ISSN 0115-8848

# TRANSACTIONS
## of the
# NATIONAL ACADEMY OF SCIENCE AND TECHNOLOGY
## Philippines

## ABSTRACTS of PAPERS
### Presented during the
### 26th NAST Annual Scientific Meeting

*On Being and Becoming: Where We Are and Where We Want To Be*

14-15 July 2004

2004
Volume 26
Issue No. 1

Republic of the Philippines
National Academy of Science and Technology
Philippines

ISSN 0115-8848

# TRANSACTIONS
# of the
# NATIONAL ACADEMY OF SCIENCE AND TECHNOLOGY
# Philippines

## ABSTRACTS of PAPERS
## Presented during the
## 26th NAST Annual Scientific Meeting

*On Being and Becoming: Where We Are and Where We Want To Be*

14-15 July 2004

**2004**
**Volume 26**
**Issue No. 1**

**Republic of the Philippines**
**National Academy of Science and Technology**
**Philippines**

# 26th ANNUAL SCIENTIFIC MEETING

## On Being and Becoming: Where We Are and Where We Want to Be

26th ASM: 14-15 July 2004; Manila Hotel

## 26th ASM Steering Committee

National Scientist Gelia T. Castillo(Chair)
Academician Ledivina V. Cariño (Co-Chair)
Academician Mercedes B. Concepcion
Academician Onofre D. Corpuz
Academician Raul V. Fabella
Academician Andrew B. Gonzalez, F.S.C.
National Scientist Alfredo V. Lagmay
Academician Emil Q. Javier

**Transactions of the**
**National Academy of Science and Technology**
**Philippines**

# ABSTRACTS of PAPERS
**Presented during the**
**26th NAST Annual Scientific Meeting**

## On Being and Becoming: Where We Are and Where We Want to Be

26th ASM: 14-15 July 2004; Manila Hotel

**2004**
**Volume 26 (No. 1)**

Republic of the Philippines
**National Academy of Science and Technology**
**Philippines**

ISSN 0115-8848

Trans. Nat. Aca. Sci. Tech. Philippines
Vol. 26, No. 1
Published by the National Academy of Science and Technology Philippines
2/F Philippine Science Heritage Center
DOST Complex
Bicutan, Taguig, Metro Manila 1631 Philippines
nast@mozcom.com; nast@dost.gov.ph
Tel. No. (632) 837-2071 loc 2170 to 73; Telefax: (632) 837-3170

Issue Editor: Academician Evelyn Mae Tecson-Mendoza

# TABLE OF CONTENTS

## POSTER SESSIONS

### *Agricultural Sciences*

***Biological Sciences***

***Chemical, Mathematical and Physical Sciences***

***Engineering Sciences and Technology***

***Health Sciences***

***Social Sciences***

# PLENARY PAPERS

# CHURCH AND SOCIETY

**Academician Bienvenido F. Nebres, S.J.**

National Academy of Science and Technology and
President, Ateneo de Manila University
Loyola Heights, 1108 Quezon City
email: bnebres@admu.edu.ph

My topic "Church and Society" is within the larger theme of this Annual Conference, which is: "On Being and Becoming: Where We Are and Where We Want To Be". In 1988 I wrote a paper for a conference in Tokyo on Paths to Modernization, entitled "Science, Technology and Spritual Values: Searching for a Filipino Path to Modernization." In the context of the recent events of EDSA 1, I reflected on the three worldviews and value-systems that competed in the martial period: the Western view of progress and prosperity promised by science and technology; the Marxist promise of greater quality and the victory of the poor and the oppressed; Christianity as both social force and religious reality in the martial law period. In the paper, I wrote: "The EDSA experience serves to confirm much of the thesis of Rey Ileto's Pasyon and Revolution. There is an ethos and worldview in the majority of Christian Filipinos, shaped by the symbols and practices of popular Christianity, which can be a basis for social change. And social change in non-violent ways. During those February days, it was a big surprise to us that the spirit and methods of active non-violence caught hold so easily and so quickly. For, after all, very few had gone through the seminars on active non-violence. But looking back now, it appealed to a deep ethos of suffering with Christ so that one might triumph with Him. An ethos shaped by the Scriptures, by the pasyon, the novenas, the reflections of the mysteries of the rosary. It is not so surprising then that so many resonated with it and accepted it.

Rey Ileto's analysis of the impact of pasyon categories as also liberating fo the peasants of 1896 and the experience of the power for courage and non-violent change in the traditional devotions in EDSA of 1986 show that the power of Jesus and the Gospels to set us free can shine through the traditional devotions and symbols as well. This can be crucial for the future path of modernization of the Philippines, as there is an urgent need for values and a worldview that can unite the modern Westernized sector and the traditional native sector."

In a very thoughtful and through-provoking book, entitled "The Battle

for God," Karen Armstrong writes about two worldviews:

"The ancient evolved two ways of thinking, speaking, and acquiring knowledge, which scholars have called *mythos* and *logos*. Both were essential; they were regarded as complementary ways of arriving at truth, and each had its special area of competence. Myth was regarded as primary; it was concerned with what was thought to be timeless and constant in our existence. Myth looked back to the origins of life, to the foundations of culture, and to the deepest levels of the human mind. Myth was not concerned with practical matters, but with meaning.

*Logos* was the rational, pragmatic, and scientific thought that enabled men and women to function well in the world. We may have lost the sense of *mythos* in the West today, but we are very familiar with *logos*, which is the basis of our society."

As the Philippines moves towards modernization, science and technology are essential, democratic ideals are essential, whether we like it or not, global influences through business, technology, our overseas workers dominate our consciousness more and more. The challenge is how we are to remain who wer are (identity), how we are to remain as a community, how we are to find meaning in a world that seems to threathen our fundamental self and values. It is the challenge of mythos being able to hold together the tensions brought about by the power of modern logos.

What is emerging in the Church of the Philippines are powerful movements that bring people together towards community and identity, in particular, various charismatic-based movements. Some remain inward turned and risk becoming closed-in fundamentalist groups. Others respond to the call of the Gospels to be their brother's and sister's keeper and are moving to help the poor -- and thus helping create the social revolution needed for modernization.

We would like to highlight progress made and challenges faced by movements seeking to build meaning-structures founded in the Christian Gospels and at the same time responsive to need to reach out to the poor and build community among all Filipinos. In many ways this is a search for Christian meaning-structures that will bridge the cultural divide between the modernized Christianity of many middle-class Filipinos and the traditional Christianity of the masses. In building that bridge, the Church can then play a critical role in both moving the Philippines forward towards modernization and at the same time keep our sense of identity, community, and meaning whole.

**Keywords**: Christianity, traditional, modern, Philippines

# THE HUMANITIES IN OUR INTELLECTUAL AND CULTURAL LIFE

**Jose Y. Dalisay, Jr., Ph.D.**

Vice President for Public Affairs
University of the Philippines, Diliman, 1101 Quezon City

Forty-five years after C.P. Snow's famous and contentious lecture at Cambridge on "The Two Cultures," we continue to suffer, not so much from this dichotomy in our ways of thinking, but rather from their shared subservience in this country to a third "culture," the culture of politics, of base survival and self-interest from the lowest to highest levels of our government and society.

If our critical faculties were truly at work, the Filipino humanist should have no trouble concluding that the way forward --culturally and economically-- can only be led by a greater awareness and application of science in our national life, especially in our education.

But rational decisions like this are held back by the supervening claims of politics, which are neither humanist nor scientific, and by a naive and retrograde conception of science and the humanities as options--mutually exclusive, and bordering on the frivolous--rather than imperatives.

The humanities, in particular, are often taken for little more than entertainment, a belletristic indulgence devoid of rigor and practical significance.

The question to ask should really not be where the humanities might be located in our intellectual and cultural life--something for which I suspect we already know the answers--but rather where intellect and culture belong in our national consciousness.

**Keywords**: third culture, humanities, cultural life, intellect

# EXCHANGE RELATIONS, ECONOMIC HISTORY, AND CURRENT PHILIPPINE INSTITUTIONS

**Emmanuel S. de Dios, Ph.D.**

Professor, School of Economics,
University of the Philippines Diliman, 1101 Quezon City

Following the work of North [1990], Acemuglu et al. [2001], Greif [2000, 2003], and others, institutions have come to be recognized among the "deep determinants" of economic development. Institutions are defined [Greif 2003] as "social factors - rules, beliefs, norms, and organizations - that guide, enable, and constrain the actions of individuals, thereby generating regularities of behavior." Institutions surrounding and affecting exchange are particularly important in economic development in light of the principle (as old as Adam Smith) that in giving rise to specialisation, exchange promotes productivity growth. Both in history and in principle, an expanding scope of exchange creates a demand for impersonal rules that go beyond immediate personal relationships to include more comprehensive common responsibility systems, and on to third-party enforcement mechanisms including the state.

The Spanish conquest suppressed the pre-existing free trade that existed between native communities and China and the South, replacing this instead by the mercantilist institutions, notably the galleon trade. For a great part of the Spanish occupation, domestic trade itself was also discouraged through arbitrary impositions, confiscation of goods by the colonial authorities, as well as the misguided formal restriction of credit transactions. This paper seeks to substantiate the hypothesis that a good deal of past Philippine under-development was due to the restriction of trade, and, more importantly, that such a restriction bore consequences for the subsequent development of Philippine institutions.

The effect was not merely to severely limit wealth-generation among the native population of the time, but more importantly to prevent the emergence of institutions that would facilitate impersonal exchange separated in timew and covering long distances. In particular, an experince of effective and impartial law failed to develop. What law there was, as embodied, e.g., in royal ordinances,

failed to correspond with facts on the ground and was violated arbitrarily by colonial officials and agencies.

It is suggested that from this pattern may have originated some of the problems that plague even current Philippine institutions, including the continuing reliance on exceptions based personal relationships rather than on impersonal rules, the weak definition of property rights and enforcement of contracts, and the lack of restraints on the actions of the powerful actors and hence their inability to make credible commitments.

**Keywords**: institutions, trade restriction, development

## PHILIPPINE AGRICULTURE IN AN URBANIZING AND GLOBALIZING WORLD

**Arsenio M. Balisacan, Ph.D.**

Director, SEAMEO Regional Center for Graduate Study and Research in Agriculture (SEARCA), Los Baños, Laguna a nd
Professor, School of Economics, University of the Philippines
Diliman, 1101 Quezon City

The paper reviews the performance of Philippine agriculture in an Asian context. It shows that domestic policies and institutional bottlenecks, rather than global environment for agricultural trade, explain much of the country's comparatively weak performance in food production, employment creation, agricultural trade, and poverty reduction. Poor governance has also weakened the sector's capacity to respond efficiently to urbanization influences, especially changes in consumption patterns and land use owing to the combined impact of population growth, rising incomes, and developments in information and technology. The "business as usual" approach to governing agriculture and the rural sector needs to be abandoned in favor of more aggressive governance reforms and strategic investment aimed at raising agricultural productivity and sustaining gains in farm incomes, reducing the "cost of doing business" in rural areas, and taking advantage of opportunities for growth offered by globalization.

**Keywords**: Philippine agriculture, globalization, urbanization, domestic policies

# PHILIPPINE MARINE RESOURCES AND THE CONCERN FOR INTERGENERATIONAL EQUITY

**Academician Edgardo D. Gomez, Ph.D.**

National Academy of Science and Technology and
University Professor, Marine Science Institute,
University of the Philippines, Diliman, 1101 Quezon City

A survey of the trends in world fisheries production reveals that, as a whole, it has leveled off from the high positive growth in the middle of the 20th century. A closer examination indicates some negative trends among many fish stocks. The only sector that continues to show a consistent increase in aquaculture, with yet unknown ecological consequences. The above trends apply to the Philippines as well, with a negative slope characterizing the municipal fisheries sector, that is, the segment of our society where the largest number of fishers earning the lowest incomes fall, the epitome of rural poverty.

The future of Philippine marine natural resources is threatened by two major factors, namely, the uncontrolled human population growth and the rising foreign demand for our marine resources, particularly from China. Compounding the issue are marine ecosystem degradation from various causes and administrative failure on the part of government as manifested by incompetence, ineptitude, and corruption. In such a scenario we are losing our intergenerational equity which bodes ill for the future of our country unless there are profound changes in attitude and practice with respect to our living marine resources.

**Keywords**: marine resources, aquaculture, marine ecosystem, degradation, generational equity

# SCIENCE CULTURE AND EDUCATION FOR CHANGE

**Ma. Victoria Carpio-Bernido, Ph.D. and Christopher C. Bernido, Ph.D.**
Research Center for Theoretical Physics
Central Visayas Institute, Jagna, 6308 Bohol

## PART I: INNOVATIVE STRATEGIES FOR SECONDARY EDUCATION IN THE PHILIPPINES

The current situation of Philippine education presents problems and challenges of staggering proportions (1). With old paradigms deemed insufficient, we present investigations of new structures that could boost effectiveness of the Philippine educational system. These apply the key observation that, *Money is not the problem. Culture is the problem.* In particular, we address the questions: What programs can foster the highest levels of learning, creativity, and productivity while overcoming severe constraints of poverty, low standards of living, substandard learning conditions, and formidable cultural barriers? What programs can generate higher levels of human development for a country by the cultivation of a healthy, cultured, and socially responsible citizenship?

We present an innovative, differentiated, and target oriented program for high-impact multi-disciplinary learning in the High School. Essential features include (1) Parallel Learning Groups (Modified Jigsaw Strategy), (2) Activity-based Multi-domain Learning, (3) In-school Comprehensive Student Poftfolio, and (4) Strategic Study and Rest. Periods. The program implemented since the School Yar 2000-2993 in a rural private high school in Bohol, proves to be robust, workable scheme even in its initial stages. It is student-teacher-administrator friendly and can easily be modified and adapted to different levels of affluence (or poverty) of public and private high schools. Although implemented with the 2002 Basic Education Curriculum (BEC), the program is compatible with other curricula. The program has resulted in the progressive enhancement of cognitive and affective learning of students, with each year's graduates, on the average, exceeding performance levels of the previous year. This is shown by external checks of performance such as the number of students who pass the University of the Philippines College Adminissions Test (UPCAT) (2).

In the evaluation of the conditions that led to the implementation of our program, we are also led to *strongly recommend* the following:

(1) **Immediate abolition of the course leading to the degree of Bachelor of Secondary Education (BSEd).** Instead, we propose a regular B.S. or A.B. degree in the field of specialization, with 18 credits of professional education courses. The foremost reason is that high school students are capable of formal abstract sophisticated thinking and expertise of the teacher challenges them. The narrow gap between high school students and BSEd majors is observed as promoting rote learning.

(2) **Separation of Physics, Chemistry and General Science as major subject areas in the Licensure Examination for Teachers (LET) administered by the Professional Regulation Commission (PRC).** The present 3-in-1 combination of Physics, Chemistry, and General Science as a *single* part (Physical Sciences) of the LET may produce teachers not qualified to teach Physics, *nor* Chemistry, *nor* General Science.

## PART II: BREAKING BARRIERS IMPEDING WIDESPREAD DEVELOPMENT OF SCIENTIFIC MANPOWER IN THE PHILIPPINES

Barriers which hinder the widespread development of scientific manpower in the Philippines are examined. Specific measures aimed at breaking these barriers are proposed. These involve concerted effort of the government and private sectors. A small privately run research center in the island province of Bohol, which has gotten support from the Department of Science and Technology and foreign agencies on a project-by-project basis, is cited as an initiative with modest but real contributions.

**Keywords**: science culture, education, innovative strategies

(1) Philippine Human Development Report (PHDR) 2000 [Human Development Network and the United Nations Development Progam (UNDP) 2000]; *See also*, Report of the Presidential Commission on Educational Reform (PCER): *Philippine Agenda for Educational Reform* (PCER, Pasig City, 2000).

