



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 10, 2026 – 10:58 AM UTC

PDB ID : 1X71 / pdb_00001x71
Title : Crystal structure of Siderocalin (NGAL, Lipocalin 2) complexed with
TRENCA-3,2-HOPO, a cepabactin analogue
Authors : Holmes, M.A.; Paulsene, W.; Jide, X.; Ratledge, C.; Strong, R.K.
Deposited on : 2004-08-12
Resolution : 2.10 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)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

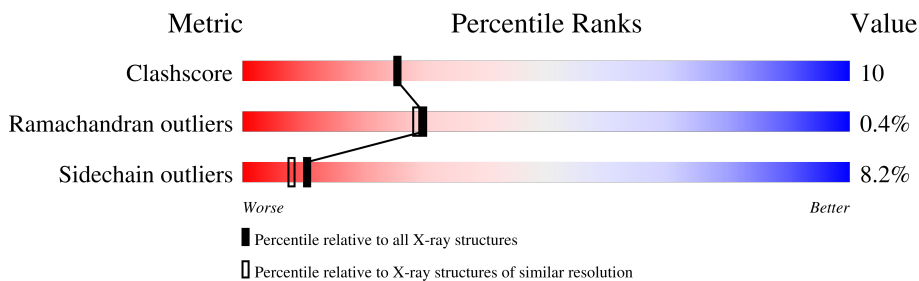
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.10 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))
Clashscore	190562	7164 (2.10-2.10)
Ramachandran outliers	187476	7099 (2.10-2.10)
Sidechain outliers	187428	7100 (2.10-2.10)

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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	178	 79% 17% ...
1	B	178	 61% 26% 8% .
1	C	178	 72% 23% ...

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 4298 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 Neutrophil gelatinase-associated lipocalin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	175	Total	C	N	O	S	0	0	0
			1391	901	230	256	4			
1	B	171	Total	C	N	O	S	0	0	0
			1337	869	223	241	4			
1	C	174	Total	C	N	O	S	0	0	0
			1396	902	232	258	4			

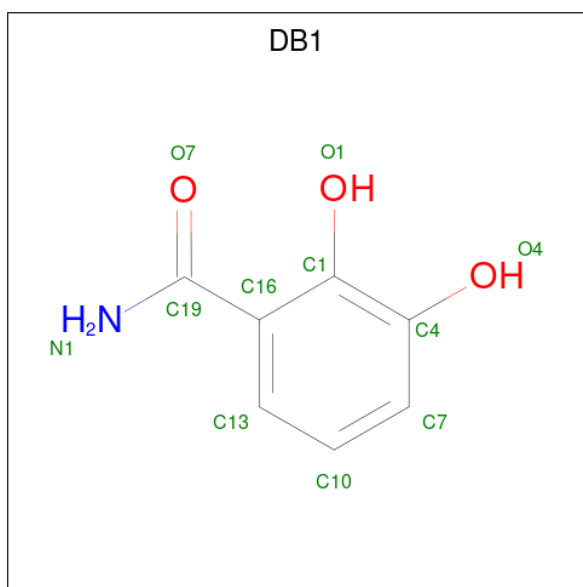
There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	87	SER	CYS	engineered mutation	UNP P80188
B	87	SER	CYS	engineered mutation	UNP P80188
C	87	SER	CYS	engineered mutation	UNP P80188

- Molecule 2 is FE (III) ION (CCD ID: FE) (formula: Fe).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Fe	0	0
			1	1		
2	B	1	Total	Fe	0	0
			1	1		
2	C	1	Total	Fe	0	0
			1	1		

- Molecule 3 is 2,3-DIHYDROXYBENZAMIDE (CCD ID: DB1) (formula: C₇H₇NO₃).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			11	7	1	3		
3	A	1	Total	C	N	O	0	0
			11	7	1	3		
3	B	1	Total	C	N	O	0	0
			11	7	1	3		
3	B	1	Total	C	N	O	0	0
			11	7	1	3		
3	C	1	Total	C	N	O	0	0
			11	7	1	3		

- Molecule 4 is water.

