



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 8, 2026 – 11:02 PM UTC

PDB ID : 5WUX / pdb_00005wux
Title : TNFalpha-certolizumab Fab
Authors : Heo, Y.S.; Lee, J.U.
Deposited on : 2016-12-21
Resolution : 2.90 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

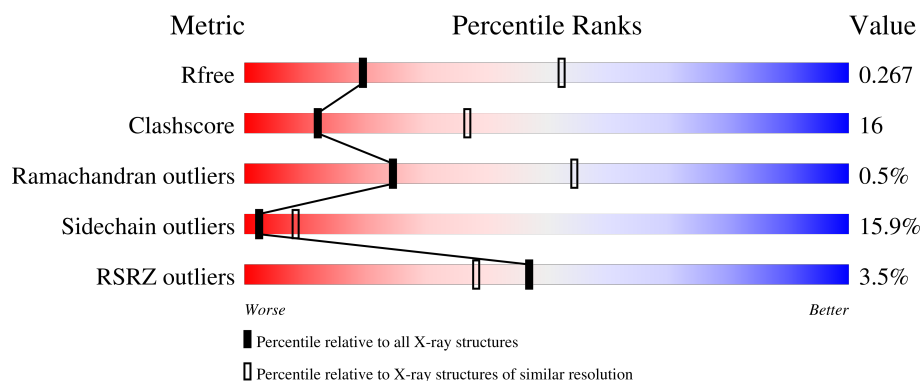
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.90 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	2481 (2.90-2.90)
Clashscore	190562	2690 (2.90-2.90)
Ramachandran outliers	187476	2623 (2.90-2.90)
Sidechain outliers	187428	2625 (2.90-2.90)
RSRZ outliers	180081	2481 (2.90-2.90)

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	224	 4% 62% 28% • 6%
1	C	224	 4% 51% 37% • 10%
1	H	224	 2% 55% 35% • 5%
2	B	214	 3% 58% 32% 8% ••
2	D	214	 5% 50% 34% 9% • 6%

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Mol	Chain	Length	Quality of chain
2	L	214	66% 29% 5%
3	E	157	7% 48% 32% 6% 13%
3	F	157	2% 54% 31% 5% 10%
3	G	157	3% 41% 41% 6% 10%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 12793 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 heavy.

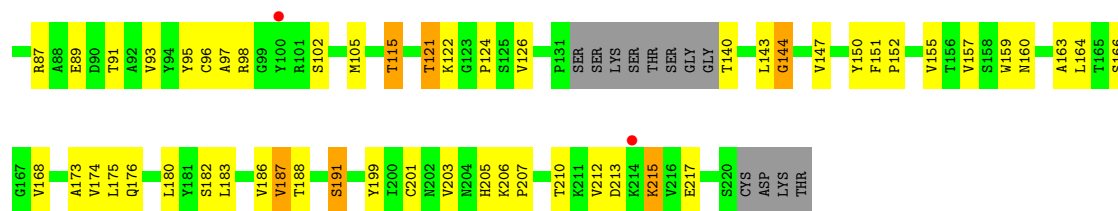
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	210	Total	C	N	O	S	0	0	0
			1586	1010	260	308	8			
1	C	202	Total	C	N	O	S	0	0	0
			1530	976	251	295	8			
1	H	212	Total	C	N	O	S	0	0	0
			1601	1019	263	311	8			

- Molecule 2 is a protein called light.

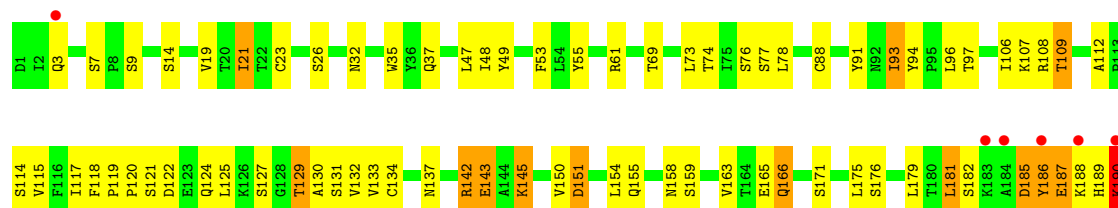
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	212	Total	C	N	O	S	0	0	0
			1632	1028	270	329	5			
2	D	201	Total	C	N	O	S	0	0	0
			1538	969	251	313	5			
2	L	213	Total	C	N	O	S	0	0	0
			1641	1033	271	332	5			

- Molecule 3 is a protein called Tumor necrosis factor alpha.

