



wwPDB X-ray Structure Validation Summary Report i

Feb 28, 2014 – 10:25 AM GMT

PDB ID : 1R4L
Title : Inhibitor Bound Human Angiotensin Converting Enzyme-Related Carboxypeptidase (ACE2)
Authors : Towler, P.; Staker, B.; Prasad, S.G.; Menon, S.; Ryan, D.; Tang, J.; Parsons, T.; Fisher, M.; Williams, D.; Dales, N.A.; Patane, M.A.; Pantoliano, M.W.
Deposited on : 2003-10-07
Resolution : 3.00 Å(reported)

This is a wwPDB validation summary report for a publicly released PDB entry.
We welcome your comments at validation@mail.wwpdb.org
A user guide is available at <http://wwpdb.org/ValidationPDFNotes.html>

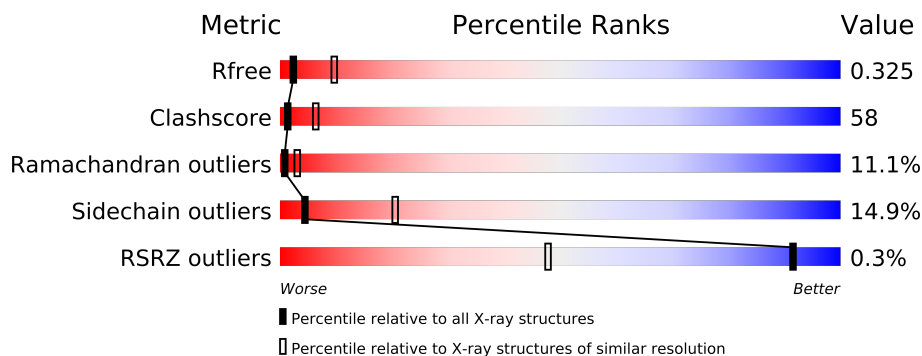
The following versions of software and data (see [references](#)) were used in the production of this report:

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 3.00 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	1216 (3.00-3.00)
Clashscore	79885	1594 (3.00-3.00)
Ramachandran outliers	78287	1537 (3.00-3.00)
Sidechain outliers	78261	1540 (3.00-3.00)
RSRZ outliers	66119	1217 (3.00-3.00)

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 ≥ 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	615	
2	B	6	
3	C	20	
4	D	18	
5	E	14	

2 Entry composition

There are 10 unique types of molecules in this entry. The entry contains 5218 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 angiotensin I converting enzyme 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	597	Total	C	N	O	S	0	0	0
			4853	3103	805	916	29			

- Molecule 2 is a protein called disordered segment of collectrin homology domain.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	B	6	Total	C	N	O	0	0	0
			31	18	6	7			

- Molecule 3 is a protein called disordered segment of collectrin homology domain.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	C	20	Total	C	N	O	0	0	0
			101	60	20	21			

- Molecule 4 is a protein called disordered segment of collectrin homology domain.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
4	D	18	Total	C	N	O	0	0	0
			91	54	18	19			

- Molecule 5 is a protein called disordered segment of collectrin homology domain.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
5	E	14	Total	C	N	O	0	0	0
			71	42	14	15			

- Molecule 6 is SUGAR (N-ACETYL-D-GLUCOSAMINE) (three-letter code: NAG) (formula: $C_8H_{15}NO_6$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
6	A	1	Total	C	N	O	0	0
			14	8	1	5		
6	A	1	Total	C	N	O	0	0
			14	8	1	5		

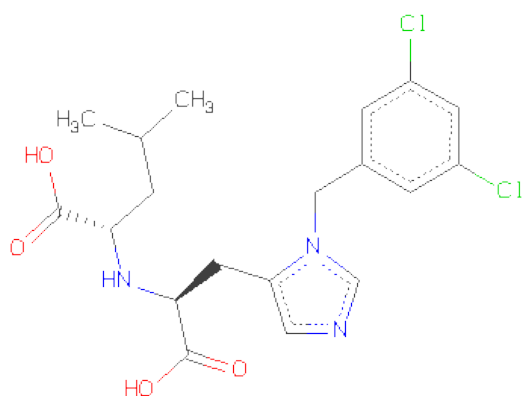
- Molecule 7 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	1	Total	Cl	0	0
			1	1		

- Molecule 8 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	A	1	Total	Zn	0	0
			1	1		

- Molecule 9 is (S,S)-2-{1-CARBOXY-2-[3-(3,5-DICHLORO-BENZYL)-3H-IMIDAZOL-4-YL]-ETHYLAMINO}-4-METHYL-PENTANOICACID (three-letter code: XX5) (formula: C₁₉H₂₃Cl₂N₃O₄).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	Cl	N	O		
9	A	1	28	19	2	3	4	0	0

- Molecule 10 is water.

