



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 5, 2024 – 07:42 AM EST

PDB ID : 1WAS  
Title : THE THREE-DIMENSIONAL STRUCTURE OF THE LIGAND-BINDING DOMAIN OF A WILD-TYPE BACTERIAL CHEMOTAXIS RECEPTOR  
Authors : Kim, S.-H.  
Deposited on : 1993-03-09  
Resolution : 2.70 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  
Xtrriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.36

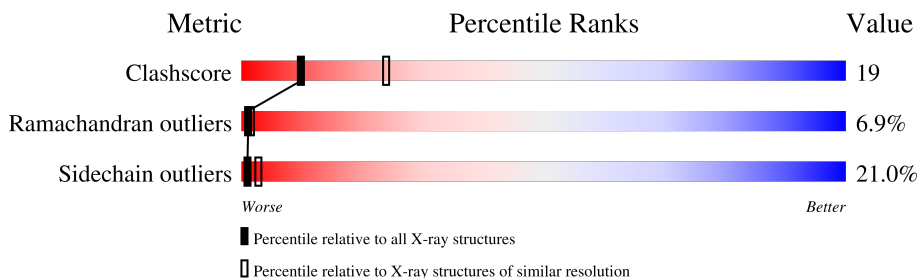
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.70 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))
Clashscore	141614	3122 (2.70-2.70)
Ramachandran outliers	138981	3069 (2.70-2.70)
Sidechain outliers	138945	3069 (2.70-2.70)

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  $\leq 5\%$

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	146	

## 2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 1144 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 BACTERIAL ASPARTATE RECEPTOR.

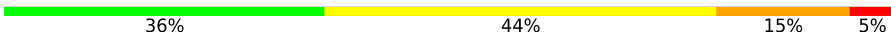
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	146	1144	703	204	228	9	5	0	0

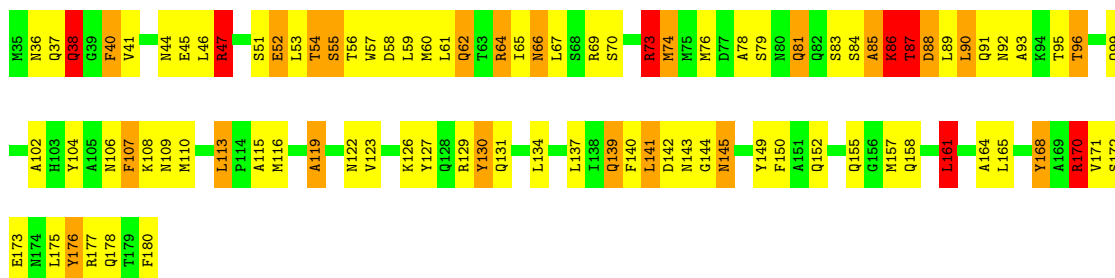
### 3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. 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. 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.

Note EDS was not executed.

- Molecule 1: BACTERIAL ASPARTATE RECEPTOR

Chain A: 



## 4 Data and refinement statistics

Xtrriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	I 41	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	65.05Å 65.05Å 72.37Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	(Not available) – 2.70	Depositor
% Data completeness (in resolution range)	(Not available) ((Not available)-2.70)	Depositor
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	X-PLOR	Depositor
R, $R_{free}$	0.192 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	1144	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	31.0	wwPDB-VP

## 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	1.65	7/1160 (0.6%)	2.18	46/1565 (2.9%)

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

All (7) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	127	TYR	CE2-CZ	-8.02	1.28	1.38
1	A	150	PHE	CB-CG	6.74	1.62	1.51
1	A	172	SER	CA-CB	-5.99	1.44	1.52
1	A	55	SER	CB-OG	-5.59	1.34	1.42
1	A	109	ASN	CB-CG	5.56	1.63	1.51
1	A	52	GLU	CB-CG	5.55	1.62	1.52
1	A	88	ASP	CB-CG	5.34	1.62	1.51

All (46) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	130	TYR	CB-CG-CD2	-11.25	114.25	121.00
1	A	47	ARG	NE-CZ-NH2	-10.40	115.10	120.30
1	A	170	ARG	NE-CZ-NH2	-9.04	115.78	120.30
1	A	130	TYR	CB-CG-CD1	8.36	126.02	121.00
1	A	175	LEU	CA-CB-CG	7.63	132.85	115.30
1	A	168	TYR	CB-CG-CD2	-7.50	116.50	121.00
1	A	127	TYR	CB-CG-CD2	-7.50	116.50	121.00
1	A	157	MET	CG-SD-CE	-7.36	88.43	100.20
1	A	54	THR	CA-C-N	7.09	132.79	117.20