(2) The last National Secondary Achievement Test (NSAT) was administered in January 2001. Due to changes in Philippine government and the 2002 BEC, no NSAT has been administered since then.

# TALENT AND INNOVATIVENESS TO MEET THE CHALLENGE OF GLOBAL STANDARDS IN SCIENTIFIC PRODUCTIVITY

**Caesar A. Saloma, Ph.D.**

National Institute of Physics, University of the Philippines
Diliman, 1101 Quezon City
csaloma@nip.edu.ph

We report the 11-year performance (1993-2003) of Philippine-based scientists in terms of publications in peer-reviewed journals that are indexed by the Institute of Scientific Information. The performance is compared with those of other ASEAN countries for the same period of time. The implications of the publication performance profile are discussed and an analysis is made concerning the factors that affect the trend that is observed in the publication output rate. To many in the science community especially those who are based in academic institutions and research institutes, publication in a peer-reviewed journal represents the completion of a scientific research project.

We briefly review J. Schumpeter's theory of business cycles and examine if the theory remains valid at present. We then discuss the possible technologies that will drive the next business cycle after the last one that occurred in the 1990s which was largely powered by products that enabled the flow of information in various media. Most probably, the next wave will be sparked by new technologies that maximize the convergence of computation and communication or offer more effective (and less intrusive) ways of treating sickness and diseases. For us in the Philippines, the crucial issue is not about predicting the next technological catalyst but on whether our country has enough intellectual capital to compete and benefit in the next economic boom. The universities are the main source of intellectual capital and the ability of leading Philippine universities to produce technically-competent PhD graduates in the natural sciences and engineering is discussed.

**Keywords**: scientific productivity, intellectual capital, publication output

# POSTER SESSION

## *AGRICULTURAL SCIENCES*

**ASD No. 1**

# ENDANGERED PLANTS IN THE FOREST LANDSCAPE OF QUEZON PROVINCE, SOUTHERN LUZON: BIODIVERSITY CONSERVATION OPTION

**[1]Inocencio E. Buot, Jr., [2]K. Osumi, [3]MCN Banaticla, [4]RN Banaticla, [5]NB Vidal and [1]DN Tandang**

[1]Institute of Biological Sciences, College of Arts and Sciences, University of the Philippines Los Banos, College, Laguna
Telephone: 49-536-2807, Fax: 49-536-2517, Email: iebuot@yahoo.com
[2]Kansai Research Center, Forestry and Forest Products and Research Institute, Nagai Kyutarou 68, Momoyama, Fushimi, Kyoto, Japan
[3]Genetic Resource Center, International Rice Research Institute, Los Banos, Laguna
[4]Environmental Forestry Program, College of Forestry and Natural Resources, University of the Philippines Los Banos, College, Laguna
[5]Biodiversity Project, Center for Integrative and Development Studies, University of the Philippines System, Diliman, Quezon City

Several small stores selling various species of plants abound along the Real-Infanta Quezon highway, southern Luzon. Interviews with the vendors who are also collectors revealed that these plants are regularly collected from the forest landscape of Polillo, Is., Quezon province and vicinities. About 90 percent of the plants are indigenous and many are endemic to the Philippines. There are many species of *Nepenthes, Hoya, Lycopodium,* palms and orchids. *Platycerium coronarium*, a relative of the endangered *P. grande* per IUCN standards and *Grammatophylum speciosum*, a very large species of orchid are very prominent owing to their size and beauty but are becoming very few.

Sustained harvesting of these plant biota would critically alter the forest landscape of Quezon. However, stopping the people from collecting without any option would also mean starvation. The study found two practical options: managed harvesting and domestication of wild plants.

**Keywords:** Endangered plants, forest landscape, Quezon province, biodiversity conservation option, managed harvesting, domestication

ASD No. 2

# MORPHOLOGICAL AND PHYSIOLOGICAL TRAITS OF SEEDLINGS PLANTED IN LA MESA DAM WATERSHED, PHILIPPINES[1]

**Marilyn S. Combalicer*[1], Don Koo Lee[2], Su Young Woo[3]**

[1] Nueva Vizcaya State University, 3700 Bayombong,
Nueva Vizcaya, Philippines
[2]College of Agriculture and Life Sciences, Seoul National University
Seoul 151-742, Republic of Korea
[3]University of Seoul, Seoul 130-743, Republic of Korea

Among the terrestrial ecosystems, grasslands and degraded areas are the most disregarded. Therefore, successful reestablishment of forest species is very important in disturbed sites to bring back its original cover. Growth and physiological characteristics of species for planting should be evaluated and studied to understand better its growth dynamics.

About six-month old native species such as *Erythrina orientalis* (Linnaeus) Merrill, *Dracontomelon dao* (Blanco) Merrill et Rolfe, *Pterocarpus indicus* Willd., and *Bischofia javanica* Blume were planted in La Mesa Dam Watershed, Philippines to determine growth and physiological characteristics. The objectives of the study were to compare the early growth performance among the species and determine which is/are suitable in the area, to compare the growth performance of species in between flat and mountain areas, and to determine any relations between growth and physiological characteristics. Randomized block design having two blocks and three replicates were established with 4 x 4-m spacing between seedlings. Growth parameters used were height, diameter, dry weight, leaf area, etc. Physiological characteristics such as net photosynthesis, transpiration rate, stomatal conductance, etc. were determined as well through the use of Licor-6400 Portable Photosynthesis System.

Results and analysis revealed that among the four species, *Erythrina orientalis* showed good growth performance as it grows fast and can fix nitrogen followed by *Pterocarpus indicus*. *Erythrina orientalis* grew very well and has a potential for biomass production and reforestation in many denuded areas in the

country. In terms of physiological characteristics, nitrogen-fixing trees, *Erythrina orientalis* and *P. indicus,* exhibited good performance in the field. Generally, the growth and physiological characteristics of four species in the mountain area which has fertile and moist soil conditions were better than in the flat area with dry soil condition.

***Keywords:*** *morphological growth, physiological characteristics*

**ASD No. 3**

## MODELING SOIL EROSION IN A WATERSHED FOR SUSTAINABLE RESOURCE MANAGEMENT

**Reynaldo L. Lanuza[1], Nenita E. dela Cruz[2] and Eduardo P. Paningbatan, Jr.[3]**

[1]Department of Environment and Natural Resources, Reg. VII, Banilad, Cebu
[2]Central Luzon State University, Science City of Muñoz,
Nueva Ecija Email: nenet_dc@yahoo.com
[3]Agriculture System Cluster, University of the Philippines Los Baños, Laguna

Most erosion models have been developed based on a plot scale and has limited application to watershed due to differences in aerial scale and the complex system occurring in a watershed. Address this limitation, a GIS-assisted methodology for modeling soil erosion was developed using PCRASTER to predict the rate of soil erosion at watershed level and identify the location of erosion-prone areas for specific mitigation measures not necessarily the whole watershed, thus maximizing resource utilization. The general methodology of desktop modeling of soil erosion at watershed scale is composed of: (a) model development and structuring; (b) formulation of assumptions; (c) gathering of information; (d) database creation, manipulation and processing and (e) dynamic modeling with PCRASTER.

Validity test of the model using three rainfall events revealed that the predicted run-off heights showed a non-significant difference with the actual observed values and high positive correlation with an average value of 0.94 and coefficient of determination ($R^2$) = 0.931. The predicted sediment concentration was fitted against the range of observed values. Sensitivity analysis showed that the model was most sensitive to Manning's roughness coefficient (n) for the run-off peak rate and vegetative cover for soil loss.

Erosion hotspots were predicted in areas with low if not absence of surface cover like the parcels of cropland under land preparation, early crop establishment stages areas without soil conservation measures, roads and footpath, and in areas with steeper slopes. The results demonstrate the predictive ability of the model and the significant influence of the surface cover in reducing the run-off and soil erosion in a watershed. This implies that the model could accurately predict runoff height and soil loss occurring in a watershed. Thus, this model could lead to the formulation of cost-effective and efficient strategies for better if not sustainable watershed management.

**Keywords:** Erosion modeling, geographic information system (GIS), watershed, sustainable resource management, "erosion hot spots"

**ASD No. 4**

## PHYSICO-CHEMICAL-RHEOLOGICAL PROPERTIES AND STRUCTURE ELUCIDATION OF CARRAGEENAN FROM SELECTED RED ALGAE IN NORTHWESTERN LUZON, PHILIPPINES

Anna Linda R. Ragasa*, L. Antonio P. Santos, Z. M. Agngarayngay, R. G. Dumlao and S. M. A. Pabico

Mariano Marcos State University, Batac 2906 Ilocos Norte Philippines
Email: arragasa@yahoo.com; mmsucmr@digitelone.com.ph

Carrageenan were extracted from six (6) species of red algae (*Eucheuma arnoldii, E. gelatinae, Kappaphycus cottonii, Halymenia durvillaei, Hypnea charoides and H. pannosa* growing abundantly in the intertidal and subtidal zones in Northwestern Luzon, Philippines. Their physico-chemical-rheological properties were characterized by a combination of chemical and spectroscopic techniques. Considerable amounts of carrageenan ranging from 17.46% to 33.24% were obtained. The viscosity and gelling properties are being considered in the food industry. The low heavy metal contents and microbial loads denote the safety of these carrageenans to be used in food formulations. Reductive acid-hydrolysis analysis in combination with different chromatographic separations showed galactose and anhydrogalactose as the major sugar residues present in the carrageenans. The IR and $^{13}$C-NMR provided evidence on the type of carrageenans (*E. arnoldii* - iota carrageenan; *E. gelatinae* - beta-kappa carrageenan; *K. cottonii, H. charoides* and *H. pannosa* - kappa carrageenan and *H. durvillaei* - lambda carrageenan). The systematic information derived in this

research opens the way for the development of new food products and commences the commercial production of these algae.

**Keywords**: carrageenan, red algae, intertidal and subtidal zones, food industry

**ASD No. 5**

## DISTRIBUTION AND SEASONALITY, BIOMASS AND YEILD OF CARRAGEENAN PRODUCING SEAWEEDS IN NORTHWESTERN PHILIPINES

**L. Antonio P. Santos*, Z.M. Agngarayngay, Anna Linda R. Ragasa, R.G. Dumlao and S.MA. Pablico**

Mariano Marcos State University, 2906 Batac, Ilocos Norte Philippines
Email: tony54sts@lycos.com ; mmsucnr@digitelone.com.ph

*Fourteen alternative non-traditional sources of carrageenan in Northwestern Luzon consisting of four families of red algae. These are the: (**Rhodomelaceae** -* Acanthopora spicifera *(Vahl) Borgesen; **Solieriaceae** -* Eucheuma arnoldii *Weber-van Bosse;;* E. denticulatum *(NL Burman) Collins & Hervey;* E. gelatinae *J Agardh;* E. muricatum *(Gmel.) Weber-van Bosse;* Eucheuma sp.; Kappaphycus cottonii *(Weber-van Bosse) Doty;* K. striatum *(Schmitz) Doty; **Cryptonemiaceae** -* Halymenia dilatata *Zanadini;* H. durvillaei *Bory de Saint-Vincent;* H. maculata *J. Agardh; and Hypneaceae -* Hypnea charoides *Sonder;* H. esperi *Bory;* H. pannosa *J. Agardh). These carrageenophytes were assessed in terms of distribution, seasonality and biomass and similarity index.*

The carrageenophytes were collected in six stations, i.e. Station 1 – Currimao, Ilocos Norte; Station 2 – Pagudpud, Ilocos Norte; Station 3 – Cabugao, Ilocos Sur; Station 4 – Balaoan, La Union; Station 5 – Bacnotan, La Union; and Station 6 – Bolinao, Pangasinan.

*H. durvillaei* had the widest range of distribution and was found in all collection stations. On the other hand, *E. gelatinae* was found only in collection station 2 while *E. denticulatum, E. muricatum, K. striatum* and *H. esperi* were found in station 3.

More species were collected during the onset of the cold months (October). Except for *K. cottonii, E. gelatinae* and *H. durvillaei*, all

carrageenophytes collected exhibited seasonality. The species *E. arnoldii* was found only from the months of July to March. Species occurring from October to June were *E. denticulatum, E. muricatum, E. striatum, Eucheuma* sp. and *Hypnea* species. *Halymenia maculata* was present from April to December, while *H. dilatata* was from April to June and October to December.

The highest biomass during the collection period was registered by *E. gelatinae* followed by *H. pannosa,* while the least was *H. esperi.* Among the sampling areas, station 3 had the most diverse carrageenophytes. The northern collection areas (stations 2 – Pagudpud, Ilocos Norte and 3 – Cabugao, Ilocos Sur) were more diverse than the southern areas.

The sampling period was significantly related to the biomass of *E. arnoldii, E. gelatinae, H. dilatata, H. maculata, H. charoides* and *H. pannosa.* The pH of the water in the various collection area had no significant relationship to the biomass of all *Eucheuma* species collected. Sechis disk (SD) transparency and collection period (quarter) when combined as factors played a significant role in the biomass of carrageenophytes. The substrates of the sampling areas were generally rocky and rocky sandy and the carrageenophytes characteristically of cling or attach to the rocks. In general, algae growth or biomass was high during sunny days and directly related to the SD transparency.

**Keywords:** Carrageenan, seasonality, distribution

**ASD No. 6**

## CARRAGEENAN YIELD AND CHARACTERIZATION OF SELECTED RED ALGAE OF NORTHWESTERN PHILIPINES

**L. Antonio P. Santos*, Z.M. Agngarayngay, Anna Linda R. Ragasa, R.G. Dumbo and S.MA. Pablico**

Mariano Marcos State University, 2906 Batac, Ilocos Norte Philippines
Email: tony54sts@lycos.com ; mmsucmr@digitelone.com.ph

The average weight and dry biomass and percentage dry biomass of the 14 non-traditional carrageenophytes in Northwestern Philippines as well as recoverable dry matter content of the collected carrageenophytes were determined. The presence of hard thalli contributed to high value of dry/wet ratio. Most of the species belonging to Solieriaceae had hard thalli where dry matter content of the species ranged from a high of 16.12% (*E. arnoldii*) to 12.00% (*K. striatum*). Hypneaceae came next with *Hypnea asperi* having 15.00% recoverable dry matter

content followed by *H. pannosa* (12.49%). The least was H. *charoides* at 9.82% where it also registered to be the least among the collections.

The percent yield follows the trend in the biomass of the carrageenophytes. Results point that variations in carrageenan yield existed among the 14 carrageenophyte species. Solieriaceae gave higher yield than the other families. Hypneaceae followed this, and then Cryptonemiaceae; the least was Rhodomelaceae. Highest yield was noted with *E. gelatinae* (35.20%) followed by *K. cottonii* (27.60%) both collected in Station 2 – Pagudpud, Ilocos Norte. Overall, the average lowest yield was obtained from *Halymenia maculata* (14.33%) taken from Cabugao, Ilocos Sur.

Results of the study show that the 14 species of red algae are potential sources of carrageenan with the following species giving the highest yield: *E. galatinae* J. Agardh, *E. arnoldii* Weber-van Bosse and *E. denticulatum* Collins and Hervey.

