



Full wwPDB NMR Structure Validation Report ⓘ

Mar 23, 2026 – 01:41 PM UTC

PDB ID : 7B3J / pdb_00007b3j
BMRB ID : 34577
Title : Dynamic complex between all-D-enantiomeric peptide D3 with wild-type amyloid precursor protein 672-726 fragment (amyloid beta 1-55)
Authors : Bocharov, E.V.; Volynsky, P.E.; Okhrimenko, I.S.; Urban, A.S.
Deposited on : 2020-12-01

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 ⓘ 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)
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
wwPDB-RCI : v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV : Wang et al. (2010)
wwPDB-ShiftChecker : v1.2
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

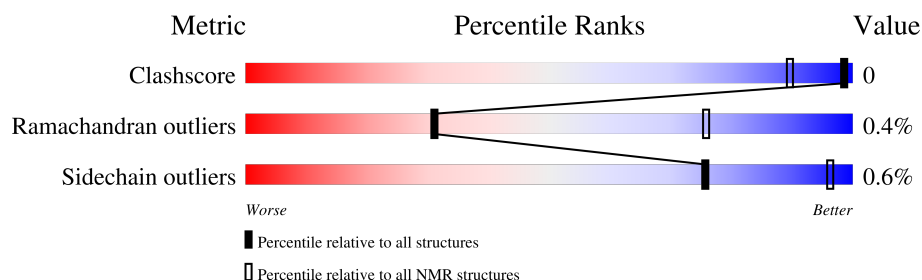
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

SOLUTION NMR

The overall completeness of chemical shifts assignment is 97%.

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	229148	14424
Ramachandran outliers	224038	12848
Sidechain outliers	223484	12823

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 $\leq 5\%$

Mol	Chain	Length	Quality of chain
1	A	55	29% 13% 58%

2 Ensemble composition and analysis

This entry contains 10 models. Model 10 is the overall representative, medoid model (most similar to other models). The authors have identified model 1 as representative, based on the following criterion: *target function*.

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:30-A:52 (23)	0.64	10

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

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

The models can be grouped into 2 clusters and 1 single-model cluster was found.

Cluster number	Models
1	1, 3, 5, 6, 7, 8, 10
2	2, 9
Single-model clusters	4

3 Entry composition [i](#)

There are 2 unique types of molecules in this entry. The entry contains 1094 atoms, of which 560 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Isoform L-APP677 of Amyloid-beta precursor protein.

Mol	Chain	Residues	Atoms						Trace
1	A	55	Total	C	H	N	O	S	0
			862	273	441	71	75	2	

- Molecule 2 is a protein (with D amino acids) called D3 all D-enantimeric peptide.

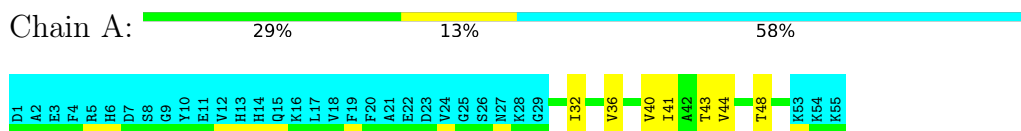
Mol	Chain	Residues	Atoms					Trace
2	B	12	Total	C	H	N	O	0
			232	65	119	32	16	

4 Residue-property plots [i](#)

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: Isoform L-APP677 of Amyloid-beta precursor protein

