AMPHIBIAN CONTRIBUTIONS TO SCIENCE

Dr. Vic Eichler, BU1850

Demonstration of Nerve Conduction and Muscle Contraction

The Italian physician Luigi Galvani (1737-1798) discovered what he called "animal electricity"—a clue to the relationship between living tissue and electricity—using a frog whose leg muscle would twitch when touched with a charged metal knife. This led to the first understanding of how nerves conduct electrical impulses causing muscles to contract.

On 1 February 2000, the Maldive Islands issued a stamp as part of a sheet of 17 commemorating the millennium and showing images of Galvani overlain by a frog, crediting both the scientist and the animal subject that proved so valuable to his findings.

Galvani & Frog
Maldive Islands Sc#2421q

Creation of the First Electric Storage Battery

Volta
Italy Sc#191

Another Italian, Alessandro Volta (1745-1827), expanded on the work of Galvani. Volta, with a background in chemistry and physics, used Galvani's studies with frogs to show that the current of "animal electricity" that had Galvani described came from the action of chemicals in the frog's leg muscle.

These findings led to the discovery of the principles of the battery that stores electrical energy. How many things do you own that use a battery? Think of your car, flashlight, wristwatch, iPhone, camera, or hundreds of other things where you live or work.

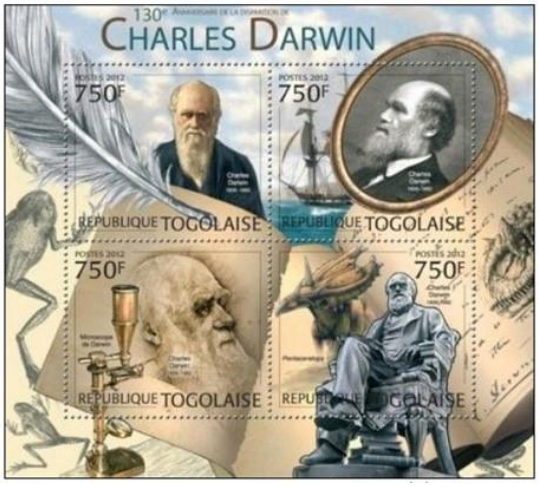
In 1927, Italy issued a set of four stamps (Sc#188–91) with denominations 20c, 50c, 60c, and 1.25 lira to commemorate the centenary of Volta's death.

Formulation of Evolutionary Theory

Charles Darwin (1809-1882) abandoned intended careers first in the ministry, and then in medicine, to become one of the foremost English naturalists. During his five year voyage on the HMS *Beagle*, he studied geology, paleontology, and invertebrate and vertebrate biology.

He was able to document what he later called the process of "Natural Selection" that indicates that life forms gradually change in succeeding generations from common ancestors to support characteristics that enable life forms to succeed as the environment changes. This explanation is a universal tenet in modern sciences.

Many countries have issued stamps honoring Darwin and his contribution to modern scientific thought. On 11 October 2012, Togo issued a MS of four and SS of one to commemorate the 130th anniversary of Darwin's death containing images of frogs.

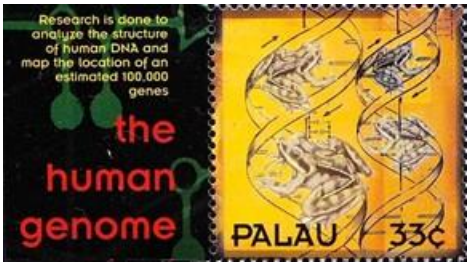


Charles Darwin
Togo Mi#4523–26

Human Genome Project

In an effort to begin identifying areas of the human genetic material that may be altered to prevent disease or illnesses, an international team of researchers launched an effort to map all the genes on human chromosomes. The project was completed in 2003.

From the very beginning of DNA studies, frogs have been involved. On 10 May 2000, Palau issued four MS of five stamps and two SS of one for medical advances. One MS stamp shows the intimate relationship of frogs and the DNA double helix structure.



Human Genome Project
Palau Sc#560e

Cutaneous Breathing Aquatic Frog

Lake Titicaca Frog
Peru Sc#1516d

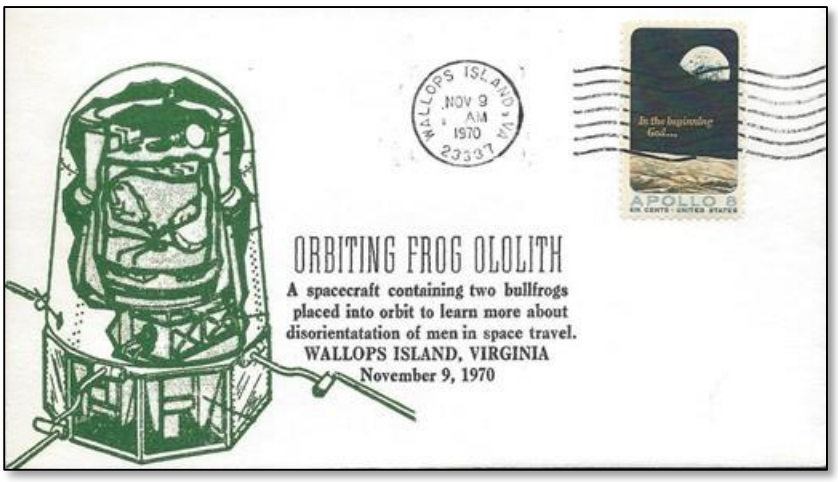
Jacques Cousteau (1910-1997) was a French underwater explorer, researcher, conservationist, and inventor of the Self-Contained Underwater Breathing Apparatus (SCUBA). In 1973 he explored Lake Titicaca, a mountain lake located between Peru and Bolivia in an unsuccessful search for Inca treasure.

What he did find instead was a colony of thousands of huge frogs with skin so loose and baggy that their size was even exaggerated. With very tiny lungs, the frogs depend on cutaneous respiration, using the extended folds of skin as a secondary respiratory tissue.

On 2 May 2006, Peru issued a block of four stamps with label to commemorate the fauna of Lake Titicaca. One stamp shows the famous Lake Titicaca Frog (*Telmatobius culeus*).

Frogs in Space

In 1970, at the dawning of extended space exploration, there was a need to understand how the granules (called otoliths) in the inner ears of vertebrates upon which our orientation on earth depends, are affected by the weightless environment of space. This was an important consideration for NASA scientists because of planned extended space flights.



Two large bullfrogs were sent aloft in a rocket and their responses to weightlessness and acceleration were studied via implanted electrodes. Findings from this project contributed to the California-based Vestibular Research Facility that assists in preparing astronauts for future flights without becoming disoriented. A cacheted first-day cover illustrating the experimental design is shown above.

20th Century Advances in Science and Medicine

Frogs have been so important in basic medical research that almost ten percent of all Nobel Prizes in Medicine and Physiology have utilized frogs. Most recently at this writing, the 2012 award by the Nobel Prize committee selected two investigators "for the discovery that mature cells (of frogs) can be reprogrammed to become pluripotent."

This research is a step toward discovering the nature of stem cells. In recognition of the great advances made in basic science and medicine, Palau issued a MS of five stamps on this subject.

Advances in Science & Medicine
Palau Sc#560