CoHemis...Update

Overcoming through cooperation

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N.S.F. WORKSHOP ON THE REPAIR OF STRUCTURES

"Rehabilitating and Repairing the Buildings and Bridges of the Americas: Hemispheric Workshop for Future Directions"

The CoHemis Center is organizing the hemispheric workshop "Rehabilitating and Repairing the Buildings and Bridges of the Americas: Hemispheric Workshop for Future Directions" for April 23 & 24, 2001 in Mayagüez, Puerto Rico. The workshop will deal with the state-of-the-art, implementation problems, and future research priorities in: structural assessments, life cycle evaluation for rehabilitated structures, fiber reinforced polymers, and sensors. To ensure its success, CoHemis needs to identify researchers and professionals from different countries of the Americas who work with assessments, repairs, rehabilitation, or instrumentation of structures.

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CoHEMIS RETURNS TO VENEZUELA

*Members of the Organizing Committee of the **IIIrd Encounter of INGENIE-Red** met with the Chancellor of Venezuela's Central University, which will host the event in Caracas. Photographed are: Dr. Luis Jacinto Fernández, Carlos Patsios, Chancellor Giuseppe Gianneto-Pace, Martín Saavedra and Freddy Britto. Missing from the picture are CoHemis' Jorge Vélez-Arocho and INGENIE-Red's Executive Secretary Miguel Arias-Albornoz.*

CoHemis' directors, Drs. Jorge Vélez-Arocho and Luis Pumarada-O'Neill, traveled to Caracas, Venezuela, on the week of September 25th for a series of important meetings. Venezuela was a key player in the foundation of the Center in 1991, and it is the site of the first Latin American university to join the CoHemis Consortium.

Dr. Vélez participated in the organizing meeting of the Third Encounter of INGENIE-Red, a network of engineering graduate programs from Latin America and the Caribbean. The well-known Universidad Central de Venezuela (UCV) hosted this meeting. Dr. Luis Jacinto Fernández, Directing President of the Commission of Graduate Studies of UCV's Faculty of Engineering, Dr. Freddy Brito, Head of UCV's Department of Communications, and Dr. Carlos Pantsios, Professor of the Universidad Simón Bolívar, represented Venezuela. Dr. Martín Saavedra-Magaña, General Coordinator of Graduate Studies of the Universidad Michoacana San Nicolás de Hidalgo (Michoacán, Mexico), presented the experiences of his university

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Seminar on Foresight and the Future

On February 19 and 20, 2001, CoHemis will present the first of a series of three activities commemorating its 10th Anniversary: a Seminar on Foresight and the Future, by the distinguished international expert Dr. Francisco José Mojica.

Foresight—the systematic study of the future, which has been perfected in Europe by Dr. Mojica's mentors—grows in importance daily as changes in our world take place at an accelerating rate and local changes generate global effects. Our era suffers and generates many of the deep changes and new rules of the game which are configuring the society and the economy of the XXIst Century. Those who understand these circumstances and can associate them with their own reality have advantages over those who ignore them. But those who in addition have an idea of the future they must face have the best opportunities to overcome competition.

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INSIDE THIS ISSUE:

NEW UPRM GRADUATE DEGREES IN COMPUTER AND INFORMATION SCIENCES AND ENGINEERING

THEIR LAUNCHING COINCIDES WITH N.S.F GRANT

UPRM has a new Ph.D. Program: the interdisciplinary doctoral program in Computing and Information Sciences and Engineering (CISE). The Mathematics Department will offer a Master's Degree in CISE as a complement to this Ph.D. Program.

CISE are inherently interdisciplinary, and can be applied to physics, biology and chemistry, as well as engineering, economics, social sciences, and health and administrative sciences. The mathematical component of scientific computing emphasizes the use of high-performance computing and the development of mathematical methods for the simulation or numerical solution of problems in sciences and engineering. The computer science and engineering component focuses on the analysis, design and development of software, signal processing, digital systems, and information systems.

It is no coincidence that the offering of these new graduate programs in CISE coincides with PRECISE, the Program for Research in Computing and Information Sciences and Engineering, a recent NSF grant to the Electrical and Computer Engineering Departments. This initiative will strengthen graduate research in the Mathematics, Electrical and Computer Engineering departments in the areas of CISE, especially Automated Information Processing and Digital Systems Implementation, Scientific Com-

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INTEGRATING REMOTE SENSING TO EDUCATION

The US National Aeronautics and Space Administration (NASA) has awarded UPRM a five year grant to establish the Partnership for Spatial and Computational Research (PaSCoR). This partnership is focused on the study and use of remote sensing (RS) and algorithm development and applications. PaSCOR will facilitate and enchance education in RS theory and application by means of new and revised courses and continuing curriculum contact with students throughout their college career, integrated with hands-on learning activities and industrial collaborations.

Ten new RS courses will be created at the Departments of Electrical and Computer Engineering, Mathematics, Geology and the School of Agricultural Sciences. In addition, seven courses will be modified at these same units to include concepts and applications of remote sensing and GIS. The courses to be developed and those to be modified will balance content with skills such as problem solving, communication and teamwork.

The educational dimension will consist of a continuous progression of courses spanning the student's entire academic career. Student of many fields will have the opportunity to earn a certificate in remote sensing upon graduation.

PaSCoR's industrial partners, such as Raytheon, the United States Geological Survey and the Puerto Rico Planning Board, will assist in various ways: providing input for curriculum development and updating; assisting in the evaluation of student projects; providing experts for lectures, seminars and workshops; providing summer internships for faculty and students; and providing jobs for program graduates.

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BOOK ON ENVIRONMENTAL BIOTECHNOLOGY

The book ***Bioremediation: From Social Reality to Ecological Solution*** is the most recent work by Dr. Arturo Massol-Deyá, Associate Professor of Biology at UPRM. Dr. Massol's central theme throughout the book is the development and use of "alliances" with bacteria, fungi and plants in searching for permanent solutions to the problem of contaminated natural sources.