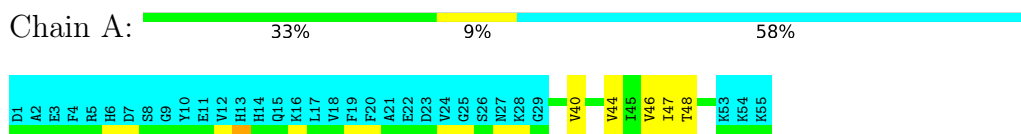


4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

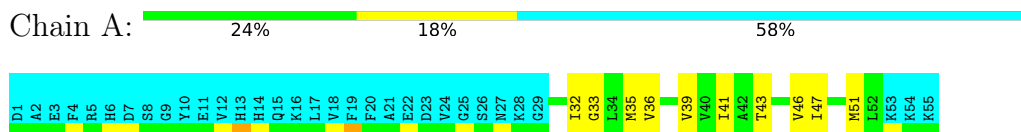
4.2.1 Score per residue for model 1

- Molecule 1: Isoform L-APP677 of Amyloid-beta precursor protein



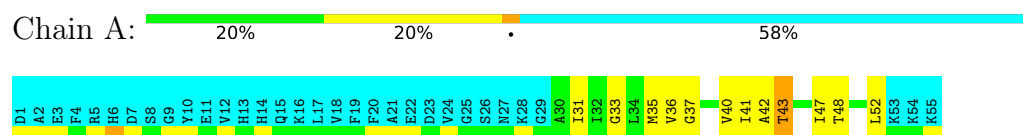
4.2.2 Score per residue for model 2

- Molecule 1: Isoform L-APP677 of Amyloid-beta precursor protein



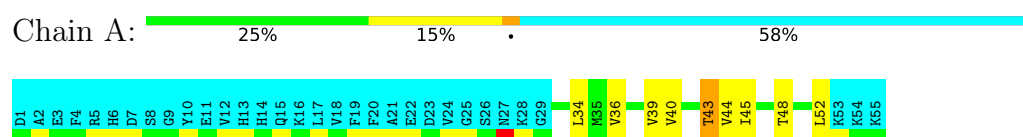
4.2.3 Score per residue for model 3

- Molecule 1: Isoform L-APP677 of Amyloid-beta precursor protein



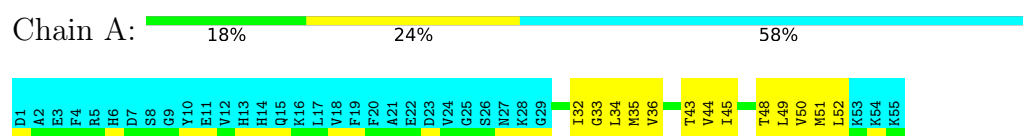
4.2.4 Score per residue for model 4

- Molecule 1: Isoform L-APP677 of Amyloid-beta precursor protein



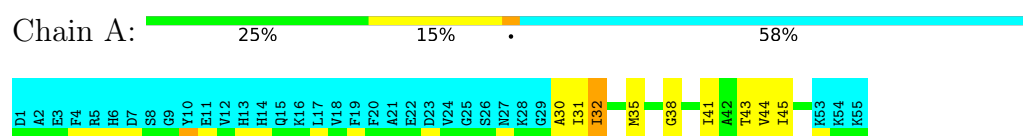
4.2.5 Score per residue for model 5

- Molecule 1: Isoform L-APP677 of Amyloid-beta precursor protein



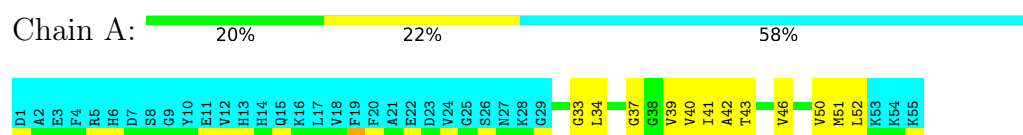
4.2.6 Score per residue for model 6

- Molecule 1: Isoform L-APP677 of Amyloid-beta precursor protein



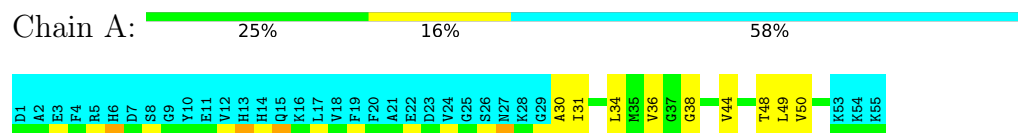
4.2.7 Score per residue for model 7

- Molecule 1: Isoform L-APP677 of Amyloid-beta precursor protein



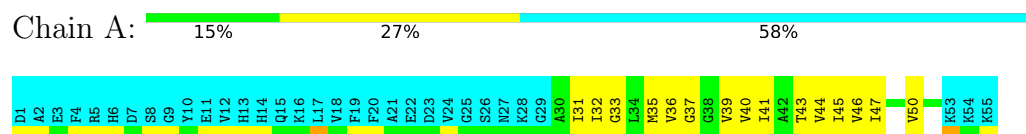
4.2.8 Score per residue for model 8

- Molecule 1: Isoform L-APP677 of Amyloid-beta precursor protein



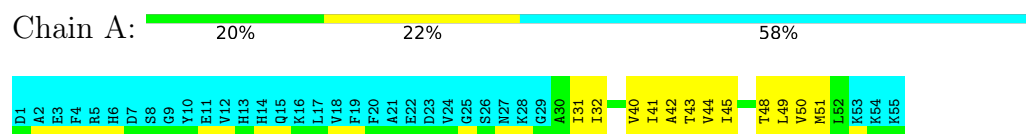
4.2.9 Score per residue for model 9

- Molecule 1: Isoform L-APP677 of Amyloid-beta precursor protein



4.2.10 Score per residue for model 10 (medoid)

- Molecule 1: Isoform L-APP677 of Amyloid-beta precursor protein



5 Refinement protocol and experimental data overview

The models were refined using the following method: *molecular dynamics*.

