



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 4, 2024 – 07:36 PM EST

PDB ID : 2DHH
Title : Crystal structure of a multidrug transporter reveal a functionally rotating mechanism
Authors : Murakami, S.; Nakashima, R.; Yamashita, E.; Matsumoto, T.
Deposited on : 2006-03-23
Resolution : 2.80 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 : 4.02b-467
Xtriage (Phenix) : 1.13
EDS : 2.36
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.36

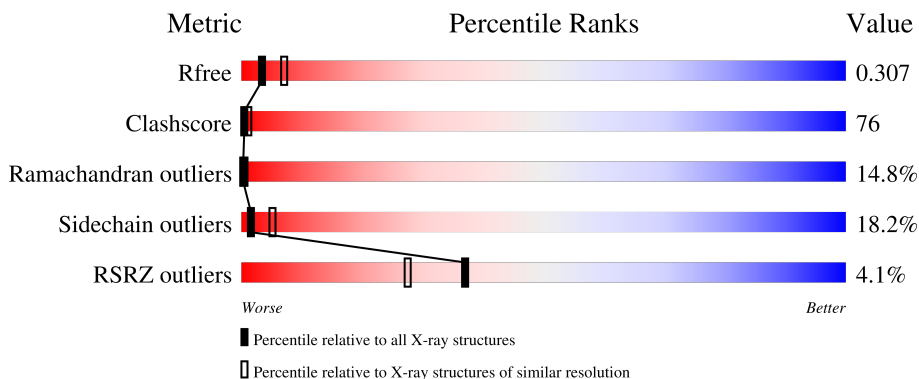
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.80 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}	130704	3140 (2.80-2.80)
Clashscore	141614	3569 (2.80-2.80)
Ramachandran outliers	138981	3498 (2.80-2.80)
Sidechain outliers	138945	3500 (2.80-2.80)
RSRZ outliers	127900	3078 (2.80-2.80)

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	1053	 4% 23% 49% 20% 5% •
1	B	1053	 4% 19% 55% 21% • •
1	C	1053	 4% 18% 53% 22% 5% •

2 Entry composition [i](#)

There are 2 unique types of molecules in this entry. The entry contains 23378 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 ACRB.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	1022	7774	5003	1283	1444	44	0	0	0
1	B	1022	7774	5003	1283	1444	44	0	0	0
1	C	1022	7774	5003	1283	1444	44	0	0	0

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1050	HIS	-	expression tag	UNP P31224
A	1051	HIS	-	expression tag	UNP P31224
A	1052	HIS	-	expression tag	UNP P31224
A	1053	HIS	-	expression tag	UNP P31224
B	1050	HIS	-	expression tag	UNP P31224
B	1051	HIS	-	expression tag	UNP P31224
B	1052	HIS	-	expression tag	UNP P31224
B	1053	HIS	-	expression tag	UNP P31224
C	1050	HIS	-	expression tag	UNP P31224
C	1051	HIS	-	expression tag	UNP P31224
C	1052	HIS	-	expression tag	UNP P31224
C	1053	HIS	-	expression tag	UNP P31224