**Keywords:** Carrageenan yield, red algaem, Northwestern Luzon, Philippines

**ASD No. 7**

## CAGE CULTURE OF NON-TRADITIONAL SOURCES OF CARRAGEENAN IN P AAYAS, BURGOS, ILOCOS NORTE

**L. Antonio P. Santos*, R.G. Dumlao, Anna Linda R. Ragasa, Z.M. Agngarayngay, A.L. Teodosio and S.MA. Pablico**

Mariano Marcos State University, 2906 Batac, Ilocos Norte Philippines
Email: tony54sts@lycos.com ; mmsucmr@digitelone.com.ph

Significant biomass of these non-traditional sources of carrageenan (Soleriaceae: *Betaphycus philippinensis* Doty, *Eucheuma arnoldii* Weber-van Bosse, *E. denticulatum* Collins & Hervey, *E. denticulatum* Collins & Hervey, *E. muricatum* Weber-van Bosse, *Kappaphycus cottonii* Doty, *K. striatum* Doty) have been identified and found to be abundant in the provinces of Ilocos Norte and Ilocos Sur

The culture of these non-traditional sources of carrageenan has not been reported in the Philippines. This study aimed to determine adaptability trials/feasibility of the culture of *Betaphycus / Eucheuma / Kappaphycus* in the

waters of Paayas, Burgos, Ilocos Norte, Philippines using the cage method, and determine the its economics using cages and hanging method.

Growth experiment was made using a Randomized Complete Block Design with treatments depending on the species of *Eucheuma* available. Each treatment was replicated (not less than three times). Propagules of various species of non-traditionally cultured *Betaphycus / Eucheuma / Kappaphycus* were secured from the various sampling stations of "Distribution and Seasonality of Carrageenan Producing Seaweeds in Northwestern Philippines" (Santos *et al.*, 2002) and cultured in cages in areas at Paayas, Burgos, Ilocos Norte (lat. 18°29'56.7"N and longi. 120°34'10.8"E) for the culture studies.

In general, red algae cultured in cages decreased in weight after initial stocking. However, the algae increased in weight after a month.

Physico-chemical parameters such as temperature (°C), water movement (cm/t), salinity (ppt) and pH (pH units) were determined. Growth of the algae (biomass) was correlated with the physico-chemical parameters at various sampling periods. Water movement and salinity had highly significant relationships with the growth of the various algae while pH was significantly related to growth. Temperature was not significantly related to the growth of cultured seaweeds.

**Keywords**: seaweed culture, non-traditional sources, Carrageenan

**ASD No. 8**

## GROWTH OF MACROPROPAGATED IPIL (*Intsia bijuga* Colebr.) SEEDLINGS IN THE NURSERY

**Axel H. Arriola[1], Yolina T. Castañeto*[2] and Minda P. Follosco-Edmiston*[3]**

[1]School of Multidisciplinary Studies Dela Salle University
College of St. Benilde, Taft Avenue, Manila
Email: axlarriola@yahoo.com
[2] College of Forestry Bayombong, 3700 Nueva Vizcaya
Email: yul0216@yahoo.com[3]
[3]Biology Department College of Science DLSU, Taft Avenue, Manila
Email: edmistonm@dlsu.edu.ph

The quality of planting stocks is a primary factor in the survival of seedlings during outplanting operation for forest restoration. To attain this objective, nursery culture technique like fertilization need to be undertaken to

assure vigorous and healthy planting stocks. Ipil (*Intsia bijuga* Colebr.) is an endangered and potential species for forest rehabilitation. Rooted stem cuttings of ipil were planted in pots and treated with different soil fertilizer alone or in combination as: Rhizo-N, Mykovam, urea, ammonium phosphate, NPK (14-14-14), and complete slow release (13-13-13). The experiment revealed significant results, obtaining a positive increment in shoot length, stem diameter, and dry weight of macropropagated ipil seedlings. Height of seedlings applied with complete slow release fertilizer was 38.60 cm, while control had 11.62 cm, this gave 235.81% increment. The stem diameter of untreated seedlings was 2.10 mm while seedlings treated with complete slow release had 4.76 mm. Dry weight of seedlings was highest for complete slow release fertilizers with 3.52 g over that of the control seedlings with 0.24 g. There was a very high increase in dry weight of tissues when treated with complete slow release fertilizer. Likewise, dry matter and organic matter production of seedlings between control and those applied with slow release fertilizer was comparable . Thus, application of fertilizers resulted in better growth of macropropagated ipil seedlings, as compared to control. However, application of 0.50 g complete slow release fertilizer (13-13-13) provided optimum growth and, thus, met the objective of producing healthy and vigorous planting stocks for upland restoration. Likewise, it is highly recommended that the next phase of the experiment be conducted in the field for a longer period to verify results.

**Keywords:** macropropagated, cuttings, *Intsia bijuga*, fertilization, fertilizer, Mykovam, urea

**ASD No. 9**

## NON-CONVENTIONAL PREPARATION OF TOBACCO STALK FIBER

**Shirley C. Agrupis, Dugay, W. Aganon, D. Pitpit, A. Fabi, and Nelly U. Castro**

College of Arts and Sciences, Mariano Marcos State University
Batac, Ilocos Norte

In an effort to establish a cleaner and greener technology in producing fiber from tobacco stalks, two separate studies on the non-conventional preparation of pulp were carried out. First, is the biomechanical pulping method, which entail a totally chemical–free and zero chemical effluent process. This involved mechanical crushing of the material and subsequent biological treatment using four fungal strains. Pulp yield (67-89% on dry stalk material) obtained was remarkably higher than that of the

conventional pulping processes. Delignification activity is markedly noticeable in *Pleurotus ostreatus* and *Phanerochaete chrysosporium* even at very low concentration affording 6.53–11.13 and 14–20 point decrease after two and four weeks, respectively. Unlike the conventional method, the same process did not show any cellulose degradation. The improvised nutrient medium (CRWNM) for the fungi proved very effective in substituting the expensive commercial potato dextrose broth (PDB) medium, making the technology more economically appealing.

The second study which is the non-conventional pulp purification used biological and indigenous bleaching agents. Both agents proved effective in brightening the tobacco stalk pulp. They did not cause any cellulose degradation but effected considerable delignification. The brightness of the pulp was comparable with the conventionally bleached pulp.

In terms of mechanical strength, non-conventionally bleached and unbeaten tobacco stalk pulp proved superior to the other bleached tobacco pulp by other bleaching processes including the commercial softwood krast bleached pulp.

**Keywords:** Non-conventional, pulp, bleaching, chemical effluent, chlorine-free bleaching, waste tobacco stalks

**ASD No. 10**

## UTILIZATION OF *TRICHOGRAMMA* PARASITOID AS BIOLOGICAL CONTROL AGENT AGAINST SUNFLOWER HEADWORM *HELICOVERPA ARMIGERA HUGNER*

**Teotimo M. Aganon[1] and Devendra Raj Adhikari[2]**

[1]Central Luzon State University, Science City of Muñoz, Nueva Ecija
[2]Nepal University, Paklihawa Campus, Nepal

The study aimed to evaluate *Trichogramma parasitois* as a potential biological control agent against sunflower headworm. Specifically it aimed to determine the most efficient *Trichogamma* species in parasitizing sunflower headworm egg, to evaluate the effectiveness of different rates of *Trichogamma chilones* application and to compare the use of *Trichogamma* and insecticide on the yield of sunflower.

Results show that among the four *Trichogamma* species tested *Trichogamma chilones* proved to be the most efficient in parasitizing *Helicoverpa armigera egg*. Percentage parasitism was greatly affected by the different rates of application of *Trichogamma chilones*. The highest percentage parasitization was obtained from those which received 70,000 parasites per hectare per release.

Percentage sunflower seed set was greatly affected by the rate of application of *Trichogamma chilones*. Sunflower applied with 70,000 parasites per hectare per release of *Trichogamma chilones* has the higher percentage seed set.

Yield of sunflower was significantly affected by the rate of application of *Trichogamme chilones*. Furhermore, when compared to insecticide treatment application of *Trichogamma chilones* was better. This implies that *Trichogamma chilones* applied at the rate of 70,000 parasites per hectare per release is effective in parasitizing sunflower headworm egg, and thus increases sunflower seed set and consequently yield.

**Keywords:** parasitoid, *Trichogamma*, biological control, sunflower, parasitization, headworm

**ASD No. 11**

## SOME MANAGEMENT PRACTICES AGAINST THE EGGPLANT LEAFHOPPER *AMRASCA BIGUTTULA BIGUTTULA ISHIDA* ON EGGPLANT

**Teotimo M. Aganon[1] and Hassan A. Nadhif[2]**

[1]Central Luzon State University, Science City of Muñoz, Nueva Ecija
[2]Plant Protection Division, Department of Agriculture, Zanzibar

The study was carried out to develop an economically and environmentally sound management strategy for the eggplant leafhopper *Amrasca biguttula biguttula Ishida* on eggplant. The study involved bioassay of *Metarhizium anisopliae* and use of rice straw mulch, plastic mulch, and insecticide for the purpose of evaluating them against the population density of eggplant leafhopper *Amrasca biguttula biguttula Ishida*.

No *Metarhizium anisopliae* was isolated from the collected insects. Alternatively, three isolates of *Metarhizium anisopliae* were evaluated for bioassay against the eggplant leafhopper. Results revealed a very low percentage mortality of not more than 10% to the insect, hence *Metarhizium anisopliae* was

found to be ineffective against the eggplant leafhopper and therefore was not evaluated in the field.

Fipronil gave the highest mean reduction of eggplant leafhopper population over the other treatments, as well as the highest yield, but there was no significant difference on the mean yield of all treatments. Moreover, the higher return on investment was obtained from fipronil (44.41%), followed by plastic mulch (36.87%), control treatment (22.47%), and rice straw mulch (15.36%), respectively.

Results indicated that, it would be advisable for a farmer with enough capital for investment to use fipronil and plastic mulch. If a farmer has limited capital, rice straw mulch will be the most ideal.

**Keywords:** leafhopper, eggplant, metarhizium, mortality, fipronil

**ASD No. 12**

## INSECTICIDAL POTENTIAL OF THE FORMULATED TOBACCO SEED, *Nicotiana tabacum* L. OIL

**Shirley C. Agrupis and A. Cacacho**

Mariano Marcos State University
College of Arts and Sciences, Batac, Ilocos Norte

The pesticidal potential of seven tobacco seed oil formulations (TSOF) against some serious insect pests were evaluated at the Crops Research Laboratory of Mariano Marcos State University and at the National Tobacco Administration, Batac, Ilocos Norte.

The different concentrations (0.25%, 0.50%, 1.5%, 2.5%, 5.0 %, 7.5 %, 10.0 %) of crude tobacco (*Nicotiana tabacum)* seed oil formulated as emulsifiable concentrate had significant insecticidal effect against stored grain insects (*Sitophilus zeamays* and *Callosubruchus chinensis*), termites (*Macrotermes gilvus*), and bean aphids (*Aphis craccivora*).

Mortality of the test insects sprayed with TSOF increased with increasing concentration.

Generally, mortality and efficacy caused by the different formulations was insect type-dependent. Highest mortality of the most

effective formulation (10% TSO) was observed after 24 h in corn weevil (100% mortality), 24 h in bean weevil (16.67% mortality), 48 h in termites (100% mortality), and 6 h in aphids (100% mortality). Corresponding efficacies were 100 %, 60%, 16, and 91%, respectively.

Except in termites, TSOF proved more effective than karate against *S. zeamays, C. chinensis, and A. craccivora.*

**Keywords:** tobacco seed oil formulation (TSOF), pesticidal, mortality, efficacy

**ASD No. 13**

## ALTERNATIVE METHODS OF CONTROLLING INSECT PESTS AND DISEASES USING BOTANICAL MATERIALS AND ANTAGONISTS

**Maxima C. Ines, T.Z. Layaoen, and M.I. Remolacio**

Mariano Marcos State University
Batac, Ilocos Norte

The effectiveness of promising botanical materials such as *Piper betel, Impatiens balsamina, Vitex negundo, Azadirachta indica, Carica papaya, Allium sativum* and the two antagonists, *Trichoderma harzianum* and *Trichoderma aureoviridae* were evaluated against garlic pests. Of the first six tested in vitro, *Allium sativum* was the most effective in suppressing the growth of *Alternaria porri* and *Sclerotium rolfsii* while the effect of the rests were not significantly different with the untreated control.

Among the dried *V. negundo, C. citratus, A. indica,* and *Eucalyptus spp* incorporated into the rice hay mulch of garlic, the *V. negundo* treated plots did not show any root rot infection caused by *Sclerotium rolfsii.* which imply that this material can cause a high degree of suppression of root rot disease, caused by *Sclerotium rolfsii.* The lowest incidence of tangle top diseases was observed from the *Azadirachta* treated plots where degree of control was better than the combinations of Feronosferon and Mancozeb.

Marigold and baraniw used as border crops to garlic significantly controlled *Thrips tabaci* infestation which eventually produced higher yield than those without borders.

The antagonists, *Trichoderma spp.* significantly controlled *Sclerotium rolfsii* and *Fusarium oxysporum*. Between the two *Trichoderma* species used, *T. harzianum* gave greater degree of suppression than the *T. aureoviridae*.

**Keywords:** Alternative method, garlic pests, botanical materials, antagonist

**ASD No. 14**

## TOWARDS APPROPRIATE *BT*-CORN IRM STRATEGIES FOR THE ASIAN CORN BORER, *OSTRINIA FURNACALIS* (GUENEE): FIELD SURVEYS AND LABORATORY STUDIES OF ALTERNATE HOST PLANTS IN MAJOR CORN GROWING AREAS

**Merdelyn T. Caasi-Lit*, Eduardo C. Fernandez, L.D. Taylo, E.G. de Leus, J.P. Mantala, and L.L. Latiza**

Entomology Laboratory, Institute of Plant Breeding, College of Agriculture
University of the Philippines Los Baños, 4031 College, Laguna
binglit@hotmail.com

*Bt*-corn is becoming an acceptable alternative crop for many farmers in the country and it is only necessary to prepare an appropriate Insect Resistance Management plan to delay the expected development of corn borer resistance. Key factor in any IRM strategy against the Asian corn borer (ACB), *Ostrinia furnacalis* (Guenee), is the use of refugia. Refugia are simply blocks or strips of corn that do not contain a *Bt* technology for corn borer. This pioneering study aims to identify and determine the distribution and abundance of possible alternate hosts of ACB in corn and non-corn agriculture systems, to establish the occurrence of ACB on these host plants and to determine the growth and development of this pest on the different alternate host plants.

A survey through designed questionnaire was conducted with the assistance of Monsanto Field Actmen from Isabela, Bukidnon and South Cotabato. This survey involved about 250 respondents, distributed in five municipalities per province, five barangays per municipality, five farmers per barangay. Potential alternate hosts were initially identified based on the presence of eggs and larvae perceived to be those of the ACB. Results showed that the

perceived potential alternate crop hosts are tomato, pepper, sitao, okra, cotton and sugarcane whereas the potential weed hosts are aguingay, napier, tigbi, paragrass and wild sorghum. The abundance of weeds in and out of the cornfield was also evaluated, designating the most abundant species as +++ and the least abundant, +. The most abundant weeds were aguingay, trilobed morning glory and spiny amaranth.

For the biological studies, ACB completes its development from egg to adult on aguingay, napier and tigbi in comparison with corn using fresh stalks under laboratory conditions. In our greenhouse experiment, first instar ACB larvae infested onto 45-day old hosts (aguingay, napier, tigbi, cotton and sitao) were observed to feed initially on the leaves of the different hosts but later transferred to corn when continuously reared on these same hosts. Several experiments in the laboratory and in mini-screencages were conducted to determine larval preference and ovipositional preference. Corn, aguingay and cotton were preferred for larval feeding and female egg laying activities. On the other hand, life history studies of ACB using whole plants revealed that ACB completes it growth and development in all the selected alternate hosts except for tomato and pepper. It may appear, however, based on several studies conducted in the laboratory and greenhouse, that tomato and pepper are transient hosts only for activities other than feeding and oviposition.

Based on insect ecological concepts, a host plant of ACB is one that can support its growth and development. This support may be extended to nectar-feeding, mating and/or oviposition by adults, pupation sites or other biological aspects and behavior vital to survival and reproduction. In as much as only seven alternate hosts were studied, it is recommended that further investigation should focus on other hosts other than the one selected above. Studies are also encouraged on the relationship of these alternate host plants and corn borer in different cropping systems in the country.

