

**Philippine-American Academy of Science and Engineering**  
**2002 Annual Meeting** **August 22-24, 2002**

**Holiday Inn Select**  
**Solomon's Island, Maryland**

*Conference Theme: New Challenges in Science and Engineering*

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**August 22, 2002 (Thursday) - - - - - The Theatre, Patuxent Concourse**

8:00 AM          Registration

**Morning Session**

9:00              Meeting Opening Remarks ..... *Prof. Severino Koh*

9:05              Welcome Address ..... *Dr. Terry Sarigumba*, 2002 PAASE President

9:15              Introduction of 2002 PAASE Founder's Lecturer in Science  
..... *Dr. Ernesto Terrado*

9:20              Address by 2002 PAASE Founder's Lecturer in Science  
  
*Climate Change As Revealed in the Arctic by Satellite and In Situ Observations*  
..... *Dr. Josefino Comiso*

10:00             **BREAK (10 MIN)**

***Earth Stewardship: Development, Responsible Management, Conservation and Protection of Natural Resources and the Environment***

10:10             Session Moderator's Opening Remarks.....Marjorie B. Medina

10:15             *Agroforestry in the Yucatan Peninsula (Southeastern Mexico)*  
.....Lita C. Rule

10:30             *A New Challenging Question in Agrochemical Exposure Assessment: What Happens to Pesticides During Drinking Water Chlorination?*  
.....Rudy A. Pisigan, Jr.

10:45             *Life-Cycle Environmental Benefits Of Using Bioethanol As A Gasoline Additive*  
..... Alvin B. Culaba

11:00             **BREAK (10 MIN)**

11:10             *Climate Signature Events – El Niño And La Niña*  
.....Celso S. Barrientos

|          |   |
|----------|---|
| 11:25    | <i>Radiation Sterilization Of Anthrax Bacillus Spores In The Mail</i><br>.....Florence Cua-Christman  |
| 11:40    | <i>Ecophysiology of Southeastern Bottomland Oak Trees</i><br>.....Rico M. Gazal   |
| 11:55    | <i>Preliminary Studies On The Sources of Jade Used In The Philippines: Developing Evidence That Ancient Filipinos Possessed Extraordinary Maritime Skills</i><br>.....W. Thomas Shier |
| 12:10 PM | <b>LUNCH</b>  |

### **Afternoon Session**

#### ***Advances in Biotechnology, Chemistry and the Life Sciences***

|      |   |
|------|---|
| 1:20 | Session Moderator's Opening Remarks.....Onofre De Jesus   |
| 1:25 | <i>Use Of The Deuterated-Retinol-Dilution (DRD) Procedure To Assess Vitamin A Status Of Elders Residing In Rural Philippine Communities: Influence Of Diet And Helminthic Infections</i><br>.....Judy D. Ribaya-Mercado |
| 1:45 | <i>Developing A Fluorescent Latex Immunoassay For Detection Of Spectinomycin Antibiotic</i><br>.....Marjorie B. Medina  |
| 2:05 | <i>Surface Plasmon Resonance-Based Competition Assay To Assess The Sera Reactivity Of Variants Of Humanized Antibodies</i><br>.....Noreen R. Gonzales   |
| 2:25 | <i>Ratiometric Optical Sensing of Glutamine in Cell Culture Media</i><br>.....Leah Tolosa   |
| 2:45 | <b>BREAK (15 MIN)</b>   |
| 3:00 | <i>The Determination Of Enantiomeric Excess In Amino Acids And Peptides By Fourier Transform Mass Spectrometry</i><br>.....Carlito B. Lebrilla  |
| 3:20 | <i>To Swim Or Not To Swim, Or Does A Leech Have Free Will?</i><br>.....Alfonso. M. Albano   |
| 3:40 | <i>Early Neuronal Changes In Pre-Symptomatic Huntington's Disease Involve Alterations In Cytoskeletal And Synaptic Elements</i><br>.....Danilo A. Tagle   |
| 4:00 | <i>Isolation And Characterization Of Genes In The Nasal Region Involved In Olfactory Axon Outgrowth And LHRH Neuronal Migration</i><br>.....Jean D.R. Tiong   |
| 4:20 | <i>Ligand-Toxin Conjugates For Targeted Pain Therapy</i><br>.....Maria Luisa A. Virata  |
| 4:40 | <b>BREAK</b>  |

**Evening Session**

**Hunting Creek Ballroom**

- 6:45            **COCKTAILS** (Cash Bar)
- 7:00            **DINNER BANQUET**
- 8:00            **AWARDS PRESENTATION**.....Emcee: *Dr. Ben De Lumen*

Founder’s Lectureship Awards  
.....Presentors: *Prof. Severino Koh and Prof. Jose B. Cruz, Jr.*

*Dr. Josefino Comiso* – Science

*Dr. Oscar Ibarra* – Engineering

Founder’s Lectureship Donors

*Prof. Jose B. Cruz, Jr.*

*Dr. Severino Koh*

*Dr. Sevilla Detera-Wadleigh*

*Dr. Florante Quioco*

*Dr. Florence Cua-Christman*

Special Awards ..... Presentors: *Dr. Leah Tolosa and Dr. Terry Sarigumba*

*Diane Comiso*

*Eden Terrado*

*Pacing Koh*

*Belen Buot*

*Pag-asa Barrientos*

*Stella Cruz*

*Helen De Lumen*

*Rosie Velasquez*

*Rose Padlan*

*Bob Wadleigh*

*Fe Blanche*

*Portia Pisigan*

*Ed Christman*

*Nattie Sarigumba*

## Philippine-American Academy of Science and Engineering

2002 Annual Meeting

August 22-24, 2002

Holiday Inn Select  
Solomon's Island, Maryland

*Conference Theme: New Challenges in Science and Engineering*

**August 23, 2002 (Friday) - - - - - The Theatre, Patuxent Concourse**

8:00 AM Registration

### Morning Session

9:00 Introduction of 2002 PAASE Founder's Lecturer in Engineering  
.....*Prof. Jose B. Cruz, Jr.*

9:05 Address by 2002 PAASE Founder's Lecturer in Engineering  
*On The Complexity of Computing – I Can't Do It, But No One Else Can Do It Either*  
.....*Prof. Oscar Ibarra*

9:45 **BREAK (10 MIN)**

### *Advances in Physics, Engineering and Computer Technology*

9:55 Session Moderator's Opening Remarks..... Romel D. Gomez

10:00 *Quantum Hydrodynamics For Nanosystems*  
.....Felixberto A. Buot

10:15 *How To Build A Quantum Computer*  
.....Danilo B. Romero

10:30 *Quantum Computing Using Superconducting Josephson Junction Qubits*  
.....Roberto C. Ramos

10:45 *Nanocontacts, Nanotubes And Ballistic Electron Transport*  
.....Romel D. Gomez

11:00 **BREAK (10 MIN)**

11:10 *Spectrally Selective Thin Film Coating For Flat Plate Collectors*  
.....Alvin B. Culaba

|          |  |                                 |
|----------|--|---------------------------------|
| 11:25    | <i>Nuclear Power in the Philippines</i><br>.....   | Ricardo Palabrica               |
| 11:40    | Introduction of the Guest Speaker<br>.....   | <b>Dr. Terry Sarigumba</b>      |
| 11:45    | Address by the Representative of the Philippine Ambassador to the US<br><br><i>Developments in the Philippine Economy</i><br>..... | <b>Ms. Lourdes Yparraquirre</b> |
| 12:15 PM | <b>LUNCH</b>   |                                 |

