



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 1, 2016 – 03:06 PM GMT

PDB ID : 4BK4  
Title : crystal structure of the human EphA4 ectodomain  
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Deposited on : 2013-04-22  
Resolution : 3.65 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  
<http://wwpdb.org/validation/2016/XrayValidationReportHelp>  
with specific help available everywhere you see the ⓘ symbol.

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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  
Mogul : 1.7 (RC4), CSD as536be (2015)  
Xtriage (Phenix) : 1.9-1692  
EDS : rb-20026688  
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)  
Refmac : 5.8.0135  
CCP4 : 6.5.0  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : trunk26865

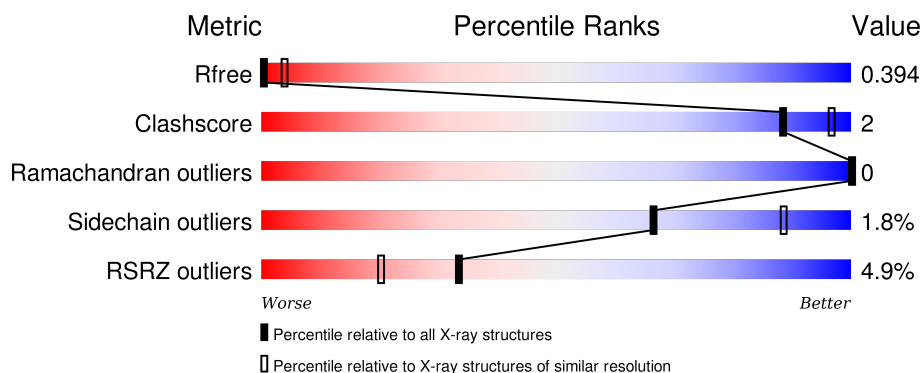
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 3.65 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))
$R_{free}$	91344	1010 (3.82-3.50)
Clashscore	102246	1125 (3.82-3.50)
Ramachandran outliers	100387	1079 (3.82-3.50)
Sidechain outliers	100360	1078 (3.82-3.50)
RSRZ outliers	91569	1017 (3.82-3.50)

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 on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. 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	568	<div> <div>5%</div> <div>84%</div> <div>7%</div> <div>10%</div> </div>
1	B	568	<div> <div>2%</div> <div>47%</div> <div>5%</div> <div>47%</div> </div>

## 2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 6344 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 EPHRIN TYPE-A RECEPTOR 4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	514	Total	C	N	O	S	0	0	0
			4002	2496	692	788	26			
1	B	300	Total	C	N	O	S	0	0	0
			2342	1460	398	462	22			

There are 80 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-11	MET	-	EXPRESSION TAG	UNP P54764
A	-10	GLY	-	EXPRESSION TAG	UNP P54764
A	-9	ILE	-	EXPRESSION TAG	UNP P54764
A	-8	LEU	-	EXPRESSION TAG	UNP P54764
A	-7	PRO	-	EXPRESSION TAG	UNP P54764
A	-6	SER	-	EXPRESSION TAG	UNP P54764
A	-5	PRO	-	EXPRESSION TAG	UNP P54764
A	-4	GLY	-	EXPRESSION TAG	UNP P54764
A	-3	MET	-	EXPRESSION TAG	UNP P54764
A	-2	PRO	-	EXPRESSION TAG	UNP P54764
A	-1	ALA	-	EXPRESSION TAG	UNP P54764
A	0	LEU	-	EXPRESSION TAG	UNP P54764
A	1	LEU	-	EXPRESSION TAG	UNP P54764
A	2	SER	-	EXPRESSION TAG	UNP P54764
A	3	LEU	-	EXPRESSION TAG	UNP P54764
A	4	VAL	-	EXPRESSION TAG	UNP P54764
A	5	SER	-	EXPRESSION TAG	UNP P54764
A	6	LEU	-	EXPRESSION TAG	UNP P54764
A	7	LEU	-	EXPRESSION TAG	UNP P54764
A	8	SER	-	EXPRESSION TAG	UNP P54764
A	9	VAL	-	EXPRESSION TAG	UNP P54764
A	10	LEU	-	EXPRESSION TAG	UNP P54764
A	11	LEU	-	EXPRESSION TAG	UNP P54764
A	12	MET	-	EXPRESSION TAG	UNP P54764
A	13	GLY	-	EXPRESSION TAG	UNP P54764

