



# wwPDB X-ray Structure Validation Summary Report ⓘ

Jan 31, 2016 – 11:33 PM GMT

PDB ID : 1XS2  
Title : Structural Basis for Catalytic Racemization and Substrate Specificity of an N-Acylamino Acid Racemase Homologue from *Deinococcus radiodurans*  
Authors : Wang, W.-C.; Chiu, W.-C.; Hsu, S.-K.; Wu, C.-L.; Chen, C.-Y.; Liu, J.-S.; Hsu, W.-H.  
Deposited on : 2004-10-18  
Resolution : 2.30 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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/validation/2016/XrayValidationReportHelp>  
with specific help available everywhere you see the ⓘ symbol.

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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 : 1.7 (RC4), CSD as536be (2015)  
Xtrriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : trunk26865

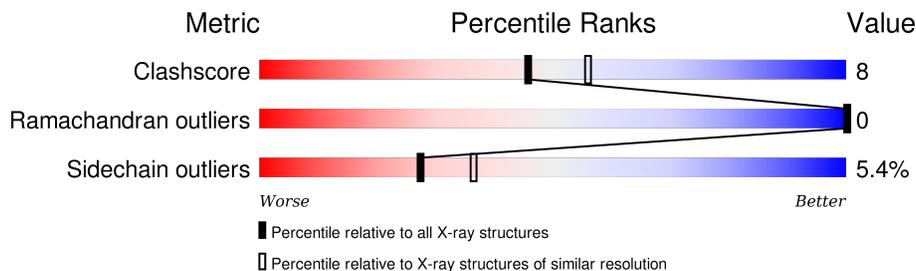
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.30 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	102246	4452 (2.30-2.30)
Ramachandran outliers	100387	4410 (2.30-2.30)
Sidechain outliers	100360	4409 (2.30-2.30)

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. 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.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	375	 81% 13% . .
1	B	375	 82% 12% . .
1	C	375	 81% 13% . .
1	D	375	 81% 15% . .

## 2 Entry composition i

There are 3 unique types of molecules in this entry. The entry contains 11768 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 N-Acylamino Acid Racemase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	360	2766	1733	507	516	10	0	0	0
1	B	360	2766	1733	507	516	10	0	0	0
1	C	360	2766	1733	507	516	10	0	0	0
1	D	360	2766	1733	507	516	10	0	0	0

There are 20 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	94	SER	ALA	SEE REMARK 999	UNP Q9RYA6
A	148	ASP	GLY	SEE REMARK 999	UNP Q9RYA6
A	158	ARG	LYS	SEE REMARK 999	UNP Q9RYA6
A	252	SER	ALA	SEE REMARK 999	UNP Q9RYA6
A	315	SER	PRO	SEE REMARK 999	UNP Q9RYA6
B	94	SER	ALA	SEE REMARK 999	UNP Q9RYA6
B	148	ASP	GLY	SEE REMARK 999	UNP Q9RYA6
B	158	ARG	LYS	SEE REMARK 999	UNP Q9RYA6
B	252	SER	ALA	SEE REMARK 999	UNP Q9RYA6
B	315	SER	PRO	SEE REMARK 999	UNP Q9RYA6
C	94	SER	ALA	SEE REMARK 999	UNP Q9RYA6
C	148	ASP	GLY	SEE REMARK 999	UNP Q9RYA6
C	158	ARG	LYS	SEE REMARK 999	UNP Q9RYA6
C	252	SER	ALA	SEE REMARK 999	UNP Q9RYA6
C	315	SER	PRO	SEE REMARK 999	UNP Q9RYA6
D	94	SER	ALA	SEE REMARK 999	UNP Q9RYA6
D	148	ASP	GLY	SEE REMARK 999	UNP Q9RYA6
D	158	ARG	LYS	SEE REMARK 999	UNP Q9RYA6
D	252	SER	ALA	SEE REMARK 999	UNP Q9RYA6
D	315	SER	PRO	SEE REMARK 999	UNP Q9RYA6

- Molecule 2 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	B	1	Total 1	Mg 1	0	0
2	A	1	Total 1	Mg 1	0	0
2	D	1	Total 1	Mg 1	0	0
2	C	1	Total 1	Mg 1	0	0

- Molecule 3 is water.