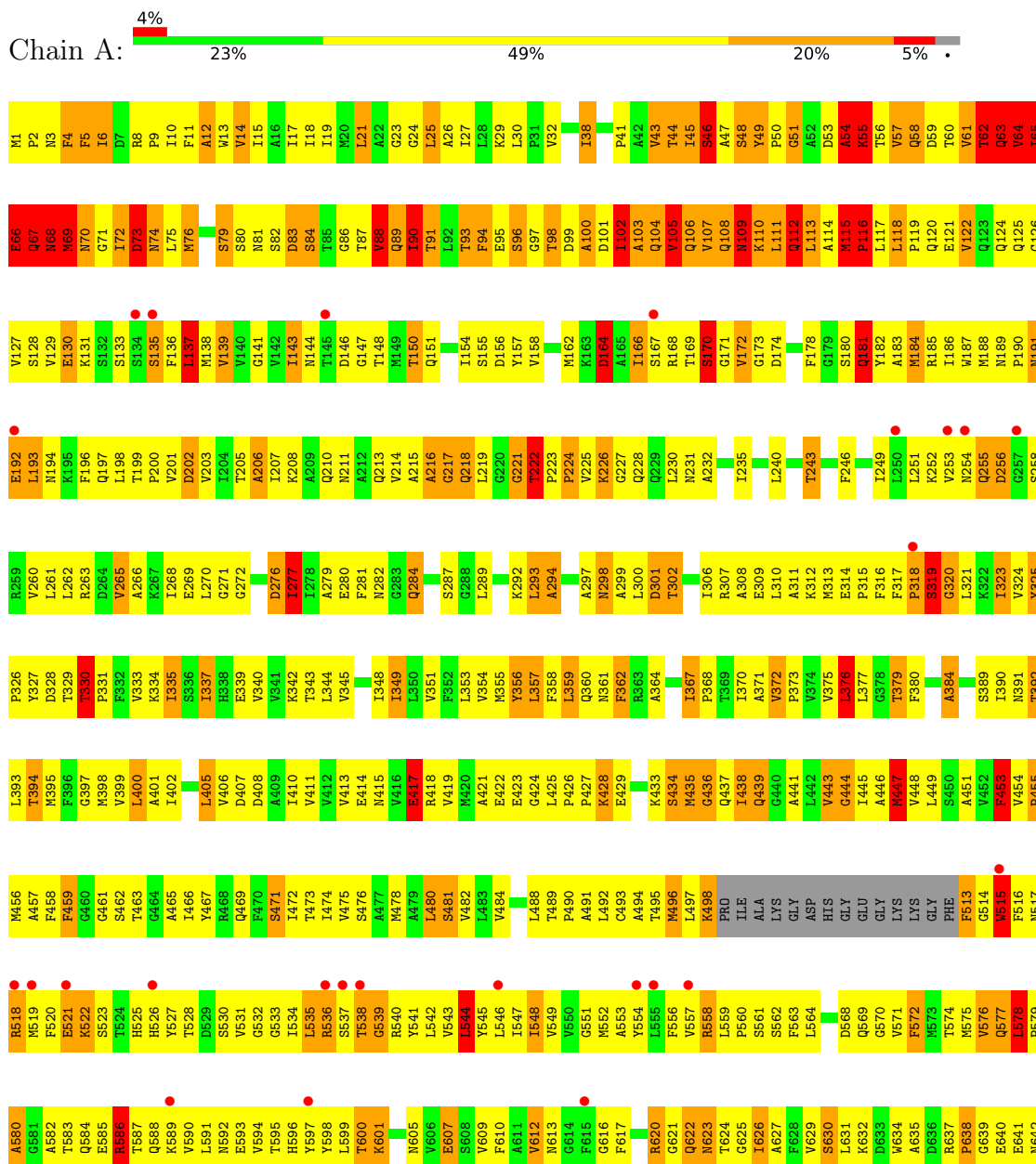
- Molecule 2 is water.

