



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 1, 2026 – 06:48 AM UTC

PDB ID : 9N1Z / pdb_00009n1z
Title : Structure of C3d Bound to a Fragment of FHR-2
Authors : Duan, H.; Geisbrecht, B.V.
Deposited on : 2025-01-27
Resolution : 2.31 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
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

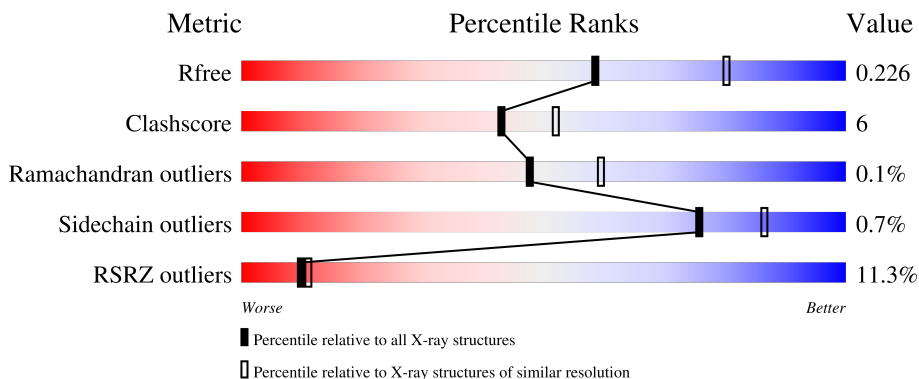
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.31 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	7754 (2.34-2.30)
Clashscore	190562	8383 (2.34-2.30)
Ramachandran outliers	187476	8303 (2.34-2.30)
Sidechain outliers	187428	8303 (2.34-2.30)
RSRZ outliers	180081	7760 (2.34-2.30)

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	297	89% 10%
1	C	297	27% 73% 22% 5%
2	B	131	4% 83% 11% 5%
2	D	131	4% 85% 7% 8%

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 6876 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 Complement C3dg fragment.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	296	Total	C	N	O	S	0	0	0
			2330	1495	393	433	9			
1	C	282	Total	C	N	O	S	0	0	0
			2227	1431	370	417	9			

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	991	GLY	-	expression tag	UNP P01024
A	992	SER	-	expression tag	UNP P01024
A	993	ARG	-	expression tag	UNP P01024
A	994	SER	-	expression tag	UNP P01024
A	995	THR	-	expression tag	UNP P01024
A	1010	ALA	CYS	engineered mutation	UNP P01024
C	991	GLY	-	expression tag	UNP P01024
C	992	SER	-	expression tag	UNP P01024
C	993	ARG	-	expression tag	UNP P01024
C	994	SER	-	expression tag	UNP P01024
C	995	THR	-	expression tag	UNP P01024
C	1010	ALA	CYS	engineered mutation	UNP P01024

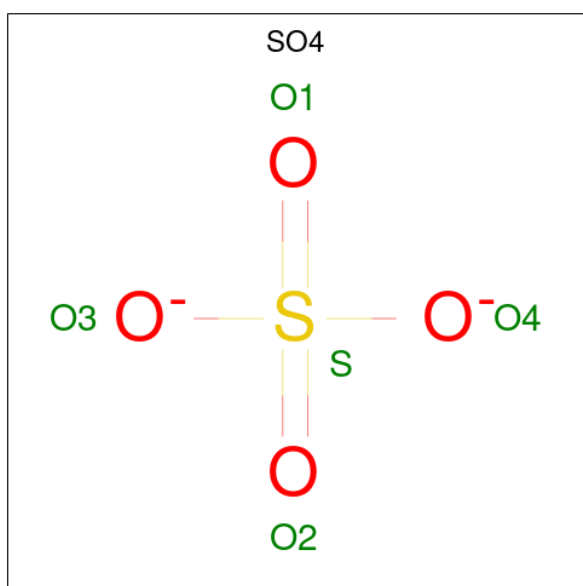
- Molecule 2 is a protein called Complement factor H-related protein 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	124	Total	C	N	O	S	0	0	0
			981	616	165	190	10			
2	D	121	Total	C	N	O	S	0	0	0
			955	602	159	184	10			

There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	140	GLY	-	expression tag	UNP P36980
B	141	SER	-	expression tag	UNP P36980
B	142	THR	-	expression tag	UNP P36980
B	143	GLY	-	expression tag	UNP P36980
B	144	SER	-	expression tag	UNP P36980
D	140	GLY	-	expression tag	UNP P36980
D	141	SER	-	expression tag	UNP P36980
D	142	THR	-	expression tag	UNP P36980
D	143	GLY	-	expression tag	UNP P36980
D	144	SER	-	expression tag	UNP P36980

- Molecule 3 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	O	S	0	0
			5	4	1		
3	B	1	Total	O	S	0	0
			5	4	1		
3	B	1	Total	O	S	0	0
			5	4	1		
3	D	1	Total	O	S	0	0
			5	4	1		

