



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 08:23 PM UTC

PDB ID : 4KG8 / pdb_00004kg8
Title : Crystal structure of light mutant
Authors : Liu, W.; Zhan, C.; Kumar, P.R.; Bonanno, J.B.; Nathenson, S.G.; Almo, S.C.;
New York Structural Genomics Research Consortium (NYSGRC); Atoms-to-
Animals: The Immune Function Network (IFN)
Deposited on : 2013-04-28
Resolution : 2.25 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

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

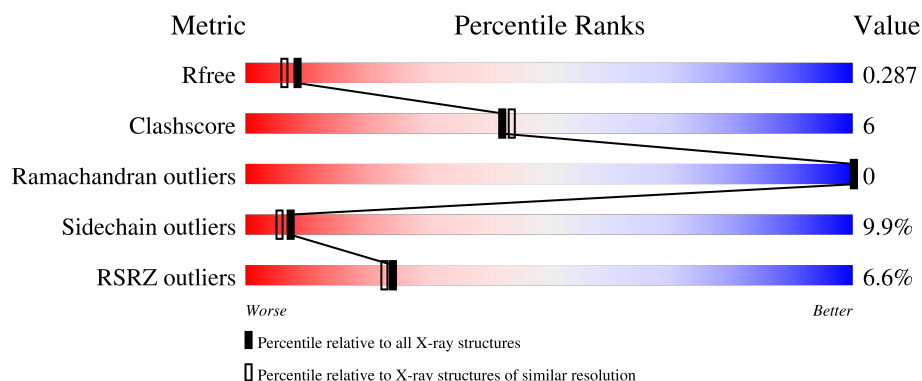
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.25 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	1898 (2.26-2.26)
Clashscore	190562	2005 (2.26-2.26)
Ramachandran outliers	187476	1965 (2.26-2.26)
Sidechain outliers	187428	1966 (2.26-2.26)
RSRZ outliers	180081	1898 (2.26-2.26)

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	158	3% 69% 11% • 18%
1	B	158	8% 59% 13% •• 24%
1	C	158	4% 54% 15% •• 27%

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 2843 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 Tumor necrosis factor ligand superfamily member 14.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	129	Total	C	N	O	S	0	0	0
			993	639	167	186	1			
1	B	120	Total	C	N	O	S	0	0	0
			924	595	152	176	1			
1	C	115	Total	C	N	O	S	0	0	0
			901	586	149	165	1			

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	195	SER	ARG	engineered mutation	UNP O43557
A	196	ASN	VAL	engineered mutation	UNP O43557
A	198	PHE	TRP	engineered mutation	UNP O43557
A	214	GLU	LYS	engineered mutation	UNP O43557
B	195	SER	ARG	engineered mutation	UNP O43557
B	196	ASN	VAL	engineered mutation	UNP O43557
B	198	PHE	TRP	engineered mutation	UNP O43557
B	214	GLU	LYS	engineered mutation	UNP O43557
C	195	SER	ARG	engineered mutation	UNP O43557
C	196	ASN	VAL	engineered mutation	UNP O43557
C	198	PHE	TRP	engineered mutation	UNP O43557
C	214	GLU	LYS	engineered mutation	UNP O43557

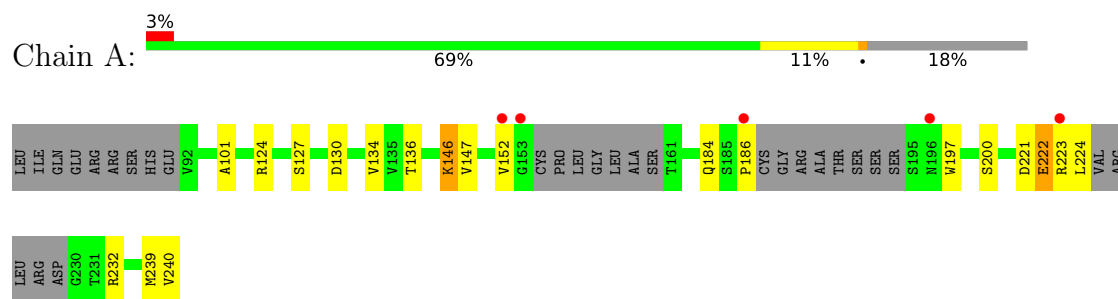
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	16	Total	O	0	0
			16	16		
2	B	4	Total	O	0	0
			4	4		
2	C	5	Total	O	0	0
			5	5		

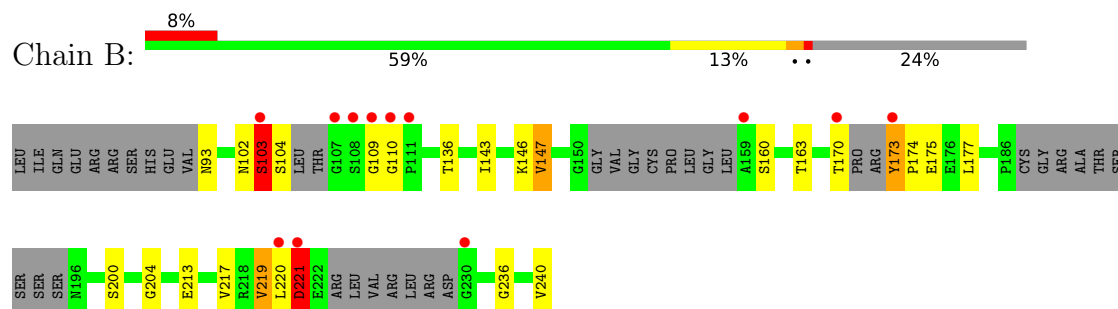
3 Residue-property plots

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.

