



# wwPDB X-ray Structure Validation Summary Report ⓘ

Sep 16, 2023 – 02:03 PM EDT

PDB ID : 4PDC  
Title : Crystal structure of Cowpox virus CPXV018 (OMCP) bound to human NKG2D  
Authors : Lazear, E.; Nelson, C.A.; Fremont, D.H.; Center for Structural Genomics of Infectious Diseases (CSGID)  
Deposited on : 2014-04-17  
Resolution : 1.99 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>.

---

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

MolProbity : 4.02b-467  
Xtriage (Phenix) : 1.13  
EDS : 2.35.1  
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) : 2.35.1

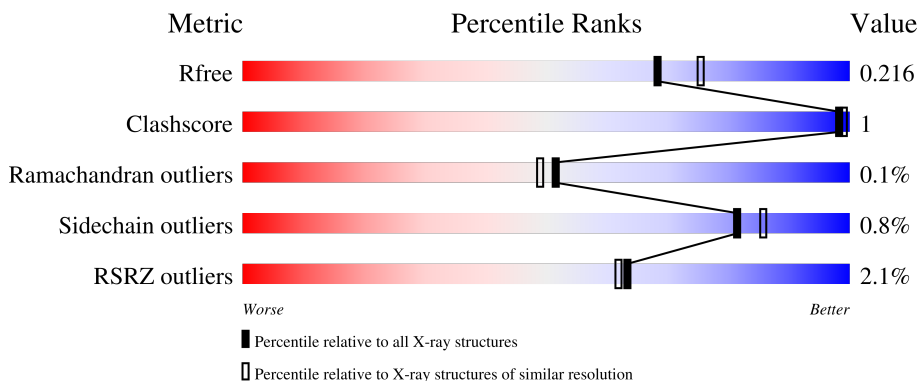
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.99 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.



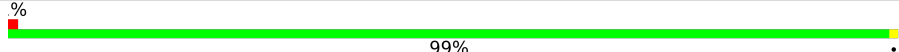
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	130704	8085 (2.00-2.00)
Clashscore	141614	9178 (2.00-2.00)
Ramachandran outliers	138981	9054 (2.00-2.00)
Sidechain outliers	138945	9053 (2.00-2.00)
RSRZ outliers	127900	7900 (2.00-2.00)

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 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	A	123	5% (poor fit), 95% (0-3 outliers), 5% (4+ outliers)
1	B	123	3% (poor fit), 97% (0-3 outliers), 2% (4+ outliers)
1	C	123	98% (0-3 outliers), 2% (4+ outliers)
1	D	123	5% (poor fit), 95% (0-3 outliers), 5% (4+ outliers)
2	E	150	99% (0-3 outliers), 1% (4+ outliers)

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Length	Quality of chain
2	F	150	 A horizontal bar chart representing the quality of the chain. The bar is green and extends to 99% of the total length. A small red square is at the start, and a small yellow square is at the end. The text '99%' is centered below the bar. A '%' symbol is at the top left of the bar, and a '.' symbol is at the top right of the bar. <p>99%</p>

## 2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 13255 atoms, of which 6104 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 NKG2-D type II integral membrane protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace	
			Total	C	H	N	O				S
1	A	123	1931	633	935	160	191	12	0	0	0
1	B	122	1916	628	929	159	188	12	0	0	0
1	C	123	1931	633	935	160	191	12	0	0	0
1	D	123	1931	633	935	160	191	12	0	0	0

- Molecule 2 is a protein called CPXV018 protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace	
			Total	C	H	N	O				S
2	E	150	2443	805	1185	200	247	6	0	0	0
2	F	150	2443	805	1185	200	247	6	0	0	0

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
E	0	GLY	-	expression tag	UNP Q8QN43
E	23	ASP	TYR	engineered mutation	UNP Q8QN43
E	95	ASP	PHE	engineered mutation	UNP Q8QN43
F	0	GLY	-	expression tag	UNP Q8QN43
F	23	ASP	TYR	engineered mutation	UNP Q8QN43
F	95	ASP	PHE	engineered mutation	UNP Q8QN43

