# Full wwPDB NMR Structure Validation Report (i)

May 7, 2024 – 12:51 pm BST

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|---|---|---|
| PDB ID | : | 2X43 |
| Title | : | STRUCTURAL BASIS OF MOLECULAR RECOGNITION BY SHERP AT MEMBRANE SURFACES |
| Authors | : | Moore, B.; Miles, A.J.; Guerra, C.G.; Simpson, P.; Iwata, M.; Wallace, B.A.; Matthews, S.J.; Smith, D.F.; Brown, K.A. |
| Deposited on | : | 2010-02-09 |

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 types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

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

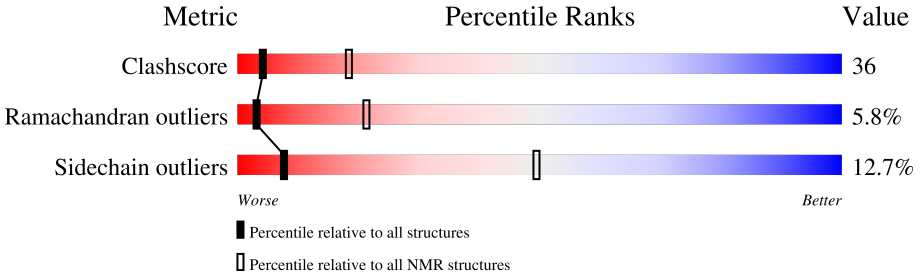
| | | |
|---|---|---|
| MolProbity | : | 4.02b-467 |
| Percentile statistics | : | 20191225.v01 (using entries in the PDB archive December 25th 2019) |
| wwPDB-RCI | : | v_1n_11_5_13_A (Berjanski et al., 2005) |
| PANAV | : | Wang et al. (2010) |
| wwPDB-ShiftChecker | : | v1.2 |
| Ideal geometry (proteins) | : | Engh & Huber (2001) |
| Ideal geometry (DNA, RNA) | : | Parkinson et al. (1996) |
| Validation Pipeline (wwPDB-VP) | : | 2.36.2 |

# 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 | 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 | S | 67 | 33% 36% 10% 21% |

# 2 Ensemble composition and analysis (i)

This entry contains 10 models. Model 4 is the overall representative, medoid model (most similar to other models). The authors have identified model 1 as representative.

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 | S:3-S:55 (53) | 0.25 | 4 |

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 | 2, 3, 4, 7, 8 |
| 2 | 1, 5, 6, 9 |
| Single-model clusters | 10 |

# 3 Entry composition (i)

There is only 1 type of molecule in this entry. The entry contains 958 atoms, of which 452 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called SHERP.

| Mol | Chain | Residues | Atoms | | | | | | Trace |
|---|---|---|---|---|---|---|---|---|---|
| | | | Total | C | H | N | O | S | |
| 1 | S | 67 | 958 | 298 | 452 | 91 | 115 | 2 | 0 |

There are 10 discrepancies between the modelled and reference sequences:

| Chain | Residue | Modelled | Actual | Comment | Reference |
|---|---|---|---|---|---|
| S | 58 | SER | - | expression tag | UNP Q9XTN3 |
| S | 59 | SER | - | expression tag | UNP Q9XTN3 |
| S | 60 | ARG | - | expression tag | UNP Q9XTN3 |
| S | 61 | ALA | - | expression tag | UNP Q9XTN3 |
| S | 62 | SER | - | expression tag | UNP Q9XTN3 |
| S | 63 | SER | - | expression tag | UNP Q9XTN3 |
| S | 64 | TYR | - | expression tag | UNP Q9XTN3 |
| S | 65 | THR | - | expression tag | UNP Q9XTN3 |
| S | 66 | LEU | - | expression tag | UNP Q9XTN3 |
| S | 67 | GLU | - | expression tag | UNP Q9XTN3 |

# 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: SHERP

Chain S: 33% 36% 10% 21%

M1 D2 Q3 E4 T5 R6 D7 Q8 M9 A12 K17 D18 N19 V20 H21 D22 K23 I24 Q25 K28 D29 D30 V31 G32 N33 K34 V38 E47 S48 I49 K50 D51 K52 L53 S54 G55 G56 S57 S58 S59 R60 A61 S62 S63 Y64 T65 L66 E67

