



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 08:31 AM UTC

PDB ID : 6ECF / pdb_00006ecf
Title : Vlm2 thioesterase domain with genetically encoded 2,3-diaminopropionic acid bound with a dodecadepsipeptide, space group P1
Authors : Alonzo, D.A.; Huguenin-Dezot, N.; Heberlig, G.W.; Mahesh, M.; Nguyen, D.P.; Dornan, M.H.; Boddy, C.N.; Chin, J.W.; Schmeing, T.M.
Deposited on : 2018-08-07
Resolution : 2.50 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
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

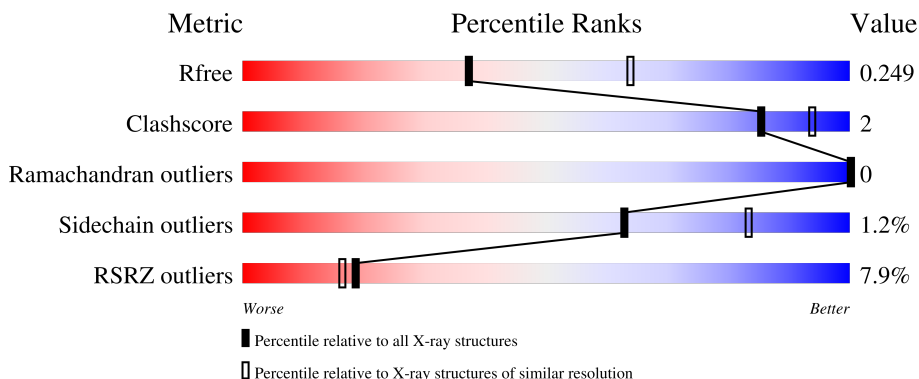
1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.50 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	5829 (2.50-2.50)
Clashscore	190562	6492 (2.50-2.50)
Ramachandran outliers	187476	6378 (2.50-2.50)
Sidechain outliers	187428	6380 (2.50-2.50)
RSRZ outliers	180081	5833 (2.50-2.50)

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	303	
1	B	303	
1	C	303	
1	D	303	
1	E	303	

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Mol	Chain	Length	Quality of chain
1	F	303	<p>7% 82% 15%</p>
2	G	12	<p>8% 25% 67%</p>
2	H	12	<p>17% 83%</p>
2	I	12	<p>25% 75%</p>
2	J	12	<p>8% 8% 83%</p>
2	K	12	<p>17% 83%</p>
2	L	12	<p>8% 8% 8% 83%</p>

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 23003 atoms, of which 11242 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 Vlm2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace	
			Total	C	H	N	O				S
1	A	251	3675	1201	1805	324	337	8	0	0	0
1	B	252	3738	1212	1847	330	341	8	0	0	0
1	C	252	3745	1215	1854	332	336	8	0	0	0
1	D	265	3863	1257	1905	340	352	9	0	0	0
1	E	262	3758	1235	1839	326	349	9	0	0	0
1	F	258	3821	1246	1888	333	345	9	0	2	0

There are 90 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	2353	MET	-	expression tag	UNP Q1PSF3
A	2354	HIS	-	expression tag	UNP Q1PSF3
A	2355	HIS	-	expression tag	UNP Q1PSF3
A	2356	HIS	-	expression tag	UNP Q1PSF3
A	2357	HIS	-	expression tag	UNP Q1PSF3
A	2358	HIS	-	expression tag	UNP Q1PSF3
A	2359	HIS	-	expression tag	UNP Q1PSF3
A	2360	HIS	-	expression tag	UNP Q1PSF3
A	2361	HIS	-	expression tag	UNP Q1PSF3
A	2362	GLU	-	expression tag	UNP Q1PSF3
A	2363	ASN	-	expression tag	UNP Q1PSF3
A	2364	LEU	-	expression tag	UNP Q1PSF3
A	2365	TYR	-	expression tag	UNP Q1PSF3
A	2366	PHE	-	expression tag	UNP Q1PSF3
A	2367	GLN	-	expression tag	UNP Q1PSF3
B	2353	MET	-	expression tag	UNP Q1PSF3
B	2354	HIS	-	expression tag	UNP Q1PSF3

