



# Full wwPDB X-ray Structure Validation Report

Mar 1, 2014 – 04:36 AM GMT

PDB ID : 3K5R  
Title : Crystal Structure of mouse T-cadherin EC1 EC2  
Authors : Shapiro, L.; Ciatto, C.  
Deposited on : 2009-10-07  
Resolution : 2.00 Å(reported)

This is a full wwPDB 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/ValidationPDFNotes.html>

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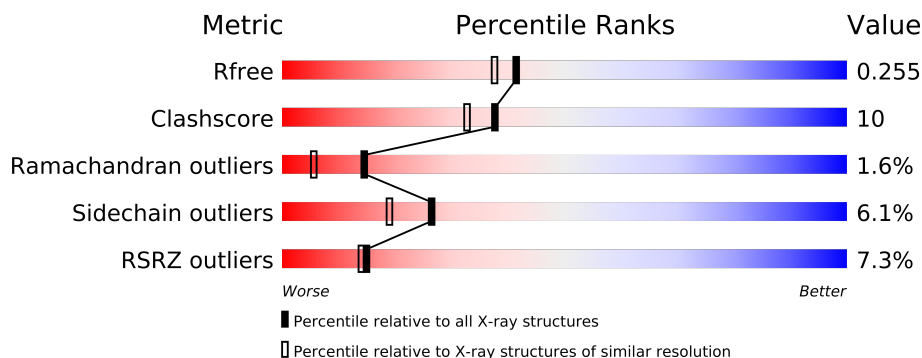
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.15 2013  
Xtriage (Phenix) : dev-1323  
EDS : stable22639  
Percentile statistics : 21963  
Refmac : 5.8.0049  
CCP4 : 6.3.0 (Settle)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)  
Validation Pipeline (wwPDB-VP) : stable22683

# 1 Overall quality at a glance



The reported resolution of this entry is 2.00 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	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	66092	4888 (2.00-2.00)
Clashscore	79885	6188 (2.00-2.00)
Ramachandran outliers	78287	6102 (2.00-2.00)
Sidechain outliers	78261	6100 (2.00-2.00)
RSRZ outliers	66119	4890 (2.00-2.00)

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. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Mol	Chain	Length	Quality of chain
1	A	218	
1	B	218	

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 3550 atoms, of which 0 are hydrogen and 0 are deuterium.

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 Cadherin 13.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	218	Total	C	N	O	S	0	0	0
			1678	1045	284	344	5			
1	B	218	Total	C	N	O	S	0	0	0
			1678	1045	284	344	5			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	0	SER	-	EXPRESSION TAG	UNP Q8VDK4
A	1	GLY	-	EXPRESSION TAG	UNP Q8VDK4
B	0	SER	-	EXPRESSION TAG	UNP Q8VDK4
B	1	GLY	-	EXPRESSION TAG	UNP Q8VDK4

- Molecule 2 is water.

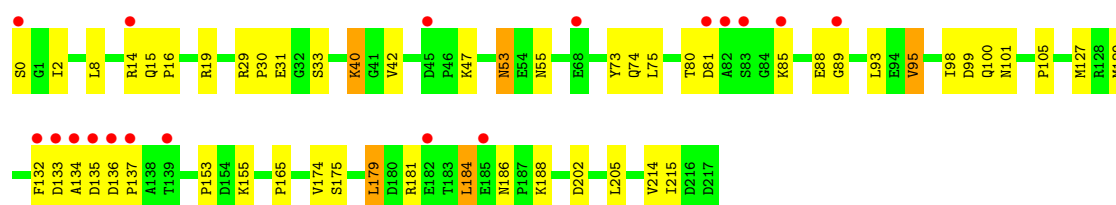
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	90	Total	O	0	0
			90	90		
2	B	104	Total	O	0	0
			104	104		