## 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: SHERP

Chain S: 31% 39% 7% • 21%

M1 D2 Q3 E4 T5 R6 D7 Q8 M9 K10 N11 A12 K17 D18 N19 V20 H21 D22 K23 I24 Q25 E26 L27 K28 D29 D30 V31 G32 N33 K34 E37 V38 E47 S48 I49 K50 D51 K52 L53 G56 S57 S58 S59 R60 A61 S62 S63 Y64 T65 L66 E67

### 4.2.2 Score per residue for model 2

• Molecule 1: SHERP

Chain S: 37% 31% 10% 21%

M1 D2 Q3 E4 T5 R6 D7 Q8 M9 K10 N11 A12 K17 D18 N19 V20 H21 D22 K23 I24 Q25 K28 D29 D30 V31 G32 N33 V46 E47 S48 I49 K50 D51 K52 L53 G56 S57 S58 S59 R60 A61 S62 S63 Y64 T65 L66 E67

### 4.2.3 Score per residue for model 3

- Molecule 1: SHERP

Chain S: 33% 36% 9% • 21%

### 4.2.4 Score per residue for model 4 (medoid)

- Molecule 1: SHERP

Chain S: 31% 34% 13% 21%

### 4.2.5 Score per residue for model 5

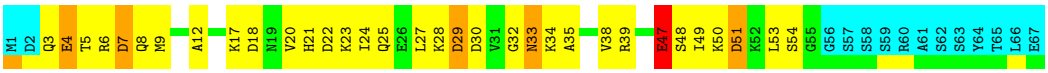
- Molecule 1: SHERP

Chain S: 34% 36% 7% • 21%

### 4.2.6 Score per residue for model 6

- Molecule 1: SHERP

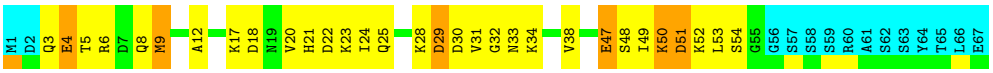
Chain S: 30% 40% 7% • 21%




### 4.2.7 Score per residue for model 7

- Molecule 1: SHERP

Chain S: 33% 37% 9% 21%



### 4.2.8 Score per residue for model 8

- Molecule 1: SHERP

Chain S: 33% 34% 12% 21%

### 4.2.9 Score per residue for model 9

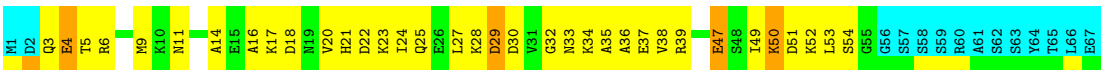
- Molecule 1: SHERP

Chain S: 27% 42% 10% 21%

### 4.2.10 Score per residue for model 10

- Molecule 1: SHERP

Chain S: 27% 46% 6% 21%



# 5 Refinement protocol and experimental data overview (i)

The models were refined using the following method: *ARIA*.

Of the 10 calculated structures, 10 were deposited, based on the following criterion: *LEAST VIOLATIONS*.

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

| Software name | Classification | Version |
|---|---|---|
| CNS | refinement | |
| NMRView | structure solution | |

No chemical shift data was provided.

# 6 Model quality (i)

## 6.1 Standard geometry (i)

There are no covalent bond-length or bond-angle outliers.

There are no bond-length outliers.

There are no bond-angle outliers.

There are no chirality outliers.

There are no planarity outliers.

## 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 | S | 403 | 358 | 397 | 29±3 |
| All | All | 4030 | 3580 | 3970 | 289 |

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 36.