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	176	Total	O	0	0
			176	176		

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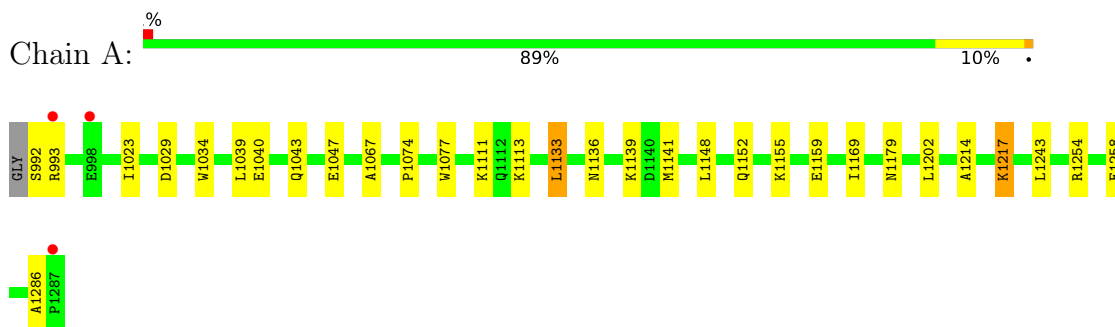
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	71	Total 71	O 71	0	0
4	C	32	Total 32	O 32	0	0
4	D	84	Total 84	O 84	0	0

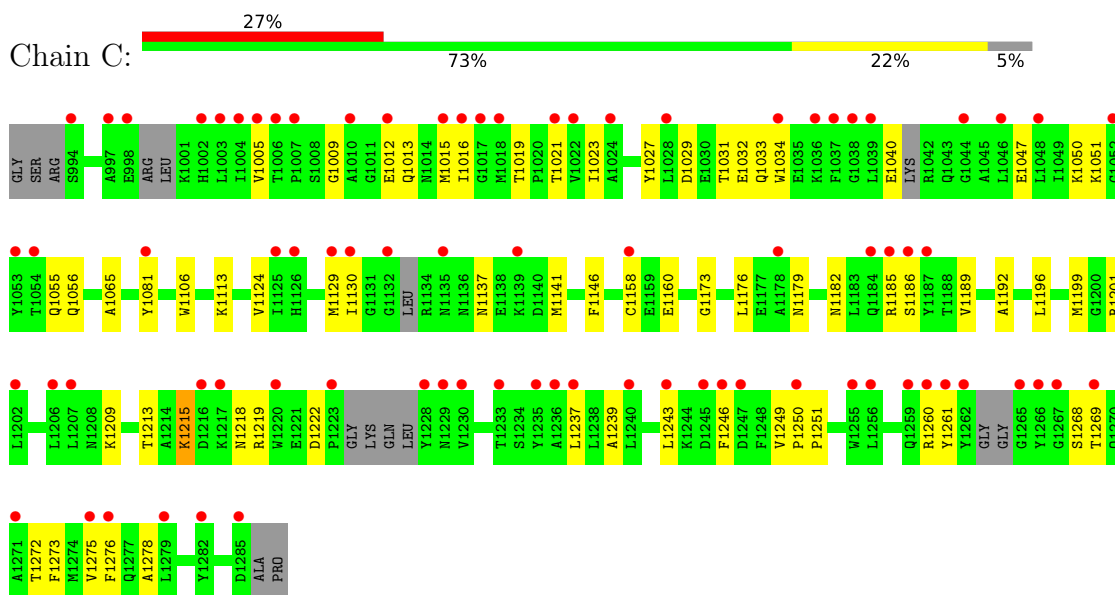
3 Residue-property plots [i](#)

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.

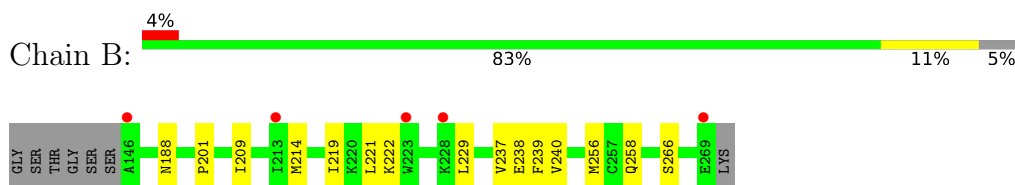
- Molecule 1: Complement C3dg fragment



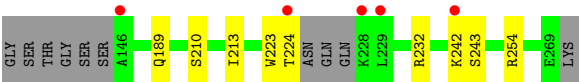
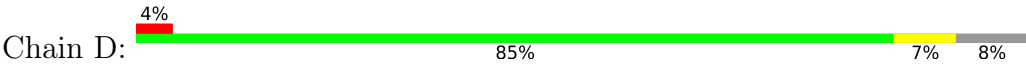
- Molecule 1: Complement C3dg fragment



