



Full wwPDB NMR Structure Validation Report ⓘ

Apr 26, 2016 – 11:38 PM BST

PDB ID : 2KR2
Title : Xenopus laevis malectin complexed with maltose (Glcalpha1-4Glc)
Authors : Schallus, T.; Feher, K.; Muhle-Goll, C.
Deposited on : 2009-11-30

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

<http://wwpdb.org/validation/2016/NMRValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

Cyrange : Kirchner and Güntert (2011)
NmrClust : Kelley et al. (1996)
MolProbity : 4.02b-467
Mogul : 1.7.1 (RC1), CSD as537be (2016)
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)
RCI : v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV : Wang et al. (2010)
ShiftChecker : rb-20027457
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : rb-20027457

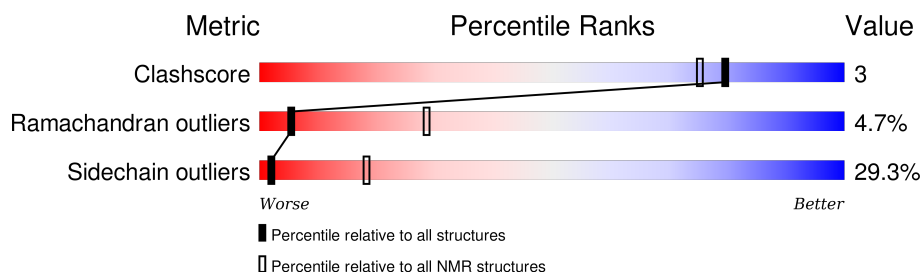
1 Overall quality at a glance

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	114402	11133
Ramachandran outliers	111179	9975
Sidechain outliers	111093	9958

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	190	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA and RNA chains that are outliers for geometric criteria:

Mol	Chain	Compound	Res	Total models with violations	
				Chirality	Geometry
2	A	GLC	191	1	-

2 Ensemble composition and analysis ⓘ

This entry contains 20 models. Model 14 is the overall representative, medoid model (most similar to other models). The authors have identified model 1 as representative, based on the following criterion: *lowest energy*.

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:6-A:33, A:49-A:64, A:69-A:180 (156)	0.29	14

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 2 single-model clusters were found.

Cluster number	Models
1	1, 2, 3, 4, 5, 7, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19
2	8, 20
Single-model clusters	6; 11

3 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 3015 atoms, of which 1498 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called Malectin-A.

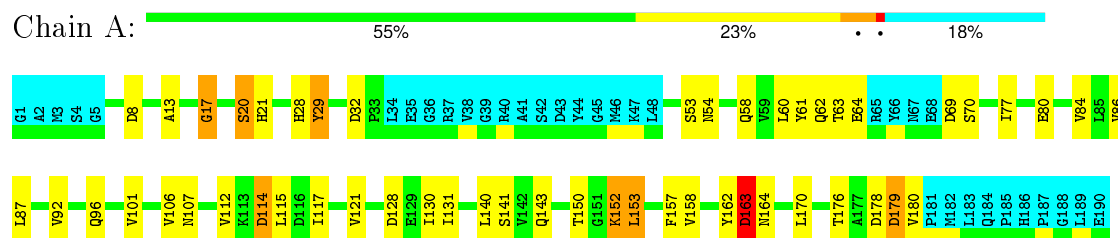
Mol	Chain	Residues	Atoms						Trace
1	A	190	Total	C	H	N	O	S	0
			2970	952	1476	252	285	5	

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	GLY	-	EXPRESSION TAG	UNP Q6INX3
A	2	ALA	-	EXPRESSION TAG	UNP Q6INX3
A	3	MET	-	EXPRESSION TAG	UNP Q6INX3

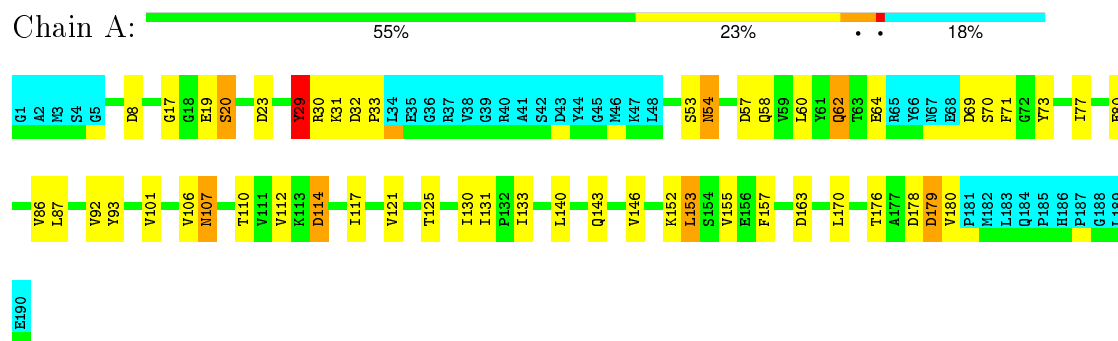
- Molecule 2 is a polymer of unknown type called SUGAR (2-MER).