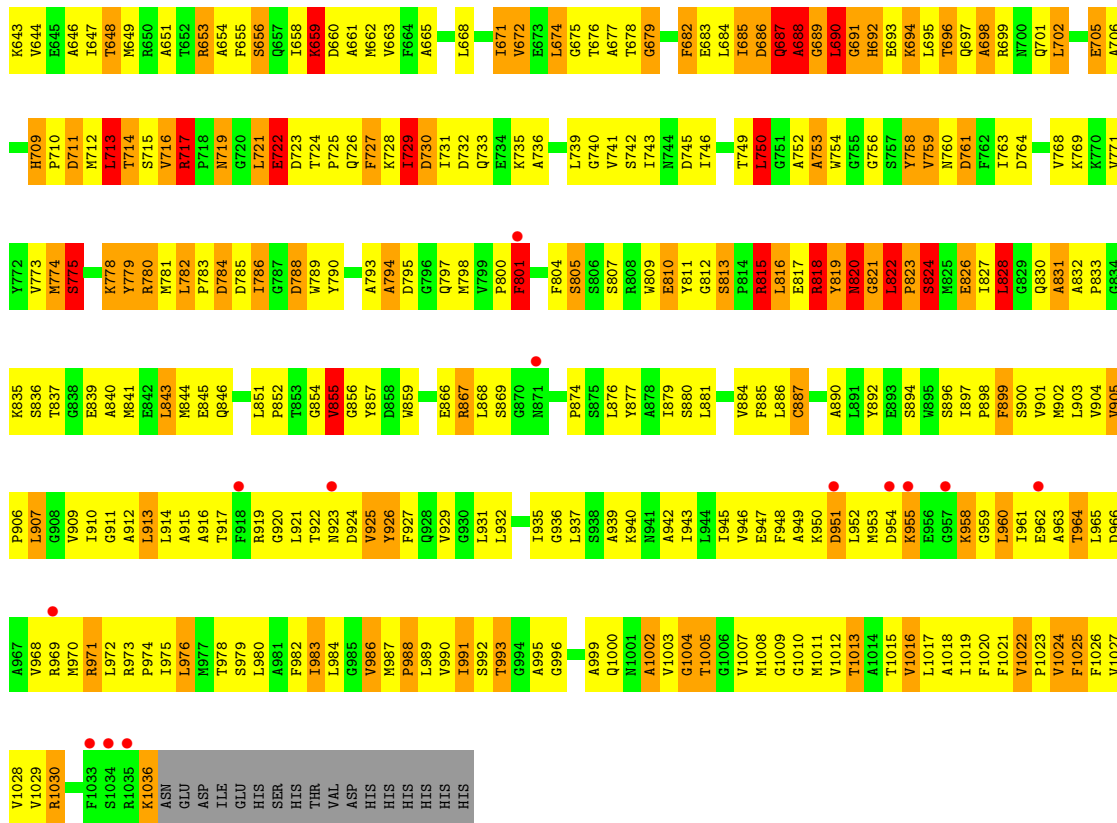
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	22	Total 22	O 22	0	0
2	B	8	Total 8	O 8	0	0
2	C	26	Total 26	O 26	0	0

3 Residue-property plots

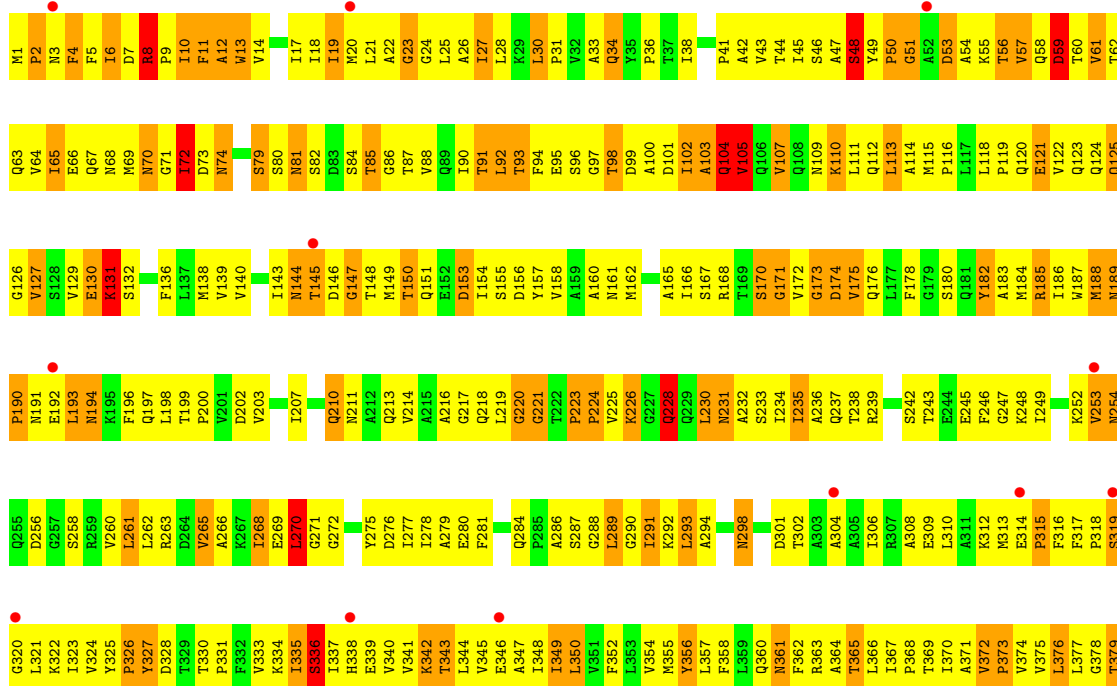
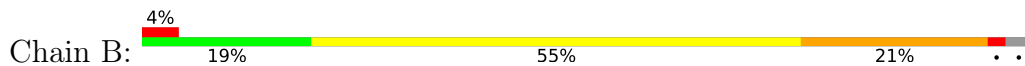
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density.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

