Sleep apneas are Increased in Mice Lacking Monoamine Oxidase A

Article by: Real et Al.
Source: Pubmed
Presented by: Megan Iida
Mice Types

• Mutant Transgenetic mice (Tg8)- lacks MAOA enzyme
  – MAOA- enzyme that depletes neurotransmitters including serotonin

• Wild Mice (C3H)- not genetically altered
• 80 mice
• 5 different groups
• 80 mice
• 5 different groups
  – Group 1: electrode implants, no drugs
• 80 mice
• 5 different groups
  – Group 1: electrode implants, no drugs
  – Group 2: electrodes and treated with saline and **clorgyline** (MAOA inhibitor)
• 80 mice
• 5 different groups
  – Group 1: electrode implants, no drugs
  – Group 2: electrode and treated with saline and *clorgyline* (MAOA inhibitor)
  – Group 3: electrodes, treated with saline and *PCPA* (reduces brain concentration of serotonin)
• 80 mice
• 5 different groups
  – Group 1: electrode implants, no drugs
  – Group 2: electrodes and treated with saline and **clorgyline** (MAOA inhibitor)
  – Group 3: electrodes, treated with saline and **PCPA** (reduces brain concentration of serotonin)
  – Group 4: no surgery, no drugs
• 80 mice
• 5 different groups
  – Group 1: electrode implants, no drugs
  – Group 2: electrodes and treated with saline and clorgyline (MAOA inhibitor)
  – Group 3: electrodes, treated with saline and PCPA (reduces brain concentration of serotonin)
  – Group 4: no surgery, no drugs
  – Group 5: no surgery, treated with either saline or PCPA
Wild Mouse

Mutant Mouse
Wild Mouse

Mutant Mouse
### Table 1—MAOA-Deficient (Tg8) Males Show Wild-Type (C3H) Amounts of Vigilance States

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Vigilance state (%)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wake</td>
<td>SWS</td>
<td>REMS</td>
<td></td>
</tr>
<tr>
<td>C3H</td>
<td>30.4 ± 10.3</td>
<td>65.0 ± 9.6</td>
<td>4.6 ± 1.7</td>
<td></td>
</tr>
<tr>
<td>Tg8</td>
<td>36.5 ± 9.1</td>
<td>57.3 ± 9.2</td>
<td>6.3 ± 2.8</td>
<td></td>
</tr>
</tbody>
</table>

### Table 2—MAOA-Deficient (Tg8) Males Show Higher Indices of Sleep Apnea Than Wild Type (C3H) Males

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Sleep</th>
<th>Apnea index</th>
<th>Sigh index</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Spontaneous</td>
<td>Post-sigh</td>
</tr>
<tr>
<td>C3H</td>
<td>2.6 ± 2.0</td>
<td>0.8 ± 0.9</td>
<td>1.7 ± 1.3</td>
</tr>
<tr>
<td>Tg8</td>
<td>8.4 ± 4.5#</td>
<td>2.9 ± 1.7#</td>
<td>4.9 ± 2.9#</td>
</tr>
<tr>
<td>C3H</td>
<td>4.9 ± 4.9</td>
<td>4.9 ± 4.9</td>
<td>0.0 ± 0.0</td>
</tr>
<tr>
<td>Tg8</td>
<td>13.9 ± 8.4#</td>
<td>13.3 ± 8.6</td>
<td>0.6 ± 1.1</td>
</tr>
</tbody>
</table>
• Group 2:
• Clorgyline (MAOA inhibitor)
• Group 2:
• Clorgyline (MAOA inhibitor)
### Table 1—MAOA-Deficient (Tg8) Males Show Wild-Type (C3H) Amounts of Vigilance States

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Vigilance state (%)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Wake</td>
<td>SWS</td>
</tr>
<tr>
<td>C3H</td>
<td>30.4 ± 10.3</td>
<td>65.0 ± 9.6</td>
<td>4.6 ± 1.7</td>
</tr>
<tr>
<td>Tg8</td>
<td>36.5 ± 9.1</td>
<td>57.3 ± 9.2</td>
<td>6.3 ± 2.8</td>
</tr>
</tbody>
</table>

### Table 2—MAOA-Deficient (Tg8) Males Show Higher Indices of Sleep Apnea Than Wild Type (C3H) Males

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Sleep</th>
<th>Apnea index</th>
<th>Sigh index</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>Spontaneous</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C3H</td>
<td>SWS</td>
<td>2.6 ± 2.0</td>
<td>0.8 ± 0.9</td>
</tr>
<tr>
<td>Tg8</td>
<td>SWS</td>
<td>8.4 ± 4.5#</td>
<td>2.9 ± 1.7#</td>
</tr>
<tr>
<td>C3H</td>
<td>REMS</td>
<td>4.9 ± 4.9</td>
<td>4.9 ± 4.9</td>
</tr>
<tr>
<td>Tg8</td>
<td>REMS</td>
<td>13.9 ± 8.4#</td>
<td>13.3 ± 8.6</td>
</tr>
</tbody>
</table>
- Group 2:
- Clorgyline (MAOA inhibitor)
- Group 2:
- Clorgyline (MAOA inhibitor)
• Group 3:
• PCPA (reduces brain concentrations of serotonin)
• Group 3:
• PCPA (reduces brain concentrations of serotonin)
• Group 3:
• PCPA (reduces brain concentrations of serotonin)
Inferences

• MAOA deficiency linked to greater sleep apnea

• Too little or too much serotonin contributes to greater sleep apnea
Significance of this study?

• Sleep apnea in the US
  – 2% of women
  – 4% of men
• Known to reduce daytime vigilance
• Linked to an increased risk of cardiovascular diseases
• “Patients with obstructive apnea syndrome showed therapeutic response to mirtazapine.”