



wwPDB X-ray Structure Validation Summary Report

Aug 20, 2023 – 06:10 PM EDT

PDB ID : 2IPK
Title : Crystal Structure of the MHC Class II Molecule HLA-DR1 in Complex with the Fluorogenic Peptide, AcPKXVKQNTLKLAT (X=3-[5-(dimethylamino)-1,3-dioxo-1,3-dihydro-2H-isoindol-2-yl]-L-alanine) and the Superantigen, SEC3 Variant 3B2
Authors : Nguyen, T.T.; Stern, L.J.
Deposited on : 2006-10-12
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

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
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtrriage (Phenix) : 1.13
EDS : 2.35
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

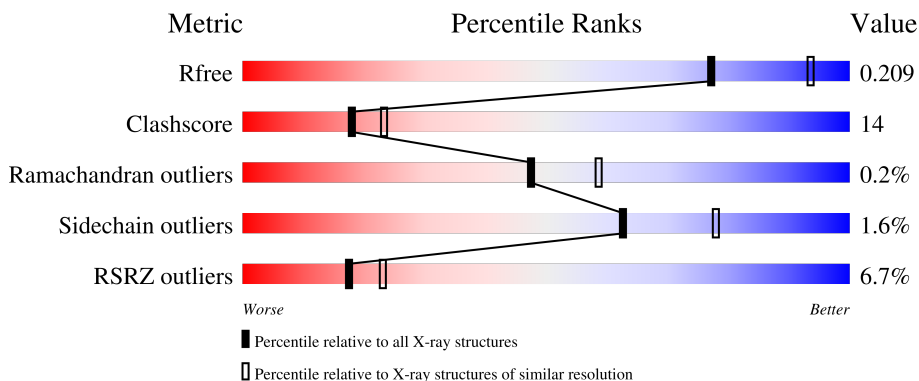
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

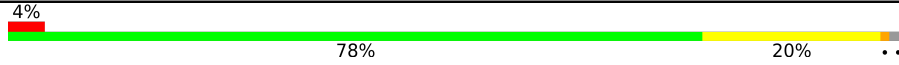



The reported resolution of this entry is 2.30 Å.

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))
R_{free}	130704	5042 (2.30-2.30)
Clashscore	141614	5643 (2.30-2.30)
Ramachandran outliers	138981	5575 (2.30-2.30)
Sidechain outliers	138945	5575 (2.30-2.30)
RSRZ outliers	127900	4938 (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 of the lower bar indicate the fraction of residues that contain outliers for ≥ 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	183	 4% 78% 20% ..
2	B	190	 7% 77% 21% ..
3	C	14	 7% 50% 43% 7%
4	D	240	 8% 78% 18% .

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	4DP	C	308	-	-	X	-

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 5464 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 HLA class II histocompatibility antigen, DR alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	179	1473	954	239	275	5	0	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	0	MET	-	cloning artifact	UNP P01903

- Molecule 2 is a protein called HLA class II histocompatibility antigen, DRB1-1 beta chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	190	1557	979	279	293	6	0	0	0

- Molecule 3 is a protein called HA related Fluorogenic Peptide, AcPKXVKQNTLKLAT (X = 3-[5-(dimethylamino)-1,3-dioxo-1,3-dihydro-2H-isoindol-2-yl]-L-alanine).

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
3	C	14	116	75	20	21	0	0	0

- Molecule 4 is a protein called Enterotoxin type C-3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
4	D	232	1899	1205	309	375	10	0	0	0

There are 5 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
D	0	MET	-	cloning artifact	UNP P0A0L3
D	43	SER	LYS	engineered mutation	UNP P0A0L3

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Chain	Residue	Modelled	Actual	Comment	Reference
D	45	PHE	LEU	engineered mutation	UNP P0A0L3
D	46	LYS	ALA	engineered mutation	UNP P0A0L3
D	47	TRP	HIS	engineered mutation	UNP P0A0L3

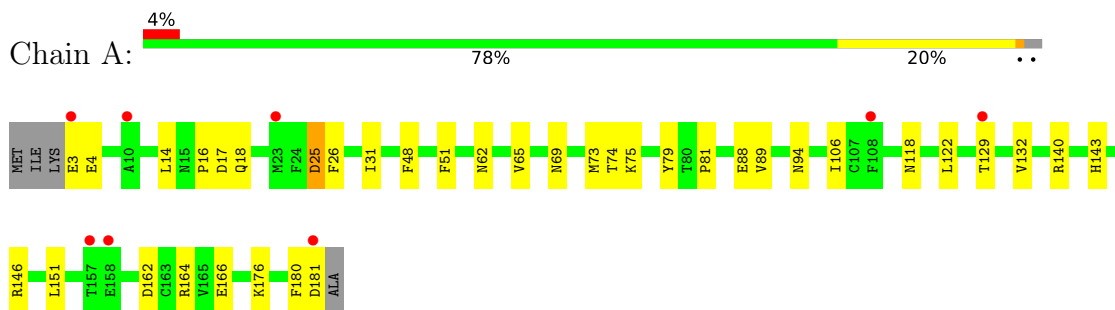
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	133	Total 133	O 133	0	0
5	B	106	Total 106	O 106	0	0
5	C	8	Total 8	O 8	0	0
5	D	172	Total 172	O 172	0	0

