



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 9, 2026 – 09:27 PM UTC

PDB ID : 2Z31 / pdb_00002z31
Title : Crystal structure of immune receptor complex
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Deposited on : 2007-05-30
Resolution : 2.70 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	:	4-5-2 with Phenix2.0
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

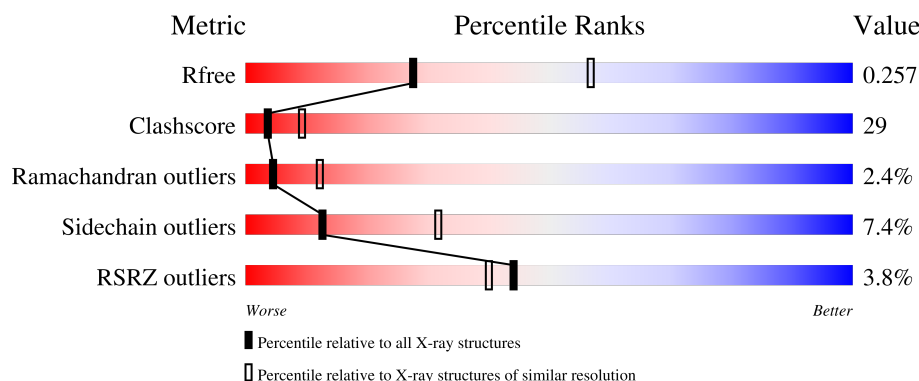
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.70 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}	180053	3538 (2.70-2.70)
Clashscore	190562	3843 (2.70-2.70)
Ramachandran outliers	187476	3778 (2.70-2.70)
Sidechain outliers	187428	3778 (2.70-2.70)
RSRZ outliers	180081	3538 (2.70-2.70)

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	112	4% 54% 38% 9%
2	B	111	5% 50% 46% • •
3	C	181	3% 49% 45% 6% •
4	D	189	3% 51% 41% 6% • •
5	P	11	9% 55% 45%

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 4841 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 T-cell receptor alpha-chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	112	Total	C	N	O	S	0	0	0
			875	553	143	177	2			

- Molecule 2 is a protein called T-cell receptor beta-chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	111	Total	C	N	O	S	0	0	0
			845	521	148	173	3			

- Molecule 3 is a protein called H-2 class II histocompatibility antigen, A-U alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	181	Total	C	N	O	S	0	0	0
			1455	941	232	279	3			

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	1	ILE	-	expression tag	UNP P14438
C	2	GLU	-	expression tag	UNP P14438
C	3	ALA	-	expression tag	UNP P14438

- Molecule 4 is a protein called H-2 class II histocompatibility antigen, A-U beta chain precursor.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	D	188	Total	C	N	O	S	0	0	0
			1581	996	282	297	6			

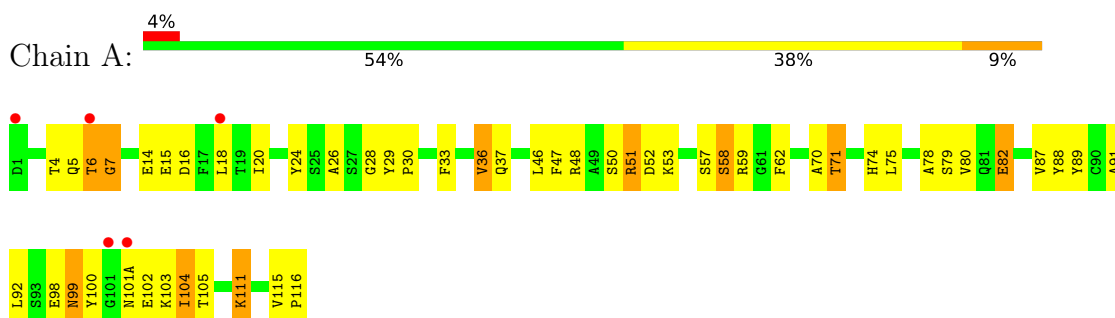
- Molecule 5 is a protein called Myelin basic protein (MBP)-peptide.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
5	P	11	Total	C	N	O	0	0	0
			85	49	19	17			