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Chain	Residue	Modelled	Actual	Comment	Reference
B	2355	HIS	-	expression tag	UNP Q1PSF3
B	2356	HIS	-	expression tag	UNP Q1PSF3
B	2357	HIS	-	expression tag	UNP Q1PSF3
B	2358	HIS	-	expression tag	UNP Q1PSF3
B	2359	HIS	-	expression tag	UNP Q1PSF3
B	2360	HIS	-	expression tag	UNP Q1PSF3
B	2361	HIS	-	expression tag	UNP Q1PSF3
B	2362	GLU	-	expression tag	UNP Q1PSF3
B	2363	ASN	-	expression tag	UNP Q1PSF3
B	2364	LEU	-	expression tag	UNP Q1PSF3
B	2365	TYR	-	expression tag	UNP Q1PSF3
B	2366	PHE	-	expression tag	UNP Q1PSF3
B	2367	GLN	-	expression tag	UNP Q1PSF3
C	2353	MET	-	expression tag	UNP Q1PSF3
C	2354	HIS	-	expression tag	UNP Q1PSF3
C	2355	HIS	-	expression tag	UNP Q1PSF3
C	2356	HIS	-	expression tag	UNP Q1PSF3
C	2357	HIS	-	expression tag	UNP Q1PSF3
C	2358	HIS	-	expression tag	UNP Q1PSF3
C	2359	HIS	-	expression tag	UNP Q1PSF3
C	2360	HIS	-	expression tag	UNP Q1PSF3
C	2361	HIS	-	expression tag	UNP Q1PSF3
C	2362	GLU	-	expression tag	UNP Q1PSF3
C	2363	ASN	-	expression tag	UNP Q1PSF3
C	2364	LEU	-	expression tag	UNP Q1PSF3
C	2365	TYR	-	expression tag	UNP Q1PSF3
C	2366	PHE	-	expression tag	UNP Q1PSF3
C	2367	GLN	-	expression tag	UNP Q1PSF3
D	2353	MET	-	expression tag	UNP Q1PSF3
D	2354	HIS	-	expression tag	UNP Q1PSF3
D	2355	HIS	-	expression tag	UNP Q1PSF3
D	2356	HIS	-	expression tag	UNP Q1PSF3
D	2357	HIS	-	expression tag	UNP Q1PSF3
D	2358	HIS	-	expression tag	UNP Q1PSF3
D	2359	HIS	-	expression tag	UNP Q1PSF3
D	2360	HIS	-	expression tag	UNP Q1PSF3
D	2361	HIS	-	expression tag	UNP Q1PSF3
D	2362	GLU	-	expression tag	UNP Q1PSF3
D	2363	ASN	-	expression tag	UNP Q1PSF3
D	2364	LEU	-	expression tag	UNP Q1PSF3
D	2365	TYR	-	expression tag	UNP Q1PSF3
D	2366	PHE	-	expression tag	UNP Q1PSF3

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Chain	Residue	Modelled	Actual	Comment	Reference
D	2367	GLN	-	expression tag	UNP Q1PSF3
E	2353	MET	-	expression tag	UNP Q1PSF3
E	2354	HIS	-	expression tag	UNP Q1PSF3
E	2355	HIS	-	expression tag	UNP Q1PSF3
E	2356	HIS	-	expression tag	UNP Q1PSF3
E	2357	HIS	-	expression tag	UNP Q1PSF3
E	2358	HIS	-	expression tag	UNP Q1PSF3
E	2359	HIS	-	expression tag	UNP Q1PSF3
E	2360	HIS	-	expression tag	UNP Q1PSF3
E	2361	HIS	-	expression tag	UNP Q1PSF3
E	2362	GLU	-	expression tag	UNP Q1PSF3
E	2363	ASN	-	expression tag	UNP Q1PSF3
E	2364	LEU	-	expression tag	UNP Q1PSF3
E	2365	TYR	-	expression tag	UNP Q1PSF3
E	2366	PHE	-	expression tag	UNP Q1PSF3
E	2367	GLN	-	expression tag	UNP Q1PSF3
F	2353	MET	-	expression tag	UNP Q1PSF3
F	2354	HIS	-	expression tag	UNP Q1PSF3
F	2355	HIS	-	expression tag	UNP Q1PSF3
F	2356	HIS	-	expression tag	UNP Q1PSF3
F	2357	HIS	-	expression tag	UNP Q1PSF3
F	2358	HIS	-	expression tag	UNP Q1PSF3
F	2359	HIS	-	expression tag	UNP Q1PSF3
F	2360	HIS	-	expression tag	UNP Q1PSF3
F	2361	HIS	-	expression tag	UNP Q1PSF3
F	2362	GLU	-	expression tag	UNP Q1PSF3
F	2363	ASN	-	expression tag	UNP Q1PSF3
F	2364	LEU	-	expression tag	UNP Q1PSF3
F	2365	TYR	-	expression tag	UNP Q1PSF3
F	2366	PHE	-	expression tag	UNP Q1PSF3
F	2367	GLN	-	expression tag	UNP Q1PSF3