- Molecule 2: Complement factor H-related protein 2



- Molecule 2: Complement factor H-related protein 2



4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α , β , γ	113.30Å 116.23Å 165.58Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.57 – 2.31 47.57 – 2.31	Depositor EDS
% Data completeness (in resolution range)	98.0 (47.57-2.31) 98.3 (47.57-2.31)	Depositor EDS
R_{merge}	0.27	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.31 (at 2.32Å)	Xtriage
Refinement program	PHENIX (1.21rc1_5127: ???)	Depositor
R, R_{free}	0.194 , 0.227 0.194 , 0.226	Depositor DCC
R_{free} test set	2003 reflections (4.14%)	wwPDB-VP
Wilson B-factor (Å ²)	35.7	Xtriage
Anisotropy	0.678	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 62.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	0.036 for -k,-h,-l	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	6876	wwPDB-VP
Average B, all atoms (Å ²)	59.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.59% 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: SO4

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	0.12	0/2379	0.30	0/3223
1	C	0.16	0/2270	0.34	0/3071
2	B	0.11	0/1006	0.30	0/1364
2	D	0.12	0/979	0.38	0/1326
All	All	0.13	0/6634	0.32	0/8984

There are no bond length outliers.

There are no bond angle outliers.

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	2330	0	2336	20	0
1	C	2227	0	2212	45	0
2	B	981	0	937	9	0
2	D	955	0	914	6	0
3	A	5	0	0	0	0
3	B	10	0	0	0	0
3	D	5	0	0	0	0
4	A	176	0	0	0	0
4	B	71	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	C	32	0	0	0	0
4	D	84	0	0	3	0
All	All	6876	0	6399	80	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.

The worst 5 of 80 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:1237:LEU:HD22	1:C:1278:ALA:HB1	1.68	0.76
1:C:1141:MET:HE1	1:C:1179:ASN:HB2	1.78	0.65
1:C:1173:GLY:HA3	1:C:1199:MET:HE1	1.80	0.63
1:C:1015:MET:HE1	1:C:1056:GLN:CD	2.24	0.62
1:C:1031:THR:HG23	1:C:1033:GLN:HG3	1.83	0.61

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	294/297 (99%)	288 (98%)	5 (2%)	1 (0%)	36	45
1	C	270/297 (91%)	261 (97%)	9 (3%)	0	100	100
2	B	122/131 (93%)	118 (97%)	4 (3%)	0	100	100
2	D	117/131 (89%)	115 (98%)	2 (2%)	0	100	100
All	All	803/856 (94%)	782 (97%)	20 (2%)	1 (0%)	48	59

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	1286	ALA

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	245/245 (100%)	243 (99%)	2 (1%)	73	85
1	C	235/245 (96%)	232 (99%)	3 (1%)	61	76
2	B	113/118 (96%)	113 (100%)	0	100	100
2	D	110/118 (93%)	110 (100%)	0	100	100
All	All	703/726 (97%)	698 (99%)	5 (1%)	76	86

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1133	LEU
1	A	1217	LYS
1	C	1032	GLU
1	C	1130	ILE
1	C	1215	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 15 such sidechains are listed below:

Mol	Chain	Res	Type
2	B	226	GLN
2	D	251	HIS
1	C	1033	GLN
2	D	259	ASN
1	C	1198	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](#)

4 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	$\# Z > 2$
3	SO4	B	302	-	4,4,4	0.66	0	6,6,6	0.11	0
3	SO4	B	301	-	4,4,4	0.67	0	6,6,6	0.10	0
3	SO4	A	1301	-	4,4,4	0.67	0	6,6,6	0.09	0
3	SO4	D	301	-	4,4,4	0.67	0	6,6,6	0.10	0

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

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 ⓘ

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	296/297 (99%)	-0.12	3 (1%) 79 81	21, 38, 74, 109	0
1	C	282/297 (94%)	1.39	80 (28%) 1 1	31, 91, 132, 151	0
2	B	124/131 (94%)	0.25	5 (4%) 42 45	31, 48, 78, 91	0
2	D	121/131 (92%)	0.05	5 (4%) 41 44	26, 41, 72, 84	0
All	All	823/856 (96%)	0.48	93 (11%) 10 11	21, 50, 116, 151	0

The worst 5 of 93 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	1262	TYR	5.5
1	C	1016	ILE	4.7
1	C	1265	GLY	4.4
1	C	1261	TYR	4.3
1	C	1276	PHE	4.3

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](#)

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($\text{\AA}^2$)	Q<0.9
3	SO4	A	1301	5/5	0.94	0.11	57,63,74,74	0
3	SO4	B	301	5/5	0.96	0.08	55,66,69,80	0
3	SO4	D	301	5/5	0.96	0.11	40,52,68,80	0
3	SO4	B	302	5/5	0.97	0.09	53,65,73,74	0

6.5 Other polymers [i](#)

There are no such residues in this entry.