**Afternoon Session**

***Strategies To Help Improve Education, Health, Science and Technology in the Philippines***

|      |   |  |
|------|---|--|
| 1:30 | Session Moderator’s Opening Remarks .....   | Alfonso M. Albano  |
| 1:35 | <i>International Educational And Scientific Exchanges – Relevance To Philippine National Development</i><br>..... | Judy Ribaya-Mercado  |
| 2:00 | <i>Developing A Role for PAASE To Accelerate Progress In The Philippines</i><br>.....                             | Jose B. Cruz, Jr.  |
| 2:25 | <i>Healing A Plundered Paradise – An Impossible Dream?</i><br>.....   | Terry Sarigumba  |
| 2:50 | <b>BREAK (15 MIN)</b>   |  |
| 3:05 | <i>Energy Issues In The Philippines</i><br>.....  | Ernesto Terrado  |
| 3:30 | <i>Experiences In The Philippines</i><br>.....  | Eduardo A. Padlan  |
| 3:55 | Open Forum  |  |
| 4:25 | Position Paper – White Paper (in publishable form)<br>.....   | Alfonso M. Albano<br>Ben De Lumen<br>Marjorie B. Medina<br>Manuel Velasquez      |
| 4:35 | Symposium Summary<br>.....  | Sevilla Detera-Wadleigh<br>Catalino Blanche<br>Romel D. Gomez<br>Josefino Comiso |
| 4:45 | <b>BREAK</b>  |  |

**Evening Session**

**Hunting Creek Ballroom**

6:45           **COCKTAILS** (Cash Bar)

7:00           **DINNER BANQUET**

8:00           **FEATURED LECTURE**

*Salt, Genes and High Blood Pressure*

.....*Dr. Pedro A. Jose*

8:45           **MUSICAL PROGRAM** (Group Singing)



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**ABSTRACTS**

**2002 PAASE Founder's Lecturer in Science**

**CLIMATE CHANGE AS REVEALED IN THE ARCTIC BY SATELLITE  
AND IN SITU OBSERVATIONS**

Josefino C. Comiso

Laboratory for Hydrospheric Processes, Code 971, NASA Goddard Space Flight Center  
Greenbelt, MD 20771

The average surface temperature of the Earth increased by about 0.4 K during the last century as inferred from meteorological station data around the globe. The rate of warming has also increased substantially during the last few decades fueling concerns about the impact of anthropogenic activities on the climate. An early signal of a climate change is expected to come from the Arctic because of the amplification of such change in the region through feedback effects associated with the high reflectivity of the snow and ice cover. Because of the general inaccessibility and the presence of a relatively thick and dynamic sea ice cover the only way to obtain pan Arctic coverage is through the use of satellite remote sensing. Two decades of co-registered satellite surface temperature and ice cover data have been analyzed and the results show large anomalies which are mainly negative in the 1980s and mainly positive in the 1990s indicating, a warming Arctic. The warming trend is also shown to be spatially variable with the highest values generally in the North American and Western Arctic regions where the trends are as high as 1.2 K per decade. Concurrently, the sea ice cover has been decreasing at the rate of 3% per decade while thinning has been observed using several decades of sonar submarine data. The biggest signal, however, comes from the thick perennial sea ice cover which is shown to be rapidly declining at the rate of 10% per decade. A sustained decline at this rate would mean a totally different Arctic Environment and profound changes in the climate before the end of this century.

**Biography:**

Josefino Comiso (Joey) received his BS degree in physics at the University of the Philippines, his MS degree in physics at Florida State University and his Ph D. in elementary particle physics at the University of California at Los Angeles (UCLA). His Ph. D. thesis was on "Pion photoproduction and a test of time reversal invariance in electromagnetic interactions." Time reversal invariance is one of three fundamental symmetries in nature and the discovery of a violation in the other two (charge conjugation and parity) led to

Nobel prizes. His research did not find any violation, a result that stands up to the present. He was in the research faculty of UCLA and the University of Virginia before joining NASA Goddard Space Flight Center where he is now a Senior Research Scientist. Since climate change was becoming a big scientific and political issue he concentrated on doing research in the polar regions where the change is expected to be amplified. He and his colleagues did pioneering work that led to the publication of the first satellite atlas on sea ice. Joey has made many important contributions and discoveries on polar processes and oceanography especially those associated with polynyas and the Odden that are main sources of the bottom water that drives the thermohaline circulation of the world's oceans. He was first to observe a cooling in the Antarctic and a rapidly retreating perennial ice cover in the Arctic during the last two decades providing new insights into the climate change phenomenon. He developed the Bootstrap algorithm that is now used by new billion dollar US and Japanese satellite systems for generating sea ice geophysical parameters. Joey was the chief scientist of a NASA aircraft mission in the Arctic that was done concurrently with a nuclear submarine and is the chief scientist of an upcoming NASA Antarctic mission. He has received many performance, achievement and special awards from NASA and is the author or co-author of numerous scientific publications including 3 books, several book chapters and a Scientific American article. He has given invited and plenary talks in many international conferences and his work has been featured in magazines, newspapers, and books, the latest being the book by Queena Lee of Ateneo University on "Ten Outstanding Filipino Scientists."

**Earth Stewardship: Development, Responsible Management, Conservation and  
Protection of Natural Resources and Environment**

**AGROFORESTRY IN THE YUCATAN PENINSULA (SOUTHEASTERN MEXICO)**

Lita C. Rule

Department of Natural Resource, Ecology & Management, Iowa State University, Ames, IA 50011

A survey of two indigenous agroforestry systems was done in 1996 in the state of Quintana Roo in the Yucatan peninsula in Mexico. These systems are the solares (home gardens) and the parcelas diversificadas con arboles (or diversified agronomic crops, trees, shrubs, and/or forage). Both systems have similar trees and agronomic crops and animal species considered particularly during the establishment phase, although solares are smaller in area. It is interesting to note that these systems are evolving, as continuous modifications are undertaken mostly in the parcelas. Use of outside inputs (fertilizer and animal vaccine) is very low. Crops are mostly sold directly to local markets, but good market facilities are a problem in many areas. Activities involve all family members (including smaller children), with hired labor used by few parcela owners, particularly those with larger land holdings. Parcela farmers are generally males, but both sexes are almost equally represented in the other system. Many of the respondents are migrants to Quintana Roo for economic reasons, and have stayed there for about 20 years. They tend to have relatively big families, have low educational attainment, but active in organized groups. Pending changes in land tenure laws in their ejidos left respondents with varied perceptions about possible impacts on their systems and tenure but many are optimistic that these changes will not affect their plans for their systems. Similarities between Philippine and Yucatan systems and farmers will be drawn during the presentation.

## **A NEW CHALLENGING QUESTION IN AGROCHEMICAL EXPOSURE ASSESSMENT: WHAT HAPPENS TO PESTICIDES DURING DRINKING WATER CHLORINATION?**

Rudy A. Pisigan, Jr.

Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington, D.C.