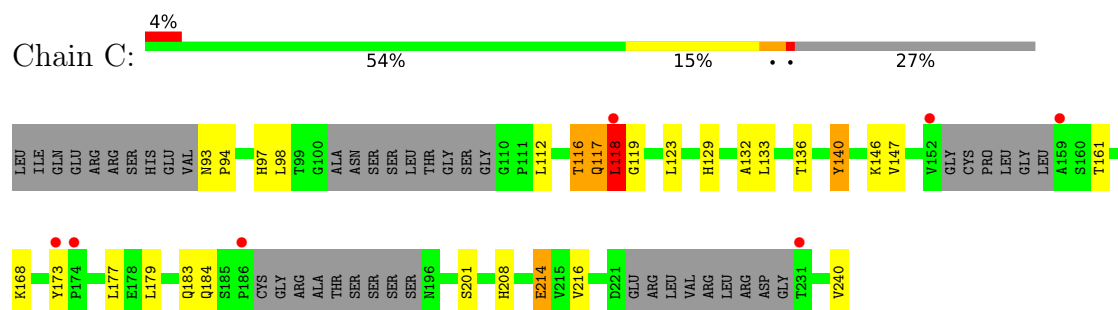
- Molecule 1: Tumor necrosis factor ligand superfamily member 14



- Molecule 1: Tumor necrosis factor ligand superfamily member 14



- Molecule 1: Tumor necrosis factor ligand superfamily member 14



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	59.64Å 46.91Å 70.40Å 90.00° 98.02° 90.00°	Depositor
Resolution (Å)	20.00 – 2.25 20.00 – 2.25	Depositor EDS
% Data completeness (in resolution range)	99.6 (20.00-2.25) 99.6 (20.00-2.25)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	0.06	Depositor
$\langle I/\sigma(I) \rangle$ ¹	5.88 (at 2.24Å)	Xtriage
Refinement program	REFMAC 5.7.0029	Depositor
R, R_{free}	0.211 , 0.286 0.216 , 0.287	Depositor DCC
R_{free} test set	949 reflections (5.09%)	wwPDB-VP
Wilson B-factor (Å ²)	34.9	Xtriage
Anisotropy	0.364	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 36.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	2843	wwPDB-VP
Average B, all atoms (Å ²)	41.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.48% 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](#)

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	1.08	0/1015	1.09	0/1374
1	B	0.99	2/943 (0.2%)	1.09	5/1273 (0.4%)
1	C	0.94	1/922 (0.1%)	1.03	1/1248 (0.1%)
All	All	1.01	3/2880 (0.1%)	1.07	6/3895 (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	2
1	B	0	1
All	All	0	3

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	140	TYR	CA-C	-5.62	1.45	1.52
1	B	217	VAL	C-O	-5.46	1.18	1.24
1	B	236	GLY	C-O	-5.22	1.18	1.23

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	103	SER	CA-C-N	6.09	132.66	121.70
1	B	103	SER	C-N-CA	6.09	132.66	121.70
1	B	221	ASP	N-CA-C	-5.67	104.27	110.91
1	C	118	LEU	N-CA-C	-5.65	95.17	111.00
1	B	102	ASN	N-CA-C	5.57	117.55	108.63
1	B	147	VAL	CB-CA-C	5.38	118.42	110.77

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	101	ALA	Peptide
1	A	222	GLU	Peptide
1	B	173	TYR	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	993	0	971	9	0
1	B	924	0	888	14	0
1	C	901	0	880	14	0
2	A	16	0	0	1	0
2	B	4	0	0	0	0
2	C	5	0	0	1	0
All	All	2843	0	2739	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 6.

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:C:118:LEU:HG	1:C:119:GLY:HA2	1.54	0.90
1:B:146:LYS:HD3	1:B:200:SER:OG	1.87	0.74
1:B:170:THR:OG1	1:B:213:GLU:OE2	2.08	0.64
1:A:146:LYS:HD3	1:A:200:SER:OG	1.96	0.64
1:B:103:SER:CB	1:B:104:SER:HB3	2.33	0.58
1:A:232:ARG:NH1	1:C:183:GLN:OE1	2.37	0.57
1:B:103:SER:HB3	1:B:104:SER:CB	2.34	0.57
1:B:103:SER:HB3	1:B:104:SER:HB3	1.87	0.56
1:C:116:THR:HB	1:C:123:LEU:HD11	1.89	0.55
1:C:168:LYS:HB2	1:C:179:LEU:HD11	1.88	0.55
1:B:173:TYR:N	1:B:174:PRO:C	2.66	0.54
1:C:118:LEU:CG	1:C:119:GLY:HA2	2.32	0.53
1:B:109:GLY:N	1:B:110:GLY:HA2	2.24	0.52