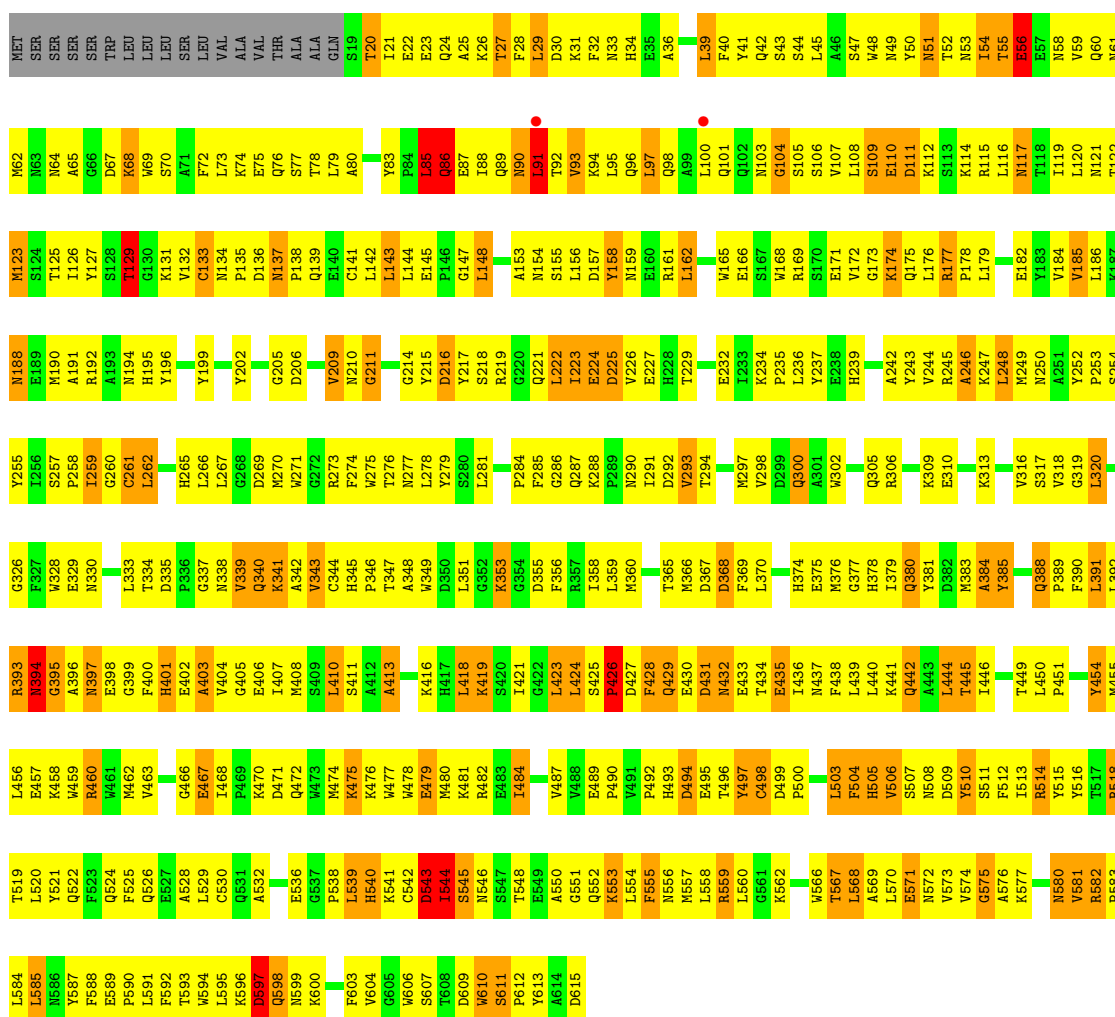
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
10	A	13	Total	O	0	0
			13	13		

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 ($\text{RSRZ} > 2$). 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.

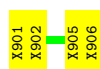
- Molecule 1: angiotensin I converting enzyme 2

Chain A:



- Molecule 2: disordered segment of collectrin homology domain

Chain B:



- Molecule 3: disordered segment of collectrin homology domain

Chain C: 

X907	X908	X909	X910	X911	X912	X913	X914	X915	X916	X917	X918	X919	X920	X921	X922	X923	X924	X925	X926
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- Molecule 4: disordered segment of collectrin homology domain

Chain D: 

X927	X928	X929	X930	X931	X932	X933	X934	X935	X936	X937	X938	X939	X940	X941	X942	X943	X944
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- Molecule 5: disordered segment of collectrin homology domain

Chain E: 