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	90	Total	O	0	0
			90	90		

*Continued on next page...*

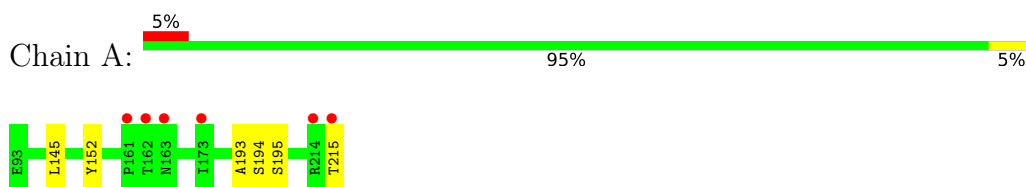
*Continued from previous page...*

<b>Mol</b>	<b>Chain</b>	<b>Residues</b>	<b>Atoms</b>		<b>ZeroOcc</b>	<b>AltConf</b>
3	B	85	Total 85	O 85	0	0
3	C	87	Total 87	O 87	0	0
3	D	96	Total 96	O 96	0	0
3	E	165	Total 165	O 165	0	0
3	F	137	Total 137	O 137	0	0

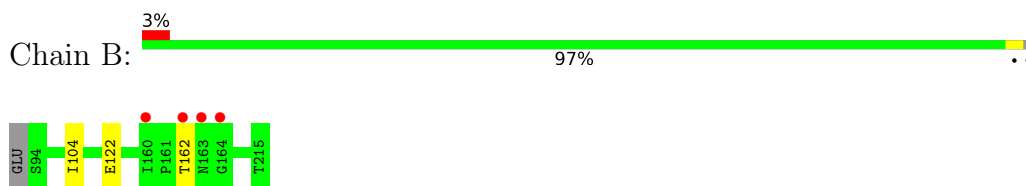
### 3 Residue-property plots [i](#)

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.

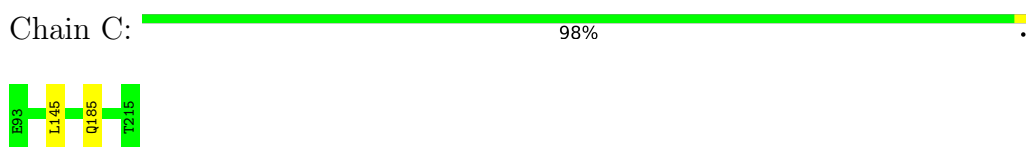
- Molecule 1: NKG2-D type II integral membrane protein



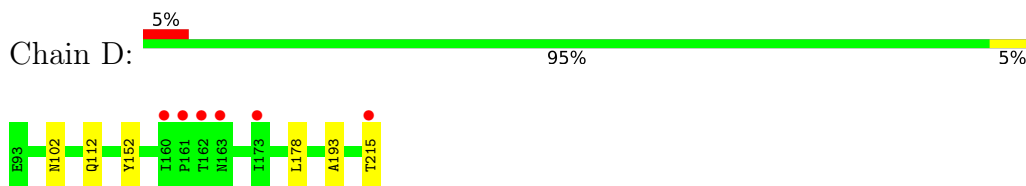
- Molecule 1: NKG2-D type II integral membrane protein



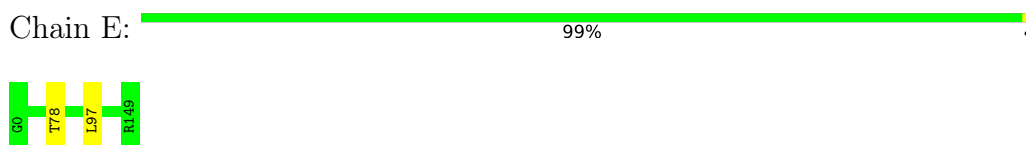
- Molecule 1: NKG2-D type II integral membrane protein



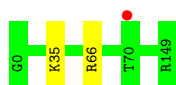
- Molecule 1: NKG2-D type II integral membrane protein



