



# wwPDB X-ray Structure Validation Summary Report ⓘ

Jun 24, 2025 – 07:01 pm BST

PDB ID : 5EOC / pdb\_00005eoc  
Title : Crystal structure of Fab C2 in complex with a Cyclic variant of Hepatitis C Virus E2 epitope I  
Authors : Berisio, R.; Ruggiero, A.; Sandomenico, A.; Patel, A.H.; Ruvo, M.; Vitagliano, L.  
Deposited on : 2015-11-10  
Resolution : 1.98 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.

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	:	4-5-2 with Phenix2.0rc1
Xtriage (Phenix)	:	2.0rc1
EDS	:	3.0
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.003 (Gargrove)
Density-Fitness	:	1.0.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.44

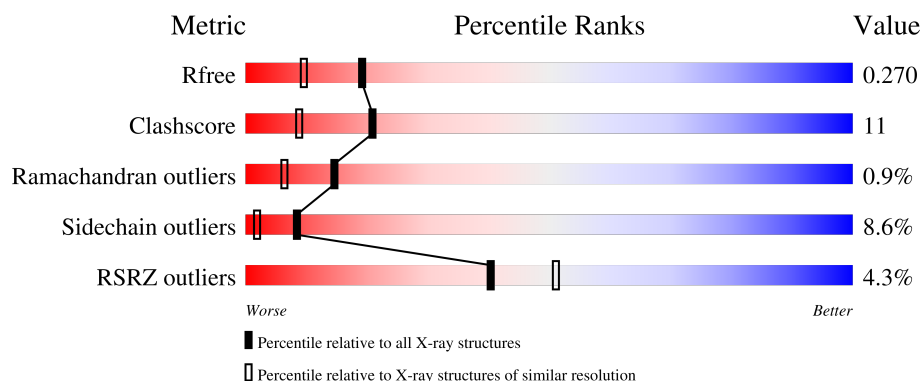
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*






The reported resolution of this entry is 1.98 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))
$R_{free}$	164625	1356 (1.98-1.98)
Clashscore	180529	1437 (1.98-1.98)
Ramachandran outliers	177936	1426 (1.98-1.98)
Sidechain outliers	177891	1426 (1.98-1.98)
RSRZ outliers	164620	1356 (1.98-1.98)

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  $\leq 5\%$ . 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	H	217	
2	L	216	
2	M	216	
3	J	217	
4	P	14	

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Mol	Chain	Length	Quality of chain
4	Q	14	<div><div></div><div>50%</div><div>57%</div><div>21%</div><div>7%</div><div>7%</div><div>7%</div></div>

## 2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 7216 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 Fab fragment (Heavy chain).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	H	212	Total	C	N	O	S	0	0	0
			1597	1010	264	315	8			

- Molecule 2 is a protein called Fab fragment (Light chain).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	L	216	Total	C	N	O	S	0	1	0
			1670	1038	291	335	6			
2	M	215	Total	C	N	O	S	0	0	0
			1655	1031	285	333	6			

- Molecule 3 is a protein called Fab fragment (Heavy chain).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	J	214	Total	C	N	O	S	0	0	0
			1614	1020	267	318	9			

- Molecule 4 is a protein called ALA-CYS-GLN-LEU-ILE-ASN-THR-ASN-GLY-SER-TRP-HIS-ILE-CYS.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	P	13	Total	C	N	O	S	0	0	0
			102	63	19	18	2			
4	Q	13	Total	C	N	O	S	0	0	0
			102	63	19	18	2			

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	H	134	Total	O	0	0
			134	134		

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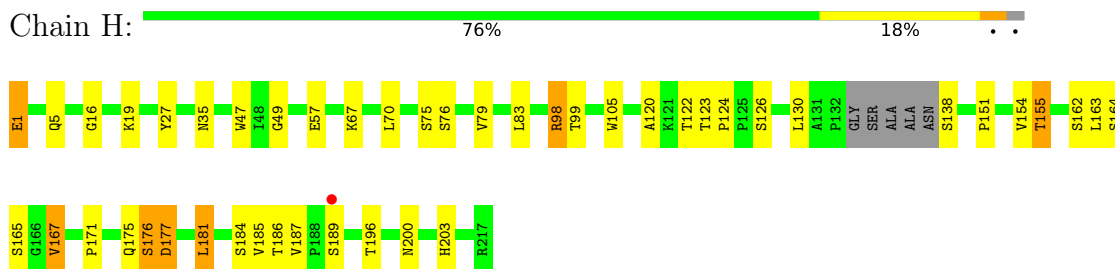
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	L	99	Total 99	O 99	0	0
5	J	123	Total 123	O 123	0	0
5	M	116	Total 116	O 116	0	0
5	P	1	Total 1	O 1	0	0
5	Q	3	Total 3	O 3	0	0