Of the 10 calculated structures, 10 were deposited, based on the following criterion: *structures with acceptable covalent geometry*.

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

Software name	Classification	Version
CYANA	structure calculation	
GROMACS	structure calculation	
GROMACS	refinement	

The following table shows chemical shift validation statistics as aggregates over all chemical shift files. Detailed validation can be found in section 7 of this report.

Chemical shift file(s)	working_cs.cif
Number of chemical shift lists	1
Total number of shifts	651
Number of shifts mapped to atoms	651
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	97%

6 Model quality (i)

6.1 Standard geometry (i)

Bond lengths and bond angles in the following residue types are not validated in this section: DSG, DPR, DAR, DHI, 2TL, DLE

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	2.13±0.11	4±2/158 (2.7± 1.2%)	2.47±0.11	12±4/217 (5.5± 1.7%)
2	B	0.00±0.00	-	0.00±0.00	-
All	All	2.13	43/1580 (2.7%)	2.48	119/2170 (5.5%)

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	Planarity
1	A	0.0±0.0	0.2±0.4
All	All	0	2

All unique bond 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(Å)	Ideal(Å)	Models	
								Worst	Total
1	A	34	LEU	CA-C	8.98	1.64	1.52	5	2
1	A	45	ILE	CA-CB	7.76	1.64	1.54	10	1
1	A	45	ILE	CA-C	7.70	1.62	1.52	9	2
1	A	37	GLY	CA-C	7.68	1.60	1.52	9	2
1	A	52	LEU	N-CA	7.50	1.56	1.46	7	1
1	A	39	VAL	CA-CB	7.39	1.63	1.54	9	1
1	A	35	MET	CA-C	-6.59	1.44	1.52	2	2
1	A	42	ALA	N-CA	-6.46	1.38	1.46	10	2
1	A	44	VAL	CA-CB	-6.45	1.46	1.54	1	2
1	A	50	VAL	CA-C	6.27	1.60	1.52	9	1
1	A	48	THR	CB-OG1	-6.13	1.33	1.43	4	2
1	A	36	VAL	N-CA	6.06	1.54	1.46	8	1
1	A	36	VAL	C-O	5.98	1.31	1.24	5	2

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)	Models	
								Worst	Total
1	A	46	VAL	CA-C	5.68	1.59	1.52	2	1
1	A	44	VAL	CA-C	5.64	1.59	1.52	5	1
1	A	32	ILE	CB-CG1	5.64	1.64	1.53	5	1
1	A	44	VAL	C-N	5.61	1.40	1.33	9	1
1	A	49	LEU	CB-CG	5.60	1.64	1.53	5	1
1	A	52	LEU	C-N	5.60	1.41	1.33	4	1
1	A	43	THR	CB-OG1	-5.56	1.34	1.43	7	1
1	A	41	ILE	CA-C	5.51	1.59	1.52	10	2
1	A	46	VAL	C-O	-5.49	1.18	1.24	2	1
1	A	34	LEU	CA-CB	5.48	1.61	1.53	7	2
1	A	43	THR	N-CA	5.46	1.53	1.46	6	1
1	A	33	GLY	CA-C	5.46	1.58	1.52	2	1
1	A	35	MET	CA-CB	5.42	1.61	1.53	3	1
1	A	50	VAL	N-CA	5.39	1.52	1.46	7	2
1	A	44	VAL	N-CA	-5.35	1.40	1.46	9	1
1	A	41	ILE	CA-CB	5.24	1.60	1.54	2	1
1	A	51	MET	N-CA	5.24	1.52	1.46	2	1
1	A	50	VAL	C-O	-5.22	1.18	1.24	8	1
1	A	49	LEU	N-CA	-5.16	1.40	1.46	8	1

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(°)	Ideal(°)	Models	
								Worst	Total
1	A	30	ALA	CA-C-O	-9.52	110.60	121.07	8	1
1	A	50	VAL	CA-C-N	8.15	131.55	120.54	5	1
1	A	50	VAL	C-N-CA	8.15	131.55	120.54	5	1
1	A	47	ILE	O-C-N	7.71	129.46	121.91	9	2
1	A	36	VAL	CA-C-O	-7.54	113.10	120.95	2	1
1	A	41	ILE	O-C-N	7.37	129.02	121.87	9	2
1	A	40	VAL	CB-CA-C	-7.11	102.41	112.22	1	1
1	A	43	THR	CA-C-O	7.10	128.08	119.49	10	2
1	A	52	LEU	O-C-N	-7.09	114.72	122.09	3	1
1	A	45	ILE	CA-C-O	-6.90	113.85	121.17	6	1
1	A	32	ILE	N-CA-C	-6.79	103.69	110.62	2	1
1	A	37	GLY	CA-C-N	6.75	127.43	120.00	7	2
1	A	37	GLY	C-N-CA	6.75	127.43	120.00	7	2
1	A	33	GLY	CA-C-N	6.74	129.60	120.44	5	3
1	A	33	GLY	C-N-CA	6.74	129.60	120.44	5	3
1	A	39	VAL	CA-C-O	-6.66	113.28	120.47	7	1
1	A	44	VAL	N-CA-CB	-6.64	102.78	110.55	4	1