- Molecule 2 is a protein called dodecadepsipeptide.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace	
2	G	4	Total	C	H	N	O	0	0	0
			56	18	30	2	6			
2	I	3	Total	C	H	N	O	0	0	0
			41	13	22	2	4			
2	H	2	Total	C	H	N	O	0	0	0
			25	8	13	1	3			
2	K	2	Total	C	H	N	O	0	0	0
			25	8	13	1	3			

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	J	2	Total	C	H	N	O	0	0	0
			25	8	13	1	3			
2	L	2	Total	C	H	N	O	0	0	0
			25	8	13	1	3			

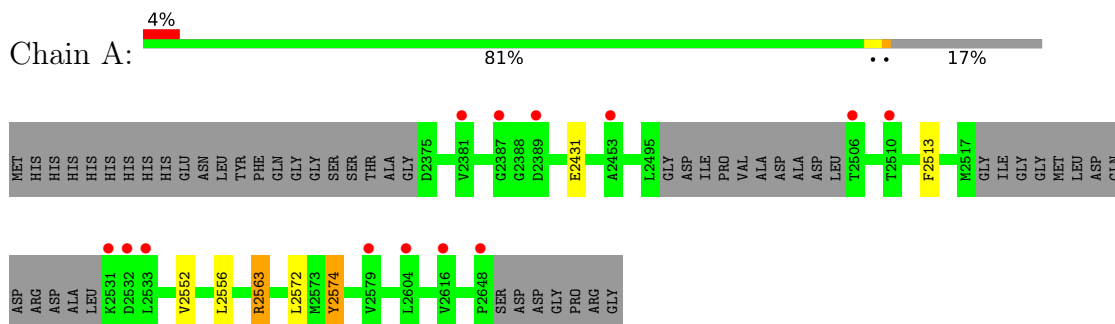
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	50	Total	O	0	0
			50	50		
3	B	23	Total	O	0	0
			23	23		
3	C	35	Total	O	0	0
			35	35		
3	D	30	Total	O	0	0
			30	30		
3	E	34	Total	O	0	0
			34	34		
3	F	34	Total	O	0	0
			34	34		

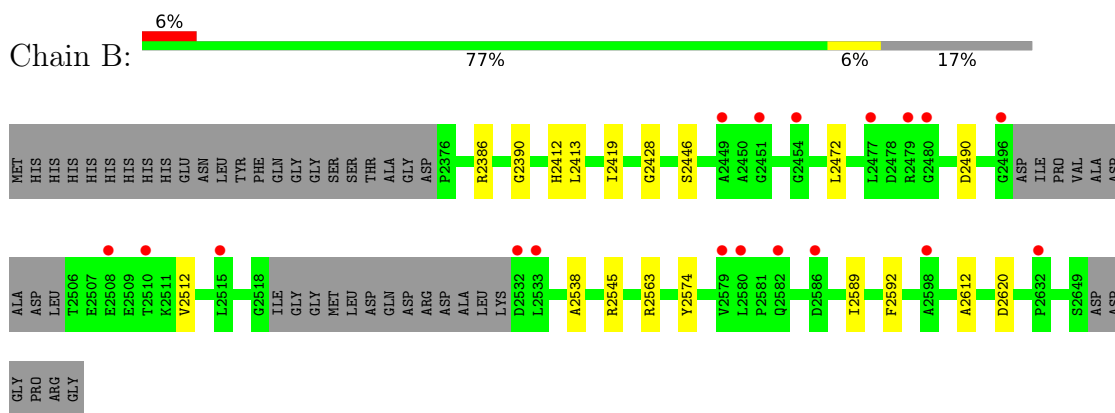
3 Residue-property plots [i](#)

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.

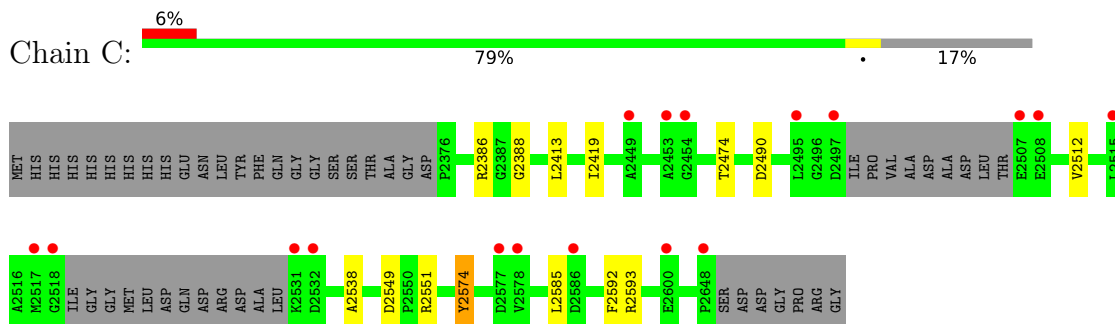
- Molecule 1: Vlm2



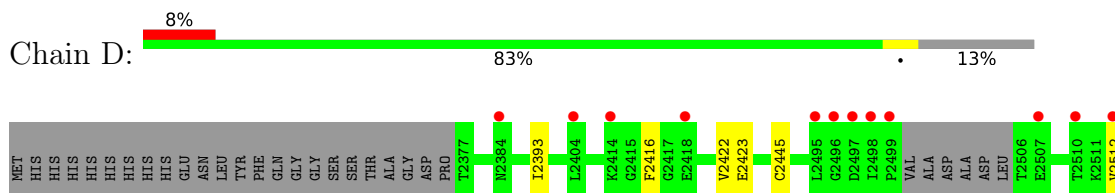
- Molecule 1: Vlm2



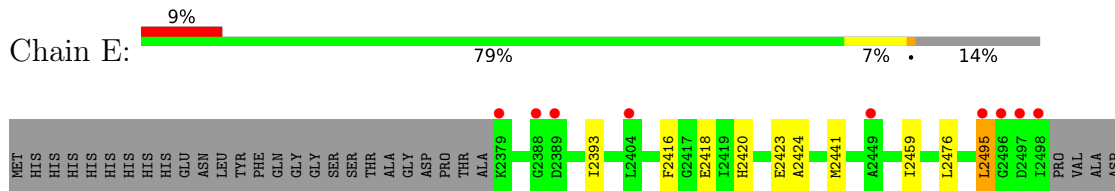
- Molecule 1: Vlm2



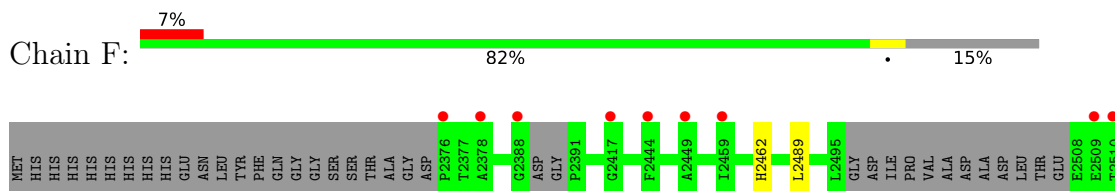
- Molecule 1: Vlm2



• Molecule 1: Vlm2



• Molecule 1: Vlm2



• Molecule 2: dodecadepsipeptide



• Molecule 2: dodecadepsipeptide



• Molecule 2: dodecadepsipeptide



VAD	20P3011	VAD	VAD	VAD	VAD	VAD	VAD	VAD	VAD
DVA	V3012	DVA	DVA	DVA	DVA	DVA	DVA	DVA	DVA
		20P	20P	20P	20P	20P	20P	20P	20P
		VAL	VAL	VAL	VAL	VAL	VAL	VAL	VAL

- Molecule 2: dodecadepsipeptide

Chain K:  17% 83%

VAD	20P3011	VAD	VAD	VAD	VAD	VAD	VAD	VAD	VAD
DVA	V3012	DVA	DVA	DVA	DVA	DVA	DVA	DVA	DVA
		20P	20P	20P	20P	20P	20P	20P	20P
		VAL	VAL	VAL	VAL	VAL	VAL	VAL	VAL

- Molecule 2: dodecadepsipeptide

Chain J:  8% 8% 83%

VAD	20P3011	VAD	VAD	VAD	VAD	VAD	VAD	VAD	VAD
DVA	V3012	DVA	DVA	DVA	DVA	DVA	DVA	DVA	DVA
		20P	20P	20P	20P	20P	20P	20P	20P
		VAL	VAL	VAL	VAL	VAL	VAL	VAL	VAL

- Molecule 2: dodecadepsipeptide

Chain L:  8% 8% 83%

VAD	20P3011	VAD	VAD	VAD	VAD	VAD	VAD	VAD	VAD
DVA	V3012	DVA	DVA	DVA	DVA	DVA	DVA	DVA	DVA
		20P	20P	20P	20P	20P	20P	20P	20P
		VAL	VAL	VAL	VAL	VAL	VAL	VAL	VAL