Pesticides from agricultural application and urban use can be transported to a surface water or groundwater source that provides raw water in the community drinking water treatment plants. Prior to human consumption, and as an important treatment operation, the raw water is commonly chlorinated to destroy pathogenic microorganisms. Owing to the predominant human exposure to the chlorinated tap water and due to limited or no chlorination effects data, laboratory jar tests and literature review were conducted to determine what happens to pesticides as the water is chlorinated. For the laboratory tests, samples of well water from a treatment plant were spiked with 30 - 100 ug/L of nine organophosphate, carbamate, and haloorganic pesticides, and then chlorinated at Uniform Formation Conditions to simulate water distribution systems. HPLC and GC/MS analyses showed significant removals (90-99%) for bromacil, chlorpyrifos-methyl, metribuzin, molinate, aldicarb, and prometryn, while the removal efficiency for endosulfan, hexazinon, and lindane was lower. Literature studies suggest that other pesticides are also susceptible to chlorine degradation. For certain carbamate pesticides, second-order kinetic plots indicate that the reaction efficiency varies with pH. At pH 6.8 to 8.3, the removal of methomyl tends to increase while that of aldicarb tends to decrease. Other carbamates such as carbaryl and propoxur did not react with chlorine. In another study that closely simulates a treatment plant operating conditions, a thiocarbamate pesticide was converted during chlorination to N-nitrosodimethylamine, a carcinogenic chemical. Other experiments conducted in Japan, England, and United States show that during chlorine treatment, diazinon, thiobencarb, prometryn, and aldicarb are transformed to chlorinated and oxidized products that may have different or higher toxicities relative to those of the corresponding parent compounds. Thus, both the laboratory jar study and literature review indicate that certain pesticides can be removed while others are not affected by chlorination of drinking water. For pesticides that are resistant to chlorination, agrochemical exposure assessment in drinking water should focus on the parent compounds that are present in the finished treated water. For pesticides that react with chlorine, the focus will shift to stable transformation products that are likely to have different fate properties and toxicological concerns.

## **LIFE-CYCLE ENVIRONMENTAL BENEFITS OF USING BIOETHANOL AS A GASOLINE ADDITIVE**

Raymond R. Tan<sup>1</sup> and Alvin B. Culaba<sup>2</sup>

<sup>1</sup>Chemical Engineering Department and <sup>2</sup>Mechanical Engineering Department,  
De La Salle University – Manila, 2401 Taft Avenue, Manila, Philippines

Ethanol can be blended with gasoline as a fuel extender, an oxygenating agent, and octane enhancer. Blends containing up to 10% ethanol by volume (E10) can be used in unmodified spark-ignition engines without significant changes in vehicle performance, while yielding reductions in over-all tailpipe emissions. Enzyme-based processing technology is expected to allow ethanol to be produced commercially from cellulosic biomass such as municipal and agricultural waste as early as 2005. Ethyl alcohol produced in this manner is called bioethanol; this production technology promises to be an effective open-loop recycling (“waste-to-energy”) pathway which simultaneously gives significant benefits of reduced fossil fuel consumption and air emissions. This paper presents results of simulations using a modified version of the GREET 1.5a fuel cycle model to estimate the relative benefits of using E10 instead of conventional gasoline. In addition to obvious savings in petroleum usage, reductions in life-cycle hydrocarbon, carbon monoxide, sulfur dioxide and carbon dioxide emissions are predicted by the model. Cumulative emissions of particulates and nitrogen oxides, on the other hand, are expected to increase.

## **CLIMATE SIGNATURE EVENTS – EL NIÑO AND LA NIÑA**

Celso S. Barrientos

Oceanic Research and Applications Division, Office of Research and Applications  
NOAA/NESDIS, Silver Spring, MD

During the past two decades, debate on climate has been intensifying. The question whether there is global warming due to human influence is still controversial. Two important climate signature events that entered in our daily consciousness are El Niño and La Niña. This presentation will briefly define these phenomena, discuss some recent significant events, and show some significant impacts. El Niño and La Niña can be most beneficial and devastating. Economic losses in the \$B are common in other parts of the globe, while beneficial effects are almost equal in other parts. The present situation of the start of a mild El Niño will be presented.

## **RADIATION STERILIZATION OF ANTHRAX BACILLUS SPORES IN THE MAIL**

Florence Cua-Christman

Christman, Cua Associates, Princeton, NJ 08540

Anthrax can infect by inhalation as spores, cutaneously, or by ingestion. The nation was awakened to the dangers of anthrax by 5 deaths by inhalation anthrax, 2 cutaneous infection and as the author discovered anthrax outbreak in the USSR in 1979. The anthrax spores were delivered to Congressman Tom Daschel, Tom Brokaw's studio in the mail, Senator Leahy, and the editor of the New York Post. Due to this, the postal system sent for irradiation by electron beam radiation for sterilization thousands of mails potentially containing the anthrax bacillus spores. The company that is doing the irradiation is Titan Scan Technologies in Lima Ohio. A recent videotape showed assembly line conveyor belt with railings irradiation designs. According to Dan Carestio of Isomedix, the D10 dose needed is 3 kGy. That is the dose that will kill 90% of the anthrax bacillus spores. According to Edward Christman, 10x that is 3 Mrad or 30 kGy. 1Gy=100 Rad. According to Larry Schneider of Sandia National Laboratory, the total dosage needed is 5.4 Mrad or 54 kGy. According to Colonel Robert Eng, the Director of the Armed Forces Radiobiology Research Institute(AFRRI), the absorbed doses required to sterilize the mail is currently 56 kGy of 10 MeV electrons. The mail is also irradiated at the Ion Beam Applications in the Bridgeport section of Logan Township. The cost is according to IBA officials a cent per letter. The irradiation per box of mail is twice; the second 180<sup>0</sup> from the first one. According to the Times, Nov. 27, 2001, the irradiated mail fallout consists of White mail might appear discolored with a yellow tint. Plastic windows on envelope could shrink or become brittle. Some mail may appear scorched. Plastic materials, like credit cards, could melt or be damaged. Photographs could appear washed out. Video and audiotapes and computer diskettes could be damaged. Compact discs have so far survived.

## ECOPHYSIOLOGY OF SOUTHEASTERN BOTTOMLAND OAK TREES

Rico M. Gazal<sup>1</sup>, M.E. Kubiske<sup>2</sup> and K.F. Connor<sup>3</sup>

<sup>1</sup>Department of Forestry, Mississippi State University, MS; <sup>2</sup>USDA Forest Service Forestry Sciences Lab; and <sup>3</sup>USDA Forest Service Center for Bottomland Hardwood Research

Leaf gas exchange and whole tree water use of individual Nuttall (*Quercus nuttallii*), overcup (*Q. lyrata*), and dominant and codominant swamp chestnut oak (*Q. michauxii*) trees in Mississippi and Louisiana were measured to determine their responses to changes in environmental moisture. Daily water use was estimated from basal sap flow measurements using thermal dissipation probes (TDP). Branch level sap flow using sap flow gauges and leaf level gas exchange were measured on the upper crowns through the use of canopy access tower. Leaf gas exchange rates, total daily water consumption and transpiration of the dominant swamp chestnut oak tree increased in response to summer precipitation. During the same period, decline in leaf gas exchange rates and water use in the codominant swamp chestnut oak tree may be due to limited access of its root system to soil water during soil drying and high vapor pressure deficit. Large stem capacitance and deep root systems buffered extreme fluctuations in leaf gas exchange rates in mature canopy oak trees. The use of water from storage compartments caused a time lag between the start of branch sap flow and the basal sap flow in mature trees. Seasonal fluxes in water use and transpiration among individual oak trees of various sizes and other bottomland hardwood species must be determined to assess their physiological and ecological contributions on the water balance of Southeastern bottomland hardwood forests.

