Full wwPDB NMR Structure Validation Report (i)

Aug 3, 2025 – 08:21 AM EDT

PDB ID	:	2K9Y / pdb_00002k9y
BMRB ID	:	16005
Title	:	EphA2 dimeric structure in the lipidic bicelle at pH 5.0
Authors	:	Mayzel, M.L.; Bocharov, E.V.; Volynsky, P.E.; Arseniev, A.S.
Deposited on	:	2008-10-27

This is a Full wwPDB NMR 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/NMRValidationReportHelp
with specific help available everywhere you see the (i) 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 (i)) were used in the production of this report:

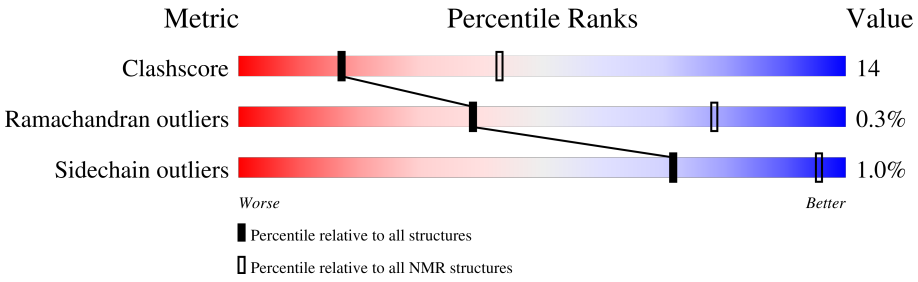
MolProbity	:	4-5-2 with Phenix2.0rc1
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
wwPDB-RCI	:	FAILED
PANAV	:	FAILED
wwPDB-ShiftChecker	:	FAILED
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.45.1

1 Overall quality at a glance

The following experimental techniques were used to determine the structure:
SOLUTION NMR

The overall completeness of chemical shifts assignment was not calculated.

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)	NMR archive (#Entries)
Clashscore	210492	14027
Ramachandran outliers	207382	12486
Sidechain outliers	206894	12463

The table below summarises the geometric issues observed across the polymeric chains and their fit to the experimental data. The red, orange, yellow and green segments indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria. A cyan segment indicates the fraction of residues that are not part of the well-defined cores, and 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 <=5%

Mol	Chain	Length	Quality of chain
1	A	41	29% 12% 59%
1	B	41	29% 12% 59%

2 Ensemble composition and analysis (i)

This entry contains 17 models. The atoms present in the NMR models are not consistent. Some calculations may have failed as a result. All residues are included in the validation scores. Model 5 is the overall representative, medoid model (most similar to other models). The authors have identified model 1 as representative, based on the following criterion: *fewest violations*.

The following residues are included in the computation of the global validation metrics.

Well-defined (core) protein residues			
Well-defined core	**Residue range (total)**	**Backbone RMSD (Å)**	**Medoid model**
1	A:535-A:551, B:535-B:551 (34)	0.13	5

Ill-defined regions of proteins are excluded from the global statistics.

Ligands and non-protein polymers are included in the analysis.

NmrClust was unable to cluster the ensemble.

Error message: Inconsistent models in file

3 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 1250 atoms, of which 646 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Ephrin type-A receptor 2.

Mol	Chain	Residues	Atoms					Trace
1	A	41	Total	C	H	N	O	0
			625	197	323	55	50	
1	B	41	Total	C	H	N	O	0
			625	197	323	55	50	

- Molecule 2 is water.

Mol	Chain	Residues	Atoms

4 Residue-property plots

4.1 Average score per residue in the NMR ensemble

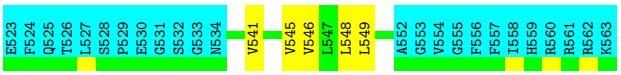
These plots are provided for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic is the same as shown in the summary in section 1 of this report. The second graphic shows the sequence where residues are colour-coded according to the number of geometric quality criteria for 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 outliers are shown as green connectors. Residues which are classified as ill-defined in the NMR ensemble, are shown in cyan with an underline colour-coded according to the previous scheme. Residues which were present in the experimental sample, but not modelled in the final structure are shown in grey.