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

| Atom-1 | Atom-2 | Clash(Å) | Distance(Å) | Models | |
|---|---|---|---|---|---|
| | | | | Worst | Total |
| 1:S:24:ILE:HG21 | 1:S:33:ASN:HA | 0.76 | 1.58 | 9 | 10 |
| 1:S:50:LYS:HG3 | 1:S:51:ASP:N | 0.67 | 2.05 | 1 | 9 |
| 1:S:24:ILE:HD11 | 1:S:35:ALA:HB3 | 0.65 | 1.69 | 5 | 3 |
| 1:S:17:LYS:O | 1:S:21:HIS:HB3 | 0.61 | 1.95 | 1 | 10 |
| 1:S:50:LYS:HG3 | 1:S:51:ASP:H | 0.61 | 1.56 | 6 | 8 |
| 1:S:28:LYS:HB3 | 1:S:32:GLY:HA3 | 0.60 | 1.73 | 3 | 10 |
| 1:S:49:ILE:HD12 | 1:S:50:LYS:N | 0.59 | 2.12 | 3 | 10 |
| 1:S:50:LYS:CG | 1:S:51:ASP:N | 0.59 | 2.65 | 1 | 1 |
| 1:S:17:LYS:HA | 1:S:21:HIS:HB2 | 0.58 | 1.75 | 8 | 10 |
| 1:S:28:LYS:O | 1:S:30:ASP:N | 0.57 | 2.37 | 10 | 10 |
| 1:S:31:VAL:HG13 | 1:S:32:GLY:N | 0.56 | 2.15 | 7 | 5 |
| 1:S:31:VAL:HG13 | 1:S:32:GLY:H | 0.56 | 1.60 | 8 | 5 |
| 1:S:4:GLU:HG3 | 1:S:47:GLU:O | 0.56 | 2.00 | 7 | 2 |
| 1:S:34:LYS:O | 1:S:38:VAL:HG23 | 0.55 | 2.02 | 3 | 9 |

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| Atom-1 | Atom-2 | Clash(Å) | Distance(Å) | Models | |
|---|---|---|---|---|---|
| | | | | Worst | Total |
| 1:S:4:GLU:HG2 | 1:S:47:GLU:O | 0.54 | 2.03 | 1 | 8 |
| 1:S:25:GLN:HA | 1:S:29:ASP:HB3 | 0.52 | 1.82 | 6 | 4 |
| 1:S:20:VAL:O | 1:S:24:ILE:HG13 | 0.51 | 2.05 | 9 | 10 |
| 1:S:4:GLU:HB2 | 1:S:50:LYS:HD2 | 0.51 | 1.83 | 10 | 1 |
| 1:S:24:ILE:CG2 | 1:S:33:ASN:HA | 0.50 | 2.36 | 5 | 3 |
| 1:S:18:ASP:O | 1:S:22:ASP:CB | 0.49 | 2.60 | 6 | 10 |
| 1:S:24:ILE:O | 1:S:25:GLN:C | 0.48 | 2.51 | 10 | 10 |
| 1:S:24:ILE:HA | 1:S:28:LYS:HB2 | 0.48 | 1.84 | 3 | 10 |
| 1:S:24:ILE:HD13 | 1:S:33:ASN:HA | 0.47 | 1.85 | 8 | 4 |
| 1:S:4:GLU:CD | 1:S:4:GLU:C | 0.47 | 2.73 | 4 | 7 |
| 1:S:25:GLN:HA | 1:S:29:ASP:HB2 | 0.47 | 1.86 | 9 | 6 |
| 1:S:24:ILE:O | 1:S:28:LYS:N | 0.47 | 2.48 | 6 | 10 |
| 1:S:4:GLU:O | 1:S:8:GLN:HB2 | 0.47 | 2.09 | 6 | 4 |
| 1:S:21:HIS:O | 1:S:25:GLN:HG3 | 0.47 | 2.09 | 7 | 8 |
| 1:S:49:ILE:O | 1:S:53:LEU:HB2 | 0.47 | 2.10 | 4 | 8 |
| 1:S:5:THR:O | 1:S:9:MET:HB3 | 0.47 | 2.09 | 6 | 8 |
| 1:S:5:THR:HA | 1:S:9:MET:HB2 | 0.47 | 1.87 | 9 | 1 |
| 1:S:28:LYS:HB3 | 1:S:32:GLY:CA | 0.47 | 2.39 | 3 | 10 |
| 1:S:27:LEU:HB2 | 1:S:28:LYS:HD2 | 0.46 | 1.88 | 6 | 3 |
| 1:S:8:GLN:O | 1:S:12:ALA:N | 0.46 | 2.48 | 5 | 9 |
| 1:S:18:ASP:O | 1:S:22:ASP:HB2 | 0.45 | 2.10 | 5 | 10 |
| 1:S:6:ARG:O | 1:S:10:LYS:HB2 | 0.45 | 2.11 | 3 | 3 |
| 1:S:24:ILE:HD12 | 1:S:36:ALA:HB2 | 0.45 | 1.88 | 10 | 1 |
| 1:S:16:ALA:HB2 | 1:S:39:ARG:HD2 | 0.44 | 1.89 | 10 | 2 |
| 1:S:50:LYS:HB2 | 1:S:50:LYS:NZ | 0.44 | 2.28 | 4 | 1 |
| 1:S:49:ILE:HA | 1:S:53:LEU:HB2 | 0.43 | 1.90 | 8 | 3 |
| 1:S:50:LYS:O | 1:S:54:SER:HB2 | 0.43 | 2.13 | 6 | 7 |
| 1:S:24:ILE:HG23 | 1:S:28:LYS:HB2 | 0.43 | 1.91 | 7 | 3 |
| 1:S:31:VAL:CG1 | 1:S:32:GLY:N | 0.42 | 2.82 | 7 | 4 |
| 1:S:47:GLU:HA | 1:S:50:LYS:HG2 | 0.42 | 1.90 | 4 | 3 |
| 1:S:24:ILE:HG12 | 1:S:28:LYS:HB2 | 0.42 | 1.92 | 6 | 2 |
| 1:S:10:LYS:N | 1:S:10:LYS:HE2 | 0.41 | 2.30 | 3 | 1 |
| 1:S:17:LYS:O | 1:S:22:ASP:N | 0.41 | 2.53 | 6 | 1 |
| 1:S:17:LYS:O | 1:S:21:HIS:CB | 0.41 | 2.68 | 8 | 1 |
| 1:S:31:VAL:HG23 | 1:S:32:GLY:H | 0.41 | 1.74 | 2 | 3 |
| 1:S:11:ASN:O | 1:S:14:ALA:HB3 | 0.41 | 2.15 | 9 | 2 |
| 1:S:46:VAL:O | 1:S:48:SER:N | 0.41 | 2.54 | 8 | 2 |
| 1:S:4:GLU:CB | 1:S:50:LYS:HD2 | 0.41 | 2.46 | 10 | 1 |
| 1:S:7:ASP:HB3 | 1:S:8:GLN:NE2 | 0.41 | 2.31 | 6 | 1 |
| 1:S:34:LYS:HD2 | 1:S:37:GLU:HB2 | 0.40 | 1.93 | 10 | 1 |
| 1:S:25:GLN:O | 1:S:29:ASP:HB2 | 0.40 | 2.16 | 1 | 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 | S | 53/67 (79%) | 37±2 (70±4%) | 13±2 (24±3%) | 3±1 (6±1%) | 3 21 |
| All | All | 530/670 (79%) | 372 (70%) | 127 (24%) | 31 (6%) | 3 21 |

