



# Full wwPDB X-ray Structure Validation Report ⓘ

Jun 16, 2024 – 01:26 PM EDT

PDB ID : 5DE2  
Title : Structural mechanism of Nek7 activation by Nek9-induced dimerisation  
Authors : Haq, T.; Bayliss, R.  
Deposited on : 2015-08-25  
Resolution : 2.78 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	:	2.37.1
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)	:	2.37.1

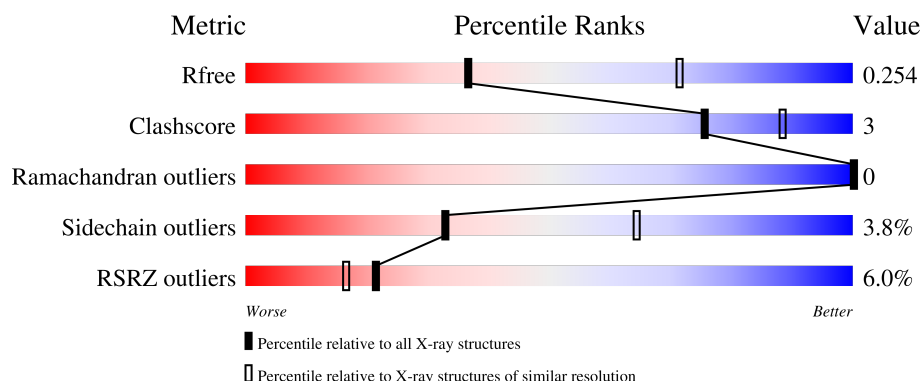
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.78 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	4107 (2.80-2.76)
Clashscore	141614	4575 (2.80-2.76)
Ramachandran outliers	138981	4487 (2.80-2.76)
Sidechain outliers	138945	4489 (2.80-2.76)
RSRZ outliers	127900	4027 (2.80-2.76)

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	310	<div> <div>3%</div> <div>78%</div> <div>8%</div> <div>14%</div> </div>
1	B	310	<div> <div>2%</div> <div>74%</div> <div>10%</div> <div>15%</div> </div>
2	C	19	<div> <div>58%</div> <div>79%</div> <div>5%</div> <div>16%</div> </div>
2	D	19	<div> <div>32%</div> <div>32%</div> <div>16%</div> <div>53%</div> </div>

## 2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 4452 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 kinase Nek7.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	267	Total	C	N	O	S	0	0	0
			2126	1360	366	382	18			
1	B	262	Total	C	N	O	S	0	2	0
			2105	1350	363	374	18			

There are 18 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	97	PHE	TYR	engineered mutation	UNP Q8TDX7
A	303	LEU	-	expression tag	UNP Q8TDX7
A	304	GLU	-	expression tag	UNP Q8TDX7
A	305	HIS	-	expression tag	UNP Q8TDX7
A	306	HIS	-	expression tag	UNP Q8TDX7
A	307	HIS	-	expression tag	UNP Q8TDX7
A	308	HIS	-	expression tag	UNP Q8TDX7
A	309	HIS	-	expression tag	UNP Q8TDX7
A	310	HIS	-	expression tag	UNP Q8TDX7
B	97	PHE	TYR	engineered mutation	UNP Q8TDX7
B	303	LEU	-	expression tag	UNP Q8TDX7
B	304	GLU	-	expression tag	UNP Q8TDX7
B	305	HIS	-	expression tag	UNP Q8TDX7
B	306	HIS	-	expression tag	UNP Q8TDX7
B	307	HIS	-	expression tag	UNP Q8TDX7
B	308	HIS	-	expression tag	UNP Q8TDX7
B	309	HIS	-	expression tag	UNP Q8TDX7
B	310	HIS	-	expression tag	UNP Q8TDX7

- Molecule 2 is a protein called Serine/threonine-protein kinase Nek9.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	C	16	Total	C	N	O	S	0	0	0
			135	89	22	23	1			

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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	D	9	Total	C	N	O	0	0	0
			76	49	15	12			

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	4	Total	O	0	0
			4	4		
3	B	6	Total	O	0	0
			6	6		

**i**

- Molecule 1: Serine/threonine-protein kinase Nek7



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	88.12Å 88.12Å 155.61Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	54.48 – 2.78 54.48 – 2.78	Depositor EDS
% Data completeness (in resolution range)	99.9 (54.48-2.78) 99.9 (54.48-2.78)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.58 (at 2.77Å)	Xtriage
Refinement program	BUSTER 2.10.1	Depositor
R, $R_{free}$	0.206 , 0.254 0.204 , 0.254	Depositor DCC
$R_{free}$ test set	930 reflections (5.11%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	64.4	Xtriage
Anisotropy	0.083	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 44.3	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.044 for -h,-k,l	Xtriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	4452	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	66.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.76% 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	0.46	0/2174	0.64	0/2939
1	B	0.44	0/2160	0.63	0/2919
2	C	0.39	0/139	0.51	0/187
2	D	0.35	0/77	0.48	0/102
All	All	0.45	0/4550	0.63	0/6147

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	2126	0	2106	9	0
1	B	2105	0	2090	18	0
2	C	135	0	132	1	0
2	D	76	0	74	2	0
3	A	4	0	0	0	0
3	B	6	0	0	0	0
All	All	4452	0	4402	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 3.

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:137:THR:O	1:B:141:TYR:HD2	1.71	0.74
1:A:199:THR:HB	1:A:200:PRO:HD2	1.72	0.71
1:A:67:ILE:HB	1:A:76:ARG:HG3	1.84	0.60
1:B:205:PRO:HG2	1:B:277:PRO:HA	1.86	0.56
1:B:141:TYR:OH	2:D:815:GLU:OE1	2.24	0.54
1:A:66:GLN:HB2	1:A:70:LEU:HD12	1.90	0.53
1:B:117:GLY:HA3	2:D:811:TRP:HZ2	1.74	0.52
1:B:100:SER:HA	1:B:108:ASN:O	2.10	0.52
1:B:137:THR:O	1:B:141:TYR:CD2	2.58	0.52
1:B:245:SER:HA	1:B:248:LYS:HD3	1.93	0.50
1:A:160:ARG:HA	1:A:213:TYR:CE1	2.46	0.50
1:B:249:LYS:HB2	1:B:254:ASP:HB3	1.93	0.49
1:B:87:LYS:HZ2	1:B:97:PHE:HE2	1.61	0.48
1:B:96:LYS:HB2	1:B:112:GLU:HB2	1.95	0.48
1:A:129:GLN:HB3	1:A:131:ARG:HD3	1.96	0.48
1:A:171:ALA:HA	2:C:811:TRP:HD1	1.80	0.46
1:B:87:LYS:HG2	1:B:97:PHE:CE2	2.51	0.45
1:A:160:ARG:HA	1:A:213:TYR:CZ	2.51	0.45
1:B:79:CYS:O	1:B:83:ILE:HG12	2.17	0.45
1:A:205:PRO:HG2	1:A:277:PRO:HA	2.00	0.44
1:B:142:PHE:CE1	1:B:226:LEU:HB2	2.53	0.42
1:B:67:ILE:HB	1:B:76:ARG:HG3	2.00	0.42
1:B:66:GLN:HB2	1:B:70:LEU:HB2	2.02	0.42
1:B:85:LEU:HB3	1:B:157:VAL:HG22	2.01	0.41
1:A:61:ALA:HB3	1:A:111:LEU:HB2	2.03	0.41
1:B:270:LEU:HD21	1:B:288:VAL:HG13	2.02	0.41
1:B:87:LYS:HG2	1:B:97:PHE:HE2	1.86	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	263/310 (85%)	252 (96%)	11 (4%)	0	100	100
1	B	260/310 (84%)	245 (94%)	15 (6%)	0	100	100
2	C	14/19 (74%)	13 (93%)	1 (7%)	0	100	100
2	D	7/19 (37%)	7 (100%)	0	0	100	100
All	All	544/658 (83%)	517 (95%)	27 (5%)	0	100	100

There are no Ramachandran outliers to report.

### 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	228/274 (83%)	218 (96%)	10 (4%)	28	58
1	B	226/274 (82%)	219 (97%)	7 (3%)	40	71
2	C	14/17 (82%)	14 (100%)	0	100	100
2	D	7/17 (41%)	6 (86%)	1 (14%)	3	9
All	All	475/582 (82%)	457 (96%)	18 (4%)	33	64

All (18) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	23	ARG
1	A	25	ASP
1	A	26	MET
1	A	44	GLN
1	A	47	GLU
1	A	54	LEU
1	A	105	ASN
1	A	156	ARG
1	A	163	LYS
1	A	172	THR
1	B	126	PHE
1	B	172	THR
1	B	248	LYS

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Mol	Chain	Res	Type
1	B	249	LYS
1	B	261	ASP
1	B	272	ASN
1	B	280	GLU
2	D	813	ARG

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	267/310 (86%)	0.06	10 (3%) 41 36	43, 61, 98, 110	1 (0%)
1	B	262/310 (84%)	0.07	6 (2%) 60 55	45, 61, 90, 95	0
2	C	16/19 (84%)	3.19	11 (68%) 0 0	91, 107, 112, 112	16 (100%)
2	D	9/19 (47%)	2.71	6 (66%) 0 0	106, 110, 118, 128	9 (100%)
All	All	554/658 (84%)	0.20	33 (5%) 21 16	43, 62, 102, 128	26 (4%)

All (33) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	C	825	PRO	6.1
2	C	822	ILE	5.3
2	C	820	GLU	5.3
2	C	819	ALA	5.2
2	D	810	GLY	4.7
2	C	821	PHE	4.6
2	D	816	LEU	4.4
2	C	824	MET	4.2
2	C	823	PRO	4.1
2	D	817	GLU	4.1
1	A	196	LEU	3.6
2	D	811	TRP	3.5
1	B	115	ASP	3.5
1	B	20	LYS	3.4
2	D	815	GLU	3.1
1	B	125[A]	HIS	3.0
1	A	239	ASP	2.9
2	C	810	GLY	2.8
2	C	816	LEU	2.7
1	A	243	LEU	2.7
1	A	56	ASP	2.7

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Mol	Chain	Res	Type	RSRZ
1	B	21	ALA	2.4
2	C	818	ASN	2.4
1	B	250	ILE	2.3
1	A	213	TYR	2.2
1	A	199	THR	2.2
1	A	237	TYR	2.2
2	D	818	ASN	2.1
1	A	197	VAL	2.1
1	A	21	ALA	2.1
1	B	130	LYS	2.0
1	A	28	TYR	2.0
2	C	811	TRP	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.