### 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.

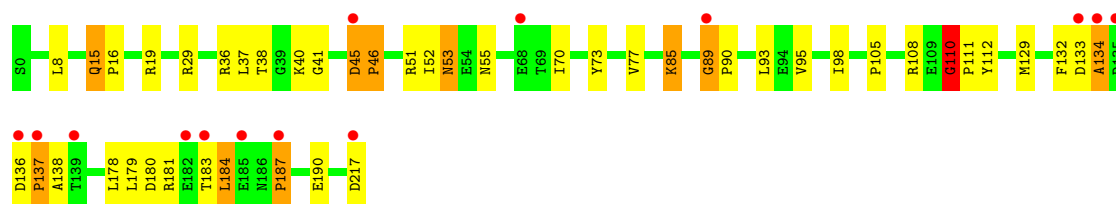
#### • Molecule 1: Cadherin 13

Chain A: 



#### • Molecule 1: Cadherin 13

Chain B: 



## 4 Data and refinement statistics

Property	Value	Source
Space group	H 3 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	107.72Å 107.72Å 226.70Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	20.00 – 2.00 19.66 – 2.00	Depositor EDS
% Data completeness (in resolution range)	100.0 (20.00-2.00) 99.9 (19.66-2.00)	Depositor EDS
$R_{merge}$	0.67	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	6.91 (at 2.01Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, $R_{free}$	0.213 , 0.259 0.211 , 0.255	Depositor DCC
$R_{free}$ test set	1733 reflections (5.31%)	DCC
Wilson B-factor (Å <sup>2</sup> )	28.4	Xtriage
Anisotropy	0.122	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.40 , 47.4	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.34$	Xtriage
Outliers	0 of 34349 reflections	Xtriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	3550	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	29.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 10.00% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

## 5 Model quality

### 5.1 Standard geometry

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	0.88	2/1708 (0.1%)	0.92	3/2328 (0.1%)
1	B	0.93	0/1708	1.04	5/2328 (0.2%)
All	All	0.90	2/3416 (0.1%)	0.98	8/4656 (0.2%)

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
1	B	0	3
All	All	0	4

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	47	LYS	CD-CE	6.42	1.67	1.51
1	A	47	LYS	CG-CD	6.37	1.74	1.52

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	45	ASP	C-N-CD	-10.23	98.09	120.60
1	B	29	ARG	NE-CZ-NH1	-8.92	115.84	120.30
1	B	29	ARG	NE-CZ-NH2	8.33	124.47	120.30
1	B	45	ASP	C-N-CA	6.88	150.91	122.00
1	B	184	LEU	CA-CB-CG	6.78	130.89	115.30
1	A	129	MET	CG-SD-CE	5.54	109.07	100.20
1	A	47	LYS	CG-CD-CE	-5.33	95.90	111.90
1	A	127	MET	CG-SD-CE	-5.09	92.06	100.20

There are no chirality outliers.

All (4) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	137	PRO	Peptide
1	B	110	GLY	Peptide
1	B	137	PRO	Peptide
1	B	45	ASP	Peptide

## 5.2 Close contacts ⓘ

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 hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	1678	0	1658	35	0
1	B	1678	0	1658	32	0
2	A	90	0	0	3	1
2	B	104	0	0	5	0
All	All	3550	0	3316	67	1

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 10.

All (67) close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:B:15:GLN:HE21	1:B:16:PRO:HA	1.27	0.97
1:B:85:LYS:HB2	2:B:312:HOH:O	1.67	0.93
1:B:181:ARG:HD3	1:B:217:ASP:OD2	1.79	0.83
1:A:40:LYS:HD2	1:A:73:TYR:HA	1.60	0.82
1:B:178:LEU:O	1:B:184:LEU:HD11	1.79	0.81
1:A:181:ARG:CZ	2:A:286:HOH:O	2.30	0.78
1:A:188:LYS:HG2	1:A:214:VAL:HG22	1.67	0.77
1:A:40:LYS:HE2	1:A:74:GLN:H	1.52	0.74
1:A:132:PHE:HA	2:A:299:HOH:O	1.92	0.69
1:A:134:ALA:O	1:A:135:ASP:HB2	1.92	0.68
1:B:180:ASP:H	1:B:184:LEU:HD13	1.61	0.65
1:B:178:LEU:O	1:B:184:LEU:CD1	2.45	0.64
1:A:73:TYR:HB2	1:A:95:VAL:HG13	1.80	0.64
1:A:105:PRO:HA	1:A:132:PHE:CZ	2.34	0.62
1:A:30:PRO:O	1:A:33:SER:HB2	1.99	0.62

