



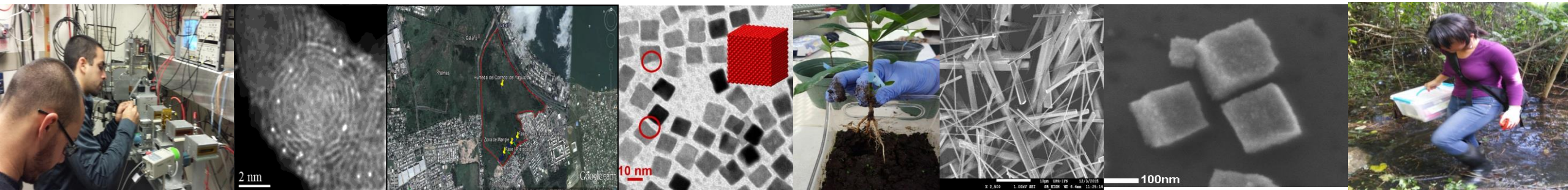
**NSF-CREST Center for Innovation, Research, and Education in  
Environmental Nanotechnology (CIRE2N)  
University of Puerto Rico, Río Piedras, Cayey and Mayagüez Campuses  
Universidad del Turabo  
NSF-CREST GRANT NUMBER HRD-1736093**

Director/ PI : Dr. Carlos Cabrera Co-Director/Co-PI Liz M. Díaz Vázquez  
CoPI: Dr. Elvira Cuevas, Dr. Luis Fonseca, Dr. Zongfang Chen



# CIRE<sup>2</sup>N mission

- Contribute to the development of a competitive STEM workforce, and strengthen the outputs of the current nanotechnologies being developed at the University of Puerto Rico, a Hispanic Serving Institution (HSI), with participants from the University of Puerto Rico, Rio Piedras, Mayagüez, and Cayey Campuses.
- Development of nanomaterials and devices to address environmental issues with the use of nanomaterials. Specifically, CIRE<sup>2</sup>N seeks to:
  - study and understand the interactions that occur when nanomaterials are utilized for the remediation of water and soil,
  - to develop nanomaterials for the adequate sensing of contaminants in the environment, and
  - to assess the capturing of contaminants for energy conversion.
- Improve Scientist science communication skills





# CIRE<sup>2</sup>N Researchers and Students



LA IUPI  
**UAPR**



CORREDOR DEL YAGUAZO INC.  
CONSERVANDO A TRAVÉS DE LA EDUCACIÓN

**caras**  
con causa

# Partners Institutions and National Laboratory

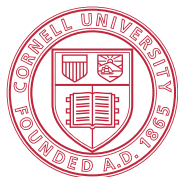
Brookhaven National Laboratory



CATEC-University of Puerto Rico



Cornell University



Cornell University

Morgan State University



Universidad de Alicante



Universitat d'Alacant  
Universidad de Alicante

Universidad de la Laguna

ULL | Universidad  
de La Laguna

University of Texas at El Paso



## IRG 1. Nanomaterials for Water and Soil Remediation

- Lead: Elvira Cuevas
- Participants: C. Cabrera, P. Carrion, Z. Chen, E. Cuevas, Liz Diaz, E. Nicolau, J.R. Ortiz, and K. Soto

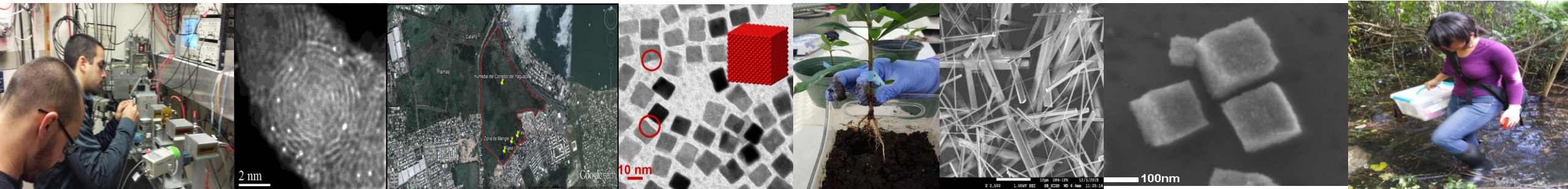
## IRG 2. Sensors for Environmental Monitoring