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)	Models	
								Worst	Total
1	A	32	ILE	CA-C-O	-6.54	112.60	120.78	9	1
1	A	47	ILE	CA-C-N	6.52	130.22	120.31	3	2
1	A	47	ILE	C-N-CA	6.52	130.22	120.31	3	2
1	A	33	GLY	O-C-N	-6.50	115.69	122.13	3	1
1	A	43	THR	CA-C-N	6.49	128.74	120.56	4	1
1	A	43	THR	C-N-CA	6.49	128.74	120.56	4	1
1	A	44	VAL	CA-CB-CG2	6.47	121.41	110.40	5	1
1	A	51	MET	CA-C-N	6.42	130.07	120.31	10	1
1	A	51	MET	C-N-CA	6.42	130.07	120.31	10	1
1	A	36	VAL	CA-CB-CG2	6.38	121.25	110.40	9	1
1	A	43	THR	O-C-N	-6.35	115.53	122.07	3	2
1	A	38	GLY	CA-C-N	6.28	130.60	120.30	8	1
1	A	38	GLY	C-N-CA	6.28	130.60	120.30	8	1
1	A	41	ILE	CA-C-O	-6.25	114.22	120.85	3	2
1	A	46	VAL	CA-CB-CG1	6.09	120.75	110.40	1	1
1	A	41	ILE	CB-CA-C	6.07	119.97	112.02	7	1
1	A	44	VAL	CA-C-N	6.06	128.32	120.56	8	2
1	A	44	VAL	C-N-CA	6.06	128.32	120.56	8	2
1	A	31	ILE	CA-C-O	-6.04	114.98	121.27	9	1
1	A	36	VAL	CA-C-N	5.92	126.55	119.98	5	2
1	A	36	VAL	C-N-CA	5.92	126.55	119.98	5	2
1	A	40	VAL	N-CA-C	5.91	116.65	110.62	9	2
1	A	52	LEU	CA-C-O	5.91	126.55	119.10	7	2
1	A	42	ALA	CA-C-N	5.90	128.11	120.44	7	1
1	A	42	ALA	C-N-CA	5.90	128.11	120.44	7	1
1	A	32	ILE	CA-C-N	5.87	126.46	120.00	9	4
1	A	32	ILE	C-N-CA	5.87	126.46	120.00	9	4
1	A	46	VAL	CA-C-N	5.87	127.95	120.56	9	1
1	A	46	VAL	C-N-CA	5.87	127.95	120.56	9	1
1	A	46	VAL	N-CA-C	5.82	117.25	110.62	7	1
1	A	52	LEU	N-CA-C	5.76	120.31	113.28	4	1
1	A	44	VAL	CB-CA-C	-5.66	104.62	112.04	10	1
1	A	31	ILE	CA-CB-CG2	5.62	120.06	110.50	8	1
1	A	49	LEU	CA-C-N	5.62	127.64	120.56	10	1
1	A	49	LEU	C-N-CA	5.62	127.64	120.56	10	1
1	A	51	MET	O-C-N	-5.62	116.02	122.09	7	1
1	A	50	VAL	N-CA-C	5.61	115.81	110.42	10	1
1	A	45	ILE	N-CA-C	5.59	115.78	110.42	4	1
1	A	33	GLY	CA-C-O	-5.57	115.34	120.80	7	1
1	A	48	THR	OG1-CB-CG2	-5.55	98.20	109.30	3	2
1	A	31	ILE	N-CA-C	5.50	116.14	110.36	9	2