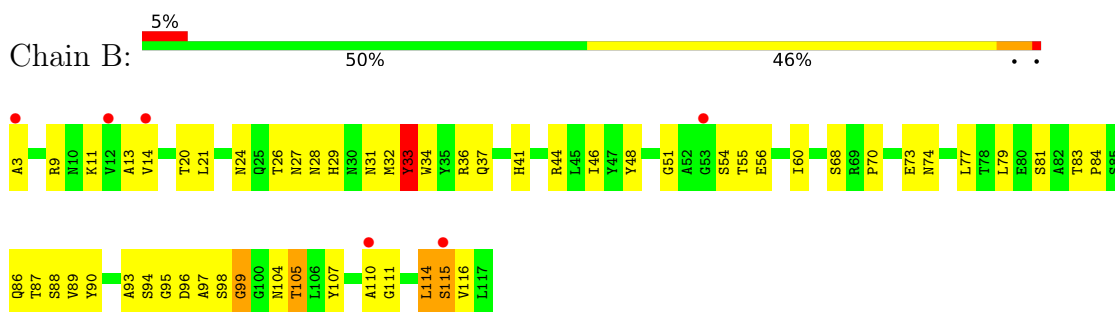
3 Residue-property plots

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.

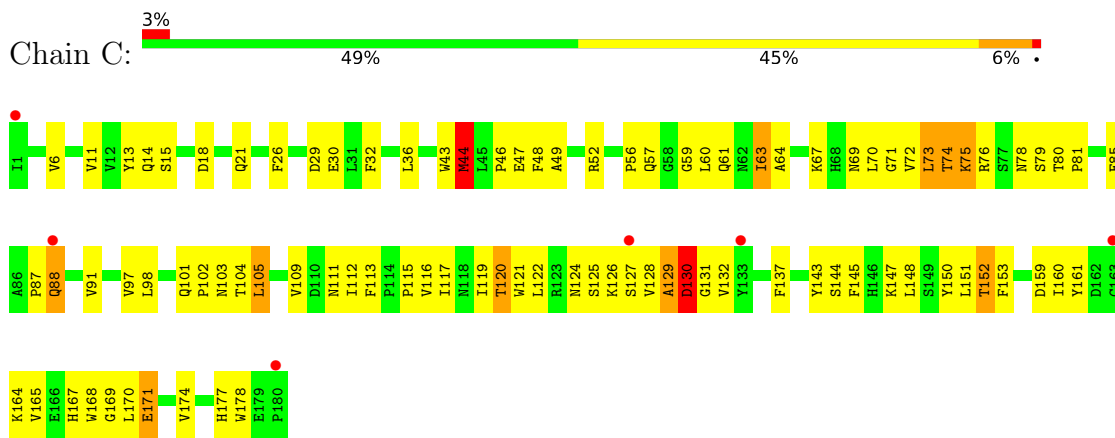
- Molecule 1: T-cell receptor alpha-chain



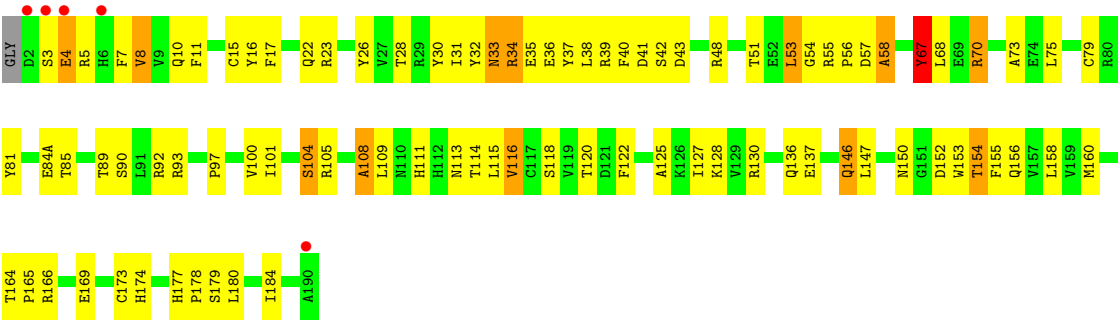
- Molecule 2: T-cell receptor beta-chain



- Molecule 3: H-2 class II histocompatibility antigen, A-U alpha chain



- Molecule 4: H-2 class II histocompatibility antigen, A-U beta chain precursor



● Molecule 5: Myelin basic protein (MBP)-peptide



4 Data and refinement statistics

Property	Value	Source
Space group	P 41 2 2	Depositor
Cell constants a, b, c, α , β , γ	97.33Å 97.33Å 174.37Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	50.00 – 2.70 50.00 – 2.70	Depositor EDS
% Data completeness (in resolution range)	99.8 (50.00-2.70) 99.7 (50.00-2.70)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	0.09	Depositor
$\langle I/\sigma(I) \rangle$	-	Xtrriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.235 , 0.287 0.259 , 0.257	Depositor DCC
R_{free} test set	1216 reflections (5.11%)	wwPDB-VP
Wilson B-factor (Å ²)	(Not available)	Xtrriage
Anisotropy	(Not available)	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 55.0	EDS
L-test for twinning ¹	$\langle L \rangle =$ (Not available), $\langle L^2 \rangle =$ (Not available)	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	4841	wwPDB-VP
Average B, all atoms (Å ²)	71.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *(Not available)*

