Full wwPDB NMR Structure Validation Report (i)

May 28, 2020 – 10:09 pm BST

PDB ID	:	2IUE
Title	:	Pactolus I-domain: Functional Switching of the Rossmann Fold
Authors	:	Sen, M.; Legge, G.B.
Deposited on	:	2006-06-02

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 following versions of software and data (see references (1)) were used in the production of this report:

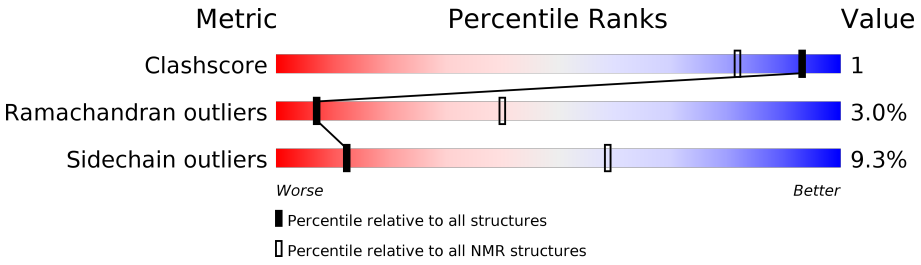
Cyrange	:	Kirchner and Güntert (2011)
NmrClust	:	Kelley et al. (1996)
MolProbity	:	4.02b-467
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
ShiftChecker	:	2.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

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 28%.

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	158937	12864
Ramachandran outliers	154571	11451
Sidechain outliers	154315	11428

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	212	67% 5% 28%

2 Ensemble composition and analysis

This entry contains 20 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 20 is the overall representative, medoid model (most similar to other models).

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:3-A:13, A:40-A:60, A:75-A:194 (152)	0.22	20

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, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 20
2	5, 18
Single-model clusters	14

3 Entry composition (i)

There is only 1 type of molecule in this entry. The entry contains 2813 atoms, of which 1168 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called INTEGRIN BETA-2-LIKE PROTEIN.

Mol	Chain	Residues	Atoms						Trace
			Total	C	H	N	O	S	
1	A	212	2813	1029	1168	293	317	6	0

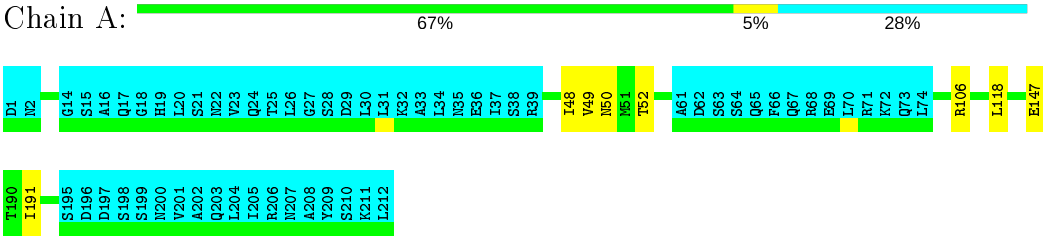
4 Residue-property plots

4.1 Average score per residue in the NMR ensemble

These plots are provided for all protein, RNA and DNA 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: INTEGRIN BETA-2-LIKE PROTEIN

Chain A:



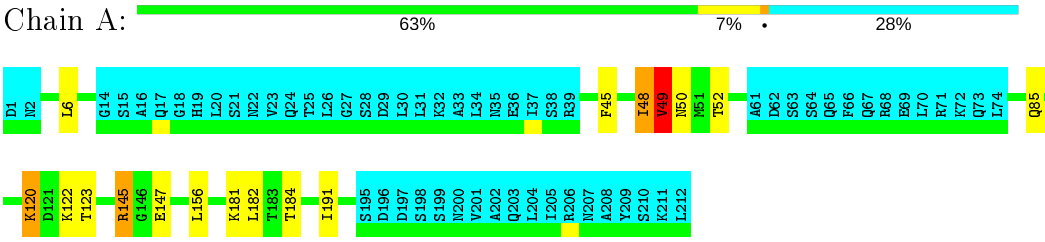
4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

4.2.1 Score per residue for model 1

• Molecule 1: INTEGRIN BETA-2-LIKE PROTEIN

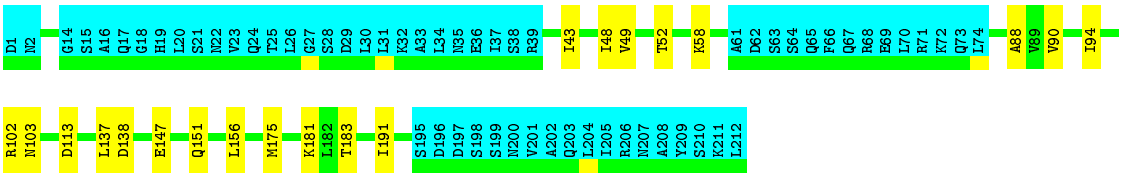
Chain A:



4.2.2 Score per residue for model 2

• Molecule 1: INTEGRIN BETA-2-LIKE PROTEIN

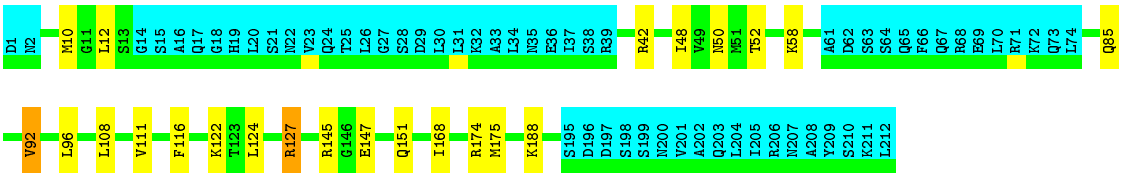
Chain A:



4.2.3 Score per residue for model 3

• Molecule 1: INTEGRIN BETA-2-LIKE PROTEIN

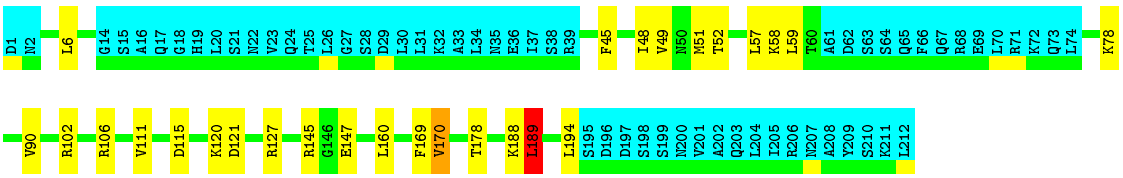
Chain A:



4.2.4 Score per residue for model 4

• Molecule 1: INTEGRIN BETA-2-LIKE PROTEIN

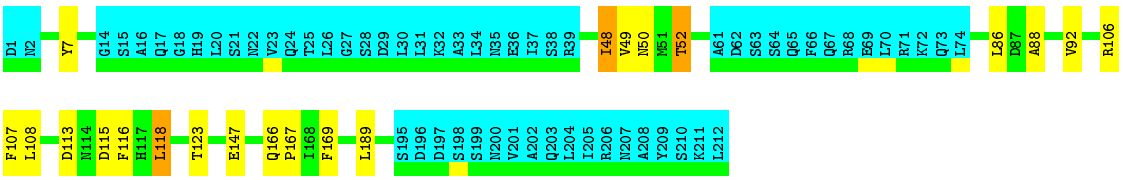
Chain A:



4.2.5 Score per residue for model 5

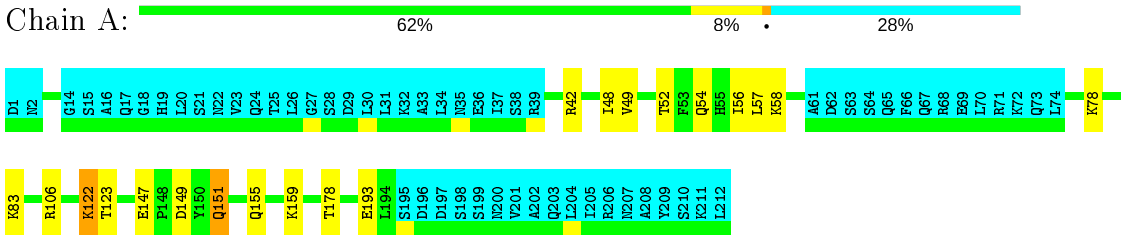
• Molecule 1: INTEGRIN BETA-2-LIKE PROTEIN

Chain A:



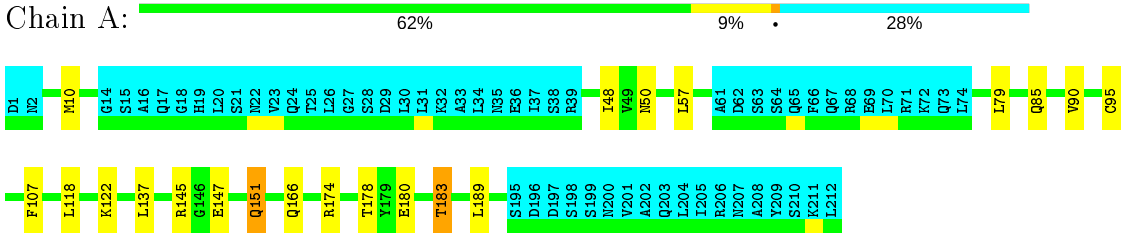
4.2.6 Score per residue for model 6

• Molecule 1: INTEGRIN BETA-2-LIKE PROTEIN



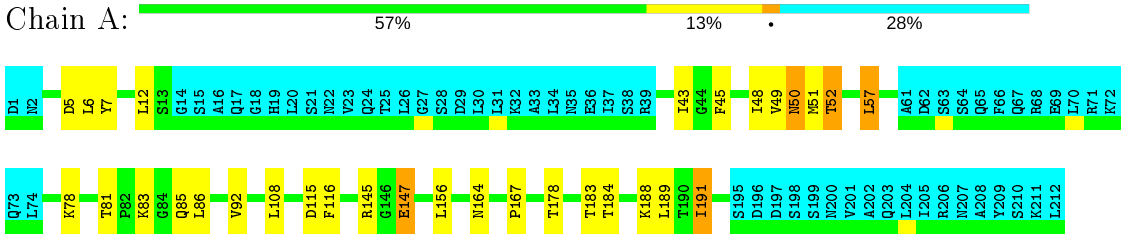
4.2.7 Score per residue for model 7

- Molecule 1: INTEGRIN BETA-2-LIKE PROTEIN



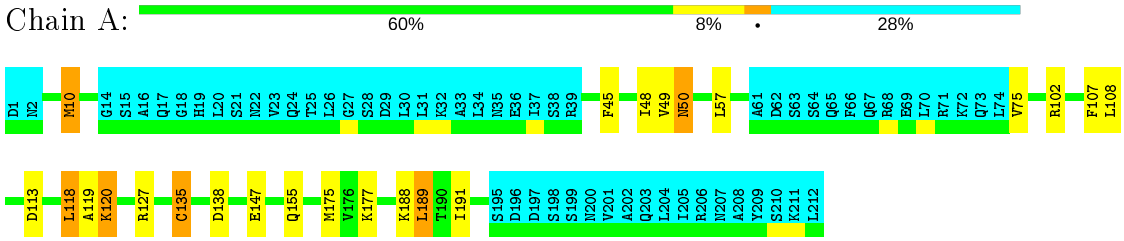
4.2.8 Score per residue for model 8

- Molecule 1: INTEGRIN BETA-2-LIKE PROTEIN



4.2.9 Score per residue for model 9

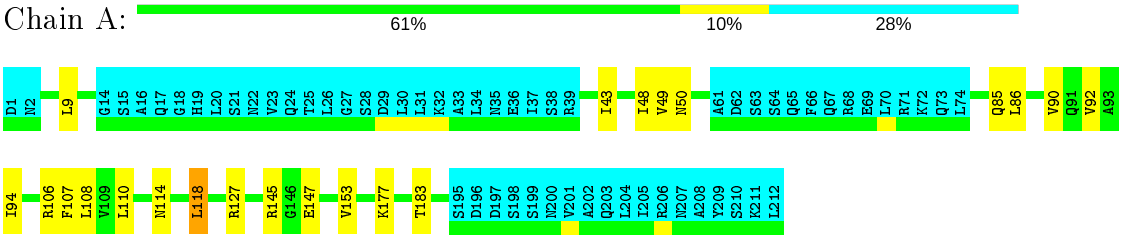
- Molecule 1: INTEGRIN BETA-2-LIKE PROTEIN



4.2.10 Score per residue for model 10

• Molecule 1: INTEGRIN BETA-2-LIKE PROTEIN

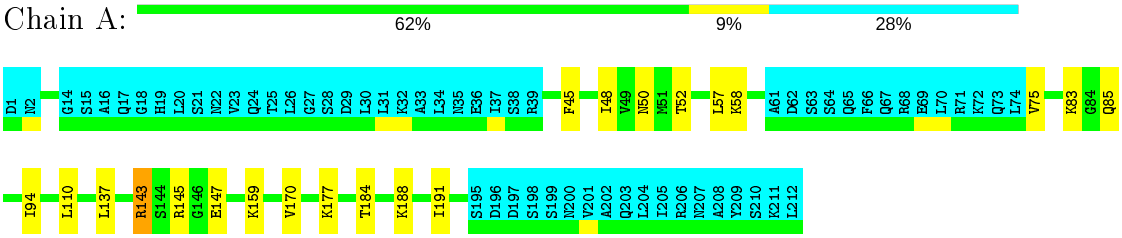
Chain A:



4.2.11 Score per residue for model 11

• Molecule 1: INTEGRIN BETA-2-LIKE PROTEIN

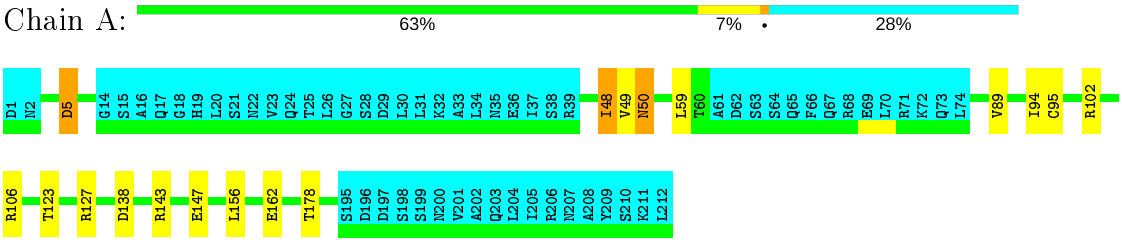
Chain A:



4.2.12 Score per residue for model 12

• Molecule 1: INTEGRIN BETA-2-LIKE PROTEIN

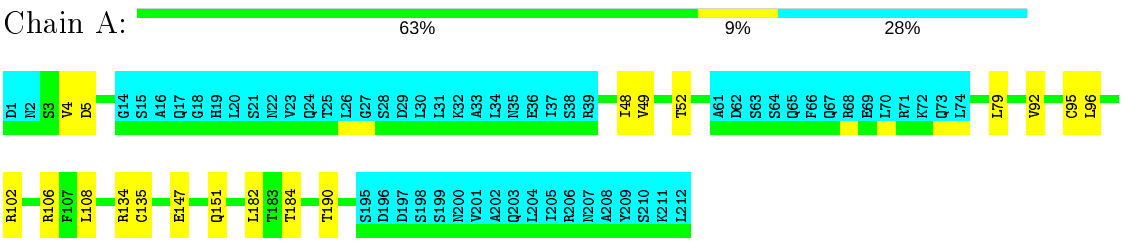
Chain A:



4.2.13 Score per residue for model 13

• Molecule 1: INTEGRIN BETA-2-LIKE PROTEIN

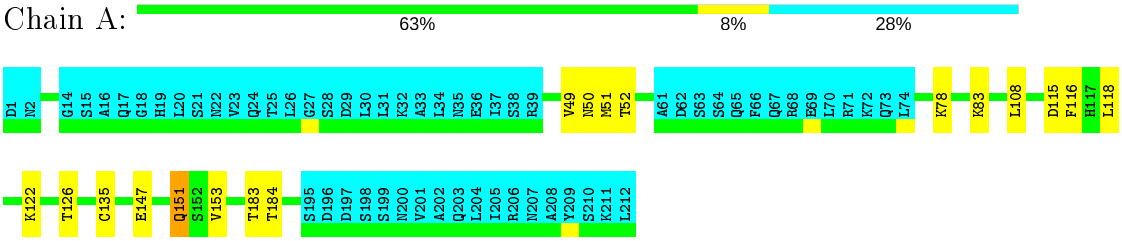
Chain A:



4.2.14 Score per residue for model 14

• Molecule 1: INTEGRIN BETA-2-LIKE PROTEIN

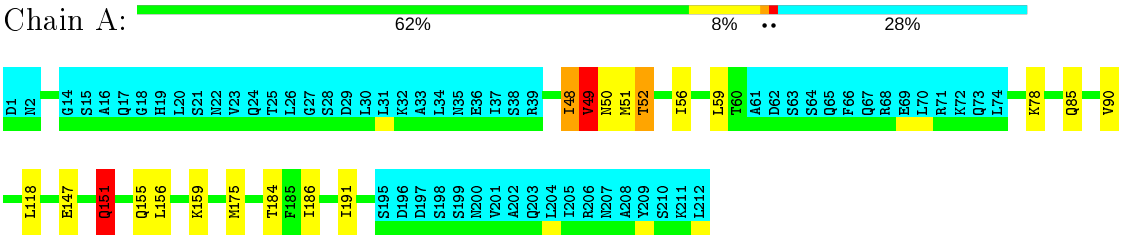
Chain A:



4.2.15 Score per residue for model 15

• Molecule 1: INTEGRIN BETA-2-LIKE PROTEIN

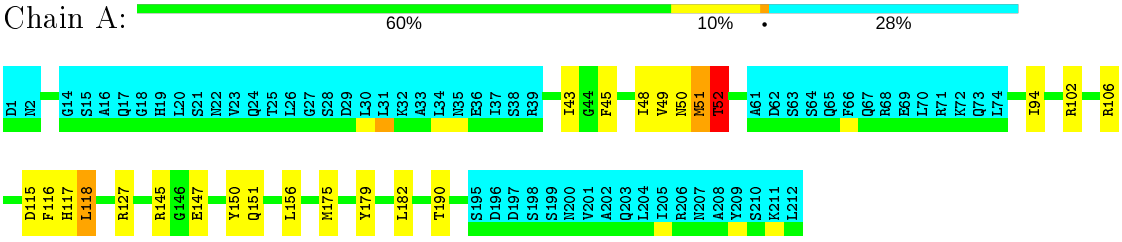
Chain A:



4.2.16 Score per residue for model 16

• Molecule 1: INTEGRIN BETA-2-LIKE PROTEIN

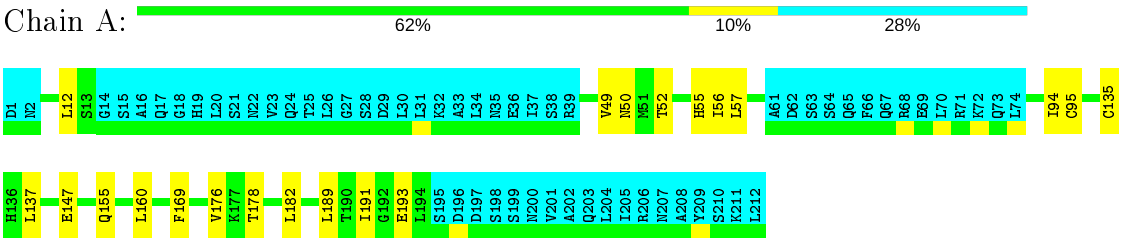
Chain A:



4.2.17 Score per residue for model 17

• Molecule 1: INTEGRIN BETA-2-LIKE PROTEIN

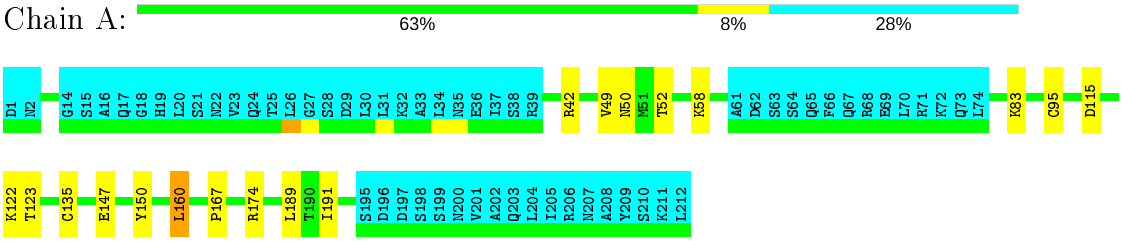
Chain A:



4.2.18 Score per residue for model 18

• Molecule 1: INTEGRIN BETA-2-LIKE PROTEIN

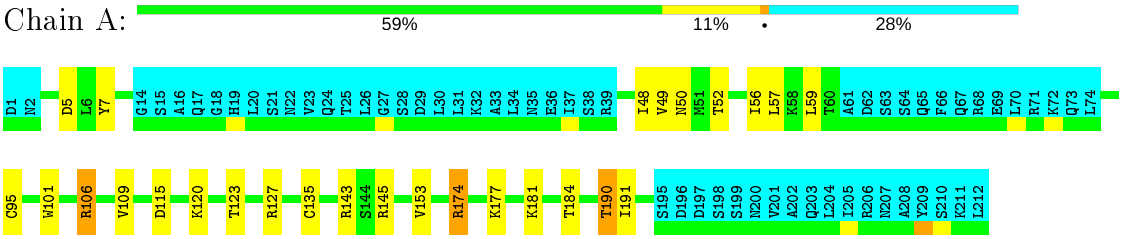
Chain A:



4.2.19 Score per residue for model 19

• Molecule 1: INTEGRIN BETA-2-LIKE PROTEIN

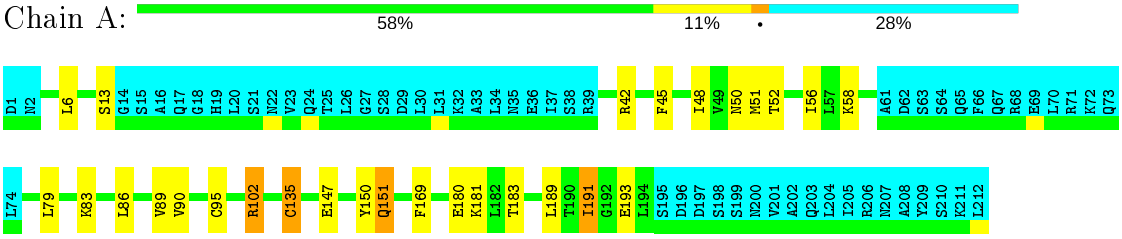
Chain A:



4.2.20 Score per residue for model 20 (medoid)

• Molecule 1: INTEGRIN BETA-2-LIKE PROTEIN

Chain A:



5 Refinement protocol and experimental data overview

The models were refined using the following method: *DYANA AMBER 8.0 AND MODELLER8V2.*

Of the 200 calculated structures, 20 were deposited, based on the following criterion: *LOWEST POTENTIAL ENERGY ENSEMBLES.*

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

Software name	Classification	Version
Amber	refinement	8.0
NMRPipe	structure solution	
NMRView	structure solution	
DYANA	structure solution	
Amber	structure solution	8.0
MOLMOL	structure solution	
MODELLER	structure solution	

The following table shows chemical shift validation statistics as aggregates over all chemical shift files. Detailed validation can be found in section 6 of this report.