X945	X946	X947	X948	X949	X950	X951	X952	X953	X954	X955	X956	X957	X958
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4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	100.53Å 86.51Å 105.86Å 90.00° 103.65° 90.00°	Depositor
Resolution (Å)	43.26 – 3.00 43.25 – 2.60	Depositor EDS
% Data completeness (in resolution range)	96.8 (43.26-3.00) 78.2 (43.25-2.60)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.07	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.57 (at 2.61Å)	Xtriage
Refinement program	CNX 2002	Depositor
R, R_{free}	0.253 , 0.337 0.242 , 0.325	Depositor DCC
R_{free} test set	1730 reflections (11.16%)	DCC
Wilson B-factor (Å ²)	60.0	Xtriage
Anisotropy	0.523	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 81.1	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Outliers	0 of 21327 reflections	Xtriage
F_o, F_c correlation	0.90	EDS
Total number of atoms	5218	wwPDB-VP
Average B, all atoms (Å ²)	73.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.46% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: ZN, NAG, XX5, CL

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	0.40	0/4989	0.69	0/6779

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	510	TYR	Sidechain

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	4853	0	4619	561	1

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	B	31	0	9	5	0
3	C	101	0	32	12	0
4	D	91	0	21	1	0
5	E	71	0	17	3	0
6	A	28	0	26	3	0
7	A	1	0	0	1	0
8	A	1	0	0	0	0
9	A	28	0	21	1	0
10	A	13	0	0	0	0
All	All	5218	0	4745	577	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 58.

The worst 5 of 577 close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
2:B:905:UNK:HA	3:C:907:UNK:HA	1.36	1.07
1:A:97:LEU:HD12	1:A:101:GLN:HE21	1.26	0.96
1:A:287:GLN:HE22	1:A:288:LYS:HG2	1.31	0.94
1:A:177:ARG:HB3	1:A:178:PRO:HD3	1.49	0.92
1:A:86:GLN:HE21	1:A:87:GLU:N	1.65	0.92

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)
1:A:582:ARG:NH1	1:A:582:ARG:NH1[2_655]	2.02	0.18

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	595/615 (97%)	400 (67%)	129 (22%)	66 (11%)	1 3

5 of 66 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	55	THR
1	A	85	LEU
1	A	86	GLN
1	A	91	LEU
1	A	110	GLU

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	523/542 (96%)	445 (85%)	78 (15%)	4 20

5 of 78 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	385	TYR
1	A	416	LYS
1	A	571	GLU
1	A	388	GLN
1	A	394	ASN

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 43 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	194	ASN
1	A	330	ASN
1	A	552	GLN
1	A	239	HIS
1	A	250	ASN

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 ⓘ

Of 5 ligands modelled in this entry, 2 are monoatomic - leaving 3 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the chemical component dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
6	NAG	A	800	1	12,14,15	0.48	0	15,19,21	0.89	0
6	NAG	A	801	1	12,14,15	0.44	0	15,19,21	0.63	0
9	XX5	A	804	8	29,29,29	1.84	8 (27%)	40,40,40	1.91	8 (20%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the chemical component dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
6	NAG	A	800	1	1/1/5/7	0/6/23/26	0/1/1/1
6	NAG	A	801	1	-	0/6/23/26	0/1/1/1
9	XX5	A	804	8	-	0/24/24/24	0/2/2/2

The worst 5 of 8 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
9	A	804	XX5	C26-C27	4.50	1.46	1.38
9	A	804	XX5	C22-C23	3.97	1.45	1.38
9	A	804	XX5	C26-C21	3.24	1.45	1.39
9	A	804	XX5	C20-N19	2.44	1.53	1.48
9	A	804	XX5	C27-CL28	2.40	1.80	1.74

The worst 5 of 8 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
9	A	804	XX5	C21-C20-N19	5.99	121.78	112.43
9	A	804	XX5	C18-N19-C15	-5.06	101.58	110.40
9	A	804	XX5	C14-C15-C16	-3.24	124.85	130.57
9	A	804	XX5	C20-N19-C18	2.70	129.43	125.66
9	A	804	XX5	C26-C27-CL28	2.46	122.18	119.14

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
6	A	800	NAG	C1

There are no torsion outliers.

There are no ring outliers.

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, 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(Å ²)	Q<0.9
1	A	597/615 (97%)	-0.18	2 (0%) 91 48	35, 68, 111, 154	0
2	B	0/6	-	-	-	-
3	C	0/20	-	-	-	-
4	D	0/18	-	-	-	-
5	E	0/14	-	-	-	-
All	All	597/673 (88%)	-0.18	2 (0%) 91 48	35, 68, 111, 154	0

All (2) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	100	LEU	2.1
1	A	91	LEU	2.0

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 ⓘ

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled ‘Q< 0.9’ lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSR	LLDF	B-factors(\AA^2)	Q<0.9
9	XX5	A	804	28/28	0.27	0.59	34,43,51,52	0
6	NAG	A	801	14/15	0.17	-0.60	115,122,128,129	0
6	NAG	A	800	14/15	0.19	-0.63	128,131,133,134	0
7	CL	A	802	1/1	0.12	-2.09	54,54,54,54	0
8	ZN	A	803	1/1	0.14	-6.36	37,37,37,37	0

6.5 Other polymers

There are no such residues in this entry.