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Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:B:133:ASP:O	1:B:134:ALA:HB3	2.01	0.60
1:A:15:GLN:HG3	1:A:16:PRO:HA	1.84	0.59
1:B:110:GLY:HA3	1:B:111:PRO:C	2.23	0.59
1:A:40:LYS:CE	1:A:74:GLN:H	2.16	0.58
1:A:8:LEU:HG	1:A:98:ILE:HD11	1.86	0.58
1:A:53:ASN:HD22	1:A:55:ASN:H	1.53	0.57
1:A:105:PRO:HA	1:A:132:PHE:CE2	2.39	0.56
1:B:53:ASN:HD22	1:B:55:ASN:H	1.53	0.56
1:B:36:ARG:NH1	1:B:38:THR:HG21	2.21	0.55
1:B:187:PRO:HA	2:B:269:HOH:O	2.08	0.53
1:A:29:ARG:HG2	1:A:33:SER:OG	2.10	0.52
1:B:180:ASP:H	1:B:184:LEU:CD1	2.23	0.52
1:B:133:ASP:O	1:B:134:ALA:CB	2.57	0.51
1:A:202:ASP:HB3	1:A:205:LEU:HD12	1.91	0.51
1:B:110:GLY:CA	1:B:111:PRO:O	2.60	0.50
1:B:105:PRO:HA	1:B:132:PHE:CZ	2.47	0.49
1:B:89:GLY:HA3	2:B:306:HOH:O	2.13	0.48
1:B:110:GLY:HA3	1:B:111:PRO:O	2.14	0.48
1:A:53:ASN:HD22	1:A:53:ASN:C	2.17	0.48
1:A:53:ASN:ND2	1:A:55:ASN:H	2.12	0.47
1:A:153:PRO:HG3	1:A:186:ASN:HB3	1.96	0.46
1:B:187:PRO:CA	2:B:269:HOH:O	2.64	0.46
1:B:40:LYS:HE2	1:B:73:TYR:HA	1.98	0.46
1:A:181:ARG:NE	2:A:286:HOH:O	2.45	0.46
1:A:133:ASP:O	1:A:134:ALA:HB3	2.16	0.46
1:A:0:SER:O	1:A:0:SER:OG	2.32	0.46
1:B:41:GLY:HA2	1:B:46:PRO:O	2.15	0.45
1:A:30:PRO:O	1:A:33:SER:CB	2.65	0.45
1:B:89:GLY:CA	2:B:306:HOH:O	2.64	0.45
1:B:15:GLN:NE2	1:B:16:PRO:HA	2.12	0.44
1:A:40:LYS:CD	1:A:74:GLN:H	2.31	0.44
1:A:133:ASP:HB3	1:A:136:ASP:CG	2.37	0.44
1:B:112:TYR:CD1	1:B:129:MET:HG2	2.53	0.44
1:A:40:LYS:HE2	1:A:74:GLN:N	2.25	0.43
1:B:40:LYS:HE3	1:B:70:ILE:HG21	1.99	0.43
1:A:133:ASP:HB3	1:A:136:ASP:HB3	1.99	0.43
1:A:184:LEU:HD21	1:A:215:ILE:HG12	2.01	0.43
1:A:14:ARG:HB2	1:A:14:ARG:CZ	2.47	0.43
1:A:80:THR:HA	1:A:85:LYS:O	2.19	0.43
1:A:2:ILE:HD11	1:A:88:GLU:HB2	2.01	0.42
1:A:99:ASP:OD1	1:A:101:ASN:HB2	2.20	0.42
1:B:37:LEU:HD22	1:B:52:ILE:HB	2.02	0.42

