



# Full wwPDB X-ray Structure Validation Report ⓘ

Jan 11, 2021 – 06:27 PM EST

PDB ID : 6VMA  
Title : T4H2 T cell receptor bound to HLA-A2 presenting gp100 peptide (IT-DQVPFSV)  
Authors : Smith, A.R.; Baker, B.M.  
Deposited on : 2020-01-27  
Resolution : 2.75 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.

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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
Xtriage (Phenix)	:	1.13
EDS	:	2.16
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)	:	2.16

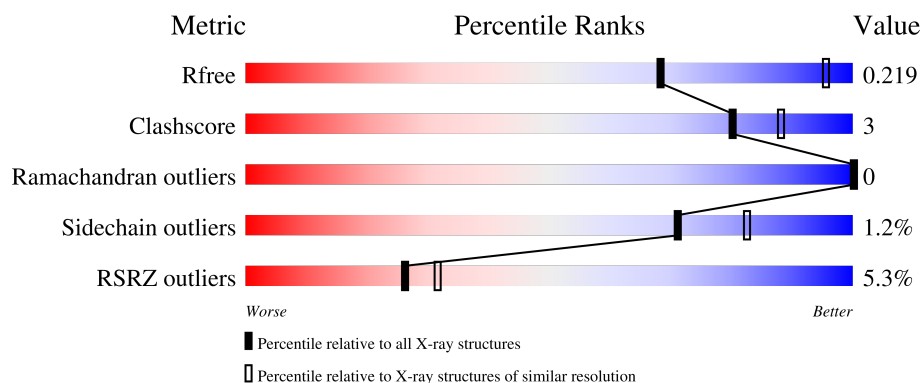
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.75 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	1235 (2.78-2.74)
Clashscore	141614	1277 (2.78-2.74)
Ramachandran outliers	138981	1257 (2.78-2.74)
Sidechain outliers	138945	1257 (2.78-2.74)
RSRZ outliers	127900	1207 (2.78-2.74)

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	275	<div> <div>2%</div> <div> <div></div> <div>91%</div> <div>8%</div> </div> </div>
2	B	100	<div> <div>7%</div> <div> <div></div> <div>92%</div> <div>8%</div> </div> </div>
3	D	206	<div> <div>12%</div> <div> <div></div> <div>92%</div> <div>5%</div> </div> </div>
4	E	241	<div> <div>3%</div> <div> <div></div> <div>93%</div> <div>7%</div> </div> </div>
5	C	9	<div> <div></div> <div> <div></div> <div>78%</div> <div>22%</div> </div> </div>

## 2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 6670 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 MHC class I antigen, A-2 alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	275	Total	C	N	O	S	0	0	0
			2247	1403	409	426	9			

- Molecule 2 is a protein called Beta-2-microglobulin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	100	Total	C	N	O	S	0	0	0
			837	533	141	159	4			

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	1	MET	-	initiating methionine	UNP P61769

- Molecule 3 is a protein called T4H2 T cell receptor alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	D	201	Total	C	N	O	S	0	0	0
			1561	973	257	323	8			

- Molecule 4 is a protein called T4H2 T cell receptor beta chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	E	239	Total	C	N	O	S	0	0	0
			1917	1212	329	369	7			

- Molecule 5 is a protein called Melanocyte protein PMEL.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
5	C	9	Total	C	N	O	0	0	0
			71	46	10	15			

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	16	Total 16	O 16	0	0
6	B	6	Total 6	O 6	0	0
6	D	1	Total 1	O 1	0	0
6	E	14	Total 14	O 14	0	0

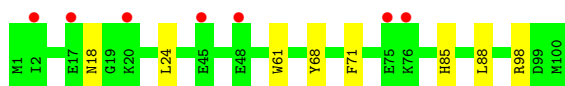
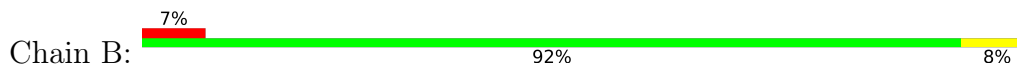
### 3 Residue-property plots [i](#)

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.

