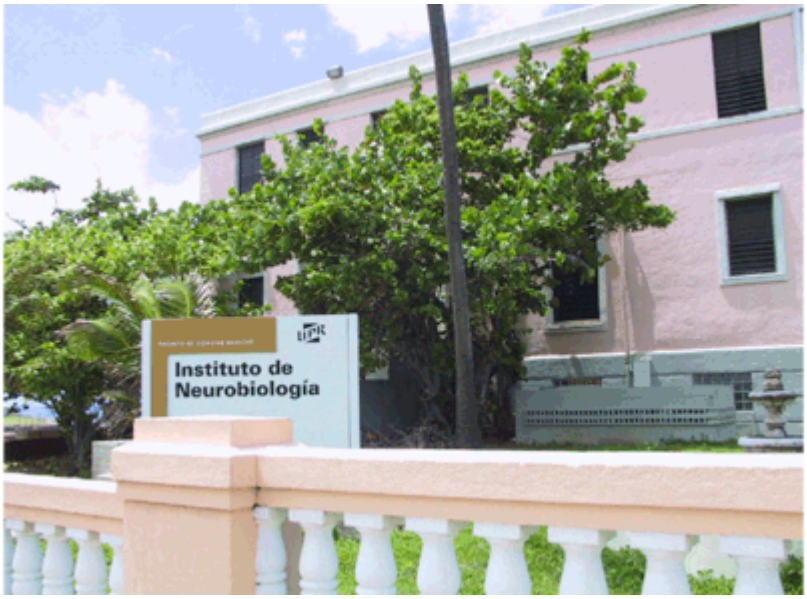
Pushing the boundaries of neurobiology: The Puerto Rico Center for Environmental Neuroscience [1]

Submitted by Mónica Ivelisse Feliú-Mójer [2] on 19 November 2012 - 10:42am



[3]

Located in historic Old San Juan, the Institute of Neurobiology has established the Puerto Rico Center for Environmental Neuroscience, becoming a pioneer in this emerging field.

Every organism, from flies to humans, experiences their surroundings through the nervous system. The senses, specialized parts of that nervous system, allow organisms to explore and respond to an ever-changing environment. The ability to interact with, respond and adapt to an environment and its changes is a key feature for any organism's survival.

The environment can positively or negatively impact an organism's nervous system. For example, the experiences we have help our brains refine their synaptic connections, strengthening important and frequently used ones while eliminating the ones we don't need. This phenomenon, known as synaptic plasticity [4], is one of the mechanisms behind learning and memory. On the other hand, environmental factors can have deleterious effects in the

development and function of our brains. Bisphenol A (BPA) [5] is an organic compound that was commonly used to make plastic objects like baby bottles. In July 2012 the Food and Drug Administration (FDA) banned the use of BPA in the manufacturing of baby bottles and sippy cups the United States [6] because it was shown to have adverse effects on brain development, behavior and learning in laboratory animals. Although the FDA says it still needs more studies [7] to understand how BPA affects the human nervous system, the results from laboratory animals were enough to raise concerns and lead to a ban.

As human activities keep altering the environment, it is important to understand how those environmental changes affect our ecosystems and the organisms living in them. Particularly, it is important to understand how those changes affect the interface between an organism and its environment: the nervous system.

That is precisely the purpose of a new research entity administratively centered at the University of Puerto Rico's prestigious Institute of Neurobiology [8] in Old San Juan and partnering with the Environmental Sciences Department at the Río Piedras Campus. The Puerto Rico Center for Environmental Neuroscience (PRCEN) [9] uses a multidisciplinary approach "to understand the complex interplay of molecular, cellular, organismal, and ecosystem dynamics faced by organisms under the increasingly stressful conditions created by human impacts on the environment," explained the director of the Institute of Neurobiology, Dr. Steve Treistman.

The Center brings together a multi-disciplinary team of biologists, neuroscientists, chemists and environmental scientists, among others, to push the boundaries of science and create new areas of research and discovery. By combining state-of-the-art cellular, molecular, physiological, and behavioral neuroscience techniques with a vast expertise in local tropical ecosystems and environmental science, researchers at the PRCEN will be true pioneers in the understanding of how anthropogenic impacts on the environment affect the function of the nervous system.

Currently, the PRCEN is focusing on the study of four interconnected Puerto Rican ecosystems: terrestrial habitats, freshwater rivers, estuaries, and marine systems. The terrestrial project [10], mostly taking place in El Yunque [11], seeks to understand how the nervous system of the *Drosophila* fruit fly captured in the wild responds to environmental stressors (like different temperatures) in different ecosystems. In the freshwater rivers project [12] scientists will study how different contaminants (like sewage water and heavy metals) affect the escape reflex (a response extremely important for survival) in two species of fish and two species of crustaceans in three rivers in Puerto Rico.

Moving down from the mountain towards the coast, the team of scientists looking at the estuary ecosystem [13] will study the effects of pollutants such as BPA in the heart and neuroendocrine system of the blue crab [14], known by some in Puerto Rico as *cocolía*.

Finally, the marine project [15] is designed to understand the consequences of environmental pressures on tropical corals. While the neuroscience connection may not be as obvious, the fact is that corals have a very simple nervous system that can sense certain chemicals to detect prey. Also, many elements of nervous system function, such as the operation of transmembrane ion pumps (which are key for the generation of neural electrical signals [16]), play a critical role in the function and dysfunction of corals and their symbiotic algae. Coral reefs, the calcium carbonate

structures formed by corals, are one of the most important ecosystems in our planet and a critical source of habitat, food, economic activity and potential biomedical tools and treatments.

The PRCEN will not only bring together some of Puerto Rico's finest scientists, but it will count on the expertise of collaborators [17] at several institutions [18] in the United States. Ultimately, Dr. Treistman and his colleagues hope that the PRCEN "will change the way we look at environmental problems, and will create a new category of scientists prepared for the environmental challenges developing from human activities." The Center also understands that their research doesn't happen in a vacuum, and that it is important to involve local communities in their work. For this purpose the PRCEN is collaborating with organizations such as the San Juan Bay Estuary Program [19] to do community outreach with local K-12 schools.

If you want to learn more about the Puerto Rico Center for Environmental Neuroscience, one the first places in the world to study this emerging field of science, you can visit their website [20]. If you are a student interested in research at the intersection between brain and environmental sciences, there are undergraduate and graduate research opportunities available [21]. You could become part of this team of pioneers!

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