### Annual Report 2022-2023 Chemistry Department

### A. Executive Summary

During the academic year 2022-2023 the Department of Chemistry offered the courses in the modalities: face-to-face, hybrid, online and distance learning. During this academic year we continue working on the rehabilitation of the third floor and the Mechanical loaf floor of the building. As a result of these circumstances, great challenges arose for the department that were attended administratively. In academic terms, the offerings of the laboratories of Organic Chemistry I (QUIM3462), Organic Chemistry II (QUIM3464) and Organic Chemistry for chemistry mayors I and II (QUIM3071L and QUIM3072L) were assisted by technology taught. The Analytical Chemistry laboratories were relocated for that year on the first floor and offered in the face-to-face modality. For the laboratories that were offered assisted by technology, the Beyond LabZ application was used to perform simulations experiments Organic of in Chemistry.

The graduate seminar program continued to be active with guest speakers, professors of the department and the university, representatives of the chemical and pharmaceutical industries as well as graduate students. In terms of service to students, we continue to use the tool to attend the registration (tickets), but we also attended students in person. New students were welcomed in person. Our researchers submitted 17 research proposals to federal agencies. Of these proposals, 3 were approved and 14 are awaiting approval. Graduate students have continued with their research projects following established safety protocols. In the 2022-2023 academic year, 36 new graduate students were accepted. On the other hand, 30 students completed their B.S. degree in Chemistry, 4 completed their MS degree in Chemistry, and 4 students completed their Ph.D. degree in Applied

#### **B.** Mission

Prepare professionals in the discipline of chemistry offering programs of excellence at both graduate and undergraduate level, and high quality research programs. Generate knowledge that contributes to the development of society and the solution of the problems that afflict it. Contribute to the culture of the academic community and society in general. During the 2021-2022 academic year, 37 students graduated from the B.S. in Chemistry program, 4 from the M.S. in Chemistry program, and 4 students from the Ph.D. program in Applied Chemistry. During this academic year, students had the opportunity to enroll in undergraduate research courses, and research activities were allowed by implementing security protocols adjusted to the situation. About 10 students from the Department of Chemistry participated in summer internships at universities in the United States.

#### C. To institutionalize a culture of strategic planning and assessment

During the 2020-2021 academic year, Dr. Rodolfo Romañach was appointed as representative to the faculty for the Strategic Planning Committee and currently

continues to work on this committee.

# D. To lead higher education throughout Puerto Rico while guaranteeing the best education for our students

- The faculty of the Department of Chemistry approved in the spring of 2020 that Chemistry lecture courses can be offered in hybrid or distance mode, following Certification 19-85 of the Academic Senate of the RUM. This allowed that in the academic year 2021-2022 several courses were offered in Distance and Hybrid modality by teachers who have the CREAD certification.
- We continue with the offer of the Certification in Biochemistry.
- During the week of June 13 to 17, 2022, Dr. Wildeliz Torres participated in the "2022 Active Learning in Organic Chemistry Workshop" where she learned about active learning techniques in organic chemistry and innovative resources available. In addition, for one year she received support during the development and implementation of a research project in the area of chemistry education.
- In the 2022-2023 academic year, new technology installations began in the classrooms. They are made to make a smart classroom, where you can have hybrid classes with a number of students in person and others virtually.
- At the moment all the classrooms and the Abbot room seminar have installed the new equipment to offer the courses in hybrid or face-to-face modality.
- A new General Chemistry Engineering course was created for engineering students. This course was approved for the Chemistry faculty meeting. It is still in the university approval committees process.
- Since the academic year 2021-2022 Dr. Carmen Amaralis Vega Olivencia founded the Vega-Olivencia Foundation to offer scholarships to students with economic need and are enrolled in our BS in Chemistry. At the moment 6 scholarships have been given.
- Dr. Joselyn Del Pilar was elected to the ACS-PR Board of Directors for the year 2023. She holds the position of delegate of the western region.
- Dr. Joselyn Del Pilar carried out an academic activity called Chemistry Hidden Figures of the course QUIM4026 (History of Chemistry).
- The American chemical Society (ACS) and The National Chemistry Honor Society, Phi Lambda Upsilon (PLU), student associations organized the first Environmental Chemistry gathering. This was done on April 20, 2022.
- On April 27, 2023, Sigma Xi held The XXV Sigma Xi Poster Day in the Chemistry building. About 60 posters were presented. These included undergraduate students and graduate students.
- Dr. Enrique Meléndez in the academic year 2020-2021 made arrangements to obtain funds for the specialized equipment NMR (Nuclear Magnetic Resonance). In this academic year we already have the instrument in the Chemistry building.
- The Doctoral Seminar program was active throughout the year 2022-2023, using the modalities: virtual, hybrid and face-to-face. This was coordinated and directed by Dr. Carmen Amaralis Vega Olivencia.

