Sep 3, 2020 – 12:56 PM EDT

PDB ID : 6ZIQ
EMDB ID : EMD-11228
Title : bovine ATP synthase stator domain, state 1
Authors : Spikes, T.E.; Montgomery, M.G.; Walker, J.E.
Deposited on : 2020-06-26
Resolution : 4.33 Å (reported)
Based on initial models : 2V7Q, 2CLY, 2WSS

This is a Full wwPDB EM Model Validation Report for a publicly released PDB/EMDB entry.

We welcome your comments at validation@mail.wwpdb.org
A user guide is available at
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:

- MolProbity : 4.02b-467
- Mogul : 1.8.5 (274361), CSD as541be (2020)
- Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
- Ideal geometry (proteins) : Engh & Huber (2001)
- Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
- Validation Pipeline (wwPDB-VP) : 2.13.1
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

**ELECTRON MICROSCOPY**

The reported resolution of this entry is 4.33 Å.

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.

<table>
<thead>
<tr>
<th>Metric</th>
<th>Whole archive (#Entries)</th>
<th>EM structures (#Entries)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clashscore</td>
<td>158937</td>
<td>4297</td>
</tr>
<tr>
<td>Ramachandran outliers</td>
<td>154571</td>
<td>4023</td>
</tr>
<tr>
<td>Sidechain outliers</td>
<td>154315</td>
<td>3826</td>
</tr>
</tbody>
</table>

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments on the bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria respectively. 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%.

<table>
<thead>
<tr>
<th>Mol</th>
<th>Chain</th>
<th>Length</th>
<th>Quality of chain</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
<td>66</td>
<td>45% 17% 38%</td>
</tr>
<tr>
<td>2</td>
<td>a</td>
<td>226</td>
<td>100%</td>
</tr>
<tr>
<td>3</td>
<td>d</td>
<td>160</td>
<td>96%</td>
</tr>
<tr>
<td>4</td>
<td>e</td>
<td>70</td>
<td>57%</td>
</tr>
<tr>
<td>5</td>
<td>f</td>
<td>87</td>
<td>95% 5%</td>
</tr>
<tr>
<td>6</td>
<td>g</td>
<td>102</td>
<td>77% 23%</td>
</tr>
<tr>
<td>7</td>
<td>j</td>
<td>60</td>
<td>80% 20%</td>
</tr>
<tr>
<td>8</td>
<td>k</td>
<td>57</td>
<td>63% 37%</td>
</tr>
<tr>
<td>9</td>
<td>M</td>
<td>75</td>
<td>60% 31% 9%</td>
</tr>
</tbody>
</table>

Continued on next page...
Continued from previous page...

<table>
<thead>
<tr>
<th>Mol</th>
<th>Chain</th>
<th>Length</th>
<th>Quality of chain</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>N</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>O</td>
<td>75</td>
<td>60% 39% 41%</td>
</tr>
<tr>
<td>10</td>
<td>b</td>
<td>214</td>
<td>97%</td>
</tr>
<tr>
<td>11</td>
<td>h</td>
<td>76</td>
<td>82% 18%</td>
</tr>
<tr>
<td>12</td>
<td>S</td>
<td>190</td>
<td>40% 28% 32%</td>
</tr>
<tr>
<td>13</td>
<td>C</td>
<td>510</td>
<td>10% 7% 83%</td>
</tr>
</tbody>
</table>
2 Entry composition

There are 13 unique types of molecules in this entry. The entry contains 22312 atoms, of which 11373 are hydrogens and 0 are deuteriums.

In the tables below, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called ATP synthase protein 8.

<table>
<thead>
<tr>
<th>Mol</th>
<th>Chain</th>
<th>Residues</th>
<th>Atoms</th>
<th>AltConf</th>
<th>Trace</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
<td>41</td>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>C</td>
<td>696</td>
<td>231</td>
</tr>
</tbody>
</table>

- Molecule 2 is a protein called ATP synthase subunit a.

