wwPDB X-ray Structure Validation Summary Report (i)

Feb 1, 2016 – 03:06 PM GMT

PDB ID	:	4BK5
Title	:	crystal structure of the human EphA4 ectodomain in complex with human ephrin A5 (amine-methylated sample)
Authors	:	Seiradake, E.; Schaupp, A.; del Toro Ruiz, D.; Kaufmann, R.; Mitakidis, N.; Harlos, K.; Aricescu, A.R.; Klein, R.; Jones, E.Y.
Deposited on	:	2013-04-22
Resolution	:	4.00 Å(reported)

The following versions of software and data (see references (i)) were used in the production of this report:

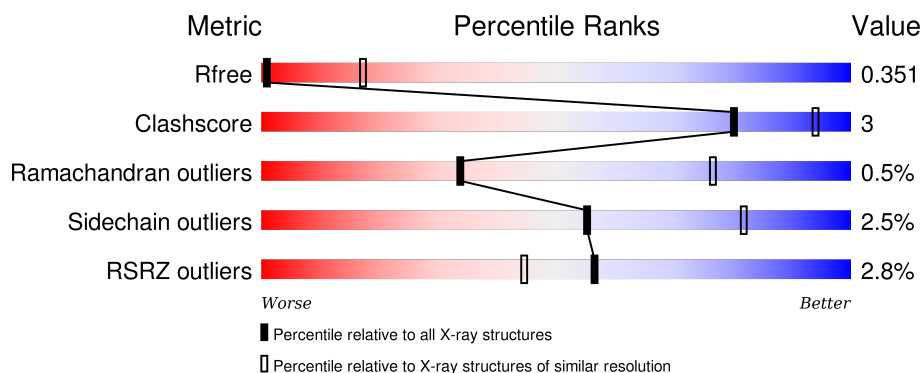|		
MolProbity	:	4.02b-467
Mogul	:	1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20026688
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	trunk26865

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
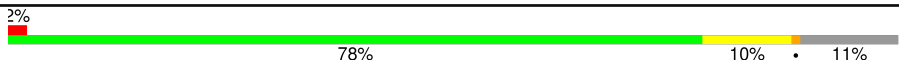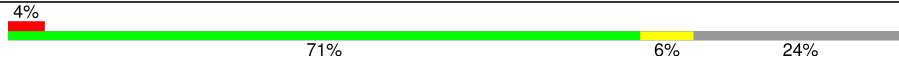*X-RAY DIFFRACTION*

The reported resolution of this entry is 4.00 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	Percentile Ranks	Value
Rfree		0.351
Clashscore		3
Ramachandran outliers		0.5%
Sidechain outliers		2.5%
RSRZ outliers		2.8%

Worse   *Better*

■ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	91344	1010 (4.42-3.56)
Clashscore	102246	1052 (4.40-3.60)
Ramachandran outliers	100387	1005 (4.40-3.60)
Sidechain outliers	100360	1013 (4.42-3.58)
RSRZ outliers	91569	1013 (4.42-3.56)

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 >=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 <=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	2% — 78% · 10% · 11%
2	C	180	4% — 71% · 6% · 24%

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 5087 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
			Total	C	N	O	S			
1	A	507	3948	2461	682	779	26	0	0	0

There are 40 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
A	14	CYS	-	EXPRESSION TAG	UNP P54764
A	15	VAL	-	EXPRESSION TAG	UNP P54764

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Chain	Residue	Modelled	Actual	Comment	Reference
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

- Molecule 2 is a protein called EPHRIN-A5.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	C	137	1139	728	197	206	8	0	0	1

There are 40 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	0	MET	-	EXPRESSION TAG	UNP P52803
C	1	GLY	-	EXPRESSION TAG	UNP P52803
C	2	ILE	-	EXPRESSION TAG	UNP P52803
C	3	LEU	-	EXPRESSION TAG	UNP P52803
C	4	PRO	-	EXPRESSION TAG	UNP P52803
C	5	SER	-	EXPRESSION TAG	UNP P52803
C	6	PRO	-	EXPRESSION TAG	UNP P52803
C	7	GLY	-	EXPRESSION TAG	UNP P52803
C	8	MET	-	EXPRESSION TAG	UNP P52803
C	9	PRO	-	EXPRESSION TAG	UNP P52803
C	10	ALA	-	EXPRESSION TAG	UNP P52803
C	11	LEU	-	EXPRESSION TAG	UNP P52803
C	12	LEU	-	EXPRESSION TAG	UNP P52803
C	13	SER	-	EXPRESSION TAG	UNP P52803
C	14	LEU	-	EXPRESSION TAG	UNP P52803
C	15	VAL	-	EXPRESSION TAG	UNP P52803
C	16	SER	-	EXPRESSION TAG	UNP P52803
C	17	LEU	-	EXPRESSION TAG	UNP P52803
C	18	LEU	-	EXPRESSION TAG	UNP P52803