- Molecule 2: CPXV018 protein



- Molecule 2: CPXV018 protein



## 4 Data and refinement statistics i

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	43.31Å 101.11Å 91.37Å 90.00° 91.63° 90.00°	Depositor
Resolution (Å)	45.66 – 1.99 45.67 – 1.99	Depositor EDS
% Data completeness (in resolution range)	92.9 (45.66-1.99) 90.4 (45.67-1.99)	Depositor EDS
$R_{merge}$	0.12	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.83 (at 2.00Å)	Xtrriage
Refinement program	PHENIX (phenix.refine: 1.8.4_1496)	Depositor
R, $R_{free}$	0.166 , 0.214 0.170 , 0.216	Depositor DCC
$R_{free}$ test set	1998 reflections (3.99%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	20.7	Xtrriage
Anisotropy	0.233	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.39 , 30.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.47$ , $\langle L^2 \rangle = 0.29$	Xtrriage
Estimated twinning fraction	0.128 for h,-k,-l	Xtrriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	13255	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	29.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.10% 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	A	0.24	0/1024	0.41	0/1388
1	B	0.25	0/1015	0.44	0/1376
1	C	0.25	0/1024	0.41	0/1388
1	D	0.25	0/1024	0.41	0/1388
2	E	0.26	0/1291	0.44	0/1745
2	F	0.26	0/1291	0.42	0/1745
All	All	0.25	0/6669	0.42	0/9030

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 [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	996	935	933	3	0
1	B	987	929	927	1	0
1	C	996	935	933	2	0
1	D	996	935	933	2	0
2	E	1258	1185	1182	1	0
2	F	1258	1185	1182	1	0
3	A	90	0	0	0	0
3	B	85	0	0	0	0
3	C	87	0	0	1	2
3	D	96	0	0	0	2

*Continued on next page...*

Continued from previous page...

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	E	165	0	0	0	0
3	F	137	0	0	0	0
All	All	7151	6104	6090	8	2

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.

The worst 5 of 8 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:D:102:ASN:O	1:D:112:GLN:NE2	2.46	0.49
1:C:185:GLN:HG2	2:F:66:ARG:NH2	2.30	0.47
1:C:185:GLN:OE1	3:C:362:HOH:O	2.21	0.45
1:A:152:TYR:CD2	1:A:193:ALA:HB2	2.52	0.45
1:A:145:LEU:HD13	1:B:104:ILE:HD11	2.00	0.42

All (2) 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:C:301:HOH:O	3:D:306:HOH:O[1_655]	2.15	0.05
3:C:318:HOH:O	3:D:306:HOH:O[1_655]	2.19	0.01

## 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	121/123 (98%)	117 (97%)	4 (3%)	0	100	100
1	B	120/123 (98%)	115 (96%)	4 (3%)	1 (1%)	19	13
1	C	121/123 (98%)	118 (98%)	3 (2%)	0	100	100

Continued on next page...

Continued from previous page...

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	D	121/123 (98%)	119 (98%)	2 (2%)	0	100	100
2	E	148/150 (99%)	145 (98%)	3 (2%)	0	100	100
2	F	148/150 (99%)	144 (97%)	4 (3%)	0	100	100
All	All	779/792 (98%)	758 (97%)	20 (3%)	1 (0%)	51	49

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	162	THR

### 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	113/113 (100%)	112 (99%)	1 (1%)	78	83
1	B	112/113 (99%)	111 (99%)	1 (1%)	78	83
1	C	113/113 (100%)	112 (99%)	1 (1%)	78	83
1	D	113/113 (100%)	111 (98%)	2 (2%)	59	63
2	E	142/142 (100%)	142 (100%)	0	100	100
2	F	142/142 (100%)	141 (99%)	1 (1%)	84	88
All	All	735/736 (100%)	729 (99%)	6 (1%)	81	86

5 of 6 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	178	LEU
1	D	215	THR
2	F	35	LYS
1	B	122	GLU
1	A	215	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	109	ASN
1	D	177	ASN
2	F	88	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 [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	123/123 (100%)	-0.04	6 (4%) 29 28	14, 25, 62, 102	0
1	B	122/123 (99%)	-0.07	4 (3%) 46 45	14, 25, 57, 93	0
1	C	123/123 (100%)	-0.17	0 100 100	13, 23, 41, 60	0
1	D	123/123 (100%)	0.06	6 (4%) 29 28	14, 26, 60, 115	0
2	E	150/150 (100%)	-0.27	0 100 100	13, 21, 40, 68	0
2	F	150/150 (100%)	-0.20	1 (0%) 87 87	13, 22, 48, 66	0
All	All	791/792 (99%)	-0.12	17 (2%) 63 62	13, 23, 51, 115	0

The worst 5 of 17 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	161	PRO	4.2
1	A	173	ILE	3.9
1	B	162	THR	3.2
1	B	164	GLY	3.1
1	B	163	ASN	3.1

### 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 monosaccharides 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.