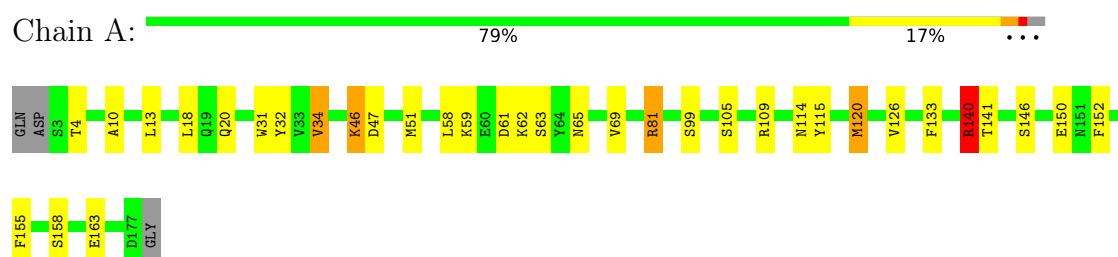
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	38	Total	O	0	0
			38	38		
4	B	8	Total	O	0	0
			8	8		
4	C	70	Total	O	0	0
			70	70		

3 Residue-property plots [i](#)

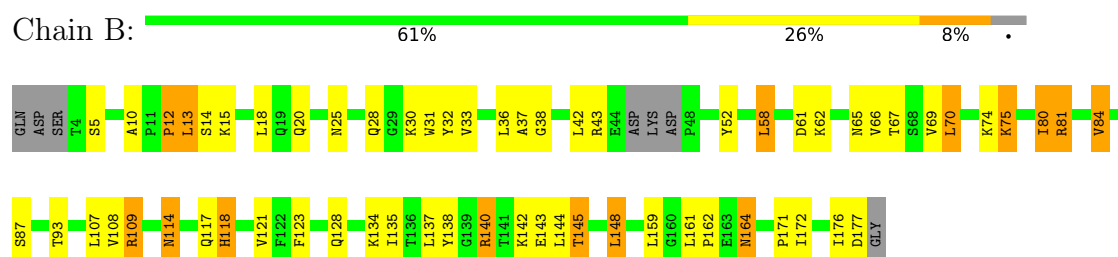
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded 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. 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.

Note EDS was not executed.

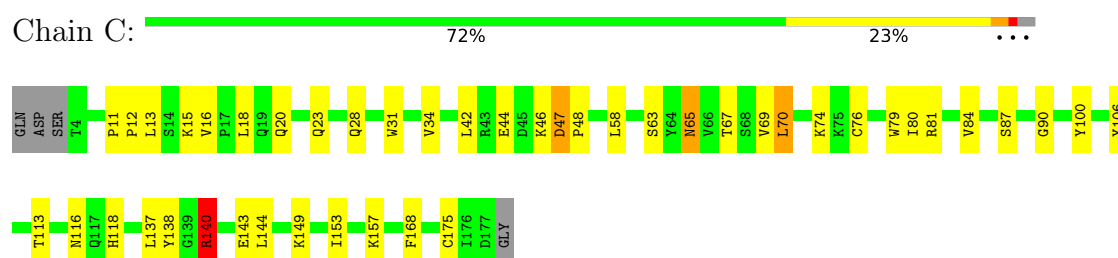
- Molecule 1: Neutrophil gelatinase-associated lipocalin



- Molecule 1: Neutrophil gelatinase-associated lipocalin



- Molecule 1: Neutrophil gelatinase-associated lipocalin



4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, α , β , γ	114.40Å 114.40Å 119.00Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	20.00 – 2.10	Depositor
% Data completeness (in resolution range)	(Not available) (20.00-2.10)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	0.05	Depositor
Refinement program	CNS	Depositor
R, R_{free}	0.225 , 0.257	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	4298	wwPDB-VP
Average B, all atoms (Å ²)	37.0	wwPDB-VP

5 Model quality ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: DB1, FE

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	1.30	4/1426 (0.3%)	1.36	8/1936 (0.4%)
1	B	1.03	0/1371	1.39	22/1862 (1.2%)
1	C	1.41	5/1431 (0.3%)	1.40	17/1942 (0.9%)
All	All	1.26	9/4228 (0.2%)	1.38	47/5740 (0.8%)

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	B	0	1
1	C	0	1
All	All	0	2

The worst 5 of 9 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	18	LEU	CA-C	7.12	1.61	1.52
1	A	120	MET	SD-CE	-6.92	1.62	1.79
1	C	16	VAL	N-CA	6.63	1.51	1.46
1	C	168	PHE	C-O	-6.29	1.18	1.24
1	C	113	THR	CA-CB	6.22	1.64	1.53