• Molecule 1: Ephrin type-A receptor 2

Chain A:

• Molecule 1: Ephrin type-A receptor 2

Chain B:



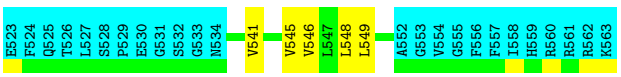
4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

4.2.1 Score per residue for model 1

• Molecule 1: Ephrin type-A receptor 2

Chain A:



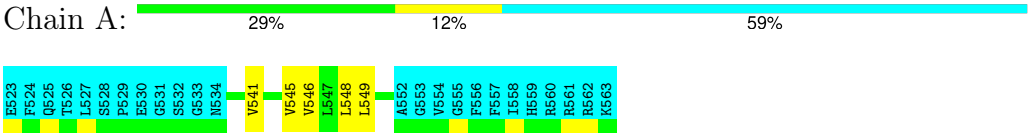
• Molecule 1: Ephrin type-A receptor 2

Chain B:

4.2.2 Score per residue for model 2

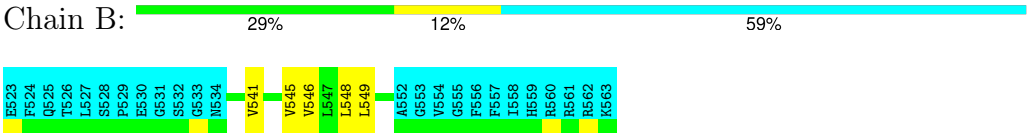
• Molecule 1: Ephrin type-A receptor 2

Chain A:



• Molecule 1: Ephrin type-A receptor 2

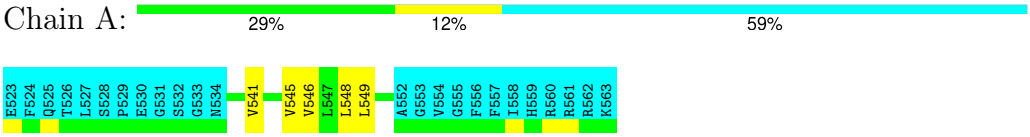
Chain B:



4.2.3 Score per residue for model 3

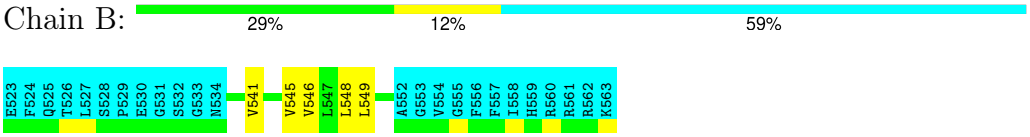
• Molecule 1: Ephrin type-A receptor 2

Chain A:



• Molecule 1: Ephrin type-A receptor 2

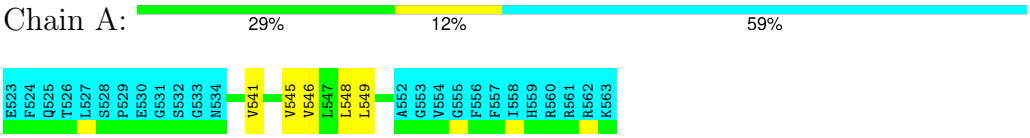
Chain B:



4.2.4 Score per residue for model 4

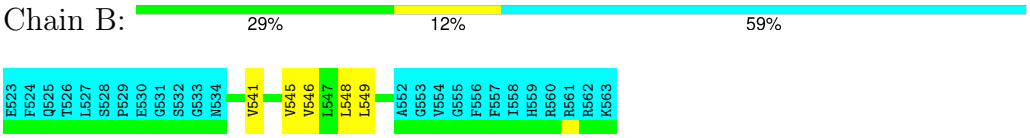
• Molecule 1: Ephrin type-A receptor 2

Chain A:



• Molecule 1: Ephrin type-A receptor 2

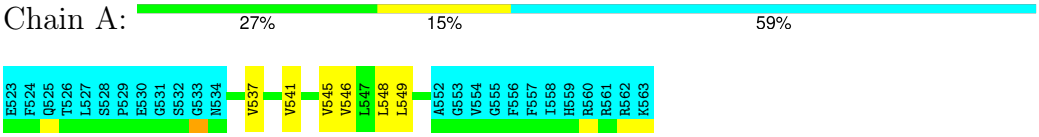
Chain B:



4.2.5 Score per residue for model 5 (medoid)

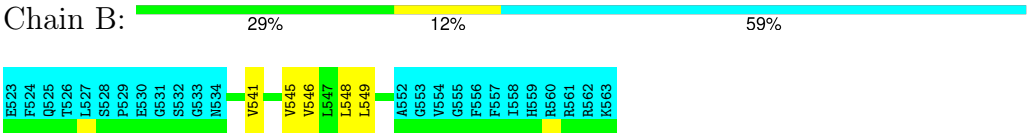
• Molecule 1: Ephrin type-A receptor 2

Chain A:



• Molecule 1: Ephrin type-A receptor 2

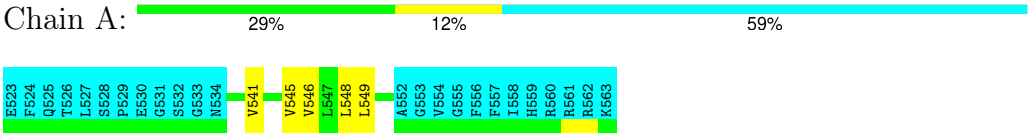
Chain B:



4.2.6 Score per residue for model 6

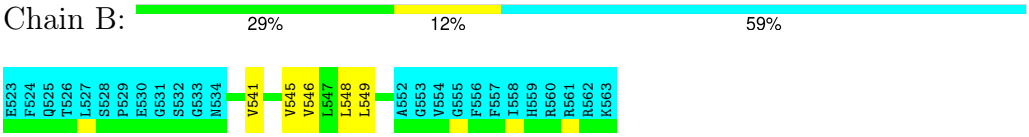
• Molecule 1: Ephrin type-A receptor 2

Chain A:



• Molecule 1: Ephrin type-A receptor 2

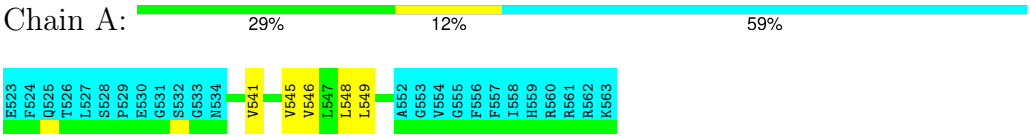
Chain B:



4.2.7 Score per residue for model 7

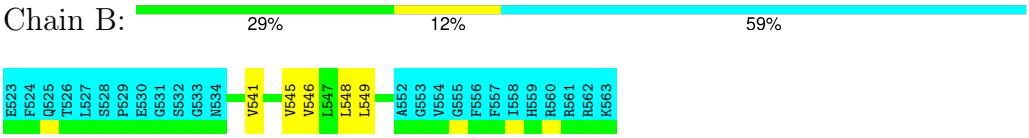
• Molecule 1: Ephrin type-A receptor 2

Chain A:



• Molecule 1: Ephrin type-A receptor 2

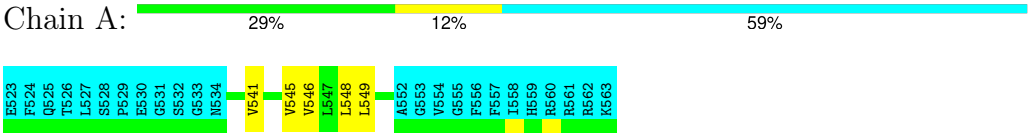
Chain B:



4.2.8 Score per residue for model 8

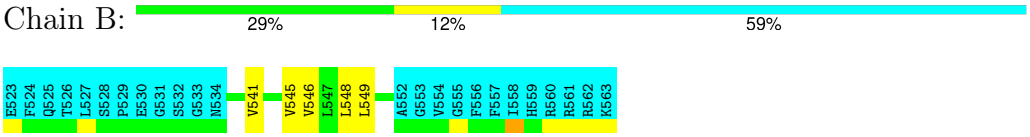
• Molecule 1: Ephrin type-A receptor 2

Chain A:



• Molecule 1: Ephrin type-A receptor 2

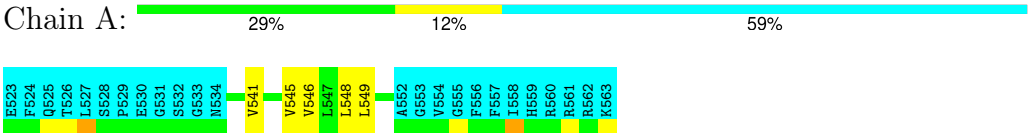
Chain B:



4.2.9 Score per residue for model 9

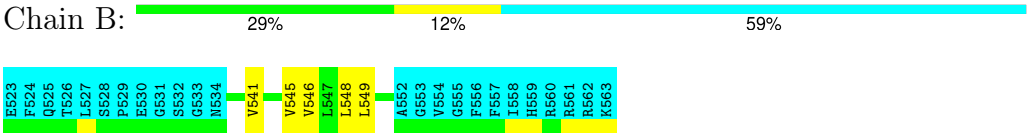
• Molecule 1: Ephrin type-A receptor 2

Chain A:



• Molecule 1: Ephrin type-A receptor 2

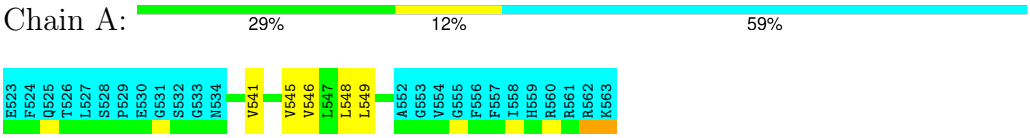
Chain B:



4.2.10 Score per residue for model 10

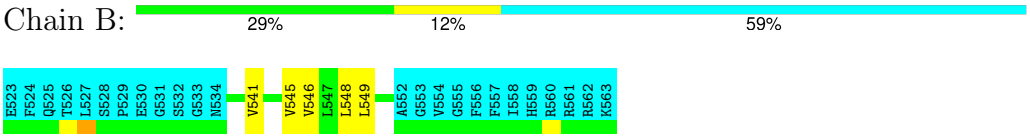
• Molecule 1: Ephrin type-A receptor 2

Chain A:



• Molecule 1: Ephrin type-A receptor 2

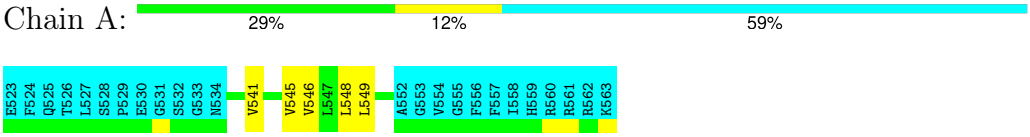
Chain B:



4.2.11 Score per residue for model 11

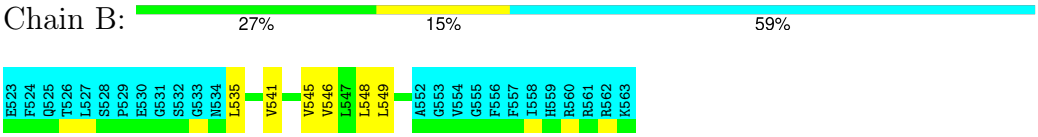
• Molecule 1: Ephrin type-A receptor 2

Chain A:



• Molecule 1: Ephrin type-A receptor 2

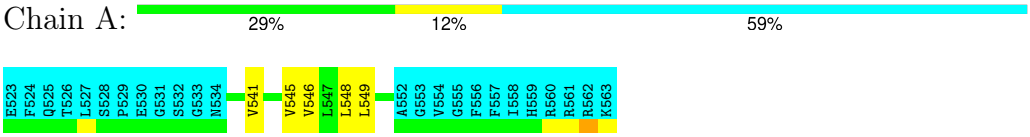
Chain B:



4.2.12 Score per residue for model 12

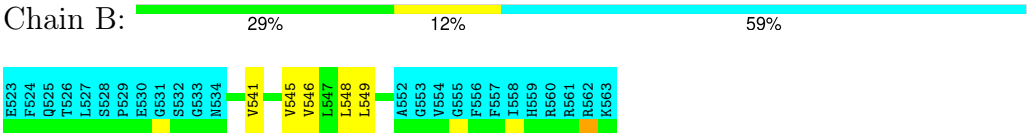
• Molecule 1: Ephrin type-A receptor 2

Chain A:



• Molecule 1: Ephrin type-A receptor 2

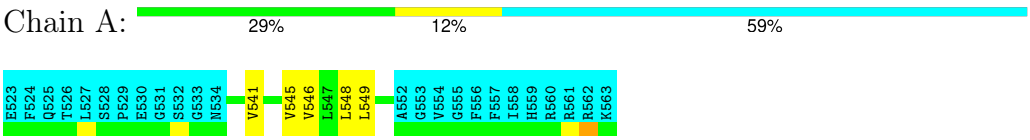
Chain B:



4.2.13 Score per residue for model 13

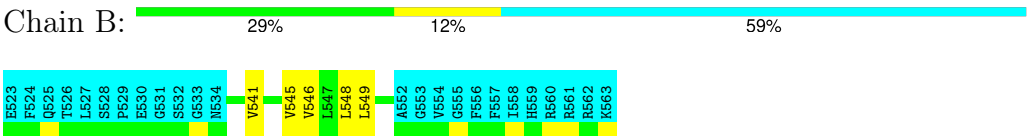
• Molecule 1: Ephrin type-A receptor 2

Chain A:



• Molecule 1: Ephrin type-A receptor 2

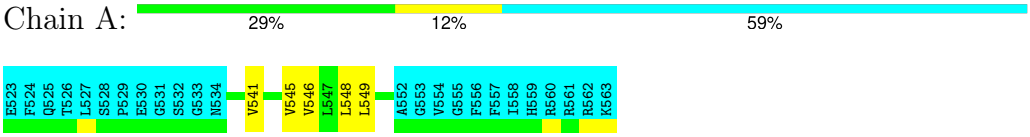
Chain B:



4.2.14 Score per residue for model 14

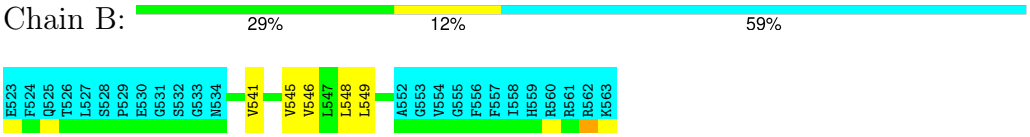
• Molecule 1: Ephrin type-A receptor 2

Chain A:



• Molecule 1: Ephrin type-A receptor 2

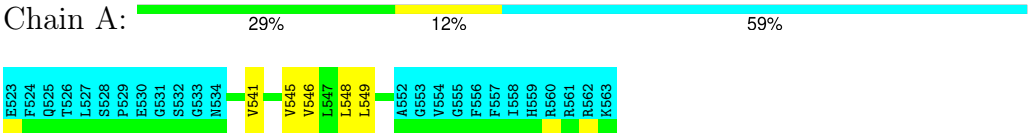
Chain B:



4.2.15 Score per residue for model 15

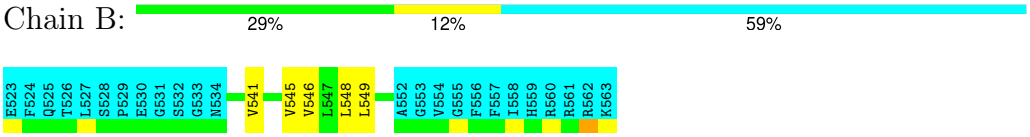
• Molecule 1: Ephrin type-A receptor 2

Chain A:



• Molecule 1: Ephrin type-A receptor 2

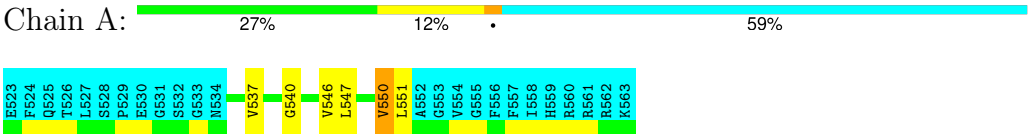
Chain B:



4.2.16 Score per residue for model 16

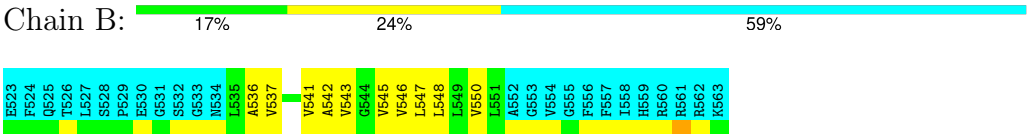
• Molecule 1: Ephrin type-A receptor 2

Chain A:



• Molecule 1: Ephrin type-A receptor 2

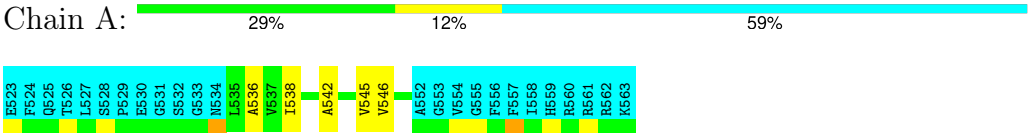
Chain B:



4.2.17 Score per residue for model 17

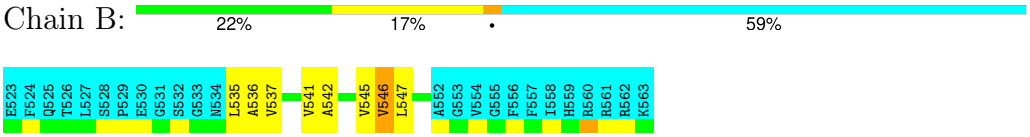
• Molecule 1: Ephrin type-A receptor 2

Chain A:



• Molecule 1: Ephrin type-A receptor 2

Chain B:



5 Refinement protocol and experimental data overview

The models were refined using the following method: *TORSION ANGLE DYNAMICS, molecular dynamics, TORSION ANGLE DYNAMICS*.

Of the 100 calculated structures, 17 were deposited, based on the following criterion: *structures with the least restraint violations*.

The following table shows the software used for structure solution, optimisation and refinement.

Software name	Classification	Version
CYANA	structure calculation	2.1
GROMACS	geometry optimization	3.3.2
GROMACS	refinement	3.3.2

No chemical shift data was provided.

6 Model quality (i)

6.1 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 (average) 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	0.30±0.10	0±0/112 (0.0± 0.0%)	0.93±0.59	1±3/155 (0.7± 1.9%)
1	B	0.30±0.09	0±0/112 (0.0± 0.0%)	0.95±0.64	1±4/155 (0.9± 2.5%)
All	All	0.31	0/3808 (0.0%)	1.12	42/5270 (0.8%)

There are no bond-length outliers.

All unique angle outliers are listed below. They are sorted according to the Z-score of the worst occurrence in the ensemble.

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})	Models	
								Worst	Total
1	B	548	LEU	CA-C-N	9.22	132.42	120.44	16	1
1	B	548	LEU	C-N-CA	9.22	132.42	120.44	16	1
1	B	543	VAL	CA-CB-CG2	8.89	125.51	110.40	16	1
1	B	545	VAL	CA-C-N	8.69	131.81	120.60	16	1
1	B	545	VAL	C-N-CA	8.69	131.81	120.60	16	1
1	A	550	VAL	CA-C-N	8.47	131.97	120.54	16	1
1	A	550	VAL	C-N-CA	8.47	131.97	120.54	16	1
1	B	541	VAL	N-CA-C	7.14	117.86	110.36	17	1
1	B	535	LEU	N-CA-C	-7.04	105.22	113.88	17	1
1	A	537	VAL	N-CA-CB	-6.91	101.83	110.47	16	1
1	B	536	ALA	N-CA-C	6.82	119.56	111.71	16	1
1	A	538	ILE	CA-C-O	-6.78	114.22	121.27	17	1
1	B	545	VAL	CA-C-O	-6.59	114.19	121.17	16	1
1	B	536	ALA	CA-C-O	6.58	127.38	119.61	17	1
1	A	540	GLY	CA-C-N	6.51	128.66	120.72	16	1
1	A	540	GLY	C-N-CA	6.51	128.66	120.72	16	1
1	A	542	ALA	CA-C-O	-6.22	113.95	120.55	17	1
1	A	546	VAL	CA-C-N	6.09	128.92	120.63	17	1
1	A	546	VAL	C-N-CA	6.09	128.92	120.63	17	1
1	A	545	VAL	CB-CA-C	6.00	119.64	111.97	17	1
1	B	546	VAL	CA-C-N	5.96	128.19	120.44	17	1
1	B	546	VAL	C-N-CA	5.96	128.19	120.44	17	1
1	A	551	LEU	CA-C-N	5.90	128.19	120.28	16	1

