REGENERATIVE BIOLOGY: AXOLOTL

MORGRIDGE
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A salamander's promise for clinical treatment and disease prevention

The axolotl leaves a lasting impression. Also called the Mexican walking fish or the Mexican salamander, this gilled amphibian is native to two high altitude lakes once located in present day Mexico City, Lake Xochimilco and Lake Chalco. Its natural habitat all but gone, the axolotl is now propagated almost exclusively in scientific environments where its incredible capabilities have become the focus of some important research.

What's special about the axolotl? With exceptional cancer resistance and significant regenerative capabilities, the axolotl has drawn the interest of scientists in the regenerative biology lab of Dr. James Thomson at the Morgridge Institute for Research.

The axolotl is more than 100 times more resistant to cancer-causing agents, or carcinogens, than mammals. When treated with carcinogens, axolotls develop a tumor less than 1 percent of the time; in contrast, mice develop tumors nearly 100 percent of the time.

The axolotl, with its natural regenerative capabilities and resistance to carcinogens, provides researchers with the hope of finding therapies for the most common causes of mortality in America, vascular disease and cancer.

In addition, when the limb of an axolotl is amputated, it regenerates perfectly including the main artery. Ultimately, researchers hope that gaining a better understanding of the axolotl will lead to the prevention of, and therapies for, the number one and two causes of death in the United States: vascular disease and cancer.

The axolotl and vascular disease

The term vascular disease encompasses a variety of conditions that impair the circulatory system, including conditions that lead to loss of limb function or amputation. It is the leading cause of death in the United States. Though coronary heart disease is a common form of vascular disease, vascular disease is also a complicating factor of many other diseases such as diabetes.

In coronary heart disease, stents and coronary bypass surgery are typically used to treat arteries blocked by plaque. Bypass surgery consists of using an artery or vein from some other part of the body and transplanting it near the heart, leaving a part of the body (the "donating" region) missing an artery or vein. Given the limitations of this procedure—including damage to the donating region and the limited number of arteries or veins that can be used per individual—the goal is to develop an alternative to bypass surgery. By studying the molecular and cellular basis of artery regrowth in the axolotl, the regenerative biology team intends to develop synthetic arteries grown from the patient's own cells and alleviate the suffering caused by a variety of vascular diseases. Though growing patient-specific arteries will be a challenge, the axolotl provides a fascinating and powerful model of instruction.

The axolotl and cancer

The American Cancer Society reports that half of all men and one-third of all women in the United States will develop cancer. While certain types of cancer run in families, most cancers do not have clear genetic links. In many cases, carcinogens found in the environment are the cause of cancer. The regenerative biology team is investigating the molecular basis of the axolotl's cancer resistance with the goal of applying this knowledge to the development of cancer therapies and cancer prevention.

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