## PRELIMINARY STUDIES ON THE SOURCES OF JADE USED IN THE PHILIPPINES: DEVELOPING EVIDENCE THAT ANCIENT FILIPINOS POSSESSED EXTRAORDINARY MARITIME SKILLS

W. Thomas Shier

Department of Medicinal Chemistry, University of Minnesota, Minneapolis, MN 55455

Jade artifacts recovered from controlled excavations throughout the Philippines have been C-14 dated by associated materials as early as 8,000 B.C., although most of them are found in the Southern Tagalog region and date from 800 B.C. to 100 A.D. Because there are no known sources of either type of true jade (nephrite or jadeite) in the Philippines, it is assumed to have been imported. To provide preliminary evidence to support proposed provenance studies, jade artifacts purchased in Manila antique shops have been analyzed for 29 elements by inductively-coupled mass spectrometry with laser ablation sampling, and compared with various jade mineral samples collected by the author or purchased from miner/collectors in various countries. Stepped adzes from the Philippines have the same appearance and elemental composition as jadeite samples from Patrick's Point, CA, USA, but different from jadeite samples from Burma, Guatemala and Covelo, CA, and carved antiques presumably from China. A bead and several ling-*os* from the Philippines have the same appearance and elemental composition as nephrite samples from Fraser River, British Columbia, Canada, but differ from nephrite samples from numerous other locations. If these observations can be extended to artifacts from controlled excavations in the Philippines, and jade samples from additional sources also prove different in composition, it will be possible to conclude that ancient Filipinos possessed extraordinary maritime skills. These skills would make Filipinos compelling candidates for numerous poorly-attributed prehistoric achievements, including the following: (i) Filipinos were the most technologically-advanced people on earth for a period of 5,000 years; (ii) Filipinos "discovered" America at least 2,000 and possibly 9,500 years before Columbus set sail; (iii) Kennewick man was a proto-Filipino; (iv) the Southern Tagalog region is the Polynesian homeland; and (v) Filipinos dominated as much as a third of the world for hundreds, and possibly thousands of years.

**USE OF THE DEUTERATED-RETINOL-DILUTION (DRD) PROCEDURE TO ASSESS  
VITAMIN A STATUS OF ELDERS RESIDING IN RURAL PHILIPPINE COMMUNITIES:  
INFLUENCE OF DIET AND HELMINTHIC INFECTIONS**

Judy D. Ribaya-Mercado<sup>1</sup>, Florentino S. Solon<sup>2</sup>, Liza S. Fermin<sup>2</sup>, Christine S. Perfecto<sup>2</sup>, Juan Antonio A. Solon<sup>3</sup>, Robert M. Russell<sup>1</sup>

<sup>1</sup>U.S. Department of Agriculture Human Nutrition Research Center on Aging at Tufts University, Boston, MA; <sup>2</sup>Nutrition Center of the Philippines, Manila; and <sup>3</sup>Department of Parasitology, College of Public Health, University of the Philippines, Manila

**BACKGROUND:** In many non-industrialized nations, vitamin A deficiency (VAD) has been reported to be a public health problem among children, and pregnant and lactating women; little attention has been paid to the elderly to determine whether they are also at risk of VAD. **OBJECTIVES:** In a cross-sectional study, we determined the vitamin A status of older adult Filipinos (mean age: 68.9 y, range: 60-100 y) who resided in the rural communities of Malabanan and Palsara, in the town of Balete, Batangas; and assessed the influence of diet and helminthic infections on vitamin A status. **METHODS:** Total-body vitamin A stores were estimated by DRD; liver vitamin A, by assuming that liver wt is 2.4% of body wt; and serum retinol, by high-performance-liquid-chromatography (HPLC). Dietary intakes of vitamin A were assessed by three non-consecutive 24-h recall, using Philippine food tables for vitamin A and  $\beta$ -carotene. Helminthic infections (*Ascaris lumbricoides*, *Trichuris trichiura*, and hookworm) were assessed by the Kato-Katz procedure. Serum carotenoids were measured by HPLC. **RESULTS:** (1) Mean total-body vitamin A stores was 65.4 mg retinol (range: 5.8-190.1 mg retinol); liver vitamin A concentration, 55.7  $\mu\text{g/g}$  (range: 7.6-179.3  $\mu\text{g/g}$ ); serum retinol concentration, 52.9  $\mu\text{g/dL}$  (range: 22.3-101.1  $\mu\text{g/dL}$ ). (2) The % of subjects with deficient liver vitamin A ( $<20 \mu\text{g/g}$ ) was 10.3%; with poor-to-marginal serum retinol ( $<30 \mu\text{g/dL}$ ), 5.2%. (3) Mean dietary vitamin A intake was 120.4 retinol activity equivalents (RAE)/d (range: 12.4-512.7 RAE/d). Dietary vitamin A correlated with total-body vitamin A stores ( $r=0.32$ ,  $P=0.006$ ) and liver vitamin A ( $r=0.24$ ,  $P=0.04$ ), but not with serum retinol. Subjects with adequate liver vitamin A ( $\geq 20 \mu\text{g/g}$ ) ingested  $126 \pm 92$  RAE/d (mean $\pm$ SD) (range: 26-513 RAE/d); subjects with inadequate liver vitamin A ingested  $69 \pm 42$  RAE/d (range: 17-141 RAE/d). (4) Total-body and liver reserves of vitamin A, but not serum retinol, correlated with serum provitamin A carotenoids ( $\beta$ -carotene,  $\alpha$ -carotene,  $\beta$ -cryptoxanthin). (5) The prevalence of helminthic infections were: 42.4% with hookworm, 22.8% with *Ascaris lumbricoides*, and 10.9% with *Trichuris trichiura*; their intensities were light to moderate, and no association with vitamin A status was observed. **CONCLUSIONS:** (1) The elderly are vulnerable to hypovitaminosis A. Filipino elders may have normal serum retinol concentrations yet poor vitamin A reserves. (2) This study is the first to show a correlation between vitamin A reserves and dietary vitamin A intakes, and between vitamin A reserves and serum provitamin A carotenoids. The use of DRD for assessing total-body stores of vitamin A is proving to be the most reliable indirect measure of vitamin A status; relationships that were not previously discerned with the use of serum retinol are being made evident with the use of DRD. (3) The vitamin A intakes of elders with adequate or deficient liver vitamin A concentrations are useful in the formulation of recommended dietary allowances for this age group. (4) No association was observed between light-to-moderate helminthic infections and vitamin A status in Filipino elders. (Supported by grant #58-3148-9-063 from the US Dept of Agriculture, Foreign Agricultural Service)

**DEVELOPING A FLUORESCENT LATEX IMMUNOASSAY FOR  
DETECTION OF SPECTINOMYCIN ANTIBIOTIC**

Marjorie B. Medina

U.S. Department of Agriculture, Agricultural Research Service, Eastern Regional Research Center,  
Wyndmoor, PA 19038

Spectinomycin is an antimicrobial agent used to treat infections caused by Gram negative and Gram positive microorganisms in poultry and swine production. There is a need to develop a rapid and sensitive method to detect spectinomycin residues in animal tissues. A latex fluorescent immunoassay was designed using reagents specially developed for this assay. Sheep polyclonal spectinomycin antibody was produced against spectinomycin conjugated to keyhole limpet hemocyanin (KLH). The spectinomycin immunoglobulin (IgG) was purified through Protein G affinity column and was immobilized onto latex particles. The spectinomycin was labeled with 5-([4,6-dichlorotriazin-2-yl]amino)-fluorescein (DTAF). The optimum assay conditions consisted of pre-incubating the latex-IgG with spectinomycin standards and/or spectinomycin spiked in bovine kidney extracts for 15 min at room temperature (RT). The DTAF-spectinomycin was added to compete for the antibody binding sites and the mixture was further incubated for 20 min at RT. The bound spectinomycin-DTAF-IgG-latex complex was separated by centrifugation at 4000 x g for 10 min. Aliquots of the supernate containing the unbound spectinomycin-DTAF were transferred to microtiter wells and the fluorescence signals were measured at 485 nm excitation and 535 nm emission. The signals were inversely proportional to the concentration of spectinomycin in the samples. The fluorescent latex immunoassay detected spectinomycin at 0 to 100 ppb with minimum detectability of 5 ppb. Plotting the % bound complex against the spectinomycin concentration, the regression correlation values (R<sup>2</sup>) were 0.976, 0.938, 0.974, 0.859 (mean=0.936). Analysis of 0 - 100 ppb spectinomycin spiked in kidney extract vs % inhibition had a regression correlation of R<sup>2</sup> 0.959. This assay provides a sensitive and rapid screening method for the detection of spectinomycin prior to chromatographic and mass spectrometric analyses.