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Chain	Residue	Modelled	Actual	Comment	Reference
A	14	CYS	-	EXPRESSION TAG	UNP P54764
A	15	VAL	-	EXPRESSION TAG	UNP P54764
A	16	ALA	-	EXPRESSION TAG	UNP P54764
A	17	GLU	-	EXPRESSION TAG	UNP P54764
A	18	THR	-	EXPRESSION TAG	UNP P54764
A	19	GLY	-	EXPRESSION TAG	UNP P54764
A	548	GLY	-	EXPRESSION TAG	UNP P54764
A	549	THR	-	EXPRESSION TAG	UNP P54764
A	550	LYS	-	EXPRESSION TAG	UNP P54764
A	551	HIS	-	EXPRESSION TAG	UNP P54764
A	552	HIS	-	EXPRESSION TAG	UNP P54764
A	553	HIS	-	EXPRESSION TAG	UNP P54764
A	554	HIS	-	EXPRESSION TAG	UNP P54764
A	555	HIS	-	EXPRESSION TAG	UNP P54764
A	556	HIS	-	EXPRESSION TAG	UNP P54764
B	-11	MET	-	EXPRESSION TAG	UNP P54764
B	-10	GLY	-	EXPRESSION TAG	UNP P54764
B	-9	ILE	-	EXPRESSION TAG	UNP P54764
B	-8	LEU	-	EXPRESSION TAG	UNP P54764
B	-7	PRO	-	EXPRESSION TAG	UNP P54764
B	-6	SER	-	EXPRESSION TAG	UNP P54764
B	-5	PRO	-	EXPRESSION TAG	UNP P54764
B	-4	GLY	-	EXPRESSION TAG	UNP P54764
B	-3	MET	-	EXPRESSION TAG	UNP P54764
B	-2	PRO	-	EXPRESSION TAG	UNP P54764
B	-1	ALA	-	EXPRESSION TAG	UNP P54764
B	0	LEU	-	EXPRESSION TAG	UNP P54764
B	1	LEU	-	EXPRESSION TAG	UNP P54764
B	2	SER	-	EXPRESSION TAG	UNP P54764
B	3	LEU	-	EXPRESSION TAG	UNP P54764
B	4	VAL	-	EXPRESSION TAG	UNP P54764
B	5	SER	-	EXPRESSION TAG	UNP P54764
B	6	LEU	-	EXPRESSION TAG	UNP P54764
B	7	LEU	-	EXPRESSION TAG	UNP P54764
B	8	SER	-	EXPRESSION TAG	UNP P54764
B	9	VAL	-	EXPRESSION TAG	UNP P54764
B	10	LEU	-	EXPRESSION TAG	UNP P54764
B	11	LEU	-	EXPRESSION TAG	UNP P54764
B	12	MET	-	EXPRESSION TAG	UNP P54764
B	13	GLY	-	EXPRESSION TAG	UNP P54764
B	14	CYS	-	EXPRESSION TAG	UNP P54764
B	15	VAL	-	EXPRESSION TAG	UNP P54764

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Chain	Residue	Modelled	Actual	Comment	Reference
B	16	ALA	-	EXPRESSION TAG	UNP P54764
B	17	GLU	-	EXPRESSION TAG	UNP P54764
B	18	THR	-	EXPRESSION TAG	UNP P54764
B	19	GLY	-	EXPRESSION TAG	UNP P54764
B	548	GLY	-	EXPRESSION TAG	UNP P54764
B	549	THR	-	EXPRESSION TAG	UNP P54764
B	550	LYS	-	EXPRESSION TAG	UNP P54764
B	551	HIS	-	EXPRESSION TAG	UNP P54764
B	552	HIS	-	EXPRESSION TAG	UNP P54764
B	553	HIS	-	EXPRESSION TAG	UNP P54764
B	554	HIS	-	EXPRESSION TAG	UNP P54764
B	555	HIS	-	EXPRESSION TAG	UNP P54764
B	556	HIS	-	EXPRESSION TAG	UNP P54764



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 32 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	166.89Å 166.89Å 192.09Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	48.18 – 3.65 48.18 – 3.65	Depositor EDS
% Data completeness (in resolution range)	99.9 (48.18-3.65) 99.9 (48.18-3.65)	Depositor EDS
$R_{merge}$	0.19	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.05 (at 3.67Å)	Xtriage
Refinement program	BUSTER 2.11.2	Depositor
R, $R_{free}$	0.349 , 0.386 0.384 , 0.394	Depositor DCC
$R_{free}$ test set	1751 reflections (5.29%)	DCC
Wilson B-factor (Å <sup>2</sup> )	178.5	Xtriage
Anisotropy	0.139	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.29 , 60.3	EDS
Estimated twinning fraction	0.046 for -h,-k,l	Xtriage
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.45$ , $\langle L^2 \rangle = 0.28$	Xtriage
Outliers	0 of 34842 reflections	Xtriage
$F_o, F_c$ correlation	0.84	EDS
Total number of atoms	6344	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	124.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.53% 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, 0.375 respectively for untwinned datasets, and 0.333, 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	0.35	0/4088	0.53	0/5563
1	B	0.34	0/2390	0.52	0/3240
All	All	0.35	0/6478	0.53	0/8803

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	4002	0	3865	15	0
1	B	2342	0	2236	16	0
All	All	6344	0	6101	31	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 (31) 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:126:TYR:HB3	1:A:145:ILE:HD11	1.88	0.56
1:B:126:TYR:HB3	1:B:145:ILE:HD11	1.88	0.55