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)	Models	
								Worst	Total
1	A	43	THR	OG1-CB-CG2	-5.47	98.36	109.30	5	1
1	A	48	THR	N-CA-C	5.44	117.91	111.33	8	1
1	A	36	VAL	O-C-N	5.42	127.13	121.87	2	1
1	A	44	VAL	O-C-N	5.38	127.37	121.83	6	2
1	A	35	MET	CA-C-N	5.32	127.75	120.46	6	2
1	A	35	MET	C-N-CA	5.32	127.75	120.46	6	2
1	A	31	ILE	CA-C-N	5.32	127.26	120.56	10	1
1	A	31	ILE	C-N-CA	5.32	127.26	120.56	10	1
1	A	43	THR	CA-CB-CG2	5.24	119.41	110.50	2	2
1	A	39	VAL	N-CA-C	5.24	116.60	110.62	9	1
1	A	39	VAL	N-CA-CB	5.23	117.65	110.54	2	1
1	A	38	GLY	O-C-N	-5.22	116.59	122.28	6	1
1	A	30	ALA	O-C-N	-5.20	115.88	122.27	6	1
1	A	40	VAL	CA-C-O	-5.19	115.74	121.29	4	1
1	A	31	ILE	CA-CB-CG1	5.18	119.21	110.40	3	1
1	A	40	VAL	CA-C-N	5.16	127.17	120.56	7	2
1	A	40	VAL	C-N-CA	5.16	127.17	120.56	7	2
1	A	47	ILE	CB-CA-C	5.15	118.56	111.97	1	1
1	A	44	VAL	CA-CB-CG1	5.12	119.11	110.40	10	1
1	A	51	MET	N-CA-CB	5.12	118.23	110.14	2	1
1	A	45	ILE	CA-C-N	5.12	129.13	120.64	5	1
1	A	45	ILE	C-N-CA	5.12	129.13	120.64	5	1
1	A	51	MET	CA-C-O	-5.11	115.43	120.90	5	1
1	A	39	VAL	O-C-N	-5.06	116.96	121.87	2	1
1	A	36	VAL	CG1-CB-CG2	-5.04	99.72	110.80	9	1
1	A	48	THR	O-C-N	5.03	127.25	122.07	10	1
1	A	39	VAL	CA-C-N	5.03	126.98	120.70	4	1
1	A	39	VAL	C-N-CA	5.03	126.98	120.70	4	1

There are no chirality outliers.

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

Mol	Chain	Res	Type	Group	Models (Total)
1	A	43	THR	Mainchain	1
1	A	35	MET	Mainchain	1

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	158	193	193	0±0
2	B	113	119	116	0±0
All	All	2710	3120	3057	1

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 0.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:40:VAL:O	1:A:43:THR:HB	0.42	2.14	3	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	23/55 (42%)	23±0 (98±2%)	0±0 (1±2%)	0±0 (0±1%)	31	76
2	B	0	-	-	-	-	-
All	All	230/670 (34%)	226 (98%)	3 (1%)	1 (0%)	31	76

All 1 unique Ramachandran outliers are listed below.

Mol	Chain	Res	Type	Models (Total)
1	A	32	ILE	1

6.3.2 Protein sidechains ⓘ

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	18/45 (40%)	18±0 (99±2%)	0±0 (1±2%)	76 96
2	B	0	-	-	-
All	All	180/450 (40%)	179 (99%)	1 (1%)	76 96

All 1 unique residues with a non-rotameric sidechain are listed below.

Mol	Chain	Res	Type	Models (Total)
1	A	34	LEU	1

6.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

12 non-standard protein/DNA/RNA residues are modelled in this entry.

In the following table, the Counts columns list the number of bonds for which Mogul statistics could be retrieved, the number of bonds that are observed in the model and the number of bonds 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 is the number of standard deviations the observed value is removed from the expected value. A bond length with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the average root-mean-square of all Z scores of the bond lengths.

Mol	Type	Chain	Res	Link	Bond lengths		
					Counts	RMSZ	#Z>2
2	DLE	B	106	2	5,7,8	0.84±0.10	0±0 (0±0%)
2	2TL	B	108	2	5,6,7	1.10±0.38	1±0 (12±9%)
2	DSG	B	111	2	6,7,8	1.15±0.18	0±0 (3±6%)
2	DHI	B	109	2	9,10,11	1.18±0.18	1±1 (13±6%)
2	DPR	B	102	2	6,7,8	0.97±0.32	0±0 (3±6%)
2	DAR	B	101	2	9,10,11	1.22±0.34	1±1 (10±11%)
2	DAR	B	112	2	10,11,11	1.14±0.20	1±1 (7±9%)

Mol	Type	Chain	Res	Link	Bond lengths		
					Counts	RMSZ	#Z>2
2	DAR	B	103	2	9,10,11	1.13±0.23	1±1 (6±7%)
2	DAR	B	110	2	9,10,11	1.36±0.30	2±1 (16±10%)
2	2TL	B	104	2	5,6,7	1.11±0.33	0±0 (4±8%)
2	DHI	B	107	2	9,10,11	1.23±0.21	1±1 (14±8%)
2	DAR	B	105	2	9,10,11	1.41±0.32	1±1 (12±9%)

In the following table, the Counts columns list the number of angles for which Mogul statistics could be retrieved, the number of angles that are observed in the model and the number of 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 angle is the number of standard deviations the observed value is removed from the expected value. A bond angle with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the average root-mean-square of all Z scores of the bond angles.