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	47	ARG	NE-CZ-NH1	7.01	123.80	120.30
1	A	40	PHE	CA-CB-CG	-6.93	97.26	113.90
1	A	57	TRP	CE2-CD2-CG	-6.88	101.80	107.30
1	A	104	TYR	CG-CD2-CE2	-6.84	115.83	121.30
1	A	47	ARG	CA-CB-CG	6.83	128.42	113.40
1	A	85	ALA	CA-C-N	-6.59	102.71	117.20
1	A	86	LYS	N-CA-C	6.47	128.46	111.00
1	A	52	GLU	OE1-CD-OE2	-6.28	115.77	123.30
1	A	36	ASN	CA-C-N	-6.26	103.43	117.20
1	A	87	THR	CA-CB-CG2	6.18	121.05	112.40
1	A	161	LEU	CA-CB-CG	6.12	129.38	115.30
1	A	90	LEU	CB-CG-CD1	-6.11	100.62	111.00
1	A	150	PHE	O-C-N	-5.91	113.25	122.70
1	A	130	TYR	O-C-N	-5.86	113.32	122.70
1	A	57	TRP	NE1-CE2-CD2	5.81	113.11	107.30
1	A	127	TYR	CB-CG-CD1	5.79	124.47	121.00
1	A	73	ARG	O-C-N	-5.72	113.54	122.70
1	A	119	ALA	N-CA-C	-5.57	95.95	111.00
1	A	168	TYR	CB-CG-CD1	5.57	124.34	121.00
1	A	104	TYR	CB-CG-CD1	-5.54	117.67	121.00
1	A	81	GLN	CA-C-N	-5.42	105.27	117.20
1	A	61	LEU	CA-C-N	5.37	129.01	117.20
1	A	58	ASP	CA-CB-CG	5.37	125.21	113.40
1	A	157	MET	CA-CB-CG	-5.34	104.23	113.30
1	A	83	SER	N-CA-C	-5.24	96.85	111.00
1	A	107	PHE	CA-C-N	5.23	128.71	117.20
1	A	122	ASN	CB-CG-ND2	5.23	129.24	116.70
1	A	85	ALA	N-CA-C	5.22	125.11	111.00
1	A	54	THR	O-C-N	-5.16	114.45	122.70
1	A	180	PHE	N-CA-C	-5.16	97.08	111.00
1	A	88	ASP	O-C-N	-5.09	114.55	122.70
1	A	73	ARG	CA-C-N	5.08	128.38	117.20
1	A	131	GLN	CG-CD-NE2	5.07	128.87	116.70
1	A	41	VAL	CA-CB-CG1	-5.07	103.29	110.90
1	A	90	LEU	CB-CA-C	-5.05	100.61	110.20
1	A	38	GLN	N-CA-C	5.02	124.56	111.00
1	A	110	MET	CA-CB-CG	5.01	121.81	113.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	113	LEU	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	1144	0	1103	43	0
All	All	1144	0	1103	43	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 19.