The worst 5 of 47 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	81	ARG	NE-CZ-NH2	13.11	131.00	119.20
1	B	81	ARG	NE-CZ-NH1	-12.46	109.04	121.50
1	A	114	ASN	N-CA-C	-7.28	103.49	112.88

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	140	ARG	CB-CG-CD	7.20	127.86	111.30
1	C	65	ASN	N-CA-C	-7.20	97.52	108.96

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	32	TYR	Sidechain
1	C	138	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	1391	0	1362	20	0
1	B	1337	0	1298	38	0
1	C	1396	0	1370	23	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0
3	A	22	0	10	2	0
3	B	22	0	10	1	0
3	C	11	0	5	0	0
4	A	38	0	0	0	0
4	B	8	0	0	0	0
4	C	70	0	0	0	0
All	All	4298	0	4055	79	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 10.

The worst 5 of 79 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:A:59:LYS:HE3	1:A:65:ASN:HD22	1.38	0.87

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:67:THR:HG23	1:C:80:ILE:HD11	1.56	0.85
1:C:12:PRO:HD2	1:C:15:LYS:CE	2.11	0.79
1:A:31:TRP:CZ3	1:A:140:ARG:HD2	2.19	0.77
1:A:140:ARG:HG2	1:C:23:GLN:NE2	2.01	0.76

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	173/178 (97%)	167 (96%)	5 (3%)	1 (1%)	21	18
1	B	167/178 (94%)	157 (94%)	9 (5%)	1 (1%)	21	18
1	C	172/178 (97%)	166 (96%)	6 (4%)	0	100	100
All	All	512/534 (96%)	490 (96%)	20 (4%)	2 (0%)	30	28

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	145	THR
1	A	46	LYS

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	152/163 (93%)	143 (94%)	9 (6%)	18	16
1	B	143/163 (88%)	127 (89%)	16 (11%)	6	3
1	C	154/163 (94%)	142 (92%)	12 (8%)	11	9
All	All	449/489 (92%)	412 (92%)	37 (8%)	10	8

5 of 37 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	44	GLU
1	C	140	ARG
1	C	47	ASP
1	C	69	VAL
1	B	36	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 9 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	96	ASN
1	C	116	ASN
1	B	65	ASN
1	B	118	HIS
1	B	164	ASN

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 ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 8 ligands modelled in this entry, 3 are monoatomic - leaving 5 for Mogul analysis.

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	DB1	A	202	2	11,11,11	3.18	6 (54%)	15,15,15	1.35	3 (20%)
3	DB1	B	201	2	11,11,11	5.67	4 (36%)	15,15,15	2.24	7 (46%)
3	DB1	A	201	2	11,11,11	2.26	3 (27%)	15,15,15	1.33	2 (13%)
3	DB1	C	201	2	11,11,11	2.58	3 (27%)	15,15,15	1.48	3 (20%)
3	DB1	B	203	2	11,11,11	3.18	6 (54%)	15,15,15	1.14	1 (6%)

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
3	DB1	A	202	2	-	0/4/4/4	0/1/1/1
3	DB1	B	201	2	-	0/4/4/4	0/1/1/1
3	DB1	A	201	2	-	0/4/4/4	0/1/1/1
3	DB1	C	201	2	-	0/4/4/4	0/1/1/1
3	DB1	B	203	2	-	0/4/4/4	0/1/1/1

The worst 5 of 22 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	201	DB1	C4-C1	13.75	1.55	1.40
3	B	201	DB1	C19-N1	9.15	1.49	1.33
3	B	203	DB1	C4-C1	8.34	1.49	1.40
3	B	201	DB1	O7-C19	7.43	1.38	1.24
3	A	202	DB1	C4-C1	7.29	1.48	1.40

The worst 5 of 16 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	201	DB1	O7-C19-N1	4.14	128.59	122.62
3	B	201	DB1	C7-C4-C1	-3.70	116.25	120.09
3	C	201	DB1	O1-C1-C16	3.02	126.49	121.11

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	201	DB1	O4-C4-C7	2.89	127.12	119.36
3	B	201	DB1	O7-C19-C16	-2.84	116.89	120.24

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

2 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	202	DB1	2	0
3	B	201	DB1	1	0

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](#)

EDS was not executed - this section is therefore empty.

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates [i](#)

EDS was not executed - this section is therefore empty.

6.4 Ligands [i](#)

EDS was not executed - this section is therefore empty.

6.5 Other polymers [i](#)

EDS was not executed - this section is therefore empty.