# Seminars offered in the Department of Chemistry during the academic year 2022-2023

DATE	LECTURER	TITLE	INSTITUTION
26/August/2022	Mr. Wilmer Carrión	Applying Science to improve production processes, expand capacity and maximize profits.	UPRM - doctoral candidate
2/September/2022	Rubert Perez, Charles	Strategies for Designing Peptide-based Molecules for the Formation of Supramolecular Polymers	DePaul University, Chicago
9/September/2022	Dr. Marco de Jesús	Probing surface roughness and morphological effects on the sorption of bioactive agents onto plasmonic nanomaterials	UPRM -Department of Chemistry
16/September/2022	Dr. Julio Cay	A journey to the 4th Industrial Revolution through Chemistry	Metro Tech Corp.
14/October/2022	Dr. Carlos R. Cabrera	Electrochemistry at the Interface of Materials Science and Biosciences	University of Texas at El Paso
21/October/2022	Dr. Mihriban Pekgulaaroyz	Materials Engineering	McGill University, Canada
28/October/2022	Dr. Pedro Tarafa	Synthesis and characterization of titanium dioxide nanoparticles doped with iron and tungsten	MATERIAL INGINEERING UPR
4/November/2022	Dr. Jocelyn Del Pilar Albaladejo	Emerging properties of cadmium selenide hierarchical metamaterials	UPRM -Department of Chemistry
11/November/2022	Dr. Oscar Marcelo Suarez	Advanced Composites for Aerospace, Environmental, and Infrastructure Applications	UPRM - Dept. of Science and Materials Engineering
18/November/2022	Mr. Javier Otero	Chemist, Potentiometric Titration - Basic Principles	President - Metro Tech Corp.

2/December/2022	Jomaryz Gonzalez	Effect of hydrogen sulfide on the uptake of Cadmium by Leucaena Leucocephala	UPRM - doctoral candidate
9/December/2022	Jeniffer Vargas	Thesis: Physiological effects of hydrogen sulfide (H2S)	UPRM - doctoral candidate
3/February/2023	Dr. Madeline Torres Lugo	Design and Characterization of tunable polymers for cell culture and biomanufacturing	UPRM - Chemical Engineering
10/February/2023	Dr. Maribella Domenech	Collagen-based culture technologies for breast cancer research	UPRM- Chemical Engineering
17/February/2023	Dr. Gustavo Lopez	Water: Tales of Two Liquids and Two Glasses	CUNY - Theoretical Chemist
24/February/2023	Dr. Rodolfo Romañach	Water: Tales of Two Liquids and Two Glasses	UPRM - Chemistry
3/March/2023	Dr. Lisandro Curci	Dr. Lisandro Cursi Electrochemical biosensors and nanomaterials electrocatalysts for energy research	UPR - Rio Piedras
10/March/2023	Dr. Marissa E. Morales Rodriguez	Security and Resilience of Solar Energy Systems	U.S. Department of Energy
17/March/2023	Dr. Miguel Muñoz	Soil: a natural system where chemistry, physics and mineralogy are integrated and complement each other	UPRM - Agricultural Sciences
24/March/2023	Dr. Wildeliz Torres Gracía	Data Science to Improve Manufacturing of Cell Therapies	UPRM - Industrial Engineering
31/March/2023	Dr. Facundo M. Fernández	Next Gen Technologies in Metabolomics: Al/ML, Triboelectric Nanogenerators, Ion Mobility and Imaging	Georgia Technology University
21/April/2023	Annette Columbus	Trace detection of C-4 on aluminum using Mid- Infrared Reflection- Absorption Quantum Cascade Laser Spectroscopy	Doctoral candidate RUM

28/April/2023	Wilmer Carrion	Detection and Characterization of Common Microorganisms Found in Biopharmaceutical Industries	Doctoral candidate RUM
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# E. To increase and diversify the Institution's sources of revenue

During the academic year 2022-2023 researchers from the Department of Chemistry submitted 17 research proposals for funding from local and international agencies.