- Lead: Luis Fonseca
- Participants: R. Diaz, P. Feng, W. Otaño, D. Piñero

## IRG 3. Nano Materials for Energy Conversion

- Lead: Zongfang Chen
- Participants: C. Cabrera, L. Diaz-Vázquez, I. Feliciano, I. González-González

**CIRE<sup>2</sup>N RESEARCH  
AREAS**





# CIRE<sup>2</sup>N Facilities

## Molecular Science Building and Nanotechnology Facilities

- Nanoscopy Facilities
- SEM, AFM, XPS XRD, TEM



## UPR- Campus : Environmental Science & Chemistry Laboratories

- GCMS, ICP-EOS, ICPMS, Spectrophotometric Techniques
- CHONS,





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## Interventions at Contaminated sites in Marsh at Cienaga Las Cucharillas/ Corredor del Yaguazo:

Training of citizens, Workshops and orientation, test Nanotechnology developments to remediate polluted soil and water.







Ciénaga Las Cucharillas

Juana Matos

Waste Landfill

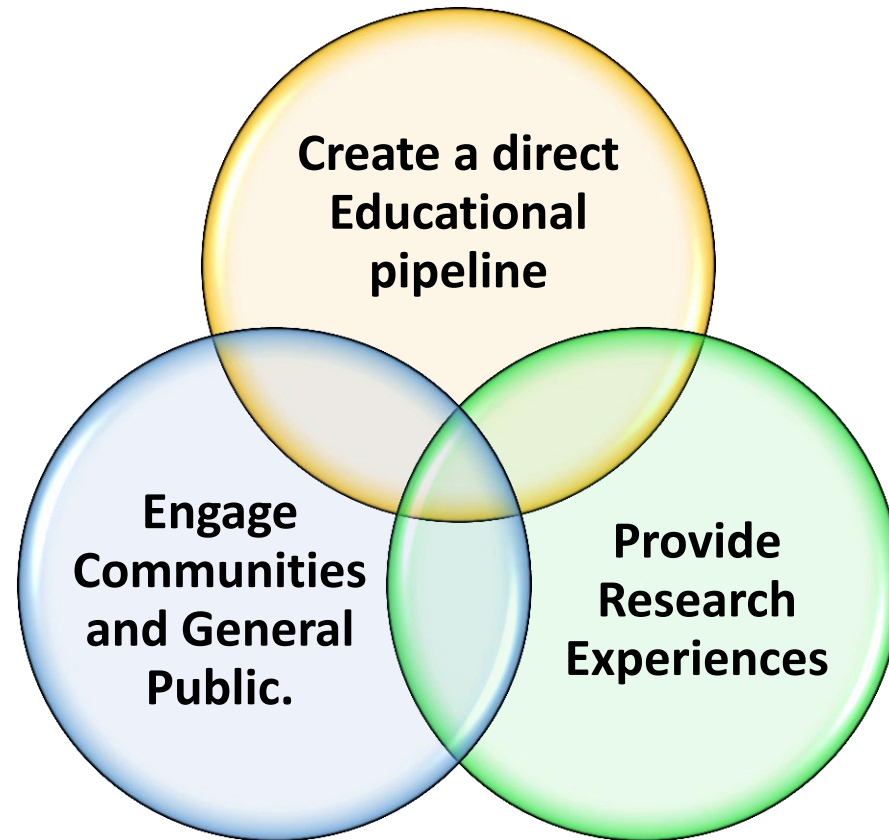
Industrial areas

Urbanized areas – all around

Puma Energy (2011-present) – Capeco (1996-2008) –  
Gulf Refinery (1955 -1995)



# Initiatives for education and STEM Training in Environmental Nanotechnology



Provide middle and high school, undergraduate, and graduate students with the necessary tools to enter into successful STEM careers including professional development and entrepreneurship.

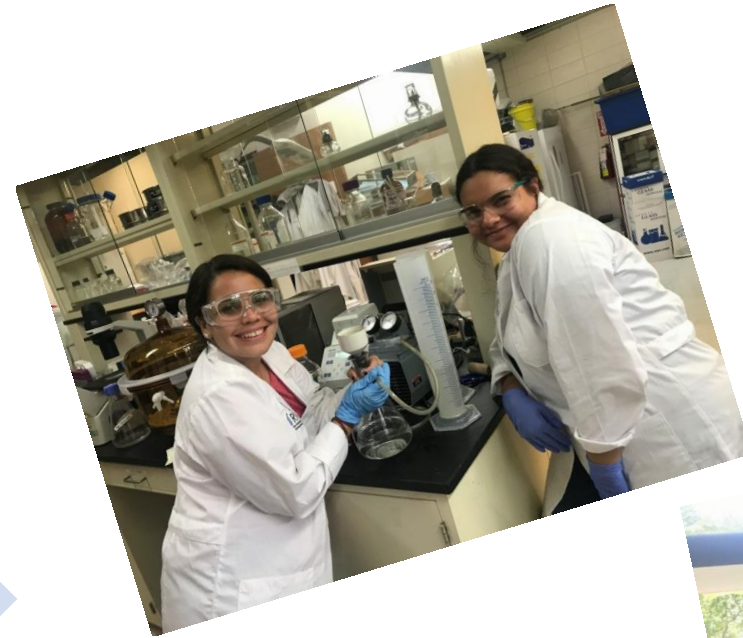
# Center Based Research Experiences:

Environmental  
Nanotechnology  
Summer Camp for  
talented high  
school students  
and their teachers

*Undergraduate  
and Graduate  
Students:*

Post doctoral  
Students and New  
Faculty

Community-based  
Participating  
Research (CBR)





# Graduate and Undergraduate Education



Research Experience ( Semester and Summer Internships)



New courses and laboratory experiences  
( Environmental Nanotechnology, Environmental Sustainability and Remediation, High Technology , Entrepreneurship)



Science Communication Training/ Outreach and Education Experiences



Professional Development Workshops, and Mentoring Program

# ***K-12 Education***

## ***1. Inclusion of inquiry-based Environmental Nanotechnology and Sustainability related science educational activities in the 6-12 curriculum.***

- CREST fellows will design educational activities related to their investigation that are aligned with the 6-12 curriculum standards in collaboration with a group of master teachers. All the educative activities will be:
  - aligned to Next Generation Science Standards
  - promote three dimensional learning
  - include environmental nanotechnology core concepts and crosscutting concepts to allow students to explore connections across the four domains of science ( Physical Science, Life Science, Earth and Space, Engineering Design);
  - provide hands on experience to build deeper understanding and allow students to apply their knowledge for the resolution of problems.

## ***2. Role model (Buddy System) program***

## ***3. Training and mentoring of , graduate students and science teachers***

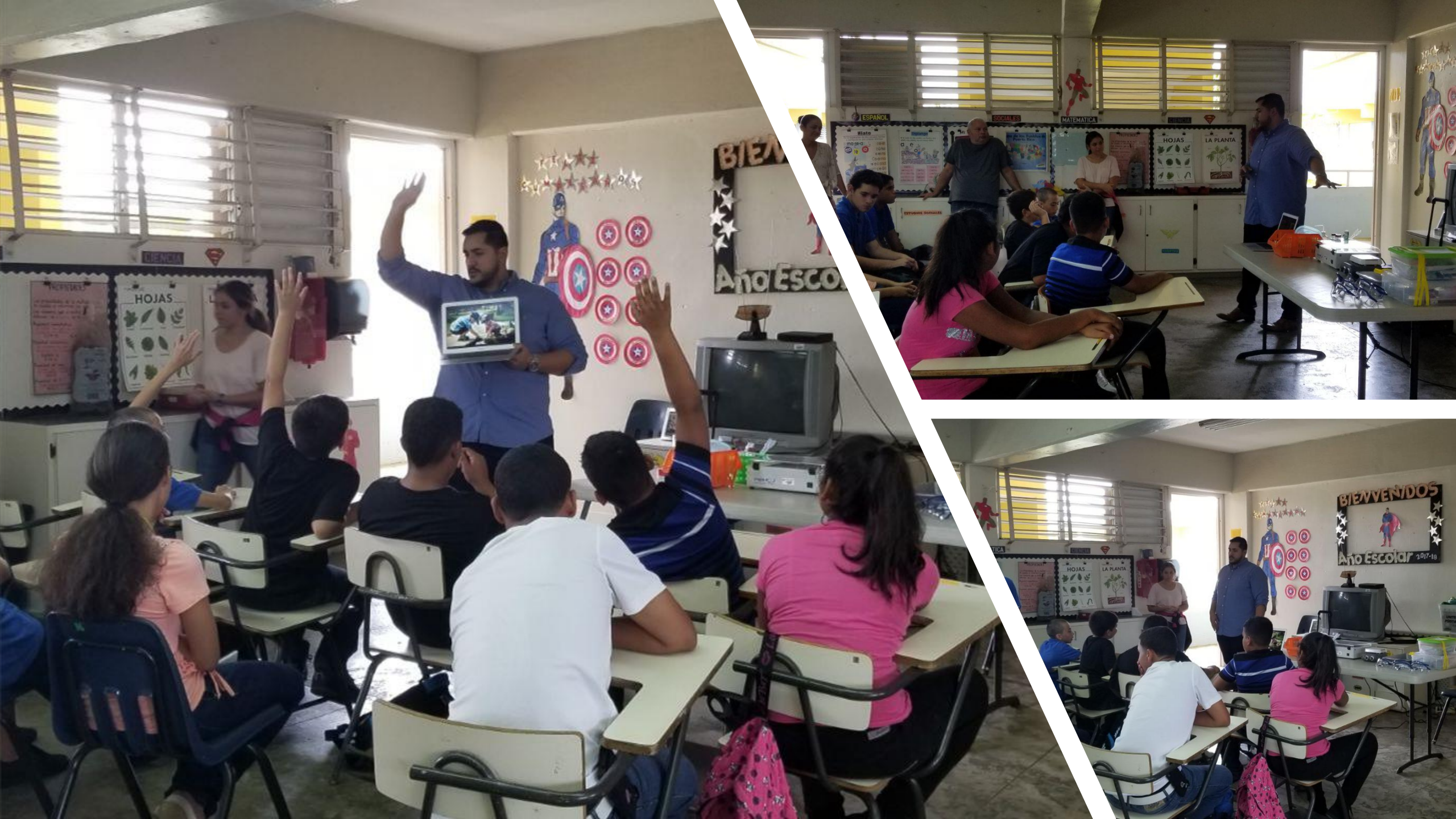






# Nano days: In-school activities







# Teacher and Students Training Nanodays



*A total of 10 public Schools participated in the Training, 149 participants*

# Guide Scientific Tours to our Research Facilities and to the *El Corredor del Yaguazo* Wetland





# Nano-Envi Summer Camp for High School Students and Teacher

- In order to promote excellence in science education at the high school level (CIRE<sup>2</sup>N) sponsors a summer research program, created specifically for high school students and teachers.
- This program allows 10 pairs of student-teacher to be trained to conduct research in the area of environmental nanotechnology in one of the laboratories of CIRE2N members during a period of 4 to 5 weeks during the summer.
- During the experience each pair of participants will develop two proposals, one of scientific research in environmental nanotechnology and a proposal to carry out an educational activity to educate in environmental nanotechnology in their respective schools or in a public forum.



# Educational Resources

- Lending Library and Web-Based Materials
- Teacher's Professional Development
- After School Programs
- Environmental Nanotechnology Discovery Center
- Summer Research Camp Program





# Outreach and Public Engagement

- The Center contributes to enhance the capabilities of the informal education community by:
  - **providing access** to CIRE<sup>2</sup>N staff, research, environmental nanotechnology, knowledge and facilities, with opportunities for informal science educators.
  - **partnerships** between the informal and formal education communities such as Museums, Malls, Community libraries and community-based organizations.
  - **Science Community Service course**
- **CIRE<sup>2</sup>N website** provide information for the general community; it includes animations and videos to educate non-scientist professionals and the general public.
- **Community-based Participating Research (CBR)**. In this initiative, the knowledge of the communities near El Yaguazo will come together with the knowledge of CIRE<sup>2</sup>N researchers and students to look for alternative directions to solve the site problems. The research questions in CBR will be defined in partnership and will be community driven

# NANODAYS- GENERAL PUBLIC- CATAÑO

*NanoDays is a national educational program festival about nano-scale science and engineering and its possible impact on the future. Our Center celebrate this festival twice a year at different location to bring our science to the general public and increase the understanding and interest in science*





# NANODAYS- MALL OF SAN JUAN



Displayed Demonstrations	24 ( 16 new demonstrations)
Participation of Volunteers	149 High school student
Total Participants	500 (2017-2018) 300 (2018-2019)



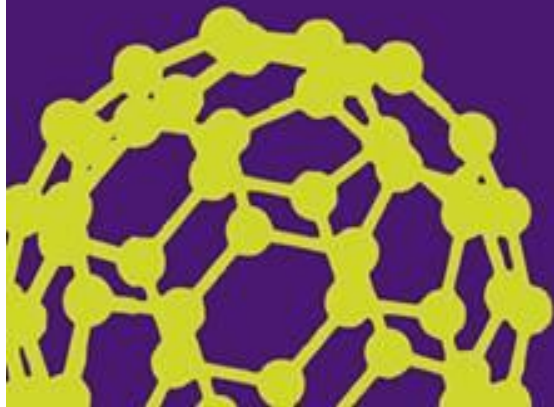
# NanoDays

The Biggest Event for the Smallest Science!

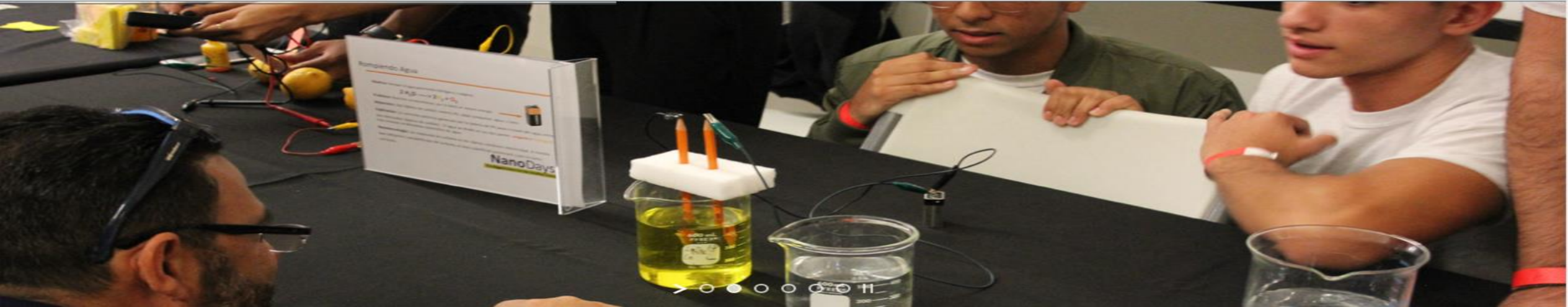
3 de Mayo de 2019

9:00am - 2:00pm

En el malecón frente a la alcaldía de Cataño







**To know more about CIRE<sup>2</sup>N research, outreach and education activities follow us in our webpage**

<http://www.cire2n.upr.edu>

**Contact us:**

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