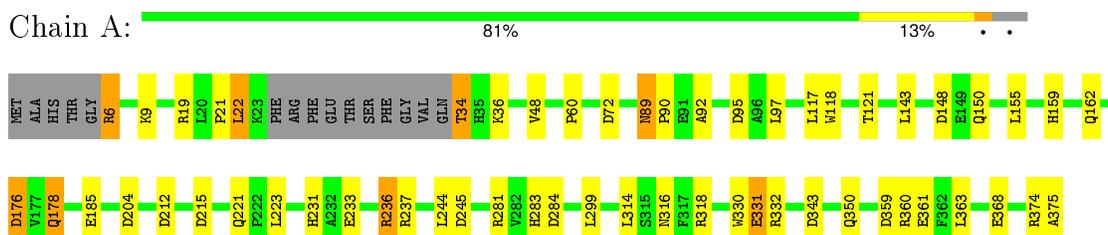
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	202	Total 202	O 202	0	0
3	B	207	Total 207	O 207	0	0
3	C	143	Total 143	O 143	0	0
3	D	148	Total 148	O 148	0	0

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

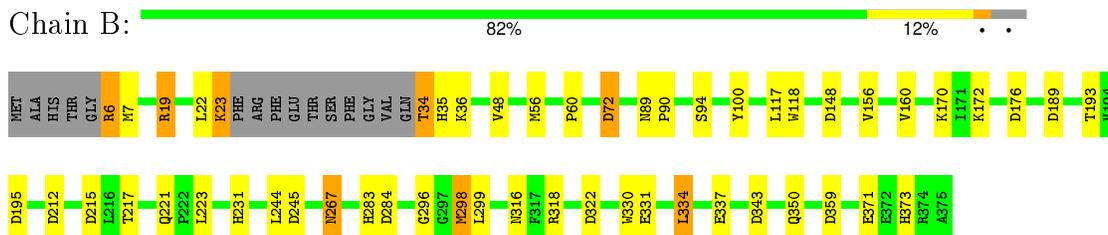
These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according 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.

Note EDS was not executed.