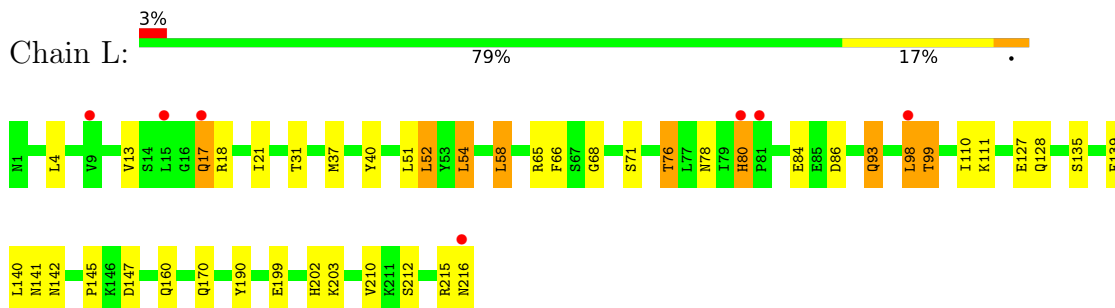
### 3 Residue-property plots [i](#)

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 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.

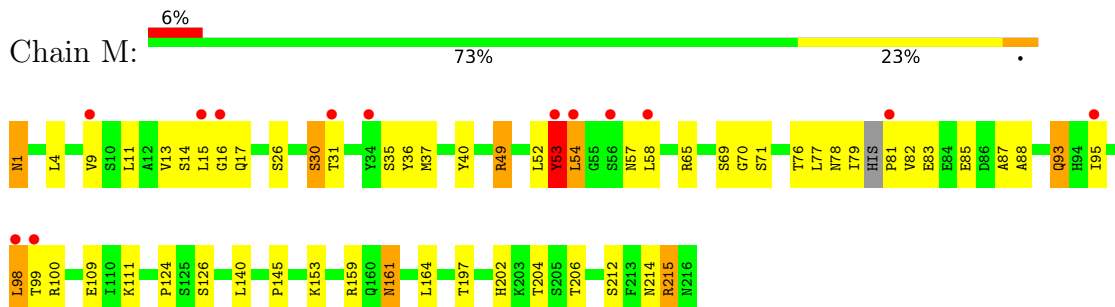
- Molecule 1: Fab fragment (Heavy chain)



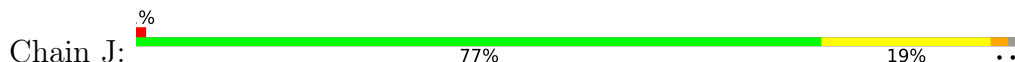
- Molecule 2: Fab fragment (Light chain)

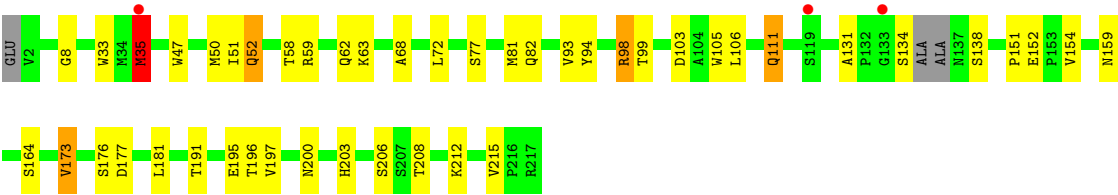


- Molecule 2: Fab fragment (Light chain)

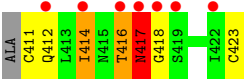


- Molecule 3: Fab fragment (Heavy chain)

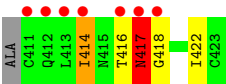




• Molecule 4: ALA-CYS-GLN-LEU-ILE-ASN-THR-ASN-GLY-SER-TRP-HIS-ILE-CYS



• Molecule 4: ALA-CYS-GLN-LEU-ILE-ASN-THR-ASN-GLY-SER-TRP-HIS-ILE-CYS



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	54.97Å 56.19Å 77.15Å 90.35° 90.18° 94.98°	Depositor
Resolution (Å)	15.00 – 1.98 15.00 – 1.98	Depositor EDS
% Data completeness (in resolution range)	92.3 (15.00-1.98) 92.3 (15.00-1.98)	Depositor EDS
$R_{merge}$	0.08	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.51 (at 1.98Å)	Xtriage
Refinement program	REFMAC 5.5.0110	Depositor
R, $R_{free}$	0.234 , 0.266 0.237 , 0.270	Depositor DCC
$R_{free}$ test set	2995 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	26.7	Xtriage
Anisotropy	0.074	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.43 , 55.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.018 for -h,-k,l 0.013 for k,h,-l 0.032 for -k,-h,-l	Xtriage
$F_o, F_c$ correlation	0.93	EDS
Total number of atoms	7216	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	36.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.11% 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 [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	H	0.89	0/1640	0.92	0/2247
2	L	0.80	0/1710	0.86	0/2320
2	M	0.82	0/1691	0.92	2/2293 (0.1%)
3	J	0.87	0/1657	0.97	5/2267 (0.2%)
4	P	0.66	0/104	1.24	1/141 (0.7%)
4	Q	0.65	0/104	1.24	2/141 (1.4%)
All	All	0.84	0/6906	0.93	10/9409 (0.1%)

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
2	L	0	1
2	M	0	1
4	P	0	1
4	Q	0	1
All	All	0	4

There are no bond length outliers.