**Keywords:** *Bt*-corn, Insect Resistance Management (IRM), Asian corn borer, *Ostrinia furnacalis* (Guenee), alternate host plants, life history, corn, *Zea mayz*

ASD No. 15

# BIO-CONTROL POTENTIALS OF *TRICHODERMA HARZIANUM* AND *BACILLUS SUBTILIS* AGAINST PURPLE BLOTCH DISEASE OF GARLIC UNDER FIELD CONDITION

**T.Z. Layaoen, M.E. Pascua, and J. Fermin**

Mariano Marcos State University
Batac, Ilocos Norte

The efficacy of *T. harzianum* and *B. subtilis* in controlling purple blotch disease caused by *Alternaria porri* on garlic was conducted under field condition in Batac, Ilocos Norte. Efficacy was measured in terms of percent disease incidence during vegetative (55 DAP), bulb formation (60 DAP), and maturity (90 DAP) stages, and plant height, bulb size and weight. Two rows of garlic plants inoculated with spore-mycelial suspension of *Alternaria porri* were maintained around the experimental areas as spreader plants.

Purple blotch incidence was significantly lower on plants treated with *T. harzianum* than on the untreated plants and comparatively similar to those treated with fungicide during vegetative and bulb formation stages. Infection rate increase during maturity stage although, differences among treatments were not significant. This increase however, did not affect the reproductive performance of the garlic plants as shown by the bigger bulbs produced in fungicide and *T. harzianum* treatments. Those treated with the fungal antagonist three times ( 30, 45, and 60 DAP) produced comparable bulb size and weight as those sprayed with fungicide. Likewise, garlic plants treated with *B. subtilis* had significantly lower incidence of purple blotch than the untreated plants during bulb formation and maturity stages. Plants that were applied at 30 and 45 DAP and at 30, 45, and 60 DAP had comparable infection rate, bulb size and weight as those treated with fungicides.

The above results show that more frequent application of either *T. harzianum* or *B. subtilis* on garlic plants provides comparable efficacy in reducing purple blotch incidence and comparable bulb size and weight as those treated with synthetic fungicides. These two biorationals therefore, have high bio-control potentials under field condition thus, could be used in IPM program for garlic and other crops that are hosts to *Alternaria porri*.

**Keywords:** Biocontrol potentials, *T. harzianum*, *B. subtilis*, garlic, purple blotch

**ASD No. 16**

# THE WEEDS IN THE PLANTATION FIELDS OF CORDILLERA

**L.G. Lirio.*, L. Molitas-Colting, and R. Lawingan.**

Benguet State University
La Trinidad, Benguet, 2601 Philippines
Email: lglirio@yahoo.com

Knowledge about weeds growing in association with the high-value crops is of significance to provide basis on the various aspects of integrated crop protection program. As a first step, proper identification of weed species is deemed critical in order to develop environmentally-sound weed control measures. Survey, collection, and identification of the weeds growing in association with ornamental and vegetable crops were done in the plantation fields of Benguet and Mt. Province. Using the quadrat sampling method, 1 x 1 sq. m. quadrats were randomly distributed throughout the plantation fields, the number of total points depending on the field size. A total of sixty-six weed species, distributed in twenty different plant families were identified. The dominant weeds cited in decreasing order of importance values, to name a few, are: Galinzoga parviflora, Solanum nigrum, Portulaca oleracea, Ageratum conyzoides, and Amaranthus viridis. It was notable that 48% of these weeds were found to have beneficial uses either as food, feed to ivestocks or possessing medicinal properties. Moreover, few species were noted to act as alternate hosts to some plant pests and diseases. Such knowledge now becomes apparently important on how our vegetable farmers and ornamental growers will deal with these noxious but beneficial plants as well.

**Keywords**: quadrat sampling, beneficial weeds, noxious weeds, alternate hosts, importance values, high-value crops, medicinal properties, Cordillera

**ASD No. 17**

# GENETIC DIVERSITY IN *Cercospora canescens* ELLIS AND MARTIN, THE CAUSE OF LEAF SPOT OF MUNGBEAN (*Vigna radiata* (L.) WILCZEK) USING REP-PCR

**Jedeliza B. Ferrater and Fe M. dela Cueva***

Plant Pathology Laboratory, Institute of Plant Breeding
College of Agriculture, University of the Philippines, College, Laguna 4031
fmdcueva@yahoo.com

Variability of *Cercospora canescens*, a fungus that causes mungbean leafspot was evaluated using rep-PCR (repetitive sequence-based polymerase chain reaction). A total of 32 isolates were collected from mungbean growing regions of Luzon and Mindanao. This study was conducted to determine and characterize the extent of variation and to delineate the phylogenetic relationships among the isolates.

Genetic diversity was assessed using rep-PCR fingerprinting. Three sets of primers (BOX, ERIC and REP) corresponding to conserved repetitive elements were used to generate genomic fingerprints.

Cluster analysis of composite rep-PCR data revealed 28 haplotypes among 29 isolates that were grouped into 7 clusters at the 50% similarity level. Groupings of the isolates tended to correlate with their geographic origin.

Nei's diversity index of the composite data obtained using rep-PCR primers was high at 0.70 which implies high level of genetic diversity. This considerable variation could lead to the emergence of new resistant strains of *Cercospora canescens*.

These results will aid plant breeders in utilizing diverse pathogen strains for future screening of mungbean cultivars and in developing effective disease management strategies.

**Keywords:** *Cercospora canescens*, mungbean, rep-PCR, genetic diversity

**ASD No. 19**

# PGPR FORMULATION AS SUBSTITUTE FOR NPK FERTILIZATION INCREASES FARMING PROFITABILITY

Ponciano M. Halos[1], Nora Inciong[2], Ben Ronduen[3], and Saturnina C. Halos[1]

[1]Arnichem Corp., College, Los Baños, Laguna
[2]Bureau of Soil Management, San Ildefonso Station, Bulacan,
[3]Department of Agriculture-RSU I, Quezon City

The new PGPR ( plant growth promoting rhizobacteria)) formulation, Vital N™ is a wettable powder containing dried new strains of *Azospirillum sp.*, vitamins and minerals. It was developed for seed/seedling inoculation. *Azospirillum* spp are free living bacteria growing around roots and reported to fix atmospheric N, promote plant growth by producing IAA for root proliferation and cytokinins for shoot growth. They can also solubilize soil phosphorus and potassium. Tests have been conducted to compare the growth and yield of corn and rice treated with Vital N™ at varying levels of fertilization. Experiments were conducted in accordance with FPA-approved protocols at the BSWM Station, San Ildefonso, Bulacan. The growth and yield of rice and corn were compared using the following treatments: No inorganic NPK added, Vital N™ inoculated, ½ recommended rate of inorganic NPK, ½ recommended rate of inorganic NPK plus Vital N™ , full recommended rate of inorganic NPK and full recommended rate of inorganic NPK plus Vital N™. Technology demonstration farms were established in 79 farmer-owned ricefields in Region 1 (Pangasinan, La Union, Ilocos Sur and Ilocos Norte) to show farmers the comparative yields of rice fertilized with ½ recommended rate of inorganic NPK plus Vital N™ and full recommended rate of inorganic NPK. Data were analyzed statistically. A random interview with farmers using Vital N™ was conducted to gauge their reaction to the technology.

Rice and corn treated with Vital N™ were more robust with more extensive roots, thicker stems and stayed green even when matured. In corn, the increase in yield due to Vital N™ ranged from 1.3-1.4 ton ears per ha. In rice, the increase in yield due to Vital N™ ranged from 0.82 -1.62 ton grains per ha. Both experiments showed that Vital N can further increase the yield of rice and corn significantly beyond that obtained using the full recommended rate of fertilization. Both experiments also showed that the application of the Vital N™ can substitute for half the recommended fertilizer requirement. The 79 technology demonstration farms in Region 1 clearly showed that by substituting Vital N™ with half the

recommended rate of fertilization, higher profits were realized by farmers. Farmers were happy and claimed that using Vital N™ increased germination rates, produced healthier seedlings of tobacco, rice, and vegetables; heavier grains and higher milling recovery in rice; higher yields and protection from fungal root rot in onions; greater number of larger fruits in water melon; earlier fruiting and longer production span in peppers, tomatoes and eggplants. Banana plantlets treated with Vital N™ were also found to have higher survival rates and were more robust.

Vital N™ was developed with the assistance of the Philippine Rice Research Institute.

**Keywords:** Vital N™, *Azospirillum sp.*, BSWM Station, NPK

**ASD No. 19**

## IMPROVED SYSTEM OF PLANT REGENERATION FROM UNIRRADIATED AND GAMMA-IRRADIATED EMBRYOGENIC CULTURES OF AVOCADO (*Persea americana* Mill.) BY SOMATIC EMBRYOGENESIS

**Renato A. Avenido*, Julita G. Dimaculangan and Julieta N. Welgas**

Institute of Plant Breeding, College of Agriculture
University of the Philippines Los Baños, College, Laguna 4031

Regenerating avocado (*Persia americana* Mill.) through somatic embryogenesis is far from being routine and often genotype-dependent. Locally, only 'RCF Purple' variety has been tissue cultured and regeneration needs optimization (Raviv et al, Plant Tissue Culture and Biotechnology, Vol. IV, No.3-4, pp 196-205, November 1998). This study is being conducted to improve, adapt and utilize the regeneration system to induce genetic variability by somaclonal variation and gamma irradiation in local avocado varieties.

Significant improvements in embryogenic culture (EC) induction from immature zygotic embryos of 'Semil' and 'Mainit' avocados were obtained in MP medium (MS salts and vitamins + 0.1 mg/L picloram). Subsequent transfers to MP, RA3 (MS + 0.1 mg/L TDZ and 0.5 mg/L $GA_3$) and BA2 (MS + 2.0 mg/L BA + 1.0 mg/L IBA) media resulted in proliferation of globular, heart and cotyledonary stages of somatic embryos. Maturation of somatic embryos was achieved in MM1 medium (B5 macro, MS micro and vitamins with 100 ml/L coconut water). After three trials from over 2,000 somatic embryos, the highest average regeneration

response of 23.7% planlet recovery was obtained using AD4 medium (B5-MS + 400 mg/L glutamine, 60 g/L sucrose and 2.0 mg/L BA). To date, there are a total of 28 rooted plantlets and 124 shoot regenerants from 'Semil' and 6 shoot regenerants from 'Mainit'. In a separate study, gamma irradiation of ECs with 20 and 30 Gy significantly reduced % re-growth/proliferation by as much as 76.2 and 86.1% for 'Mainit' and 31.4 and 84.3% for 'Semil', respectively. As for 'Semil', $LD_{50}$ based on formation of cotyledonary stage SE was at 20 Gy. Seventy-two regenerants have so far been obtained from irradiated cultures. All these regenerants are being micro-propagated for subsequent variant/mutant screening.

**Keywords**: Avocado, *in vitro* mutation, gamma ray, plant regeneration, tissue culture,
somatic embryos

ASD No. 20

## PLANT REGENERATION VIA DIRECT SHOOT ORGANOGENESIS FROM SEEDLING EXPLANTS OF POLE SITAO *Vigna unguiculata* {L.} Walp. var. *sesquipedalis* {L.} Koern.)

**Renato A. Avenido, Julita G. Dimaculangan, Julieta N. Welgas and Edwin E. Del Rosario**

Institute of Plant Breeding, College of Agriculture
University of the Philippines Los Baños, College, Laguna 4031

Complete system for *in vitro* shoot induction, plantlet recovery and *ex vitro* establishment for pole sitao (*Vigna unguiculata* {L.} Walp. var *sesquipedalis* {L.} Koern.) was established for the first time using the protocol originally developed for mungbean and other Asiatic *Vigna* spp. as model. Cotyledon and cotyledonary node (CN) explants excised from aseptic seedlings were cultured using MS salts and B5 vitamins medium with 1.0 to 2.0 mg/L benzyladenine (BA). On the average, percent shoot formation in cultivars 'UPL PS 1' and 'UPL PS 2' were higher using CN (67.6 and 80.4 %) than that of cotyledons (25.2 and 17.8%). However, higher responses can be obtained from cotyledons if younger seedlings (i.e., 1 to 2-d-old) were used. A test on eight pole sitao genotypes (cultivars and advanced breeding lines) for shoot regeneration efficiency revealed genotypic effects with a range of 43.3 to 100%. Individual shoots were excised and rooted at high frequencies (90-100%) using agar-solidified MS-B5 basal medium with 100 ml/L coconut water. Survival of acclimatized regenerants ranged from 47.4 to 88.9 % when transplanted to a 1:1 mixture of garden soil and coir dust under greenhouse conditions. All tissue culture-derived seedlings are morphologically

normal; they flowered and produced pods filled with seeds under field conditions. The system may be applied in micropropagation of inter-specific hybrids and other biotechnology-assisted manipulations (ex. *in vitro* selection and mutagenesis and genetic engineering) in pole sitao.

**Keywords:** Cotyledon, cotyledonary node, legumes, plant regeneration, tissue culture, yard-long bean

**ASD No. 21**

## DEVELOPING PLANT REGENERATION SYSTEMS FOR *IN VITRO* CONSERVATION OF MANDARIN (*Citrus reticulata* Blanco) AND PUMMELO (*Citrus maxima* {Burm.} Merr.)

**Renato A. Avenido, Leah E. Endonela, Liliana F. Patena and Ramon C. Barba**

Institute of Plant Breeding, College of Agriculture
University of the Philippines Los Baños, College, 4031 Laguna

Plant regeneration systems are being developed for *in vitro* conservation of the polyembryonic mandarin (*Citrus reticulata* Blanco) and monoembryonic pummelo (*Citrus maxima* {Burm.} Merr.). Mandarin seeds without the seed coat germinated faster (7 days) and at 100% frequency than those with seed coat (33 days and 12-52%). More vigorous seedlings with stunted roots and stout stems were obtained in G medium (B5-MS basal medium with 1 mg/L benzylaminopurine, BAP). From these seedlings, cotyledonary node (CN) and epicotyl explants were excised and re-cultured onto fresh G medium. Cotyledonary node explants either regenerated 3-5 shoots from each axillary bud three weeks after inoculation or that somatic embryos were induced from the base of the cut portion. Multiple shoots formed directly from the apical cut portion of the epicotyl sections closest to the shoot tips (segment a) when cultured onto B5-MS basal medium with 1-2 mg/L BAP. Conversely, organogenic calli were induced from the basipetal cut portion of all the epicotyl sections when cultured in G medium with 1 mg/L naphthalene acetic acid (NAA) with segment c (that closest to the CN) being the most responsive. Multiple shoots were also obtained from axillary buds of young sprouts and seeds from immature fruits of indexed mandarin trees. In pummelo, somatic embryos were induced from albedo tissues of immature fruits in MS and BP media with 1 mg/l each of BAP and 2,4-D. Removal of these growth regulators allowed germination of the embryos and subsequent shoot growth. Organogenic calli was observed using B5, MS and BP media with 0.5 mg/L 2,4-D. After 3-5 months, shoots were regenerated. These regeneration systems are

being utilized using virus-free indexed materials for slow growth and cryopresevation studies.

**Keywords:** Albedo, cotyledonary node, epicotyl, organogenesis, somatic embryogenesis, tissue culture

**ASD No. 22**

## EFFECTS OF PHYSICAL, CHEMICAL AND LIGHT TREATMENTS ON GERMINATION AND GROWTH OF TISSUE-CULTURED COCONUTS

**Pablito M. Magdalita[1]*, Olivia P. Damasco[1], Joseph C. Berode[1] and Stephen W. Adkins[2]**

[1]Institute of Plant Breeding, University of the Philippines Los Baños College, 4031 Laguna, Philippines
[2]School of Land and Food Sciences, The University of Queensland, Brisbane, Australia

The acclimatization and *ex vitro* establishment of tissue cultured coconut plantlets regenerated either from zygotic or somatic embryos can result in serious losses. Although high germination rates can be achieved on a culture medium, the survival of zygotic embryo-derived plantlets in soil is very low (0-30%). Hence, treatments that could promote development of good quality seedlings having good shoot and root is needed to increase seedling survival *ex vitro*. The effects of physical, chemical and light treatments on the germination and growth of coconut embryos and the tissue culture-derived seedlings, respectively, were investigated. All experiments were conducted in completely randomized design (CRD) with 3 replications. The germination of coconut embryos was promoted significantly when incubated in a liquid $Y_3$ medium placed in a rollerdrum. Gibberellic acid ($GA_3$) significantly affected growth of seedlings including: shoot length, shoot width, root width, fresh and oven dry weights but not root length. However, $GA_3$ did not promote percent germination. In addition, light quality significantly affected growth of seedlings including: leaf length, shoot length, fresh weight, oven dry weight, number of roots and leaves but not light quantity. Blue, red and yellow light (400-700 nm) significantly promoted growth (leaf length, shoot length, fresh weight, oven dry weight, number of roots and number of leaves) in comparison with the control. These conditions could be used to improve the growth of tissue culture coconuts *in vitro* before they could be acclimatized.

**Keywords:** coconut, tissue culture, gibberellic acid, light, rollerdrum

**ASD No. 23**

# CRYOPRESERVATION BY ENCAPSULATION-DEHYDRATION AND SHOOT REGENERATION IN LIME (*Citrus aurantifolia* Swing.)

**Lilian F. Patena*, Leah E. Endonela*, Luzminda C. Refuerzo and Ramon C. Barba**

Institute of Plant Breeding, College of Agriculture,
University of the Philippines Los Baños
College, Laguna 4031 Philippines

Cryopreservation of plant material is the only viable option for the long-term storage of germplasm of vegetatively propagated species and species with recalcitrant seed (Ashmore, 1997). This involves the storage at ultra low temperature (-196°C). At this temperature, cell division and metabolic processes stop and plant material can be stored without modification or alteration for unlimited period of time. Lime (*Citrus aurantifolia* Swing.), one of the valuable citrus species in the Philippines due to its high percentage of acid (citric) in the juice, was used to develop a cryopreservation technique. Good quality somatic embryos were encapsulated using 2.5% or 3.0% sodium alginate and dehydrated for 1,3 or 9 hr. The dried beads were immersed in liquid nitrogen for 12 and 24 hr, then quickly thawed at 60±2°C for 3-5 mins. and cultured on the recovery medium. Cultures treated with 2.5% sodium alginate and 0.5 M sugar and dehydrated for three hr were found most responsive. Remarkable increase in size was observed in all the samples seven days after inoculation onto the recovery medium. Somatic embryos proliferated with or without liquid nitrogen treatment. Proliferation was higher in Rp medium (BP, Barba and Patena, medium with 0.5 mg/L 2,4-D, 60 g/L sugar and 100 ml/L coconut water) compared to Mr medium (MS medium with 60 g/L sugar and 200 ml/L coconut water) and in the control compared to the liquid nitrogen-treated samples. The somatic embryos matured and germinated and eventually regenerated shoots. This study shows that lime somatic embryos are amenable to cryopreservation and that the encapsulation-dehydration technique can be used to store lime on a long-term basis.

**Keywords:** somatic embryos, cryopreservation, encapsulation-dehydration, *in vitro* conservation

**ASD No. 24**

# SOMATIC EMBRYOGENESIS AND PLANTLET REGENERATION IN CALAMANSI (*X Citro fortunella microcarpa* Bunge.)

**Lilian F. Pateña, Leah E. Endonela, Luzminda C. Refuerzo and Ramon C. Barba**

Institute of Plant Breeding, College of Agriculture
University of the Philippines Los Baños, Laguna

Calamansi (*X Citrofortunella microcarpa* Bunge.), alsocalled 'calamondin' or 'kalamansi' in Tagalog and 'limonsito' in Cebuano, is the most important citrus fruit crop of the Philippines. A system for somatic embryogenesis and plantlet regeneration of this crop was developed for use in genetic transformation and *in vitro* conservation. Somatic embryos were induced using nucellar tissues from immature seeds cultured onto BCO and MCO media (BP, Barba and Pateña, and MS, Murashige and Skoog, media, respectively, with 20g/L sugar and 100 ml/L coconut water). Highest somatic embryo formation was observed in BCO cultures obtained from immature fruits with diameter of 6.0-9.5 mm. Somatic embryo induction decreased as the fruit diameter increased. Somatic embryos were also induced from nucellar tissues cultured onto LMr medium (MS macro and micro, MT vitamins and amino acids with 1.0 mg/L each of kinetin and NAA, 2.0 mg/L BAP and 50 g/L sugar). Proliferation of somatic embryos was enhanced when subcultured onto Gp, Mp and Rp media (Gamborg's B5, MS and BP media, respectively, with 0.5 mg/L 2,4-D, 60 g/L sugar and 100 ml/L coconut water). Maturation and germination of somatic embryos were observed in BCO and MCO media. Plantlets developed in 3-5 weeks and have been acclimatized for transplant to soil. This system for somatic embryogenesis and plantlet regeneration of calamansi can now be used for genetic transformation and *in vitro* conservation studies.

**Keywords:** nucellus, somatic embryogenesis, plantlet regeneration, transformation, *in vitro* conservation

**ASD No. 25**

# SOMATIC EMBRYOGENESIS AND PLANTLET REGENERATION IN LIME (*Citrus aurantifolia* Swing.)

**Lilian F. Pateña*, Luzviminda C. Refuerzo, Leah E. Enduveia* and Ramon C. Barba**

Institute of Plant Breeding, College of Agriculture
University of the Philippines Los Baños, Laguna

Lime (*Citrus aurantifolia* Swing.) is one of the valuable citrus species in the Philippines. It has the highest percentage composition for acid as citric but somewhat lower in ascorbic acid than lemon. It is used as juice and as component of alcoholic drinks, beverages and medicinal preparations. Developing a tissue culture system for somatic embryogenesis and plantlet regeneration of this crop would be a useful tool for its micropropagation and *in vitro* conservation. Somatic embryos were induced using nucellar tissues from immature seeds cultured onto G medium (B5-MS with 1.0 mg/L BAP). Somatic embryos were also induced from undeveloped seeds of mature fruit cultured onto Rr medium (BP, Barba and Pateña, medium with 60g/L sugar and 200 ml/L coconut water). Proliferation of somatic embryos was enhanced when subcultured onto Gp, Mp and Rp media (Gamborg's B5, MS and BP media, respectively, with 0.5 mg/L 2,4-D, 60 g/L sugar and 100 ml/L coconut water). Maturation and germination of somatic embryos were observed in BCO and MCO media (BP, Barba and Pateña, and MS, Murashige and Skoog, media, respectively, with 20 g/L sugar and 100 ml/L coconut water). but remained in cotyledonary stage for 5-7 weeks. When the cultures were aged (one year or older) and subcultured onto LMr medium (MS macro and micro, MT vitamins and amino acids with 1.0 mg/L each of kinetin and NAA, 2.0 mg/L BAP and 50 g/L sugar), the somatic embryos germinated and developed into plantlets.

**Keywords:** nucellus, somatic embryogenesis, plantlet regeneration, micropropagation, *in vitro* conservation

**ASD No. 26**

# CROSS COMPATIBILITY OF ELITE PAPAYA INBRED LINES TO AN INTERSPECIFIC HYBRID OF *Carica papaya* L. x *Carica quercifolia* (Saint-Hil.) Hieron

**Andres Godwin C. Sajise[1], Simeona V. Siar[1] and Juanito B. Sangalang[2]**

[1]Institute of Plant Breeding and [2]Department of Horticulture
College of Agriculture, University of the Philippines Los Baños, Laguna 4031

The cross compatibility of four papaya inbred lines to $F_1$ interspecific hybrid, *Carica papaya* x *C. quercifolia* line 410 was studied. Parental lines used were characterized morphologically. In addition, resistance to papaya ringspot virus (PRSV-P) and pollen viability of line 410 was evaluated under Philippine conditions.

The genotypic compatibility among four crosses between $F_1$ interspecific hybrid and papaya inbreds (4108, 4172, 5648, and 5893) are evident. Inbreds 5648 and 5893 produced fruits filled with a large number of seeds. All crosses produced viable embryos that grow easily *in vitro*. Remarkable difference was observed in morphological characters among papaya inbreds as well as between papaya and $F_1$ interspecific hybrid line 410. Cluster analysis separated parent materials into three sub groups. Papaya inbreds derived from local selections (4108 and 4172) and inbreds that were introduced from other countries (5648 and 5893) were subdivided. Line 410 has a separate cluster.

Symptomatology and serological test by indirect ELISA (Enzyme Linked Immunosorbent Assay) confirmed that interspecific hybrid line 410 plants have resistance against PRSV-P. Tetrazolium test, a pollen viability assay, showed a number of viable pollen under local conditions

**Keywords:** Inbred lines, $F_1$ interspecific hybrid, cross compatibility, Papaya Ringspot Virus (PRSV), pollen viability

**ASD No. 27**

# DEVELOPMENT OF THERMOSENSITIVE GENETIC MALE STERILE (TGMS) LINES AT PHILRICE

**Alex T. Rigor[1], Albert Christian S. Sufier[1], Virginia P. Luciano[1], Wilhelmina V. Barroga[2], Imelda A. dela Cruz[2], Tomas M. Masajo[3], John C. de Leon[2] and Edilberto D. Redoña[2]**

[1]Philippine Rice Research Institute - Isabela,
San Mateo 3318 Isabela, Philippines
[2]Philippine Rice Research Institute - CES, Science City of Muñoz
3120 Nueva Ecija, Philippines
[3]Philippine Rice Research Institute
Los Baños, College 4031 Laguna, Philippines
Email: atrigor@philrice.gov.ph

Thermosensitive genetic male sterility (TGMS) is controlled by a single recessive nuclear gene which interacts with temperature to express pollen sterility or fertility. Its use can simplify the method of exploiting heterosis or hybrid vigor in rice. Also, it is an alternative to the use of cytoplasmic male sterility (CMS) in developing and producing seeds of hybrids.

TGMS lines are sterile at high temperature and fertile at low temperature, thus, multiplying seed of sterile line is easier since there is no need for a maintainer line. In addition, TGMS lines do not require pollen parent with restorer gene hence a wider array of varieties and elite lines could be utilized in crosses thus increasing the chances of finding heterotic combinations. R&D efforts on the use of the system are therefore being pursued intensively at PhilRice. As early as 1994, TGMS lines from different sources were assembled and evaluated as possible donors of *tgms* gene(s) in crosses in breeding for improved TGMS lines. Recently, four agronomically improved and potentially useful TGMS lines were identified from breeding populations alternately grown and evaluated in so-called male fertile environment (MFE) and male sterile environment (MSE). Results of more than two consecutive years of testing indicate that they have stable fertility/ sterility behavior in MFE and MSE and can be useful female parents in the development and production of new hybrids.

**Keywords:** thermosensitive, TGMS, hybrid rice, breeding, male sterility

**ASD No. 28**

# GENETIC FIDELITY TESTING IN CITRUS USING ISOZYME MARKERS

**Roberta N. Garcia, Leah E. Endonela, and Lilian F. Patena**

*Institute of Plant Breeding, College of Agriculture*

*University of the Philippines Los Baños, College, Laguna 4031 Philippines*

Isozymes have been extensively studied and utilized to assess genetic variations in plant populations generated via *in vivo* and *in vitro* techniques. In our ACIAR-IPGRI-funded citrus project which commenced in January 2003, we developed five enzyme systems to assess genetic diversity between tissue-cultured and non-tissue cultured calamansi, pummelo, mandarin and lime. These systems included shikimate dehydrogenase (SDH), isocitric dehydrogenase (IDH), acid phosphatase (ACP), malate dehydrogenase (MDH) and glutamate oxaloacetate transaminase (GOT). Results showed two SDH banding patterns, one for calamansi and mandarin and another for pummelo and lime. Calamansi and pummelo exhibited a single IDH band. This band was seen in both the tissue-cultured and non-tissue cultured samples, although faint bands were observed in tissue-cultured calamansi and pummelo as well as in non-tissue cultured pummelo. Two ACP bands and three MDH-2 bands were seen in tissue-cultured and non-tissue cultured calamansi. No difference was observed in ACP and MDH-2 enzyme patterns between the tissue-cultured and non-tissue cultured calamansi. For GOT, two bands of activity were obtained both for calamansi and pummelo. Pummelo showed darkly stained bands compared to the light to faint bands of calamansi. The lightly to faint enzyme patterns observed is generally a result of limited sample for analysis. However, this could still be improved using more leaf tissues. In spite of this limitation, it was clearly seen that the tissue-cultured and non-tissue cultured calamansi and pummelo carried similar IDH, ACP, MDH-2 and GOT patterns. No variations have been observed so far between the tissue-cultured and non-tissue cultured materials. These five enzymes systems that were developed can now be utilized to test the genetic fidelity of tissue-cultured (new and aged cultures) and cryopreserved materials.

**Keywords:** genetic fidelity, isozymes, tissue culture

**ASD No. 29**

# GENETIC VARIABILITY OF RESTORER LINES IN RICE (*Oryza sativa* L.)

**Samuel A. Ordoñez Jr. [1]*, Jose E. Hernandez[2], Peter S. Guzman[4], Teresita H. Borromeo[3] and Edilberto D. Redoña[3]**

[1]Philippine Rice Research Institute (PhilRice) Isabela, San Mateo, 3318, Isabela,
[2]PhilRice CES Science City of Muñoz, 3119 Nueva Ecija
[3]Department of Agronomy, University of the Philippines Los Baños
[4]Formerly with the Department of Agronomy, University of the Philippines Los Baños
Email: saordoñez@philrice.gov.ph

Estimates of genetic variance are useful in designing breeding programs, as the higher the genetic variability and magnitude of diversity, the greater the probability of heterosis. The genetic variability of restorer germplasm at PhilRice were determined by developing half-sib hybrids following the line x tester mating design involving 20 randomly selected restorers and three commercially usable CMS lines and evaluated in two environments. In addition, these restorers were assayed for molecular analysis using SSR markers to determine the molecular divergence at the DNA level.

Analysis of variance for both locations revealed highly significant ($P<0.01$) differences among restorer lines, CMS lines and restorer lines x CMS lines for all traits. Estimates of genetic variance of restorer lines ($s^2L$) for traits measured were highly significant based on F-test, except for number of productive tillers. Confidence interval estimates ($s^2L$) for all traits were also significantly different from zero except number of productive tillers. This indicates that estimates obtained were significant and that genetic variability exists for these traits.

The 65 SSR markers were polymorphic. A total of 266 alleles ranging from 2 to 8 alleles locus$^{-1}$ and a mean of 4.09 alleles locus$^{-1}$ were detected. The Nei and Li genetic similarity coefficients among restorers and CMS ranged from 0.22 to 0.71. Twenty four percent of the total alleles detected were rare (63/266) and these were distributed throughout the entire chromosomes of the rice genome. Combined mean performance across locations revealed that several hybrids out yielded the best checks. Twenty-five percent (15/60) of hybrids evaluated at

UPLB exhibited 16.73 – 44.29% yield advantage over the highest yielding check, PSB Rc72H. At PhilRice CES, three hybrids (5%) out yielded the highest yielding check PSB Rc28.

Overall, the results indicate the presence of a wide range of genetic variability and molecular divergence in the PhilRice restorer germplasm, indicating great potential to generate outstanding hybrids for commercial cultivation.

**Keywords:** Genetic variability, molecular diversity, germplasm, restorer lines, SSR markers

**ASD No. 30**

## MORPHOLOGICAL CHARACTERIZATION AND DNA FINGER PRINTING OF CMS LINES BRED AT PHILRICE

**Imeldalyn G. Pacada*, J.C. de Leon, E.D. Redoña, V.H. Elec and I. A. dela Cruz**

Philippine Rice Research Institute (PhilRice),
Maligaya, Science City of Muñoz, 3119 Nueva Ecija

Morphological characterization of CMS lines bred at PhilRice showed appreciable differences between lines for 1,000 grain weight, grain length and width, culm length and number, date to fifty percent flowering, culm strength, flag leaf angle, and secondary branching. Using microsatellite markers and compared with 37 other CMS lines used in our hybrid rice breeding program, the PhilRice-bred CMS lines appeared to be more distantly related and genetically diverse. Informative microsatellite markers with unique alleles that can only be found in PhilRice CMS lines were also identified. With these results we hope to increase the efficiency of heterotic hybrid identification at the Institute.

**Keywords:** CMS (Cytoplasmic Male Sterile), hybrid rice, microsatellite markers

**ASD No. 31**

# GLYPHOSATE TOLERANCE AND INSECTICIDE EFFICACY AGAINST ASIATIC CORN BORER, *Ostrinia furnacalis* (GUENEE) OF TRANSGENIC ROUNDUP READY CORN (NK 603/MON 810) UNDER SCREENHOUSE CONDITIONS[1]

**Aida D. Solsoloy[2], L.C. Paracan[2], Arthur R. Baria[3], and R.G. Cabangbang[3]**

[2]Cotton Research Center, Development Administration
Batac, Ilocos Norte 2906, Philippines, [3]Monsanto Phils., Inc.

The glyphosate-tolerance and insecticidal effectiveness of transgenic roundup ready (RupR) corn line NK 603/MON 810 expressing the *Bacillus thuringiensis* gene against the Asiatic corn borer, *Ostrinia furnacalis* (Guenee) was evaluated under screenhouse conditions in comparison with isohybrid DK818.

Roundup® herbicide at two dosage rates: 0.72 and 1.42 kg a.e. ha-1 was applied at 15, 30 and 15 and 30 days after planting (DAP) on both corn hybrids. To assess susceptibility to corn borer, the plants were artificially infested with neonate larvae at 20 and 40 DAP. Herbicide effect and insect pest damage were determined on the transgeniccorn and non-transgenic counterpart in comparison with respective untreated checks.

Agronomic performance indicated comparable seedling emergence and vigor between the transgenic cotton and isohybrid line. Herbicide application at both rates totally killed the treated isohybrid line DK 818, while full growth and development was noted for the transgenic corn until maturity. Extreme susceptibility to corn borer was noted on artificially infested isohybrid line as evidenced by severe occurrence of leaf perforations, petiole or stalk breakage and clumped whorl causing stunted growth. On the other hand, only a few pinpricks on the leaves of transgenic corn were observed that had negligible adverse effect on the plant's growth and development.

RupR corn NK 603/MON 818 was highly tolerant to glyphosate at either dosages applied at early or middle vegetative stage. It was highly resistant to corn borer infestation. With inherent glyphosate-tolerance and insect resistance to corn borer properties, this hybrid should be evaluated under different local corn growing conditions for adaptation assessment, in addition to consideration of possible effects on the environment.

[1]Project funded by Monsanto Phils., Inc.

**Keywords**: glyphosate-tolerance, RupR, *Bacillus thuringiensis*, Asiatic corn borer

**ASD No. 32**

## SCREENING OF $R_1$ PAPAYA LINES DERIVED FROM MICROPROJECTILE BOMBARDMENT FOR RESISTANCE TO PAPAYA RINGSPOT VIRUS

**Lolita D. Valencia*, Pablito M. Magdalita*, and Violeta N. Villegas**

*University Researcher, Institute of Plant Breeding, College of Agriculture
University of the Philippines Los Baños, College, Laguna 4031

Transformation of Davao 'Solo' papayas was done to develop resistance to ringspot virus using microprojectile bombardment. Twenty-seven $R_1$ papaya lines derived from $R_0$ lines were utilized in the screening for resistance to papaya ringspot virus (PRSV). Resistance to the disease was based on symptomatology and serology whereby virus was detected by enzyme-linked immunosorbent assay (ELISA) after 4-8 weeks of inoculation with IPB-PRSV isolate. One hundred and sever individual plants coming from 17 $R_1$ lines including PB 4.3, PB 4.6, PB 4.8, PB 4.10, PB 4.11, PB 5.1, PB 5.5, PB 5.8, PB 5.12, PB 6.8, PB 8.2, PB 8.5, PB 12.9, PB 13.6, PB 13.8, PB 13.10, and PB 15.6 were considered putative resistant $R_1$ lines. The putative resistant plant lines were free of PRSV infection and negative to ELISA after four to eight weeks of inoculation. In contrast, the susceptible plant lines had typical symptoms of PRSV that developed 14 days after inoculation. The symptoms include: leaf mottling, mosaic, chlorosis, vein-clearing, severe leaf malformation, stunting and elongated oily streaks on the stem and petiols.

**Keywords:** microprojectile bombardment, papaya ringspot virus, $R_1$ lines, symptomatology, enzyme linked immunosorbent assay, resistance, transformation

**ASD No. 33**

## DEVELOPMENT OF TRANSGENIC PAPAYA WITH DELAYED RIPENING CHARACTERISTICS CONTAINING THE ACC OXIDASE GENE VIA THE *Agrobactrium*-MEDIATED TRANSFORMATION

**Pablito M. Magdalita, Antonio C. Laurena and R.L. Comia**

Institute of Plant Breeding, College of Agriculture
University of the Philippines Los Baños, Laguna

ACC oxidase is one of the regulatory enzymes that control ethylene biosynthesis. By controlling this enzyme, the effect of ethylene during ripening

of climacteric fruits such as papaya can also be regulated. The partial cDNA of ACC oxidase (isolated from ripening papaya fruits) was inserted in a binary vector pGA643 in the antisense orientation and the resulting gene construct was transfected into *Agrobacterium tumefaciens* strain LBA4404 via electrophoretic techniques. Transformation of papaya somatic embryos and multiple shoots was done using an *Agrobacterium*-mediated co-cultivation method. After a brief exposure of plant tissues to the bacteria, putatively transformed somatic embryos and multiple shoots were transferred and maintained in Solid Embryo Induction Medium (SEIM) supplemented with carbenicillin and kanamycin. Approximately 22% (178 out of 802) of the somatic embryos and 6% of the multiple shoots (48 out of 780) are currently grown in SEIM with carbenicillin to get rid of the bacterium. Nineteen per cent (19%) of the somatic embryos and 77% of the multiple shoots are already grown in the kanamycin selection medium in preparation for plant regeneration.

**Keywords:** *Agrobacterium*, ACC oxidase, Transformation, SomaticEmbryo Induction Medium (SEIM)

**ASD No. 34**

## BANANA BUNCHY TOP VIRUS RESISTANCE IN BANANA (*Musa* sp.) Cv. LAKATAN DEVELOPED BY IRRADIATION OF SHOOT CULTURES

**Olivia P. Damasco*, Judith B. Estrella, Leila S. Caymo, Teodora O. Dizon, Ruel C. Rabara, Felipe S. dela Cruz Jr. and Evelyn Mae T. Mendoza**

Institute of Plant Breeding, College of Agriculture
University of the Philippines Los Banos, College, 4031 Laguna

Banana bunchy top virus (BBTV) is the most destructive virus disese of banana in the Philippines. Incorporation of resistance to this virus diseasey conventional hybridization is not possible due to sterility of most commercal banana cultivars. Gamma irradiation coupled with *in vitro* technology wa explored as a means to develop BBTV resistance.

The sensitivity of banana shoot cultures to varying doses (5 to 100 GY of Cobalt 60 gamma radiation was determined. Irradiated shoot cultures were micropropagated for three to five cycles and plants regenerated were potted out and evaluated for BBTV resistance. Plants were indexed for BBTV using symptomatology, ELISA and PCR techniques.

A total of 6,012 plants regenerated from irradiated shoot cultures were subjected to artificial BBTV inoculation using the aphid vector *Pentalonia nigronervosa*. . From these plants, 64 putative BBTV resistant lines were selected in the field after 36 months of evaluation. The selected putative BBTV resistant plants exhibited varying degree of resistance reaction to the virus Twenty six (26) lines showed no BBTV symptom expression in both irradiated and first generation sucker plants. The other 38 lines exhibited limited symptom expression. Yield and agronomic characteristics of some putative resistant lines were comparable to non irradiated micropropagated plants. Suckers from these putative BBTV resistant lines were collected; micropropagated and plants are now being evaluated for the second cycle stability of BBTV resistance trait.

**Keywords:** banana, mutation, BBTV, gamma radiation, *in vitro* technology

Funded by: IAEA, PCARRD-DOST, IPB-UPLB

**ASD No. 35**

## EFFECT OF DRYING OILS ON PROPERTIES OF PHENOLIC VARNISH FROM CASHEW NUT SHELL LIQUID

**Irma I. Palanginan * and Mildred M. Fidel**

Forest Products Research and Development Institute, College, 4031 Laguna
Email : irma_palanginan@yahoo.com

The total production of cashew nuts during the last ten years averaged around 100,000 MT per year. The average amount of cashew nut shell liquid (CNSL) generated by the cashew industry for the last ten years is estimated to be around 25,000 MT. Utilization of CNSL into varnish can bring benefit to the furniture industry.

The effect of different drying oils on properties of phenolic varnish from cashew nut shell liquid was evaluated. Drying oils tested include linseed oil, tung oil, soya bean oil and rubber seed oil with levels varied at 20, 30 and 40 parts by weight (pbw). Results showed that drying time of CNSL varnishes proceeded from the shortest to longest time in this order: tung oil<linseed oil<soya bean oil<rubber seed oil. CNSL varnishes with tung oil followed a decrease in drying time with an increased in amount of oil from 20-40 pbw. CNSL varnishes with linseed oil, soya bean oil and rubber seed oil have longer drying time with

increased amount of oil from 20-40 pbw. All other properties such as adhesion, gloss, resistance to hot coffee, soft drinks and 45% alcohol, hot-and-cold check resistance were comparable with commercial varnish.

**Keywords:** cashew nut shell liquid, tung oil, linseed oil, soya bean oil, rubber seed oil, adhesion, hot-and cold check resistance

**ASD No. 36**

## UTILIZATION OF FRESH GOLDEN SNAIL MEAT AS FEEDS FOR SWINE

**M.S. Salazar, R. R. Sair and A.G. Alos**

College of Agriculture and Forestry
Mariano Marcos State University, Batac, Ilocos Norte
Email: rddirectorate@hotmail.com

Feeding trials using fresh golden snail meat as replacement for commercial mash and soybean oil meal were conducted to compare the growth performance of pigs fed with and without fresh golden snail meat and to assess the profitability of using fresh golden snail meat on growing-finishing pigs. The study was conducted in seven municipalities of Ilocos Norte, namely Bacarra, Batac, Dingras, Pagudpud, Piddig, Sarrat and Solsona. One cooperator was selected in each municipality. Two dietary treatments in each trial were randomly assigned to piglets distributed to each cooperator using Randomized Complete Block Design (RCBD). Dietary treatments were pure commercial mash (CM) and 90% CM + 10% equivalent amount of fresh golden snail meat (FGSM) in the first feeding trial and formulated rations (FR) with and without FGSM in the second feeding trial.

Result showed that pigs fed with CM + 10% equivalent amount of FGSM had comparable growth performance, feed consumption and backfat thickness to those fed with CM. However, required less amount of feeds to produce a kg gain in weight. Thus, the gain obtained per pig is PhP815.00 higher than those fed with pure CM.

Similarly, pigs fed FR with and without FGSM had comparable total and daily gain in weight, feed consumption, feed conversion efficiency and backfat

thickness. No signs of lungworm infestation was observed. In addition, feeding FR with FGSM provide more profit of PhP485.00 than those fed FR without FGSM.

Based on the result of both feeding trials, FGSM could replace 10% commercial mash; and 37.5% and 60% soybean oil meal in formulated grower and finisher ration respectively. Thus, FGSM is a good protein source for swine and provide additional income to swine raisers.

**Keywords:** Golden snail, swine/hog/pig

## *BIOLOGICAL SCIENCES*

**BSD No. 1**

### PARTICIPATORY INVENTORY AND CONSERVATION STUDIES OF ENDEMIC, ENDANGERED AND ECONOMICALLY IMPORTANT FLORA IN SELECTED FORESTS OF MINDANAO

**Victor B. Amoroso and Cecilia B. Amoroso**

Central Mindanao University, Musuan, Bukidnon
E-mail: v.amoroso@eudoramail.com; cbamoroso@yahoo.com

Mindanao forests have not been spared from wanton destruction due to human activities. An inventory of flora in selected forests of Mindanao was conducted to assess its status and conserve the endangered, endemic, and economically important species in the said mountains.

Through survey, collection and participatory establishment of a 1-ha plot, an assessment of plant diversity in Mt. Musuan, Mt. Kalatungan and Mt. Malindang in Mindanao revealed the presence of 963 species, 231 genera and 182 families. Noteworthy was the discovery of new records of mosses in the Philippines, viz., *Chaetomitrium horridulum*, *Metadistichophyllum rhizophorum* and *Camptochaeta subporotricholdes*. Assessment of conservation status of each species showed 12 endangered species, 252 endemic species, 17 rare species, 187 economically important species and 10 species of socio-cultural importance. An initiative to conserve these endangered, endemic, rare and economically

important species was conducted by propagating them in the garden and in the greenhouse as part of the *ex situ* conservation and as sources of explants for *in vitro* culture. Those plants that were successfully cultured/propagated through *in vitro* were *Lycopodium clavatum* (rare and ornamental fern ally), *Lycopodium cernuum* (medicinal and ornamental fern ally), *Uvaria rufa* (ornamental and medicinal), *Dillenia philippinensis* (endemic and ornamental), *Arisaema* sp. (ornamental), *Medinilla* sp. (rare and ornamental) and *Diospyros philippinensis* (endemic). Through the participation of the Subanons and Talaandigs, the abundance, local names and uses of the botanical resources were made possible. Some species considered to be endangered, endemic and economically important were saved through *in situ* and *ex situ* conservation. Findings of this study have led the community to identify the Nursery and Economic Garden as livelihood projects.

**Keywords:** flora, inventory, assessment, *ex situ* conservation

**BSD No. 2**

## ALTITUDINAL GRADIENT DISTRIBUTION OF PTERIDOPHYTES ON MT. BANAHAW DE LUCBAN, LUZON ISLAND, PHILIPPINES

**Maria Celeste N. Banaticla and Inocencio E. Buot Jr.**

Institute of Biological Sciences, College of Arts and Sciences
University of the Philippines Los Banos, College, Laguna
Email: iebuot@yahoo.com

An altitudinal transect study of pteridophytes was conducted at the northeastern slope of Mt. Banahaw de Lucban. Ninety-three (93) species representing 47 genera and 24 families were found in the study area. Fourteen percent (14%) of which are Philippine endemics. The most represented families are Polypodiaceae (11 spp.), Hymenophyllaceae (11 spp.) and Aspleniaceae (9 spp.) while the most represented genera are *Asplenium* (9 spp.), *Lycopodium* (5 spp.) and Selaginella (5 spp.). The pterido-flora of the mountain exhibits a strong Malesian floristic affinity.