Mol	Chain	Residues	Atoms			
2	A	2	Total	C	H	O
			45	12	22	11



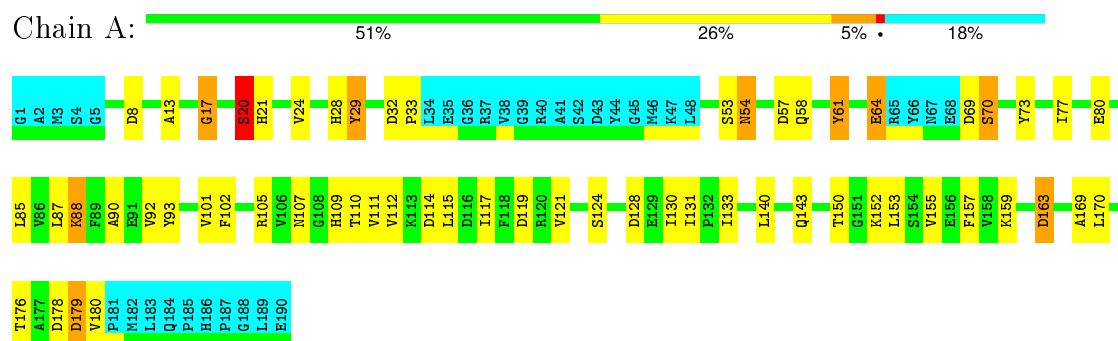
4.2.3 Score per residue for model 3

- Molecule 1: Malectin-A



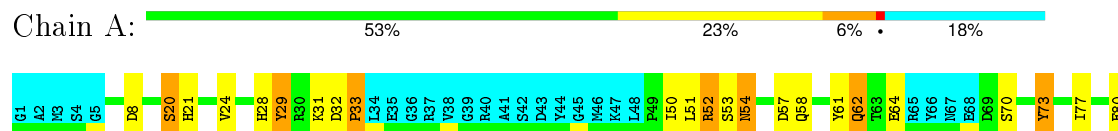
4.2.4 Score per residue for model 4

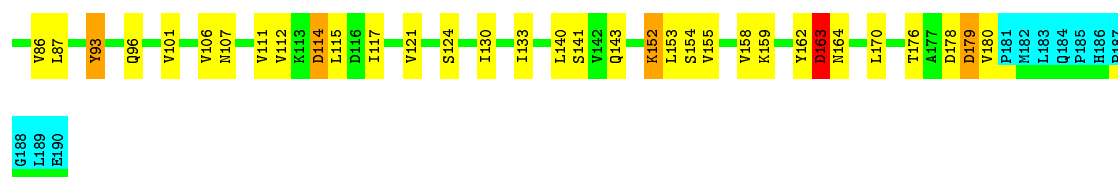
- Molecule 1: Malectin-A



4.2.5 Score per residue for model 5

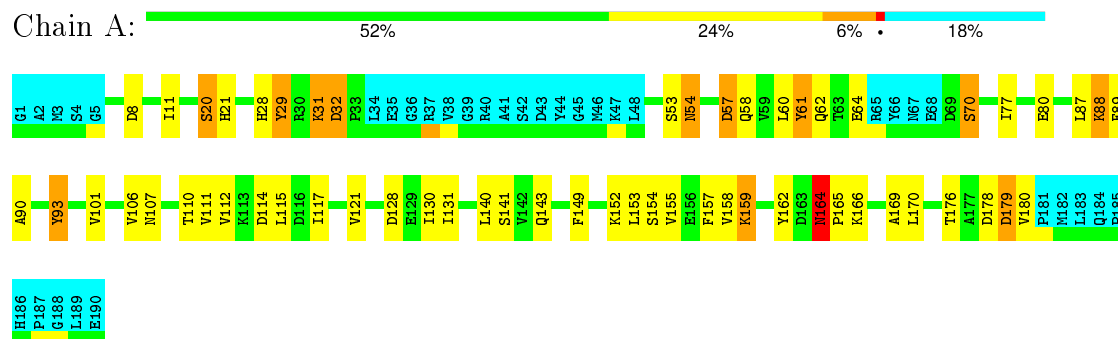
- Molecule 1: Malectin-A





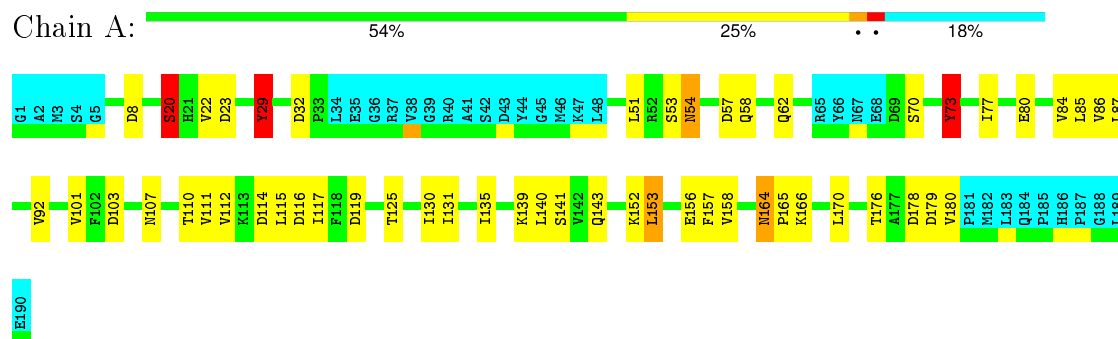
4.2.6 Score per residue for model 6

- Molecule 1: Malectin-A



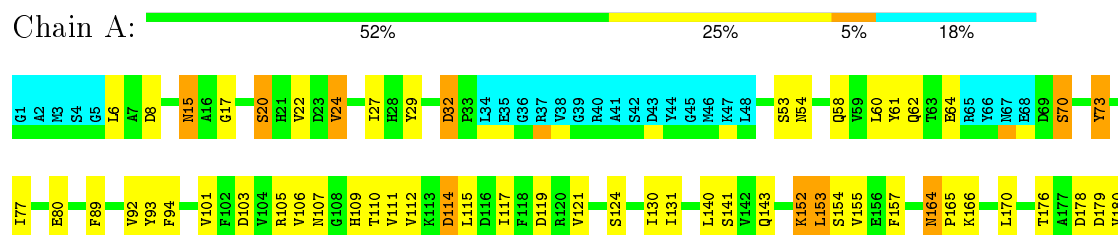
4.2.7 Score per residue for model 7

- Molecule 1: Malectin-A



4.2.8 Score per residue for model 8

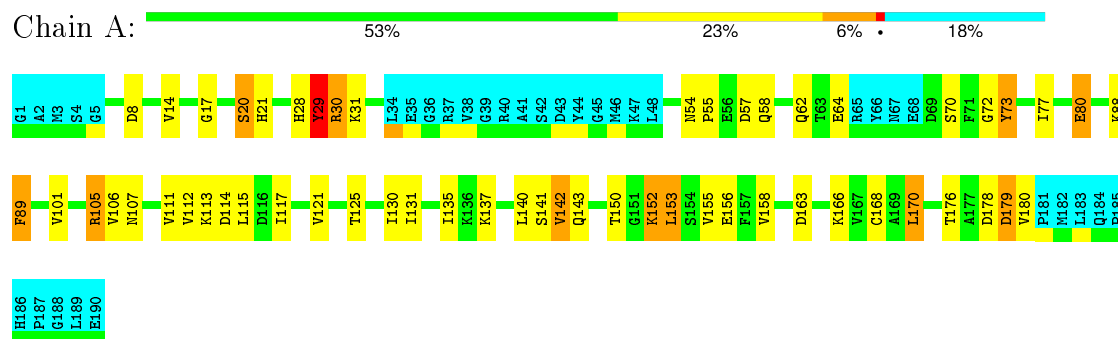
- Molecule 1: Malectin-A



P181
M182
L183
Q184
P185
H186
P187
G188
L189
E190

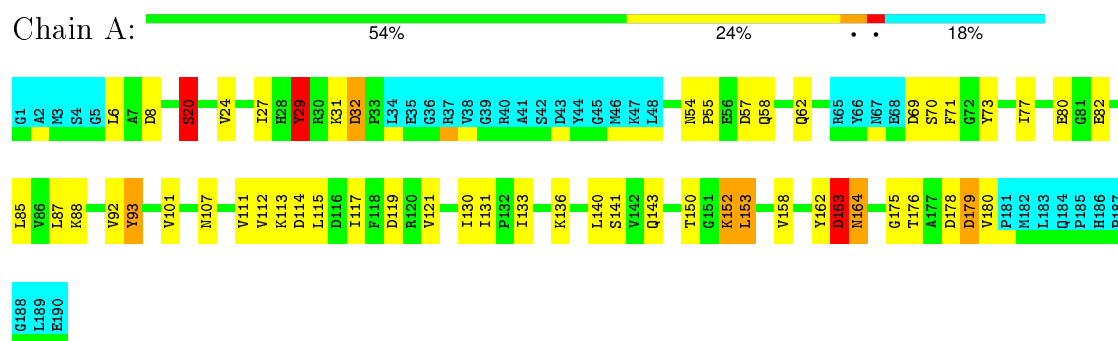