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| Chain	Residue	Modelled	Actual	Comment	Reference
C	19	SER	-	EXPRESSION TAG	UNP P52803
C	20	VAL	-	EXPRESSION TAG	UNP P52803
C	21	LEU	-	EXPRESSION TAG	UNP P52803
C	22	LEU	-	EXPRESSION TAG	UNP P52803
C	23	MET	-	EXPRESSION TAG	UNP P52803
C	24	GLY	-	EXPRESSION TAG	UNP P52803
C	25	CYS	-	EXPRESSION TAG	UNP P52803
C	26	VAL	-	EXPRESSION TAG	UNP P52803
C	27	ALA	-	EXPRESSION TAG	UNP P52803
C	28	GLU	-	EXPRESSION TAG	UNP P52803
C	29	THR	-	EXPRESSION TAG	UNP P52803
C	30	GLY	-	EXPRESSION TAG	UNP P52803
C	172	GLY	-	EXPRESSION TAG	UNP P52803
C	173	THR	-	EXPRESSION TAG	UNP P52803
C	174	LYS	-	EXPRESSION TAG	UNP P52803
C	175	HIS	-	EXPRESSION TAG	UNP P52803
C	176	HIS	-	EXPRESSION TAG	UNP P52803
C	177	HIS	-	EXPRESSION TAG	UNP P52803
C	178	HIS	-	EXPRESSION TAG	UNP P52803
C	179	HIS	-	EXPRESSION TAG	UNP P52803
C	180	HIS	-	EXPRESSION TAG	UNP P52803

3 Residue-property plots ⓘ

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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: EPHRIN TYPE-A RECEPTOR 4
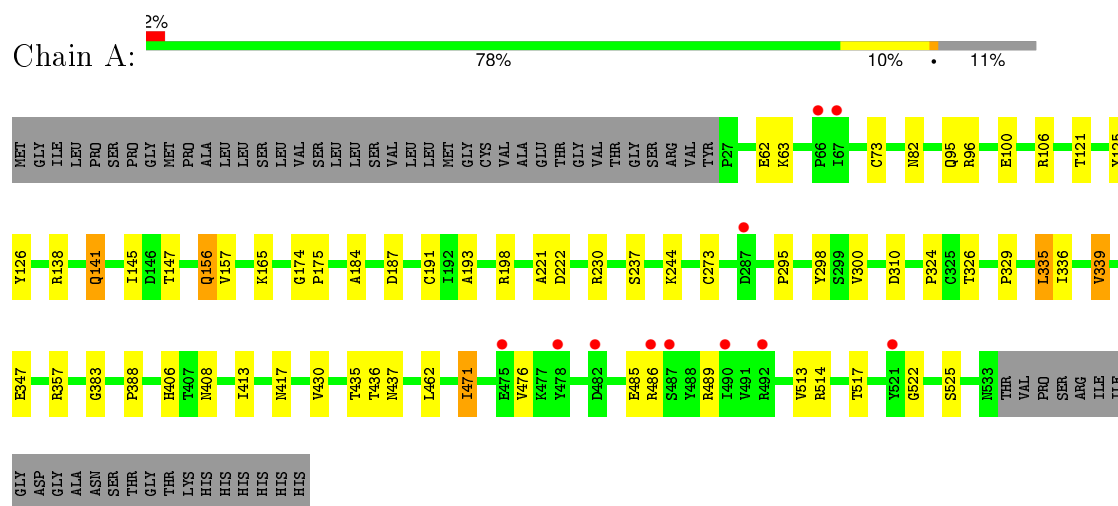
• Molecule 2: EPHRIN-A5
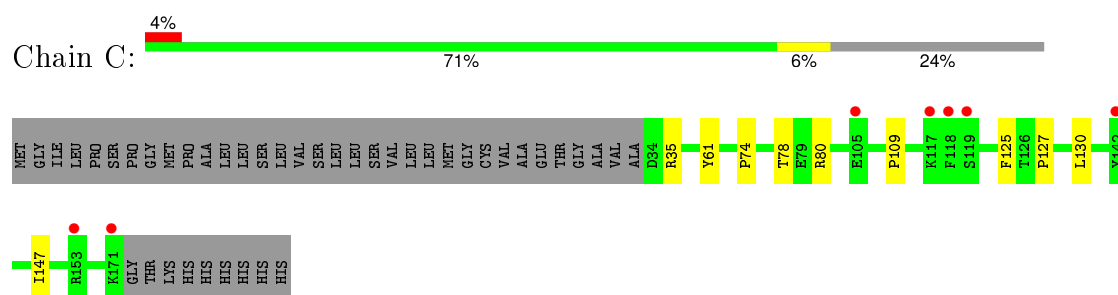
4 Data and refinement statistics (i)