This second edition, published in Spanish in 2000 by CasaPueblo, in Adjuntas, Puerto Rico, covers the following topics: environment and society; a brief history of the environmental issues in Puerto Rico; general principles of bioremediation; biodegradation; biogeography and microbial diversity; bioaugmentation; microbial interaction in bioremediation; bioremediation of aquifers contaminated by nitrates; bioremediation of soils contaminated by diesel fuel; phytoremediation (plants that absorb soil contaminants); bioremediation vs. other technologies; and social risks and costs.

Dr. Massol is a distinguished microbiologist specializing in environmental issues. He has traveled to Latin America for joint research projects and is prepared to give short courses sponsored by CoHemis consortium institutions that cover his expenses. If you are interested in communicating with Dr. Massol or acquiring his book, you may contact him by e-mail at: a_massol@stahl.rumac.uprm.edu.

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AQUACULTURE: CREATING NEW COMMERCIAL OPPORTUNITIES

The world's fishing industry generates over 80 billion dollars a year and employs more than 200 million people. But the yield of the world's fishing waters has consistently declined since 1990, while the demand for fish products has risen significantly. The need to enhance fish-farming techniques and reduce our dependence on the ocean's wild fish stock increases every day. Fish farms generate 42.3 billion dollars yearly and 27.8 metric tons of fish products. Aquaculture allows the use of domesticated and genetically modified species that are of higher quality and yield than wild species.

The strategy of implementing aquaculture takes careful, multidisciplinary planning and efficient technology transfer. The process must be sufficiently flexible to adjust to the changing needs of the industry. Aquaculture planning, in salt as well as fresh water, should be framed within the concept of ecodevelopment. It is necessary to establish practice codes and controls so that aquaculture is sustainable over time

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A Caribbean Collaboration Initiative in Cuba

ENERGY EFFICIENT CONSTRUCTION IN THE CARIBBEAN

Atlantea course instructors: from left, Prof. Dania González, Dr. Omar Herrera, Dr. Jorge E. González, Dr. Conrado Moreno, Dr. David Serrano, Dr. Fernando Abruña, and Prof. Nastia Almao.

The first Short Course on Energy Efficient Constructions in the Caribbean was held on April 20-22, 2000 in the Cuban *Instituto Superior Politécnico José Antonio Echeverría* (IPSJAE) in Havana, Cuba. The course came as an answer to the great need identified by energy experts from the Caribbean basin of buildings designed to consume less energy within the context of warm and humid climates. The University of Zulia, a member of the CoHemis Consortium, was the third major participant in the course. It brought together experts on building bioclimate from Cuba, Puerto Rico and Venezuela, who presented to a select group of 30 Cuban professionals, including architects and mechanical and civil engineers.

The course lasted 18 hours, including sessions of discussion and evaluation. The subjects covered included: bioclimate, passive and active illumination and cooling, air conditioning systems, and alternative energy systems in buildings. Six instructors, all of them internationally well-known researchers and professors, taught their topics in separate modules. They were: Dr. Fernando Abruña, Professor, School of Architecture, University of Puerto Rico at Rio Piedras; Dr. David Serrano and Dr. Jorge E. González, Professors, Department of Mechanical Engineering, UPRM; Professor Nastia Almao, Senior Professor from the University of Zulia; Dr. Dania González-Couret, Professor from IPSJAE's Faculty of Architecture; and Dr. Conrado Moreno, Professor, Center for the Study of Renewable Energy Technologies (CETER), IPSJAE.

The course participants evaluated the course positively and enthusiastically, recommending that the topics be taught in the schools of architecture and engineering across the Caribbean.

It was sponsored by the Atlantea Program of the Office of the President of the University of Puerto Rico. The main objective of this program is to promote academic collaboration between Puerto Rico and other Caribbean nations.

For more information, visit the internet site: www.me.urpm.edu/jgonzalez/atlantea.

ENCOUNTER OF EDUCATION AND THINKING

International Dialogue on Critical Thinking and the Education of the XXIst Century

March 14 - 17 in Mayagüez, PR

Hundreds of educators from the Western Hemisphere will meet in UPRM between March 14th and 17th under the motto "Economics, Technology, Education and Thinking." The Second International (XIII National) Encounter of Education and Thinking is being organized by UPR's Project for the Development of Thinking Skills. Its fundamental purpose is to examine, from a human development point of view, cultural and historical perspectives, cognition, critical thinking, and liberation pedagogy—that is, the ideas and experiences that help us enhance and liberate our educational practices—and to support bottom-up educational reforms.

The participants are expected to discuss what formal education in the new century could and should be. Reflections and educational proposals to be considered will be those founded upon the accumulated knowledge and educational practice of faculty; the accumulated knowledge of education sciences; and trends that point away from conventional paradigms and formulas. They shall respond to the educational needs that arise from changes and tendencies in the economy, politics, society, and culture, and should include philosophical humanist, constructivist, and liberating conceptions.

For more information, call (1-787) 832 – 4040, extension 3829; fax: (1-787) 831-5249; e-mail: cep_rum@rumac.uprm.edu, or visit: http://www.ce.uprm.edu/cohemis

2ND NSF-UPRM INTERDISCIPLINARY ETHICS WORKSHOP

CoHemis and UPRM's Center for Philosophy in its Interdisciplinary Function organized the Second Workshop on Ethics Research and Interdisciplinary Training for Engineering, Sciences and Business Administration last December (1999). This initiative is sponsored by the NSF's Science, Technology and Society Program.

The workshop began with a presentation by CoHemis Director Dr. Luis Pumarada on the role that ethical principles can play in the search for sustainable development. Dr. William Frey led a team of presenters and facilitated the interaction of the twentyfive worshop participants.

The activity was held in a country inn of Puerto Rico's coffee country.