¹Theoretical 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	0.55	0/897	1.05	6/1213 (0.5%)
2	B	0.54	0/863	0.94	1/1170 (0.1%)
3	C	0.50	0/1500	1.03	8/2047 (0.4%)
4	D	0.51	0/1620	0.98	3/2201 (0.1%)
5	P	0.57	0/86	1.04	0/112
All	All	0.52	0/4966	1.00	18/6743 (0.3%)

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	B	0	1
4	D	0	1
All	All	0	2

There are no bond length outliers.

The worst 5 of 18 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	144	SER	N-CA-C	-8.39	97.60	109.69
4	D	67	TYR	N-CA-C	8.17	123.08	113.20
4	D	137	GLU	N-CA-C	7.21	120.84	110.10
3	C	63	ILE	N-CA-C	-6.66	103.83	110.62
1	A	50	SER	N-CA-C	6.46	121.16	113.28

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	B	33	TYR	Sidechain

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Mol	Chain	Res	Type	Group
4	D	67	TYR	Sidechain

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	875	0	815	48	0
2	B	845	0	794	48	0
3	C	1455	0	1386	112	0
4	D	1581	0	1515	96	0
5	P	85	0	81	5	0
All	All	4841	0	4591	275	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 29.

The worst 5 of 275 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:87:THR:HG23	2:B:115:SER:HA	1.16	1.14
1:A:37:GLN:HE22	2:B:37:GLN:HE22	1.09	1.00
4:D:113:ASN:HD22	4:D:114:THR:H	0.95	0.91
4:D:150:ASN:HD21	4:D:156:GLN:HE21	1.19	0.90
1:A:99:ASN:HD22	1:A:99:ASN:H	0.91	0.89

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	110/112 (98%)	94 (86%)	12 (11%)	4 (4%)	2	6
2	B	109/111 (98%)	99 (91%)	9 (8%)	1 (1%)	14	35
3	C	179/181 (99%)	151 (84%)	24 (13%)	4 (2%)	5	14
4	D	186/189 (98%)	160 (86%)	21 (11%)	5 (3%)	4	10
5	P	9/11 (82%)	9 (100%)	0	0	100	100
All	All	593/604 (98%)	513 (86%)	66 (11%)	14 (2%)	4	12

5 of 14 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	7	GLY
1	A	78	ALA
2	B	99	GLY
4	D	108	ALA
3	C	125	SER

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	92/92 (100%)	82 (89%)	10 (11%)	6	16
2	B	91/91 (100%)	83 (91%)	8 (9%)	9	23
3	C	162/162 (100%)	153 (94%)	9 (6%)	19	44
4	D	175/175 (100%)	163 (93%)	12 (7%)	14	34
5	P	8/8 (100%)	8 (100%)	0	100	100
All	All	528/528 (100%)	489 (93%)	39 (7%)	13	32

5 of 39 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
4	D	8	VAL

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Mol	Chain	Res	Type
4	D	116	VAL
4	D	22	GLN
4	D	67	TYR
4	D	146	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 22 such sidechains are listed below:

Mol	Chain	Res	Type
3	C	88	GLN
4	D	136	GLN
4	D	113	ASN
4	D	146	GLN
2	B	24	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 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, 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	112/112 (100%)	0.59	5 (4%) 38 34	61, 68, 78, 83	0
2	B	111/111 (100%)	0.78	6 (5%) 31 27	26, 73, 83, 88	0
3	C	181/181 (100%)	0.72	6 (3%) 49 45	59, 72, 88, 98	0
4	D	188/189 (99%)	0.49	5 (2%) 56 53	63, 70, 83, 103	0
5	P	11/11 (100%)	1.05	1 (9%) 15 12	64, 66, 77, 85	0
All	All	603/604 (99%)	0.64	23 (3%) 44 40	26, 71, 84, 103	0

The worst 5 of 23 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	3	ALA	4.1
3	C	133	TYR	3.9
4	D	6	HIS	3.2
4	D	190	ALA	3.0
3	C	1	ILE	2.8

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 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.