Chemical shift file(s)	input_cs.cif
Number of chemical shift lists	1
Total number of shifts	804
Number of shifts mapped to atoms	799
Number of unparsed shifts	0
Number of shifts with mapping errors	5
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	28%

No validations of the models with respect to experimental NMR restraints is performed at this time.

COVALENT-GEOMETRY INFOmissingINFO

5.1 Too-close contacts

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in 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	1182	856	1210	3±2
All	All	23640	17123	24200	60

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 1.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:111:VAL:HG12	1:A:170:VAL:HG22	0.70	1.63	4	1
1:A:90:VAL:HG21	1:A:156:LEU:HD22	0.65	1.69	15	1
1:A:86:LEU:HD23	1:A:156:LEU:HD21	0.62	1.72	8	1
1:A:85:GLN:CG	1:A:110:LEU:HD21	0.55	2.32	11	1
1:A:181:LYS:O	1:A:184:THR:HG22	0.54	2.02	19	1
1:A:151:GLN:CD	1:A:151:GLN:H	0.54	2.05	14	1
1:A:151:GLN:H	1:A:151:GLN:CD	0.53	2.07	7	2
1:A:51:MET:O	1:A:52:THR:HG23	0.52	2.05	8	2
1:A:90:VAL:O	1:A:94:ILE:HD12	0.52	2.05	10	2
1:A:151:GLN:NE2	1:A:151:GLN:H	0.51	2.02	15	2
1:A:48:ILE:HD13	1:A:49:VAL:N	0.50	2.21	1	3
1:A:160:LEU:HD22	1:A:167:PRO:HG3	0.48	1.84	18	1
1:A:92:VAL:HG11	1:A:108:LEU:HD13	0.48	1.85	3	2
1:A:90:VAL:CG1	1:A:156:LEU:HD22	0.47	2.39	2	1
1:A:118:LEU:HD22	1:A:119:ALA:H	0.47	1.70	9	1
1:A:49:VAL:CG2	1:A:50:ASN:H	0.47	2.22	15	1
1:A:10:MET:CE	1:A:45:PHE:CZ	0.47	2.98	9	1
1:A:170:VAL:HG23	1:A:194:LEU:HB2	0.46	1.86	4	1
1:A:59:LEU:HD11	1:A:101:TRP:CE3	0.46	2.46	19	1
1:A:169:PHE:CD2	1:A:189:LEU:HD21	0.46	2.45	17	2
1:A:49:VAL:HG23	1:A:50:ASN:H	0.46	1.70	15	1
1:A:169:PHE:CD2	1:A:189:LEU:HD11	0.46	2.46	20	1
1:A:167:PRO:HG2	1:A:189:LEU:HG	0.45	1.88	5	2
1:A:50:ASN:C	1:A:52:THR:H	0.45	2.14	15	2
1:A:122:LYS:HE3	1:A:150:TYR:CZ	0.45	2.47	18	1
1:A:122:LYS:HE2	1:A:127:ARG:CG	0.45	2.42	3	1
1:A:118:LEU:H	1:A:118:LEU:HD23	0.45	1.71	16	1
1:A:90:VAL:HG21	1:A:151:GLN:CG	0.44	2.43	20	1
1:A:180:GLU:O	1:A:183:THR:HG22	0.44	2.11	7	1
1:A:107:PHE:CD2	1:A:166:GLN:HB2	0.44	2.48	7	1
1:A:9:LEU:HD12	1:A:92:VAL:HG21	0.43	1.89	10	1
1:A:48:ILE:HD13	1:A:88:ALA:HB2	0.43	1.89	5	1
1:A:5:ASP:HB2	1:A:59:LEU:HD13	0.43	1.90	19	1
1:A:122:LYS:N	1:A:122:LYS:HE2	0.43	2.29	6	1
1:A:117:HIS:HB3	1:A:150:TYR:CE2	0.43	2.49	16	1
1:A:118:LEU:HD21	1:A:153:VAL:HG23	0.43	1.90	10	1
1:A:118:LEU:H	1:A:118:LEU:CD2	0.43	2.27	16	1
1:A:7:TYR:CD1	1:A:92:VAL:HG21	0.42	2.49	5	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:86:LEU:HB2	1:A:116:PHE:CZ	0.42	2.49	8	2
1:A:120:LYS:O	1:A:123:THR:HG22	0.42	2.15	19	1
1:A:118:LEU:H	1:A:118:LEU:HD13	0.42	1.75	5	1
1:A:175:MET:CE	1:A:179:TYR:CE1	0.42	3.02	16	1
1:A:108:LEU:HD13	1:A:110:LEU:HD13	0.41	1.91	10	1
1:A:92:VAL:HG11	1:A:108:LEU:HD23	0.41	1.93	8	1
1:A:90:VAL:HG21	1:A:151:GLN:HG3	0.41	1.91	20	1
1:A:13:SER:OG	1:A:83:LYS:HE2	0.41	2.15	20	1
1:A:86:LEU:HD22	1:A:116:PHE:CE2	0.40	2.51	5	1
1:A:48:ILE:HG21	1:A:88:ALA:HB2	0.40	1.92	2	1
1:A:107:PHE:CE1	1:A:166:GLN:HG3	0.40	2.52	5	1