EXCERPT FROM DR. LUIS PUMARADA'S PRESENTATION AT THE ETHICS WORKSHOP:

BETWEEN UTOPIA AND DISASTER

Please excuse me for going beyond a mere welcome and expression of gratefulness for your participation in this valuable ethics retreat. However, I find myself in front of a group of professors of ethics and of persons who are interested in ethics at a point when I am sincerely worried about the future. Since I find it difficult to accept the thesis that societies learn only through catastrophes, I cannot avoid bringing to your attention that together we can perhaps stop future global disaster.

I see our planet besieged by a series of interlaced, destructive tendencies, among them: the deterioration of the environment, rampant consumerism, the approaching exhaustion of natural resources, and an inequality that becomes more immoral as the global production of goods increases. The negative and increasing impact that humanity is having on the environment, the ecology, and the non-renewable resources of the planet becomes more obvious the more we learn about ecological and climatic systems and about the impacts of population growth and human activities. It is clear that if the growth of the population of the third world and the consumerist styles of the first one, are not reversed, the quality of life of the children and grandchildren of all worlds will keep getting worse.

The deterioration of the future is a very complex phenomenon, related to most of humanity's fields of knowledge and action. There are many actors whose actions can either push or stop a socio-environmental disaster. Among the most important such actors are scientists, engineers and agronomists; religious leaders; entrepreneurs and managers; professors, psychologists and publicists; politicians and government officials. But above all there are the citizens, in our multiple roles as consumers, waste managers, family planners, educators and voters. The more such actors worldwide recognize the effects of their own actions and omissions on the environment, ecology, equity and natural resources, the better the chance for a sustainable, desirable future.

I understand that happiness, which All human beings have a right to, can not be measured in terms of possession of material goods, but in terms of spiritual peace. Material goods as a part of happiness are only required for covering basic needs, such as health, security, shelter, potable water, food and work. Therefore, attaining happiness for those who already posses enough material goods depends more on being in peace with what one has and doesn't have than on continuing to accumulate and to want ever more material goods.

Since my field is systems planning, I tend to explore and seek ways to induce desired futures and avoid undesired ones. I believe that it is urgently necessary for directing the world towards an environmentally and socioeconomically sustainable future that future-based ethical principles are adopted. Ethical values based on the direct and indirect effects of alternative actions on desirable and undesirable futures should guide the actions of more and more key actors.

The unproductive and impoverishing population growth of most third world countries can be stopped through programs of education, the most important, plus nutrition, health, appropriate technology, and essential infrastructure. Both the technology and the necessary resources to provide the basic needs of all humanity in a sustainable manner do exist. What doesn't exist is the will to shift present their uses, overcoming the resistance of those who oppose the process motivated by their immediate interests.

Publicity pushes consumption of products which are unessential and whose manufacture and final disposition deplete and contaminate the resources of the planet. Most of the world's consumption is concentrated in some thirty rich countries, while a full-day's hard work of a large part of humanity does not assure the means necessary to survive. Publicity has appropriated the most powerful tool of social education that has ever existed, television, and uses it to induce consumers to crave for products which are usually not needed and which frequently harm their users.

In order to reduce the eagerness to consume, and thus to allow the richer classes and nations to agree to share with those less fortunate, the powerful message of television must change. It must sell happiness not as having this or that, but as sharing love, having faith, helping others, working, learning, enjoying nature, and not wishing unnecessary things.

Global perception shows that, since the resources of the planet are limited, when a person or nation appropriates a large portion of these resources, others are deprived

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Venezuela...

when they hosted the Second Encounter two years ago. Dr. Miguel Arias-Albornoz, from the University of Santiago (Chile) also participated. The University of Santiago hosted the First Encounter of INGENIE-Red, and Dr. Arias is INGENIE-Red's Executive Secretary.

During the organizing meeting, the Third Encounter was set for October 2 to 4, 2001, in Caracas, Venezuela. Dr. Giuseppe Gianetto, UCV's Chancellor, placed the facilities of the institution at the disposal of the Encounter. The support offered by UCV will ensure the success of this important meeting.

In the grounds of the National Geology and Mineral Institute (Ingeomin) of the Ministry of Energy and Mines, Dr. Vélez-Arocho attended a planning meeting for the important international course that CoHemis is planning for the first week of April, 2001 in Caracas: "Effects on Health and the Environment of Toxic Metals and Trace Elements." (See page 9). This course is conducted by researchers of the United States Armed Forces Institute of Pathology, the US Environmental Protection Agency, and the US Geological Service. It has been offered with great success in Puerto Rico, New Zealand, Mexico and China.

Dr. Zonia Osorio de Fernández, Ingeomin's President, directed this fruitful meeting, which was attended by other Ingeomin personnel: Rosario Bajo de Osina, Research Manager, and Luis Serpa, Geochemist.

Participants at the INGEOMIN meeting: Geochemist Luis Serpa, Research Manager Rosario Bajo de Osuna, President Dra. Zonia Osorio, and CoHemis Codirector, Jorge Vélez-Arocho.

CoHemis' directors visited Venezuela's National council for Science and Technology (CONACIT) and met with Dr. Daniel López-Hernández, CONACIT's new president, and with its International Cooperation Manager, María Elena de la Rosa. In this productive meeting, the officials of CONACIT were updated on CoHemis relations with Venezuela since the foundation of the Center, in which the recently passed away Dr. Graciela Sosa—then Planning Manager of CONACIT—had a tremendous influence. Dr. López was interested in the course on toxic metals and promised to support CoHemis' efforts. He designated De la Rosa as the official liaison between both institutions.

Drs. Vélez and Pumarada also met with Juan León-Livinalli, the Vice Chancellor of the Universidad Simón Bolívar. USB was the first Latin American institution to become a member of the Consortium. In the beautiful, historic building that houses Dr. León's office, they discussed ways to speed up and enhance the participation of USB researchers in the upcoming activities of the Center.

