# wwPDB NMR Structure Validation Summary Report (i)

Apr 26, 2016 – 01:44 PM BST

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| PDB ID | : | 1A9L |
| Title | : | SOLUTION STRUCTURE OF A SUBSTRATE FOR THE ARCHAEAL PRE-TRNA SPLICING ENDONUCLEASES: THE BULGE-HELIX-BULGE MOTIF, NMR, 12 STRUCTURES |
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| Deposited on | : | 1998-04-07 |

This is a wwPDB NMR Structure Validation Summary 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 (i) symbol.

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

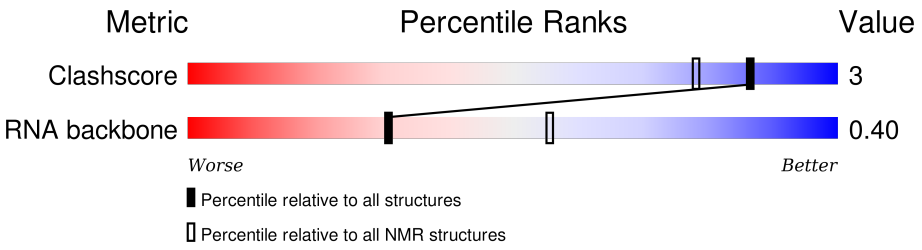
| | | |
|---|---|---|
| Cyrange | : | Kirchner and Güntert (2011) |
| NmrClust | : | Kelley et al. (1996) |
| MolProbity | : | 4.02b-467 |
| Mogul | : | unknown |
| Percentile statistics | : | 20151230.v01 (using entries in the PDB archive December 30th 2015) |
| RCI | : | v_1n_11_5_13_A (Berjanski et 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 (i)

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 |
| RNA backbone | 3027 | 600 |

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 | 38 | 47% 26% 16% 11% |

## 2 Ensemble composition and analysis (i)

This entry contains 12 models. This entry does not contain protein, therefore identification of well-defined residues and clustering analysis are not possible. All residues are included in the validation scores.

# 3 Entry composition (i)

There is only 1 type of molecule in this entry. The entry contains 1231 atoms, of which 415 are hydrogens and 0 are deuteriums.

- Molecule 1 is a RNA chain called PRE-TRNA BULGE-HELIX-BULGE MOTIF.

| Mol | Chain | Residues | Atoms | | | | | | Trace |
|---|---|---|---|---|---|---|---|---|---|
| | | | Total | C | H | N | O | P | |
| 1 | A | 38 | 1231 | 365 | 415 | 155 | 259 | 37 | 0 |

# 4 Residue-property plots (i)

## 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: PRE-TRNA BULGE-HELIX-BULGE MOTIF

Chain A: 47% 26% 16% 11%

## 4.2 Residue scores for the first model from the NMR ensemble

No representative models were identified. Colouring as in section 4.1 above.

- Molecule 1: PRE-TRNA BULGE-HELIX-BULGE MOTIF

Chain A: 39% 26% 16% 18%

# 5 Refinement protocol and experimental data overview (i)

The models were refined using the following method: *TORSION ANGLE MOLECULAR DYNAMICS*.

Of the 65 calculated structures, 12 were deposited, based on the following criterion: *LEAST RESTRAINT VIOLATION*.

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

| Software name | Classification | Version |
|---|---|---|
| CNS | refinement | |
| X-PLOR | structure solution | 3.851 |
| CNS | structure solution | |

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 (i)

## 6.1 Standard geometry (i)

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the (average) root-mean-square of all Z scores of the bond lengths (or angles).

| Mol | Chain | Bond lengths | | Bond angles | |
|---|---|---|---|---|---|
| | | RMSZ | #Z>5 | RMSZ | #Z>5 |
| 1 | A | 0.80±0.02 | 0±0/914 (0.0±0.0%) | 1.82±0.05 | 28±6/1425 (2.0±0.4%) |
| All | All | 0.80 | 1/10968 (0.0%) | 1.82 | 334/17100 (2.0%) |