The worst 5 of 10 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	J	131	ALA	CA-C-N	7.82	127.88	119.90
3	J	131	ALA	C-N-CA	7.82	127.88	119.90
3	J	52	GLN	CA-C-N	-6.86	113.10	119.82
3	J	52	GLN	C-N-CA	-6.86	113.10	119.82
4	Q	416	THR	N-CA-C	-6.29	101.93	111.56

There are no chirality outliers.

All (4) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	L	98	LEU	Peptide
2	M	16	GLY	Peptide
4	P	417	ASN	Peptide
4	Q	417	ASN	Peptide

## 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	H	1597	0	1549	31	0
2	L	1670	0	1608	29	0
2	M	1655	0	1597	47	0
3	J	1614	0	1572	47	0
4	P	102	0	92	5	0
4	Q	102	0	92	2	0
5	H	134	0	0	12	0
5	J	123	0	0	9	0
5	L	99	0	0	1	0
5	M	116	0	0	8	0
5	P	1	0	0	0	0
5	Q	3	0	0	0	0
All	All	7216	0	6510	145	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 11.

The worst 5 of 145 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:H:1:GLU:N	1:H:1:GLU:OE1	1.69	1.25
3:J:98:ARG:NH1	3:J:99:THR:O	1.98	0.97
1:H:98:ARG:NH1	1:H:99:THR:O	1.99	0.95
1:H:35:ASN:HD22	1:H:47:TRP:HE1	1.21	0.89
2:M:95:ILE:HD12	2:M:95:ILE:O	1.72	0.88

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	H	208/217 (96%)	197 (95%)	9 (4%)	2 (1%)	13	5
2	L	215/216 (100%)	202 (94%)	11 (5%)	2 (1%)	14	6
2	M	211/216 (98%)	199 (94%)	10 (5%)	2 (1%)	14	6
3	J	210/217 (97%)	200 (95%)	10 (5%)	0	100	100
4	P	11/14 (79%)	9 (82%)	1 (9%)	1 (9%)	0	0
4	Q	11/14 (79%)	8 (73%)	2 (18%)	1 (9%)	0	0
All	All	866/894 (97%)	815 (94%)	43 (5%)	8 (1%)	14	6

5 of 8 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	H	176	SER
2	L	80	HIS
2	M	215	ARG
4	P	417	ASN
1	H	16	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	H	182/188 (97%)	163 (90%)	19 (10%)	5	1
2	L	188/190 (99%)	174 (93%)	14 (7%)	11	4
2	M	187/190 (98%)	169 (90%)	18 (10%)	7	1

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
3	J	185/188 (98%)	174 (94%)	11 (6%)	16	6
4	P	12/12 (100%)	10 (83%)	2 (17%)	2	0
4	Q	12/12 (100%)	10 (83%)	2 (17%)	2	0
All	All	766/780 (98%)	700 (91%)	66 (9%)	8	2

5 of 66 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	M	99	THR
2	M	159	ARG
4	Q	422	ILE
2	L	76	THR
2	L	71	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 28 such sidechains are listed below:

Mol	Chain	Res	Type
3	J	39	GLN
4	Q	421	HIS
3	J	111	GLN
2	M	170	GLN
3	J	82	GLN

### 5.3.3 RNA ⓘ

There are no RNA molecules 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 oligosaccharides 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 [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	H	212/217 (97%)	-0.06	1 (0%) 87 91	19, 32, 46, 57	0
2	L	216/216 (100%)	0.20	7 (3%) 50 61	18, 36, 52, 62	1 (0%)
2	M	215/216 (99%)	0.34	13 (6%) 29 39	18, 36, 55, 61	0
3	J	214/217 (98%)	0.08	3 (1%) 73 81	18, 32, 47, 53	0
4	P	13/14 (92%)	2.01	7 (53%) 0 0	57, 61, 66, 68	0
4	Q	13/14 (92%)	1.99	7 (53%) 0 0	61, 62, 69, 70	0
All	All	883/894 (98%)	0.19	38 (4%) 40 51	18, 34, 55, 70	1 (0%)

The worst 5 of 38 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	L	80	HIS	4.5
3	J	133	GLY	3.8
4	P	414	ILE	3.8
2	M	9	VAL	3.5
2	M	53	TYR	3.3

### 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 oligosaccharides in this entry.

### 6.4 Ligands [i](#)

There are no ligands in this entry.

## 6.5 Other polymers [i](#)

There are no such residues in this entry.