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:82:ASN:HB2	1:B:187:ASP:HB3	1.89	0.54
1:A:457:VAL:H	1:A:500:ILE:HG13	1.73	0.53
1:B:91:ARG:HB2	1:B:180:GLY:H	1.74	0.52
1:A:471:ILE:HA	1:A:517:THR:HG22	1.91	0.52
1:A:389:GLN:HB2	1:A:393:LEU:HD13	1.92	0.52
1:B:105:LEU:HD12	1:B:192:ILE:HD12	1.91	0.51
1:A:443:SER:HB2	1:A:523:ASP:HB2	1.93	0.51
1:B:114:VAL:HG13	1:B:118:CYS:HB2	1.91	0.50
1:B:157:VAL:H	1:B:163:ILE:HG23	1.76	0.50
1:B:269:ARG:HH22	1:B:277:LYS:HE3	1.77	0.50
1:A:329:PRO:HG3	1:A:417:ASN:HB2	1.94	0.49
1:A:406:HIS:H	1:A:437:ASN:HB2	1.78	0.49
1:B:175:PRO:HB3	1:B:221:ALA:HB1	1.93	0.49
1:A:335:LEU:HD12	1:A:430:VAL:HG12	1.95	0.49
1:A:100:GLU:HB3	1:A:198:ARG:HB2	1.94	0.49
1:A:265:GLY:H	1:A:282:LYS:HB3	1.79	0.47
1:B:265:GLY:H	1:B:282:LYS:HB3	1.79	0.47
1:B:203:LYS:HE2	1:B:216:ASP:HB3	1.97	0.47
1:A:226:LEU:HD22	1:A:246:TYR:HB3	1.98	0.46
1:A:138:ARG:HB3	1:A:141:GLN:HB2	1.98	0.46
1:B:48:SER:HB3	1:B:49:PRO:HD3	1.98	0.44
1:A:300:VAL:HG22	1:A:308:THR:HG22	1.99	0.44
1:B:300:VAL:HG22	1:B:308:THR:HG22	1.99	0.44
1:B:30:GLU:HG3	1:B:203:LYS:H	1.83	0.44
1:B:96:ARG:HH21	1:B:222:ASP:HA	1.84	0.43
1:B:295:PRO:HD2	1:B:324:PRO:HB3	2.00	0.42
1:A:295:PRO:HD2	1:A:324:PRO:HB3	2.01	0.42
1:A:39:VAL:HG21	1:A:43:LEU:HA	2.01	0.42
1:B:255:VAL:HA	1:B:256:PRO:HD3	1.97	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	512/568 (90%)	483 (94%)	29 (6%)	0	100	100
1	B	298/568 (52%)	280 (94%)	18 (6%)	0	100	100
All	All	810/1136 (71%)	763 (94%)	47 (6%)	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	446/489 (91%)	435 (98%)	11 (2%)	55	83
1	B	259/489 (53%)	257 (99%)	2 (1%)	86	94
All	All	705/978 (72%)	692 (98%)	13 (2%)	66	88

All (13) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	105	LEU
1	A	107	ASP
1	A	300	VAL
1	A	339	VAL
1	A	369	CYS
1	A	386	TYR
1	A	389	GLN
1	A	463	GLU
1	A	483	GLN
1	A	516	ARG
1	A	534	THR
1	B	300	VAL
1	B	325	CYS

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

Mol	Chain	Res	Type
1	B	74	ASN
1	B	80	GLN
1	B	210	ASN
1	B	259	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 carbohydrates 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	514/568 (90%)	0.31	26 (5%) 32 19	77, 116, 186, 300	0
1	B	300/568 (52%)	0.34	14 (4%) 35 22	65, 115, 228, 300	0
All	All	814/1136 (71%)	0.32	40 (4%) 33 20	65, 116, 212, 300	0

All (40) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	237	SER	7.9
1	A	161	ASP	6.6
1	B	140	ASN	4.5
1	B	254	LEU	3.9
1	A	232	SER	3.9
1	A	257	ILE	3.9
1	A	287	ASP	3.5
1	B	240	LYS	3.0
1	A	272	GLU	3.0
1	A	40	GLN	2.9
1	B	246	TYR	2.8
1	A	258	GLY	2.8
1	B	218	ILE	2.8
1	A	132	ASP	2.8
1	A	241	ASP	2.8
1	A	427	ASP	2.8
1	A	333	LEU	2.7
1	A	411	PHE	2.7
1	A	274	GLN	2.6
1	B	185	PHE	2.6
1	B	184	ALA	2.4
1	A	231	GLY	2.4
1	A	259	ASN	2.4
1	B	226	LEU	2.3

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Mol	Chain	Res	Type	RSRZ
1	A	425	ASN	2.3
1	B	161	ASP	2.3
1	B	229	VAL	2.3
1	A	539	ILE	2.2
1	B	287	ASP	2.2
1	B	133	LYS	2.2
1	A	183	LEU	2.2
1	A	261	LEU	2.2
1	A	90	THR	2.1
1	A	243	PRO	2.1
1	B	123	ASN	2.1
1	A	447	VAL	2.1
1	A	521	TYR	2.0
1	A	27	PRO	2.0
1	A	64	ASN	2.0
1	A	273	CYS	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 carbohydrates 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.