**SURFACE PLASMON RESONANCE-BASED COMPETITION ASSAY TO ASSESS THE SERA  
REACTIVITY OF VARIANTS OF HUMANIZED ANTIBODIES**

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While clinical trials are the only way to evaluate the immunogenicity, in patients, of murine or genetically engineered humanized variants of a potentially therapeutic or diagnostic monoclonal antibody (MAb), ethical and logistical considerations of clinical trials do not permit the evaluation of variants of a given MAb that are generated to minimize its immunogenicity. The most promising variant could be identified by comparing the reactivities of the parental antibody (Ab) and its variants to the sera of patients containing anti-variable region (anti-VR) Abs to the administered parental Ab. We have developed a surface plasmon resonance (SPR) biosensor-based assay to monitor the binding of the sera anti-VR Abs to the parental Ab and the inhibition of this binding by the variants. SPR biosensors allow the real-time detection and monitoring of the binding between an immobilized protein and its soluble ligand without the need for prior purification and labeling of the mobile analyte. This new assay requires no radiolabeling, is relatively less

time-consuming, and uses only small amounts of serum (5-20  $\mu$ l of diluted serum) through a new microfluidic sample handling technique. To validate the assay, we have tested the relative reactivities of the CDR-grafted anti-carcinoma Ab, HuCC49, and its two variants, designated V5 and V10, to the sera of patients who were earlier administered radiolabeled murine CC49 in a clinical trial. A comparison of  $IC_{50}$ s (the concentrations of the competitor Abs required for 50% inhibition of the binding of sera to immobilized HuCC49) showed that V5 and V10 were less reactive than HuCC49 to the three patients' sera tested. We have also demonstrated, for the first time, the specific detection and comparison of relative amounts of anti-VR Abs present in the sera of different patients without prior removal of anti-murine Fc Abs and/or circulating antigen. This may facilitate the rapid screening, for the presence of anti-VR Abs, of the sera of patients undergoing clinical trials.

## **RATIOMETRIC OPTICAL SENSING OF GLUTAMINE IN CELL CULTURE MEDIA**

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Glutamine is a major source of nitrogen and carbon in cell culture media. Thus, glutamine monitoring is important in bioprocess control. Here we report a reagentless glutamine sensor based on the *E. coli* glutamine binding protein (GlnBP) that is sensitive in the submicromolar ranges. The S179C variant of GlnBP was labeled at the -SH and N-terminal positions with acrylodan and ruthenium bis-(2,2'-bipyridyl)-1, 10-phenanthroline-9-isothiocyanate, respectively. Conformational changes that occur upon binding of glutamine to the GlnBP result in the quenching of acrylodan emission while the ruthenium emission remains unaffected. Thus, the role of ruthenium is as a long-lived internal reference. The apparent binding constant,  $K_d'$ , of 0.72  $\mu$ M was calculated from the ratio of emission intensities of acrylodan and ruthenium ( $I_{515}/I_{610}$ ). The presence of the long-lived ruthenium allowed for modulation sensing at lower frequencies (1-10 MHz) approaching an accuracy of  $\pm 0.02$   $\mu$ M glutamine. Additionally, the large difference between the lifetimes of the dyes makes it possible to utilize dual-frequency lifetime discrimination [1] and the relatively low frequencies required for the measurements allow for reliable low-cost instrumentation. Finally, the extraordinary sensitivity of GlnBP allows for > 1000X dilution of the culture media thereby eliminating the effects of background interferences from the media components.

[1]. Kostov, Y., Harms, P., Rao, G. (2001) Ratiometric sensing using dual-frequency lifetime discrimination. *Anal. Biochem.*, **297**, 105-108.

## **THE DETERMINATION OF ENANTIOMERIC EXCESS IN AMINO ACIDS AND PEPTIDES BY FOURIER TRANSFORM MASS SPECTROMETRY**

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Host-guest complexes involving amino acids, peptides, and pharmaceutical compounds as guest and cyclodextrin and linear oligosaccharides as host are readily formed in the gas phase using electrospray ionization. These complexes are trapped in the analyzer cell of a Fourier transform mass spectrometer where they are allowed to undergo guest exchange with a gaseous amine. The reaction is enantioselective and is used as the basis for a mass spectrometry method for determining enantiomeric excess. A number of oligosaccharides including cyclic ( $\alpha$ -,  $\beta$ -, and  $\gamma$ -cyclodextrin) and linear oligosaccharide were used as hosts.

The nature of the interactions between the host and guests and the enantioselectivity were examined using molecular modeling calculations. We found that the "three-point interaction model" still operates in the gas phase. For amino acids and pharmaceutical compounds, cyclodextrin hosts provided the highest enantioselectivity. Amino acids have molecular sizes that complement the inner cavity sizes of cyclodextrins resulting in optimal enantioselectivity. Peptides with one chiral amino acid residues were examined. For the peptides, linear oligosaccharides (specifically maltoheptaose) provided the highest enantioselectivity. Maltoheptaose formed a quasi-cavity that adjusts its size to fit larger hosts. The larger sizes of peptides were well accommodated by maltoheptaose producing very high enantioselectivity. The analytical application of the enantioselective reaction is illustrated with amino acids, peptides and pharmaceutical compounds. The method is fast requiring only a few seconds and is sensitive to the amount of material. As little as a few picomoles of amino acids is analyzed without derivatization. In addition, amino acids that have similar masses, such as leucine and isoleucine, and unusual amino acids such as allo-leucine and allo-threonine were distinguishable from the native using this method.

### **TO SWIM OR NOT TO SWIM, OR DOES A LEECH HAVE FREE WILL?**

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Electrical stimulation of a trigger interneuron of an isolated nerve cord preparation of the medicinal leech, *Hirudo medicinalis*, sometimes leads to swimming; sometimes it does not. Does the state of the leech's nervous system prior to stimulation determine its response? How does one characterize the state of its nervous system? What distinguishes post-stimulus ventral cord signals that precede swimming from those that do not? We investigate signals transmitted in the ventral cord of the leech before and after stimulation and seek quantitative measures that may enable us to confront these questions. We find that there are a number of linear and nonlinear measures that provide statistically significant distinctions between post-stimulus signals that lead to swimming from those that do not. We also find a number of measures that may be used to characterize the leech's pre-stimulus state.

### **EARLY NEURONAL CHANGES IN PRE-SYMPTOMATIC HUNTINGTON'S DISEASE INVOLVE ALTERATIONS IN CYTOSKELETAL AND SYNAPTIC ELEMENTS**

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Huntington's disease (HD) is an inherited brain disorder and is characterized by movement, cognitive and psychiatric disturbances with selective loss of neurons in the striatum and cerebral cortex of the brain. Onset of symptoms typically occurs at age 35-45 years, after which the patient experiences a steady decline over the next 15-20 years. As one of the early successes of the Human Genome Project, the gene and mutation therein that causes HD was identified and found to be caused by a polyglutamine repeat expansion in the protein. Using genetic tools, we have made transgenic mice which model the behavioral and motor dysfunctions, selective neuronal loss and polyglutamine protein aggregates much like those in the human disease. Since it was hypothesized that bioenergetic defects may underlie the selective neuronal loss in the HD and patients may benefit from coenzyme Q treatment, we determined if bioenergetic deficiencies play an early role in HD pathogenesis. Biochemical measurements of mitochondrial electron transport

Complexes I-IV did not reveal changes in the striatum and cerebral cortex in early symptomatic mice. Similar results were obtained on tissues from human pre-symptomatic (PRE) and pathological grade 1 (G1) HD cases, but with significant changes occurring in only advanced HD cases. However, histological Golgi staining of early stage HD showed morphologic abnormalities that included a significant decrease in the number of dendritic spines and a thickening of proximal dendrites in striatal and cortical neurons in both human and mice. Moreover, cDNA microarray analyses have identified alterations in transcript levels primarily in three categories of genes whose protein products are involved in cytoarchitecture, neurotransmission and Ca<sup>2+</sup> regulation. Immunocytochemical characterizations of proteins involved in these functional pathways further implicate their involvement in early HD pathogenesis. We propose that the expression of the mutant HD protein causes aberrant interaction with proteins involved in synaptic function and cytoskeletal integrity and thus implying that HD may benefit from treatment with neurotrophic factors, including BDNF or neuroimmunophilins.

