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GE mice shed light on how hearts develop

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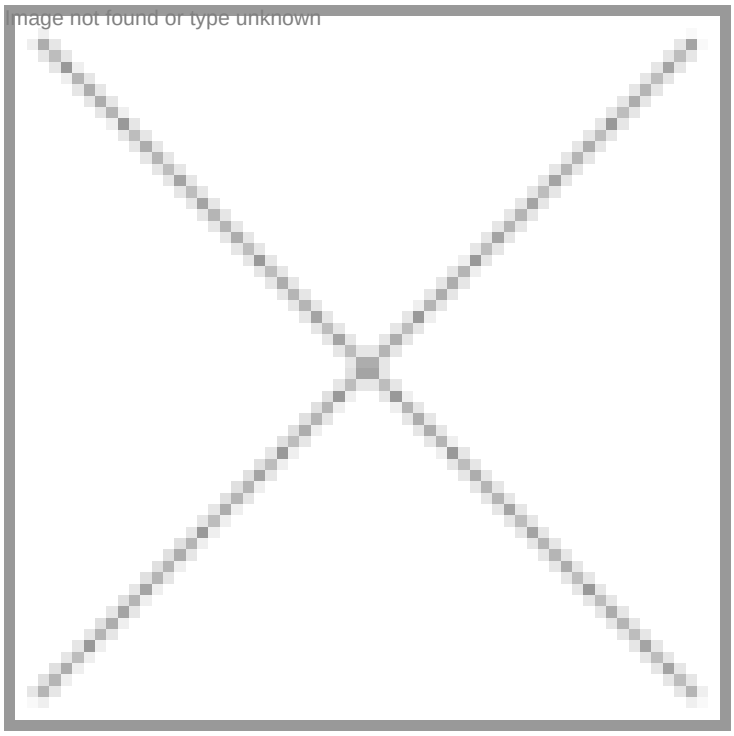

GE mice shed light on how hearts develop

Cornell researchers have genetically engineered mice whose hearts glow with a green light every time they beat. The development gives researchers insights into how hearts develop in living mouse embryos and could improve our understanding of irregular heartbeats, known as arrhythmias, as well as open doors to observing cellular processes to better understand basic physiology and disease.

Cornell researchers are breeding new lines of mice with similar proteins that target neurons in the brain, in parasympathetic nerves, in blood vessels or in Purkinje fibers, which prompt the heart's ventricles to pump. The researchers have also transplanted cells from the mice with glowing hearts into normal mice to see whether the transplanted cells function normally within the host heart, which could offer insights for heart repair.

In the study, the mouse was engineered to express a specially designed molecule that fluoresces when calcium, which increases dramatically with each muscle contraction, is released in heart cells. Co-author Junichi Nakai of the RIKEN Brain Science Institute in Wako-shi, Japan, developed the fluorescent molecule by modifying a green fluorescent protein (derived from bioluminescent jellyfish) and making it glow brightly enough to be observed in the working heart.

Calcium turns the sensor molecule off and on like a molecular switch. Greater fluorescence indicates higher calcium levels, and the sensor shows the patterns, rate and force of heart contractions.

Using this technique, the researchers were able to track the embryo's developing heart to glean insights into how the heart forms. In mammals, the heart is the first organ to function and starts beating prior to its full development.
Source: Cornell University

Gold Nanorods offer effective cancer treatment

Researchers at the Georgia In- stitute of Technology and the University of California, San Francisco, have found a more effective and safer way to detect and kill cancer cells. By changing the shapes of gold nanospheres into cylindrical gold nanorods, they can detect malignant tumors hidden deeper under the skin, like breast cancer, and selectively destroy them with lasers only half as powerful as before-without harming the healthy cells.

Last year, Mostafa El-Sayed, director of the Laser Dyanamics Laboratory and Regents' professor of chemistry at Georgia Tech and his son Ivan El-Sayed showed that gold nanoparticles coated with a cancer antibody were very effective at binding to tumor cells. When bound to the gold, the cancer cells scattered light, making it very easy to identify the noncancerous cells from the malignant ones. The nanoparticles also absorbed the laser light more easily, so that the coated malignant cells only required half the laser energy to be killed compared to the benign cells. This makes it relatively easy to ensure that only the malignant cells are being destroyed.

Many cancer cells have a protein, known as Epidermal Growth Factor Receptor (EFGR), all over their surface, while healthy cells typically do not express the protein as strongly. By conjugating, or binding, the gold nanorods to an antibody for EFGR, suitably named anti-EFGR, researchers were able to get the nanoparticles to attach themselves to the cancer cells.

In this latest study, researchers incubated two malignant oral epithelial cell lines and one benign epithelial cell lines with nanorods conjugated to anti-EFGR. Not only were the malignant lines clearly identifiable as such under a simple optical microscope, but after being exposed to a continuous sapphire laser in the near infrared spectrum, the malignant lines only required half the laser energy to kill them as the healthy cells.

Now, the scientists have discovered that by changing the spheres into rods, they can lower the frequency to which the nanoparticles respond from the visible light spectrum used by the nanospheres to the near-infrared spectrum. Since these lasers can penetrate deeper under the skin than lasers in the visible spectrum, they can reach tumors that are inaccessible to visible lasers.

Source: Georgia Institute of Technology