

## Cell Biology under the Puerto Rican Sun

Located in the northeastern Caribbean Sea, the island of Puerto Rico is neighbored on the east by the Dominican Republic and on the west by the Virgin Islands. The Caribbean Islands are composed of approximately 40 independent island-countries and dependencies with approximately 40 million inhabitants. Puerto Rico has approximately 4 million residents on an island stretching 100 (east to west) by 35 (north to south) miles.

### Major Academic Research Institutions

Puerto Rican public and private colleges enroll approximately 210,000 students per year. The University of Puerto Rico (UPR) system ([www.upr.edu](http://www.upr.edu)) has 11 campuses with enrollment estimated at 65,000 students. Most of the research activities take place in Mayagüez (UPRM; [www.uprm.edu](http://www.uprm.edu)), Río Piedras ([www.rrp.upr.edu](http://www.rrp.upr.edu)), and the Medical Sciences Campus ([www.rcm.upr.edu](http://www.rcm.upr.edu)). The Cayey ([www.cayey.upr.edu](http://www.cayey.upr.edu)) and Humacao ([www.upr.clu.edu](http://cuhttp://www.upr.clu.edu)) campuses also provide comprehensive four-year liberal arts educational programs with some research activities. Cell biology research activities are also carried out at private institutions such as Ponce School of Medicine (PSM; [www.psm.edu](http://www.psm.edu)) and the Universidad Central del Caribe (UCC; [www.uccaribe.edu](http://www.uccaribe.edu)).

### Funding, Collaborations, and Government Relations

Despite its privileged location at the heart of the Caribbean, much of the scientific exchange in Puerto Rico takes place with U.S. mainland institutions. Perhaps this is dictated by available funding from federal government agencies. Puerto Rico has access to National Institutes of Health (NIH), National Science Foundation (NSF), and Department of Defense funding, just like any institution in the U.S. mainland. Puerto Rican scientists have been increasingly successful at attracting research funding. To further encourage competitive researchers to apply to mainstream research opportunities in the U.S., the government of Puerto Rico passed the “Law for the Development of the

Knowledge-Based Economy in Puerto Rico” in 2008. Among other things, this law provides a tax incentive for salary portions from eligible research funding (research that is open to all). Scientists are anxiously waiting for its implementation, which is dependent on Puerto Rican authorities.

In 2004, another law created the Puerto Rico Science and Technology Trust, which has been focusing its funding priorities on the development of biotechnology start-up companies. One such example is Custom-Designed Immunologics (CDI; [www.cdi-lab.com](http://www.cdi-lab.com)). CDI developed and validated a proprietary platform for the production of monoclonal antibodies against proprietary antigens. This company operates within the Bioprocess Development and Training Complex (BDTC; [www.bdtp-pr.com](http://www.bdtp-pr.com)). This facility is a collaboration among industry, government, and academia to enhance Puerto Rico’s capability in biotechnology manufacturing, research, and bioprocess training. A partnership between PSM and Johns Hopkins University is providing funding for graduate students in Ponce to receive cutting-edge training at the BDTC in antibody production. Other large-scale partnerships between Puerto Rican and mainland institutions, such as the U56 PSM–Moffitt Cancer Center and the U54 UPRMSC–MD Anderson Cancer Center, are at the leading edge of collaborative efforts. These provide well-structured support to accomplish larger long-term goals.

### Premier Education for U.S. Minority Scientists

By federal standards, Puerto Ricans are considered underrepresented minorities in the sciences. As such, the Puerto Rican scientific community is committed to train the next generation of minority scientists at all levels, from undergraduate to graduate levels. As part of that commitment, the Department of Biology at UPRM has funding support from NSF’s Course, Curriculum, and Laboratory Improvement program and the Howard Hughes Medical Institute to bring innovative cell



biology research activities to the cell biology teaching laboratory. The department has 1,200 students enrolled, and these large-scale projects are expected to increase students' research skills. At the same time, the heavy teaching load imposes a burden on scientists; they need to excel in education as well as develop a competitive research program.

While the majority of Puerto Rican undergraduates go to medical school and graduate programs in the U.S. mainland, a new opportunity may help change that trend. Starting in August 2010, the UCC is starting a PhD degree in cell and molecular biology. Other sources of support are private institutions, foundations, and societies.

For instance, support from the ASCB's NIH Minority Access to Research Careers grant-funded Linkage Fellow program has greatly contributed to the promotion of cell biology in Puerto Rico. It also supported increased opportunities available in the field. The grant currently funds two Linkage Fellows, one at a public and one at a private institution. It also provides travel awards for students to present their work at the Society's Annual Meetings. The ASCB Minorities Affairs Committee administers the programs with staff support.

While we contribute to increasing the number of well-trained minority undergraduate students sought after by many institutions in the U.S., one hopes that some of these talented students return to the island after their training to contribute to the development of the scientific community. A few of us have just done that, while others have decided to stay abroad. Wherever we may be, CienciaPR ([www.cienciapr.org](http://www.cienciapr.org)) has been the premier resource devoted to facilitate the dissemination of information regarding research in Puerto Rico and how Puerto Rico contributes to the advancement of scientific knowledge.

### Challenges and Expectations

The process of scientific inquiry, in any field, requires long-term strategies, vision, and investment in human capital, resources, and infrastructure. Unfortunately, the UPR system and its administration are tied to local party politics. Thus, the continuous changes in government vision and priorities significantly slow implementation of any long-term strategies to promote research. On a smaller scale, but nevertheless with significant long-

term impact, we experience (with certain frequency) university shutdowns. Some argue that shutdowns may be regarded as part of the culture of the UPR system. Violent events in the 70s led to the implementation of a "no-confrontation" policy from the university. This means that demonstrators who decide to block access to university facilities interfere with research activities. This has resulted in significant monetary losses, in addition to other hard-to-quantify losses. These include the negative impact on students' and researchers' productivity and morale. Perhaps the "no confrontation" policy should harmoniously coexist with a "research and development" policy that guarantees unrestricted access to facilities whenever others exercise their right to demonstrate.

### Overcoming Challenges, Meeting Expectations

One may argue that the Puerto Rican scientific community has been in a privileged position to be successful. However, a generalized opinion is that we have fallen short of that goal. Then, the question is: What do we need to be successful? If we consider the following equation to be true—"Success = (Funding) × (Time) × (Resources)"—as soon as any component equals zero, we fail. Thus, the success of the Puerto Rican scientific community on the island requires local institutions to provide adequate start-up funding and enough protected time to jump-start a competitive research program.

Success also requires true collaborations with those mainland institutions that benefit from recruitment of our most valuable resource, our students. This type of collaboration will result in mutually beneficial long-term relationships by ensuring a sustained flow of highly trained students. Last, but no less important, is a long-term vision for the consistent development of the sciences in Puerto Rico that is not affected by party politics. After all, scientific inquiry should be free to produce knowledge. This is especially true because we have the talent to do so. ■

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