### **ISOLATION AND CHARACTERIZATION OF GENES IN THE NASAL REGION INVOLVED IN OLFACTORY AXON OUTGROWTH AND LHRH NEURONAL MIGRATION**

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Luteinizing hormone-releasing hormone (LHRH) neurons are essential for reproduction. During development, LHRH neurons migrate from the nasal placode to the hypothalamus. Improper migration of LHRH neurons results in gonadal dysfunction and is often associated with anosmia as that observed in Kallmann's syndrome. The link between these two symptoms is due to the fact that *in vivo* LHRH neurons migrate out of olfactory pits (OP) in association with olfactory axons. *In vitro* studies conducted in our laboratory using nasal explants obtained from mice during development showed LHRH neurons migrated from bilateral OP to midline nasal cartilage (MNC), turned and moved parallel to MNC, rarely crossing MNC. In unilateral OP explants, devoid of MNC, LHRH cells migrated into the periphery but did not turn. Turning of LHRH neurons reoccurred in co-cultures of OP with MNC. However, LHRH cells did not turn in co-cultures of OP with tail or limb cartilage and LHRH cells migrated across these tissues. These *in vitro* results suggest guidance molecules are present in MNC but not in tail and limb cartilages. To identify guidance molecules in MNC, subtractive cDNA hybridization analyses on mouse embryonic stage E11.5 tissues, in particular nose vs tail and nose vs limb were performed. Clone L161, with homology to a region of the vomeronasal organ olfactory cluster, was characterized. Northern analysis on whole embryos at various embryonic stages (E7, E11, E15 and E17) showed highest L161 expression at E11 and E15; while multiple tissues from adult mice also showed expression. In addition, Northern analysis on noses and whole heads of mice at E11.5, E14.5 and E17.5 showed L161 mRNA consistently more abundant in nose, with peak expression at E14.5. *In situ* hybridization on embryonic mouse is being done to localize expression of L161 mRNA *in vivo*. These data are consistent with L161 expression on nasal cartilage participating in olfactory axon outgrowth and subsequently LHRH neuronal migration.

## LIGAND-TOXIN CONJUGATES FOR TARGETED PAIN THERAPY

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Pain affects over 70% of all cancer patients; where over 36% with metastatic disease have pain severe enough to impair normal functions. Current treatments to manage pain are costly and even controversial. Chronic use of opioids, for one, is often feared to induce tolerance, drug dependency or cause side effects. Our present study offers a molecular neurosurgical alternative to treating pain. We have designed pain receptor-specific toxin conjugates to effectively prevent neurons from transmitting pain signals to the brain. The toxin component is a 35 kDa modified protein (cysPE35) derived from *Pseudomonas aeruginosa* exotoxin A, a cytotoxin known to disable elongation factor-2. Receptor-mediated entry of these toxin conjugates inhibits protein synthesis and leads to cell death. CysPE35 is first expressed in *E. coli*, isolated from inclusion bodies, refolded at pH 9.5, purified by anion exchange chromatography and gel filtration. Purified cysPE35 is then coupled via disulfide linkage to a D-TNB-modified pain ligand. Identity of the product is then confirmed by immunoblot analysis. Cytotoxic activity is evaluated *in vitro* in [<sup>3</sup>H]leucine incorporation assays using cell lines expressing the corresponding receptor. To date, we have made conjugates of PE35 to pain-related neuropeptides like substance P (SP) and neuropeptide FF. Our results show that SP-PE35 can kill CHO cell lines stably expressing SP receptors ( $IC_{50}=3.5 \times 10^{-10}$  M) and can selectively ablate SP receptor-bearing neurons from the dorsal horn of rat spinal cord. We have also observed that SP-PE35, administered into cerebrospinal fluid, can induce analgesia to thermal injury in a rat model.

### **2002 PAASE Founder's Lecturer in Engineering**

#### **ON THE COMPLEXITY OF COMPUTING -- I CAN'T DO IT, BUT NO ONE ELSE CAN DO IT EITHER**

Oscar H. Ibarra

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The notion of an "algorithm" is one of the most important concepts in computer science. Theory of computation and complexity is a formalization of our understanding of what an algorithmic process is. It is a field of study which investigates the existence or non-existence of algorithms for computational problems. It also aims to develop techniques for designing efficient algorithms as well as to explain why some problems are inherently difficult to solve in terms of their time and/or space requirements. We present a brief overview of the field.

#### **Biography:**

Oscar H. Ibarra received the B.S. degree in Electrical Engineering from the University of the Philippines and the M.S. and Ph.D. degrees, also in Electrical Engineering, from the University of California, Berkeley. He is a Professor and past Chair of the Department of Computer Science at the University of California, Santa Barbara. Previously, he was with the faculties of UC Berkeley (1967-1969) and the University of Minnesota (1969-1990). His research interests include the design and analysis of algorithms, theory of computation, computational complexity, parallel computing, and formal verification.

Oscar is a past recipient of a John Simon Guggenheim Memorial Foundation Fellowship. He is a Fellow of the Association for Computing Machinery (ACM), the Institute of Electrical and Electronics Engineers (IEEE), the American Association for the Advancement of Science (AAAS), and the Minnesota Supercomputer Institute. He received the first ITL Infosys Distinguished Speaker Award at the International Conference on High Performance Computing in 1996. In 2001, he received the prestigious IEEE Computer Society's Harry M. Goode Memorial Award "for outstanding contributions to the information processing field." He was presented an Award of Distinction in Computer Science by the Computing Society of the Philippines during the 6th International Symposium on Parallel Architectures, Algorithms, and Networks in May, 2002. On the occasion of his 60th birthday, a workshop, "Computer Science: From Theory to Practice", was held in Singapore on August 14. He was recently awarded an Invitation Fellowship for research by the Japan Society for the Promotion of Science (JSPS) and will visit the Japan Advanced Institute of Science and Technology (JAIST) in the fall quarter 2002.

Oscar is the Editor-in-Chief of the International Journal of Foundations of Computer Science. He is an Editor of Theoretical Computer Science and the Journal of Parallel and Distributed Computing. He has also served on the editorial boards of the IEEE Transactions on Computers, the IEEE Transactions on Parallel and Distributed Systems, and the Journal of VLSI Signal Processing. He has served or is currently serving as Program Committee Chair of a number of international conferences in computer science. He has presented invited lectures at various institutions and symposia.

Oscar has graduated twenty Ph.D. students.

