



# wwPDB X-ray Structure Validation Summary Report ⓘ

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PDB ID : 3RC4  
Title : Molecular mechanisms of viral and host-cell substrate recognition by HCV  
NS3/4A protease  
Authors : Romano, K.P.; Schiffer, C.A.  
Deposited on : 2011-03-30  
Resolution : 1.50 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

<https://www.wwpdb.org/validation/2017/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	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.11
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)	:	2.11

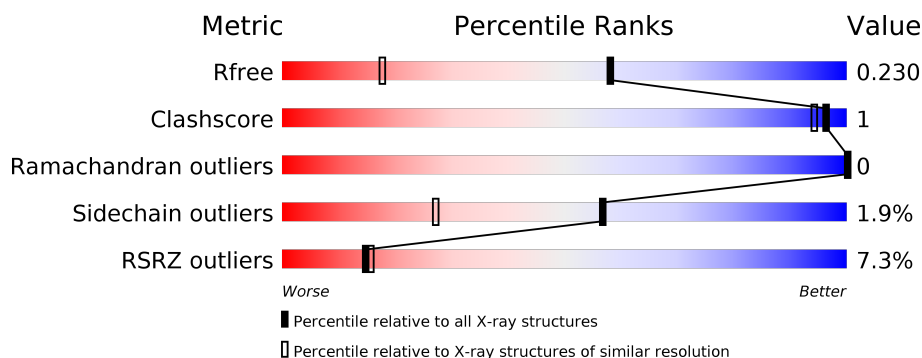
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 1.50 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	2936 (1.50-1.50)
Clashscore	141614	3144 (1.50-1.50)
Ramachandran outliers	138981	3066 (1.50-1.50)
Sidechain outliers	138945	3064 (1.50-1.50)
RSRZ outliers	127900	2884 (1.50-1.50)

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 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	203	<div> <div>4%</div> <div> <div></div> <div>95%</div> <div>••</div> </div> </div>
2	B	13	<div> <div>46%</div> <div> <div>31%</div> <div>15%</div> <div>54%</div> </div> </div>

## 2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 1645 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 NS3/4A Protease.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	199	Total	C	N	O	S	0	1	0
			1440	892	263	277	8			

There are 36 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	980	GLY	-	expression tag	UNP D6MZ98
A	981	SER	-	expression tag	UNP D6MZ98
A	982	HIS	-	expression tag	UNP D6MZ98
A	983	MET	-	expression tag	UNP D6MZ98
A	984	ALA	-	expression tag	UNP D6MZ98
A	985	SER	-	expression tag	UNP D6MZ98
A	986	MET	-	expression tag	UNP D6MZ98
A	987	LYS	-	expression tag	UNP D6MZ98
A	988	LYS	-	expression tag	UNP D6MZ98
A	989	LYS	-	expression tag	UNP D6MZ98
A	990	GLY	-	expression tag	UNP D6MZ98
A	991	SER	-	expression tag	UNP D6MZ98
A	992	VAL	-	expression tag	UNP D6MZ98
A	993	VAL	-	expression tag	UNP D6MZ98
A	994	ILE	-	expression tag	UNP D6MZ98
A	995	VAL	-	expression tag	UNP D6MZ98
A	996	GLY	-	expression tag	UNP D6MZ98
A	997	ARG	-	expression tag	UNP D6MZ98
A	998	ILE	-	expression tag	UNP D6MZ98
A	999	ASN	-	expression tag	UNP D6MZ98
A	1001	SER	ALA	engineered mutation	UNP D6MZ98
A	1002	GLY	PRO	engineered mutation	UNP D6MZ98
A	1003	ASP	ILE	engineered mutation	UNP D6MZ98
A	1013	GLU	LEU	engineered mutation	UNP D6MZ98
A	1014	GLU	LEU	engineered mutation	UNP D6MZ98
A	1017	GLN	ILE	engineered mutation	UNP D6MZ98
A	1018	GLU	VAL	engineered mutation	UNP D6MZ98

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Chain	Residue	Modelled	Actual	Comment	Reference
A	1021	GLN	LEU	engineered mutation	UNP D6MZ98
A	1047	SER	CYS	engineered mutation	UNP D6MZ98
A	1052	LEU	CYS	engineered mutation	UNP D6MZ98
A	1072	THR	ILE	engineered mutation	UNP D6MZ98
A	1080	LYS	GLN	engineered mutation	UNP D6MZ98
A	1086	GLN	PRO	engineered mutation	UNP D6MZ98
A	1091	SER	ALA	engineered mutation	UNP D6MZ98
A	1139	ALA	SER	engineered mutation	UNP D6MZ98
A	1159	SER	CYS	engineered mutation	UNP D6MZ98