Mol	Type	Chain	Res	Link	Bond angles		
					Counts	RMSZ	#Z>2
2	DLE	B	106	2	6,8,10	1.60±0.60	1±1 (15±11%)
2	2TL	B	108	2	5,7,9	1.59±0.42	1±1 (22±18%)
2	DSG	B	111	2	4,8,10	1.62±0.79	1±1 (27±28%)
2	DHI	B	109	2	8,12,14	1.36±0.32	1±1 (17±16%)
2	DPR	B	102	2	7,8,10	1.57±0.42	1±1 (17±12%)
2	DAR	B	101	2	5,11,13	1.69±0.40	2±1 (30±24%)
2	DAR	B	112	2	9,13,13	1.45±0.49	2±1 (17±15%)
2	DAR	B	103	2	5,11,13	1.68±0.48	2±1 (32±18%)
2	DAR	B	110	2	5,11,13	1.85±0.61	2±1 (30±13%)
2	2TL	B	104	2	5,7,9	1.79±0.76	2±1 (36±29%)
2	DHI	B	107	2	8,12,14	1.29±0.43	1±1 (16±13%)
2	DAR	B	105	2	5,11,13	1.57±0.52	1±1 (22±18%)

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
2	DAR	B	112	2	-	0±0,11,11,11	-
2	DLE	B	106	2	-	0±0,5,6,8	-
2	DSG	B	111	2	-	0±0,5,6,8	-
2	DAR	B	105	2	-	0±0,8,9,11	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	DAR	B	110	2	-	0±0,8,9,11	-
2	2TL	B	108	2	-	0±0,5,6,8	-
2	2TL	B	104	2	-	0±0,5,6,8	-
2	DPR	B	102	2	-	0±0,0,9,11	0±0,1,1,1
2	DHI	B	107	2	-	0±0,5,6,8	0±0,1,1,1
2	DAR	B	103	2	-	0±0,8,9,11	-
2	DAR	B	101	2	-	0±0,8,9,11	-
2	DHI	B	109	2	-	0±0,5,6,8	0±0,1,1,1

All unique bond 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(Å)	Ideal(Å)	Models	
								Worst	Total
2	B	105	DAR	CB-CA	5.84	1.62	1.53	10	3
2	B	101	DAR	CB-CA	4.66	1.60	1.53	10	3
2	B	102	DPR	CA-N	3.94	1.41	1.48	6	2
2	B	109	DHI	CB-CA	3.74	1.61	1.53	1	3
2	B	104	2TL	CG2-CB	3.21	1.61	1.51	3	1
2	B	103	DAR	CD-NE	3.18	1.53	1.46	8	2
2	B	101	DAR	CD-NE	3.16	1.53	1.46	2	2
2	B	107	DHI	O-C	3.13	1.31	1.20	4	2
2	B	110	DAR	CZ-NE	3.12	1.27	1.33	9	1
2	B	110	DAR	CB-CA	3.08	1.48	1.53	9	6
2	B	109	DHI	CD2-NE2	3.03	1.44	1.36	8	1
2	B	103	DAR	CB-CA	2.85	1.57	1.53	4	2
2	B	107	DHI	CE1-ND1	2.85	1.39	1.33	8	5
2	B	107	DHI	CA-N	2.81	1.55	1.48	1	1
2	B	112	DAR	CG-CD	2.73	1.62	1.51	6	1
2	B	111	DSG	OD1-CG	2.70	1.15	1.23	8	1
2	B	110	DAR	CD-NE	2.69	1.52	1.46	3	4
2	B	104	2TL	CA-N	2.69	1.55	1.47	7	1
2	B	107	DHI	CD2-CG	2.64	1.41	1.36	2	1
2	B	105	DAR	CD-NE	2.62	1.52	1.46	1	4
2	B	108	2TL	CG2-CB	2.60	1.59	1.51	10	2
2	B	105	DAR	CZ-NE	2.60	1.28	1.33	9	2
2	B	112	DAR	OXT-C	2.59	1.22	1.30	4	3
2	B	109	DHI	CE1-ND1	2.57	1.38	1.33	4	3
2	B	110	DAR	CA-N	2.55	1.55	1.48	6	2
2	B	103	DAR	O-C	2.50	1.29	1.20	6	1
2	B	109	DHI	CG-ND1	2.43	1.44	1.38	10	4
2	B	112	DAR	CZ-NH1	2.42	1.25	1.34	6	1
2	B	110	DAR	CG-CD	2.36	1.60	1.51	7	1