<table>
<thead>
<tr>
<th>Mol</th>
<th>Chain</th>
<th>Residues</th>
<th>Atoms</th>
<th>AltConf</th>
<th>Trace</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>a</td>
<td>226</td>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>C</td>
<td>3611</td>
<td>1155</td>
</tr>
</tbody>
</table>

- Molecule 3 is a protein called ATP synthase subunit d, mitochondrial.

<table>
<thead>
<tr>
<th>Mol</th>
<th>Chain</th>
<th>Residues</th>
<th>Atoms</th>
<th>AltConf</th>
<th>Trace</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>d</td>
<td>155</td>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>C</td>
<td>2549</td>
<td>821</td>
</tr>
</tbody>
</table>

- Molecule 4 is a protein called ATP synthase subunit e, mitochondrial.

<table>
<thead>
<tr>
<th>Mol</th>
<th>Chain</th>
<th>Residues</th>
<th>Atoms</th>
<th>AltConf</th>
<th>Trace</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>e</td>
<td>41</td>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>C</td>
<td>687</td>
<td>218</td>
</tr>
</tbody>
</table>

- Molecule 5 is a protein called ATP synthase subunit f, mitochondrial.

<table>
<thead>
<tr>
<th>Mol</th>
<th>Chain</th>
<th>Residues</th>
<th>Atoms</th>
<th>AltConf</th>
<th>Trace</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>f</td>
<td>83</td>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>C</td>
<td>1411</td>
<td>456</td>
</tr>
</tbody>
</table>

- Molecule 6 is a protein called ATP synthase subunit g, mitochondrial.

<table>
<thead>
<tr>
<th>Mol</th>
<th>Chain</th>
<th>Residues</th>
<th>Atoms</th>
<th>AltConf</th>
<th>Trace</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>g</td>
<td>79</td>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>C</td>
<td>1291</td>
<td>420</td>
</tr>
</tbody>
</table>
- Molecule 7 is a protein called ATP synthase subunit ATP5MPL, mitochondrial.

<table>
<thead>
<tr>
<th>Mol</th>
<th>Chain</th>
<th>Residues</th>
<th>Atoms</th>
<th>AltConf</th>
<th>Trace</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>j</td>
<td>48</td>
<td>Total C</td>
<td>H N O S</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>828 267</td>
<td>428 66  65 2</td>
<td>0</td>
</tr>
</tbody>
</table>

- Molecule 8 is a protein called ATP synthase membrane subunit DAPIT, mitochondrial.

<table>
<thead>
<tr>
<th>Mol</th>
<th>Chain</th>
<th>Residues</th>
<th>Atoms</th>
<th>AltConf</th>
<th>Trace</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>k</td>
<td>36</td>
<td>Total C</td>
<td>H N O S</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>596 192</td>
<td>307 47  48 2</td>
<td>0</td>
</tr>
</tbody>
</table>

- Molecule 9 is a protein called ATP synthase F(0) complex subunit C1, mitochondrial.

<table>
<thead>
<tr>
<th>Mol</th>
<th>Chain</th>
<th>Residues</th>
<th>Atoms</th>
<th>AltConf</th>
<th>Trace</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>M</td>
<td>68</td>
<td>Total C</td>
<td>H N O S</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>994 326</td>
<td>507 75  82 4</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>N</td>
<td>75</td>
<td>Total C</td>
<td>H N O S</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1096 356</td>
<td>559 83  94 4</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>O</td>
<td>44</td>
<td>Total C</td>
<td>H N O S</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>707 234</td>
<td>364 51  55 3</td>
<td>0</td>
</tr>
</tbody>
</table>

- Molecule 10 is a protein called ATP synthase F(0) complex subunit B1, mitochondrial.

<table>
<thead>
<tr>
<th>Mol</th>
<th>Chain</th>
<th>Residues</th>
<th>Atoms</th>
<th>AltConf</th>
<th>Trace</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>b</td>
<td>209</td>
<td>Total C</td>
<td>H N O S</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3456 1095</td>
<td>1755 292 308 6</td>
<td>0</td>
</tr>
</tbody>
</table>

- Molecule 11 is a protein called ATP synthase-coupling factor 6, mitochondrial.