BETWEEN UTOPIA AND DISASTER...

of their benefits. Whoever accumulates many more resources than he can possibly use, and by doing so leaves other human beings without means for a decent life, is violating human rights. Who can justify the morality of unlimited private property when the three richest people on earth have more money than the gross internal products of the 48 poorer countries?

Paraphrasing Abraham Lincoln, a world half wasteful and half hungry cannot last a long time. Given the limited resources of the planet, it is totally impossible to obtain a greater equity based on all 6 billion humans approaching the level of consumption of the developed countries. Therefore, equity within the limits of the resources of the planet can be improved only if the citizens with higher living standards, the ones who contaminate most and use up most of the resources of the planet, develop less consumerist lifestyles and agree to share their goods and income to improve the basic infrastructure and education of those less fortunate. Religion can be crucial in making possible this radical change of attitude.

But these changes will not take place as long as powerful media keep pushing consumption. The professionals of the publicity industry must hold as antiethical to dissuade people to consume products that significantly affect the environment either through their manufacture or disposition, as well as things that can cause personal harm, such as alcohol, tobacco or gambling.

This may seem utopian, but we have reached a time when we must choose between utopia and catastrophe. Between an utopian future that will require much persuasion, conflict and sacrifice, and a catastrophic one of conflicts, terrorism, scarcities, and environmental degradation that will take place if each one of us just goes on with his own life, leaving things in the hands of those who enrich themselves as a result of the present tendencies.

"Environment 2000"

The Solid Waste Disposal Authority of Puerto Rico celebrated the first "Environmental Convention" from April 13 to 15 of 2000 in San Juan. The conference brought together experts from the fields of solid waste management, recyclable materials, environment, and infrastructure, from government agencies, academia and industry.

Two of the international presenters were contacted by CoHemis. Dr. Carlos Hernandez, from the Costa Rican Agricultural School of the Tropical Humid Region (EARTH), presented a paper on "Agricultural Waste Disposal and Experiences in EARTH." University of Florida's Dr. Mark Brown presented "Decision Making in Public Policy and Emergent Analysis".

New Engineering Ph.D. Program in UPRM

The long awaited Ph.D. Program in Chemical Engineering in UPRM finally began in August 1999, and at present it has four Puerto Rican students and one Colombian student. The Chemical Engineering Department is interested in attracting prospective students from Puerto Rico as well as Latin America and the Caribbean who are capable of completing a rigorous program of core courses and carrying out research that contributes to the progress of the field.

Candidates who have completed at least a bachelor's degree in Chemical Engineering or related fields with a grade point average of 3.00 of a maximum o¡f 4.00 may apply. Those students whose preparation is not in Chemical Engineering must take remedial courses to put them at the same level as Chemical Engineering graduates. The program has a normal duration of four years, or less if the student has previous graduate coursework. The required core courses are: Analysis of Mathematical Problems in Chemical Engineering I and II; Reactor Design, Catalysis, Transport Phenomena, and Advanced Thermodynamics. To complete their graduation requirements, students must defend their research theses in oral presentations.

For years now, UPRM's Chemical Engineering Department has been granting Bachelor of Science, and two graduate degrees: a Master's of Science with a thesis (M.S.) and a master's degree with a project (M.E.). The master's programs require four core courses: Analysis of Mathematical Problems in Chemical Engineering I; Reactor Design, Transport Phenomena, and Advanced Thermodynamics. There are elective courses in environmental topics, pharmacology, biotechnology, materials sciences, energy and others. Along with the Chemical Engineering B.S. degree, students can obtain Certificates in Environmental Engineering or Manufacturing Engineering by taking specified courses in these fields.

The Department has seven research laboratories that deal mainly with the following areas: industrial pollution control, energy conversion, biotechnology, heterogeneous cathalysis, separations, biomedical engineering, thermodynamics, process simulation, and supercritical fluids. In support of the Ph. D. program, a new building with 6000 square meters dedicated to labs and pilot plants will be built starting August 2001. UPRM aims to place its Chemical Engineering research at the level of the best 50 departments in the Americas for the academic year 2004-2005.

A semester of graduate studies in UPRM costs approximately $5,000 for Puerto Rican residents and $6,000 for an international student. This includes enrollment, housing, food, materials, and medical insurance. The Department offers financial aid to students based on merit and academic progress. This aid can cover the totality of the students' costs for residents as well as international students for up to four consecutive semesters. Professors with external research funding can also provide financial support for their student assistants between academic years (during June and July).

All the documents required for admission into the graduate programs must be submitted before February 15th for the Fall semester, and before September 15th for the Spring semester.

For more information, contact the program's website at: http://atomo.uprm.edu or email : ew_velazquez@rumad.uprm.edu. By regular mail, you may write to: Chemical Engineering Graduate Program, PO Box 9046, Mayagüez, Puerto Rico, 00681-9046. Telephones: (1-787) 832-4040, extension 2577; Fax: (1787) 834-3655.

Jupiter and the Sun: observed and photographed from Mayagüez

Little more than three years ago, the University of Nariño in Colombia sent a one of its young professors to the University of Puerto Rico at Mayagüez to finish his graduate studies in Physics, specializing in Astronomy. Professor Alberto Quijano Bondniza chose to study in Mayagüez motivated by the existence UPRM's Astronomic Observatory and especially by the relationship between the Campus and the world-renowned Radio Observatory of Arecibo.

Quijano spends most of his time processing images and taking photographs for a book on digital image processing in Astronomy. Some of the images captured by him have been the only ones produced in a Latin American university to be published online by NASA's Jet Propulsion Laboratory. His work concentrates on the two largest objects of our solar system: the Sun and Jupiter.

Quijano has been observing the Sun for years, studying, among other aspects, the phenomenon of solar spots. He also wishes to make more precise measurements of the sun's rotation. He states that he has one of the most complete collections of solar images, numbering more than a hundred.