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:143:ILE:O	1:B:204:GLY:HA2	2.11	0.51
1:C:133:LEU:O	1:C:214:GLU:HA	2.10	0.50
1:B:103:SER:CB	1:B:104:SER:CB	2.91	0.49
1:A:239:MET:HE3	2:A:303:HOH:O	2.12	0.49
1:A:186:PRO:HG2	1:A:197:TRP:CZ3	2.51	0.46
1:C:132:ALA:HB2	1:C:216:VAL:HG12	1.99	0.45
1:A:222:GLU:O	1:A:223:ARG:HG3	2.16	0.45
1:C:116:THR:O	1:C:117:GLN:HG2	2.16	0.45
1:A:240:VAL:HG12	1:A:240:VAL:OXT	2.15	0.45
1:C:129:HIS:O	1:C:129:HIS:CD2	2.69	0.44
1:C:97:HIS:O	1:C:98:LEU:HD23	2.17	0.43
1:C:208:HIS:CD2	2:C:304:HOH:O	2.70	0.43
1:B:220:LEU:C	1:B:221:ASP:OD1	2.61	0.43
1:B:173:TYR:N	1:B:174:PRO:CA	2.81	0.43
1:A:223:ARG:HA	1:A:224:LEU:C	2.43	0.42
1:A:127:SER:HB2	1:A:134:VAL:HB	2.01	0.42
1:B:163:THR:O	1:B:219:VAL:HA	2.19	0.41
1:B:103:SER:HB3	1:B:104:SER:HB2	2.00	0.41
1:B:163:THR:HB	1:B:220:LEU:HG	2.02	0.41
1:C:93:ASN:ND2	1:C:94:PRO:HD3	2.36	0.41
1:C:146:LYS:HA	1:C:201:SER:O	2.21	0.41
1:A:124:ARG:NE	1:C:140:TYR:OH	2.54	0.40

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	121/158 (77%)	116 (96%)	5 (4%)	0	100	100
1	B	108/158 (68%)	101 (94%)	7 (6%)	0	100	100
1	C	105/158 (66%)	98 (93%)	7 (7%)	0	100	100

Continued on next page...

Continued from previous page...

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
All	All	334/474 (70%)	315 (94%)	19 (6%)	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	104/129 (81%)	97 (93%)	7 (7%)	15	14
1	B	96/129 (74%)	86 (90%)	10 (10%)	7	5
1	C	94/129 (73%)	82 (87%)	12 (13%)	4	3
All	All	294/387 (76%)	265 (90%)	29 (10%)	7	5

All (29) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	130	ASP
1	A	136	THR
1	A	146	LYS
1	A	147	VAL
1	A	152	VAL
1	A	184	GLN
1	A	221	ASP
1	B	93	ASN
1	B	103	SER
1	B	136	THR
1	B	147	VAL
1	B	160	SER
1	B	175	GLU
1	B	177	LEU
1	B	219	VAL
1	B	221	ASP
1	B	240	VAL
1	C	112	LEU

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	C	116	THR
1	C	117	GLN
1	C	118	LEU
1	C	136	THR
1	C	147	VAL
1	C	161	THR
1	C	173	TYR
1	C	177	LEU
1	C	184	GLN
1	C	214	GLU
1	C	240	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	93	ASN
1	B	117	GLN
1	C	93	ASN
1	C	129	HIS
1	C	196	ASN
1	C	208	HIS

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

There are no such residues in this entry.

5.8 Polymer linkage issues

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, 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	129/158 (81%)	-0.14	5 (3%) 43 43	15, 25, 61, 83	0
1	B	120/158 (75%)	0.56	12 (10%) 12 12	19, 42, 78, 105	0
1	C	115/158 (72%)	0.48	7 (6%) 27 25	18, 44, 79, 90	0
All	All	364/474 (76%)	0.28	24 (6%) 24 23	15, 37, 77, 105	0

All (24) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	110	GLY	4.9
1	B	159	ALA	4.1
1	A	152	VAL	3.9
1	C	186	PRO	3.5
1	B	108	SER	3.4
1	C	231	THR	3.3
1	B	230	GLY	3.2
1	B	109	GLY	3.2
1	B	170	THR	3.2
1	B	220	LEU	3.1
1	B	173	TYR	3.0
1	B	221	ASP	2.7
1	B	107	GLY	2.7
1	A	196	ASN	2.7
1	C	173	TYR	2.7
1	A	186	PRO	2.7
1	C	118	LEU	2.6
1	B	111	PRO	2.6
1	C	152	VAL	2.6
1	C	159	ALA	2.5
1	A	153	GLY	2.4
1	B	103	SER	2.4
1	C	174	PRO	2.2

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	A	223	ARG	2.1

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 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.