



# Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 07:12 AM UTC

PDB ID : 5D71 / pdb\_00005d71  
Title : Crystal structure of MOR04302, a neutralizing anti-human GM-CSF antibody Fab fragment in complex with human GM-CSF  
Authors : Eyllenstein, R.; Weinfurtner, D.; Steidl, S.; Boettcher, J.; Augustin, M.  
Deposited on : 2015-08-13  
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](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.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
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

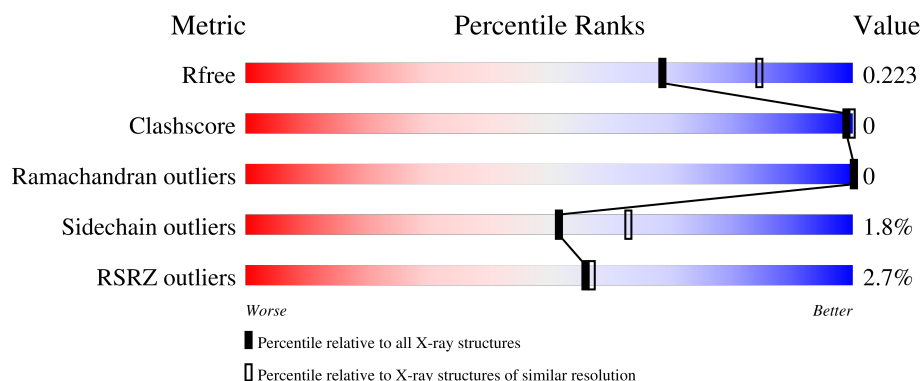
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

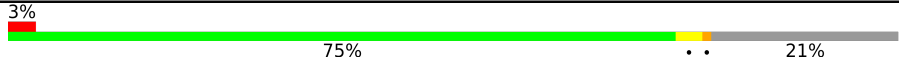
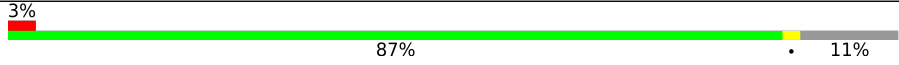
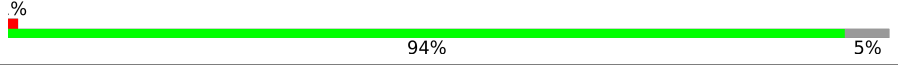
The reported resolution of this entry is 2.25 Å.

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  $\geq 3$ , 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	144	
2	H	236	
3	L	209	

## 2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 4196 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 Granulocyte-macrophage colony-stimulating factor.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	114	Total	C	N	O	S	65	0	0
			918	581	154	175	8			

There are 17 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	111	LYS	-	expression tag	UNP P04141
A	112	ASP	-	expression tag	UNP P04141
A	113	PHE	-	expression tag	UNP P04141
A	114	LEU	-	expression tag	UNP P04141
A	115	LEU	-	expression tag	UNP P04141
A	116	VAL	-	expression tag	UNP P04141
A	117	ILE	-	expression tag	UNP P04141
A	118	PRO	-	expression tag	UNP P04141
A	119	PHE	-	expression tag	UNP P04141
A	120	ASP	-	expression tag	UNP P04141
A	121	CYS	-	expression tag	UNP P04141
A	122	TRP	-	expression tag	UNP P04141
A	123	GLU	-	expression tag	UNP P04141
A	124	PRO	-	expression tag	UNP P04141
A	125	VAL	-	expression tag	UNP P04141
A	126	GLN	-	expression tag	UNP P04141
A	127	GLU	-	expression tag	UNP P04141

- Molecule 2 is a protein called Immunglobulin G1 Fab fragment, heavy chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	H	211	Total	C	N	O	S	36	0	0
			1575	996	263	310	6			

- Molecule 3 is a protein called Immunglobulin G1 Fab fragment, light chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	L	198	Total	C	N	O	S	34	2	0
			1488	932	246	305	5			

- Molecule 4 is DI(HYDROXYETHYL)ETHER (CCD ID: PEG) (formula:  $C_4H_{10}O_3$ ).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	H	1	Total	C	O	0	0
			7	4	3		

- Molecule 5 is SULFATE ION (CCD ID: SO4) (formula:  $O_4S$ ).



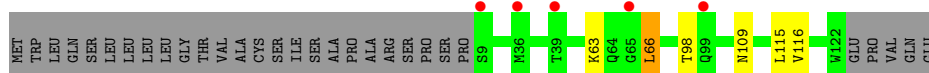
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	L	1	Total	O	S	0	0
			5	4	1		
5	L	1	Total	O	S	0	0
			5	4	1		

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	39	Total	O	0	0
			39	39		
6	H	59	Total	O	0	0
			59	59		
6	L	100	Total	O	0	0
			100	100		



- Molecule 1: Granulocyte-macrophage colony-stimulating factor



- Q1**, **V12**, **E56**, **S128**, **G133**, **V169**, **L178**, **L189**, **G190**, **T191**, **Q192**, **K209**, **E212**, **P213**