All 5 unique Ramachandran outliers are listed below. They are sorted by the frequency of occurrence in the ensemble.

| Mol | Chain | Res | Type | Models (Total) |
|---|---|---|---|---|
| 1 | S | 29 | ASP | 10 |
| 1 | S | 47 | GLU | 10 |
| 1 | S | 33 | ASN | 8 |
| 1 | S | 37 | GLU | 2 |
| 1 | S | 3 | GLN | 1 |

### 6.3.2 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 | S | 44/56 (79%) | 38±1 (87±3%) | 6±1 (13±3%) | 8 49 |
| All | All | 440/560 (79%) | 384 (87%) | 56 (13%) | 8 49 |

All 16 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 | S | 4 | GLU | 9 |
| 1 | S | 51 | ASP | 9 |
| 1 | S | 7 | ASP | 7 |
| 1 | S | 50 | LYS | 7 |
| 1 | S | 28 | LYS | 5 |

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| Mol | Chain | Res | Type | Models (Total) |
|---|---|---|---|---|
| 1 | S | 9 | MET | 3 |
| 1 | S | 47 | GLU | 3 |
| 1 | S | 23 | LYS | 3 |
| 1 | S | 53 | LEU | 2 |
| 1 | S | 10 | LYS | 2 |
| 1 | S | 11 | ASN | 1 |
| 1 | S | 19 | ASN | 1 |
| 1 | S | 52 | LYS | 1 |
| 1 | S | 33 | ASN | 1 |
| 1 | S | 39 | ARG | 1 |
| 1 | S | 5 | THR | 1 |

### 6.3.3 RNA (i)

There are no RNA molecules in this entry.

## 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 monosaccharides 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