



# Full wwPDB X-ray Structure Validation Report ⓘ

Jun 11, 2024 – 05:41 PM EDT

PDB ID : 1BUH  
Title : CRYSTAL STRUCTURE OF THE HUMAN CDK2 KINASE COMPLEX  
WITH CELL CYCLE-REGULATORY PROTEIN CKSHS1  
Authors : Bourne, Y.; Tainer, J.A.  
Deposited on : 1998-09-03  
Resolution : 2.60 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)	:	1.20.1
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

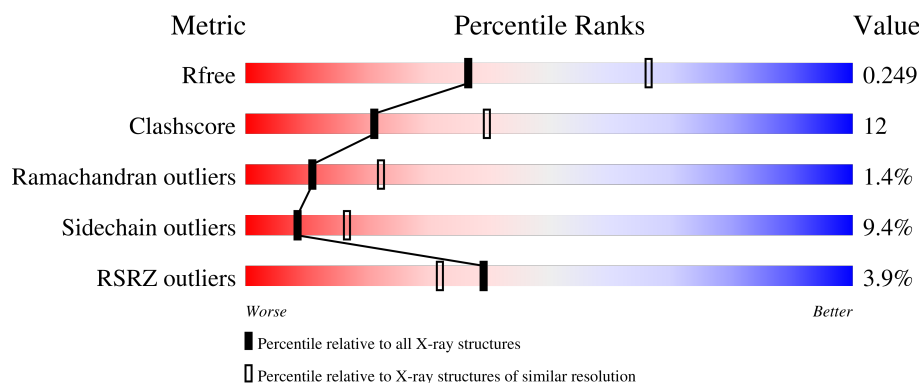
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.60 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	3163 (2.60-2.60)
Clashscore	141614	3518 (2.60-2.60)
Ramachandran outliers	138981	3455 (2.60-2.60)
Sidechain outliers	138945	3455 (2.60-2.60)
RSRZ outliers	127900	3104 (2.60-2.60)

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	298	<div> <div>5%</div> <div> <div></div> <div>68%</div> <div>25%</div> <div>• •</div> </div> </div>
2	B	79	<div> <div>56%</div> <div>25%</div> <div>6%</div> <div>• 11%</div> </div>

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 3043 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 PROTEIN (CDK2 HUMAN).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	287	Total	C	N	O	S	0	0	0
			2311	1506	392	405	8			

- Molecule 2 is a protein called PROTEIN (CKSHS1 HUMAN).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	70	Total	C	N	O	S	0	0	0
			605	392	103	107	3			

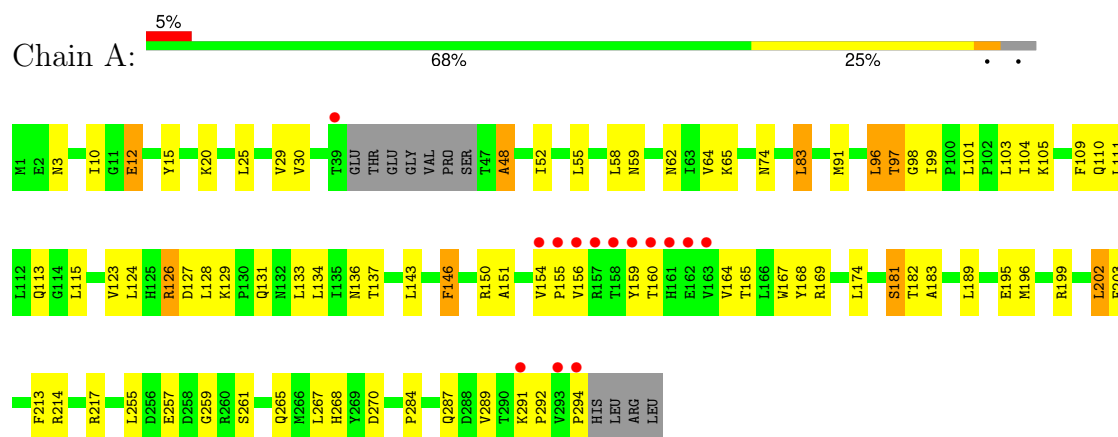
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	101	Total	O	0	0
			101	101		
3	B	26	Total	O	0	0
			26	26		

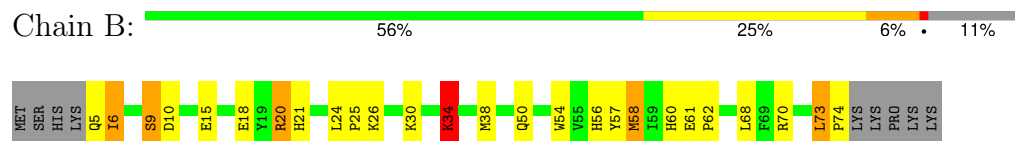
### 3 Residue-property plots

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: PROTEIN (CDK2 HUMAN)



#### • Molecule 2: PROTEIN (CKSHS1 HUMAN)



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	56.80Å 69.95Å 60.53Å 90.00° 114.50° 90.00°	Depositor
Resolution (Å)	20.00 – 2.60 22.02 – 2.60	Depositor EDS
% Data completeness (in resolution range)	97.0 (20.00-2.60) 97.4 (22.02-2.60)	Depositor EDS
$R_{merge}$	0.10	Depositor
$R_{sym}$	0.10	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.58 (at 2.60Å)	Xtriage
Refinement program	X-PLOR 3.8	Depositor
R, $R_{free}$	0.190 , 0.250 0.194 , 0.249	Depositor DCC
$R_{free}$ test set	612 reflections (4.70%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	26.6	Xtriage
Anisotropy	0.238	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 69.6	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.51$ , $\langle L^2 \rangle = 0.35$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.93	EDS
Total number of atoms	3043	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	24.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.28% 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	0.56	0/2370	0.78	0/3215
2	B	0.49	0/626	0.79	0/849
All	All	0.55	0/2996	0.78	0/4064

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	2311	0	2364	51	0
2	B	605	0	581	20	0
3	A	101	0	0	1	0
3	B	26	0	0	0	0
All	All	3043	0	2945	71	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 12.

All (71) 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:105:LYS:HG2	1:A:289:VAL:HG12	1.59	0.84

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:58:LEU:HD21	1:A:123:VAL:HG21	1.62	0.82
1:A:213:PHE:O	1:A:217:ARG:HG3	1.85	0.76
1:A:91:MET:HE1	1:A:196:MET:HA	1.69	0.74
2:B:34:LYS:HE3	2:B:34:LYS:HA	1.72	0.69
1:A:143:LEU:HD22	1:A:146:PHE:HE1	1.59	0.68
2:B:9:SER:HB3	2:B:21:HIS:O	1.94	0.67
1:A:91:MET:CE	1:A:196:MET:HA	2.26	0.65
2:B:26:LYS:N	2:B:26:LYS:HD2	2.12	0.64
2:B:57:TYR:CD1	2:B:70:ARG:HB2	2.33	0.64
1:A:12:GLU:HB3	1:A:159:TYR:OH	1.97	0.64
1:A:150:ARG:O	1:A:150:ARG:HG3	1.97	0.63
2:B:21:HIS:HB3	2:B:68:LEU:HD23	1.82	0.62
1:A:83:LEU:HD23	1:A:136:ASN:HB3	1.80	0.62
2:B:38:MET:H	2:B:56:HIS:CD2	2.17	0.62
1:A:99:ILE:HB	1:A:104:ILE:HD11	1.83	0.60
1:A:156:VAL:O	1:A:164:VAL:HG22	2.02	0.59
2:B:38:MET:H	2:B:56:HIS:HD2	1.50	0.59
1:A:3:ASN:ND2	1:A:25:LEU:HD13	2.17	0.59
1:A:115:LEU:HD22	1:A:189:LEU:HD22	1.85	0.58
1:A:181:SER:HB3	1:A:183:ALA:H	1.68	0.58
2:B:50:GLN:HG2	2:B:54:TRP:CD1	2.40	0.57
1:A:291:LYS:N	1:A:292:PRO:HD3	2.20	0.56
1:A:268:HIS:HD2	1:A:270:ASP:H	1.53	0.56
1:A:91:MET:HE1	1:A:196:MET:CA	2.35	0.56
1:A:62:ASN:ND2	1:A:110:GLN:HB3	2.21	0.56
2:B:18:GLU:HB2	2:B:73:LEU:HD11	1.88	0.56
1:A:59:ASN:HD22	1:A:65:LYS:HD2	1.70	0.56
1:A:48:ALA:O	1:A:52:ILE:HG13	2.06	0.55
2:B:26:LYS:HD2	2:B:26:LYS:H	1.71	0.55
2:B:18:GLU:HB2	2:B:73:LEU:CD1	2.36	0.55
1:A:126:ARG:NH2	1:A:169:ARG:NE	2.55	0.54
1:A:104:ILE:HG12	1:A:196:MET:HG2	1.88	0.54
1:A:126:ARG:HH22	1:A:169:ARG:NE	2.05	0.53
1:A:52:ILE:HG23	1:A:55:LEU:HD12	1.90	0.52
1:A:3:ASN:HD21	1:A:25:LEU:HD13	1.72	0.52
1:A:202:LEU:HD13	1:A:203:PHE:CZ	2.45	0.52
2:B:57:TYR:CD2	2:B:58:MET:HB2	2.45	0.51
1:A:128:LEU:HD11	1:A:143:LEU:HD23	1.93	0.50
1:A:129:LYS:O	1:A:133:LEU:HD13	2.11	0.50
2:B:57:TYR:CE1	2:B:70:ARG:HB2	2.48	0.49
1:A:165:THR:HG21	1:A:168:TYR:HE2	1.79	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:91:MET:HE1	1:A:195:GLU:O	2.14	0.48
1:A:59:ASN:HD21	1:A:65:LYS:NZ	2.12	0.48
1:A:96:LEU:HD12	1:A:97:THR:HG23	1.97	0.47
1:A:255:LEU:HG	1:A:259:GLY:HA3	1.96	0.47
1:A:109:PHE:O	1:A:113:GLN:HG3	2.14	0.47
2:B:30:LYS:N	2:B:30:LYS:HE2	2.29	0.47
1:A:165:THR:HG21	1:A:168:TYR:CE2	2.49	0.47
1:A:155:PRO:O	1:A:164:VAL:HG21	2.15	0.46
1:A:15:TYR:HB2	3:A:501:HOH:O	2.15	0.46
2:B:20:ARG:HG2	2:B:20:ARG:HH11	1.80	0.46
1:A:91:MET:HG2	1:A:99:ILE:HD11	1.96	0.46
1:A:98:GLY:HA2	1:A:199:ARG:HD3	1.97	0.46
2:B:5:GLN:O	2:B:6:ILE:HB	2.16	0.46
1:A:261:SER:O	1:A:265:GLN:HG3	2.16	0.46
2:B:60:HIS:CE1	2:B:62:PRO:HD2	2.51	0.45
1:A:99:ILE:HD12	1:A:196:MET:HG3	1.99	0.45
1:A:59:ASN:ND2	1:A:65:LYS:HD2	2.31	0.45
1:A:127:ASP:CB	1:A:154:VAL:HG11	2.46	0.45
1:A:268:HIS:HD2	1:A:270:ASP:N	2.16	0.44
1:A:96:LEU:HD12	1:A:96:LEU:C	2.38	0.43
1:A:91:MET:HE1	1:A:195:GLU:C	2.38	0.43
2:B:18:GLU:HG2	2:B:54:TRP:HH2	1.84	0.43
1:A:10:ILE:HD11	1:A:20:LYS:HB2	2.02	0.41
1:A:137:THR:HA	1:A:294:PRO:HG3	2.02	0.41
2:B:73:LEU:HA	2:B:74:PRO:O	2.21	0.41
1:A:124:LEU:CD1	1:A:182:THR:HG22	2.51	0.41
1:A:169:ARG:NH1	1:A:169:ARG:HG3	2.37	0.40
2:B:24:LEU:HA	2:B:25:PRO:HD3	1.81	0.40
1:A:64:VAL:HG21	1:A:134:LEU:HD12	2.03	0.40