Property	Value	Source
Space group	H 3 2	Depositor
Cell constants a, b, c, α, β, γ	256.95Å 256.95Å 252.51Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	70.41 – 4.00 70.41 – 4.00	Depositor EDS
% Data completeness (in resolution range)	99.9 (70.41-4.00) 99.9 (70.41-4.00)	Depositor EDS
R_{merge}	0.41	Depositor
R_{sym}	(Not available)	Depositor
$<I/\sigma(I)>$ [1]	1.13 (at 4.01Å)	Xtriage
Refinement program	BUSTER 2.11.2	Depositor
R, R_{free}	0.312 , 0.321 0.333 , 0.351	Depositor DCC
R_{free} test set	1361 reflections (5.02%)	DCC
Wilson B-factor (Å^2)	154.9	Xtriage
Anisotropy	0.161	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.27 , 121.7	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning[2]	$<|L|> = 0.43, <L^2> = 0.25$	Xtriage
Outliers	0 of 27150 reflections	Xtriage
F_o,F_c correlation	0.80	EDS
Total number of atoms	5087	wwPDB-VP
Average B, all atoms (Å^2)	187.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.03% of the height of the origin peak. No significant pseudotranslation is detected.*

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[1]Intensities estimated from amplitudes.
[2]Theoretical values of $<|L|>$, $<L^2>$ 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	0.36	0/4032	0.56	0/5484
2	C	0.38	0/1177	0.50	0/1592
All	All	0.37	0/5209	0.55	0/7076

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	3948	0	3801	31	0
2	C	1139	0	1053	6	0
All	All	5087	0	4854	34	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.

The worst 5 of 34 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:138:ARG:HB3	1:A:141:GLN:HB2	1.85	0.58
2:C:35:ARG:HG2	2:C:61:TYR:HB2	1.86	0.58

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:329:PRO:HD3	1:A:417:ASN:HB2	1.87	0.57
1:A:471:ILE:HA	1:A:517:THR:HG22	1.87	0.56
1:A:336:ILE:HB	1:A:347:GLU:HB3	1.87	0.56

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	503/568 (89%)	477 (95%)	23 (5%)	3 (1%)	30	73
2	C	133/180 (74%)	124 (93%)	9 (7%)	0	100	100
All	All	636/748 (85%)	601 (94%)	32 (5%)	3 (0%)	34	76

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	388	PRO
1	A	485	GLU
1	A	383	GLY

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.

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	439/489 (90%)	427 (97%)	12 (3%)	52	80
2	C	126/161 (78%)	124 (98%)	2 (2%)	70	88
All	All	565/650 (87%)	551 (98%)	14 (2%)	55	82

5 of 14 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	335	LEU
1	A	339	VAL
1	A	471	ILE
1	A	300	VAL
1	A	462	LEU

Some 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 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 (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(Å²)	Q<0.9
1	A	507/568 (89%)	0.14	11 (2%)	65	54	76, 162, 253, 293	0
2	C	137/180 (76%)	0.27	7 (5%)	32	23	135, 244, 285, 291	0
All	All	644/748 (86%)	0.16	18 (2%)	56	44	76, 176, 270, 293	0

The worst 5 of 18 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	C	117	LYS	3.0
1	A	478	TYR	2.9
1	A	482	ASP	2.7
1	A	287	ASP	2.5
2	C	119	SER	2.5

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.