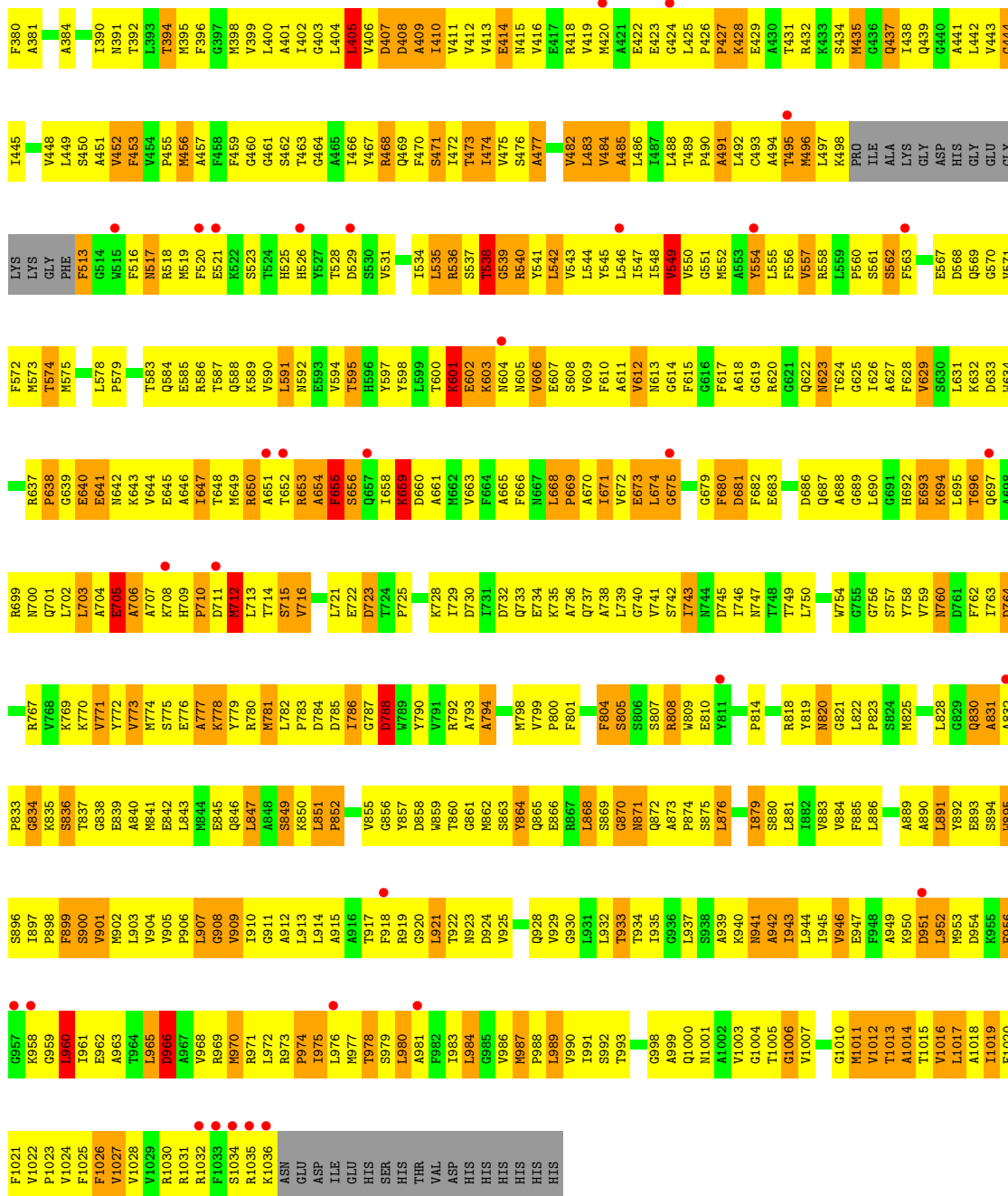
- Molecule 1: ACRB



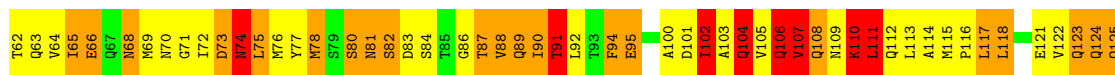
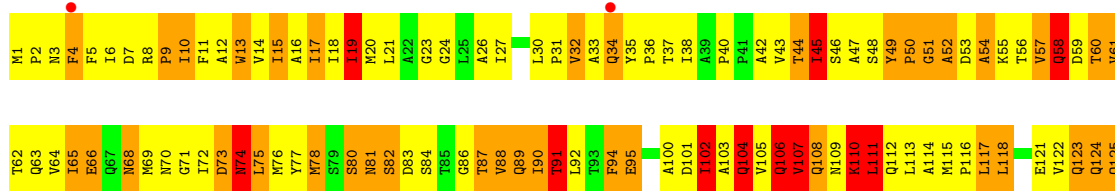
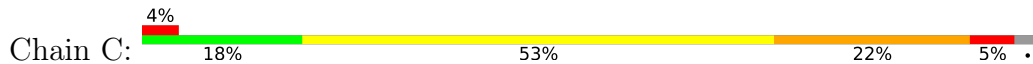


