EELLS REVEALS THE MYSTERY OF THE HEALING LIGHT

By Laura L. Hunt

Poisoning by methanol, the most common kind of industrial solvent, delivers a nasty first punch: It renders the victim blind within days. After 60 years of research, scientists know how it occurs. And thanks to Janis Eells and her collaborators, they also know what reverses the damage.

They literally shine a light on the problem.

Working with a colleague at the Medical College of Wisconsin (MCW), Eells, a neurotoxicologist in UWM's College of Health Sciences, has used near-infrared (NIR) light to heal both poison-induced blindness and other eye injuries in lab animals.

"We've known for a while that some wavelengths of light, like ultraviolet, are destructive to the human body," says Eells, a Wisconsin Distinguished Professor. "Now we are learning that there are also wavelengths that appear to be protective."

In fact, scientists also have plenty of evidence that NIR light has the power to heal soft-tissue wounds. Eells is among a relative few who are beginning to understand how it works.

Her previous 20 years of research into the biology of severe eye injuries has actually helped Eells explain the healing-light mystery. In the ocular environment, she has uncovered much about what triggers either cell death or survival – and now she's identified the role of NIR light.

"The work holds immense potential, because the harm caused by methanol is similar to the damage inflicted by aging and many neurodegenerative diseases," she says.

EYE-OPENING STUDY

In 2002, Dr. Harry Whelan at MCW shared with Eells his success with healing mouth wounds in pediatric patients using a non-invasive regimen of NIR light at a particular wavelength. Eells was initially skeptical that it could help with what was once considered permanent blindness after methanol poisoning.

But she put it to the test anyway, treating afflicted lab rats with NIR therapy, three times a day for two minutes. During the process, Eells' team recorded the signals being sent from the rats' retinas to their brains in order to gauge whether vision was normal or close to it.

Those receiving the light therapy suffered almost no vision impairment.

"I was stunned when we did it and it worked," she says. "So we did it over and over to confirm the results. They were striking."

Although FDA testing is still under way, Eells' discoveries have led the U.S. Department of Defense to purchase hand-held NIR light-emitting units for use on the battlefield to treat tissue injuries.

"She has contributed to all aspects of the study on NIR therapy, from understanding the basic process and its application, to treatment in the visual system and beyond," says Whelan, a professor of neurology, pediatrics and hyperbaric medicine at MCW. "Her work connected the dots between clinical observation and applied treatment."

Eells was a faculty member at MCW for 17 years prior to joining UWM in 2003. She has provided retinal toxicology expertise for the National Institutes of Health, Environmental Protection Agency and World Health Organization. Her work on the action of NIR light on cell survival also was featured in a recent issue of the prestigious science journal *Nature*.

LIGHT-READING

Methanol poisoning affects a part of the cell called mitochondria, which are the energy supply centers of the cell.

"But now we know that they do amazing things beyond that," says Eells. "They control the life and death of the cell. They signal the nucleus, telling the cell to die in a neat and tidy way, so it doesn't take out its neighbors at the same time."

Peter Jakubowski

Janis Eells, associate professor of Clinical Laboratory Sciences, applies near-infrared light to a tissue culture. The light, used at specific intervals, at a specific wavelength, has healing properties.

That trait alone may make mitochondria important players in the spread of cancer. But there's more. When mitochondria can no longer efficiently provide cellular energy, the stage is set for a rise in destructive "free radicals," which play a key role in aging and cancer.

So what effect does NIR light have on the mitochondria?

Like chloroplasts in plants, it now appears that mitochondria can also convert light into metabolic energy the animal cell can use.

While most visible light cannot penetrate our skin, NIR light can reach cells several centimeters down at the site of internal injuries, where it acts upon an important mitochondrial enzyme, cytochrome oxidase.

"Through this enzyme, the light gives a molecular kick to the mitochondria, telling the cell to turn on a large number of antioxidant and energy-boosting genes and proteins," she says.

Eells and partner Whelan, a UWM alumnus ('81 BS Chemistry), are now looking at whether the cause of healing with NIR light is the same in both eye injuries and soft-tissue wounds.

"We think so. But we don't know yet," says Whelan. "There maybe a similar mechanism of action occurring. But we believe that in all the medical applications benefiting from near IR light, it is the interaction of the cytochrome oxidase with the light that is the cause of the improvement."

Since first publishing on NIR therapy on methanol-induced blindness, Eells and Whelan also have written about the effects of light on cytochrome oxidase and the prevention of cell death for a whole host of other ailments. Eells believes NIR light will yield more secrets involving cell survival.

External funding organizations agree. She currently has grants to study the efficacy of NIR light in Parkinson's Disease and in retinal degeneration. She also is collaborating with UWM Assistant Professor Jeri-Annette Lyons in examining NIR light treatment for multiple sclerosis, and with UWM Professor Ann Snyder in testing it for treatment of diabetes.

"This could be a complete new paradigm in healing," says Eells. "Being involved in research that may help us understand the molecular basis of cell survival and also has clinical application is this scientist's dream come true."

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