# Shining a light on the nervous system to thwart disease

November 15 2017

Researchers from Case Western Reserve University School of Medicine, Vanderbilt University, and University of Pittsburgh have received a four-year, $9 million grant from the National Institutes of Health to develop enhanced infrared light technology (infrared neuromodulation) for potentially treating a variety of diseases, including cardiac arrhythmias, high and low blood pressure, asthma, sleep apnea and diarrhea, one of the leading killers of children worldwide.

Depending on the need, infrared neuromodulation can stimulate or inhibit electrical signals that alter important bodily functions (e.g., blood pressure) by targeting specific areas of the nervous system or even single nerve cells with laser precision.

The multi-disciplinary team of researchers, led by Michael W. Jenkins, PhD, assistant professor of pediatrics and biomedical engineering at Case Western Reserve University School of Medicine, will examine the effects of neuromodulation on various nerve structures, including the nodose ganglion, a cluster of cells that sends and receives control signals for several organs (e.g., heart, lungs, stomach). Many of the cells in the nodose ganglion connect to these organs through the vagus nerve to manage such vital actions as heart rate, respiration, and digestion. As part of the autonomic nervous system, these physiological processes are not under direct conscious control.

"We have recently shown that infrared neuromodulation can alter blood pressure and respiration, often generating results not currently possible with electrical current or drugs," said Jenkins. "Our aim is to create a better understanding of how this process can be used for treating human diseases."

Under the grant, the researchers will develop new technologies to precisely send infrared light to nerves and ganglia in animals, watch the ensuing activity, and map the molecular components in 3D with high resolution. By delivering light to various locations, some never before assessed with this level of precision, and following resultant activity and molecular constituents of the cells, Jenkins and his colleagues expect to gain a better understanding of how infrared light blocks or induces electrical signals at the cellular level, knowledge which is crucial for treating patients in the future.

"Different parts of the nodose ganglion affect different parts of the body," said Stephen J. Lewis, PhD, professor of pediatrics at Case Western Reserve University School of Medicine and a member of the research team. "If we want to lower blood pressure, we can target one part of the ganglion with infrared light. If we want to stop diarrhea, we target the part that controls peristalsis, which pushes ingested food through the digestive tract towards its release at the anus. By slowing peristalsis down, we can stop diarrhea from taking a fatal toll on people, especially young children in less developed countries, who are particularly susceptible to death from dehydration."

In addition, as part of their efforts at better understanding how infrared neuromodulation works, the researchers will develop computational models to simulate mechanisms by which the light interacts with tissue and affects neural signaling. This will require the expertise of one of the inventors of infrared nerve modulation, E. Duco Jansen, professor of biomedical engineering at Vanderbilt University, and Hillel Chiel, professor of biology at Case Western Reserve University, who studies the biophysics of neurons and neural circuitry. These complex simulations will enable the research team to devise additional experiments to gain further insights into the underlying processes and possible future applications of infrared neuromodulation in patient care.

Provided by Case Western Reserve University

Citation: Shining a light on the nervous system to thwart disease (2017, November 15) retrieved 9 April 2024 from https://medicalxpress.com/news/2017-11-nervous-thwart-disease.html