



# Full wwPDB X-ray Structure Validation Report ⓘ

Aug 22, 2023 – 07:45 AM EDT

PDB ID : 2QOL  
Title : Human EphA3 kinase and juxtamembrane region, Y596:Y602:S768G triple mutant  
Authors : Davis, T.; Walker, J.R.; Newman, E.M.; Mackenzie, F.; Butler-Cole, C.; Weigelt, J.; Sundstrom, M.; Arrowsmith, C.H.; Edwards, A.M.; Bochkarev, A.; Dhe-Paganon, S.; Structural Genomics Consortium (SGC)  
Deposited on : 2007-07-20  
Resolution : 1.07 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 : 2.35  
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

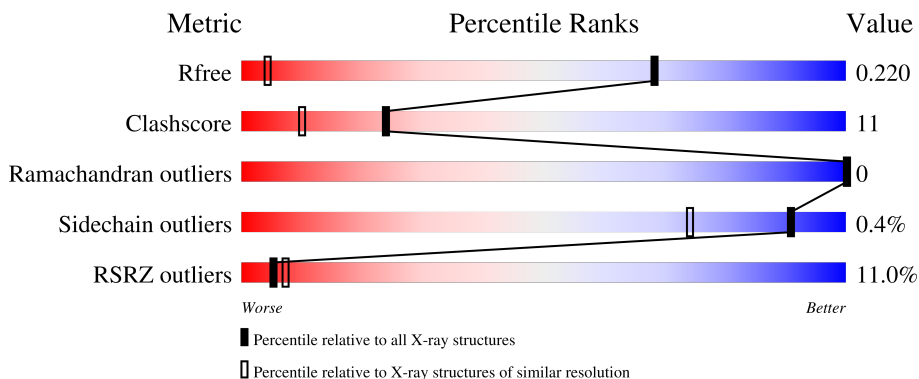
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.07 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	1386 (1.12-1.04)
Clashscore	141614	1021 (1.10-1.06)
Ramachandran outliers	138981	1381 (1.12-1.04)
Sidechain outliers	138945	1379 (1.12-1.04)
RSRZ outliers	127900	1359 (1.12-1.04)

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	373	

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 2797 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 receptor.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	273	2375	1533	393	434	15	0	35	0

There are 5 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	575	GLY	-	expression tag	UNP Q6P4R6
A	576	SER	-	expression tag	UNP Q6P4R6
A	596	PHE	TYR	engineered mutation	UNP Q6P4R6
A	602	PHE	TYR	engineered mutation	UNP Q6P4R6
A	768	GLY	SER	engineered mutation	UNP Q6P4R6

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	422	Total	O	0	0
			422	422		



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	54.30Å 38.29Å 75.88Å 90.00° 102.15° 90.00°	Depositor
Resolution (Å)	26.55 – 1.07 26.54 – 1.07	Depositor EDS
% Data completeness (in resolution range)	100.0 (26.55-1.07) 92.5 (26.54-1.07)	Depositor EDS
$R_{merge}$	0.04	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.04 (at 1.07Å)	Xtrriage
Refinement program	REFMAC	Depositor
R, $R_{free}$	0.195 , 0.211 0.203 , 0.220	Depositor DCC
$R_{free}$ test set	6252 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	11.2	Xtrriage
Anisotropy	0.004	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.37 , 62.3	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.34$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	2797	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	17.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 10.15% 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	0.37	0/2507	0.56	0/3372

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	A	0	1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	893	SER	Peptide

### 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	2375	0	2485	54	0
2	A	422	0	0	13	0
All	All	2797	0	2485	54	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 11.