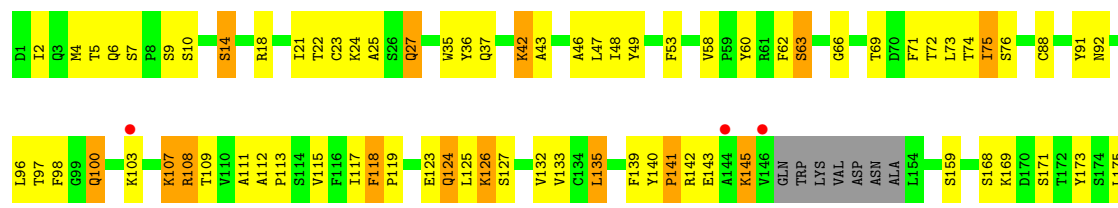
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	E	136	Total	C	N	O	S	0	0	0
			1057	681	177	197	2			
3	F	141	Total	C	N	O	S	0	0	0
			1104	708	190	204	2			
3	G	141	Total	C	N	O	S	0	0	0
			1104	708	190	204	2			



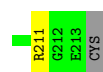
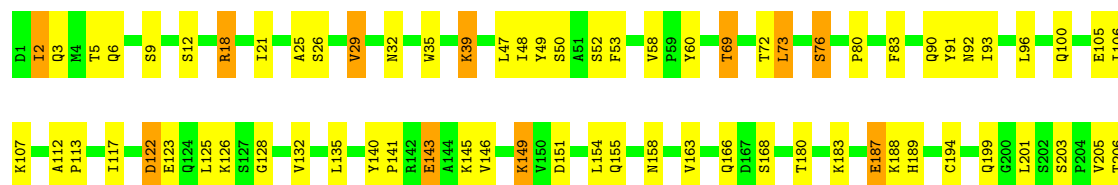
• Molecule 2: light



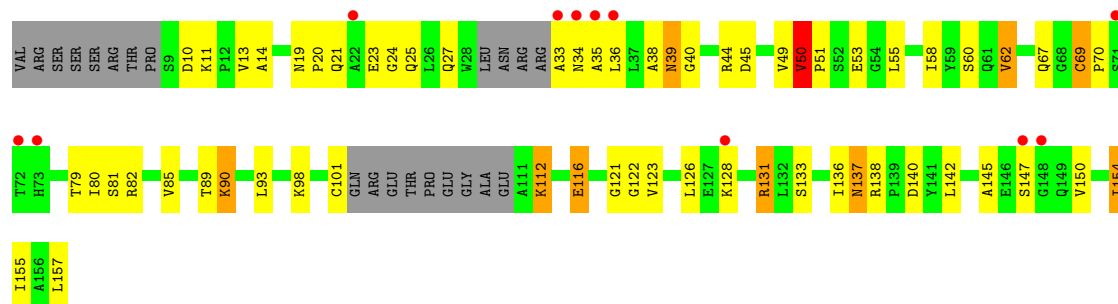
• Molecule 2: light



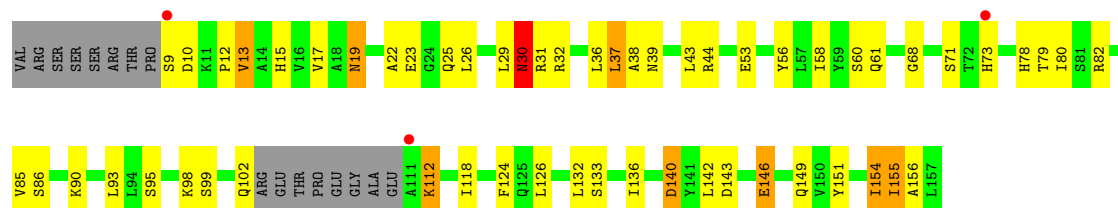
• Molecule 2: light



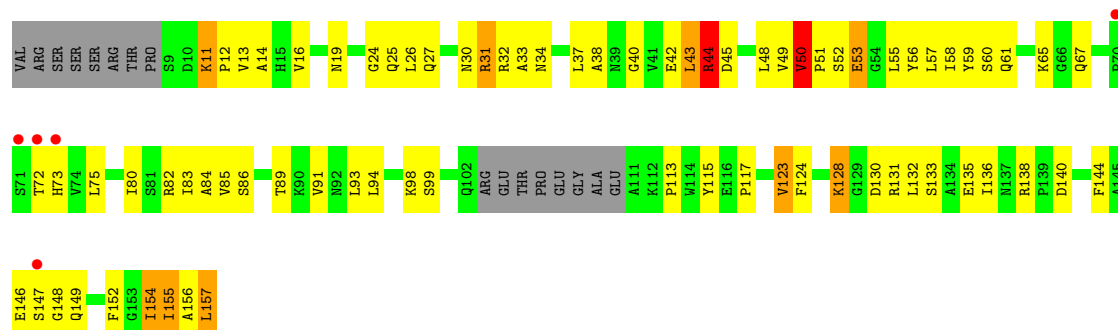
• Molecule 3: Tumor necrosis factor alpha



- Molecule 3: Tumor necrosis factor alpha



- Molecule 3: Tumor necrosis factor alpha



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	148.59Å 207.22Å 112.63Å 90.00° 118.81° 90.00°	Depositor
Resolution (Å)	30.00 – 2.90 30.00 – 2.90	Depositor EDS
% Data completeness (in resolution range)	95.1 (30.00-2.90) 95.3 (30.00-2.90)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.93 (at 2.90Å)	Xtriage
Refinement program	PHENIX 1.9_1692	Depositor
R, R_{free}	0.226 , 0.266 0.230 , 0.267	Depositor DCC
R_{free} test set	3217 reflections (4.83%)	wwPDB-VP
Wilson B-factor (Å ²)	79.8	Xtriage
Anisotropy	0.561	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 73.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	12793	wwPDB-VP
Average B, all atoms (Å ²)	87.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.49% 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

5.1 Standard geometry

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	0.49	0/1627	0.90	2/2219 (0.1%)
1	C	0.42	0/1569	0.91	4/2137 (0.2%)
1	H	0.44	0/1642	0.87	2/2238 (0.1%)
2	B	0.44	0/1669	0.92	4/2268 (0.2%)
2	D	0.45	0/1571	0.97	9/2134 (0.4%)
2	L	0.42	0/1678	0.92	2/2280 (0.1%)
3	E	0.50	0/1080	1.00	2/1468 (0.1%)
3	F	0.47	0/1128	1.00	8/1533 (0.5%)
3	G	0.48	0/1128	0.99	5/1533 (0.3%)
All	All	0.45	0/13092	0.94	38/17810 (0.2%)

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
1	A	0	3
1	C	0	2
2	D	0	1
3	E	0	1
3	G	0	1
All	All	0	8

There are no bond length outliers.

The worst 5 of 38 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	179	GLY	N-CA-C	-8.41	104.68	114.69
3	F	112	LYS	CA-C-N	8.03	128.52	119.92
3	F	112	LYS	C-N-CA	8.03	128.52	119.92
3	G	45	ASP	N-CA-C	-7.02	104.01	112.58
1	C	40	ALA	CA-C-N	-7.00	111.62	120.23

There are no chirality outliers.

5 of 8 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	209	ASN	Peptide
1	A	210	THR	Peptide
1	A	72	LEU	Peptide
1	C	209	ASN	Peptide
1	C	64	VAL	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	A	1586	0	1542	40	0
1	C	1530	0	1487	54	0
1	H	1601	0	1560	49	0
2	B	1632	0	1586	60	0
2	D	1538	0	1499	55	0
2	L	1641	0	1592	42	0
3	E	1057	0	1052	41	0
3	F	1104	0	1104	34	0
3	G	1104	0	1104	56	0
All	All	12793	0	12526	395	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 16.

The worst 5 of 395 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:151:ASP:H	2:B:191:VAL:HG12	1.25	1.01
3:E:131:ARG:HH11	3:E:131:ARG:HB2	1.25	1.01
1:C:128:PRO:HD3	1:C:214:LYS:HZ3	1.34	0.90
1:C:128:PRO:HD3	1:C:214:LYS:NZ	1.86	0.89
2:D:125:LEU:O	2:D:183:LYS:NZ	2.07	0.87

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	206/224 (92%)	198 (96%)	7 (3%)	1 (0%)	24	54
1	C	196/224 (88%)	189 (96%)	6 (3%)	1 (0%)	24	54
1	H	208/224 (93%)	198 (95%)	10 (5%)	0	100	100
2	B	210/214 (98%)	197 (94%)	12 (6%)	1 (0%)	24	54
2	D	197/214 (92%)	184 (93%)	11 (6%)	2 (1%)	12	39
2	L	211/214 (99%)	200 (95%)	11 (5%)	0	100	100
3	E	130/157 (83%)	123 (95%)	6 (5%)	1 (1%)	16	44
3	F	137/157 (87%)	134 (98%)	3 (2%)	0	100	100
3	G	137/157 (87%)	128 (93%)	7 (5%)	2 (2%)	8	28
All	All	1632/1785 (91%)	1551 (95%)	73 (4%)	8 (0%)	24	54

5 of 8 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	209	ASN
2	D	191	VAL
3	G	31	ARG
1	A	210	THR
2	B	190	LYS

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	174/186 (94%)	159 (91%)	15 (9%)	10	30
1	C	168/186 (90%)	144 (86%)	24 (14%)	3	11
1	H	176/186 (95%)	146 (83%)	30 (17%)	2	7
2	B	185/187 (99%)	148 (80%)	37 (20%)	1	4
2	D	176/187 (94%)	138 (78%)	38 (22%)	1	3
2	L	186/187 (100%)	164 (88%)	22 (12%)	5	17
3	E	114/133 (86%)	91 (80%)	23 (20%)	1	4
3	F	119/133 (90%)	102 (86%)	17 (14%)	3	11
3	G	119/133 (90%)	99 (83%)	20 (17%)	2	7
All	All	1417/1518 (93%)	1191 (84%)	226 (16%)	2	8

5 of 226 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	H	18	LEU
3	G	146	GLU
1	H	215	LYS
3	G	140	ASP
3	F	124	PHE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 20 such sidechains are listed below:

Mol	Chain	Res	Type
3	E	125	GLN
3	F	39	ASN
3	G	61	GLN
3	F	102	GLN
1	C	13	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 [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	210/224 (93%)	0.51	8 (3%) 44 36	54, 78, 128, 140	0
1	C	202/224 (90%)	0.57	10 (4%) 34 27	60, 92, 131, 149	0
1	H	212/224 (94%)	0.48	4 (1%) 66 58	54, 92, 123, 137	0
2	B	212/214 (99%)	0.37	7 (3%) 49 40	47, 80, 133, 166	0
2	D	201/214 (93%)	0.61	11 (5%) 30 24	57, 96, 157, 174	0
2	L	213/214 (99%)	0.08	0 100 100	48, 72, 99, 122	0
3	E	136/157 (86%)	0.52	11 (8%) 18 15	54, 82, 128, 159	0
3	F	141/157 (89%)	0.19	3 (2%) 63 54	48, 72, 116, 146	0
3	G	141/157 (89%)	0.38	5 (3%) 47 38	54, 81, 119, 166	0
All	All	1668/1785 (93%)	0.42	59 (3%) 47 38	47, 83, 133, 174	0

The worst 5 of 59 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	206	LYS	5.4
2	B	186	TYR	4.9
3	E	148	GLY	4.1
2	D	193	ALA	3.9
2	D	191	VAL	3.9

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.