To obtain clearer images of Jupiter than the ones obtained with traditional telescopes, the Colombian modified a telescope by adapting to it a VCR, and after a few adjustments he got an image four times as large as the ones collected until then.

His interest on Jupiter is a more educational one. In 1765, Danish astronomer Ole Roemer (1644 – 1710) designed an experiment to measure the speed of light using that planet's lunar eclipses. Prof. Quijano repeats Roemer's experiment with his students to give them the opportunity to learn and gain practical experience by applying theories of physics.

When his work in URPM is over, Quijano will return to Colombia with his degree, with a great deal of research projects in hand, and with the necessary knowledge to establish an astronomic observatory in Nariño that will let him complete the projects he began in Puerto Rico.

LATIN AMERICAN STUDENTS IN UPRM:

CoHemis... update *includes in each issue an interview with one of the hundreds of Latin American science and engineering graduate students in UPRM.*

Explaining the circularity of the Universe, from Lima to Puerto Rico

Alfredo Villanueva Cueva, a native of Lima, Peru, was considering pursuing an engineering degree when he realized that what he liked the most about engineering was mathematics. What he did not imagine then was that a few years later he would be in Puerto Rico, studying the under the supervision of a Chilean professor, trying to explain the concepts proposed by Einstein that constitute the frontiers of human knowledge.

"Since I started school, and through the greater part of high school, I thought of mathematics as a kind of recipe to solve problems. But in a course I took on mathematical reasoning I discovered that the essence of mathematics is very intuitive and common-sensical," he told us. "Much of what was considered pure or theoretical mathematics in the past is not anymore, since people have found useful applications for it."

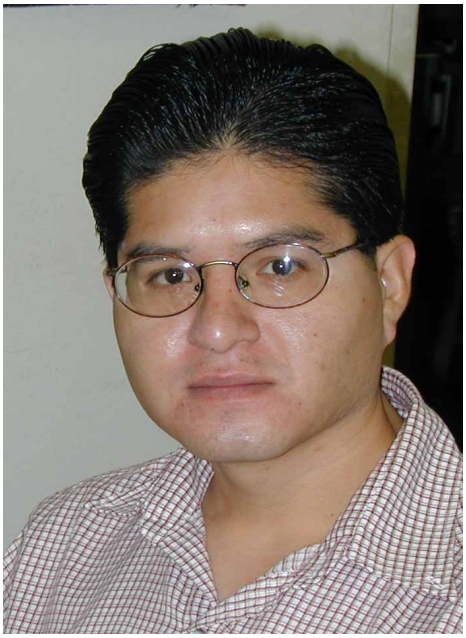
After finishing high school, Alfredo spent some time working as a computer programmer and other similar jobs until he was able to enter the *Universidad Nacional Mayor de San Marcos* in Lima. He received a degree in pure mathematics in 1996 from that prestigious institution. After graduation, the talented young man taught Calculus and Numerical Methods in that same university.

While teaching, he learned about Puerto Rico from a friend who was visiting Lima, the son of a Peruvian professor from the University of Puerto Rico at Mayaguez, Dr. Valdivia. His friend was a graduate student in Applied Mathematics in Puerto Rico and told Alfredo about UPRM's Mathematics Department and the scholarships available at that time. Only a few months later, in 1998, Alfredo traveled to Mayagüez to begin his graduate studies with Dr. Julio Vidaurriaga, a specialist in Pure Mathematics.

Alfredo, who is single, prefers to live off-campus in Mayagüez rather than in the University's graduate student housing. One of the things he most appreciates about Puerto Rico is the hospitality of its people. In his first year he found it hard to adapt to the Mayagüez weather, which is consistently warmerthan that of Lima. Alfredo has met other Peruvian students at UPRM, most of them from Cuzco. Like Alfredo, they have come to Mayagüez attracted by what their friends have told them about postgraduate studies at UPRM.

Currently, Alfredo is getting ready to defend his thesis, which is on the "Classification of Lie semi-simple Algebras." He expects to receive his Master's degree in Pure Mathematics by June, 2000. Meanwhile, he continues teaching Calculus courses as a teaching assistant at UPRM.

An enthusiast of the history of mathematics, Alfredo explains very excitedly that Lie



was a Norwegian expert in differential equations who attempted to solve them by comparing the structures of variational differences with those of the abstract group. Algebra is the mathematical field that studies math from the structural point of view focusing on relationships between systems (as in, for example, the relationship between real and complex numbers). Lie Groups are used in quantum physics, relativity, control theory and other areas. Alfredo's thesis is in the area of differential geometry, a type of geometry that attempts to generalize the concept of surface in three dimensions. Traditionally, calculus developed for surfaces has a three-dimensional coordinate system, which does not allow the study of other types of spaces. Differential Geometry describes surfaces in terms of relative curvature and torsion.

Alfredo explains it with an example: "If a one-dimensional being living in a one-dimensional circular space started moving in a given direction, it would eventually return to its original starting point. For this being, which is only aware of forward and backward motion in a line, it would be paradoxical and inexplicable to end up at the starting point. He could explain that phenomenon, at least in theory, if he had an analytical tool that would generalize the space characteristics independent of his forward-and-backward reference system, sincehe would find that his space has curvature.

The fact that classical mathematical models based on traditional calculus cannot completely explain the behavior of some astral bodies the way we observe them from Earth, suggests the need to develop a more general mathematics. It was Einstein who first proposed, along with the relativity of time, that if we could fix a starting point in the universe and moved in a single direction, we would eventually arrive at our original starting point. Differential Geometry seeks to explain that phenomenon.

The relativity of time, namely, the fact that events happening in two different places occur in different times rather than simultaneously, is a well-accepted concept. Using synchronized high-precision atomic clocks, scientists have experimentally proven that a clock moving at high speed, say, aboard a supersonic airplane, measures a different time than the clock that stays at rest.

Alfredo plans to enter a doctoral program in Pure Mathematics in the United States by January, 2000. He is in the process of applying for admission and financial aid.