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Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:B:53:ASN:ND2	1:B:55:ASN:H	2.17	0.41
1:A:174:VAL:CG2	1:A:179:LEU:HD13	2.50	0.41
1:B:8:LEU:HG	1:B:98:ILE:HD11	2.02	0.41
1:B:93:LEU:C	1:B:93:LEU:HD23	2.40	0.41
1:A:40:LYS:HE2	1:A:74:GLN:CB	2.51	0.41
1:B:136:ASP:O	1:B:138:ALA:HA	2.20	0.40
1:B:110:GLY:CA	1:B:111:PRO:C	2.90	0.40
1:B:77:VAL:O	1:B:90:PRO:HA	2.22	0.40
1:B:133:ASP:HB3	1:B:136:ASP:HB3	2.03	0.40
1:A:42:VAL:HG23	1:A:75:LEU:HD22	2.03	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
2:A:265:HOH:O	2:A:265:HOH:O[10_545]	1.28	0.92

## 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	216/218 (99%)	201 (93%)	13 (6%)	2 (1%)	25	14
1	B	216/218 (99%)	198 (92%)	13 (6%)	5 (2%)	10	3
All	All	432/436 (99%)	399 (92%)	26 (6%)	7 (2%)	14	5

All (7) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	46	PRO
1	A	89	GLY
1	B	89	GLY
1	B	110	GLY
1	A	81	ASP
1	B	134	ALA

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Mol	Chain	Res	Type
1	B	137	PRO

### 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	190/190 (100%)	178 (94%)	12 (6%)	25	18
1	B	190/190 (100%)	179 (94%)	11 (6%)	28	21
All	All	380/380 (100%)	357 (94%)	23 (6%)	26	19

All (23) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	19	ARG
1	A	31	GLU
1	A	40	LYS
1	A	53	ASN
1	A	93	LEU
1	A	95	VAL
1	A	100	GLN
1	A	155	LYS
1	A	165	PRO
1	A	175	SER
1	A	179	LEU
1	A	184	LEU
1	B	15	GLN
1	B	19	ARG
1	B	51	ARG
1	B	53	ASN
1	B	85	LYS
1	B	95	VAL
1	B	108	ARG
1	B	179	LEU
1	B	183	THR
1	B	187	PRO
1	B	190	GLU

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

Mol	Chain	Res	Type
1	A	12	ASN
1	A	53	ASN
1	A	100	GLN
1	B	12	ASN
1	B	15	GLN
1	B	53	ASN
1	B	100	GLN

### 5.3.3 RNA ⓘ

There are no RNA chains 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 ⓘ

There are no carbohydrates in this entry.

### 5.6 Ligand geometry ⓘ

There are no ligands in this entry.

### 5.7 Other polymers ⓘ

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	218/218 (100%)	0.45	18 (8%)	11 11	19, 28, 41, 62	0
1	B	218/218 (100%)	0.36	14 (6%)	19 18	18, 28, 43, 59	0
All	All	436/436 (100%)	0.41	32 (7%)	15 14	18, 28, 42, 62	0

All (32) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	134	ALA	10.3
1	B	137	PRO	9.3
1	A	137	PRO	7.0
1	A	136	ASP	6.6
1	A	135	ASP	6.4
1	A	0	SER	5.6
1	A	133	ASP	5.0
1	B	135	ASP	4.9
1	B	183	THR	4.8
1	B	182	GLU	4.6
1	B	134	ALA	4.3
1	A	83	SER	4.3
1	B	89	GLY	4.0
1	B	133	ASP	3.9
1	B	185	GLU	3.7
1	B	136	ASP	3.4
1	A	132	PHE	3.3
1	A	139	THR	3.3
1	B	217	ASP	3.3
1	A	89	GLY	2.7
1	A	82	ALA	2.7
1	B	139	THR	2.6
1	A	185	GLU	2.6
1	A	14	ARG	2.5

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Mol	Chain	Res	Type	RSRZ
1	A	81	ASP	2.5
1	A	85	LYS	2.4
1	B	68	GLU	2.4
1	A	182	GLU	2.4
1	A	68	GLU	2.4
1	A	45	ASP	2.4
1	B	45	ASP	2.3
1	B	187	PRO	2.1

## 6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

## 6.3 Carbohydrates ⓘ

There are no carbohydrates in this entry.

## 6.4 Ligands ⓘ

There are no ligands in this entry.

## 6.5 Other polymers ⓘ

There are no such residues in this entry.