<table>
<thead>
<tr>
<th>Mol</th>
<th>Chain</th>
<th>Residues</th>
<th>Atoms</th>
<th>AltConf</th>
<th>Trace</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>h</td>
<td>62</td>
<td>Total C</td>
<td>H N O S</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1009 326</td>
<td>495 87  99 2</td>
<td>0</td>
</tr>
</tbody>
</table>

- Molecule 12 is a protein called ATP synthase subunit O, mitochondrial.

<table>
<thead>
<tr>
<th>Mol</th>
<th>Chain</th>
<th>Residues</th>
<th>Atoms</th>
<th>AltConf</th>
<th>Trace</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>S</td>
<td>129</td>
<td>Total C</td>
<td>H N O S</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2048 627</td>
<td>1057 171 186 7</td>
<td>0</td>
</tr>
</tbody>
</table>

- Molecule 13 is a protein called ATP synthase subunit alpha, mitochondrial.
There is a discrepancy between the modelled and reference sequences:

<table>
<thead>
<tr>
<th>Chain</th>
<th>Residue</th>
<th>Modelled</th>
<th>Actual</th>
<th>Comment</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>1</td>
<td>GLU</td>
<td>GLN</td>
<td>microheterogeneity</td>
<td>UNP P19483</td>
</tr>
</tbody>
</table>
3  Residue-property plots

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-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 outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

- Molecule 1: ATP synthase protein 8

Chain 8:

- Molecule 2: ATP synthase subunit a

Chain a:

There are no outlier residues recorded for this chain.

- Molecule 3: ATP synthase subunit d, mitochondrial

Chain d:

- Molecule 4: ATP synthase subunit e, mitochondrial

Chain e:

- Molecule 5: ATP synthase subunit f, mitochondrial

Chain f:

- Molecule 6: ATP synthase subunit g, mitochondrial

Chain g:
• Molecule 7: ATP synthase subunit ATP5MPL, mitochondrial

Chain j:

• Molecule 8: ATP synthase membrane subunit DAPIT, mitochondrial

Chain k:

• Molecule 9: ATP synthase F(0) complex subunit C1, mitochondrial

Chain M:

• Molecule 9: ATP synthase F(0) complex subunit C1, mitochondrial

Chain N:

• Molecule 9: ATP synthase F(0) complex subunit C1, mitochondrial

Chain O:

• Molecule 10: ATP synthase F(0) complex subunit B1, mitochondrial

Chain b:

• Molecule 11: ATP synthase-coupling factor 6, mitochondrial

Chain h:
• Molecule 12: ATP synthase subunit O, mitochondrial

Chain S:

• Molecule 13: ATP synthase subunit alpha, mitochondrial

Chain C:
## 4 Experimental information

<table>
<thead>
<tr>
<th><strong>Property</strong></th>
<th><strong>Value</strong></th>
<th><strong>Source</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>EM reconstruction method</td>
<td>SINGLE PARTICLE</td>
<td>Depositor</td>
</tr>
<tr>
<td>Imposed symmetry</td>
<td>POINT, C2</td>
<td>Depositor</td>
</tr>
<tr>
<td>Number of particles used</td>
<td>90850</td>
<td>Depositor</td>
</tr>
<tr>
<td>Resolution determination method</td>
<td>FSC 0.143 CUT-OFF</td>
<td>Depositor</td>
</tr>
<tr>
<td>CTF correction method</td>
<td>PHASE FLIPPING AND AMPLITUDE CORRECTION</td>
<td>Depositor</td>
</tr>
<tr>
<td>Microscope</td>
<td>FEI TITAN KRIOS</td>
<td>Depositor</td>
</tr>
<tr>
<td>Voltage (kV)</td>
<td>300</td>
<td>Depositor</td>
</tr>
<tr>
<td>Electron dose (e⁻ / Å²)</td>
<td>4.6</td>
<td>Depositor</td>
</tr>
<tr>
<td>Minimum defocus (nm)</td>
<td>Not provided</td>
<td>Depositor</td>
</tr>
<tr>
<td>Maximum defocus (nm)</td>
<td>Not provided</td>
<td>Depositor</td>
</tr>
<tr>
<td>Magnification</td>
<td>Not provided</td>
<td>Depositor</td>
</tr>
<tr>
<td>Image detector</td>
<td>GATAN K2 QUANTUM (4k x 4k)</td>
<td>Depositor</td>
</tr>
</tbody>
</table>
5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: M3L.

