

A heart beats to a different drummer (w/ Video)

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Love, exercise and, new research shows, an infrared laser can make a heart beat faster. Scientists at Case Western Reserve University and Vanderbilt University found that pulsed light can pace contractions in an avian embryonic heart, with no apparent damage to the tissue.

The work, "Optical pacing of the embryonic [heart](#)," will be published in the advanced online issue of [Nature Photonics](#) on Aug. 15, 2010.

According to the scientists, this non-invasive device may prove an effective tool in understanding how environmental factors that alter an embryo's heart rate lead to congenital defects. It may also lead to investigations of cardiac electrophysiology at the cellular, tissue and organ levels, and possibly the development of a new generation of pacemakers.

"The mechanisms behind many congenital defects are not well known. But, there is a suspicion that when the early embryonic heart beats slower or faster than normal, that changes gene regulation and changes development," said Michael Jenkins, a postdoctoral researcher in biomedical engineering at Case Western Reserve.

"If we can precisely control pacing, we could figure out how structure, function and [gene expression](#) all work together," said Michiko Watanabe, PhD, professor of pediatrics, genetics and anatomy at Case Western Reserve School of Medicine.

Jenkins came up with the idea to try the [infrared laser](#) on an embryonic heart. He stumbled on an obscure paper from the 1960s in which researchers found that continuous exposure to visible light accelerated the heart rate of an embryonic chicken. He also knew of the success that Eric D. "Duco" Jansen, a professor of biomedical engineering at Vanderbilt University, had using an infrared laser to stimulate nerves. He then hypothesized that pulsed infrared light may enable pacing of the [embryonic heart](#).

Case Western Reserve explained the proposed experiment to Jansen, who agreed to collaborate.

How does the laser make the heart beat?

The investigators believe a pulse of infrared light creates a temperature gradient in heart tissue that opens ion channels in a cascade along a heart cell. This effect spurs along an electrical impulse that makes the heart contract.

It's early in the research, "but we think this has exciting implications, especially if we can extend this into the adult heart," said Andrew Rollins, professor of biomedical engineering at Case Western Reserve.

Rollins' lab is now experimenting with adult heart tissue, to determine whether the laser could be used as an implantable pacemaker or to pace an adult heart during surgery or other clinical work.

Watanabe, who specializes in heart development and has studied heart conduction in the developing heart, said the findings could lead to the development of a pacemaker for a child's or baby's heart or even in utero. However, many more studies have to be done to show it would work and be safe. In a young heart, electrodes can cause damage and long term use of traditional pacemakers can lead to heart failure, she

said.

More information: [www.nature.com/nphoton/journal ...
photon.2010.166.html](http://www.nature.com/nphoton/journal...photon.2010.166.html)

Provided by Case Western Reserve University

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