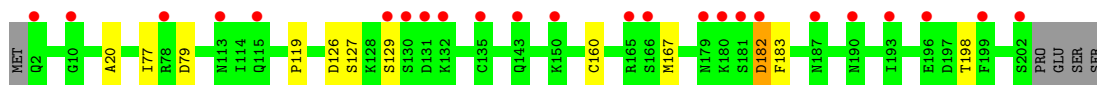
- Molecule 1: MHC class I antigen, A-2 alpha chain



- Molecule 2: Beta-2-microglobulin



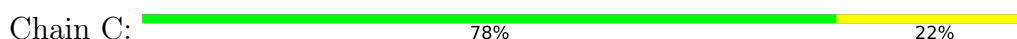
- Molecule 3: T4H2 T cell receptor alpha chain



- Molecule 4: T4H2 T cell receptor beta chain



- Molecule 5: Melanocyte protein PMEL



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 64	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	129.93Å 129.93Å 115.41Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	19.95 – 2.75 19.95 – 2.75	Depositor EDS
% Data completeness (in resolution range)	98.3 (19.95-2.75) 98.3 (19.95-2.75)	Depositor EDS
$R_{merge}$	0.07	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.15 (at 2.75Å)	Xtriage
Refinement program	PHENIX 1.13_2998, PHENIX 1.13_2998	Depositor
R, $R_{free}$	0.176 , 0.219 0.176 , 0.219	Depositor DCC
$R_{free}$ test set	1983 reflections (7.05%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	48.5	Xtriage
Anisotropy	0.043	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 40.9	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.039 for h,-h-k,-l	Xtriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	6670	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	59.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.43% 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	0.27	0/2312	0.45	0/3137
2	B	0.25	0/860	0.46	0/1162
3	D	0.26	0/1594	0.46	0/2162
4	E	0.27	0/1970	0.44	0/2680
5	C	0.30	0/72	0.48	0/97
All	All	0.27	0/6808	0.45	0/9238

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	2247	0	2096	16	0
2	B	837	0	803	4	0
3	D	1561	0	1468	6	0
4	E	1917	0	1816	11	0
5	C	71	0	71	1	0
6	A	16	0	0	0	0
6	B	6	0	0	1	0
6	D	1	0	0	0	0
6	E	14	0	0	0	0
All	All	6670	0	6254	35	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 3.

All (35) 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:187:THR:HB	1:A:272:LEU:HD11	1.64	0.80
1:A:28:VAL:HG11	1:A:179:LEU:HD13	1.77	0.66
4:E:116:ASN:HD22	4:E:182:ASP:HB2	1.62	0.65
3:D:126:ASP:HB3	3:D:129:SER:O	2.00	0.61
3:D:119:PRO:HB2	3:D:198:THR:HG22	1.84	0.60
3:D:126:ASP:OD1	3:D:127:SER:N	2.37	0.58
1:A:5:MET:HB2	1:A:168:LEU:HD13	1.89	0.55
2:B:85:HIS:HB3	2:B:88:LEU:HD23	1.89	0.53
5:C:3:ASP:OD1	5:C:4:GLN:N	2.39	0.51
4:E:150:ASP:HB2	4:E:173:PRO:HG2	1.92	0.51
4:E:50:ILE:HG12	4:E:51:VAL:H	1.75	0.49
4:E:13:LYS:HZ1	4:E:113:ASP:HA	1.78	0.48
1:A:42:SER:HA	4:E:220:TRP:O	2.13	0.48
2:B:18:ASN:OD1	2:B:98:ARG:NH1	2.43	0.48
1:A:259:CYS:HB3	1:A:272:LEU:HB2	1.95	0.48
1:A:117:ALA:HB2	2:B:61:TRP:CE2	2.49	0.48
1:A:197:HIS:ND1	1:A:198:GLU:HG3	2.29	0.47
1:A:203:CYS:SG	1:A:272:LEU:HD12	2.56	0.46
1:A:81:LEU:HD13	1:A:118:TYR:CD1	2.52	0.45
3:D:160:CYS:HB3	4:E:190:ARG:HH21	1.81	0.45
4:E:35:ARG:HD3	4:E:59:ILE:HD12	1.98	0.44
1:A:28:VAL:HG23	1:A:33:PHE:CD1	2.53	0.43
1:A:109:PHE:HB2	1:A:165:VAL:HG21	2.00	0.43
3:D:182:ASP:N	3:D:182:ASP:OD1	2.50	0.43
1:A:231:VAL:O	1:A:243:LYS:HE3	2.18	0.43
3:D:20:ALA:HB3	3:D:77:ILE:HB	2.01	0.43
1:A:28:VAL:HG23	1:A:33:PHE:CE1	2.54	0.43
1:A:33:PHE:CD2	1:A:34:VAL:HG13	2.54	0.43
4:E:13:LYS:NZ	4:E:113:ASP:HA	2.33	0.42
4:E:35:ARG:HB3	4:E:45:ILE:HD11	2.01	0.42
4:E:30:ALA:HA	4:E:48:SER:O	2.20	0.42
2:B:24:LEU:O	2:B:68:TYR:HA	2.20	0.41
1:A:233:THR:OG1	1:A:243:LYS:HD2	2.21	0.41
1:A:94:THR:HG21	6:B:201:HOH:O	2.21	0.41
4:E:182:ASP:N	4:E:182:ASP:OD1	2.55	0.40