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 root-mean-square of all Z scores of the bond lengths (or angles).

<table>
<thead>
<tr>
<th>Mol</th>
<th>Chain</th>
<th>Bond lengths</th>
<th>Bond angles</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>RMSZ</td>
<td>#</td>
</tr>
<tr>
<td>1</td>
<td>8</td>
<td>0.33</td>
<td>0/355</td>
</tr>
<tr>
<td>2</td>
<td>a</td>
<td>0.32</td>
<td>0/1779</td>
</tr>
<tr>
<td>3</td>
<td>d</td>
<td>0.29</td>
<td>0/1304</td>
</tr>
<tr>
<td>4</td>
<td>e</td>
<td>0.29</td>
<td>0/343</td>
</tr>
<tr>
<td>5</td>
<td>f</td>
<td>0.32</td>
<td>0/711</td>
</tr>
<tr>
<td>6</td>
<td>g</td>
<td>0.27</td>
<td>0/646</td>
</tr>
<tr>
<td>7</td>
<td>j</td>
<td>0.30</td>
<td>0/410</td>
</tr>
<tr>
<td>8</td>
<td>k</td>
<td>0.26</td>
<td>0/294</td>
</tr>
<tr>
<td>9</td>
<td>M</td>
<td>0.32</td>
<td>0/484</td>
</tr>
<tr>
<td>9</td>
<td>N</td>
<td>0.36</td>
<td>0/534</td>
</tr>
<tr>
<td>9</td>
<td>O</td>
<td>0.36</td>
<td>0/338</td>
</tr>
<tr>
<td>10</td>
<td>b</td>
<td>0.32</td>
<td>0/1733</td>
</tr>
<tr>
<td>11</td>
<td>h</td>
<td>0.32</td>
<td>0/526</td>
</tr>
<tr>
<td>12</td>
<td>S</td>
<td>0.29</td>
<td>0/1000</td>
</tr>
<tr>
<td>13</td>
<td>C</td>
<td>0.28</td>
<td>0/665</td>
</tr>
<tr>
<td>All</td>
<td>All</td>
<td>0.31</td>
<td>0/11122</td>
</tr>
</tbody>
</table>

There are no bond length outliers.

All (7) bond angle outliers are listed below:

<table>
<thead>
<tr>
<th>Mol</th>
<th>Chain</th>
<th>Res</th>
<th>Type</th>
<th>Atoms</th>
<th>Z</th>
<th>Observed(°)</th>
<th>Ideal(°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>O</td>
<td>70</td>
<td>LEU</td>
<td>CB-CG-CD2</td>
<td>5.99</td>
<td>121.18</td>
<td>111.00</td>
</tr>
<tr>
<td>9</td>
<td>O</td>
<td>52</td>
<td>LEU</td>
<td>CB-CG-CD2</td>
<td>5.76</td>
<td>120.80</td>
<td>111.00</td>
</tr>
<tr>
<td>9</td>
<td>O</td>
<td>65</td>
<td>LEU</td>
<td>CB-CG-CD1</td>
<td>5.69</td>
<td>120.67</td>
<td>111.00</td>
</tr>
<tr>
<td>9</td>
<td>O</td>
<td>65</td>
<td>LEU</td>
<td>CB-CG-CD2</td>
<td>5.69</td>
<td>120.67</td>
<td>111.00</td>
</tr>
<tr>
<td>9</td>
<td>N</td>
<td>65</td>
<td>LEU</td>
<td>CB-CG-CD1</td>
<td>-5.44</td>
<td>101.75</td>
<td>111.00</td>
</tr>
<tr>
<td>9</td>
<td>O</td>
<td>52</td>
<td>LEU</td>
<td>CB-CG-CD1</td>
<td>5.40</td>
<td>120.18</td>
<td>111.00</td>
</tr>
<tr>
<td>9</td>
<td>O</td>
<td>70</td>
<td>LEU</td>
<td>CB-CG-CD1</td>
<td>5.33</td>
<td>120.06</td>
<td>111.00</td>
</tr>
</tbody>
</table>

There are no chirality outliers.
There are no planarity outliers.