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)	Models	
								Worst	Total
2	B	107	DHI	CB-CA	2.34	1.58	1.53	3	1
2	B	108	2TL	CA-N	2.34	1.54	1.47	4	1
2	B	107	DHI	CD2-NE2	2.33	1.42	1.36	6	2
2	B	108	2TL	CB-CA	2.31	1.60	1.53	9	2
2	B	108	2TL	OG1-CB	2.29	1.37	1.43	7	1
2	B	109	DHI	CA-N	2.27	1.41	1.48	4	1
2	B	105	DAR	CG-CB	2.20	1.61	1.52	3	2
2	B	101	DAR	CZ-NH2	2.19	1.24	1.32	4	1
2	B	112	DAR	CD-NE	2.18	1.51	1.46	2	1
2	B	101	DAR	CG-CB	2.16	1.61	1.52	10	1
2	B	103	DAR	CZ-NE	2.15	1.29	1.33	9	1
2	B	101	DAR	CZ-NE	2.14	1.29	1.33	8	1
2	B	112	DAR	CB-CA	2.13	1.48	1.53	1	1
2	B	111	DSG	CG-ND2	2.11	1.25	1.32	1	1
2	B	107	DHI	CG-ND1	2.09	1.44	1.38	7	1
2	B	110	DAR	O-C	2.08	1.27	1.20	8	1
2	B	101	DAR	O-C	2.06	1.27	1.20	4	1

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(°)	Ideal(°)	Models	
								Worst	Total
2	B	106	DLE	CB-CA-C	5.97	120.18	110.99	4	6
2	B	110	DAR	NE-CZ-NH2	5.76	130.56	120.67	1	7
2	B	111	DSG	OD1-CG-ND2	5.54	107.74	122.53	2	3
2	B	104	2TL	OG1-CB-CA	5.29	120.19	109.01	5	3
2	B	108	2TL	OG1-CB-CA	4.92	119.42	109.01	1	5
2	B	102	DPR	CB-CA-C	4.75	106.14	112.66	3	5
2	B	102	DPR	O-C-CA	4.37	113.54	124.77	2	4
2	B	103	DAR	NE-CZ-NH2	4.34	128.13	120.67	4	5
2	B	105	DAR	NH1-CZ-NE	4.13	128.66	119.27	10	3
2	B	103	DAR	CB-CG-CD	4.13	123.99	112.07	6	5
2	B	105	DAR	NE-CZ-NH2	4.02	127.57	120.67	5	2
2	B	110	DAR	CB-CG-CD	3.83	123.12	112.07	4	1
2	B	112	DAR	CB-CA-N	3.79	100.23	110.12	9	2
2	B	104	2TL	CG2-CB-CA	3.76	103.61	112.16	9	5
2	B	112	DAR	NH1-CZ-NH2	3.61	109.80	120.07	6	3
2	B	107	DHI	CB-CG-CD2	3.55	122.07	129.33	5	4
2	B	104	2TL	O-C-CA	3.51	115.75	124.77	6	4
2	B	112	DAR	NE-CZ-NH2	3.49	126.67	120.67	6	4
2	B	109	DHI	CB-CG-CD2	3.40	122.39	129.33	5	5