- Molecule 2 is a protein called Product TRIF.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	6	Total	C	N	O	S	0	0	0
			40	23	6	10	1			

- Molecule 3 is SULFATE ION (three-letter code: SO4) (formula: O<sub>4</sub>S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	O	S	0	0
			5	4	1		

- Molecule 4 is ZINC ION (three-letter code: ZN) (formula: Zn).

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

- Molecule 5 is water.

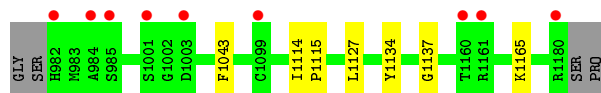
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	153	Total 158	O 158	0	5
5	B	1	Total 1	O 1	0	0

### 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 the various outlier classes 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.

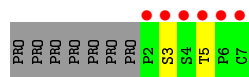
- Molecule 1: NS3/4A Protease

Chain A: 



- Molecule 2: Product TRIF

Chain B: 



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	53.90Å 58.15Å 61.30Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	17.24 – 1.50 17.24 – 1.50	Depositor EDS
% Data completeness (in resolution range)	87.1 (17.24-1.50) 87.2 (17.24-1.50)	Depositor EDS
$R_{merge}$	0.05	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.78 (at 1.50Å)	Xtriage
Refinement program	REFMAC	Depositor
R, $R_{free}$	0.186 , 0.215 0.195 , 0.230	Depositor DCC
$R_{free}$ test set	1416 reflections (5.12%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	20.1	Xtriage
Anisotropy	0.070	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.46 , 60.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	1645	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	30.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 16.19% 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

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: ZN, SO4

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	0.46	0/1467	0.64	0/1996
2	B	0.47	0/41	0.50	0/54
All	All	0.46	0/1508	0.64	0/2050

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

### 5.2 Too-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 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	1440	0	1425	3	0
2	B	40	0	36	0	0
3	A	5	0	0	0	0
4	A	1	0	0	0	0
5	A	158	0	0	0	0
5	B	1	0	0	0	0
All	All	1645	0	1461	3	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 1.

All (3) 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:1114:ILE:HD11	1:A:1134:TYR:HE2	1.80	0.47
1:A:1115:PRO:HB2	1:A:1127:LEU:HD22	1.97	0.46
1:A:1043:PHE:HA	1:A:1137:GLY:O	2.21	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	198/203 (98%)	197 (100%)	1 (0%)	0	100	100
2	B	4/13 (31%)	3 (75%)	1 (25%)	0	100	100
All	All	202/216 (94%)	200 (99%)	2 (1%)	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	152/164 (93%)	151 (99%)	1 (1%)	84	69
2	B	6/13 (46%)	4 (67%)	2 (33%)	0	0
All	All	158/177 (89%)	155 (98%)	3 (2%)	57	27

All (3) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1165	LYS
2	B	3	SER
2	B	5	THR

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	1027	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 carbohydrates in this entry.

## 5.6 Ligand geometry [i](#)

Of 2 ligands modelled in this entry, 1 is monoatomic - leaving 1 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	$\# Z  > 2$
3	SO4	A	1	-	4,4,4	0.12	0	6,6,6	0.30	0

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 [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

## 6 Fit of model and data [i](#)

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

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	199/203 (98%)	0.14	9 (4%) 33 36	16, 26, 48, 62	0
2	B	6/13 (46%)	5.05	6 (100%) 0 0	48, 55, 59, 60	0
All	All	205/216 (94%)	0.28	15 (7%) 15 16	16, 26, 55, 62	0

The worst 5 of 15 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	2	PRO	8.4
2	B	4	SER	6.1
2	B	3	SER	5.0
2	B	6	PRO	4.1
2	B	5	THR	3.8

### 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 carbohydrates in this entry.

### 6.4 Ligands [i](#)

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. The B-factors column lists the minimum, median, 95<sup>th</sup> 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	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
4	ZN	A	1183	1/1	0.97	0.06	28,28,28,28	0
3	SO4	A	1	5/5	0.98	0.08	24,26,28,30	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.