According to Alfredo, Brazil is the Latin American country that has made the greatest contribution to Pure Mathematics. Its Institute for Pure and Applied Mathematics (IMPA) is world-renowned for its work in System Dynamics (differential equations that rule the behavior of systems under continuous change). Other Latin American countries, including Puerto Rico, have done little research in the area of pure mathematics due to lack of funding.

New degrees...

puting, and Software Sciences and Engineering.

The PRECISE program strengthens the current research environment in Computing and Information Science and Engineering, making it more diverse, competitive, and sustainable, and it encourages the formation of interdisciplinary groups. PRECISE also includes the formation of partnerships with industry, government and other universities.

The interdisciplinary CISE Ph.D. program is expected to begin in January 2001, and the Math Department is hoping to have established its Master's program in Computer Sciences by the beginning of the 2001 academic year. There will be financial aid in both programs for outstanding students. The Ph. D. program has a normal length of four years, and it focuses on the philosophy, nature, representation, and transformation of information, including theoretical and experimental aspects.

On the other hand, the Master's program has a normal duration of two years. It seeks to form professionals capable of proposing efficient and dependable solutions to scientific or technological problems that demand the use of large-scale computing systems. It will have four core courses: Mathematical Numerical Analysis, Linear Numerical Algebra, Algorithm Analysis, and High-performance Computing.

For additional information please contact Dr. Domingo Rodríguez by e-mail at: domingo@ece.uprm.edu.

Foresight Conference...

Mojica is a Doctor in Human Sciences from the University of Paris V "René Descartes" (Sorbonne), and he completed a Post Doc in Foresight and Strategy under the direction of the internationally recognized futurist Michel Godet. He has published, among others, the following books: *Foresight: Techniques for Visualizing the Future; Some Elements of Strategic Planning Applied to Higher Education;* and *Analysis of the XXIst Century*. All are in Spanish.

The presentation will include a theoretical component and an application workshop. Dr. Mojica will discuss what kind of development will take place in the future; what changes will be introduced in society; what kind of citizens we will have; and how we will be affected by a globalization that submits all aspects of human activity— economic, social, and cultural —to worldwide competition. He will present: the concept and characteristics of Foresight; the principal rules of the game that will operate in the next century; managing a model that enables users to choose the best options and organizational strategies; and analyses of alternative futures and their impacts on society. Finally, he will demonstrate the use of software designed to accelerate and improve the precision of foresight models.

Dr. Mojica founded the Latin American Foresight Network, and was the academic and technical director of the "First Ibero-American Encounter of Foresight Studies" in 1997. He has presented papers in the three encounters that followed, as well as conducted seminars in the Externado University of Colombia, UNAM, and the University of the United Nations.

Fore more information you may contact CoHemis at: cohemis@ece.uprm.edu; tel. (1-787) 265–6380; fax (1-787) 265-6340; or visit http://www.ece.uprm.edu/cohemis/

***Second in this series** will be the conference "**Issues in the Education of Engineers for a Global Economy in Latin America**". It will be held in March by Dr. Luiz Scavarda, former Dean of Engineering and assistant to the Chancellor of the Catholic Pontifical University of Rio de Janeiro (PUC-Rio) . The conference will take place as part of the Encounter on Education and Thinking* *(See page 3).*

Remote Sensing and Education...

An undergraduate Certificate Program consisting of 12 credit hours in the areas of remote sensing, GIS and GPS, plus 6 credit hours of undergraduate research, will have been developed at the end of the five-year period. About 125 students are expected to benefit from this program, and more than 50% of these students are expected to complete a Master of Science Degree.

A CD-ROM with all the educational materials developed under this program will be produced and disseminated. In addition, a video will be developed on the PaSCoR program. For additional information, you may contact Prof. Lueny Morell at <lueny@ece.uprm.edu>.

Aquaculture...

and causes the least effects on the endemic biotic resources of the land and the oceans. To face these challenges, UPRM has a Research and Development Center of Commercial Aquaculture in Puerto Rico (CIDACPR, for its initials in Spanish). This Center's mission is to deal with the problems of development and research needs confronted by the local industry and those that it may face in the future. Recently, the Puerto Rico Industrial Development Company granted CIDAPR 2.8 million dollars to improve the infrastructure of its research stations and to create five business centers.

CIDACPR dedicates its educational efforts to informal education: training government personnel and training users. The Ph.D. and the Master's programs of the UPRM's Department of Marine Sciences provide the formal education.

The Agricultural Extension Service and the Sea Grant Program are services provided by UPRM that join efforts with CIDACPR in the implementation of training modules for small-business development in aquaculture and in helping fish farmers.

The development of aquaculture requires an operational infrastructure, scientific investigation, and formal and informal training at all levels. Academia can provide industry with knowledge of technological advances, allowing it to grow and expand. CIDAPR provides to the government and the private production sectors the intellectual component that is generated in its aquaculture research stations. This technology transfer is indispensable for the orderly and the economically and ecologically efficient success of aquaculture.

The Center's actions offer opportunities for the development of business niches and programs of continued education for small-business development in the form of training modules which encourage production in organized cores. Each module is shaped after concrete needs of the industry and the socioeconomic information of the locale or sector being addressed. They constitute a flexible and easily implemented form of the concept of business incubators.

SHORT COURSE IN TRACE ELEMENTS AND TOXIC METALS

CoHemis and the U.S. Armed Forces Institute of Pathology (AFIP) offered on November 15-17, 2000, the short course titled "Trace Elements and Heavy Toxic Metals: Impact on the Quality of the Environment and the Development of Diseases." This course had been offered two years ago at the Cardiovascular Center of Puerto Rico and the Caribbean, in San Juan, and it will be presented on April, 2001 in Caracas, Venezuela (See page 1). The course in Mayagüez was praised by its participants even more than the one in San Juan, due to the expertise demonstrated by the speakers and the general presentation itself.