All (43) 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:69:ARG:O	1:A:73:ARG:HB2	1.90	0.71
1:A:130:TYR:HD2	1:A:161:LEU:HD12	1.59	0.67
1:A:130:TYR:CD2	1:A:161:LEU:HD12	2.32	0.65
1:A:44:ASN:O	1:A:47:ARG:HG3	1.97	0.64
1:A:62:GLN:HA	1:A:65:ILE:HD12	1.80	0.63
1:A:69:ARG:HB3	1:A:89:LEU:HD23	1.82	0.62
1:A:92:ASN:O	1:A:96:THR:HB	2.03	0.58
1:A:86:LYS:O	1:A:88:ASP:N	2.38	0.57
1:A:170:ARG:HG3	1:A:171:VAL:HG23	1.85	0.57
1:A:95:THR:O	1:A:99:GLN:HG3	2.06	0.55
1:A:53:LEU:HD21	1:A:123:VAL:HG11	1.90	0.54
1:A:126:LYS:HG3	1:A:164:ALA:HB2	1.89	0.53
1:A:113:LEU:O	1:A:116:MET:HG2	2.11	0.51
1:A:139:GLN:O	1:A:143:ASN:HB2	2.11	0.51
1:A:70:SER:O	1:A:74:MET:SD	2.69	0.50
1:A:86:LYS:HA	1:A:90:LEU:HB2	1.93	0.50
1:A:141:LEU:HD13	1:A:149:TYR:CD2	2.47	0.50
1:A:96:THR:HA	1:A:99:GLN:HE21	1.76	0.50
1:A:126:LYS:O	1:A:129:ARG:HG2	2.12	0.49
1:A:126:LYS:HG3	1:A:164:ALA:CB	2.43	0.48
1:A:140:PHE:CD2	1:A:149:TYR:HA	2.50	0.47
1:A:119:ALA:HB1	1:A:168:TYR:HD1	1.79	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:137:LEU:N	1:A:137:LEU:HD23	2.30	0.46
1:A:90:LEU:HD11	1:A:142:ASP:HB3	1.97	0.46
1:A:67:LEU:HD13	1:A:137:LEU:HD12	1.97	0.45
1:A:66:ASN:HB2	1:A:93:ALA:HB2	1.98	0.45
1:A:56:THR:O	1:A:60:MET:HG3	2.17	0.45
1:A:170:ARG:HG3	1:A:171:VAL:N	2.31	0.44
1:A:51:SER:O	1:A:54:THR:HB	2.17	0.44
1:A:88:ASP:HB3	1:A:89:LEU:HD12	1.99	0.44
1:A:79:SER:O	1:A:81:GLN:N	2.52	0.43
1:A:119:ALA:HB1	1:A:168:TYR:CD1	2.54	0.43
1:A:137:LEU:HD21	1:A:152:GLN:NE2	2.34	0.43
1:A:52:GLU:HA	1:A:55:SER:OG	2.19	0.42
1:A:102:ALA:O	1:A:106:ASN:ND2	2.51	0.42
1:A:173:GLU:O	1:A:176:TYR:N	2.52	0.42
1:A:88:ASP:O	1:A:91:GLN:HG3	2.21	0.41
1:A:59:LEU:HD11	1:A:99:GLN:NE2	2.36	0.41
1:A:115:ALA:HB3	1:A:116:MET:HE3	2.02	0.41
1:A:64:ARG:NH1	1:A:158:GLN:OE1	2.54	0.40
1:A:173:GLU:O	1:A:177:ARG:N	2.54	0.40
1:A:90:LEU:CD1	1:A:142:ASP:HB3	2.51	0.40
1:A:113:LEU:O	1:A:115:ALA:N	2.54	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	144/146 (99%)	108 (75%)	26 (18%)	10 (7%)	<b>1</b> <b>1</b>

All (10) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	38	GLN
1	A	85	ALA
1	A	87	THR
1	A	78	ALA
1	A	145	ASN
1	A	37	GLN
1	A	178	GLN
1	A	40	PHE
1	A	86	LYS
1	A	144	GLY

### 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	119/119 (100%)	94 (79%)	25 (21%)	<b>1</b> <b>3</b>

All (25) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	38	GLN
1	A	45	GLU
1	A	46	LEU
1	A	47	ARG
1	A	62	GLN
1	A	64	ARG
1	A	66	ASN
1	A	73	ARG
1	A	74	MET
1	A	76	MET
1	A	84	SER
1	A	86	LYS
1	A	87	THR
1	A	96	THR
1	A	107	PHE
1	A	108	LYS
1	A	134	LEU

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Mol	Chain	Res	Type
1	A	139	GLN
1	A	141	LEU
1	A	145	ASN
1	A	155	GLN
1	A	161	LEU
1	A	165	LEU
1	A	170	ARG
1	A	176	TYR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	62	GLN
1	A	81	GLN
1	A	99	GLN
1	A	152	GLN
1	A	167	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 [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

EDS was not executed - this section is therefore empty.

### 6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

EDS was not executed - this section is therefore empty.

### 6.3 Carbohydrates [i](#)

EDS was not executed - this section is therefore empty.

### 6.4 Ligands [i](#)

EDS was not executed - this section is therefore empty.

### 6.5 Other polymers [i](#)

EDS was not executed - this section is therefore empty.