5.2 Torsion angles (i)

5.2.1 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	152/212 (72%)	133±2 (87±1%)	15±2 (10±1%)	5±2 (3±1%)	7	40
All	All	3040/4240 (72%)	2655 (87%)	294 (10%)	91 (3%)	7	40

All 15 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	147	GLU	19
1	A	52	THR	14
1	A	49	VAL	14
1	A	50	ASN	13
1	A	191	ILE	7
1	A	57	LEU	6
1	A	115	ASP	6
1	A	188	LYS	3
1	A	138	ASP	2
1	A	120	LYS	2
1	A	59	LEU	1

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Mol	Chain	Res	Type	Models (Total)
1	A	174	ARG	1
1	A	79	LEU	1
1	A	85	GLN	1
1	A	103	ASN	1

5.2.2 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	132/184 (72%)	120±3 (91±2%)	12±3 (9±2%)	12	59
All	All	2640/3680 (72%)	2394 (91%)	246 (9%)	12	59

All 78 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	A	48	ILE	16
1	A	151	GLN	9
1	A	58	LYS	7
1	A	118	LEU	7
1	A	184	THR	6
1	A	95	CYS	6
1	A	178	THR	6
1	A	135	CYS	6
1	A	78	LYS	5
1	A	83	LYS	5
1	A	85	GLN	5
1	A	191	ILE	5
1	A	127	ARG	5
1	A	183	THR	5
1	A	106	ARG	5
1	A	56	ILE	5
1	A	123	THR	5
1	A	175	MET	4
1	A	137	LEU	4
1	A	6	LEU	4
1	A	122	LYS	4

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Mol	Chain	Res	Type	Models (Total)
1	A	177	LYS	4
1	A	94	ILE	4
1	A	189	LEU	4
1	A	50	ASN	4
1	A	155	GLN	4
1	A	182	LEU	4
1	A	102	ARG	4
1	A	159	LYS	3
1	A	113	ASP	3
1	A	160	LEU	3
1	A	145	ARG	3
1	A	193	GLU	3
1	A	108	LEU	3
1	A	12	LEU	3
1	A	156	LEU	3
1	A	43	ILE	3
1	A	5	ASP	3
1	A	57	LEU	3
1	A	10	MET	3
1	A	120	LYS	3
1	A	190	THR	3
1	A	181	LYS	3
1	A	188	LYS	2
1	A	89	VAL	2
1	A	153	VAL	2
1	A	107	PHE	2
1	A	79	LEU	2
1	A	49	VAL	2
1	A	174	ARG	2
1	A	52	THR	2
1	A	96	LEU	2
1	A	90	VAL	2
1	A	75	VAL	2
1	A	143	ARG	2
1	A	59	LEU	2
1	A	115	ASP	2
1	A	86	LEU	1
1	A	176	VAL	1
1	A	4	VAL	1
1	A	51	MET	1
1	A	186	ILE	1
1	A	162	GLU	1

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Mol	Chain	Res	Type	Models (Total)
1	A	121	ASP	1
1	A	180	GLU	1
1	A	147	GLU	1
1	A	54	GLN	1
1	A	116	PHE	1
1	A	168	ILE	1
1	A	170	VAL	1
1	A	124	LEU	1
1	A	138	ASP	1
1	A	55	HIS	1
1	A	114	ASN	1
1	A	126	THR	1
1	A	92	VAL	1
1	A	164	ASN	1
1	A	81	THR	1

5.2.3 RNA

There are no RNA molecules in this entry.

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

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

5.4 Carbohydrates

There are no carbohydrates in this entry.

5.5 Ligand geometry

There are no ligands in this entry.

5.6 Other polymers

There are no such molecules in this entry.

5.7 Polymer linkage issues

There are no chain breaks in this entry.

6 Chemical shift validation

The completeness of assignment taking into account all chemical shift lists is 28% for the well-defined parts and 31% for the entire structure.

6.1 Chemical shift list 1

File name: input_cs.cif

Chemical shift list name: *assigned_chem_shift_list_1*

6.1.1 Bookkeeping

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	804
Number of shifts mapped to atoms	799
Number of unparsed shifts	0
Number of shifts with mapping errors	5
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	0

The following assigned chemical shifts were not mapped to the molecules present in the coordinate file.

- Residue not found in structure. All 5 occurences are reported below.

Chain	Res	Type	Atom	Shift Data		
				Value	Uncertainty	Ambiguity
A	230	SER	CA	59.6	0.1	1
A	230	SER	C	175.5	0.1	1
A	230	SER	N	121.6	0.02	1
A	230	SER	CB	64.8	0.1	1
A	230	SER	H	7.6	0.02	1

6.1.2 Chemical shift referencing

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	Correction ± precision, *ppm*	Suggested action
$^{13}C_{\alpha}$	167	0.19 ± 0.05	None needed (< 0.5 ppm)
$^{13}C_{\beta}$	152	0.84 ± 0.12	Should be applied
$^{13}C'$	163	2.98 ± 0.09	Should be applied

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Nucleus	# values	Correction ± precision, *ppm*	Suggested action
^{15}N	161	-0.89 ± 0.28	Should be applied

6.1.3 Completeness of resonance assignments

The following table shows the completeness of the chemical shift assignments for the well-defined regions of the structure. The overall completeness is 28%, i.e. 516 atoms were assigned a chemical shift out of a possible 1861. 0 out of 31 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^{1}H	^{13}C	^{15}N
Backbone	420/750 (56%)	104/299 (35%)	212/304 (70%)	104/147 (71%)
Sidechain	96/983 (10%)	0/572 (0%)	96/365 (26%)	0/46 (0%)
Aromatic	0/128 (0%)	0/69 (0%)	0/55 (0%)	0/4 (0%)
Overall	516/1861 (28%)	104/940 (11%)	308/724 (43%)	104/197 (53%)

The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 31%, i.e. 799 atoms were assigned a chemical shift out of a possible 2589. 0 out of 42 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^{1}H	^{13}C	^{15}N
Backbone	648/1050 (62%)	160/419 (38%)	328/424 (77%)	160/207 (77%)
Sidechain	151/1387 (11%)	0/808 (0%)	151/507 (30%)	0/72 (0%)
Aromatic	0/152 (0%)	0/82 (0%)	0/65 (0%)	0/5 (0%)
Overall	799/2589 (31%)	160/1309 (12%)	479/996 (48%)	160/284 (56%)

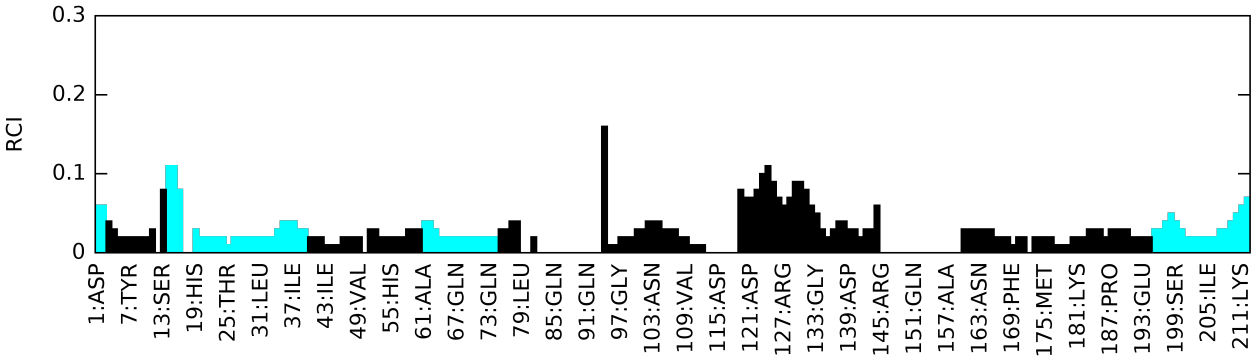
6.1.4 Statistically unusual chemical shifts

There are no statistically unusual chemical shifts.

6.1.5 Random Coil Index (RCI) plots

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.

Random coil index (RCI) for chain A:


RCI
0.3
0.2
0.1
0
1:ASP
7:TYR
13:SER
19:HIS
25:THR
31:LEU
37:ILE
43:ILE
49:VAL
55:HIS
61:ALA
67:GLN
73:GLN
79:LEU
85:GLN
91:GLN
97:GLY
103:ASN
109:VAL
115:ASP
121:ASP
127:ARG
133:GLY
139:ASP
145:ARG
151:GLN
157:ALA
163:ASN
169:PHE
175:MET
181:LYS
187:PRO
193:GLU
199:SER
205:ILE
211:LYS