Among the topics covered were: Diversity of Trace Elements and Toxic Metals in Environmental Health; Hepatic and Renal Effects of Exposure to Toxic Metals; Impact of Trace Metals in the Pediatric Community; Trace Elements and Toxic Metals in Clinical Diagnosis: the Importance of Pre-Clinical Procedures; Programs for Evaluating Exposure to Toxic Metals; Lead Analysis; Concepts in Evaluating Environmental Risks Posed by Metals and Trace Elements; and Analytical Methods for Characterizing and Identifying Trace Elements and Toxic Metals in Geo-environmental Systems.

Dr. José A. Centeno, principal investigator at AFIP's Division of Environmental Pathology, directed the course, with the collaboration of: Drs. Geoffrey S. Plumlee and coal expert Robert Finkelman of the U.S. Geological Survey; Dr. Herman Gibb from the United States Environmental Protection Agency; Dr. Karen Chou, from Michigan State University; and UPRM's Drs. Arturo Massol and Ingrid Klich.

José A. Centeno, Herman Gibb, Geoffrey Plumlee, Robert Finkelman and Karen Chou: the distinguished researchers who visited UPRM to present the seminar together with two Mayagüez researchers.

Because of the importance and relevance of this topic, CoHemis and Dr. Centeno are willing to offer it in other places in Latin America. For more information, visit *www.ece.uprm.edu/cohemis* or contact CoHemis at (1-787) 265-6380, fax (1-787) 265-6340; or contact us by e-mail: *cohemis@ece.uprm.edu*.

A NEW FOCUS FOR THE PROFESSIONAL DEVELOPMENT OF STUDENTS

The UPR/MIT/Tren Urbano Initiative

The "UPR/MIT/Tren Urbano Program for Professional Development" represents an innovative focus on the education of future professionals in engineering, business administration, architecture, and planning. This program is administered by the University of Puerto Rico through the Center for the Transfer of Transportation Technology (CTTT) of UPRM. This is a joint effort by MIT's Center for the Study of Transportation, the Tren Urbano Office of Puerto Rico, and the Puerto Rico Department of Transportation and Public Works (DTOP).

The project was created in the summer of 1994 by the then Secretary of Transportation and Public Works and co-founder of the CoHemis Center, Dr. Carlos I. Pesquera. It aims to prepare the future professionals who would work in the different phases of the heavy rail system being built in Puerto Rico.

The initiative is producing research projects at undergraduate and graduate levels that have direct and immediate application in the areas of planning, design, construction, and operation of the system, and they include marketing strategies.

The three fundamental objectives of the Program are:

* Enhancing the capacity of bilingual professionals with the skills and knowledge to develop an integrated system of public transportation

* Establishing an interdisciplinary education model with the participation of professors from the Faculties of Engineering and Business Administration of UPRM, and the Schools of Planning and Architecture of UPR's main campus.

* Strengthening education and applied infrastructure research

At present, approximately 15 to 20 students from the engineering, business administration, architecture and urban planning programs from the University of Puerto Rico system and 10 students from MIT are chosen to participate every year. These students participate in an internship program of one to two years which includes two annual conferences of 5 to 7 days each. The first conference is for the students from Puerto Rico and it is held in Boston, Massachusetts. There they learn through case studies how a heavy rail line is developed in an urban area. Local experts in mass transport development discuss topics related to the planning, design, construction, operation, and maintenance of these systems. The students visit metro stations, maintenance shops, and other key facilities. On the other hand, MIT students spend several days each January in Puerto Rico, learning first-hand about the problems of transportation of San Juan and the role that the Tren Urbano will play in addressing these.

The UPR/MIT/Tren Urbano Program emphasizes the interdisciplinary nature of a large-scale infrastructure project so that the students learn the importance of all aspects of such a project. They learn about transportation systems, architecture, social factors, urban planning, marketing strategies, financing, security, and public participation. Since its establishment in 1994, approximately 145 students and 23 professors have participated in the Program.

For more information, visit the Program's website at: *http://cirweb.upr.clu.edu/trenurbano*

SUBSURFACE REMOTE SENSING

UPRM PARTICIPATES IN IMPORTANT RESEARCH CONSORTIUM

The prestigious Engineering Research Center Program of the US National Science Foundation (NSF) recently awarded a group of universities that includes UPRM a grant to create the Center for Subsurface Sensing and Imaging Systems (CenSSIS). The Center combines expertise in wave physics, sensor engineering, inverse scattering, computational modeling, image processing, and data management to create new sensing systems prototypes. Dr. Luis O. Jiménez, Director of the UPRM component, explains that the Center seeks to develop technologies meant to revolutionize the ability to detect and image objects that are underground, underwater, or embedded within living tissue or manmade structures.

The CenSSIS partnership includes four Academic Core Partners: Northeastern University (lead partner), Boston University, Rensselaer Polytechnic Institute, and the University of Puerto Rico at Mayagüez—and four Strategic Affiliates: Massachusetts General Hospital, Brigham and Women's Hospital, Lawrence Livermore National Laboratory, and the Woods Hole Oceanographic Institution. Over 25 industrial partners will provide their insight to face the research challenges and help speed technology transfer.

CenSSIS will attack currently intractable problems in sensing and imaging involving the detection, location, and identification of objects that are obscured beneath various absorptive, diffusive, or dispersive media through waves reflected from under the surface. Mapping plumes underground, detecting tumors, or identifying developmental defects in the interior of an embryo are diverse applications that share a common problem: distinguishing an object from its surrounding medium.

These diverse applications have similar research barriers and similar solutions whether the probing wave is electromagnetic or acoustic, whether the medium is soil or tissue, or whether the target is a land mine or a tumor. To address the barriers, the Center will focus on three interdisciplinary research thrusts: Subsurface Sensing and Modeling; Physics-based Signal Processing and Image Understanding; and Image / Data Information Management. Biological, medical, soil, and sea test beds will be used to enable a wide range of next-generation sensing and imaging systems.