There are no symmetry-related clashes.

## 5.3 Torsion angles ⓘ

### 5.3.1 Protein backbone ⓘ

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	283/298 (95%)	265 (94%)	15 (5%)	3 (1%)	14	30
2	B	68/79 (86%)	61 (90%)	5 (7%)	2 (3%)	4	7
All	All	351/377 (93%)	326 (93%)	20 (6%)	5 (1%)	11	22

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	48	ALA
1	A	151	ALA
2	B	34	LYS
1	A	167	TRP
2	B	6	ILE

### 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	253/263 (96%)	231 (91%)	22 (9%)	10	20
2	B	67/76 (88%)	59 (88%)	8 (12%)	5	9
All	All	320/339 (94%)	290 (91%)	30 (9%)	8	17

All (30) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	12	GLU
1	A	29	VAL
1	A	30	VAL
1	A	74	ASN
1	A	83	LEU
1	A	96	LEU
1	A	97	THR
1	A	101	LEU
1	A	103	LEU
1	A	111	LEU
1	A	126	ARG

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Mol	Chain	Res	Type
1	A	131	GLN
1	A	146	PHE
1	A	160	THR
1	A	174	LEU
1	A	181	SER
1	A	202	LEU
1	A	214	ARG
1	A	257	GLU
1	A	267	LEU
1	A	284	PRO
1	A	287	GLN
2	B	9	SER
2	B	10	ASP
2	B	15	GLU
2	B	20	ARG
2	B	34	LYS
2	B	58	MET
2	B	61	GLU
2	B	73	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	3	ASN
1	A	59	ASN
1	A	60	HIS
1	A	211	GLN
1	A	268	HIS
2	B	56	HIS
2	B	65	HIS

### 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 [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 [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	287/298 (96%)	-0.52	14 (4%)	29	23	4, 16, 62, 89	0
2	B	70/79 (88%)	-0.53	0	100	100	11, 24, 53, 68	0
All	All	357/377 (94%)	-0.52	14 (3%)	39	32	4, 19, 61, 89	0

All (14) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	161	HIS	6.2
1	A	160	THR	5.7
1	A	154	VAL	4.9
1	A	39	THR	4.3
1	A	159	TYR	3.7
1	A	157	ARG	3.5
1	A	155	PRO	3.2
1	A	162	GLU	3.0
1	A	294	PRO	2.5
1	A	293	VAL	2.2
1	A	158	THR	2.2
1	A	156	VAL	2.1
1	A	163	VAL	2.0
1	A	291	LYS	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.