4.2.9 Score per residue for model 9

- Molecule 1: Malectin-A



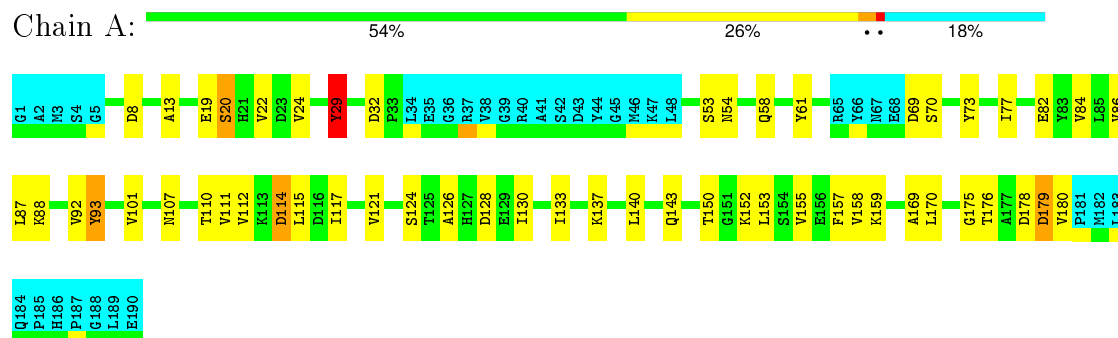
4.2.10 Score per residue for model 10

- Molecule 1: Malectin-A



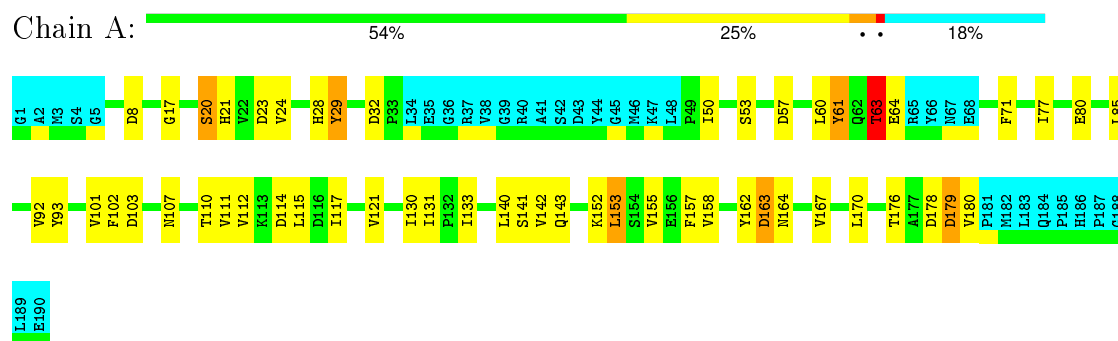
4.2.11 Score per residue for model 11

- Molecule 1: Malectin-A

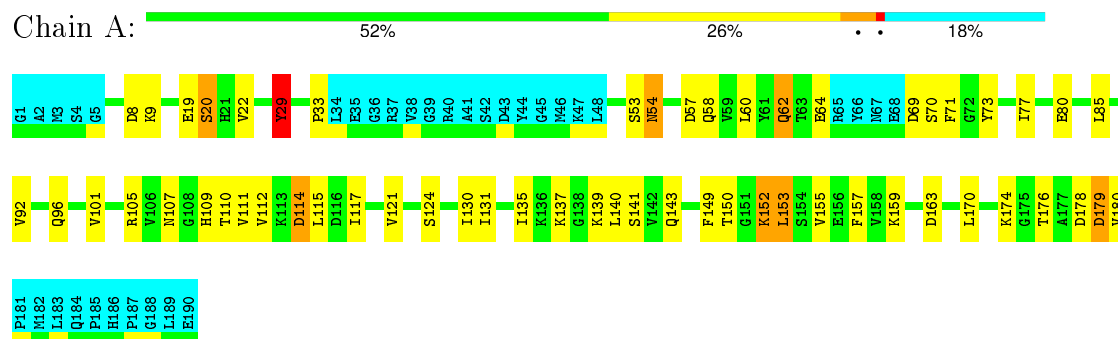


4.2.12 Score per residue for model 12

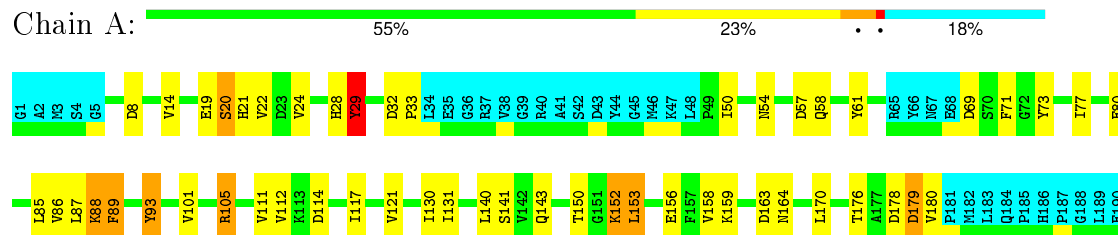
- Molecule 1: Malectin-A



- Molecule 1: Malectin-A

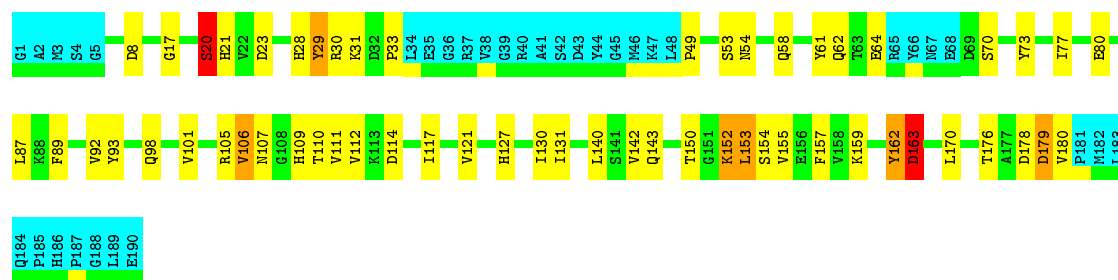


- Molecule 1: Malectin-A



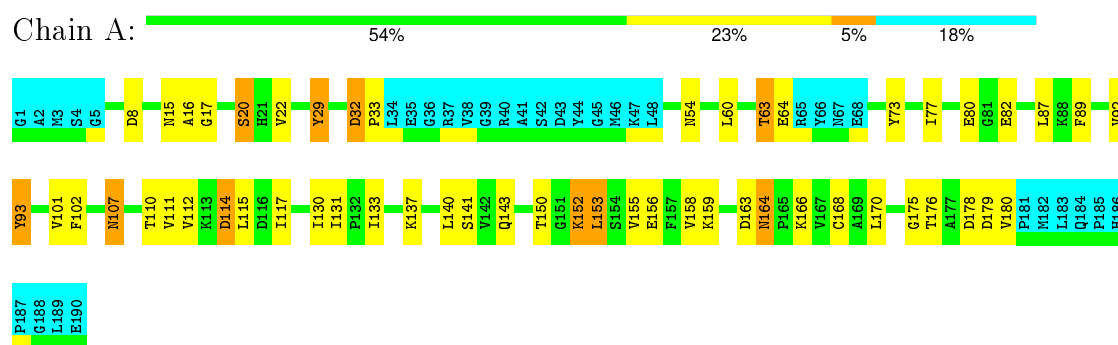
- Molecule 1: Malectin-A





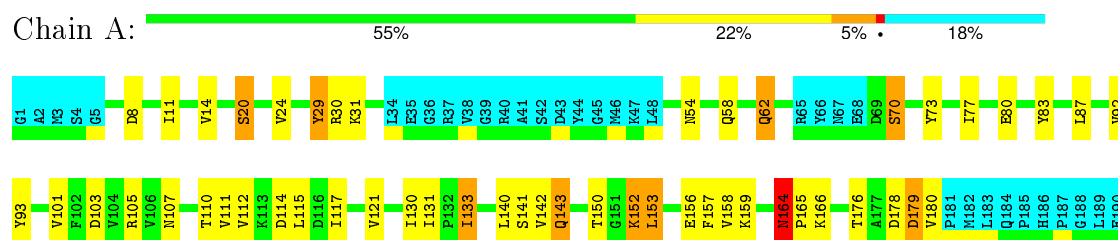
4.2.16 Score per residue for model 16

- Molecule 1: Malectin-A



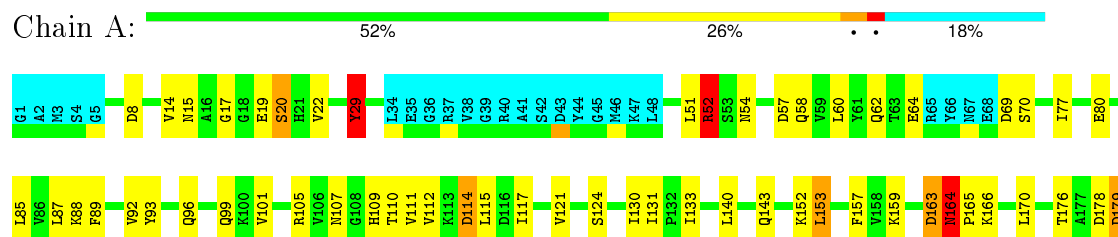
4.2.17 Score per residue for model 17

- Molecule 1: Malectin-A



4.2.18 Score per residue for model 18

- Molecule 1: Malectin-A

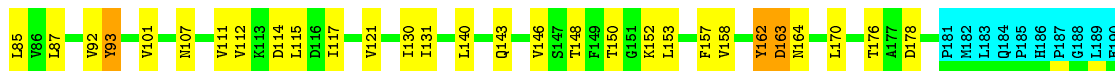
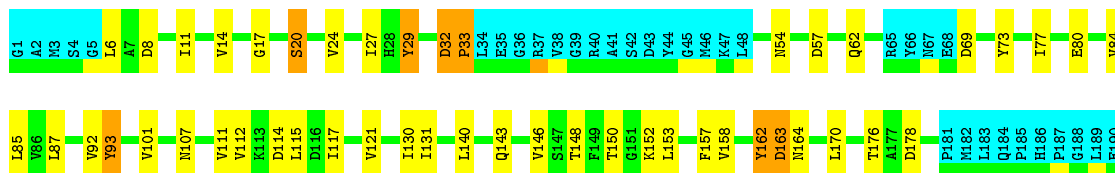




4.2.19 Score per residue for model 19

- Molecule 1: Malectin-A

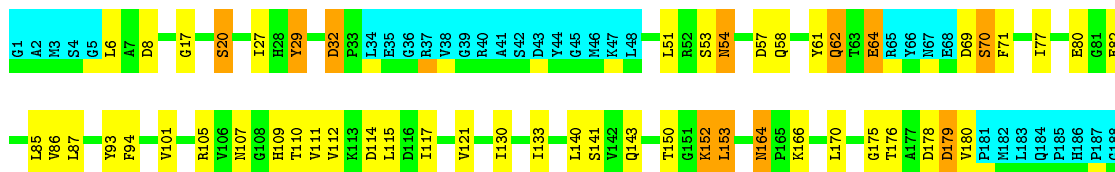
Chain A: 57% 22% 18%



4.2.20 Score per residue for model 20

- Molecule 1: Malectin-A

Chain A: 54% 22% 6% 18%



5 Refinement protocol and experimental data overview ⓘ

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

Of the 200 calculated structures, 20 were deposited, based on the following criterion: ?.

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

Software name	Classification	Version
ARIA	structure solution	1.2
ARIA	refinement	1.2

No chemical shift data was provided. No validations of the models with respect to experimental NMR restraints is performed at this time.

6 Model quality

6.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: BGC, GLC

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	1.26±0.05	2±1/1264 (0.2±0.1%)	0.96±0.02	1±1/1714 (0.0±0.0%)
2	A	0.00±0.00	-	0.00±0.00	-
All	All	1.26	46/25280 (0.2%)	0.96	14/34280 (0.0%)

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	0.6±0.7
2	A	0.1±0.2	0.0±0.0
All	All	1	12

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	29	TYR	CE1-CZ	16.30	1.59	1.38	13	9
1	A	29	TYR	CE2-CZ	-15.82	1.18	1.38	13	9
1	A	157	PHE	CE1-CZ	11.05	1.58	1.37	12	1
1	A	61	TYR	CE2-CZ	-10.92	1.24	1.38	5	7
1	A	157	PHE	CE2-CZ	-9.63	1.19	1.37	12	1
1	A	61	TYR	CE1-CZ	9.51	1.50	1.38	5	6
1	A	73	TYR	CE1-CZ	-7.54	1.28	1.38	8	3
1	A	89	PHE	CE2-CZ	6.71	1.50	1.37	9	5
1	A	73	TYR	CE2-CZ	6.21	1.46	1.38	8	3
1	A	63	THR	N-CA	5.06	1.56	1.46	16	1
1	A	142	VAL	CA-CB	5.03	1.65	1.54	17	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	29	TYR	CE1-CZ-OH	-7.30	100.40	120.10	13	3
1	A	29	TYR	CD1-CE1-CZ	-6.56	113.90	119.80	13	3
1	A	101	VAL	CA-CB-CG1	5.45	119.08	110.90	5	1
1	A	14	VAL	CA-CB-CG1	5.29	118.84	110.90	14	3
1	A	61	TYR	CB-CG-CD1	5.23	124.14	121.00	8	2
1	A	142	VAL	CA-CB-CG1	5.16	118.64	110.90	9	1
1	A	164	ASN	CB-CA-C	5.07	120.53	110.40	18	1

All unique chiral outliers are listed below.

Mol	Chain	Res	Type	Atoms	Models (Total)
2	A	191	GLC	C1	1

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	29	TYR	Sidechain	4
1	A	149	PHE	Sidechain	2
1	A	89	PHE	Sidechain	2
1	A	102	PHE	Sidechain	2
1	A	73	TYR	Sidechain	1
1	A	71	PHE	Sidechain	1

6.2 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	1235	1221	1215	8±2
All	All	25160	24860	24720	169

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 3.

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

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:54:ASN:O	1:A:58:GLN:HB2	0.79	1.76	8	15
1:A:21:HIS:O	1:A:28:HIS:HA	0.66	1.90	15	9
1:A:57:ASP:O	1:A:61:TYR:HB2	0.60	1.95	12	4
1:A:58:GLN:O	1:A:62:GLN:HB3	0.59	1.97	15	3
1:A:105:ARG:HB3	1:A:109:HIS:O	0.58	1.97	13	6
1:A:20:SER:HA	1:A:29:TYR:O	0.57	2.00	11	18
1:A:83:TYR:O	1:A:133:ILE:HG13	0.56	2.00	17	1
1:A:14:VAL:O	1:A:170:LEU:HB2	0.56	1.99	9	2
1:A:70:SER:H	1:A:164:ASN:ND2	0.55	2.00	17	5
1:A:19:GLU:N	1:A:29:TYR:OH	0.54	2.40	13	3
1:A:15:ASN:H	1:A:15:ASN:HD22	0.52	1.47	8	1
1:A:162:TYR:O	1:A:163:ASP:HB2	0.52	2.04	2	3
1:A:70:SER:H	1:A:164:ASN:HD21	0.52	1.48	17	4
1:A:60:LEU:O	1:A:60:LEU:HG	0.51	2.05	2	3
1:A:15:ASN:OD1	1:A:60:LEU:HA	0.51	2.06	16	1
1:A:17:GLY:HA2	1:A:64:GLU:C	0.49	2.28	3	9
1:A:107:ASN:OD1	1:A:153:LEU:HA	0.49	2.07	18	4
1:A:88:LYS:HB3	1:A:169:ALA:HB3	0.48	1.84	4	3
1:A:88:LYS:HZ3	1:A:126:ALA:HA	0.48	1.68	11	1
1:A:64:GLU:HB3	1:A:167:VAL:HG22	0.47	1.86	12	2
1:A:152:LYS:HG2	1:A:153:LEU:N	0.47	2.24	14	12
1:A:58:GLN:O	1:A:62:GLN:CB	0.46	2.62	15	9
1:A:82:GLU:HB2	1:A:175:GLY:O	0.46	2.11	20	5
1:A:55:PRO:O	1:A:58:GLN:HB3	0.46	2.11	9	2
1:A:163:ASP:O	1:A:164:ASN:HB2	0.45	2.10	10	1
1:A:51:LEU:O	1:A:52:ARG:HB2	0.45	2.12	18	2
1:A:88:LYS:HD2	1:A:89:PHE:N	0.45	2.27	14	1
1:A:13:ALA:O	1:A:29:TYR:HA	0.44	2.13	11	3
1:A:135:ILE:HA	1:A:139:LYS:O	0.44	2.13	7	2
1:A:15:ASN:ND2	1:A:168:CYS:O	0.44	2.50	16	1
1:A:106:VAL:HA	1:A:154:SER:O	0.44	2.12	6	4
1:A:60:LEU:HG	1:A:60:LEU:O	0.44	2.11	16	1
1:A:88:LYS:HD3	1:A:88:LYS:C	0.43	2.34	6	1
1:A:107:ASN:OD1	1:A:153:LEU:HG	0.43	2.14	16	2
1:A:6:LEU:HG	1:A:27:ILE:HD11	0.43	1.91	10	4
1:A:49:PRO:HD2	1:A:62:GLN:NE2	0.43	2.29	15	1
1:A:61:TYR:O	1:A:88:LYS:HE3	0.42	2.14	11	1
1:A:80:GLU:HB3	1:A:135:ILE:O	0.42	2.15	9	3
1:A:88:LYS:HE2	1:A:90:ALA:HB2	0.42	1.90	4	2
1:A:16:ALA:O	1:A:64:GLU:HA	0.42	2.15	1	1
1:A:105:ARG:HG3	1:A:156:GLU:O	0.42	2.14	14	2
1:A:159:LYS:HG3	1:A:163:ASP:O	0.42	2.15	18	1

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Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:102:PHE:HE1	1:A:163:ASP:O	0.41	1.98	4	1
1:A:89:PHE:O	1:A:127:HIS:HB3	0.41	2.15	15	1
1:A:17:GLY:HA3	1:A:63:THR:O	0.41	2.15	12	1
1:A:19:GLU:HA	1:A:29:TYR:OH	0.41	2.15	3	1
1:A:58:GLN:O	1:A:62:GLN:HB2	0.41	2.16	20	1
1:A:73:TYR:N	1:A:73:TYR:CD1	0.41	2.89	7	1
1:A:71:PHE:CE1	1:A:164:ASN:ND2	0.41	2.89	14	1
1:A:15:ASN:HB2	1:A:60:LEU:HD12	0.40	1.92	18	1
1:A:9:LYS:O	1:A:174:LYS:HG2	0.40	2.17	13	1
1:A:159:LYS:HB3	1:A:164:ASN:OD1	0.40	2.16	6	1
1:A:96:GLN:NE2	1:A:99:GLN:NE2	0.40	2.70	18	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	156/190 (82%)	123±3 (79±2%)	26±3 (17±2%)	7±2 (5±1%)	5	28
All	All	3120/3800 (82%)	2455 (79%)	519 (17%)	146 (5%)	5	28

All 21 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	20	SER	20
1	A	143	GLN	20
1	A	114	ASP	20
1	A	93	TYR	12
1	A	164	ASN	11
1	A	33	PRO	8
1	A	166	LYS	8
1	A	31	LYS	7
1	A	165	PRO	6
1	A	163	ASP	6
1	A	30	ARG	5

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Mol	Chain	Res	Type	Models (Total)
1	A	124	SER	4
1	A	17	GLY	4
1	A	162	TYR	3
1	A	63	THR	3
1	A	94	PHE	2
1	A	70	SER	2
1	A	52	ARG	2
1	A	24	VAL	1
1	A	125	THR	1
1	A	64	GLU	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	136/162 (84%)	96±2 (71±2%)	40±2 (29±2%)	2	18
All	All	2720/3240 (84%)	1923 (71%)	797 (29%)	2	18

All 86 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	176	THR	20
1	A	178	ASP	20
1	A	140	LEU	20
1	A	152	LYS	20
1	A	112	VAL	20
1	A	8	ASP	20
1	A	117	ILE	20
1	A	77	ILE	20
1	A	130	ILE	20
1	A	101	VAL	19
1	A	180	VAL	19
1	A	153	LEU	19
1	A	29	TYR	19
1	A	179	ASP	19
1	A	111	VAL	18

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Mol	Chain	Res	Type	Models (Total)
1	A	80	GLU	18
1	A	121	VAL	18
1	A	131	ILE	17
1	A	170	LEU	17
1	A	115	LEU	16
1	A	70	SER	16
1	A	87	LEU	15
1	A	107	ASN	15
1	A	92	VAL	15
1	A	110	THR	14
1	A	73	TYR	14
1	A	163	ASP	14
1	A	150	THR	13
1	A	141	SER	13
1	A	158	VAL	13
1	A	32	ASP	13
1	A	157	PHE	13
1	A	53	SER	12
1	A	155	VAL	12
1	A	93	TYR	11
1	A	54	ASN	11
1	A	62	GLN	11
1	A	69	ASP	11
1	A	57	ASP	10
1	A	24	VAL	10
1	A	133	ILE	10
1	A	85	LEU	9
1	A	159	LYS	9
1	A	114	ASP	8
1	A	20	SER	7
1	A	22	VAL	7
1	A	86	VAL	7
1	A	164	ASN	6
1	A	88	LYS	6
1	A	106	VAL	5
1	A	64	GLU	4
1	A	84	VAL	4
1	A	124	SER	4
1	A	119	ASP	4
1	A	23	ASP	4
1	A	71	PHE	4
1	A	137	LYS	4

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Mol	Chain	Res	Type	Models (Total)
1	A	103	ASP	4
1	A	128	ASP	4
1	A	162	TYR	3
1	A	105	ARG	3
1	A	11	ILE	3
1	A	96	GLN	3
1	A	50	ILE	3
1	A	142	VAL	3
1	A	51	LEU	3
1	A	156	GLU	3
1	A	60	LEU	3
1	A	113	LYS	3
1	A	146	VAL	2
1	A	143	GLN	2
1	A	33	PRO	2
1	A	125	THR	2
1	A	31	LYS	2
1	A	98	GLN	1
1	A	30	ARG	1
1	A	19	GLU	1
1	A	116	ASP	1
1	A	52	ARG	1
1	A	63	THR	1
1	A	168	CYS	1
1	A	129	GLU	1
1	A	166	LYS	1
1	A	136	LYS	1
1	A	148	THR	1
1	A	15	ASN	1

6.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

6.5 Carbohydrates ⓘ

2 carbohydrates 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	GLC	A	191	2	11,11,12	2.63±0.02	1±0 (9±0%)
2	BGC	A	192	2	12,12,12	2.06±0.02	0±0 (0±0%)

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	GLC	A	191	2	15,15,17	1.43±0.01	0±0 (0±0%)
2	BGC	A	192	2	17,17,17	0.93±0.02	0±0 (0±0%)

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	GLC	A	191	2	-	0±0,2,19,22	0±0,1,1,1
2	BGC	A	192	2	-	0±0,2,22,22	0±0,1,1,1

All unique bond outliers are listed below.

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)	Models	
								Worst	Total
2	A	191	GLC	C2-C3	5.75	1.60	1.52	14	20

There are no bond-angle outliers.

All unique chiral outliers are listed below.

Mol	Chain	Res	Type	Atoms	Models (Total)
2	A	191	GLC	C1	1

There are no torsion outliers.

There are no ring outliers.

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

No chemical shift data were provided