The research component to be carried out in UPRM deals with detecting and identifying objects under the ocean surface by means of remote sensing platforms and sensor fusion. These technologies will be applied to identify coral reefs, ocean bottom, and manmade objects. The algorithms developed will be applied to biomedical imaging as well as tumor detection and estimation of oxygen levels in hemoglobin. Other CenSSIS institutions will be studying structural damage inside concrete elements by means of remote sensing techniques, among other topics.

Due to its location in the Western Technological Corridor of Puerto Rico, the work done in UPRM is expected to create an industry of data imaging and processing that attracts local and multinational companies.

Caribbean Islands Water Resources Congress

The Puerto Rico Water Resources Research Institute and the Virgin Islands Water Resources Research Institute are organizing the Sixth Caribbean Islands Water Resources Congress. This event, co-sponsored by CoHemis, will be held in the Mayagüez Resort and Casino on February 22nd and 23rd, 2001.

The following are among the topics to be presented: watershed management; infrastructure and water distribution; erosion, sedimentation and geomorphology; dxtreme hydrologic dvents (droughts/floods and hurricanes); sustainable development of water resources; desalination, water reuse, and other water-supply sources (Caribbean and Tropical Islands experience); climate change impact in the Tropics/Caribbean (global change, El Niño, La Niña); management of limited freshwater resources (conservation, reuse, availability); surface and ground quality; social aspects and water issues: water price, water use, etc.; and small community water systems: water supply and wastewater.

For more information, contact Dr. Walter Silva-Araya, Technical Program Chairperson, Puerto Rico Water Resources Research Institute, tel. (1-787) 265-3826; fax: (1-787) 832-0119; e-mail: WRRI_RUM@rumac.upr.clu.edu.

The US Geological Survey recently extended its funding for the Puerto Rico Water Resources Research Institute, directed by Dr. Jorge Rivera-Santos. The Institute and CoHemis have been working together for some years.

Cooperation Agreement between UPR and the US Geological Survey

The University of Puerto Rico and the US Geological Survey signed an important agreement with the purpose of augmenting efforts of collaboration in general areas of scientific research.

This agreement will consolidate the coordination of research efforts, data inventories, and the study and exchange of information in earth and natural sciences, geology, hydrology, remote sensing, cartography, and biology in the Caribbean. It will also facilitate faculty and student exchanges for research projects in the areas of management and interpretation of resources and natural risks.

R & R Structures Workshop...

The National Science Foundation has granted UPRM's Dr. Daniel Wendichansky and CoHemis $49,900 to organize this event. The number of participants who will present written papers will be limited to 30. The presentations and the discussions will be in English.

The participants should be: researchers and engineers from government agencies who face or attack the structural problems f deteriorated structures; manufacturers and vendors of R&R products, and designers and builders who do R & R labors. Researchers will represent fields such as structures, imbedded and remote sensors, materials, artificial intelligence, and signal processing. Practitioners will present their needs for data, technologies, instrumentation, or analytical models to apply new types of information. Manufacturers and vendors may exhibit and discuss their information and technology needs and other problems.

The grant, which provides funds for inviting some researchers and professionals, comes from the Building Systems Program directed by Drs. Jack Scalzi and Vijaya Gopu, from the NSF's Engineering Division. The event's co-sponsors include ISIS Canada, John Hopkins University's Center for Non-destructive Evaluation, University of West Virginia's Constructed Facilities Center and UPRM's Center for Civil Infrastructure Research.

Dr. Wendichansky has a BS in Civil Engineering from Argentina's National University of Cordoba, an MS from UPRM, and a Ph.D. from the State University of New York (SUNY) at Buffalo. Most of his work is related to structural assessments, non-destructive evaluations, and repair and rehabilitation techniques. He belongs to the faculty of the UPRM Department of Civil Engineering, is an active consultant, and has participated in NSF panels for evaluating research proposals on structures.

This is the third workshop organized by CoHemis and NSF in a field that at a hemispheric level requires billions of dollars and extensive technological efforts. In 1994, UPRM hosted the conference-workshop "Repair and Rehabilitation of the Infrastructure of the Americas", and in 1997 the University of Zulu hosted in Maracaibo, Venezuela the conference-workshop "Repair and Rehabilitation of Reinforced Concrete Structures". CoHemis produced proceedings for both events, the second one an ASCE publication subtitled "the State-of-the-Art."

Abstracts are being solicited in the following subjects, focused on bridges and buildings:

1. Materials research needs for FRPs, sensors and new technologies in either development or demonstration stages.

2. Research or study needs in: structural assessments, liability for R&R or sensor work, life cycle estimation for repaired or rehabilitated structures, and design of repairs and sensor applications.

3. Problems in the maintenance of repaired or sensor-provided structures and in construction work related to R&R or sensor work on existing structures.

4. Innovative application experiences with FRPs, sensors, and new R&R technologies in either development or demonstration stages.

5. Results from monitoring the performance of repaired or rehabilitated bridges and buildings: interpretations, applications, lessons, and new directions for practice and research.

6. Summary of active and projected national projects, research activities and national priorities in specific countries or groups of countries of Latin America or the Caribbean related to the workshop topics.

7. Future trends, issues and research needs related to the workshop topics.

Both oral and poster papers will be accepted. Interested individuals are invited to submit a one-page abstract, together with a short Vita, by fax or e-mail by January 31, 2001, to the address and/or number shown at the end of the article.

Persons who want to have more information, suggest future research topics, or submit names of individuals or companies who may want to participate in the event should access the website <http://ce.uprm.edu/RR>, or contact CoHemis Director Dr. Luis Pumarada-O'Neill at 1-787-265-6380, by fax at 1-787-265-6340, or by e-mail at: cohemis@ece.uprm.edu.

Remembering the previous NSF-CoHemis workshop on repair and rehabilitation of structures