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Gene transfer allows mammals to produce heart-healthy fats

Study with transgenic mice could lead to omega-3-containing meats, dairy products

Researchers from Massachusetts General Hospital (MGH) have found that tissues from mice transgenic for a gene usually found in the c.elegans roundworm contain omega-3 fatty acids, consumption of which has been shown to protect against heart disease. Usually mammals cannot produce omega-3s from the more abundant omega-6 fatty acids, which do not have the health benefits of omega-3s. The finding, published in the February 5 issue of Nature, could lead to development of omega-3-rich meat, milk and eggs.

Many studies have confirmed that consumption of omega-3s can reduce the incidence and effects of cardiovascular disease for both the general public and those with existing disease. The American Heart Association currently recommends consumption of two or more weekly servings of fish, particularly fatty fish like trout and salmon, which are naturally high in omega 3s.

"Correction of the usually omega-3-deficient Western diet has become a key step toward reducing the risk of several modern diseases," says lead author Jing X. Kang, MD, PhD, of the MGH Department of Medicine. "The current approach to increasing omega-3s in animal food products is to feed livestock with fish meal or other marine products, which is time consuming, costly and limited by the availability of those feeds."

Investigating a potential novel way further to increase omega-3 consumption, the MGH researchers developed a strain of mice that have the c. elegans gene fat-1, which codes for an enzyme that converts omega-6 acids to omega-3s. The transgenic mice appeared perfectly healthy and were raised, along with normal mice, on a diet low in omega-3s.

Tissues from the transgenic mice were found to be high in omega-3 fatty acids, while the tissues from normal mice had fats primarily consisting of omega-6s, as do most mammals. The ability to transmit fat-1 into mammals without losing its effectiveness or causing any apparent harm to the transgenic animals raises the possibility of developing farm animals that naturally produce omega-3 rich food products.

"The obvious followup to our finding would be to create livestock animals transgenic for fat-1 and see if their tissues also contain omega 3s," says Kang, who is an associate professor of Medicine at Harvard Medical School. "This mouse model also will be useful in studies to further investigate impact of the omega 3/omega 6 ratio in disease prevention and treatment. Another possibility to explore would be gene

therapy to introduce fat-1 directly into human tissue."

Kang's co-authors are Jingdong Wang, MS, and Zhao Kang, MD, MGH Medicine, and Lin Wu, PhD, MGH Dermatology. The research was supported by grants from the National Cancer Institute, the American Cancer Society and the American Institute for Cancer Research.

Massachusetts General Hospital, established in 1811, is the original and largest teaching hospital of Harvard Medical School. The MGH conducts the largest hospital-based research program in the United States, with an annual research budget of more than $350 million and major research centers in AIDS, cardiovascular research, cancer, cutaneous biology, medical imaging, neurodegenerative disorders, transplantation biology and photomedicine. In 1994, MGH and Brigham and Women's Hospital joined to form Partners HealthCare System, an integrated health care delivery system comprising the two academic medical centers, specialty and community hospitals, a network of physician groups, and nonacute and home health services.

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