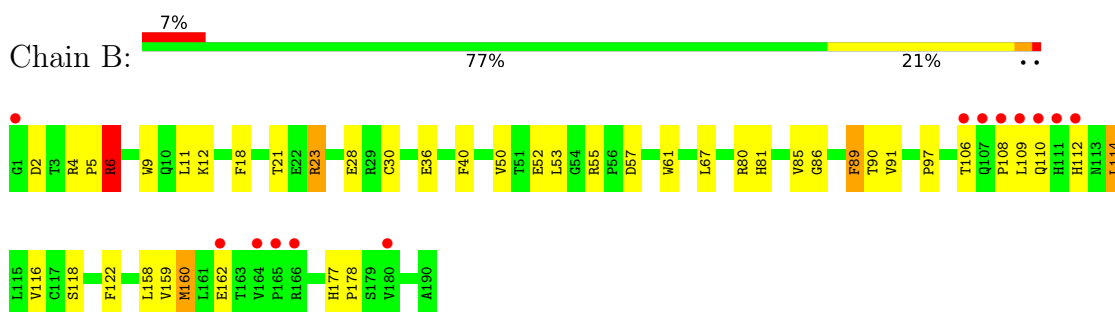
3 Residue-property plots [i](#)

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.

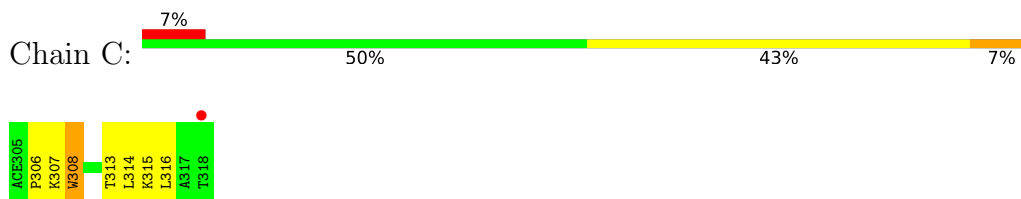
- Molecule 1: HLA class II histocompatibility antigen, DR alpha chain



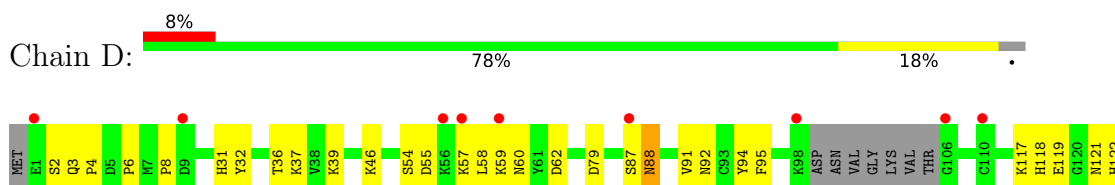
- Molecule 2: HLA class II histocompatibility antigen, DRB1-1 beta chain

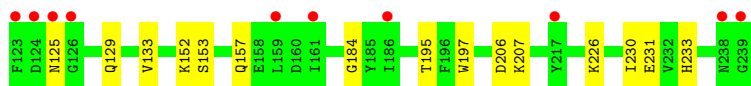


- Molecule 3: HA related Fluorogenic Peptide, AcPKXVKQNTLKLAT (X=3-[5-(dimethylamino)-1,3-dioxo-1,3-dihydro-2H-indol-2-yl]-L-alanine)



- Molecule 4: Enterotoxin type C-3





4 Data and refinement statistics i

Property	Value	Source
Space group	H 3	Depositor
Cell constants a, b, c, α , β , γ	171.98Å 171.98Å 121.13Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	32.50 – 2.30 32.50 – 2.19	Depositor EDS
% Data completeness (in resolution range)	99.6 (32.50-2.30) 99.1 (32.50-2.19)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	0.09	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.96 (at 2.20Å)	Xtrriage
Refinement program	CNS	Depositor
R, R_{free}	0.203 , 0.224 0.187 , 0.209	Depositor DCC
R_{free} test set	3438 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å ²)	40.6	Xtrriage
Anisotropy	0.078	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.29 , 42.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	0.021 for h,-h-k,-l	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	5464	wwPDB-VP
Average B, all atoms (Å ²)	48.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.48% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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](#)