Five altitudinal pteridophyte zones are proposed based on the results of cluster analysis and principal component analysis: **Zone 1,** *Cyathea contaminans – Dicranopteris - Nephrolepis - Diplazium* patches from 700 – 800 m a.s.l.; **Zone 2,** *Sphaerostephanos hirsutus* var. *hirsutus - Selaginella delicatula* patches from 750 – 900 m a.s.l.; **Zone 3,** *Cyathea philippinensis - Selaginella* patches from 900 – 1200 m a.s.l.; **Zone 4,** *Cyathea philippinensis - Cyathea*

*callosa - Asplenium cymbifolium - Selaginella cumingiana* patches from 1200 – 1550 m a.s.l. and; **Zone 5 which is further divided into Sub-zone 5A,** *Cyathea callosa - Cyathea loheri* - Hymenophyllaceae patches from 1550 – 1800 m a.s.l. and **Sub-zone 5B,** Cyathea loheri – Cephalomanes apiifolia patches from 1800 – 1875 m a.s.l. These pteridophyte zones coincide with the woody species zones and differ significantly with the altitudinal fern zones on Mt. Makiling.

Species diversity gradually increases with elevation, reaching a maximum at 814 – 886 m a.s.l. On the other hand, species cover did not show any direct relationship with altitude. Majority of the fern patches shelters all the pteridophyte height classes designated in this study. At least 85% of the pteridophyte species are preferential.

Stepwise multiple regression analysis reveals that altitude and soil pH exhibit a linear relationship with pteridophyte species distribution. Altitude and soil pH influences 65% of the variation in principal component 1 [PC1 = 0.0839 + 0.0010(altitude) - 0.2072(soil pH); r = 0.8058] and explains 27% of the variation in principal component 2 [PC2 = 2.0453 - 0.0005(altitude) - 0.2560(soil pH); r = 0.5206]. On the other hand, slope was found to be linearly related to species diversity, explaining 16% of the variation in $H'$ [$H'$ = 1.4928 + 0.0092(Slope); r = 0.3995]. The strong linear relationship expressed by pteridophyte distribution with elevation justifies the designation of altitudinal pteridophyte zones.

**Keywords:** Pteridophytes, distribution, Mt. Banahaw de Lucban

**BSD No. 3**

## BIOLOGY AND CULTIVATION OF *Schizophyllum commune*, A NEWLY CULTIVATED PHILIPPINE EDIBLE MUSHROOM WITH NUTRICEUTICAL AND ANTIBACTERIAL PROPERTIES

**Renato G. Reyes,* Evaristo A. Abella, John Keith Gisala, Marco Gaudencio Bulseco and Gladys Grace Gatdula**

Center for Tropical Mushroom Research and Development
Department of Biological Sciences,
College of Arts and Sciences, Central Luzon State University,
Science City of Munoz, Nueva Ecija 3120

Our group studied the biology and cultivation of this wild edible mushroom *Schizophyllum commune* which may lead to the development of research - based production technology. Also, its nutriceutical and antibacterial properties were evaluated.

Spores of *S. commune* germinated best when immersed in rice bran decoction (pH 7.5) and incubated under illuminated condition at 32°C. Domestication studies showed that *S. commune* can be cultivated on natural substrates. Coconut water is the most appropriate culture medium for the mycelial production. Milled rice and palay seeds could support luxuriant mycelial growth and thus could serve as best mother spawning materials or starters. Its fruiting bodies grow best on a combination of sawdust and 5% rice bran. Among the logs evaluated, mango yielded quality fruiting bodies compared to ipil -ipil, rain tree and paper tree.

With regard to the nutriceutical and antibacterial properties, *S. commune* contains appreciable amount of protein (22%), crude fiber (3.59%), and carbohydrates (59.56 %) which merit it to be considered as nutritious food. The immobilized form of *S. commune* could overcome and suppress the growth and further colonization of *Staphylococcus aureus* and *Escherichia coli*.

These significant findings affirm that *S. commune* is a newly cultivated edible mushroom with nutriceutical and antibacterial properties.

**Keywords:** fungal flora, nutriceutical, Philippine fungi, *Schizophyllum commune*, wild edible mushroom

**BSD No. 4**

## COMMUNITY STRUCTURE OF MACROPHYTES, BENTHIC MOLLUSCS, MEIOFAUNA AND MANGROVES IN THE EXPLOITED INTERTIDAL SAND FLAT IN DARUMAWANG IN PANGUIL BAY, MINDANAO

**Anna Arlene Eya and Cesar G. Demayo**

Department of Biological Sciences
MSU-Iligan Institute of Technology, Iligan City

The community structure of marine organisms was assessed in an exploited intertidal sandflat in Panguil bay. A stratified sampling method using transects lines and quadrats was employed to study the intertidal flat. Diversity indices, cluster analysis, detrended correspondence analysis, principal component analysis were used to evaluate the data collected in two sampling periods. Physicochemical parameters of the water and sediment of the area was also studied in relation to the distribution and abundance of organisms. Only one species of algae and one species of seaweed was found. There are two species of mollusks found in the area with 29 bivalves and 3 gastropods. The dominant species is *Modiolus metcalfei* followed by *Katylesia hiantina* and third is *Meretrix meretrix*. There are 11 groups of meiofauna present in the area

with nematoda as the dominant organism. Only two species of mangroves were found, Sonneratia and Avicennia. Multivariate analysis showed the community structure of the organisms in the intertidal flat generally has only few species as indicated by its low species richness value and are randomly distributed but not directly associated with the physicochemical properties of the sediments and water.

**Keywords:** community structure, Macrophytes, mollusks, seaweeds, mangrove, Panguil Bay

**BSD No. 5**

## THE REPTILES OF MT. KIMANGKIL IN MINDANAO

**Dennis Warguez, Cesar G. Demayo and Olga M. Nuñeza**

Department of Biological Sciences
MSU-Iligan Institute of Technology, Iligan City

An inventory of reptiles in Mt. Kimangkil of Mindanao Island in the Philippines was conducted employing the cruising method. A total of 132 reptiles represented by 17 species, among which are Philippine endemics of 8 lizards and five snakes. Altitudinal distribution and habitat preferences of the collected species were noted while a preliminary data on their breeding season were collected. Overall assessment revealed that the presence of a large number of Philippine endemics in Mt. Kimangkil indicates that the area is of excellent quality providing habitat to a large number of reptiles including *Dasia griffini* and *Hologerrum philippinum* which are known to exist only in Palawan and Luzon respectively. The data presented are the first ever established for Mt. Kimangkil setting a milestone in the discovery of possible new subspecies in the area.

**Keywords:** reptiles, Mt. Kimangkil, *Dasia griffini*, *Hologerrum philippinum*

**BSD No. 6**

## TAXONOMIC AND ECOLOGICAL STUDY OF PLANKTONS IN MARAGONDON RIVER, CAVITE

**Erwin P. Elazegui, Allan S. Ibasco and Maria Winesa B, Magbanua**

College of Science, Technological University of the Philippines
Ayala Blvd. , Manila

A plankton study of Maragondon River, Cavite was conducted for classification and identification purposes. Three stations of 50 meters across the river were established. Plankton collection was done vertically and horizontally. Four parameters were observed: pH, temperature, dissolved oxygen, salinity, depth and current. Collected water samples were placed in a container preserved with 4% formalin. Plankton species present were analyzed using the Sedgewick Rafter counting chamber and a binocular microscope. The study obtained 14 genera of phytoplanktons and 9 genera of zooplanktons. *Coscinodiscus radiatus and Calanus helgolandicus* were the most abundant species of planktons. The Simpson index of diversity is 11.9 for phytoplanktons and 7.9 for zooplanktons indicating high diversity of planktons thriving in the river. pH , temperature and depth were recorded and correlated with the number of planktons counted.

**Keywords:** planktons, taxonomic, ecological, phytoplanktons, zooplanktons

**BSD No. 7**

## GARGANTUAN LADYBIRD BEETLES OF THE PHILIPPINES (COLEOPTERA, COCCINELLIDAE, COCCINELLINAE, COCCINELLINI)

**Jessamyn D. Recuenco-Adorada**

National Crop Protection Center, College of Agriculture
University of the Philippines Los Baños
4031 College, Laguna

Five species of ladybird beetles belonging to the tribe Coccinellini with a size ranging from 8mm to 13mm, *Anisolemnia reichi* (Mulsant), *Docimocaria commingi* (Mulsant, *Leis manillana* (Mulsant, *L. paulinae* (Mulsant) and *Synonycha grandis* Thunberg were described. These enormous ladybirds were found to be important predators of aphids. Four species were found to be endemic to the Philippines except for *S. grandis.*

**Keywords:** gargantuan, ladybird beetles, endemic, Coccinellini

**BSD No. 8**

# FAUNAL INVENTORY IN THE MANGROVES AND MANGROVE COMMUNITIES OF THE THREE ISLANDS OF CAMOTES

**Serapion N. Tanduyan[1], Ponciano C. Bontia[1], Rosalyn Pascual-Opiniano[2], Rachel Luz V. Rica[2], Ricardo B. Gonzaga[1], Virginia D. Bensig[1] and Hermes M. Alburo[3]**

[1]Cebu State College of Science and Technology-
Fishery and Industrial CollegeSan Francisco, Cebu Campus
[2]CSCST – Main Campus, Cebu City
[3]CSCST – AIFC, Argao, Cebu

A faunal inventory in the mangrove areas of the Camotes group of Islands was conducted. There were eight mangrove areas where the study was conducted. Area 1 is Timarong, Poro, Cebu; Area 2 is Tiguis, Poro, Cebu; Area 3 is Unidos, San Francisco, Cebu: Area 4 is McArthur, Tudela, Cebu; Area 5 is Villahermosa, Tudela; Area 6 is Puertobello, Tudela, Cebu; Area 7 is Upper Poblacion, Pilar Cebu and Area 8 is Lower Poblacion, Pilar, Cebu. Sampling was done using a 600-m encircling net installed during high tide and harvested during low tide. Fish and invertebrates collected from each area were identified and individuals were counted. Result showed 74 species of fish inhabit the mangroves of Camotes belonging to 61 genera and 35 families. Twenty-five species of invertebrates were likewise found belonging to 19 genera and families. Among the areas sampled, area 2 was found to have the highest frequency of fish and invertebrates. The most dominant species of fish and invertebrates common to all areas are *Atherinomorous ogilbyi* and *Charbdis hawaiiensis*, respectively.

**Keywords:** mangroves, Camotes Islands, inventory, fauna.

**BSD No. 9**

## SYNOPTIC REVISION OF SOUTHEAST ASIAN LAC INSECTS (KERRIIDAE, COCCOIDEA, HEMIPTERA)

**Ireneo L. Lit, Jr.**

Entomology Section, Museum of Natural History
University of the Philippines Los Baños, 4031 College, Laguna
Email: junlit@hotmail.com

Eleven species of lac insects, including three previously known from the Philippines, are reported from Southeast Asia. *Tachardina aurantiaca* (Cockerell) is redescribed from Christmas Island, Indonesia and Malaysia and the Maldives. A species of *Kerria* from Vietnam is described as new to science. Diagnostic characters and distributional notes are provided for the rest of the species, namely: *Kerria (Chamberliniella) fici* (Green), *K.(C.) greeni* Chamberlin, *K.(C.) javana* Chamberlin, *K.(C.) rangoonensis* Chamberlin, *K.(K.) chinensis* (Mahdihassan), *K.(K.) lacca lacca* (Kerr), *K.(K.) lacca takahashii* Varshney, *Paratachardina minuta* (Morrison) and *Paratachardina* sp. Based on preliminary cladistic analyses, *Kerria* species from Southeast Asia form a monophyletic group, which is sister to the other *Kerria* species from India, Sri Lanka and the rest of Asia. A taxonomic key and illustrations are provided to facilitate their identification. Several reasons are offered and discussed as possible explanations for the seemingly depauperate lac insect fauna of this biogeographically significant region.

**Keywords:** lac insects, Hemiptera, Coccoidea, Kerriidae, *Kerria*, *Paratachardina*, *Tachardina*, taxonomy, biogeography

**BSD No. 10**

## BIOLOGY AND POPULATION ABUNDANCE OF STRIPED FLEA BEETLE, *Phyllotreta striolata* Fab. (COLEOPTERA: CHRYSOMELIDAE) ON PAK-CHOI, *Brassica campestris* var. *chinensis*

**Marilyn G. Patricio and Amelita C. Quinsay**

Research Office, Central Luzon State University,
Science City of Muñoz, 3120 Nueva Ecija

The striped flea beetle, *Phyllotreta. striolata* Fab. (Coleoptea:Chrysomelidae), is one of the major problem to pak-choi production in Central Luzon. Adult beetles fed on the cotyledon, surface leaves and produced

small pits, later these damage tissue breaks up producing a shot hole appearance. The severe infestation on emerging plants resulted to uneven growth and death of seedlings.

The biology of *P. striolata* was studied under laboratory condition at temperature and relative humidity ranged from 27 to 32°C and 52 to 38%, respectively. The population abundance was monitored on 8 crops of pak-choi from December 2002 to November 2003 at Experimental Research Area of Central Luzon State University, Science City of Muñoz, Nueva Ecija.

The total development period of *P. striolata* lasted for 18.35 ± 0.25 days, ranged from 16-18 days. The incubation period of the eggs lasted 3.53 ± 0.30 days (range, 3-5 days) with 73.1% hatchability. The *P. striolata* underwent three larval instars. The duration of the larval stadia are: 1st stadium, 2.54 ± 0.36 days (range, 2-4 days) second stadium, 2.83 ± 0.21 days (range, 3-5 days) and third stadium, 3.14 ± 0.14 days (range, 2-5 days). The prepupa and pupal stadia are: 2.30 ± 0.06 days (range, 2-3 days) and 4.02 ± 0.15 days (range, 3-6 days), respectively.

Adult longevity lasted for 39.68 ± 14.03 days (range, 21-62 days) in male and 36.56 ± 11.53 days (range, 20-59 days) in female. The mean female fecundity was 563.16 ± 149.24 (range, 325-961 eggs/female).

Chinese cabbage, *Brassica pekinensis* (Lour.) was the most preferred host plant, followed by pak-choi, *Brassica campestris var. chinensis* L. and Indian mustard, *Brassica juncea* L. The population of adult *P. striolata* was abundant in December to April with peak of population in March and declined in May. Population of *P. striolata* was not observed in June to August. Its population was significantly affected by rainfall. Results provided biological informations and population trends of *P. striolata*, which may contribute to the formulation of effective control measures in Central Luzon.

**Keywords:** *Phyllotreta striolata;* Development period; Population Abundance; Cruciferae; *Brassica campestris* var. *chinensis*

**BSD No. 11**

# REPRODUCTIVE POTENTIAL OF COTTON BOLLWORM, *Helicoverpa armigera* Hubner (Lepidoptera: Noctuidae) AND ITS HOST ICHNEUMONID WASP, *Eriborus argenteopilosus* (HYMENOPTERA:ICHNEUMONIDAE)

**Leonardo T. Pascua*[1] and Miriam E. Pascua[2]**

[1]Cotton Research Center, Cotton Development Administration,
Batac 2906 Ilocos Norte
[2]College of Agriculture and Forestry,
Mariano Marcos State University, Batac, 2906 Ilocos Norte
leonardo pascua@yahoo.net

In the Philippines, cotton production is always threatened by the cotton bollworm *Helicoverpa armigera* Hubner (Lepidoptera:Noctuidae). This pest is considered as the most serious pests of cotton. It attacks the terminal buds, young leaves, flowers, squares and bolls causing a reduction in seedcotton yield by 28 to 97%.

In the Philippines, many naturally occurring parasitoids play an important role in reducing the population of the cotton bollworm, *Helicoverpa armigera* (Hubner) in cotton fields. They can be used to manage the pest in a sustainable way. One of the potential parasitod is the *Eriborus argenteopilosus*.