### **Advances in Physics, Engineering and Computer Technology**

#### **QUANTUM HYDRODYNAMICS FOR NANOSYSTEMS**

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Hermite polynomial expansion is used to drastically reduce the number of degrees of freedom associated with the momentum variables in quantum transport simulations. The result is a quantum hierarchy in real space. A general procedure for a quantum hierarchy decoupling and truncation scheme to derive the quantum hydrodynamic (QHD) and quantum drift-diffusion (QDD) transport equations is given. The method employed is rigorous and the results are straightforward consequence of the fundamental quantum distribution function equations, thereby incorporating quantum coherence in QHD and QDD transport equations. Numerical results are presented and a rigorous foundation is given for a decoupling procedure whereby the lower-order equations in the hierarchy are renormalized in terms of self-consistent effective quantum potential, quantum diffusion coefficient, and moments, endowed with all quantum corrections to order  $\hbar^2$ . The novel feature of the decoupling scheme given here is that it incorporates all of the quantum corrections to order  $\hbar^2$  within the lattice Weyl-Wigner formalism of solid-state physics. It is based on the Buot formula for  $TrH^n$ , valid at all temperatures without the need for an expansion in terms of small parameter of Wigner. This is important conceptually, since existing QHD formulations are based on restrictive assumption of a small parameter that is not valid in heterojunction semiconductor devices, and also failed to account for the nonequilibrium quantum corrections.

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## **HOW TO BUILD A QUANTUM COMPUTER**

Danilo B. Romero

Physics Department, University of Maryland, College Park, MD

In fewer than 20 years, the continued miniaturization of electronic circuitry on silicon chips will reach atomic dimensions, necessitating a new paradigm if progress is to continue at the rate that we have been accustomed to. One such emerging paradigm is the field of quantum information and computation, a confluence of the disciplines of physical science, mathematics, computer science, and engineering. This field harnesses the effects of quantum mechanics, known to govern the behavior of atomic objects, to perform computation and information-processing tasks that are intractable even with the most sophisticated modern computers.

The fundamental building block of a quantum computer is the quantum bit, or qubit. This talk will describe the quantum mechanical behavior of the information stored in qubits and how it can be exploited to perform tasks that would be impossible with a conventional computer. I will review the various schemes that have been proposed to implement a qubit with particular emphasis on those that take advantage of the large infrastructure that exists within the electronic industry.

## **QUANTUM COMPUTING USING SUPERCONDUCTING JOSEPHSON JUNCTION QUBITS**

Roberto C. Ramos

Center for Superconductivity Research, University of Maryland, College Park, MD

In recent years, there have been many proposals for building a quantum bit or 'qubit', the most basic element of a quantum computer. Of particular interest is the superconducting, single, isolated Josephson junction, whose energy states can be used as a qubit and whose state can be measured by its switching from the zero voltage state to the running state. In contrast to its atomic, NMR and other solid-state counterparts, this qubit has many distinct advantages: scalability, existence of fabrication infrastructure, a built-in readout and relative insensitivity to electrical and magnetic noise. In this talk, I will report the state of the art of this promising qubit, discuss our contributions to the field through our macroscopic quantum tunneling experiments performed at near zero Kelvin temperatures and the prospects of building multi-qubit systems.

## **NANOCONTACTS, NANOTUBES AND BALLISTIC ELECTRON TRANSPORT**

Romel D. Gomez

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One of the most intriguing aspects of shrinking an object down to nanometer length scales is the change of its electrical properties. Familiar entities such as electrical resistance no longer follow the rules derived from classical physics, but instead obey the rules of quantum mechanics. As a consequence, "exotic" phenomena begin to manifest themselves, even at room temperature. Electrons, for example, flow into narrow channels without scattering, and in magnetic materials, the electronic spin, which is purely quantum

mechanical, determines the electrical resistance. In this talk, I will describe two systems, namely transport through nanocontacts and nanotubes that exhibit unique properties that could be exploited in the practical fields of sensing, computing, “spintronics” and “nanoelectronics”.

### **SPECTRALLY SELECTIVE THIN FILM COATING FOR FLAT PLATE COLLECTORS**

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A spectrally selective antireflection optical thin-film coating to reduce the reflectance of glass cover of a solar flat-plate collector was designed and fabricated. The antireflection coating was applied on the incident surface of a 3 mm thick clear glass, commonly used in flat-plate collectors. The transmittance of solar radiation of 89% of clear glass increased to 92% on the entire visible light range of the spectrum. Consequently, the collector efficiency of the flat-plate collector also increased by 3%. The design focused on the optical properties of glass and the interference of light waves to alter the optical characteristics of glass to a preferred value on a selected spectrum. Fabrication was done using the high vacuum system technology.

### **NUCLEAR POWER IN THE PHILIPPINES**

Ricardo Palabrica

A personal, retrospective look at the history of nuclear power development in the Philippines, including milestones and key activities associated with what would have been its first nuclear power plant, will be presented. The unprecedented challenges that confronted the local utility (National Power Corporation) and regulatory body (Philippine Atomic Energy Commission) in implementing a project with stringent engineering requirements and inherent political implications will be discussed. Factors that may have contributed to the unsuccessful implementation of the nuclear project will be identified. Lessons learned from the experience will be drawn. This informal presentation will be based on the perspective gained by the speaker while working as a nuclear regulator in the Philippine Atomic Energy Commission, and as part of operational safety review teams of the International Atomic Energy Agency that conducted safety evaluations of nuclear power plants worldwide.

### **Featured Lecture**

#### **SALT, GENES AND HIGH BLOOD PRESSURE**

Pedro A. Jose and Robin A. Felder

Georgetown University Medical Center, Washington, D.C. and  
The University of Virginia Center for the Health Sciences, Charlottesville, VA

Hypertension or high blood pressure, if untreated can lead to heart disease, stroke, myocardial infarction, and end-stage renal disease. It causes more morbidity and mortality than all the next five diseases

combined, including cancer. Twenty five percent of middle-aged Americans have essential hypertension with no known cause. The causes of essential hypertension have been difficult to decipher because it is a complex trait with both genetic and environmental determinants. However, 30-50% of essential hypertension is heritable.

Thirty to 35% of subjects with normal blood pressure and 50 to 70% of subjects with essential hypertension are sodium chloride (salt) sensitive. Salt sensitivity, independent of blood pressure status, increases the risk for cardiovascular morbidity and mortality. Dopamine, best known as a neurotransmitter in the brain involved in the pleasure of cocaine addiction and in the shaking of Parkinsonism, is also made by the kidney tubules and plays a crucial role in the day-to-day fine-tuning of water and sodium balance in the body. When too much salt is eaten, dopamine production in the kidneys increases. Acting as a “key,” dopamine unlocks a receptor called D<sub>1</sub> receptor to increase salt excretion. The G protein-coupled receptor kinase type 4 (GRK4) protein immediately turns off the dopamine receptor to allow it to reset so that the process can be repeated over and over until the normal salt-water level in the body is achieved. People with hypertension have genetic variants of GRK4 that increase its activity and disable the D<sub>1</sub> receptor in the kidney (*Proc Natl Acad Sci USA* 2002;**99**:3872). GRK4 gene variants, by themselves, or in concert with other genes, prevent the elimination of salt; excess salt and water are retained and high blood pressure ensues. These GRK4 gene variants have also been shown to produce high blood pressure and interfere with kidney function in transgenic mice. Moreover, prevention of the translation of GRK4 gene in the kidney of rats ameliorates their high blood pressure.

Current drugs are effective in decreasing blood pressure but these drugs do not cure the problem. Indeed, 50% of people with high blood pressure are not treated or do not have their blood pressures under control. More alarming is the fact that 30% of people with high blood pressure do not even know they have high blood pressure! A blood test has been developed that can predict, with a 70-75% accuracy, the development of high blood pressure. This test should help physicians to determine the salt sensitive individual, devise better treatment (or even cure), and prevent the occurrence of hypertension, itself.