Bond lengths and bond angles in the following residue types are not validated in this section: 4DP, ACE

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	0.41	0/1518	0.66	1/2070 (0.0%)
2	B	0.38	0/1597	0.66	1/2168 (0.0%)
3	C	0.38	0/94	0.69	0/123
4	D	0.37	0/1941	0.61	0/2611
All	All	0.39	0/5150	0.64	2/6972 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	6	ARG	NE-CZ-NH2	-5.19	117.70	120.30
1	A	88	GLU	N-CA-C	-5.03	97.42	111.00

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	1473	0	1407	34	0
2	B	1557	0	1488	71	0
3	C	116	0	126	29	0
4	D	1899	0	1829	39	0
5	A	133	0	0	3	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	B	106	0	0	1	0
5	C	8	0	0	0	0
5	D	172	0	0	3	0
All	All	5464	0	4850	134	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 14.

The worst 5 of 134 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)
2:B:85:VAL:HG13	3:C:306:PRO:HB2	1.56	0.88
2:B:116:VAL:HG13	2:B:160:MET:HE1	1.56	0.87
2:B:21:THR:HG23	2:B:80:ARG:HD3	1.55	0.86
4:D:88:ASN:H	4:D:88:ASN:HD22	1.23	0.86
2:B:89:PHE:HD1	2:B:89:PHE:H	1.24	0.85

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	177/183 (97%)	172 (97%)	5 (3%)	0	100	100
2	B	188/190 (99%)	181 (96%)	7 (4%)	0	100	100
3	C	11/14 (79%)	11 (100%)	0	0	100	100
4	D	228/240 (95%)	220 (96%)	7 (3%)	1 (0%)	34	42
All	All	604/627 (96%)	584 (97%)	19 (3%)	1 (0%)	47	58

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
4	D	57	LYS

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	164/167 (98%)	163 (99%)	1 (1%)	86	94
2	B	171/171 (100%)	166 (97%)	5 (3%)	42	58
3	C	11/11 (100%)	11 (100%)	0	100	100
4	D	214/221 (97%)	211 (99%)	3 (1%)	67	81
All	All	560/570 (98%)	551 (98%)	9 (2%)	62	78

5 of 9 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
4	D	88	ASN
4	D	125	ASN
2	B	89	PHE
2	B	114	LEU
2	B	160	MET

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 17 such sidechains are listed below:

Mol	Chain	Res	Type
4	D	157	GLN
4	D	238	ASN
4	D	60	ASN
4	D	88	ASN
4	D	92	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](#)

1 non-standard protein/DNA/RNA residue is modelled in this entry.

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	4DP	C	308	3	19,20,21	2.58	4 (21%)	24,29,31	2.08	7 (29%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	4DP	C	308	3	-	0/7/26/28	0/2/2/2

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	C	308	4DP	CAL-CAJ	-5.83	1.39	1.48
3	C	308	4DP	CAK-CAI	-5.75	1.39	1.48
3	C	308	4DP	CAI-NAN	-5.24	1.33	1.39
3	C	308	4DP	CAJ-NAN	-5.19	1.33	1.39

The worst 5 of 7 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	308	4DP	CAK-CAI-NAN	5.13	109.52	105.88
3	C	308	4DP	CAL-CAJ-NAN	4.58	109.13	105.88
3	C	308	4DP	CAI-NAN-CAJ	-3.80	108.93	112.03
3	C	308	4DP	CAF-CAK-CAI	2.77	134.14	129.63
3	C	308	4DP	CAL-CAK-CAI	-2.76	105.87	108.26

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 9 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	C	308	4DP	9	0

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, 95th 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 ²)	Q<0.9
1	A	179/183 (97%)	-0.07	8 (4%) 33 40	24, 37, 88, 138	0
2	B	190/190 (100%)	0.23	13 (6%) 17 22	25, 47, 98, 165	0
3	C	12/14 (85%)	0.21	1 (8%) 11 15	36, 45, 76, 82	0
4	D	232/240 (96%)	0.18	19 (8%) 11 15	25, 41, 89, 133	0
All	All	613/627 (97%)	0.12	41 (6%) 17 23	24, 42, 90, 165	0

The worst 5 of 41 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	109	LEU	6.9
2	B	110	GLN	6.4
2	B	108	PRO	6.0
2	B	111	HIS	5.6
1	A	3	GLU	5.0

6.2 Non-standard residues in protein, DNA, RNA chains [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, 95th 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(Å ²)	Q<0.9
3	4DP	C	308	19/20	0.82	0.26	30,34,39,41	0

6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

6.4 Ligands

There are no ligands in this entry.

6.5 Other polymers

There are no such residues in this entry.