<u>Proposals submitted by the Department of Chemistry during the academic year 2022-</u> 2023

Proposal Tittle	Principal Investigator	Total Cost	Proposal Status	Sponsor Name
Plasmon-Mediated Decarbonization Using Metallic and Bimetallic Metal and Metal Oxide Nano-Assemblies at UPRM	Marco De Jesus Ruiz	\$2,250,000.00	Pending	Department of Energy [DOE]
Innovative Wide Area Sensing Mitigation Technologies For CWMD	Samuel Hernandez Rivera	\$499,995.00	Awarded	Department of Homeland Security [DHS]
Multivariate Data Analysis for Process Understanding and Accuracy	Rodolfo J Romanach	\$84,074.00	Awarded	Avara Pharmaceutical Services
1890-HSI Partnership To Enhance Graduate Competitiveness And Faculty Knowledge In Tropical Agriculture	Felix Roman Velazquez	\$64,998.00	Pending	Alcorn State University
Proof-of-Concept of Quantum Cascade Laser for Quantitation of Active Pharmaceutical Ingredient and Drug Product in Development and Manufacturing	Samuel Hernandez Rivera	\$74,105.00	Awarded	Pfizer Inc
Consortium of Land-Grant Minority Serving Institutions to Cultivate the Next Generation of Diverse and Inclusive Food and Agriculture Professionals and Leaders	Felix Roman Velazquez	\$950,001.00	Pending	Alcorn State University
Caribbean Collaborative Center for Food, Agriculture, Natural Resources and Human Sciences (C3-FANH)	Felix Roman Velazquez	\$10,000,000.00	Pending	

Automated and AI-Supported Nanostructured Hybrid Chemical Sensors for the In-Situ Detection of Aerosol-Delivered Chemical Threats	Samuel Hernandez Rivera	\$1,450,743.00	Pending	PR QUANTUM SOLUTIONS, LLC
Remote Optical System for Threat Emergency Response (ROSTER)	Samuel Hernandez Rivera	\$1,450,743.00	Pending	PR QUANTUM SOLUTIONS, LLC
Modular Aerosol Chemical Hazard Detector (MACHD)	Samuel Hernandez Rivera	\$1,450,743.00	Pending	PR QUANTUM SOLUTIONS, LLC
Convergence of Advanced Sensors and Artificial Intelligence for Early Detection of Chem-Bio Threats in Fresh Produce (CASAIED CBT-FP)	Samuel Hernandez Rivera	\$3,387,500.00	Pending	National Science Foundation [NSF]
MRI: Acquisition of a Zeiss 560 VP FE-SEM for chemical and surface characterization and training	Marco De Jesus Ruiz	\$988,884.00	Pending	National Science Foundation [NSF]
Phase I - Feasibility Study for the Continuous Mixing of a Pharmaceutical Formulation	Rodolfo J Romanach	\$101,112.00	Pending	McNeil Consumer Healthcare
Multifunctional Zeolite Composite for Photodegradation of Per- and Polyfluoroalkyl substances (PFAS) in Aqueous Medium	Joselyn Del Pilar Albaladejo	\$284,828.00	Pending	National Science Foundation [NSF]
Innovative Wide Area Sensing Mitigation Technologies For CWMD	Miguel Castro Rosario	\$250,000.00	Pending	Department of Economic Development and Commerce
Multivariate Data Analysis for Process Understanding and Accuracy	Rodolfo J Romanach	\$400,365.00	Pending	The National Institute for Pharmaceutical Technology & Education
1890-HSI Partnership To Enhance Graduate Competitiveness And Faculty Knowledge In Tropical Agriculture	Miguel Castro Rosario	\$4,862,345.00	Pending	National Institutes of Health [HHS-NIH]

# F. To implement efficient and expedient administrative procedures

- The administrative staff of the Department of Chemistry continues to take training in the use of technology to carry out administrative procedures, to hold meetings, and to serve students virtually and in person.
- Roadmaps continue to be used for administrative procedures.

- In the week of the administrative staff, an activity was carried out to recognize all the staff with the contributions of the Department faculty members. The activity consisted of a lunch and the next day a snack and a gift to our administrative staff.
- The meetings of the different committees were held in person, hybrid and virtually.

#### G. To strengthen research and competitive creative endeavors

During the 2022-2023 academic year, researchers from the Department of Chemistry, for the most part, continued with the development of their research projects and the mentoring of graduate and undergraduate students.