### **Additional Abstracts**

#### **ACHRAS ZAPOTA STEM BARK EXTRACT CAUSES ENDOTHELIUM- DEPENDENT RELAXATION IN RAT AORTIC RINGS BY NITRIC OXIDE PATHWAY**

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Preparations of rat isolated aortic rings were exposed to cumulative vasorelaxant concentrations (2-25µg/mL) of the aqueous solution of the methanol extract of the bark of *A. zapota*. In preparations that were deprived of endothelium, the relaxant effect was abolished. Likewise, the relaxation of endothelium-intact aortic rings was blocked when these were incubated with N-nitro-L-arginine (L-NO-Arg) prior to contraction with an agonist and exposure to relaxant concentrations of the methanol extract.

## **THE GLYCAEMIC RESPONSE OF NONDIABETIC AND STEPROZOTOCIN-INDUCED DIABETIC MICE TO *SYZYGIUM CUMINI* LINN. AT DIFFERENT PRANDIAL STATES**

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The seeds and leaves of *Syzygium cumini* L. are reputed to have hypoglycemic property. This study aims to provide a scientific basis for its traditional use as a hypoglycemic agent and to determine whether the fruit juice is useful in lowering blood glucose in diabetic conditions.

The lyophilized fruit juice of *Syzygium cumini* L. was given orally at a dose of 1.25g/kg body weight to overnight fasted nondiabetic and streptozotocin-induced diabetic mice at different prandial states: fasting, postprandial (sample was given simultaneously with glucose solution) and postprandial (sample was given 30 minutes before glucose load). Blood was collected from the ocular vein at different time intervals and the glucose level was determined by enzymatic colorimetric method.

Results showed that there was an increase in the fasting blood glucose of nondiabetic mice 60 minutes after the administration of the lyophilized juice, with subsequent lowering at 120 minutes. Similar activity was observed when the fruit extract was given to diabetic mice. At postprandial state, hyperglycemia was observed in nondiabetic mice initially which was followed by a decrease in the blood glucose level at 75 minutes. However, a control in the rise of postprandial blood glucose level in diabetic mice was noted. This indicates that the fruit juice could be a potential hypoglycemic agent for diabetes mellitus.

## **FORMATION OF N-FATTY ACYL HYDROLYZED FUMONISIN B1, A MYCOTOXIN DERIVATIVE WITH ENHANCED TOXICITY, IN FRIED CORN PRODUCTS**

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Fumonisin B1 is a putative tumor promoter produced by *Fusarium verticillioides*, and a ubiquitous contaminant of stored corn worldwide, including in corn grown in the Philippines during the rainy season. Corn is the second most important starchy staple crop in the Philippines. N-palmitoyl-hydrolyzed fumonisin B1 has been reported by Humpf *et al.* (*J. Biol. Chem.*, 273, 19060, 1998) to be about 10 times as toxic *in vitro* as intact fumonisin B1. We have prepared a series of N-fatty acyl-HFB1 derivatives with varying fatty acid chain lengths, and demonstrated that *in vitro* toxicity against four mammalian cell lines increased with chain length to a maximum at C-12 or greater, equal to about ten times intact fumonisin B1 toxicity. Degree of unsaturation in the fatty acid chain had no substantial effect on toxicity. Radiotracer studies indicate that hydrolyzed fumonisin B1 in tortilla chips is efficiently (80-95%) N-fatty acylated during frying in pre-heated oils (coconut, corn, soybean, lard), and efficiently extracted from the chip into the oils. Substances are being sought which can specifically bind N-fatty acyl-hydrolyzed fumonisin B1 in heated oil rich in triglyceride-derived 1,2- and 1,3-diols, by interacting with the one structural feature unique to the toxin derivative, the amide moiety. Efficient binders may permit the development of filter packings for removal of N-fatty acyl-HFB1 from hot oil during commercial frying operations. We have screened a series of 17 dyes, most of which are known for fast staining to wool with no apparent covalent binding. N-palmitoyl-hydrolyzed fumonisin B1 was examined for ability to induce spectral changes (I<sub>max</sub> or absorptivity) in the dyes in acid and neutral media. Only Coomassie brilliant blue G exhibited spectral changes in the presence of N-palmitoyl-hydrolyzed fumonisin B1.

## THE YELLOW PIGMENTS USED IN THE RAPID IDENTIFICATION OF TOXIGENIC STRAINS OF *ASPERGILLUS FLAVUS* ARE AFLATOXIN BIOSYNTHETIC INTERMEDIATES

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Aflatoxins are a serious contaminant of copra, corn and other crops used as animal feed in the Philippines. Aflatoxins, among the most potent carcinogens known, are produced by some, but not all, strains of *Aspergillus flavus* and *A. parasiticus*. The higher % toxigenic strains in the soil reservoir of *A. flavus* than in naturally infected crop plants lend support to strategies for reducing aflatoxin contamination by preinoculation with non-toxigenic strains. Saito and Machida (*Mycoscience*, **40**, 205, 1999) developed a rapid method for identifying AF-producing and non-producing strains of *A. flavus* and *A. parasiticus*, which may provide a useful pre-screen for identifying non-toxigenic strains. In this method, the reverse side of colonies of aflatoxin-producing strains on potato dextrose agar (PDA) medium turns from yellow to pink immediately after exposure to ammonium hydroxide vapor. *A. flavus* cultures on PDA were lyophilized, extracted with methanol until no more yellow pigment was obtained and fractionated by reversed (C18-silica) and normal (silica gel) phase chromatography. The yellow pigments are pH indicator dyes, which turn from yellow to pink between pH 5.5 and 6.5 with any base, and yellow again when the pH is lowered with acid. By comparing UV spectra, negative ESI-MS/MS and <sup>1</sup>H-NMR properties with literature values, 7 pigments representing most of the color, were identified as known intermediates in the biosynthesis of AF: versicolorin C, versicolorin A hemiacetal, nidurufin, averufin, versicolorin A, norsolorinic acid, and averantin.. Seven additional pigments with similar UV spectra could not be identified as known aflatoxin biosynthetic intermediates. Identification of the pigments that predict AF production by *A. flavus* strains as being AF biosynthetic intermediates provides a convenient rationalization for the predictive power of the method. Only strains with a mutation in a biosynthetic enzyme beyond that which makes norsolorinic acid would be expected to give false positive results.

Note: W. T. Shier has 2 additional Abstracts as listed here: 1. Preliminary Studies on the Sources of Jade Used in the Philippines: Developing Evidence that Ancient Filipinos Possessed Extraordinary Maritime Skills 2. The Yellow pigments used in the rapid identification of toxigenic strains of *Aspergillus flavus* are aflatoxin biosynthetic intermediates 3. Formation of N-fatty acyl hydrolyzed fumonisin B1, a mycotoxin derivative with enhanced toxicity, in fried corn products

## THE ROLE OF SHORT-ROTATION FORESTRY IN THE BIOFUEL INDUSTRY

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Resource Management Frontiers

The US Department of Energy envisions a new energy economy with the private industry, academia and public sector pooling their resources to tap the enormous potential of an integrated bio-based energy production. There are several advantages in using biomass as energy source: (1) reliance on naturally abundant and renewable resource, (2) reduction of dependence on imported fossil fuel, (3) opportunity to contribute to the nation's economic growth, (4) strengthening of U. S. energy security (5) revitalization of rural America and (6) protection of the environment against pollution through reduction of greenhouse emission. Integration is the key strategic mechanism that drives this vision to its fulfillment and growing biomass through short-rotation forestry plays a key role in this integrated picture. To speed up the contribution of biomass production to the development of a new energy economy, an aggressive research program, followed by a strong technology transfer process, needs to be enforced to fill existing knowledge gaps and develop a strong national strategy in biomass production.