- D1 I48 TYR LYS LYS ARG PRO SER GLY ILE PRO E60 E160 T209 GLU ALA

## 4 Data and refinement statistics

Property	Value	Source
Space group	I 21 3	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	158.68Å 158.68Å 158.68Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	112.20 – 2.25 112.20 – 2.25	Depositor EDS
% Data completeness (in resolution range)	100.0 (112.20-2.25) 100.0 (112.20-2.25)	Depositor EDS
$R_{merge}$	0.07	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.15 (at 2.24Å)	Xtriage
Refinement program	REFMAC 5.2.0005	Depositor
R, $R_{free}$	0.180 , 0.219 0.186 , 0.223	Depositor DCC
$R_{free}$ test set	1393 reflections (4.41%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	47.0	Xtriage
Anisotropy	0.000	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.33 , 48.6	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.029 for -l,-k,-h	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	4196	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	51.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.42% 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](#)

Bond lengths and bond angles in the following residue types are not validated in this section: SO4, PEG

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	0.73	0/938	0.95	1/1272 (0.1%)
2	H	0.69	1/1614 (0.1%)	0.73	0/2198
3	L	0.70	0/1523	0.74	0/2077
All	All	0.70	1/4075 (0.0%)	0.79	1/5547 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	H	56	GLU	CD-OE1	-5.84	1.14	1.25

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	116	VAL	CA-CB-CG2	5.97	120.54	110.40

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	918	0	905	1	0
2	H	1575	0	1527	2	0
3	L	1488	0	1440	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	H	7	0	10	0	0
5	L	10	0	0	0	0
6	A	39	0	0	0	0
6	H	59	0	0	0	0
6	L	100	0	0	0	0
All	All	4196	0	3882	3	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 0.

All (3) 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:H:169:VAL:HG21	3:L:160:GLU:HB3	1.95	0.48
1:A:63:LYS:HA	1:A:66:LEU:HD22	1.98	0.46
2:H:178:LEU:C	2:H:178:LEU:HD12	2.45	0.41

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	112/144 (78%)	110 (98%)	2 (2%)	0	100	100
2	H	207/236 (88%)	204 (99%)	3 (1%)	0	100	100
3	L	196/209 (94%)	195 (100%)	1 (0%)	0	100	100
All	All	515/589 (87%)	509 (99%)	6 (1%)	0	100	100

There are no Ramachandran outliers to report.

### 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	105/131 (80%)	101 (96%)	4 (4%)	29	36
2	H	175/198 (88%)	171 (98%)	4 (2%)	44	55
3	L	165/172 (96%)	165 (100%)	0	100	100
All	All	445/501 (89%)	437 (98%)	8 (2%)	51	63

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	66	LEU
1	A	98	THR
1	A	109	ASN
1	A	115	LEU
2	H	12	VAL
2	H	178	LEU
2	H	209	LYS
2	H	212	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	86	GLN
1	A	109	ASN
2	H	81	GLN
2	H	82(A)	ASN
2	H	171	GLN
2	H	199	ASN
3	L	37	GLN

### 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](#)

3 ligands are 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	$\# Z  > 2$
4	PEG	H	301	-	6,6,6	0.54	0	5,5,5	0.37	0
5	SO4	L	301	-	4,4,4	0.26	0	6,6,6	0.26	0
5	SO4	L	302	-	4,4,4	0.29	0	6,6,6	0.39	0

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
4	PEG	H	301	-	-	3/4/4/4	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	H	301	PEG	O2-C3-C4-O4
4	H	301	PEG	O1-C1-C2-O2

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Mol	Chain	Res	Type	Atoms
4	H	301	PEG	C4-C3-O2-C2

There are no ring outliers.

No monomer is involved in short contacts.

## 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	114/144 (79%)	0.44	5 (4%) 39 38	28, 55, 80, 96	23 (20%)
2	H	211/236 (89%)	0.05	6 (2%) 55 55	33, 48, 79, 107	19 (9%)
3	L	198/209 (94%)	-0.21	3 (1%) 72 73	17, 43, 62, 75	17 (8%)
All	All	523/589 (88%)	0.03	14 (2%) 56 57	17, 47, 75, 107	59 (11%)

All (14) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	H	191	THR	4.6
3	L	48	ILE	4.3
2	H	128	SER	3.8
3	L	209	THR	3.7
2	H	133	GLY	3.6
1	A	9	SER	2.8
2	H	192	GLN	2.6
3	L	60	GLU	2.5
2	H	190	GLY	2.4
1	A	36	MET	2.2
1	A	65	GLY	2.2
2	H	189	LEU	2.1
1	A	39	THR	2.0
1	A	99	GLN	2.0

### 6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

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](#)

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, 95<sup>th</sup> 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( $\text{\AA}^2$ )	Q<0.9
4	PEG	H	301	7/7	0.60	0.21	76,84,93,93	0
5	SO4	L	301	5/5	0.90	0.10	65,67,71,77	0
5	SO4	L	302	5/5	0.90	0.11	49,49,56,61	5

### 6.5 Other polymers [i](#)

There are no such residues in this entry.