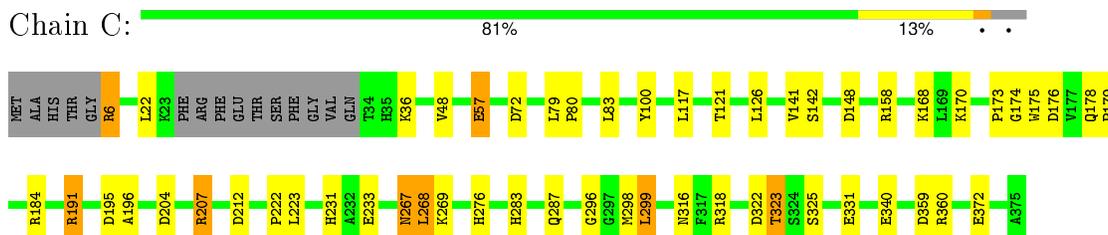
- Molecule 1: N-Acylamino Acid Racemase



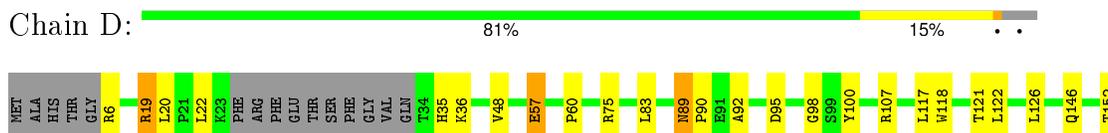
- Molecule 1: N-Acylamino Acid Racemase

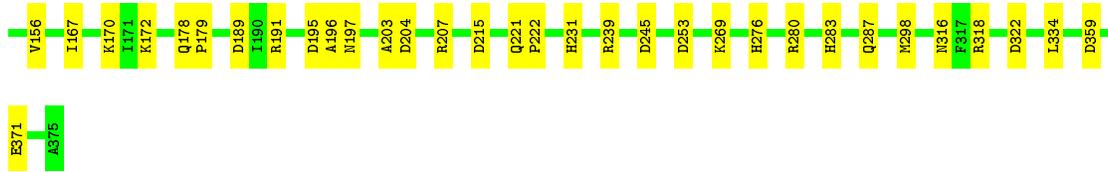


- Molecule 1: N-Acylamino Acid Racemase



- Molecule 1: N-Acylamino Acid Racemase





## 4 Data and refinement statistics

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

Property	Value	Source
Space group	P 4	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	116.67Å 116.67Å 120.62Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	30.00 – 2.30	Depositor
% Data completeness (in resolution range)	98.8 (30.00-2.30)	Depositor
$R_{merge}$	0.10	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	REFMAC 5.1.24	Depositor
R, $R_{free}$	0.173 , 0.238	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	11768	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	34.0	wwPDB-VP

## 5 Model quality [i](#)

### 5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: MG

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	0.68	0/2817	0.86	11/3822 (0.3%)
1	B	0.66	0/2817	0.83	10/3822 (0.3%)
1	C	0.62	0/2817	0.80	6/3822 (0.2%)
1	D	0.62	0/2817	0.80	9/3822 (0.2%)
All	All	0.64	0/11268	0.82	36/15288 (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

There are no bond length outliers.

The worst 5 of 36 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	195	ASP	CB-CG-OD2	6.81	124.43	118.30
1	B	189	ASP	CB-CG-OD2	6.38	124.04	118.30
1	C	148	ASP	CB-CG-OD2	6.37	124.04	118.30
1	A	148	ASP	CB-CG-OD2	6.36	124.03	118.30
1	B	343	ASP	CB-CG-OD2	6.18	123.86	118.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	97	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	2766	0	2769	47	0
1	B	2766	0	2769	43	0
1	C	2766	0	2769	50	0
1	D	2766	0	2769	34	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0
2	D	1	0	0	0	0
3	A	202	0	0	7	0
3	B	207	0	0	12	1
3	C	143	0	0	14	0
3	D	148	0	0	6	1
All	All	11768	0	11076	171	1

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 8.

The worst 5 of 171 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:283:HIS:HE1	1:A:316:ASN:H	1.08	1.00
1:C:287:GLN:NE2	1:C:318:ARG:HH11	1.60	0.98
1:A:178:GLN:HE21	1:A:178:GLN:H	1.07	0.97
1:C:283:HIS:HE1	1:C:316:ASN:H	1.17	0.88
1:A:221:GLN:NE2	1:A:245:ASP:H	1.72	0.88

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	Interatomic distance (Å)	Clash overlap (Å)
3:B:2462:HOH:O	3:D:4522:HOH:O[3_555]	2.05	0.15

## 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	356/375 (95%)	343 (96%)	13 (4%)	0	100	100
1	B	356/375 (95%)	342 (96%)	14 (4%)	0	100	100
1	C	356/375 (95%)	342 (96%)	14 (4%)	0	100	100
1	D	356/375 (95%)	344 (97%)	12 (3%)	0	100	100
All	All	1424/1500 (95%)	1371 (96%)	53 (4%)	0	100	100

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	284/296 (96%)	268 (94%)	16 (6%)	26	35
1	B	284/296 (96%)	268 (94%)	16 (6%)	26	35
1	C	284/296 (96%)	266 (94%)	18 (6%)	22	29
1	D	284/296 (96%)	273 (96%)	11 (4%)	39	53
All	All	1136/1184 (96%)	1075 (95%)	61 (5%)	27	36

5 of 61 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	298	MET
1	C	36	LYS
1	D	172	LYS

*Continued on next page...*

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Mol	Chain	Res	Type
1	B	299	LEU
1	B	334	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 32 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	267	ASN
1	B	373	HIS
1	D	231	HIS
1	B	316	ASN
1	C	35	HIS

### 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](#)

Of 4 ligands modelled in this entry, 4 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

## 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

EDS was not executed - this section will therefore be empty.

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

EDS was not executed - this section will therefore be empty.

### 6.3 Carbohydrates

EDS was not executed - this section will therefore be empty.

### 6.4 Ligands

EDS was not executed - this section will therefore be empty.

### 6.5 Other polymers

EDS was not executed - this section will therefore be empty.