• Molecule 1: ACRB





● Molecule 1: ACRB



G126	V127	S128	S129	V130	E131	K131	S134	S135	F136	L137	M138	V139	V140	G141	V142	I143	M144	M145	D146	G147	L148	M149	T150	E151	D152	D153	S155	D156	V157	V158	A159	A160	M161	M162	K163	D164	A165	I166	S167	R168	Q219	Q220	P221	P223	P224	V225	K226	Q227	Q228	S167	Q229	L230	L230	M231	A232	S233	L234	I235	A236	Q237	T238	R239	L240	A303	A304	T241	S242	T243	Y182	A183	M184	E244	E245	F246	G247	I186
M187	M188	M189	P190	L251	K252	E192	L193	K194	K195	F196	Q197	L198	T199	P200	V201	D202	V203	I204	T205	A206	D207	Q210	M211	A212	Q213	V214	A215	A216	D217	Q218	L219	G220	G221	T222	P223	P224	V225	K226	Q227	Q228	S167	Q229	L230	L230	M231	A232	S233	L234	I235	A236	Q237	T238	R239	L240	A303	A304	T241	S242	T243	Y182	A183	M184	E244	E245	F246	G247	I186									
K248	L249	L250	K312	M313	E314	P315	F316	F317	S318	S319	G320	L321	K322	L323	V324	D325	V326	A327	A328	K329	L330	P331	F332	V333	K334	L335	S336	L337	H338	A339	E340	I341	V342	V343	V344	V345	D407	D408	A409	I410	V411	V412	G290	V351	F352	L293	A294	T295	G296	A297	M298	L299	L300	Q360	N361	F362	A303	A304	P427	T365	L366	L367	A308	P368	T369											
L370	A371	P372	P373	V374	L375	L376	L377	G378	L379	F380	V260	L261	L262	R263	D264	V265	A266	K267	L268	E269	L270	T394	G321	V333	K334	L335	M398	L399	T399	F394	M395	F396	G397	M398	F459	G460	E339	A401	I402	G403	L404	V405	G283	L344	D407	V345	E346	D408	A409	I410	V411	V412	G290	V351	F352	L293	A294	T295	G296	A297	M298	L299	L300	Q360	N361	F362	A303	A304	P427	T365	L366	L367	A308	P368	T369	
R432	K433	S434	M435	G436	L437	L438	Q439	Q440	A441	L442	V443	G444	I445	A446	M447	L448	F449	S450	A451	V452	F453	V454	G455	A456	A457	F458	F459	G460	E339	A401	I402	G403	L404	V405	G283	L344	D407	V345	E346	D408	A409	I410	V411	V412	G290	V351	F352	L293	A294	T295	G296	A297	M298	L299	L300	Q360	N361	F362	A303	A304	P427	T365	L366	L367	A308	P368	T369									
C483	A494	T495	M496	L497	L498	P499	I499	ALA	LYS	GLY	ASP	HIS	GLY	GLU	GLY	GLY	LYS	LYS	LYS	PHE	F513	G514	M515	F516	M517	R518	M519	F520	E521	K522	S523	T524	H525	H526	T528	D529	S530	V531	G532	G533	L534	L535	M415	V416	E417	R418	V419	M420	A421	E422	V484	A485	L486	I487	L488	T489	P490	A491	M552	M552																
A553	L554	F555	L556	V557	R558	L559	F560	F628	V629	K632	D633	V634	D568	Q569	G570	E641	V571	F572	A573	L574	M575	V576	L578	F579	R586	L587	Q588	A589	K589	V590	L591	N592	E593	V594	T595	H596	L597	L598	L599	T600	K601	L602	L603	V606	E607	S608	V609	F610	A611	V612	N613	G614	F615	G616	F617	A618	G619	R620																		
G621	Q622	N623	G624	G625	I626	A627	F628	V629	K632	D633	V634	D568	Q569	G570	E641	V571	F572	A573	L574	M575	V576	L578	F579	R586	L587	Q588	A589	K589	V590	L591	N592	E593	V594	T595	H596	L597	L598	L599	T600	K601	L602	L603	V606	E607	S608	V609	F610	A611	V612	N613	G614	F615	G616	F617	A618	G619	R620																			