All (54) 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:627:VAL:CG1	1:A:635[B]:VAL:HG13	1.53	1.37
1:A:626:VAL:HA	1:A:636[B]:CYS:HB3	1.24	1.19
1:A:627:VAL:HG12	1:A:635[B]:VAL:HG13	1.18	1.07
1:A:627:VAL:CG1	1:A:635[B]:VAL:CG1	2.40	1.00
1:A:625:LYS:O	1:A:636[B]:CYS:HB2	1.63	0.98
1:A:627:VAL:HG13	1:A:635[B]:VAL:HG13	1.57	0.83
1:A:625:LYS:O	1:A:636[B]:CYS:CB	2.29	0.80
1:A:743:VAL:HG13	2:A:409:HOH:O	1.83	0.79
1:A:626:VAL:HA	1:A:636[B]:CYS:CB	2.12	0.76
1:A:736[B]:TYR:OH	2:A:307:HOH:O	2.03	0.74
1:A:894:ALA:HB3	2:A:337:HOH:O	1.91	0.71
1:A:803:SER:HA	2:A:409:HOH:O	1.93	0.68
1:A:682[B]:ILE:CD1	1:A:736[B]:TYR:CD2	2.77	0.67
1:A:892:THR:HG22	1:A:893:SER:H	1.60	0.66
1:A:884:ASN:ND2	1:A:887[A]:SER:OG	2.29	0.65
1:A:893:SER:N	1:A:894:ALA:C	2.51	0.64
1:A:892:THR:HG22	1:A:893:SER:N	2.14	0.63
1:A:682[B]:ILE:CD1	1:A:736[B]:TYR:HD2	2.12	0.63
1:A:627:VAL:HG13	1:A:635[B]:VAL:CG1	2.21	0.60
1:A:673:ILE:O	2:A:414:HOH:O	2.17	0.60
1:A:626:VAL:CA	1:A:636[B]:CYS:HB3	2.17	0.59
1:A:683:ILE:O	2:A:408:HOH:O	2.15	0.59
1:A:682[B]:ILE:HD12	1:A:736[B]:TYR:CD2	2.37	0.59
1:A:628:GLY:O	1:A:635[B]:VAL:HG12	2.03	0.58
1:A:670[B]:GLU:HG3	1:A:765[B]:PHE:C	2.24	0.58
1:A:682[B]:ILE:HD11	1:A:736[B]:TYR:HD2	1.69	0.57
1:A:892:THR:HG22	1:A:894:ALA:C	2.27	0.54
1:A:625:LYS:O	1:A:636[A]:CYS:HB2	2.08	0.53
1:A:617:ASP:OD1	1:A:619[A]:THR:HG23	2.10	0.51
1:A:620[A]:ASN:HD22	1:A:641[A]:LYS:HB3	1.75	0.51
1:A:845:PRO:HG3	1:A:894:ALA:HB1	1.94	0.50
1:A:636[B]:CYS:SG	2:A:111:HOH:O	2.48	0.50
1:A:894:ALA:CB	2:A:262:HOH:O	2.61	0.49
1:A:888:LEU:HD11	2:A:413:HOH:O	2.13	0.48
1:A:627:VAL:HG13	1:A:628:GLY:N	2.28	0.47
1:A:724:VAL:HG11	2:A:413:HOH:O	2.13	0.47
1:A:730:ILE:HD13	1:A:752[B]:ILE:HD13	1.95	0.47
1:A:720[A]:VAL:HG12	1:A:888:LEU:HD13	1.96	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:892:THR:CG2	1:A:893:SER:H	2.24	0.46
1:A:862[B]:GLN:NE2	1:A:867:ASN:O	2.49	0.46
1:A:892:THR:CG2	1:A:893:SER:N	2.79	0.46
1:A:894:ALA:CB	2:A:337:HOH:O	2.57	0.45
1:A:627:VAL:CG1	1:A:628:GLY:N	2.80	0.44
1:A:617:ASP:OD1	1:A:619[B]:THR:OG1	2.34	0.44
1:A:653[A]:LYS:HG2	1:A:667:PHE:CE1	2.53	0.43
1:A:646[B]:LYS:CE	2:A:174:HOH:O	2.66	0.43
1:A:894:ALA:HB2	2:A:262:HOH:O	2.17	0.43
1:A:892:THR:C	1:A:894:ALA:C	2.79	0.41
1:A:893:SER:OG	1:A:894:ALA:N	2.54	0.41
1:A:627:VAL:CG1	1:A:635[A]:VAL:HG12	2.51	0.41
1:A:653[A]:LYS:HG2	1:A:667:PHE:CZ	2.55	0.41
1:A:892:THR:O	1:A:894:ALA:O	2.39	0.40
1:A:627:VAL:HG11	1:A:635[A]:VAL:HG12	2.03	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	301/373 (81%)	296 (98%)	5 (2%)	0	<a href="#">100</a> <a href="#">100</a>

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	277/323 (86%)	276 (100%)	1 (0%)	91 74

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	893	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	704	ASN
1	A	757	ASN
1	A	884	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 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

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	273/373 (73%)	0.80	30 (10%) <b>5</b> <b>7</b>	7, 12, 23, 29	42 (15%)

All (30) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	894	ALA	11.4
1	A	893	SER	7.7
1	A	627	VAL	6.1
1	A	904	ASP	5.1
1	A	883	ARG	4.8
1	A	625	LYS	4.5
1	A	632	PHE	4.2
1	A	609	VAL	4.1
1	A	610	HIS	4.0
1	A	899	SER	4.0
1	A	628	GLY	3.6
1	A	626	VAL	3.5
1	A	788	ILE	3.2
1	A	891	ILE	2.9
1	A	629	ALA	2.9
1	A	636[A]	CYS	2.7
1	A	694	PRO	2.6
1	A	721[A]	ILE	2.5
1	A	660	THR	2.5
1	A	635[A]	VAL	2.5
1	A	691	LYS	2.4
1	A	900	ASN	2.4
1	A	662	LYS	2.3
1	A	653[A]	LYS	2.3
1	A	892	THR	2.3
1	A	597	VAL	2.3
1	A	848	ASP	2.3

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Mol	Chain	Res	Type	RSRZ
1	A	613	ALA	2.3
1	A	661	GLU	2.3
1	A	611	GLU	2.1

## 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.