There are no symmetry-related clashes.



## 5.3 Torsion angles

### 5.3.1 Protein backbone

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	273/275 (99%)	272 (100%)	1 (0%)	0	100	100
2	B	98/100 (98%)	98 (100%)	0	0	100	100
3	D	199/206 (97%)	196 (98%)	3 (2%)	0	100	100
4	E	237/241 (98%)	233 (98%)	4 (2%)	0	100	100
5	C	7/9 (78%)	7 (100%)	0	0	100	100
All	All	814/831 (98%)	806 (99%)	8 (1%)	0	100	100

There are no Ramachandran outliers to report.

### 5.3.2 Protein sidechains

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	231/231 (100%)	228 (99%)	3 (1%)	69	81
2	B	95/95 (100%)	94 (99%)	1 (1%)	73	84
3	D	179/184 (97%)	175 (98%)	4 (2%)	52	70
4	E	208/210 (99%)	207 (100%)	1 (0%)	88	92
5	C	9/9 (100%)	9 (100%)	0	100	100
All	All	722/729 (99%)	713 (99%)	9 (1%)	71	82

All (9) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	45	MET
1	A	182	THR
1	A	231	VAL
2	B	71	PHE
3	D	79	ASP
3	D	167	MET
3	D	182	ASP
3	D	183	PHE
4	E	168	CYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

### 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

### 6.1 Protein, DNA and RNA chains

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	275/275 (100%)	-0.18	5 (1%) 68 76	28, 47, 89, 134	0
2	B	100/100 (100%)	0.08	7 (7%) 16 19	34, 61, 103, 117	0
3	D	201/206 (97%)	0.40	24 (11%) 4 5	31, 74, 124, 146	0
4	E	239/241 (99%)	-0.15	8 (3%) 46 54	32, 52, 85, 121	0
5	C	9/9 (100%)	-0.35	0 100 100	30, 36, 55, 68	0
All	All	824/831 (99%)	0.00	44 (5%) 26 31	28, 54, 108, 146	0

All (44) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	D	181	SER	5.2
3	D	131	ASP	5.1
1	A	275	GLU	4.2
1	A	16	GLY	3.9
3	D	196	GLU	3.8
3	D	190	ASN	3.8
3	D	130	SER	3.8
3	D	115	GLN	3.7
3	D	166	SER	3.6
4	E	39	GLY	3.6
3	D	193	ILE	3.5
1	A	197	HIS	3.5
4	E	133	SER	3.2
1	A	196	ASP	3.2
2	B	75	GLU	3.1
3	D	202	SER	3.1
3	D	10	GLY	2.9
3	D	78	ARG	2.8
3	D	165	ARG	2.8
3	D	180	LYS	2.8

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Mol	Chain	Res	Type	RSRZ
1	A	17	ARG	2.7
3	D	129	SER	2.7
4	E	15	GLY	2.7
3	D	2	GLN	2.6
3	D	113	ASN	2.6
4	E	38	PRO	2.6
3	D	187	ASN	2.5
3	D	179	ASN	2.4
2	B	17	GLU	2.4
2	B	20	LYS	2.4
2	B	2	ILE	2.4
2	B	76	LYS	2.3
4	E	40	GLN	2.3
4	E	216	GLU	2.3
2	B	48	GLU	2.2
3	D	182	ASP	2.2
4	E	202	ARG	2.2
2	B	45	GLU	2.1
3	D	132	LYS	2.1
4	E	129	GLU	2.1
3	D	135	CYS	2.1
3	D	150	LYS	2.0
3	D	199	PHE	2.0
3	D	143	GLN	2.0

## 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.