Q687	A688	G689	L690	G691	H692	E693	K694	L695	T696	D761	F762	L763	D764	R765	L766	G767	F768	K769	K770	V771	W772	Y773	W774	M775	S776	E776	L713	T714	S715	W716	R717	F718	N719	G720	L721	E722	A723	T724	F725	W726	Y727	F728	K728	L729	D730	I731	D732	Q733	E734	K735	A738	S742	I743	N744	D745	I746	N747	L748	T749																	
L750	G751	A752	A753	W754	G755	Y758	V759	L760	D761	F762	L763	D764	R765	L766	G767	F768	K769	K770	V771	W772	Y773	W774	M775	S776	E776	L713	T714	S715	W716	R717	F718	N719	G720	L721	E722	A723	T724	F725	W726	Y727	F728	K728	L729	D730	I731	D732	Q733	E734	K735	A738	S742	I743	N744	D745	I746	N747	L748	T749																		
S813	P814	R815	L816	E817	R818	L819	M820	G821	L822	R823	S824	M825	E826	L827	L828	G829	Q830	A831	A832	P833	G834	K835	S836	G838	E839	S900	M841	E842	L843	M844	E845	F846	L847	A848	S849	K850	L851	P852	T853	G854	L855	G856	Y857	D858	W859	R860	G861	M862	S863	Y864	Q865	F866	R867	F868	S869	G870	M871	Q872																		
A873	P874	S875	L876	Y877	A878	L879	S880	L881	L882	R883	W884	F885	L886	G887	L888	A889	K890	L891	Y892	E893	S894	W895	S896	L897	P898	F899	S900	M841	E842	L843	M844	E845	F846	L847	A848	S849	K850	L851	P852	T853	G854	L855	G856	Y857	D858	W859	R860	G861	M862	S863	Y864	Q865	F866	R867	F868	S869	G870	M871	Q872																	
T933	T934	G935	G936	L937	S938	A939	K940	R941	L942	R943	L944	T945	V946	E947	F948	A949	K950	D951	L952	R953	M954	G955	G956	G957	K958	L959	F960	T961	E962	A963	T964	L965	D966	A967	V968	R969	N970	R971	L972	R973	P974	L975	L976	N977	T978	S979	L980	A981	F982	L983	L984	G985	V986	N987	P988	L989	T993	G994																		

S897	G898	A999	Q1000	V1003	G1004	V1007	M1008	G1009	G1010	M1011	V1012	T1013	A1014	T1015	V1016	L1017	A1018	I1019	F1020	F1021	V1022	P1023	V1024	F1025	F1026	V1027	V1028	V1029	R1030	R1031	R1032	F1033	S1034	R1035	K1036	ASN	GLU	ASP	ASP	ILE	GLU	HIS	SER	HIS	HIS	THR	VAL	ASP	HIS	HIS	HIS	HIS	HIS	HIS	HIS
------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	225.87Å 134.42Å 163.19Å 90.00° 97.71° 90.00°	Depositor
Resolution (Å)	10.00 – 2.80 10.00 – 2.80	Depositor EDS
% Data completeness (in resolution range)	99.0 (10.00-2.80) 99.0 (10.00-2.80)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.40 (at 2.80Å)	Xtrriage
Refinement program	REFMAC 5.2.0005	Depositor
R, R_{free}	0.268 , 0.307 0.262 , 0.307	Depositor DCC
R_{free} test set	5752 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	73.4	Xtrriage
Anisotropy	0.444	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 104.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.46$, $\langle L^2 \rangle = 0.29$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	23378	wwPDB-VP
Average B, all atoms (Å ²)	93.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.99% 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	1.50	104/7920 (1.3%)	1.28	74/10756 (0.7%)
1	B	1.02	6/7920 (0.1%)	1.05	18/10756 (0.2%)
1	C	1.54	94/7920 (1.2%)	1.33	82/10756 (0.8%)
All	All	1.37	204/23760 (0.9%)	1.23	174/32268 (0.5%)

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	4
1	B	0	2
1	C	0	6
All	All	0	12

The worst 5 of 204 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	67	GLN	CB-CG	23.76	2.16	1.52
1	C	129	VAL	CB-CG2	21.03	1.97	1.52
1	C	167	SER	N-CA	20.35	1.87	1.46
1	A	818	ARG	CG-CD	20.25	2.02	1.51
1	C	166	ILE	CA-CB	20.11	2.01	1.54

The worst 5 of 174 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	164	ASP	CB-CG-OD1	-17.91	102.18	118.30
1	C	767	ARG	CD-NE-CZ	-16.19	100.94	123.60
1	C	168	ARG	N-CA-C	10.95	140.57	111.00
1	A	818	ARG	NE-CZ-NH2	9.96	125.28	120.30
1	A	111	LEU	CB-CA-C	-9.93	91.33	110.20

There are no chirality outliers.

5 of 12 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	62	THR	Mainchain
1	A	65	ILE	Mainchain
1	A	66	GLU	Peptide
1	A	818	ARG	Mainchain
1	B	102	ILE	Peptide

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	7774	0	7931	1178	0
1	B	7774	0	7931	1189	0
1	C	7774	0	7931	1304	0
2	A	22	0	0	30	0
2	B	8	0	0	6	0
2	C	26	0	0	35	0
All	All	23378	0	23793	3559	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 76.

The worst 5 of 3559 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:127:VAL:CA	1:C:127:VAL:CB	1.75	1.63
1:C:158:VAL:CB	1:C:158:VAL:CG2	1.77	1.60
1:A:69:MET:CB	1:A:69:MET:CG	1.74	1.60
1:C:58:GLN:CB	1:C:58:GLN:CG	1.74	1.55
1:A:68:ASN:N	1:A:68:ASN:CA	1.70	1.55

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	1018/1053 (97%)	621 (61%)	243 (24%)	154 (15%)	0	0
1	B	1018/1053 (97%)	611 (60%)	259 (25%)	148 (14%)	0	0
1	C	1018/1053 (97%)	642 (63%)	225 (22%)	151 (15%)	0	0
All	All	3054/3159 (97%)	1874 (61%)	727 (24%)	453 (15%)	0	0

5 of 453 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	53	ASP
1	A	63	GLN
1	A	64	VAL
1	A	65	ILE
1	A	67	GLN

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	833/859 (97%)	678 (81%)	155 (19%)	1	5
1	B	833/859 (97%)	688 (83%)	145 (17%)	2	6
1	C	833/859 (97%)	679 (82%)	154 (18%)	1	5
All	All	2499/2577 (97%)	2045 (82%)	454 (18%)	1	5

5 of 454 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	456	MET
1	C	952	LEU
1	B	943	ILE
1	C	907	LEU
1	C	624	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 89 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	623	ASN
1	C	123	GLN
1	B	726	GLN
1	B	871	ASN
1	C	189	ASN

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 monosaccharides 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	1022/1053 (97%)	-0.06	38 (3%) 41 31	5, 97, 116, 127	0
1	B	1022/1053 (97%)	0.05	44 (4%) 35 25	49, 102, 116, 127	0
1	C	1022/1053 (97%)	-0.06	44 (4%) 35 25	5, 94, 118, 127	0
All	All	3066/3159 (97%)	-0.02	126 (4%) 37 27	5, 99, 117, 127	0

The worst 5 of 126 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	1034	SER	11.4
1	C	870	GLY	8.3
1	C	513	PHE	6.5
1	C	538	THR	6.4
1	C	536	ARG	5.7

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 monosaccharides 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.