Millisecond Light Pulses To Shift Circadian Rhythms

Biquan Luo, Gucci J. Gu, Kristin Gleitsman, Vanessa Burns, Grant Ognibene
Sleep. It’s good for you.

Sleep plays a critical role in:
- Immune function
- Metabolism
- Learning
- Memory
The circadian biological clock regulates sleep patterns.
So What?

"No! I don't want to go to bed!"

BUCKMAN 2011

Beauty Sleep in progress
Circadian rhythm disregulation affects many millions of people in the US alone

For example:
- Jet lag
  - Hundreds of millions of people per year
- Delayed Sleep Phase Disorder
  - ~16% of teens and young adults
Medical Side Effects of Sleep Deprivation in Teens

Correlates to:

- High blood pressure
- Inability to concentrate
- Depression
- Weight gain
- Aggression
- Illness
Adults...

Insufficient Sleep Is a Public Health Epidemic

- Enhance effects of alcohol and nicotine
- Cause >100,000 traffic accidents each year
- Lead to inflammation and other medical problems in adults

Continued public health surveillance of sleep quality, duration, behaviors, and disorders is needed to monitor sleep difficulties and their health impact.
Current treatments for jet lag and DSPD

- Sleeping pills
- Calm night activities
- Sleep diary
- Chronotherapy
- Bright light therapy
Next-generation light therapy: mask prototype
Next-generation light therapy: beacon prototype
Millisecond Light Pulses (MLP)

- Utilizes light on the day/night cycle to delay and advance circadian rhythm in accordance with the phase response curve.
- Light emission at optimal wavelength, frequency, and exposure length
- Alters melatonin level which regulates sleep and wake cycles.
- Invisible: only be sensed by a specialized group of light receptors on retina
- Penetrating eyelids: can be used during sleep
- Clinically effective: shifts a person’s circadian rhythm by as much as four hours in a 24 hour period, as shown in clinical trials (unpublished data by Stanford Sleep Center)
LumosTech allows you...
# Why is our technology better?

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Criteria</th>
<th>Clinical effectiveness</th>
<th>Affects daily activities</th>
<th>Advert health effect</th>
<th>Personalization</th>
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</thead>
<tbody>
<tr>
<td>LumosTech MLP</td>
<td></td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
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<tr>
<td>Bright light box</td>
<td>Variable</td>
<td>Mildly interrupting</td>
<td>Possible</td>
<td>No</td>
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<tr>
<td>Chronotherapy</td>
<td>Variable</td>
<td>Strongly disrupting</td>
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<td>No</td>
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<td>Sleeping pills</td>
<td>~90%</td>
<td>No</td>
<td>Possible</td>
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<tr>
<td>Calm night activities</td>
<td>Limited</td>
<td>Mildly interrupting</td>
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<tr>
<td>Sleep diary</td>
<td>Limited</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Potential Market and Customers

• Patent not currently licensed
• FDA approval not required
• Markets: Frequent fliers and teenagers with DSPD
• Distribution channels
  o Direct to consumers
    Online and/or local distribution centers
  o Larger companies
    Airline and/or hospitality industry
• License technology to larger companies
• Kickstarter and/or Venture Funding
Where do we go now?

- Stanford Venture Studio
  - Participate in a community
  - Share space at the GSB with other Stanford entrepreneurs

- Oxbridge BioTech Roundtable OneStart Competition
  - One of 35 teams selected to contend for seed funding, lab/office space, and additional resources
Thank you!

- Dr. H Craig Heller
- Dr. Jamie Zeitzer
- Gucci J. Gu
- Vanessa Burns
- Biquan Luo
- Bruce Davis
- Evan Elder
- Grant Ognibene
- Kristin Gleitsman