# Scientific Articles of the Department of Chemistry published during the academic year 2022-2023.

- Del Pilar Albadalejo, J.; Alonso-Sevilla, S.; Cintron, N. I.; Feng, X.; Garcia, Á. D.; Martínez-Torres, D. D.; Rodríguez, A. M.; Román-Montalvo, N. I.; Torres, J. I.; Yang, Y.; Peña-Duarte, A.; Singhal, R.; Debefve, L. M.; Pollock, C. J.; Cabrera, C. R.; Abruña, H. D.; Santiago-Berríos, M. E. B., Ex Situ and In Situ Analyses of the Mechanism of Electrocatalytic Hydrogen Peroxide Production by CoxZn1–xO (0 < x < 0.018) Materials in Alkaline Media. ACS Applied Energy Materials 2022, 5 (6), 6597-6605.
- Rivera Vazquez D, Munoz Forti K, Figueroa Rosado MM, Gutierrez Mirabal PI, Suarez-Martinez E, Castro-Rosario ME. Effect of CaS Nanostructures in the Proliferation of Human Breast Cancer and Benign Cells In Vitro. Applied Sciences. 2022;12(20):10494.
- González-Velázquez, J.; Salas-Vázquez, E.; Flores-Tavizón, E.; López-Moreno, M. L., Effect of Cadmium on Macro and Micronutrient Uptake and Translocation by Leucaena leucocephala. Bull. Environ. Contam. Toxicol. 2022.
- Frenkel-Pinter, M.; Bouza, M.; Fernández, F. M.; Leman, L. J.; Williams, L. D.; Hud, N. V.; Guzman-Martinez, A., Thioesters provide a plausible prebiotic path to protopeptides. Nature Communications 2022, 13 (1), 2569.
- C, M.; Frenkel-Pinter, M.; Smith, K. H.; Rivera-Santana, V. F.; Sargon, A. B.; Jacobson, K. C.; Guzman-Martinez, A.; Williams, L. D.; Leman, L. J.; Liotta, C. L.; Grover, M. A.; Hud, N. V., Water-Based Dynamic Depsipeptide Chemistry: Building Block Recycling and Oligomer Distribution Control Using Hydration–Dehydration Cycles. JACS Au 2022, 2 (6), 1395-1404.

## H. To impact our Puerto Rican society

- Welcome to new graduates August 5, 2022.
- Welcome to new graduate students August 8, 2022 and January 17, 2023.
- The university held the Open House in October 2022.
- During the summer of 2022, The College of Arts and Sciences camp was carry out for high school students. The chemistry department had the participation of associations, staff, professors and graduates.

#### I. To strengthen school spirit, pride, and identity

- Amended exit assessment forms for students who are candidates for graduation so that they can evaluate the administrative, academic and infrastructural matters of the departmen.
- The American Chemical Society (ACS) student association were the hosts of the ACS Goofy Games during the month of April. There was a great participation of the other twenty chapters around the Island.
- The ACS, also participated in the Chemistry Festival held in San Juan, PR, during the month of April. This was during the celebration of Chemistry Week. The purpose of this festival is to impact the community of the Island and share the knowledge of Chemistry through experiments and other practical activities of a scientific nature.
- The ACS held a fraternization (Chem-off), as part of one of the activities was to prepare a "crime scene" in which the members of the association had to observe and solve.

Fecha	Nombre	Invitado por:
25/ago/22	First ACS Assembly	
6/sept/22	Goodnotes Workshop	
13/sept/22	Revalid Conference for Chemists	CQPR
18/oct/22	Suicide Prevention Talk	
22/oct/22	Beach Cleaning	
26/oct/22	Eco Bricks Workshop	
1/nov/22	Second ACS Assembly	
8/nov/22	Movie night	
16/nov/22	Fundraiser Papalaya	
17/nov/22	Linkedin Workshop	
1/dic/22	Chemoff	
8/dic/22	Talk Introduction to nanomaterials	
7/feb/23	Third ACS Assembly	
14/feb/23	Sale Valentine's Skewers	
9/mar/23	MCAT Talk	CQPR
9/mar/23	Talk for Nature	PLU
16/mar/23	Quarter ACS Assembly	
23/mar/23	Workshop with Ecorriqueñas	
28/mar/23	Heterogenous catalysis Talk	
30/mar23	Blood drive	PLU
1/abril/23	Beach Cleaning	
13/april/23	Toxicology Talk	

Activities of the ACS during the year 2022-2023

16/april/23	Workshop Caring for medicinal plants	
18/april/23	Forensic Chemistry Talk	
20/april/23	Environmental Conference	
23/april/23	Chemistry Festiva	
27/april/23	Sigma poster day	

# J. Internacional activity

- In the Department of Chemistry, we have 15 international graduate students. Of these 14 are from Colombia and 1 from India.
- In the Department we have 2 international professors. Of these 1 is from Mexico and 1 from Colombia.