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 | 14.2±2.2 |
| All | All | 0 | 171 |

All unique bond outliers are listed below.

| Mol | Chain | Res | Type | Atoms | Z | Observed(Å) | Ideal(Å) | Models | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Worst | Total |
| 1 | A | 19 | A | P-O5' | 5.32 | 1.65 | 1.59 | 4 | 1 |

5 of 96 unique angle outliers are listed below. They are sorted according to the Z-score of the worst occurrence in the ensemble.

| Mol | Chain | Res | Type | Atoms | Z | Observed($^o$) | Ideal($^o$) | Models | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Worst | Total |
| 1 | A | 13 | A | N9-C1'-C2' | 11.60 | 129.09 | 114.00 | 2 | 10 |
| 1 | A | 19 | A | C1'-O4'-C4' | -11.17 | 100.96 | 109.90 | 4 | 1 |
| 1 | A | 19 | A | C5'-C4'-C3' | 10.50 | 132.81 | 116.00 | 4 | 1 |
| 1 | A | 13 | A | O4'-C1'-N9 | -10.39 | 99.89 | 108.20 | 5 | 10 |
| 1 | A | 12 | G | N9-C1'-C2' | 10.04 | 127.05 | 114.00 | 12 | 12 |

There are no chirality outliers.

5 of 35 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 | 18 | G | Sidechain | 12 |
| 1 | A | 23 | A | Sidechain | 12 |
| 1 | A | 14 | G | Sidechain | 12 |
| 1 | A | 13 | A | Sidechain | 12 |
| 1 | A | 25 | C | Sidechain | 11 |

## 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 | 816 | 415 | 415 | 3±1 |
| All | All | 9792 | 4980 | 4980 | 38 |

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.

5 of 7 unique clashes are listed below, sorted by their clash magnitude.

| Atom-1 | Atom-2 | Clash(Å) | Distance(Å) | Models | |
|---|---|---|---|---|---|
| | | | | Worst | Total |
| 1:A:21:A:H2' | 1:A:22:G:O4' | 0.56 | 1.99 | 4 | 12 |
| 1:A:18:G:N2 | 1:A:21:A:C5 | 0.48 | 2.81 | 4 | 9 |
| 1:A:18:G:N2 | 1:A:21:A:C6 | 0.47 | 2.82 | 6 | 11 |
| 1:A:10:C:H2' | 1:A:11:A:O4' | 0.43 | 2.13 | 8 | 3 |
| 1:A:20:G:C5 | 1:A:21:A:C6 | 0.43 | 3.06 | 12 | 1 |

## 6.3 Torsion angles (i)

### 6.3.1 Protein backbone (i)

There are no protein molecules in this entry.

### 6.3.2 Protein sidechains (i)

There are no protein molecules in this entry.

### 6.3.3 RNA (i)

| Mol | Chain | Analysed | Backbone Outliers | Pucker Outliers | Suiteness |
|---|---|---|---|---|---|
| 1 | A | 37/38 (97%) | 8±1 (22±3%) | 2±1 (4±2%) | 0.40±0.03 |
| All | All | 444/456 (97%) | 97 (22%) | 18 (4%) | 0.40 |

The overall RNA backbone suiteness is 0.40.

5 of 17 unique RNA backbone outliers are listed below:

| Mol | Chain | Res | Type | Models (Total) |
|---|---|---|---|---|
| 1 | A | 26 | G | 12 |
| 1 | A | 13 | A | 12 |
| 1 | A | 19 | A | 10 |
| 1 | A | 14 | G | 9 |
| 1 | A | 22 | G | 9 |

5 of 6 unique RNA pucker outliers are listed below:

| Mol | Chain | Res | Type | Models (Total) |
|---|---|---|---|---|
| 1 | A | 12 | G | 11 |
| 1 | A | 31 | U | 2 |
| 1 | A | 30 | A | 2 |
| 1 | A | 21 | A | 1 |
| 1 | A | 19 | A | 1 |

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

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

## 6.5 Carbohydrates (i)

There are no carbohydrates 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)

No chemical shift data were provided