ARG:HD2	2.32	0.44
1:B:355:LEU:N	1:B:355:LEU:HD23	2.33	0.43
1:A:115:HIS:HD2	4:A:407:HOH:O	2.02	0.42
1:B:286:ALA:HB1	1:B:292:ALA:HA	2.01	0.42
1:B:349:THR:HG22	4:B:594:HOH:O	2.20	0.42
1:A:49:ASP:OD2	1:A:49:ASP:O	2.38	0.42
1:A:148:HIS:HE1	4:A:461:HOH:O	2.02	0.41
1:A:150:ARG:HB2	1:A:152:PHE:CE2	2.55	0.41
1:A:44:PRO:N	4:A:607:HOH:O	2.52	0.41
1:B:354:LYS:HD3	4:B:653:HOH:O	2.21	0.41
1:B:228:ILE:HG23	1:B:229:PRO:HD2	2.04	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	157/158 (99%)	151 (96%)	6 (4%)	0	100	100
1	B	158/158 (100%)	155 (98%)	3 (2%)	0	100	100
All	All	315/316 (100%)	306 (97%)	9 (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	137/136 (101%)	128 (93%)	9 (7%)	16	3
1	B	138/136 (102%)	132 (96%)	6 (4%)	29	7
All	All	275/272 (101%)	260 (94%)	15 (6%)	21	4

All (15) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	23	LYS
1	A	50	GLN
1	A	85	LYS
1	A	88	ARG
1	A	109	GLU
1	A	110	ARG
1	A	148	HIS
1	A	154	LYS
1	A	155	LEU
1	B	255	ASN
1	B	278	LEU
1	B	284	ARG
1	B	303	ASN
1	B	344	ARG

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Mol	Chain	Res	Type
1	B	355	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	115	HIS
1	A	148	HIS
1	B	217	GLN
1	B	315	HIS

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 6 ligands modelled in this entry, 6 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 (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	158/158 (100%)	-0.18	7 (4%)	34	34	9, 15, 44, 73	0
1	B	158/158 (100%)	-0.28	6 (3%)	40	40	7, 16, 37, 77	0
All	All	316/316 (100%)	-0.23	13 (4%)	37	37	7, 15, 40, 77	0

All (13) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	48	GLN	7.1
1	A	47	PRO	5.3
1	B	291	PRO	5.0
1	B	283	VAL	4.3
1	A	49	ASP	3.4
1	A	45	LEU	3.2
1	A	46	GLY	3.0
1	B	351	ALA	2.6
1	B	284	ARG	2.5
1	B	292	ALA	2.2
1	A	83	VAL	2.2
1	B	286	ALA	2.0
1	A	50	GLN	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)

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, 95th 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	MG	A	361	1/1	0.98	0.04	20,20,20,20	0
2	MG	B	362	1/1	0.99	0.02	11,11,11,11	0
2	MG	B	363	1/1	0.99	0.05	16,16,16,16	0
3	CL	A	364	1/1	0.99	0.05	20,20,20,20	0
3	CL	B	365	1/1	0.99	0.02	17,17,17,17	0
3	CL	A	366	1/1	1.00	0.04	18,18,18,18	0

6.5 Other polymers (i)

There are no such residues in this entry.