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})	Models	
								Worst	Total
1	A	551	LEU	C-N-CA	5.90	128.19	120.28	16	1
1	B	546	VAL	CB-CA-C	5.89	119.42	111.88	16	1
1	B	546	VAL	CA-C-O	-5.84	114.57	121.05	17	1
1	B	537	VAL	CA-C-N	5.79	129.63	120.47	16	1
1	B	537	VAL	C-N-CA	5.79	129.63	120.47	16	1
1	B	542	ALA	N-CA-C	5.79	117.68	111.36	16	1
1	A	545	VAL	CA-C-N	5.77	128.04	120.60	17	1
1	A	545	VAL	C-N-CA	5.77	128.04	120.60	17	1
1	B	545	VAL	CA-CB-CG1	5.44	119.65	110.40	17	1
1	A	551	LEU	N-CA-C	5.43	117.63	111.11	16	1
1	B	550	VAL	N-CA-C	5.42	115.62	110.53	16	1
1	A	537	VAL	CA-C-O	-5.38	115.45	121.05	16	1
1	B	541	VAL	O-C-N	-5.20	116.74	121.94	17	1
1	A	546	VAL	N-CA-C	5.19	115.92	110.62	16	1
1	B	535	LEU	CA-C-N	5.17	128.96	120.63	17	1
1	B	535	LEU	C-N-CA	5.17	128.96	120.63	17	1
1	B	542	ALA	N-CA-CB	-5.08	102.64	110.16	16	1
1	B	546	VAL	CA-CB-CG1	5.06	119.00	110.40	17	1
1	A	536	ALA	O-C-N	-5.05	116.31	122.22	17	1

There are no chirality outliers.

There are no planarity outliers.

6.2 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 each 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 averaged over the ensemble.

Mol	Chain	Non-H	H(model)	H(added)	Clashes
1	A	112	139	139	4±2
1	B	112	139	139	4±2
All	All	3812	4734	4726	116

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 14.

All unique clashes are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:546:VAL:HG22	1:B:546:VAL:HG22	0.79	1.55	10	15
1:A:541:VAL:O	1:A:545:VAL:HG23	0.62	1.94	1	15
1:B:541:VAL:O	1:B:545:VAL:HG23	0.62	1.94	11	15
1:B:548:LEU:HD13	1:B:548:LEU:O	0.57	2.00	1	15
1:A:548:LEU:O	1:A:548:LEU:HD13	0.56	2.00	2	15
1:A:549:LEU:HD23	1:A:549:LEU:O	0.56	2.01	1	15
1:B:549:LEU:HD23	1:B:549:LEU:O	0.55	2.01	1	15
1:A:549:LEU:HD22	1:B:549:LEU:HD22	0.43	1.91	15	5
1:A:549:LEU:HD22	1:B:549:LEU:CD2	0.41	2.45	9	3
1:A:549:LEU:CD2	1:B:549:LEU:HD22	0.41	2.46	1	2
1:B:542:ALA:O	1:B:546:VAL:HG23	0.40	2.16	17	1

6.3 Torsion angles (i)

6.3.1 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 PDB entries followed by that with respect to all NMR entries. 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	17/41 (41%)	17±0 (98±3%)	0±0 (2±3%)	0±0 (0±1%)	38	78
1	B	17/41 (41%)	17±0 (99±2%)	0±0 (0±1%)	0±0 (0±1%)	38	78
All	All	578/1394 (41%)	570 (99%)	6 (1%)	2 (0%)	38	78

All 2 unique Ramachandran outliers are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type	Models (Total)
1	A	550	VAL	1
1	B	541	VAL	1

6.3.2 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 PDB entries followed by that with respect to all NMR entries. 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	12/31 (39%)	12±0 (100±2%)	0±0 (0±2%)	85 97
1	B	12/31 (39%)	12±1 (99±4%)	0±1 (1±4%)	60 94
All	All	408/1054 (39%)	404 (99%)	4 (1%)	71 95

All 3 unique residues with a non-rotameric sidechain are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type	Models (Total)
1	B	547	LEU	2
1	A	547	LEU	1
1	B	537	VAL	1

6.3.3 RNA (i)

There are no RNA molecules in this entry.

6.4 Non-standard residues in protein, DNA, RNA chains (i)

There are no non-standard protein/DNA/RNA residues in this entry.

6.5 Carbohydrates (i)

There are no oligosaccharides in this entry.

6.6 Ligand geometry (i)

There are no ligands in this entry.

6.7 Other polymers (i)

There are no such molecules in this entry.

6.8 Polymer linkage issues (i)

There are no chain breaks in this entry.