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)	Models	
								Worst	Total
2	B	112	DAR	NH1-CZ-NE	3.40	126.98	119.27	2	3
2	B	106	DLE	CB-CA-N	3.37	103.11	110.48	4	2
2	B	101	DAR	NH1-CZ-NE	3.31	126.79	119.27	8	4
2	B	108	2TL	O-C-CA	3.26	116.37	124.77	7	3
2	B	107	DHI	CD2-NE2-CE1	3.24	113.14	107.36	2	1
2	B	101	DAR	CG-CD-NE	3.23	121.26	112.20	1	4
2	B	111	DSG	OD1-CG-CB	3.18	127.51	120.87	2	4
2	B	111	DSG	CB-CG-ND2	3.14	123.71	116.19	2	1
2	B	112	DAR	OXT-C-O	3.10	117.05	124.08	6	2
2	B	104	2TL	OG1-CB-CG2	3.07	100.49	109.68	5	6
2	B	105	DAR	NH1-CZ-NH2	3.05	111.40	120.07	6	3
2	B	101	DAR	NE-CZ-NH2	3.04	125.89	120.67	9	3
2	B	103	DAR	NH1-CZ-NE	2.98	126.04	119.27	10	3
2	B	106	DLE	CD2-CG-CB	2.95	121.70	111.08	6	1
2	B	111	DSG	CA-CB-CG	2.94	118.12	112.21	6	3
2	B	112	DAR	CB-CG-CD	2.90	103.69	112.07	4	1
2	B	110	DAR	NH1-CZ-NH2	2.80	112.11	120.07	10	3
2	B	109	DHI	CD2-NE2-CE1	2.78	112.33	107.36	2	1
2	B	103	DAR	NH1-CZ-NH2	2.77	112.18	120.07	4	3
2	B	107	DHI	CG-CD2-NE2	2.69	102.40	106.54	5	3
2	B	109	DHI	CD2-CG-ND1	2.69	114.29	108.86	4	1
2	B	109	DHI	CA-CB-CG	2.68	120.37	113.77	2	2
2	B	110	DAR	NH1-CZ-NE	2.60	125.17	119.27	6	4
2	B	102	DPR	CD-N-CA	2.55	113.68	107.21	4	2
2	B	105	DAR	CB-CG-CD	2.54	119.41	112.07	5	2
2	B	101	DAR	NH1-CZ-NH2	2.50	112.96	120.07	8	2
2	B	107	DHI	NE2-CE1-ND1	2.47	105.43	111.49	2	1
2	B	108	2TL	CG2-CB-CA	2.46	106.57	112.16	4	1
2	B	109	DHI	NE2-CE1-ND1	2.43	105.53	111.49	2	1
2	B	107	DHI	CA-CB-CG	2.38	119.64	113.77	7	2
2	B	107	DHI	CB-CG-ND1	2.35	128.77	121.74	4	1
2	B	112	DAR	CB-CA-C	2.30	104.36	110.45	2	1
2	B	102	DPR	CG-CB-CA	2.29	96.63	105.05	3	1
2	B	109	DHI	CB-CG-ND1	2.25	128.47	121.74	10	3
2	B	108	2TL	OG1-CB-CG2	2.20	103.11	109.68	2	2
2	B	109	DHI	CG-CD2-NE2	2.16	103.22	106.54	2	1
2	B	101	DAR	CB-CG-CD	2.13	105.92	112.07	5	2
2	B	105	DAR	CG-CD-NE	2.10	106.30	112.20	1	1
2	B	107	DHI	CD2-CG-ND1	2.07	113.03	108.86	6	1

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

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.

7 Chemical shift validation [i](#)

The completeness of assignment taking into account all chemical shift lists is 97% for the well-defined parts and 86% for the entire structure.

7.1 Chemical shift list 1

File name: `working_cs.cif`

Chemical shift list name: *starch_output*

7.1.1 Bookkeeping [i](#)

The following table shows the results of parsing the chemical shift list and reports the number of nuclei with statistically unusual chemical shifts.

Total number of shifts	651
Number of shifts mapped to atoms	651
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	0

7.1.2 Chemical shift referencing [i](#)

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	Correction $\pm$ precision, ppm	Suggested action
$^{13}\text{C}_\alpha$	54	1.59 ± 0.14	Should be checked
$^{13}\text{C}_\beta$	48	2.79 ± 0.06	Should be checked
$^{13}\text{C}'$	52	2.45 ± 0.10	Should be applied
^{15}N	55	1.29 ± 0.28	Should be applied

7.1.3 Completeness of resonance assignments [i](#)

The following table shows the completeness of the chemical shift assignments for the well-defined regions of the structure. The overall completeness is 97%, i.e. 313 atoms were assigned a chemical shift out of a possible 322. 0 out of 9 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^1H	^{13}C	^{15}N
Backbone	118/118 (100%)	49/49 (100%)	46/46 (100%)	23/23 (100%)
Sidechain	195/204 (96%)	136/142 (96%)	59/62 (95%)	0/0 (—%)

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	Total	¹H	¹³C	¹⁵N
Overall	313/322 (97%)	185/191 (97%)	105/108 (97%)	23/23 (100%)

The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 86%, i.e. 650 atoms were assigned a chemical shift out of a possible 756. 0 out of 13 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	¹H	¹³C	¹⁵N
Backbone	275/281 (98%)	114/116 (98%)	106/110 (96%)	55/55 (100%)
Sidechain	375/415 (90%)	258/275 (94%)	117/130 (90%)	0/10 (0%)
Aromatic	0/60 (0%)	0/31 (0%)	0/26 (0%)	0/3 (0%)
Overall	650/756 (86%)	372/422 (88%)	223/266 (84%)	55/68 (81%)

7.1.4 Statistically unusual chemical shifts [i](#)

There are no statistically unusual chemical shifts.

7.1.5 Random Coil Index (RCI) plots [i](#)

The image below reports *random coil index* values for the protein chains in the structure. The height of each bar gives a probability of a given residue to be disordered, as predicted from the available chemical shifts and the amino acid sequence. A value above 0.2 is an indication of significant predicted disorder. The colour of the bar shows whether the residue is in the well-defined core (black) or in the ill-defined residue ranges (cyan), as described in section 2 on ensemble composition. If well-defined core and ill-defined regions are not identified then it is shown as gray bars.

Random coil index (RCI) for chain A:

