



Full wwPDB NMR Structure Validation Report ⓘ

May 29, 2020 – 09:00 am BST

PDB ID : 5Y08
Title : Solution structure of the apo doublet acyl carrier protein from prodigiosin biosynthesis
Authors : Wattana-amorn, P.
Deposited on : 2017-07-15

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 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
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

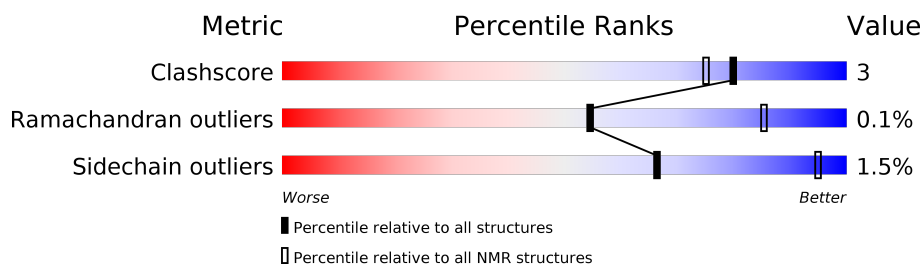
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

SOLUTION NMR

The overall completeness of chemical shifts assignment is 93%.

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 $\leq 5\%$

Mol	Chain	Length	Quality of chain
1	A	205	

2 Ensemble composition and analysis ⓘ

This entry contains 20 models. Model 1 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:11-A:90 (80)	0.38	18
2	A:102-A:190 (89)	0.53	1

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 6 clusters. No single-model clusters were found.

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

3 Entry composition

There is only 1 type of molecule in this entry. The entry contains 3110 atoms, of which 1548 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called 4-hydroxy-2,2'-bipyrrrole-5-methanol synthase PigH.

Mol	Chain	Residues	Atoms						Trace
1	A	205	Total	C	H	N	O	S	0
			3110	977	1548	262	319	4	

There are 17 discrepancies between the modelled and reference sequences:

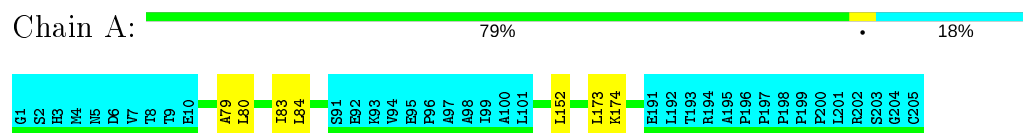
Chain	Residue	Modelled	Actual	Comment	Reference
A	1	GLY	-	expression tag	UNP Q5W264
A	2	SER	-	expression tag	UNP Q5W264
A	3	HIS	-	expression tag	UNP Q5W264
A	192	LEU	-	expression tag	UNP Q5W264
A	193	THR	-	expression tag	UNP Q5W264
A	194	ARG	-	expression tag	UNP Q5W264
A	195	ALA	-	expression tag	UNP Q5W264
A	196	PRO	-	expression tag	UNP Q5W264
A	197	PRO	-	expression tag	UNP Q5W264
A	198	PRO	-	expression tag	UNP Q5W264
A	199	PRO	-	expression tag	UNP Q5W264
A	200	PRO	-	expression tag	UNP Q5W264
A	201	LEU	-	expression tag	UNP Q5W264
A	202	ARG	-	expression tag	UNP Q5W264
A	203	SER	-	expression tag	UNP Q5W264
A	204	GLY	-	expression tag	UNP Q5W264
A	205	CYS	-	expression tag	UNP Q5W264

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: 4-hydroxy-2,2'-bipyrrole-5-methanol synthase PigH

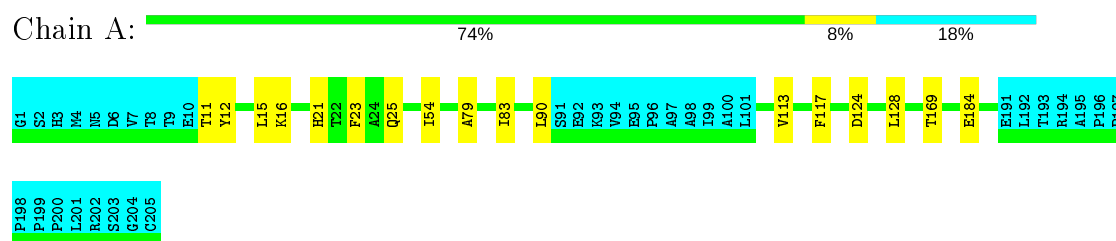


4.2 Scores per residue for each member of the ensemble

Colouring as in section 4.1 above.

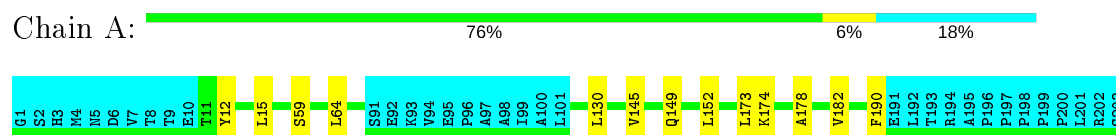
4.2.1 Score per residue for model 1 (medoid)

- Molecule 1: 4-hydroxy-2,2'-bipyrrole-5-methanol synthase PigH



4.2.2 Score per residue for model 2

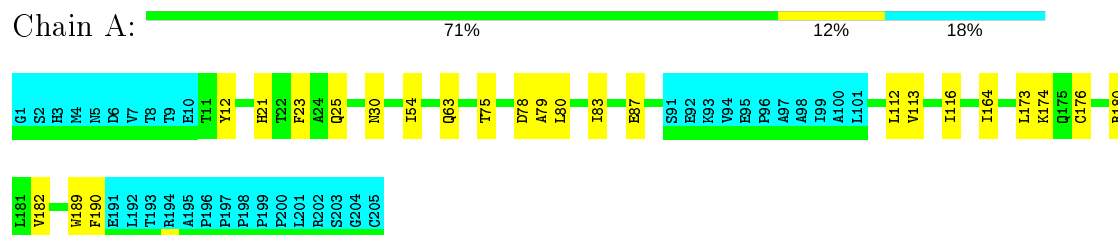
- Molecule 1: 4-hydroxy-2,2'-bipyrrole-5-methanol synthase PigH



G204
G205

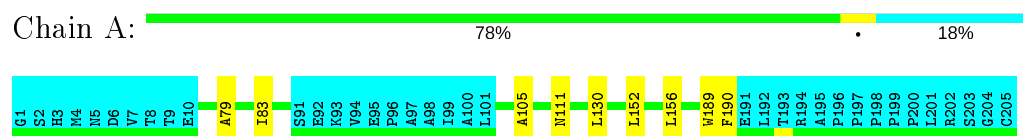
4.2.3 Score per residue for model 3

- Molecule 1: 4-hydroxy-2,2'-bipyrrole-5-methanol synthase PigH



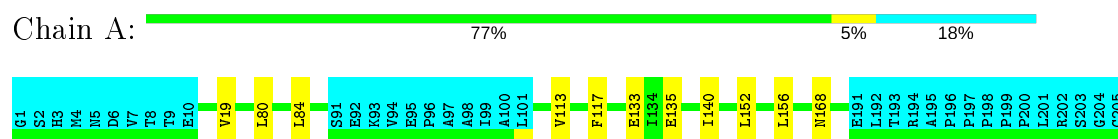
4.2.4 Score per residue for model 4

- Molecule 1: 4-hydroxy-2,2'-bipyrrole-5-methanol synthase PigH



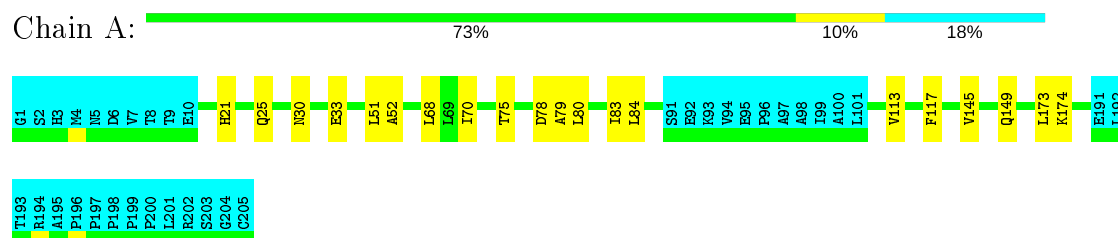
4.2.5 Score per residue for model 5

- Molecule 1: 4-hydroxy-2,2'-bipyrrole-5-methanol synthase PigH



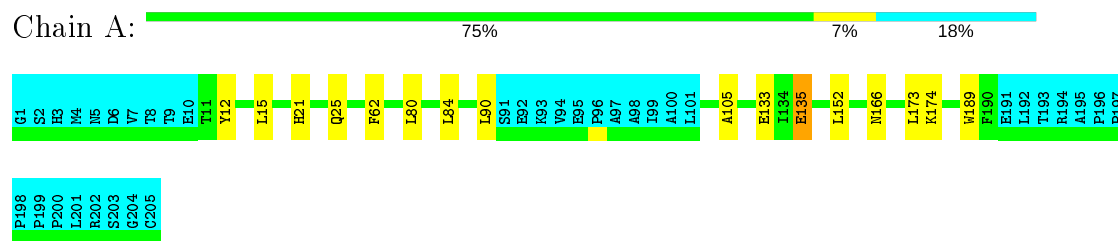
4.2.6 Score per residue for model 6

- Molecule 1: 4-hydroxy-2,2'-bipyrrole-5-methanol synthase PigH



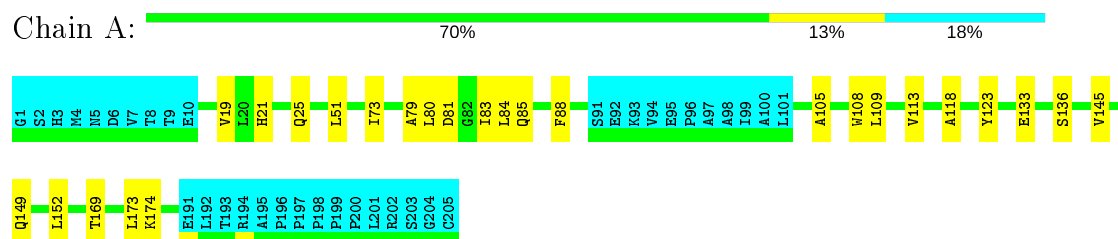
4.2.7 Score per residue for model 7

- Molecule 1: 4-hydroxy-2,2'-bipyrrole-5-methanol synthase PigH



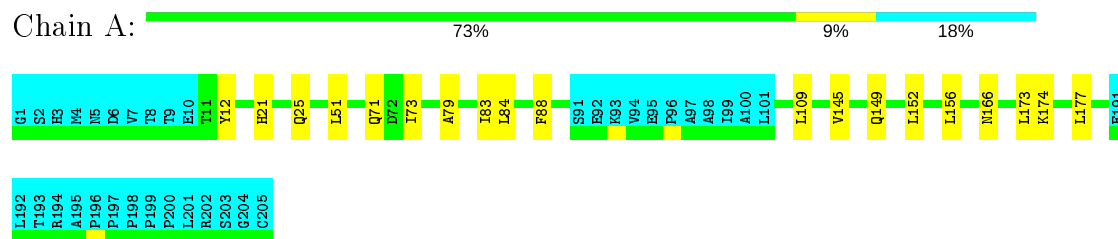
4.2.8 Score per residue for model 8

- Molecule 1: 4-hydroxy-2,2'-bipyrrole-5-methanol synthase PigH



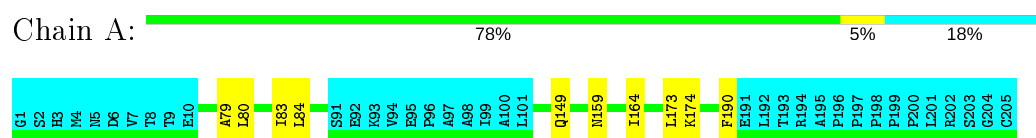
4.2.9 Score per residue for model 9

- Molecule 1: 4-hydroxy-2,2'-bipyrrole-5-methanol synthase PigH



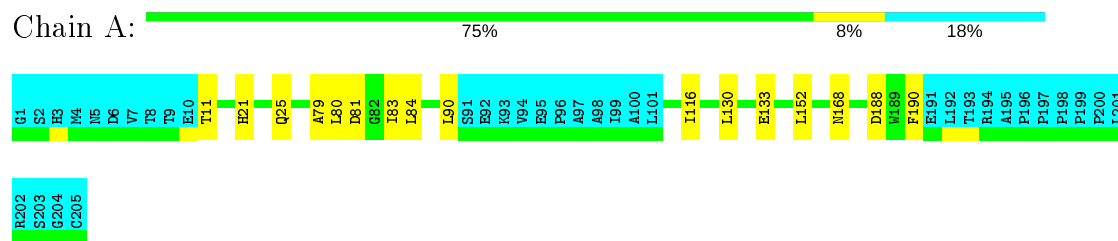
4.2.10 Score per residue for model 10

- Molecule 1: 4-hydroxy-2,2'-bipyrrole-5-methanol synthase PigH



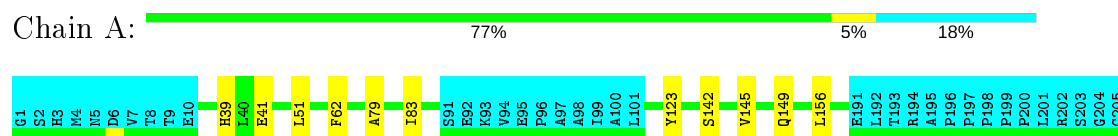
4.2.11 Score per residue for model 11

- Molecule 1: 4-hydroxy-2,2'-bipyrrole-5-methanol synthase PigH



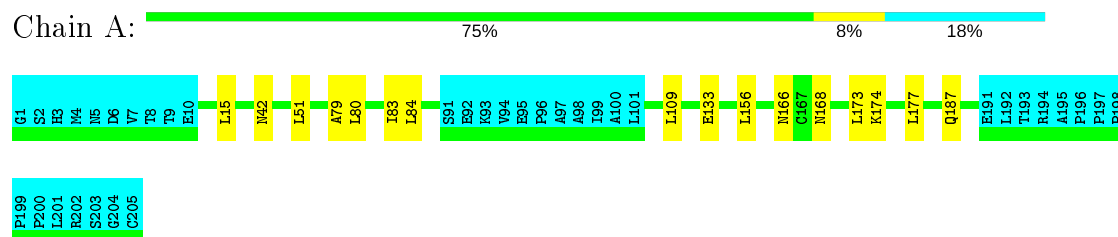
4.2.12 Score per residue for model 12

- Molecule 1: 4-hydroxy-2,2'-bipyrrole-5-methanol synthase PigH



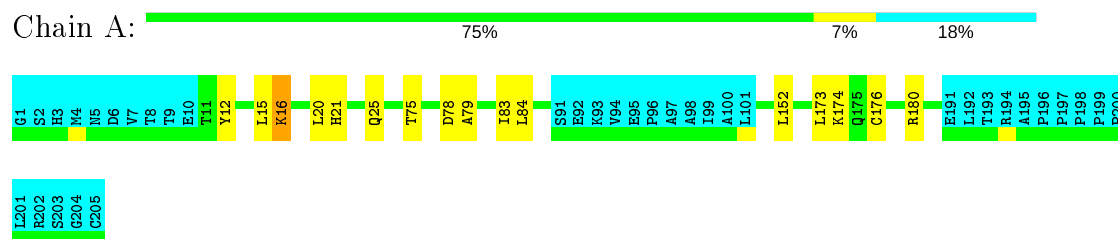
4.2.13 Score per residue for model 13

- Molecule 1: 4-hydroxy-2,2'-bipyrrole-5-methanol synthase PigH



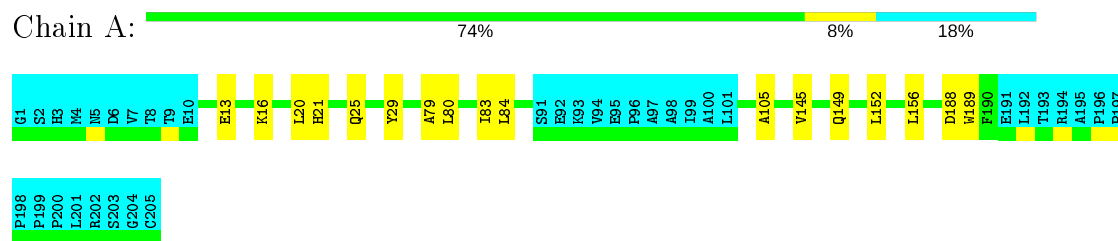
4.2.14 Score per residue for model 14

- Molecule 1: 4-hydroxy-2,2'-bipyrrole-5-methanol synthase PigH



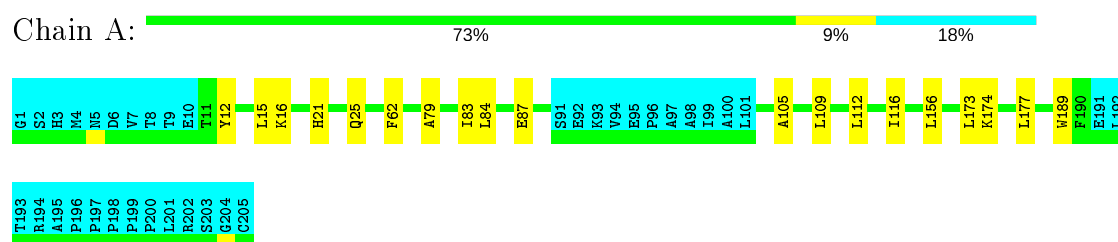
4.2.15 Score per residue for model 15

- Molecule 1: 4-hydroxy-2,2'-bipyrrole-5-methanol synthase PigH



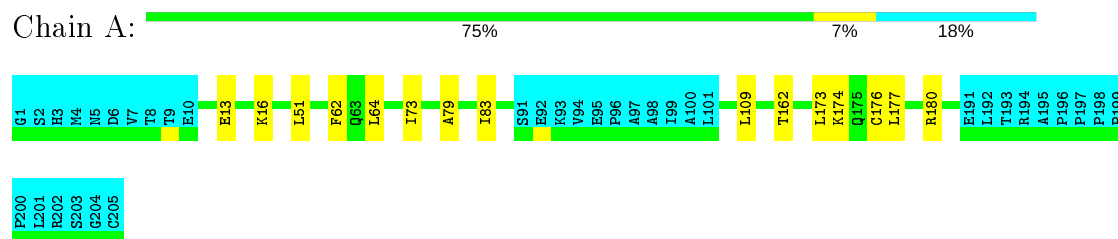
4.2.16 Score per residue for model 16

- Molecule 1: 4-hydroxy-2,2'-bipyrrole-5-methanol synthase PigH



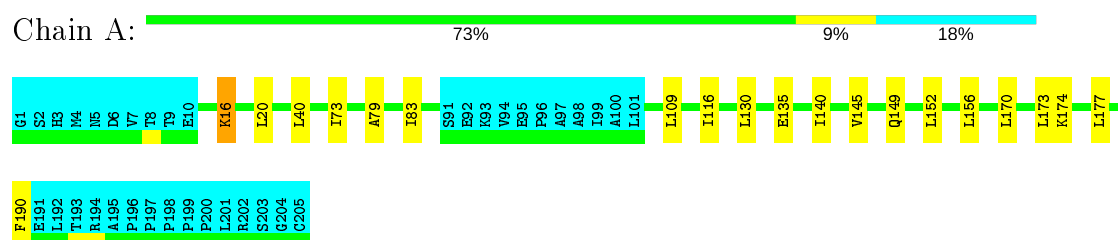
4.2.17 Score per residue for model 17

- Molecule 1: 4-hydroxy-2,2'-bipyrrole-5-methanol synthase PigH



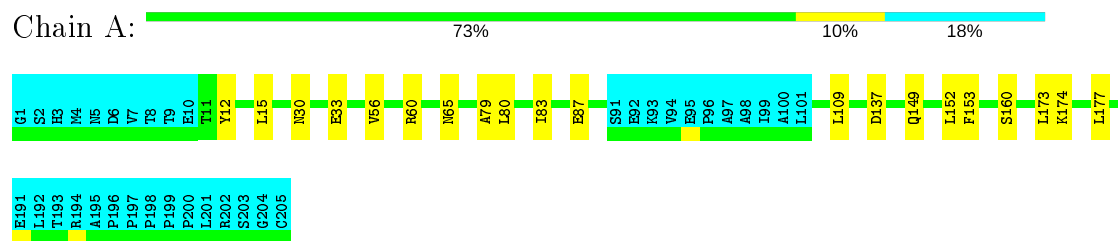
4.2.18 Score per residue for model 18

- Molecule 1: 4-hydroxy-2,2'-bipyrrole-5-methanol synthase PigH



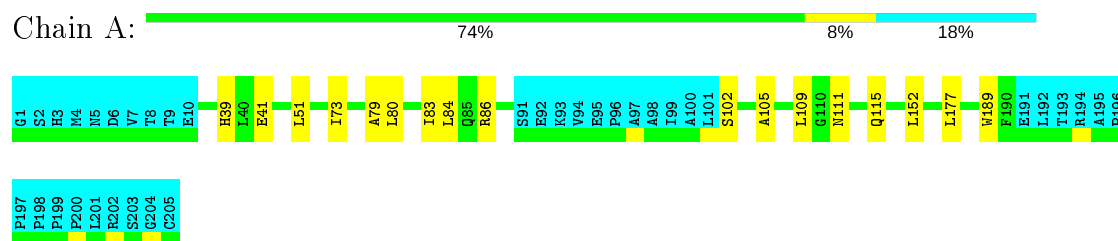
4.2.19 Score per residue for model 19

- Molecule 1: 4-hydroxy-2,2'-bipyrrole-5-methanol synthase PigH



4.2.20 Score per residue for model 20

- Molecule 1: 4-hydroxy-2,2'-bipyrrole-5-methanol synthase PigH



5 Refinement protocol and experimental data overview

The models were refined using the following method: *simulated annealing*.

Of the 200 calculated structures, 20 were deposited, based on the following criterion: *structures with the lowest energy*.

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

Software name	Classification	Version
CNS	refinement	
ARIA	structure calculation	

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	2487
Number of shifts mapped to atoms	2487
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Assignment completeness (well-defined parts)	93%

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	1299	1285	1282	7±2
All	All	25980	25700	25640	141

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:80:LEU:O	1:A:84:LEU:HG	0.60	1.96	7	9
1:A:133:GLU:HA	1:A:168:ASN:O	0.59	1.98	11	3
1:A:109:LEU:HD12	1:A:177:LEU:HB3	0.56	1.77	17	7
1:A:51:LEU:HD11	1:A:73:ILE:HB	0.55	1.78	20	2
1:A:16:LYS:O	1:A:20:LEU:HG	0.55	2.01	18	3
1:A:79:ALA:O	1:A:83:ILE:HG12	0.54	2.02	18	11
1:A:30:ASN:O	1:A:33:GLU:HG2	0.54	2.03	6	2
1:A:86:ARG:NE	1:A:86:ARG:HA	0.51	2.21	20	1
1:A:173:LEU:HD12	1:A:174:LYS:N	0.51	2.20	3	13
1:A:118:ALA:HA	1:A:123:TYR:O	0.50	2.07	8	1
1:A:176:CYS:O	1:A:180:ARG:HG2	0.49	2.08	14	3
1:A:79:ALA:O	1:A:83:ILE:HG13	0.49	2.06	8	6
1:A:56:VAL:O	1:A:60:ARG:HG2	0.49	2.08	19	1
1:A:21:HIS:O	1:A:25:GLN:HG2	0.49	2.08	16	10
1:A:105:ALA:HB1	1:A:189:TRP:CH2	0.48	2.43	7	5
1:A:51:LEU:HD21	1:A:73:ILE:HB	0.48	1.84	9	2
1:A:12:TYR:O	1:A:15:LEU:HB3	0.48	2.09	19	5
1:A:39:HIS:CD2	1:A:41:GLU:HG2	0.47	2.44	12	2
1:A:153:PHE:CD2	1:A:160:SER:HA	0.47	2.44	19	1
1:A:142:SER:HA	1:A:145:VAL:HG12	0.47	1.86	12	1
1:A:145:VAL:O	1:A:149:GLN:HG3	0.47	2.10	18	7
1:A:109:LEU:O	1:A:113:VAL:HG23	0.46	2.10	8	1
1:A:84:LEU:HD22	1:A:88:PHE:CD2	0.46	2.44	9	1
1:A:51:LEU:HG	1:A:51:LEU:O	0.46	2.10	9	1
1:A:113:VAL:HG22	1:A:117:PHE:CE2	0.45	2.47	6	2
1:A:130:LEU:HA	1:A:170:LEU:HB2	0.45	1.89	18	1
1:A:112:LEU:O	1:A:116:ILE:HG12	0.45	2.11	16	2
1:A:75:THR:HB	1:A:78:ASP:OD1	0.45	2.11	14	1
1:A:62:PHE:HB2	1:A:64:LEU:CD1	0.45	2.41	17	1
1:A:81:ASP:O	1:A:85:GLN:HG3	0.45	2.11	8	1
1:A:65:ASN:ND2	1:A:87:GLU:HB3	0.45	2.26	19	1
1:A:75:THR:HB	1:A:78:ASP:OD2	0.44	2.13	6	2
1:A:113:VAL:HG22	1:A:117:PHE:CE1	0.44	2.48	1	1
1:A:111:ASN:O	1:A:115:GLN:HG3	0.44	2.11	20	1
1:A:11:THR:HG22	1:A:90:LEU:HG	0.44	1.89	11	2
1:A:133:GLU:HG3	1:A:136:SER:H	0.44	1.71	8	1
1:A:182:VAL:HG22	1:A:189:TRP:HE1	0.43	1.73	3	1
1:A:19:VAL:HG21	1:A:80:LEU:HD13	0.43	1.89	8	2
1:A:178:ALA:O	1:A:182:VAL:HG23	0.43	2.13	2	1
1:A:149:GLN:HA	1:A:152:LEU:HB3	0.43	1.91	19	1
1:A:23:PHE:CD2	1:A:54:ILE:HG21	0.43	2.48	1	1
1:A:164:ILE:HD12	1:A:176:CYS:SG	0.42	2.55	3	1

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Clash(Å)	Distance(Å)	Models	
				Worst	Total
1:A:116:ILE:HG13	1:A:152:LEU:HD23	0.42	1.89	18	2
1:A:84:LEU:HD22	1:A:88:PHE:CG	0.42	2.49	8	1
1:A:52:ALA:HA	1:A:70:ILE:CG2	0.42	2.44	6	1
1:A:40:LEU:CD1	1:A:73:ILE:HG22	0.42	2.44	18	1
1:A:149:GLN:NE2	1:A:164:ILE:HB	0.42	2.30	10	1
1:A:105:ALA:HA	1:A:108:TRP:CD1	0.42	2.50	8	1
1:A:162:THR:HB	1:A:180:ARG:NH2	0.42	2.29	17	1
1:A:124:ASP:O	1:A:128:LEU:HG	0.41	2.15	1	1
1:A:23:PHE:CD1	1:A:54:ILE:HG21	0.41	2.50	3	1
1:A:12:TYR:CE1	1:A:16:LYS:HE3	0.41	2.51	16	1
1:A:133:GLU:HB3	1:A:135:GLU:OE1	0.41	2.16	7	1
1:A:156:LEU:O	1:A:156:LEU:HD23	0.41	2.16	12	1
1:A:15:LEU:HA	1:A:90:LEU:HD11	0.41	1.93	7	1
1:A:15:LEU:HD21	1:A:84:LEU:HD21	0.41	1.91	16	2
1:A:135:GLU:HA	1:A:140:ILE:O	0.41	2.16	18	2
1:A:59:SER:HA	1:A:64:LEU:CD1	0.40	2.47	2	1
1:A:113:VAL:HG21	1:A:173:LEU:HD13	0.40	1.94	3	1

5.2 Torsion angles ⓘ

5.2.1 Protein backbone ⓘ

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	169/205 (82%)	166±1 (98±1%)	3±1 (2±1%)	0±0 (0±0%)	54	85
All	All	3380/4100 (82%)	3311 (98%)	64 (2%)	5 (0%)	54	85

All 3 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	87	GLU	2
1	A	166	ASN	2
1	A	159	ASN	1

5.2.2 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	144/174 (83%)	142±1 (99±1%)	2±1 (1±1%)	66	95
All	All	2880/3480 (83%)	2837 (99%)	43 (1%)	66	95

All 19 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	152	LEU	9
1	A	156	LEU	7
1	A	16	LYS	4
1	A	51	LEU	3
1	A	130	LEU	3
1	A	80	LEU	2
1	A	62	PHE	2
1	A	169	THR	2
1	A	137	ASP	1
1	A	111	ASN	1
1	A	187	GLN	1
1	A	30	ASN	1
1	A	166	ASN	1
1	A	63	GLN	1
1	A	71	GLN	1
1	A	135	GLU	1
1	A	184	GLU	1
1	A	42	ASN	1
1	A	68	LEU	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 [i](#)

There are no carbohydrates in this entry.

5.5 Ligand geometry [i](#)

There are no ligands in this entry.

5.6 Other polymers [i](#)

There are no such molecules in this entry.

5.7 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Chemical shift validation

The completeness of assignment taking into account all chemical shift lists is 93% for the well-defined parts and 90% for the entire structure.

6.1 Chemical shift list 1

File name: input_cs.cif

Chemical shift list name: *assigned_chem_shift_list*

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	2487
Number of shifts mapped to atoms	2487
Number of unparsed shifts	0
Number of shifts with mapping errors	0
Number of shifts with mapping warnings	0
Number of shift outliers (ShiftChecker)	1

6.1.2 Chemical shift referencing

The following table shows the suggested chemical shift referencing corrections.

Nucleus	# values	Correction \pm precision, ppm	Suggested action
$^{13}\text{C}_\alpha$	200	-0.53 ± 0.11	Should be applied
$^{13}\text{C}_\beta$	190	0.12 ± 0.08	None needed (< 0.5 ppm)
$^{13}\text{C}'$	192	-0.30 ± 0.13	None needed (< 0.5 ppm)
^{15}N	194	0.28 ± 0.27	None needed (< 0.5 ppm)

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 93%, i.e. 1846 atoms were assigned a chemical shift out of a possible 1993. 4 out of 37 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	^1H	^{13}C	^{15}N
Backbone	837/843 (99%)	336/337 (100%)	334/338 (99%)	167/168 (99%)
Sidechain	912/1024 (89%)	553/586 (94%)	333/399 (83%)	26/39 (67%)

Continued on next page...

Continued from previous page...

	Total	¹ H	¹³ C	¹⁵ N
Aromatic	97/126 (77%)	51/66 (77%)	44/52 (85%)	2/8 (25%)
Overall	1846/1993 (93%)	940/989 (95%)	711/789 (90%)	195/215 (91%)

The following table shows the completeness of the chemical shift assignments for the full structure. The overall completeness is 90%, i.e. 2168 atoms were assigned a chemical shift out of a possible 2402. 7 out of 42 assigned methyl groups (LEU and VAL) were assigned stereospecifically.

	Total	¹ H	¹³ C	¹⁵ N
Backbone	980/1011 (97%)	394/403 (98%)	392/410 (96%)	194/198 (98%)
Sidechain	1089/1257 (87%)	663/725 (91%)	398/485 (82%)	28/47 (60%)
Aromatic	99/134 (74%)	52/70 (74%)	45/54 (83%)	2/10 (20%)
Overall	2168/2402 (90%)	1109/1198 (93%)	835/949 (88%)	224/255 (88%)

6.1.4 Statistically unusual chemical shifts ⓘ

The following table lists the statistically unusual chemical shifts. These are statistical measures, and large deviations from the mean do not necessarily imply incorrect assignments. Molecules containing paramagnetic centres or hemes are expected to give rise to anomalous chemical shifts.

Mol	Chain	Res	Type	Atom	Shift, ppm	Expected range, ppm	Z-score
1	A	76	ILE	HG13	-0.84	3.26 – -0.84	-5.0

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:

