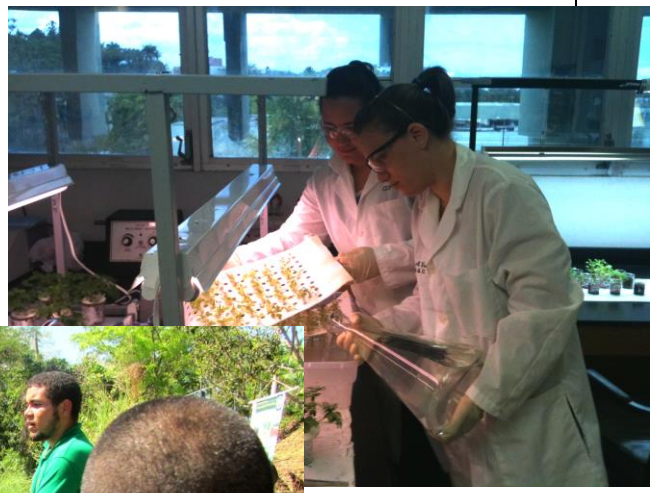
UPRM-CETARS: Interdisciplinary approach from K-12 to PhD to work in problems facing agriculture



Felix R. Roman, PD

Outline of presentation

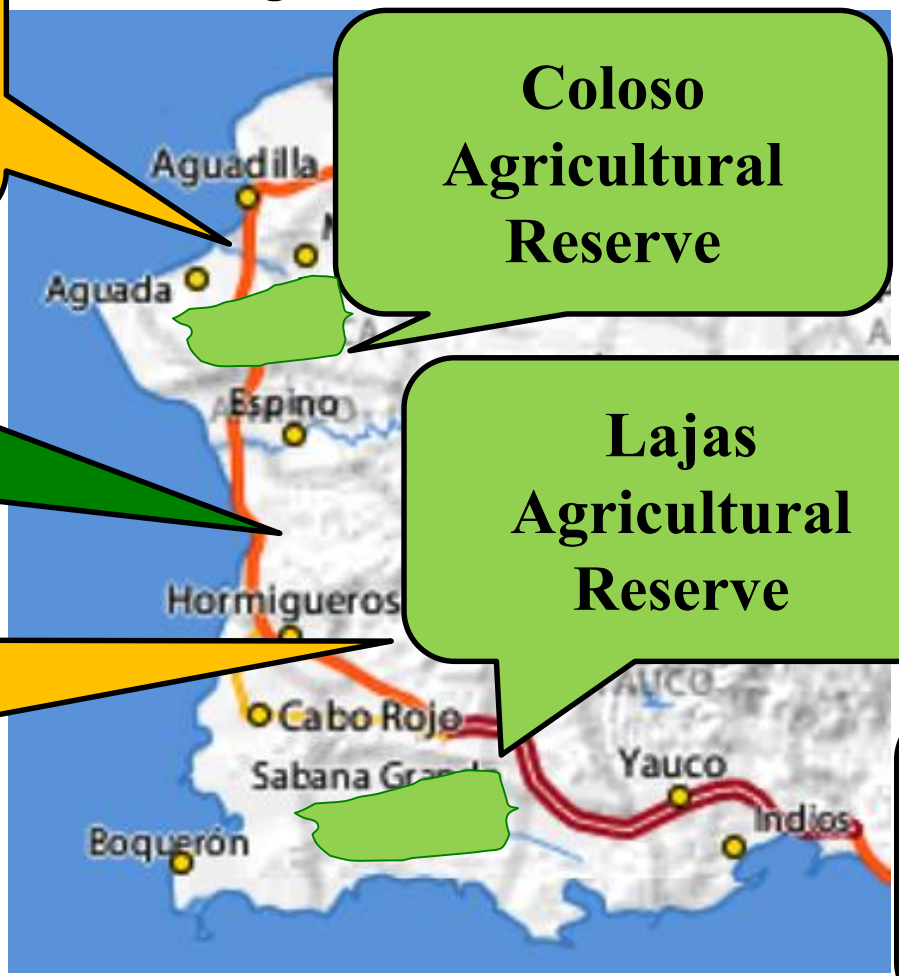
1. University of Puerto Rico at Mayaguez
2. UPRM-CETARS Goals
3. CETARS Sites
4. Organizational structure
5. Project activities
    1. Developed courses
    2. Reseach projects
    3. Intenships
    4. K-12 outreach
    5. Peermentoring (UPRA)
6. Activities implemented which were not originally proposed
7. Project outcomes and impacts

UPRM-CETARS GOALS:

1. **Strengthen** collaborative research-education between Food Science, Applied Chemistry, Crops and Environmental Sciences and Engineering Science and Materials
2. **Develop** outreach activities at participating institutions from K-12 to recruit talented students into agriculture or related sciences
3. **Increase** the participation of minority students in programs related to agricultural sciences and the protection of natural resources
4. **Enhance** the research skills of students by exposing them to experiential research-learning and community service
5. **Foster** student-centered research to solve real-life problems faced by communities, small developing agro-industries and government agencies
6. **Develop** a technical "critical mass" supporting multi-institution collaborations to solve technical problems in Puerto Rico
7. **Promote** faculty development and competitiveness in agriculture and related sciences.

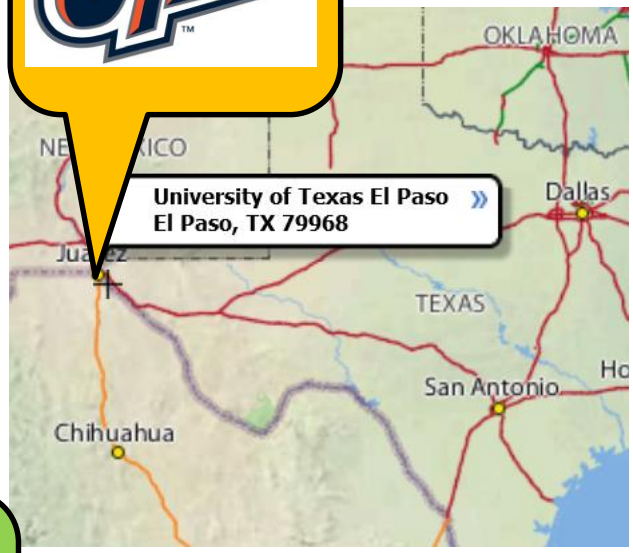
UPR-CETARS Sites:

UPRM is the only land-grant institution in Puerto Rico with a College of Agricultural Sciences!



Coloso Agricultural Reserve

Lajas Agricultural Reserve



CETARS Organizational Structure

Clerical Support
Samirah Mercado UPRM

CETARS PI: Felix R. Roman
Field: Chemistry
Role: Overall project management and supervision

Advisory Committee:
- Julio Colon. PR Dept. of Agriculture
- Karl Sodenmberg EPA-Region II Dir.
- Ing. Kevin Casey, Green Energy Recycling Inc.

Role: Asses Project performance and effectiveness. Recommend strategies and

Trust 1: Outreach
Co-Pi : W. de la Torre
Field: Agriculture
Role: Agribusiness ,K6-12, outreach and community coordinator.

T1-Senior Personnel :
J. López-UPRM, UPRM (K12)
C. Ruiz, UPRA (K9)
A. González, IAUPR (K6)
R. Tremont, UPRH (Environmental)
R. Estremera, & Lee UPRA (Chemistry)

Trust 2: Academic Enhancement
Co-Pi : O. Perales
Field: Engineering
Role: Education and research training coordinator

T2-Senior Personnel :
M.A. De Jesus, UPRM (Nano Env. Chem)
M. Suarez, UPRM (Nano Engineering)
J. Gardea, UTEP (Environmental)
Edna Negron, UPRM (Agric. Food Quality)
F. González, IAUPR (Apiculture)

Trust 3: Experiential Training
Co-Pi : M. De Jesus, J. López-Garriga
Field: Environmental, Biophysics
Role: Experiential research and development. coordinator

T3-Senior Personnel :
Martha L. Lopez, UPRM (Environmental)
Axel Vélez, IAUPR (Soil specialist)
Roberto Tremont, UPRH (Emerging technologies)
O. Perales Pérez (Engineering)

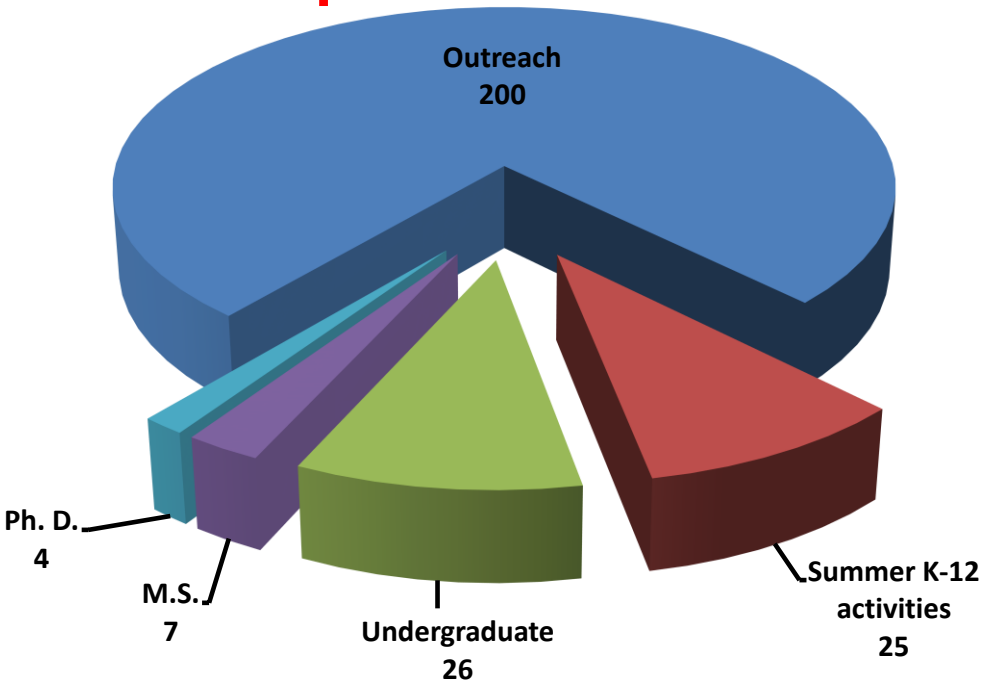
Trust 4: Liaison Office
Co-Pi : J. Gardea, M. Laura López
Field: Phytoremediation
Role: Liason with industry, agribusiness and research institutes coordinator

T4-Senior Personnel :
W. De la Torre (agriculture)
Felix R. Roman (Chemistry)
Marco. De Jesus (Chemistry)
Marcelo Suarez (Engineering)

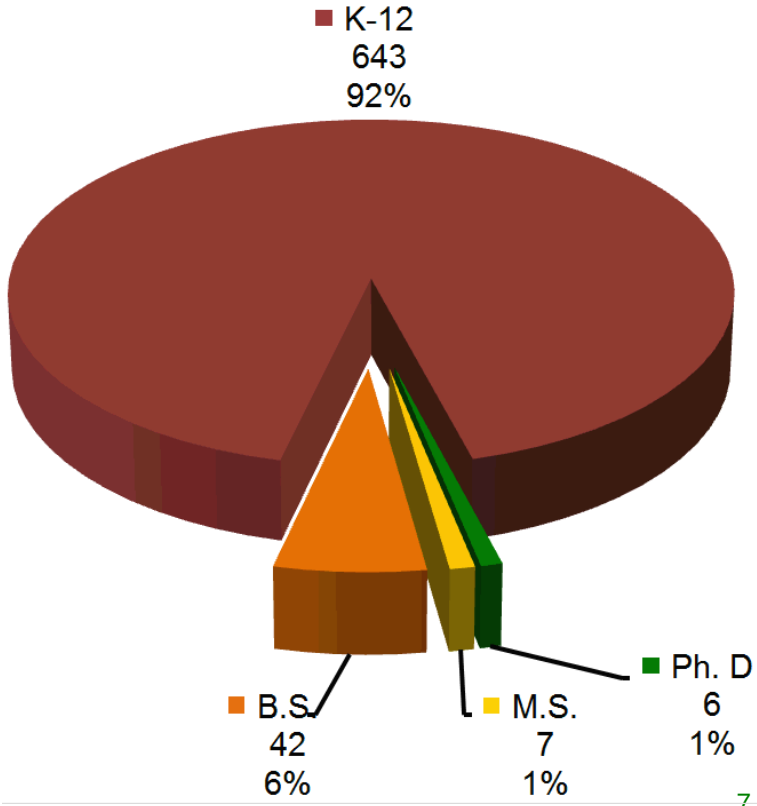
Assessment Office
Dr. Catherine Mazak, Internal
Dr. Danny Reible, External

CETARS Participation Threshold:

An academic retention of 80% was expected

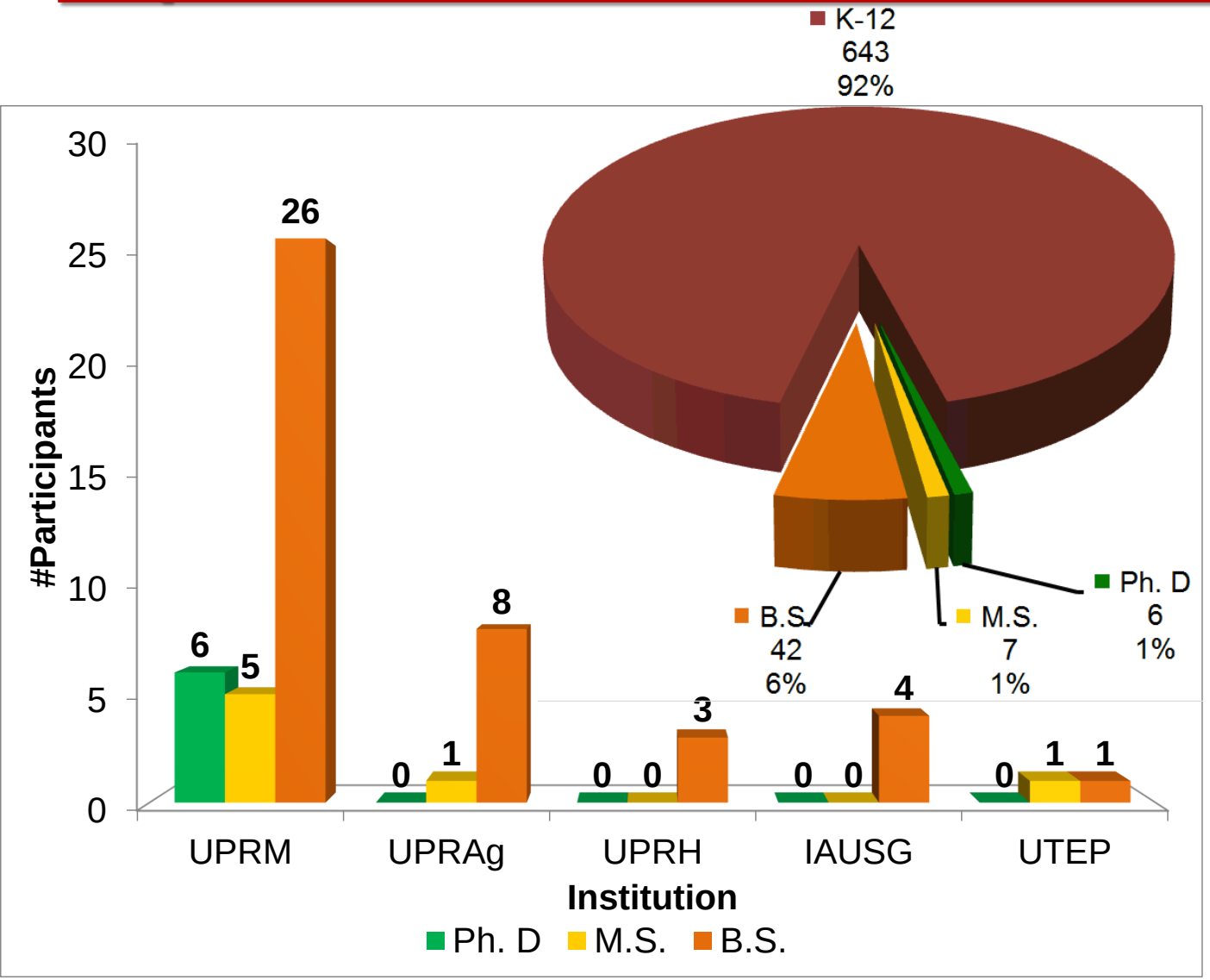


- **100% academic retention**
- **>220% Increase in outreach**
- **62% B.S. increase**
- **33% Ph.D. increase**



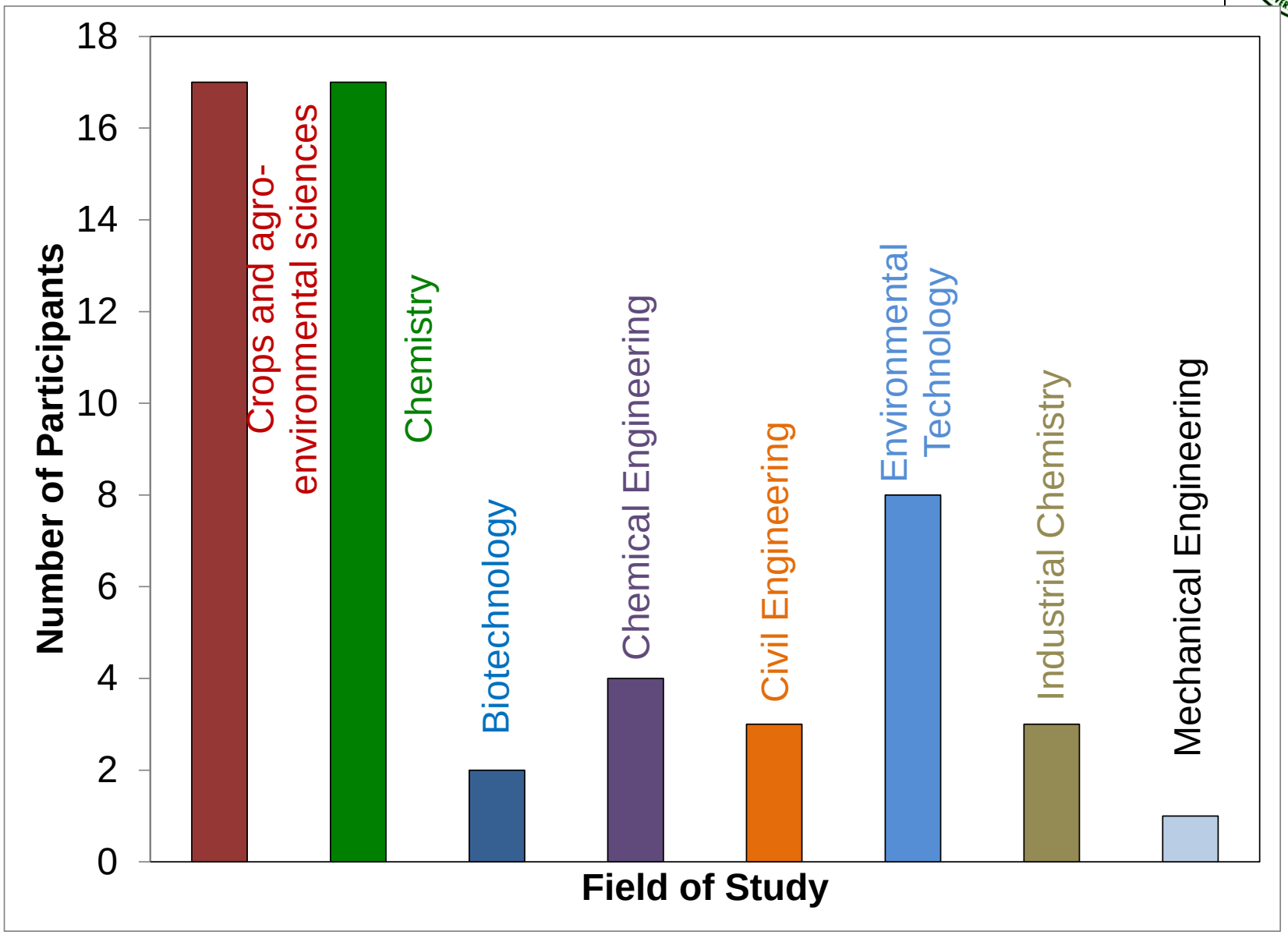
- **27% CETARS students enrolled in USDA Internships**
- **5% enrolled in NSF internships**

Impacted Students Distribution



- **100% of the participants are Hispanic**
- **69% of the B.S.-Ph.D. students are female**
- **7% of the B.S. graduates and will continue studies in USDA related fields**

Student enrollment by discipline



Studens participating Internships

- During the first year 15 CETARS students (27% of CETARS undergraduate population) have been selected to be part of internships at USDA and related agencies.
- The participating agencies/Institutions are USDA-ARS-NCAUR, USDA-NRCS, FSIS, USFS, HACU, NSF-funded programs, university programs and in the private sector.
- Additionally, three students will participate in NSF-sponsored internship activities.
- This year we have 50% of our students in are participating in internships at the above institutions.

CETARS Experiential Learning

- All the 42 CETARS undergraduate students 37 are actively involved in experiential learning activities.
- The experiential learning activities involves: (1) Special outreach activities at public schools (preparation of school vegetable gardens) in which 10 students from Agricultural Sciences are directly involved.
- Students from Arts and Science and Engineering visit other 10 K-12 publics schools to provide workshops and training in water and soils quality.
- A group of 10 students work to construct a Vegetable garden in Alzamora farm on campus for the Agricultural tour .
- All students are presently involved in Research-training.

Publications:

1- During the first two years we published 20 articles in peer review journals were of which 3 were cover pages (two at UPRM and two at UTEP)

2) One of the publication was selected as an Advancement in Engineering.

On the inside front cover, **Luis Alamo-Nole** and co-workers at the University of Puerto Rico, Mayaguez, USA, present a size-exclusion method that was developed for the separation of thiol-capped Cd(Se,S) quantum dots (QDs) synthesized in the aqueous phase, which is fast and reproducible.

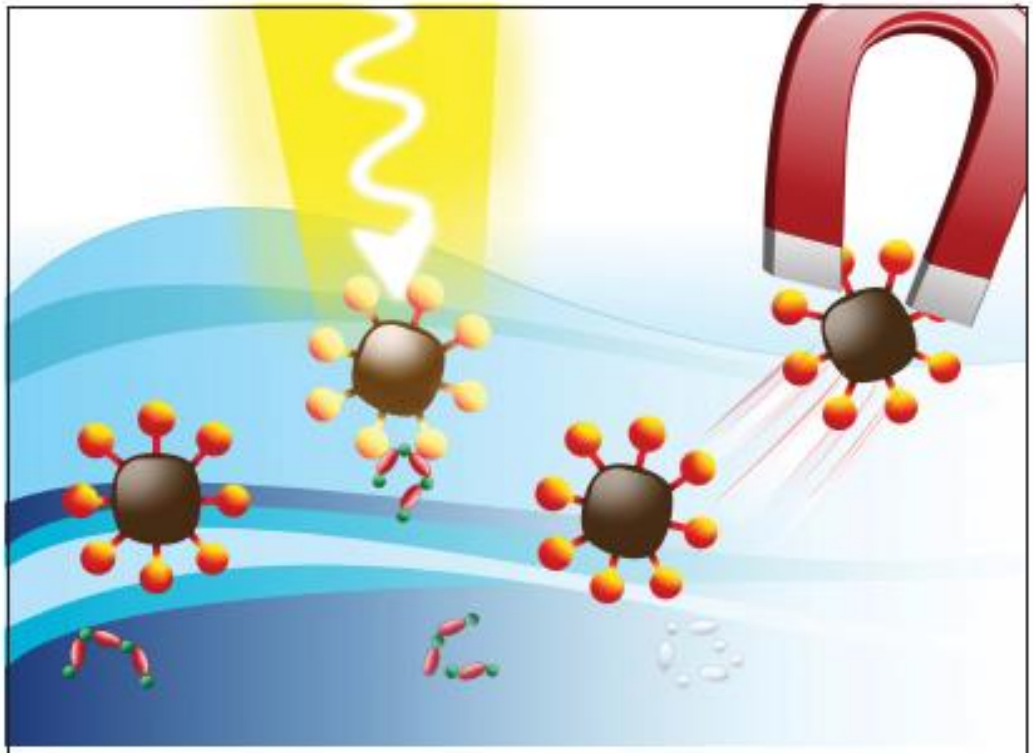
Preparative size-exclusion chromatography for separation and purification of water -stable Cd-based quantum dots

Luis Alamo-Nole, Sonia Bailon-Ruiz, Oscar Perales-Perez and Felix R. Roman
***Anal. Methods*, 2012, 4, 3127-3132**
DOI: 10.1039/C2AY25629K

http://blogs.rsc.org/ay/2012/10/03/issue-10-online-now/

RSC Publishing

PAPER
Alamo-Nole *et al.*
Preparative size-exclusion chromatography for separation and purification of water-stable Cd-based quantum dots

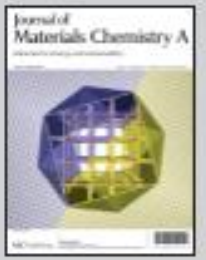


The featured work was performed at The Center for Environmental Nanotechnologies and Sustainability (CENS) of the University of Puerto Rico at Mayaguez (UPRM). Its main goal is the development of novel and affordable nanotechnology-enabled water remediation technologies.

Title: Photocatalytic activity of quantum dot–magnetite nanocomposites to degrade organic dyes in the aqueous phase

Water-stable quantum dots of Cd(Se,S) and a fluorescent magnetic nanocomposite (Cd(Se,S)–magnetite) were synthesized and evaluated as photocatalysts in the photo-degradation of methylene blue (MB). A degradation of 99.1% of MB was achieved in the presence of 160 ppm-quantum dots.

As featured in:



See L. Alamo-Nole *et al*, *J. Mater. Chem. A*, 2013, **1**, 5509.

RSC Publishing

www.rsc.org/MaterialsA

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Sorption of Triclosan onto Tyre Crumb Rubber

J. Lopez-Morales, O. Perales-Perez, F. Roman-Velazquez

Adsorption Science & Technology, Volume 30, Number 10 / December 2012

Department of Chemistry, University of Puerto Rico, Mayaguez, Puerto Rico, 00680
Department of Engineering Science and Materials, University of Puerto Rico, Mayaguez, Puerto Rico, 00680

Abstract

The effectiveness of using tyre crumb rubber (TCR) as an adsorbent for the removal of triclosan (TCS) from aqueous solutions was evaluated as a function of pH through controlled batch experiments. Carbon black (CB) and styrene-butadiene polymer (SBP), which are the main components in TCR, were individually evaluated and their contribution in the sorption process was assessed. At pH 3, the maximum rate of adsorption of TCS onto TCR, CB and SBP was 89, 95 and 92%, respectively. The Freundlich model provided the best fit for the experimental data obtained, as indicated by the mean relative percent deviation modulus (P). Our study results indicate that the removal of TCS using SBP follows an absorption process. Maximum desorption rate of TCS from TCR was approximately 89%. Results of

Project outcomes

- **The CETARS project serves a student population 55 students (42 undergraduate, 7 MS and 6 PhD in five campuses) of which 38 of the 55 are females, representing 69% of the served population of which 100% are Hispanics; Crops and agro-environmental sciences: 17, Chemistry: 17, Biotechnology 2, Chemical Engineering: 4, Civil Engineering: 3, Environmental Technology 8, Industrial Chemistry 3, Mechanical Engineering, 1. We have a 100% retention.**
- **The CETARS project has 42 undergraduate students of which all are actively involved in experiential learning activities thus representing a 100 % participation.**

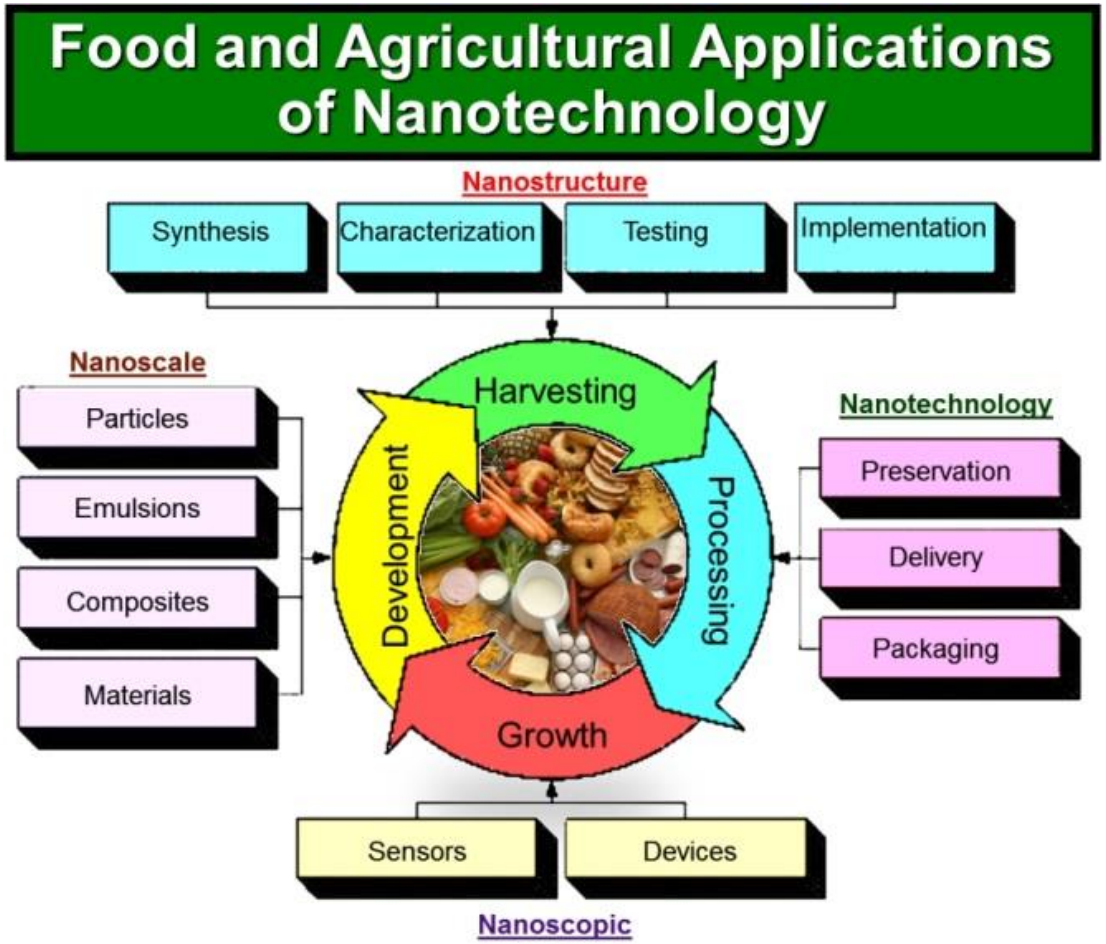
- **There are 20 publications in peer review journals publications and over 50 presentations local and national meetings. 3 cover pages.**
- **At present from 25 CETARS undergraduate students from all campuses, 44% increased their GPA after they enrolled at CETARS; 28% of the students remain with the same GPA, 20% of the students decreased their GPA, and 8% of the students are in their first year at University. The average GPA is 3.30/4.00.**
- **Two courses were offered as part of the program in the January-May 2012 semester at UPRM: CHEM 6007, 'Food and Agricultural Applications of Nanotechnology', and AGRO 4035 'Introduction to Conservation of Natural Resources.**

- **The CETARS project has proven quite a success in terms of recruiting female students from underrepresented groups (62% average participation). Around 25% of the female undergraduate and graduate students mentioned that CETARS increased their academic GPA and expertise.**
- **Over 30 K-12 schools distributed through 7 municipalities in PR where visited for a total of 643 students served.**
- **These schools where visited by UPRM outreach resources to establish a school vegetable garden and present lectures at least 10 training sessions and lectures related to crop and sustainable development. Fifteen lectures/workshops were presented per elementary school, for a total of 150 lectures.**

Degrees Awarded first year

- Tania Burgos; B.S. in Agronomy, UPRM (May 2012): Admitted at the PhD program in Soil Sciences at Ohio State Univeristy.
- Elena Flores; B.S. in Chemistry, UPRM (May 2012); Admitted at the PhD program in Applied Chemistry at UPRM.
- Wildelys Colon Jusino; B.S. Chemistry, IAUSG (May 2012); File for admission to graduate program in Florida
- Nathalie González; B.S. Chemistry, IAUSG (May 2012); File for admission to graduate program in Florida

Developing Curriculum

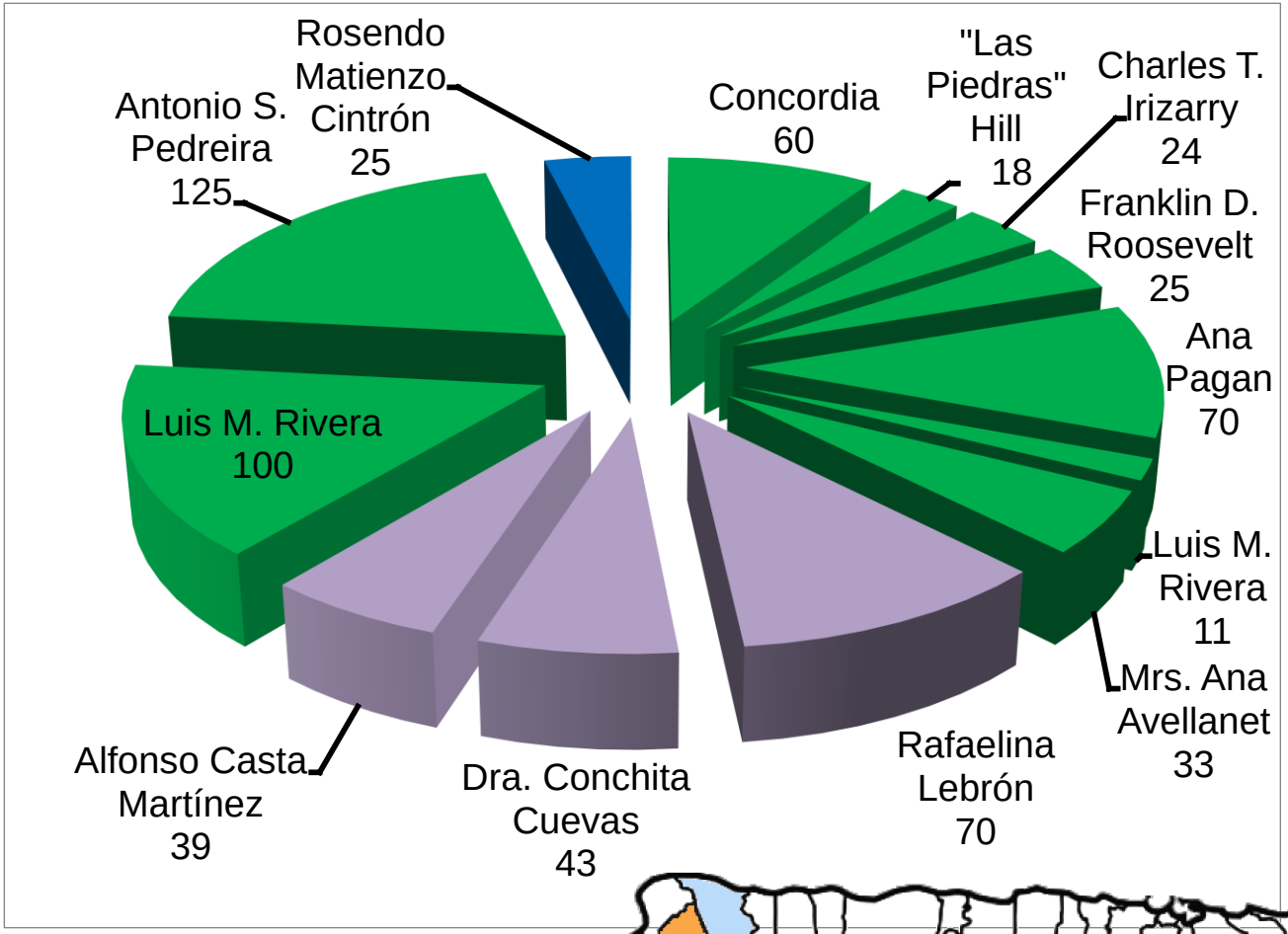


- **Two Courses where developed and implemented:**
  - ✓ **QUIM-6007 with 64% enrollment (shown)**
  - ✓ **AGRO-4035 with 94% enrollment**
  - ✓ **On education training activities the average CETARS participation was of 28%**

Activities implemented but not originally proposed

- Resume writing workshops
- Internships webinars/workshops
- CETARS lecture series
- Moodle workshop.
- Agricultural tour – 10 schools and 100 students
- Science on wheels show- 2 visitis and over 200 students participated of this activities.

Outreach Student Distribution



- **643 K-6 students from under-represented and underprivileged schools where impacted.**
- **Project impacted 8 municipalities over the PR area**
- **>99% of PR population are Hispanic and >52% female population**

UPRM
IAUSG
UPRH

Outreach and Training Activities

- **Constructions of home gardens at 10 participating public schools and weekly follow-up visits to provide educative lectures and workshops to students.**
- **Globe program outreach activity for K-12 students and teachers to measure soil and water properties and quality.**
- **Mentoring; Undergraduate and graduate students are actively participating of research and outreach activities under faculty mentorship.**
- **Food Safety workshops: 1) Food safety from farm to the table; 2) Food defense, traceability and transportation; 3) Serve safe food for food handlers; 4) Prevention on *Salmonela Enteritidis* in shell eggs during production, storage and transportation.**

OUTREACH HIGHLIGHTS UPRM

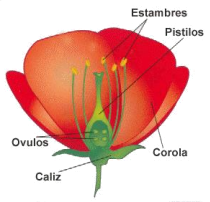
K-12 Activities at Schools

CETARS Lecture series

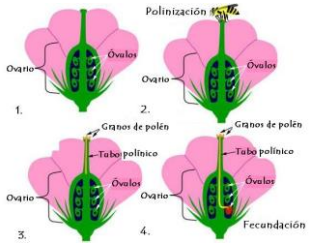
Brochures

Flor

Flor- estructura de reproducción sexual característica de las plantas y tiene el propósito de producir semillas y frutos atravez de la polinización.



Polinización- proceso de transferencia de polen de un estambre o sacos polínicos a el estigma o parte receptiva de la flor, fecundando así los óvulos haciendo posible la producción de frutos.



Frutos

Frutos- ovario maduro de una flor.

Maduración del fruto- proceso en el cual la fruta llega a su completo desarrollo. Se adquiere un determinado sabor y textura.

Recinto Universitario de Mayagüez
Universidad de Puerto Rico
Tel: (787) 832-4040

UNIVERSIDAD DE PUERTO RICO
RECINTO UNIVERSITARIO DE MAYAGUEZ
COLEGIO DE CIENCIAS AGRICOLAS

Estación # 4

Manejo de Cultivos

Activities and Achievements InterAmerican-CETARS 2011-2012

Dr. Angela González

Outreach

Develop outreach activities at participating institutions from K-12 to recruit talented students into agriculture or related sciences

- Environmental and Chemistry Demonstrations:
  - Paseo la Princesa,
  - Bellas Artes de Caguas
  - Collaboration with ACS – Puerto Rico Chapter
  - Inter American University Centennial Celebration
  - Sábana Grande – Family Biking Day
    - Collaboration with School – Luis Negrón López
- Demonstrations impacted aprox. 300 individuals/students

Outreach

Professional development

Name Event/Location Description	Number served by the activity
Research Activities Conducted at the Center for Environmental Nanotechnology and Sustainability Dr. Félix Román, UPRM	30
Nanotechnology, nanomedicine, bio-nano/ agro - nanotecnology... what else? Dr. Oscar Perales, UPRM	30
Graduate School Environmental Science Program (FIU) *Advanced oxidation of Naturally Occurring Toxins* Dr. Kevin O'shea, FIU	30
USDA Internships Webinar USDA	5
Resume Workshop Dr. Kevin Carroll, UPRM	20
Ciencia y Tecnología: El uso de la teledetección en estudios Ambientales Dra. Aurora Justiniano, IAU-SG	33
Green Chemistry Dr. Angela Gonzalez, IAU-SG	61
Wastewater Analysis Workshop EPA – RUM	~50

Professional development

Public and Community Service

Activities and Achievements UPRH-CETARS 2011-2012

Dr. Rolando Tremont

Activity	objectives	results
Meeting with faculty researchers from the Department of Natural Sciences. November, 2011.	Presentation of the CETARS proposal.	three researchers are participating in the proposal CETARS-UPRH: Dr. Mirna Rivera Claudio Dr. Ileana Rodríguez Prof. Jorge Castillo Dr. Rolando J. Tremont (Co-PD)
I requested that the Environmental Chemistry course, semester January-May 2012, had two laboratory sections.	This is part of the objectives of the proposal, expand the offering of this course to more students.	Two sections of Environmental Chemistry Laboratory are being offered in the semester January-May 2012. The evidence is in the course offerings of the Department of Chemistry.
Meeting with High school Teachers of East area of Puerto Rico. January, 2012.	Presentation of the CETARS Proposal	They represent several high school. They pledged to recruit students to participate in summer activities of CETARS-UPRH.
High school student (grade 12) doing research in my lab.	Training in laboratory techniques and learning methods of electrochemical analysis.	Collaboration in the study of heavy metals in soils of Vieques island.

Activity	Title	results
Seminar for high school students: School: Rafaelina Lebrón Flores, Patillas, PR. May 2, 2012	Global warming	70 students and 6 teachers impacted
Seminar for high school students: School: Dra. Conchita Cuevas, Gurabo, PR. March 28, 2012	Alternative energy sources.	43 students and 8 teachers impacted
Seminar for high school students: School: Escuela Superior Alfonso Casta Martínez, Maunabo, PR. March 26, 2012	Consecuences of excesive use of non renewable energy sources	39 students and 5 teachers impacted

Students in undergraduate research

Researcher	Student	Period
Mirna Rivera Claudio	Adriana Oliveras Cabrera (Chemistry)	January-May 2012 And Summer 2012
Ileana Rodríguez Vélez	Diana Medina (Microbiology)	January-May 2012 And Summer 2012
Rolando Tremont	Verónica Ramírez (Chemistry)	January-May 2012 And Summer 2012
	Natalia Olmeda (Chemistry)	Summer 2012
	Kiara Velázquez (Chemistry)	Summer 2012

Activities in Summer 2012

Activity	Population	Calendar, date and place
Workshop of agricultural sciences and environmental sciences.	High School Students (Grades 10, 11 and 12): 40 students	Group 1: June 11-15, 2012 Group 2: June 18-22, 2012 Group 3: June25-29, 2012 Department of Chemistry, UPR-Humacao.
Workshop of agricultural sciences and environmental sciences.	High school teachers: 13 teachers.	July 2-6, 2012 Department of Chemistry, UPR-Humacao.
Scientific research of several researchers with undergraduate Students.	Dr. Mirna Rivera Claudio Dr. Ileana Rodríguez Vélez Dr. Rolando Tremont	June-July, 2012 Department of Chemistry, UPR-Humacao.
Assistance Workshop offered by experts from EPA.	Students: Adriana Oliveras Cabrera, Diana Medina, Verónica Ramírez, and Natalia Olmeda. Researchers: Dr. Ileana Rodríguez and Dr. Rolando Tremont	UPR-Mayaguez, July 9-13, 2012

Desimination Activities

PROJECT SUMMARY

Project Achievements

- The CETARS project serves a student population:
  - 55 students (42 undergraduate, 7 MS and 6 PhD in five campuses)
    - of which 38 of the 55 are females, representing 69% of the served population of which 100% are Hispanics;
    - Crops and agro-environmental sciences: 17, Chemistry: 17, Biotechnology 2, Chemical Engineering: 4, Civil Engineering: 3, Environmental Technology 8, Industrial Chemistry 3, Mechanical Engineering, 1.
    - We have a 100% retention.
- The CETARS project has 42 undergraduate students of which 37 are actively involved in experiential learning activities thus representing a 88% involvement.
- 5 publications in peer review journals publications and 23 presentations in meetings.

Student Academic Profile

- 44% increased their GPA after they enrolled at CETARS;
- 28% of the students remain with the same GPA,
- 20% of the students decreased their GPA,
- Around 25% of the female undergraduate and graduate students mentioned that CETARS increased their academic GPA and expertise.

- 8% of the students are in their first year at University.
- The average GPA is 3.30/4.00.

Outreach

- Over 13 K-12 schools distributed through 7 municipalities in PR where visited for a total of 643 students served.
- Over 69% of these schools where visited by UPRM outreach resources to establish a school vegetable garden and present lectures at least 10 training sessions and lectures related to crop and sustainable development.
- Fifteen lectures/workshops were presented per elementary school, for a total of 150 lectures presented.