### 5.2 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 the 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 within the asymmetric unit, whereas Symm-Clashes lists symmetry related clashes.

<table>
<thead>
<tr>
<th>Mol</th>
<th>Chain</th>
<th>Non-H</th>
<th>H(model)</th>
<th>H(added)</th>
<th>Clashes</th>
<th>Symm-Clashes</th>
</tr>
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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 18.

All (137) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

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<tr>
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There are no symmetry-related clashes.

5.3 Torsion angles

5.3.1 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 EM entries.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

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<th>Chain</th>
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<th>Favoured</th>
<th>Allowed</th>
<th>Outliers</th>
<th>Percentiles</th>
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<td>29 (74%)</td>
<td>10 (26%)</td>
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<td>100 100</td>
</tr>
<tr>
<td>2</td>
<td>a</td>
<td>224/226 (99%)</td>
<td>210 (94%)</td>
<td>14 (6%)</td>
<td>0</td>
<td>100 100</td>
</tr>
<tr>
<td>3</td>
<td>d</td>
<td>153/160 (96%)</td>
<td>134 (88%)</td>
<td>19 (12%)</td>
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<td>100 100</td>
</tr>
<tr>
<td>4</td>
<td>e</td>
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<td>100 100</td>
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<tr>
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<td>74 (91%)</td>
<td>7 (9%)</td>
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<td>100 100</td>
</tr>
<tr>
<td>6</td>
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<td>71 (92%)</td>
<td>6 (8%)</td>
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<td>100 100</td>
</tr>
<tr>
<td>7</td>
<td>j</td>
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<td>43 (94%)</td>
<td>3 (6%)</td>
<td>0</td>
<td>100 100</td>
</tr>
<tr>
<td>8</td>
<td>k</td>
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<td>32 (94%)</td>
<td>2 (6%)</td>
<td>0</td>
<td>100 100</td>
</tr>
<tr>
<td>9</td>
<td>M</td>
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<td>62 (95%)</td>
<td>3 (5%)</td>
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<td>41/75 (55%)</td>
<td>38 (93%)</td>
<td>3 (7%)</td>
<td>0</td>
<td>100 100</td>
</tr>
<tr>
<td>10</td>
<td>b</td>
<td>207/214 (97%)</td>
<td>196 (95%)</td>
<td>11 (5%)</td>
<td>0</td>
<td>100 100</td>
</tr>
<tr>
<td>11</td>
<td>h</td>
<td>60/76 (79%)</td>
<td>49 (82%)</td>
<td>11 (18%)</td>
<td>0</td>
<td>100 100</td>
</tr>
<tr>
<td>12</td>
<td>S</td>
<td>125/190 (66%)</td>
<td>114 (91%)</td>
<td>11 (9%)</td>
<td>0</td>
<td>100 100</td>
</tr>
<tr>
<td>13</td>
<td>C</td>
<td>87/510 (17%)</td>
<td>78 (90%)</td>
<td>9 (10%)</td>
<td>0</td>
<td>100 100</td>
</tr>
<tr>
<td>All</td>
<td>All</td>
<td>1350/2043 (66%)</td>
<td>1233 (91%)</td>
<td>117 (9%)</td>
<td>0</td>
<td>100 100</td>
</tr>
</tbody>
</table>
There are no Ramachandran outliers to report.

5.3.2 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 EM entries.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

<table>
<thead>
<tr>
<th>Mol</th>
<th>Chain</th>
<th>Analysed</th>
<th>Rotameric</th>
<th>Outliers</th>
<th>Percentiles</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
<td>41/66 (62%)</td>
<td>41 (100%)</td>
<td>0</td>
<td>100 100</td>
</tr>
<tr>
<td>2</td>
<td>a</td>
<td>200/200 (100%)</td>
<td>200 (100%)</td>
<td>0</td>
<td>100 100</td>
</tr>
<tr>
<td>3</td>
<td>d</td>
<td>139/142 (98%)</td>
<td>137 (99%)</td>
<td>2 (1%)</td>
<td>67  81</td>
</tr>
<tr>
<td>4</td>
<td>e</td>
<td>34/59 (58%)</td>
<td>33 (97%)</td>
<td>1 (3%)</td>
<td>42  64</td>
</tr>
<tr>
<td>5</td>
<td>f</td>
<td>72/75 (96%)</td>
<td>72 (100%)</td>
<td>0</td>
<td>100 100</td>
</tr>
<tr>
<td>6</td>
<td>g</td>
<td>67/83 (81%)</td>
<td>67 (100%)</td>
<td>0</td>
<td>100 100</td>
</tr>
<tr>
<td>7</td>
<td>j</td>
<td>42/49 (86%)</td>
<td>42 (100%)</td>
<td>0</td>
<td>100 100</td>
</tr>
<tr>
<td>8</td>
<td>k</td>
<td>31/46 (67%)</td>
<td>31 (100%)</td>
<td>0</td>
<td>100 100</td>
</tr>
<tr>
<td>9</td>
<td>M</td>
<td>45/50 (90%)</td>
<td>45 (100%)</td>
<td>0</td>
<td>100 100</td>
</tr>
<tr>
<td>9</td>
<td>N</td>
<td>50/50 (100%)</td>
<td>50 (100%)</td>
<td>0</td>
<td>100 100</td>
</tr>
<tr>
<td>9</td>
<td>O</td>
<td>34/50 (68%)</td>
<td>34 (100%)</td>
<td>0</td>
<td>100 100</td>
</tr>
<tr>
<td>10</td>
<td>b</td>
<td>186/190 (98%)</td>
<td>185 (100%)</td>
<td>1 (0%)</td>
<td>88  93</td>
</tr>
<tr>
<td>11</td>
<td>h</td>
<td>56/70 (80%)</td>
<td>56 (100%)</td>
<td>0</td>
<td>100 100</td>
</tr>
<tr>
<td>12</td>
<td>S</td>
<td>110/165 (67%)</td>
<td>110 (100%)</td>
<td>0</td>
<td>100 100</td>
</tr>
<tr>
<td>13</td>
<td>C</td>
<td>73/413 (18%)</td>
<td>73 (100%)</td>
<td>0</td>
<td>100 100</td>
</tr>
<tr>
<td>All</td>
<td>All</td>
<td>1180/1708 (69%)</td>
<td>1176 (100%)</td>
<td>4 (0%)</td>
<td>92  95</td>
</tr>
</tbody>
</table>

All (4) residues with a non-rotameric sidechain are listed below:

<table>
<thead>
<tr>
<th>Mol</th>
<th>Chain</th>
<th>Res</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>d</td>
<td>47</td>
<td>LYS</td>
</tr>
<tr>
<td>3</td>
<td>d</td>
<td>77</td>
<td>LYS</td>
</tr>
<tr>
<td>4</td>
<td>e</td>
<td>35</td>
<td>ARG</td>
</tr>
<tr>
<td>10</td>
<td>b</td>
<td>120</td>
<td>LYS</td>
</tr>
</tbody>
</table>

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:
<table>
<thead>
<tr>
<th>Mol</th>
<th>Chain</th>
<th>Res</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
<td>32</td>
<td>ASN</td>
</tr>
<tr>
<td>1</td>
<td>8</td>
<td>36</td>
<td>ASN</td>
</tr>
<tr>
<td>2</td>
<td>a</td>
<td>101</td>
<td>ASN</td>
</tr>
<tr>
<td>2</td>
<td>a</td>
<td>119</td>
<td>ASN</td>
</tr>
<tr>
<td>2</td>
<td>a</td>
<td>168</td>
<td>HIS</td>
</tr>
<tr>
<td>6</td>
<td>g</td>
<td>57</td>
<td>ASN</td>
</tr>
<tr>
<td>9</td>
<td>N</td>
<td>45</td>
<td>GLN</td>
</tr>
<tr>
<td>10</td>
<td>b</td>
<td>122</td>
<td>HIS</td>
</tr>
</tbody>
</table>

5.3.3 RNA

There are no RNA molecules in this entry.

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

3 non-standard protein/DNA/RNA residues are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or 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 length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

<table>
<thead>
<tr>
<th>Mol</th>
<th>Type</th>
<th>Chain</th>
<th>Res</th>
<th>Link</th>
<th>Bond lengths</th>
<th>Bond angles</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Counts</td>
<td>RMSZ</td>
</tr>
<tr>
<td>9</td>
<td>M3L</td>
<td>M</td>
<td>43</td>
<td>9</td>
<td>10,11,12</td>
<td>0.42</td>
</tr>
<tr>
<td>9</td>
<td>M3L</td>
<td>N</td>
<td>43</td>
<td>9</td>
<td>10,11,12</td>
<td>0.51</td>
</tr>
<tr>
<td>9</td>
<td>M3L</td>
<td>O</td>
<td>43</td>
<td>9</td>
<td>10,11,12</td>
<td>0.55</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Mol</th>
<th>Type</th>
<th>Chain</th>
<th>Res</th>
<th>Link</th>
<th>Chirals</th>
<th>Torsions</th>
<th>Rings</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>M3L</td>
<td>M</td>
<td>43</td>
<td>9</td>
<td>-</td>
<td>2/9/10/12</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>M3L</td>
<td>N</td>
<td>43</td>
<td>9</td>
<td>-</td>
<td>6/9/10/12</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>M3L</td>
<td>O</td>
<td>43</td>
<td>9</td>
<td>-</td>
<td>1/9/10/12</td>
<td>-</td>
</tr>
</tbody>
</table>

There are no bond length outliers.
There are no bond angle outliers.

There are no chirality outliers.

All (9) torsion outliers are listed below:

<table>
<thead>
<tr>
<th>Mol</th>
<th>Chain</th>
<th>Res</th>
<th>Type</th>
<th>Atoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>M</td>
<td>43</td>
<td>M3L</td>
<td>N-CA-CB-CG</td>
</tr>
<tr>
<td>9</td>
<td>M</td>
<td>43</td>
<td>M3L</td>
<td>C-CA-CB-CG</td>
</tr>
<tr>
<td>9</td>
<td>N</td>
<td>43</td>
<td>M3L</td>
<td>N-CA-CB-CG</td>
</tr>
<tr>
<td>9</td>
<td>N</td>
<td>43</td>
<td>M3L</td>
<td>C-CA-CB-CG</td>
</tr>
<tr>
<td>9</td>
<td>O</td>
<td>43</td>
<td>M3L</td>
<td>CG-CD-CE-NZ</td>
</tr>
<tr>
<td>9</td>
<td>N</td>
<td>43</td>
<td>M3L</td>
<td>CD-CE-NZ-CM2</td>
</tr>
<tr>
<td>9</td>
<td>N</td>
<td>43</td>
<td>M3L</td>
<td>CD-CE-NZ-CM3</td>
</tr>
<tr>
<td>9</td>
<td>N</td>
<td>43</td>
<td>M3L</td>
<td>CD-CE-NZ-CM1</td>
</tr>
<tr>
<td>9</td>
<td>N</td>
<td>43</td>
<td>M3L</td>
<td>CE-CD-CG-CB</td>
</tr>
</tbody>
</table>

There are no ring outliers.

1 monomer is involved in 2 short contacts:

<table>
<thead>
<tr>
<th>Mol</th>
<th>Chain</th>
<th>Res</th>
<th>Type</th>
<th>Clashes</th>
<th>Symm-Clashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>M</td>
<td>43</td>
<td>M3L</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

5.5 Carbohydrates

There are no monosaccharides in this entry.

5.6 Ligand geometry

There are no ligands in this entry.

5.7 Other polymers

There are no such residues in this entry.

5.8 Polymer linkage issues

There are no chain breaks in this entry.