4 Data and refinement statistics i

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	77.00Å 77.13Å 90.33Å 91.77° 114.89° 117.94°	Depositor
Resolution (Å)	78.55 – 2.50 78.55 – 2.50	Depositor EDS
% Data completeness (in resolution range)	97.6 (78.55-2.50) 95.4 (78.55-2.50)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.77 (at 2.51Å)	Xtriage
Refinement program	PHENIX 1.13_2998	Depositor
R, R_{free}	0.197 , 0.249 0.199 , 0.249	Depositor DCC
R_{free} test set	2683 reflections (3.98%)	wwPDB-VP
Wilson B-factor (Å ²)	37.6	Xtriage
Anisotropy	0.354	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 30.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.076 for k,-h-k,h+1 0.076 for -h-k,h,h+k+1 0.031 for h,-h-k,-h-l 0.023 for -h-k,k,-l 0.035 for k,h,-h-k-l	Xtriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	23003	wwPDB-VP
Average B, all atoms (Å ²)	48.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.79% 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: DPP, DVA, VAD, 2OP

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	0/1910	0.27	0/2600
1	B	0.11	0/1931	0.27	0/2623
1	C	0.12	0/1931	0.28	0/2622
1	D	0.13	0/1998	0.27	0/2717
1	E	0.12	0/1958	0.27	0/2664
1	F	0.12	0/1979	0.27	0/2687
2	G	0.19	0/6	0.70	0/7
2	H	0.23	0/6	0.28	0/7
2	I	0.19	0/6	0.27	0/7
2	J	0.19	0/6	0.33	0/7
2	K	0.15	0/6	0.38	0/7
2	L	0.18	0/6	0.24	0/7
All	All	0.12	0/11743	0.27	0/15955

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	1870	1805	1803	6	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	B	1891	1847	1846	10	0
1	C	1891	1854	1852	7	0
1	D	1958	1905	1902	7	0
1	E	1919	1839	1836	13	0
1	F	1933	1888	1881	7	0
2	G	26	30	30	3	0
2	H	12	13	14	0	0
2	I	19	22	23	0	0
2	J	12	13	14	2	0
2	K	12	13	14	0	0
2	L	12	13	14	2	0
3	A	50	0	0	0	0
3	B	23	0	0	2	0
3	C	35	0	0	0	0
3	D	30	0	0	0	0
3	E	34	0	0	1	0
3	F	34	0	0	0	0
All	All	11761	11242	11229	50	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 2.

All (50) 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:E:2572:LEU:HD21	2:J:3012:VAL:HG21	1.58	0.83
1:F:2572:LEU:HD21	2:L:3012:VAL:HG21	1.65	0.77
1:C:2474:THR:HG22	1:C:2585:LEU:HD21	1.69	0.73
1:F:2584:LYS:NZ	1:F:2610:ASN:O	2.24	0.70
1:E:2572:LEU:CD2	2:J:3012:VAL:HG21	2.22	0.69
1:A:2572:LEU:HD21	2:G:3012:VAL:HG21	1.79	0.64
1:A:2431:GLU:O	1:A:2563:ARG:NH2	2.34	0.61
1:D:2393:ILE:HD11	1:D:2416:PHE:CD2	2.40	0.57
1:E:2599:PRO:HA	1:E:2602:ALA:HB3	1.89	0.55
1:D:2512:VAL:HG23	1:D:2538:ALA:HB1	1.90	0.54
1:F:2572:LEU:CD2	2:L:3012:VAL:HG21	2.35	0.54
1:F:2575:SER:O	1:F:2578:VAL:HG12	2.09	0.53
1:B:2413:LEU:HD12	1:B:2419:ILE:HD13	1.92	0.51
1:B:2512:VAL:HG13	1:B:2538:ALA:HB1	1.93	0.51
1:E:2600:GLU:O	1:E:2604:LEU:HD13	2.11	0.51
1:F:2519:ILE:HG23	1:F:2529:ALA:HB3	1.93	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:E:2424:ALA:HB1	1:E:2441:MET:HE1	1.94	0.49
1:C:2386:ARG:NH2	1:C:2388:GLY:O	2.46	0.49
1:B:2412:HIS:O	3:B:2701:HOH:O	2.20	0.48
1:D:2393:ILE:HD11	1:D:2416:PHE:CE2	2.49	0.48
1:A:2572:LEU:CD2	2:G:3012:VAL:HG21	2.43	0.47
1:E:2514:ILE:HG23	1:E:2515:LEU:HD12	1.97	0.47
1:E:2510:THR:O	1:E:2514:ILE:HG22	2.14	0.47
1:A:2513:PHE:CZ	2:G:3010:DVA:N	2.83	0.47
1:C:2549:ASP:OD2	1:C:2551:ARG:NH1	2.48	0.46
1:C:2413:LEU:HD12	1:C:2419:ILE:HD13	1.98	0.46
1:E:2495:LEU:HD12	1:E:2495:LEU:H	1.81	0.45
1:D:2512:VAL:HG13	1:D:2513:PHE:H	1.81	0.45
1:E:2459:ILE:HD11	1:E:2476:LEU:HD12	1.98	0.45
1:E:2393:ILE:HD11	1:E:2416:PHE:CE2	2.52	0.45
1:E:2555:PHE:O	3:E:2701:HOH:O	2.21	0.44
1:B:2446:SER:HA	1:B:2472:LEU:HD11	1.99	0.44
1:A:2552:VAL:HG13	1:A:2556:LEU:HD23	1.99	0.44
1:B:2386:ARG:NH1	1:B:2390:GLY:O	2.51	0.44
1:B:2620:ASP:OD2	3:B:2702:HOH:O	2.21	0.44
1:B:2428:GLY:O	1:B:2563:ARG:NH1	2.51	0.44
1:F:2520:GLY:N	1:F:2573:MET:O	2.49	0.44
1:C:2512:VAL:HG13	1:C:2538:ALA:HB1	2.00	0.43
1:B:2490:ASP:N	1:B:2592:PHE:O	2.50	0.43
1:F:2462:HIS:HA	1:F:2489:LEU:HB2	1.99	0.43
1:A:2574:TYR:C	1:A:2574:TYR:CD1	2.97	0.43
1:B:2574:TYR:C	1:B:2574:TYR:CD1	2.96	0.43
1:C:2574:TYR:CD1	1:C:2574:TYR:C	2.97	0.43
1:D:2422:VAL:HG21	1:D:2445:CYS:SG	2.59	0.43
1:D:2574:TYR:C	1:D:2574:TYR:CD1	2.97	0.43
1:D:2423:GLU:OE2	1:D:2560:TYR:OH	2.35	0.41
1:E:2418:GLU:HB3	1:E:2420:HIS:CE1	2.55	0.41
1:B:2589:ILE:HD12	1:B:2612:ALA:HB2	2.03	0.41
1:C:2490:ASP:N	1:C:2592:PHE:O	2.52	0.41
1:E:2574:TYR:CD1	1:E:2574:TYR:C	2.99	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	244/303 (80%)	237 (97%)	7 (3%)	0	100	100
1	B	245/303 (81%)	239 (98%)	6 (2%)	0	100	100
1	C	245/303 (81%)	238 (97%)	7 (3%)	0	100	100
1	D	260/303 (86%)	250 (96%)	10 (4%)	0	100	100
1	E	255/303 (84%)	248 (97%)	7 (3%)	0	100	100
1	F	253/303 (84%)	241 (95%)	12 (5%)	0	100	100
All	All	1502/1818 (83%)	1453 (97%)	49 (3%)	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	185/241 (77%)	183 (99%)	2 (1%)	65	84
1	B	190/241 (79%)	189 (100%)	1 (0%)	81	92
1	C	188/241 (78%)	186 (99%)	2 (1%)	65	84
1	D	192/241 (80%)	189 (98%)	3 (2%)	55	79
1	E	187/241 (78%)	181 (97%)	6 (3%)	34	62
1	F	192/241 (80%)	192 (100%)	0	100	100
2	G	1/3 (33%)	1 (100%)	0	100	100
2	H	1/3 (33%)	1 (100%)	0	100	100

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
2	I	1/3 (33%)	1 (100%)	0	100	100
2	J	1/3 (33%)	1 (100%)	0	100	100
2	K	1/3 (33%)	1 (100%)	0	100	100
2	L	1/3 (33%)	1 (100%)	0	100	100
All	All	1140/1464 (78%)	1126 (99%)	14 (1%)	63	83

All (14) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	2563	ARG
1	A	2574	TYR
1	B	2545	ARG
1	C	2574	TYR
1	C	2593	ARG
1	D	2531	LYS
1	D	2565	LEU
1	D	2574	TYR
1	E	2423	GLU
1	E	2495	LEU
1	E	2565	LEU
1	E	2566	ARG
1	E	2572	LEU
1	E	2601	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	2420	HIS
1	B	2639	GLN
1	C	2633	HIS
1	E	2420	HIS
1	E	2597	HIS
1	E	2639	GLN
1	F	2568	GLN
1	F	2597	HIS

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains

9 non-standard protein/DNA/RNA residues 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
1	DPP	E	2463	2,1	4,5,6	1.02	0	1,5,7	0.60	0
1	DPP	F	2463	2,1	4,5,6	0.95	0	1,5,7	0.05	0
1	DPP	A	2463	2,1	4,5,6	0.89	0	1,5,7	0.34	0
1	DPP	D	2463	2,1	4,5,6	0.96	0	1,5,7	0.23	0
1	DPP	B	2463	2,1	4,5,6	0.94	0	1,5,7	0.41	0
1	DPP	C	2463	2,1	4,5,6	0.97	0	1,5,7	0.42	0
2	VAD	G	3009	2	5,6,7	0.50	0	5,7,9	1.59	1 (20%)

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
1	DPP	E	2463	2,1	-	2/2/4/6	-
1	DPP	F	2463	2,1	-	2/2/4/6	-
1	DPP	A	2463	2,1	-	2/2/4/6	-
1	DPP	D	2463	2,1	-	1/2/4/6	-
1	DPP	B	2463	2,1	-	2/2/4/6	-
1	DPP	C	2463	2,1	-	0/2/4/6	-
2	VAD	G	3009	2	-	4/5/6/8	-

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	G	3009	VAD	CG1-CB-CA	2.12	114.54	111.10

There are no chirality outliers.

All (13) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	2463	DPP	N-CA-CB-NG
1	B	2463	DPP	N-CA-CB-NG
1	E	2463	DPP	N-CA-CB-NG
1	F	2463	DPP	N-CA-CB-NG
1	F	2463	DPP	C-CA-CB-NG
2	G	3009	VAD	C-CA-CB-CG1
2	G	3009	VAD	C-CA-CB-CG2
2	G	3009	VAD	OE-CA-CB-CG1
2	G	3009	VAD	OE-CA-CB-CG2
1	B	2463	DPP	C-CA-CB-NG
1	E	2463	DPP	C-CA-CB-NG
1	D	2463	DPP	N-CA-CB-NG
1	A	2463	DPP	C-CA-CB-NG

There are no ring outliers.

No monomer is involved in short contacts.

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	250/303 (82%)	0.48	13 (5%)	33	29	27, 43, 64, 77	0
1	B	251/303 (82%)	0.54	18 (7%)	21	19	32, 47, 70, 87	0
1	C	251/303 (82%)	0.49	17 (6%)	23	20	30, 45, 70, 83	0
1	D	264/303 (87%)	0.57	25 (9%)	14	12	29, 44, 72, 102	0
1	E	261/303 (86%)	0.69	26 (9%)	12	10	33, 48, 80, 92	0
1	F	257/303 (84%)	0.62	21 (8%)	17	15	25, 46, 77, 98	1 (0%)
2	G	1/12 (8%)	0.60	0	100	100	52, 52, 52, 52	0
2	H	1/12 (8%)	0.89	0	100	100	58, 58, 58, 58	0
2	I	1/12 (8%)	0.16	0	100	100	52, 52, 52, 52	0
2	J	1/12 (8%)	1.87	0	100	100	71, 71, 71, 71	0
2	K	1/12 (8%)	0.94	0	100	100	59, 59, 59, 59	0
2	L	1/12 (8%)	2.90	1 (100%)	0	0	73, 73, 73, 73	0
All	All	1540/1890 (81%)	0.57	121 (7%)	18	16	25, 46, 73, 102	1 (0%)

All (121) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	2508	GLU	5.3
1	F	2579	VAL	4.1
1	F	2444[A]	PHE	4.0
1	F	2578	VAL	4.0
1	D	2499	PRO	3.9
1	D	2519	ILE	3.8
1	D	2525	GLN	3.8
1	F	2585	LEU	3.7
1	B	2632	PRO	3.7
1	E	2498	ILE	3.5
1	D	2526	ASP	3.5

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Mol	Chain	Res	Type	RSRZ
1	D	2575	SER	3.4
1	B	2508	GLU	3.4
1	F	2528	ASP	3.4
1	B	2579	VAL	3.4
1	E	2388	GLY	3.4
1	B	2496	GLY	3.2
1	E	2519	ILE	3.2
1	D	2524	ASP	3.1
1	C	2497	ASP	3.1
1	A	2389	ASP	3.1
1	B	2532	ASP	3.1
1	D	2384	ASN	3.1
1	E	2582	GLN	3.0
1	D	2626	ALA	3.0
1	F	2388	GLY	3.0
1	B	2510	THR	3.0
1	C	2517	MET	2.9
1	E	2497	ASP	2.9
2	L	3012	VAL	2.9
1	A	2506	THR	2.9
1	D	2418	GLU	2.8
1	E	2523	LEU	2.8
1	A	2387	GLY	2.8
1	D	2585	LEU	2.8
1	A	2533	LEU	2.8
1	D	2533	LEU	2.7
1	C	2578	VAL	2.7
1	B	2449	ALA	2.7
1	E	2512	VAL	2.7
1	B	2451	GLY	2.6
1	C	2577	ASP	2.6
1	E	2521	GLY	2.6
1	C	2515	LEU	2.6
1	E	2449	ALA	2.6
1	E	2524	ASP	2.6
1	A	2510	THR	2.6
1	D	2529	ALA	2.6
1	B	2454	GLY	2.5
1	E	2496	GLY	2.5
1	D	2530	LEU	2.5
1	D	2512	VAL	2.5
1	F	2512	VAL	2.5

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Mol	Chain	Res	Type	RSRZ
1	D	2598	ALA	2.5
1	E	2551	ARG	2.5
1	B	2480	GLY	2.5
1	C	2648	PRO	2.5
1	C	2507	GLU	2.5
1	A	2532	ASP	2.5
1	E	2525	GLN	2.5
1	B	2477	LEU	2.4
1	E	2613	ALA	2.4
1	A	2648	PRO	2.4
1	E	2526	ASP	2.4
1	C	2453	ALA	2.4
1	C	2518	GLY	2.4
1	B	2515	LEU	2.4
1	E	2585	LEU	2.4
1	B	2479	ARG	2.4
1	F	2526	ASP	2.4
1	C	2531	LYS	2.4
1	E	2583	ARG	2.3
1	F	2513	PHE	2.3
1	E	2404	LEU	2.3
1	F	2509	GLU	2.3
1	F	2449	ALA	2.3
1	F	2417	GLY	2.3
1	D	2497	ASP	2.3
1	E	2597	HIS	2.3
1	C	2532	ASP	2.3
1	D	2495	LEU	2.2
1	E	2495	LEU	2.2
1	F	2532	ASP	2.2
1	B	2580	LEU	2.2
1	C	2449	ALA	2.2
1	D	2404	LEU	2.2
1	D	2496	GLY	2.2
1	D	2498	ILE	2.2
1	A	2453	ALA	2.2
1	F	2584	LYS	2.2
1	D	2510	THR	2.2
1	C	2454	GLY	2.2
1	C	2600	GLU	2.2
1	A	2531	LYS	2.2
1	E	2379	LYS	2.2

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Mol	Chain	Res	Type	RSRZ
1	B	2582	GLN	2.1
1	D	2523	LEU	2.1
1	F	2459	ILE	2.1
1	E	2532	ASP	2.1
1	C	2495	LEU	2.1
1	F	2510	THR	2.1
1	F	2575	SER	2.1
1	F	2378	ALA	2.1
1	B	2533	LEU	2.1
1	D	2507	GLU	2.1
1	E	2602	ALA	2.1
1	A	2604	LEU	2.1
1	F	2647	LEU	2.1
1	E	2518	GLY	2.1
1	D	2532	ASP	2.1
1	E	2389	ASP	2.1
1	A	2381	VAL	2.0
1	D	2414	LYS	2.0
1	C	2586	ASP	2.0
1	F	2376	PRO	2.0
1	F	2599	PRO	2.0
1	A	2579	VAL	2.0
1	A	2616	VAL	2.0
1	B	2598	ALA	2.0
1	B	2586	ASP	2.0
1	E	2649	SER	2.0

6.2 Non-standard residues in protein, DNA, RNA chains [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(\AA^2)	Q<0.9
2	DVA	I	3010	7/8	0.57	0.22	68,84,91,97	0
2	VAD	G	3009	7/8	0.59	0.21	69,83,93,94	0
2	DVA	G	3010	7/8	0.66	0.20	63,69,83,83	0
1	DPP	E	2463	6/7	0.89	0.11	32,38,48,51	0
1	DPP	F	2463	6/7	0.90	0.09	32,39,48,54	0
1	DPP	A	2463	6/7	0.92	0.10	29,33,39,45	0
1	DPP	C	2463	6/7	0.93	0.08	32,36,45,54	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
1	DPP	D	2463	6/7	0.95	0.11	29,35,42,48	0
1	DPP	B	2463	6/7	0.97	0.05	33,36,43,45	0

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.