The reproductive potential of a parasitoid and its host is one of the factors to be considered in evaluating its performance as a biological control agent. A parasitiod is considered as a promising biological control agent when its reproductive potential is equal or higher than that of its host insect.

The study was conducted under screen house conditions for *H. armigera* and under laboratory conditions for *E. argenteopilosus*. The reproductive potential of the two insects were calculated using an age-specific life table analysis.

The intrinsic rate of increase ($r_m$) was 0.13 and the finite rate of increase in numbers (l) was 1.14 females/female/day with a net reproductive rate of 171.9.

A generation was completed in 39.7 days. Populations can increase weekly 2.5 times. When reaching the stable age distribution, *H. armigera* population age composition was 52.30% eggs, 18.94% first instar larvae, 12.38% second instar larvae, 5.53% third instar larvae, 4.57% fourth instar larvae, 2.10% fifth instar larvae, 1.42% sixth instar larvae, 2.31% pupae and 0.45% adults.

*Eriborus argenteopilosus* had a net reproductive rate of 36.2 and completed its generation in 21.4 days. The egg and larvae developed within 10.6 days and the pupa in 8.3 days. The intrinsic rate of increase and finite rate of increase in numbers were 0.17 and 1.18 females per female per day, respectively. The population of the wasp would be able to multiply 3.2 times every week.

The intrinsic rate of increase of *E. argenteopilosus* was 23 % higher than its host insect, *H. armigera*. Therefore, *E. argenteopilosus* can be an effective biological control agent for *H. armigera*.

**Keywords:** cotton, reproductive potential, *Helicoverpa armigera*, *Eriborus argenteopilosus*, intrinsic rate of increase, finite rate of increase

**BSD No. 12**

## PHILIPPINE SPECIES OF *MESOCYCLOPS* (CRUSTACEA: COPEPODA) AS BIOLOGICAL CONTROL OF *AEDES AEGYPTI* (LINNAEUS)

**Cecilia P.Reyes[1], Estrella I. Cruz [2]and Soledad L. Bautista[1]**

[1]Department of Biology, Emilio Aguinaldo College,
Ermita, Manila
[2]Department of Medical Entomology and Parasitology,
DOD-RITM, Muntinlupa

Rice fields, swamps, irrigation canals, and rivers in Luzon were surveyed for copepods. The following species were recovered: *Mesocyclops aspericornis* (Daday), *Mesocyclops ogunnus* Onabamiro (new record), *Microcyclops* sp., *Eucyclops* sp., *Thermocyclops decipiens* Keifer, and *Thermocyclops* sp.

Predatory capacity of local population of *Mesocyclops* species were evaluated, for the first time in the Philippines, as biological control of *Aedes*

*aegypti* (L.) mosquitoes. Under laboratory condition, *Mesocyclops* attacked the mosquito first instar larvae by the tail, side and head. Mean of first instar larvae consumed by *M. aspericornis* and *M. ogunnus* were 23.96 and 15.00 respectively. Analysis of variance showed that there was a highly significant difference between the mean number of first instar mosquito larvae consumed by *M. spericornis* and *M. ogunnus* which indicated that *M. aspericornis* is a more efficient predator of dengue mosquito larvae.

Larvitrap Index, Larval Density Index , and Larvitrap Density Index of Estero de Tanque showed that *Aedes aegypti* (65%) and *Aedes albopictus* (35%) were present in the area. House Index, Container Index and Breteau Index revealed that the area was sensitive for transmission of dengue. *Aedes* mosquitoes bred in indoor and outdoor containers such as plant vases, drums, used automobile tires, and plastic containers. KAP survey revealed that residents had insufficient information on dengue etiology, breeding sites, and biting habits of dengue mosquitoes.

Results of small scale field trials showed that the mean number of surviving larvae in experimental drums was 63.10 and 202.95 in control drums. T-test of means indicated that there was a significant difference between the mean number of surviving larvae in the drums with and without *M. aspericornis*. Findings indicated that *M. aspericornis* females are good biological control agents for they destroyed/consumed about two thirds of the wild, dengue mosquito larvae population.

**Keywords:** copepods, *Mesocyclops, Aedis aegypti,* dengue, mosqiotoes, biological control

**BSD No. 13**

# ISOLATION AND CHARACTERIZATION OF *Vibrio spp.* FROM THE SEDIMENT OF CAGED AND UNCAGED SITES IN TAAL LAKE

**V.S. Prudente, Nellie C. Lopez, W. L. Barraquio and Arsenia A. Casauay**

Institute of Biology, University of the Philippines, Diliman, Quezon City

Fish kills have been frequently reported in several tilapia cage sites in Taal lake. Fermentative bacteria, particularly *Vibrio* spp. which include members potentially pathogenic to tilapia may be regarded as one of the causal suspects. This study reports on the isolation and characterization of *Vibrio*-like bacteria in the sediments of caged (Leviste) and uncaged (Quiling) sites in Taal Lake.

Four sediment samples from each site were pooled and from each two 5-gram replicate subsamples were taken for microbial analyses. The subsamples were diluted ten-fold in sterile saline solution. Aliquot ( 0.1 mL) of the dilutions were spread plated onto thiosulfate citrate bile salts sucrose (TCBS) agar plates and incubated at room temperature for 24 h. Colonies formed were regarded as putative vibrios. Discrete colonies were purified twice by streaking onto trypticase soy agar + 1.5 % NaCl (TSANa). The isolates were maintained on TSANa for characterization and identification. Morphological, physiological and biochemical tests were performed on the isolates. Twenty-four and forty-eight h cultures of the putative vibrios were tested for bioluminescent activity in TSANa and TCBS. Four *Vibrio*-like isolates were selected and further characterized using API20E and BIOLOG GN2 plate.

Twenty-six *Vibrio*-like bacteria were isolated from highly-diluted TCBS plate cultures. All the isolates were Gram-negative facultative anaerobic rods, straight and/or curved, and grow at temperatures 30 and 35 °C. All the isolates except one, catabolized glucose with acid production. Two isolates, both from the uncaged site, exhibited bioluminescent activity. This study reports for the first time the isolation of bioluminescent *Vibrio*-like bacteria from the sediment of Taal Lake.

The API20E and BIOLOG GN2 profiles of the bioluminescent and two other isolates from the caged site revealed resemblance of three isolates to non-*Vibrio* species, however, one bioluminescent isolate resembled *Vibrio vulnificus*, a pathogenic vibrio.

**Keywords:** Taal Lake, tilapia, *Vibrio*, bioluminescent bacteria

**BSD No. 14**

# MORPHOLOGICAL CHANGES DURING THE STARVATION IN NILE TILAPIA *Oreochromis niloticus* L. LARVAE

**Melodina D. Fabillo[1], Annabelle A. Herrera[1,2], and Jose S. Abucay[2]**

[1]Insitute of Biology, College of Science
University of the Philippines Diliman, Quezon City
[2]Freshwater Aquaculture Center, Central Luzon State University
Muñoz, Nueva Ecija

Starvation in considered an important cause of early mortality in fishes. In commonly grown food fish like nile tilapia, *Oreochromis niloticus* L, mortality is observed when newly-hatched larvae are starved for approximately 10 days. This study investigated the external morphology (length and weight) and internal morphology (height of cell layers in the intestine and stomach) of samples which were deprived of first feeding (exogenous feeding) for a maximum of eight days, had survived and were fed after starvation. One thousand newly-hatched larvae were equally distributed in down-welling basins and first fed at different times (fed upon hatching, fed after two days starvation, fed after four days starvation, fed after six days starvation, fed after eight days starvation). Feeding was administered in $1m^3$ fine-meshed "hapa" or net enclosure installed in fertilized earthen pond where the fish samples were reared. Sampling were done in an interval of two days for 30 days, where, after measurements of lengths and weights, gut samples were taken and processed in the laboratory using standard histological procedures. Nile tilapia fish larvae deprived of first feeding for a maximum of eight days had survived. However, growth and development of cells in the digestive tract which are determinants of efficient digestion were significantly delayed. Light microscopy had shown that the growth and developmental features of the digestive organs in older fish samples which were previously were comparable to those of the young samples which were fed immediately upon hatching, suggesting that delaying first feeding in nile tilapia larvae in fish farms should be avoided if quality of fish for consumption is to be considered an important factor in fish production.

**Keywords**: first feeding, fish larvae, *Oreochromis niloticus* L.

**BSD No. 15**

# BIOREMEDIATION POTENTIAL OF CYANOBACTERIA AND MICROALGAE ISOLATED FROM SOME MINING AREAS IN THE PHILIPPINES

**Jamin Immaculae C. Jao and Ernelea P. Cao**

Institute of Biology and Natural Sciences Research Institute
College of Science, University of the Philippines, Diliman, Quezon City

Cyanobacteria and microalgae have been reported to survive in extreme environments. In the Philippines, metal pollution has become a growing concern due to effluents from mining sites and other industries. This study was conducted in order to determine the bioremediation potential of cyanobacteria and microalgae isolated from three mining sites, namely Baguio-Benguet Mining Corporation and Philex Mining Corporation in Benguet and Dizon Mines in Zambales. A total of 56 isolates were obtained. These isolates were classified as follows: 15 from Family Chroococales, 12 Oscillatoriales and 5f Nostocales. A rapid screening procedure for cadmium resistance was employed following the methodology of Matsunaga and co-workers (1999). This utilized microtiter plates inoculated with 2.5 mL of each strain in each well and incubated with varying $CdCl_2$ concentrations (0, 0.20, 2.0, 20, 50, 100, 500, 1000 Î¼M. Fifteen out of the 56 isolates were found to be able to survive up to a maximum concentration of 50 Î¼M $CdCl_2$. Further screening was done by incubating them in 50 Î¼M $CdCl_2$ for two weeks and determining the metal removal rate through Atomic Absorption Spectrophotometry. Isolate designated as Bnt 4a was computed to have the highest removal rate of 94.80%. Metal removal was correlated with the structural features of the organisms, where the cell wall can serve as the binding site of the cadmium cations.

**Keywords:** bioremediation, cyanobacteria, microalgae, cadmium resistance, atomic absorption spectrophotometry

**BSD No. 16**

# MERCURY UPTAKE AND PHYTOCHELATIN PRODUCTION IN *IPOMOEA AQUATICA* FORSK.

**Rosemarie dR Josue[1], James A. Villanueva[2], Maribel L. Dionisio-Sese[3], and Gilda C. Rivero[4]**

[1]Mindanao State University-Maguindanao, Dalican, Odin Sinsuat, Maguindanao
[2]Institute of Chemistry, College of Science, University of the Philippines, Diliman, Quezon City
[3]Institute of Biological Sciences, College of Arts and Sciences University of the Philippines, College, Laguna
[4]Institute of Biology, College of Science, University of the Philippines, Diliman, 1101 Quezon City

The Hg content of the vegetative organs and their subcellular fractions were determined in *Ipomoea aquatica* Forsk. plants grown in nutrient solutions supplemented with three levels of Hg, *viz.* : 0, 0.5, and 1.0 mg $L^{-1}$. The mercury-binding phytochelatin-like peptides involved in the uptake and accumulation of Hg were purified and quantified using reversed phase-high performance chromatography.

The increase in plant height and recovery in dry weight of *Ipomoea aquatica* plants grown in nutrient solutions with as high as 1.0 mg $L^{-1}$ Hg for 7 days indicate a high degree of tolerance to Hg. The translocation of significant levels of $Hg^{2+}$ that were 6- to 7-fold the levels found in the control plants or 65- to 75-fold the soil Hg, effectively took place in the young leaves. The levels of $Hg^{2+}$ were higher in the total protoplasmic fractions than in the cell wall fractions. The presence of $Hg^{2+}$ was detected in all subcellular fractions but higher levels were noted in the vacuoles and subsequently higher levels were noted in the vacuolar sap than in the tonoplast.

The sulfhydryl and glutathione-containing phytochelatin-like substances were detected mostly in the fractions from the young leaf extracts. The levels of phytochelatin-like peptides and the concentrations of $Hg^{2+}$ have a direct relationship and are highest in the young leaves. The phytochelatin-like peptides were also detected at high levels in the stems and least in the mature leaves, although $Hg^{2+}$ concentrations were higher in the mature leaves than in the stems.

These observations hint at oxidized glutathione and an accompanying derivative of the phytochelatin-like peptide as the chelating agent for the toxic heavy metal, mercury. The levels of oxidized GSH had been over-expressed in all vegetative organs, especially in the young leaves of the plants exposed to 1.0 mg $L^{-1}$ Hg for 7 days.

**Keywords:** *Ipomoea aquatica*, mercury, phytochelatins, subcellular fractions, uptake

**BSD No. 17**

## DETECTION OF PATHOGENIC AND NONPATHOGENIC STRAINS OF *Acanthamoeba spp.* THROUGH THE POLYMERASE CHAIN REACTION

**Leah L. Shiong Shu [1,2] and Windell L. Rivera *[1,2]**

[1]Institute of Biology, University of the Philippines, Diliman
[2]Molecular Protozoology Laboratory, Natural Science Research Institute, University of the Philippines, Diliman, 1101 Quezon City
Email: mpl.biology@up.edu.ph

*Acanthamoeba* spp. is a group of opportunistic pathogens commonly found in the soil, and has been proven to cause several diseases in humans. DNA samples of environmental and clinical isolates of *Acanthamoeba* were extracted and amplified through PCR. To distinguish the pathogenic from the nonpathogenic strains of *Acanthamoeba*, the ac6 primer was used to generate PCR products indicative of the cyst's pathogenicity. Under less restrictive conditions, with an optimum annealing temperature of 56°C, bands of 200, 350, 400, 600, and 1000 bp were amplified from all the strains of *Acanthamoeba*. However, under restrictive conditions, with an optimum annealing temperature of 62°C, bands of 200 and 400 bp were produced only from the pathogenic Nh1 and Cot strains. This shows successful differential amplification of the ac6 locus based on the pathogenicity of the *Acanthamoeba* isolates. The banding patterns from the PCR products can also be used to establish genetic diversity based on the geographical location of the sources of the *Acanthamoeba* isolates.

**Keywords:** *Acanthamoeba*, PCR, pathogenicity

**BSD No. 18**

# EFFECT OF HYDROGEN SULFIDE ON EXTRACELLULAR PROTEOLYTIC ACTIVITY IN MARINE SEDIMENTS

**G.V. Bolalin[1], X. dR. Cutchon[1], S.A. Sustento[1], W.T. Reichardt[2]**

[1]Department of Biology, College of Arts and Sciences
University of the Philippines, Manila, Ermita, Manila
[2]Marine Science Institute, College of Science
University of the Philippines, Diliman, 1101 Quezon City
geromebolalin@yahoo.com

Extracellular proteolytic activity (EPA) is a bottleneck in the recycling of nitrogen in marine sediments. $H_2S$ presence, protein content, redox potential and EPA were determined in samples of sediment affected and unaffected by organic load from fish farming activities in Bolinao Bay, Pangasinan. Fish farming in net cages causes accumulation fish-feed borne proteins in marine sediments that have rapidly become oxygen-depleted. So to study the effect of $H_2S$ and anoxic condition on EPA, we used an enzyme assay employing a dye-labeled scleroprotein as the enzyme substrate. The data suggest that redox potential was negatively correlated with protein content as well as with $H_2S$ presence, whereas correlation analyses of $H_2S$ presence vs. EPA showed a moderate negative correlation. Visual examination of some sulfidic samples showed confluent white mats of *Beggiatoa* indicating strong reooxidation of $S^{2-}$ to elemental sulfur ($S^o$) in this type of sediment. EPA in the anoxic sediment with $H_2S$ was significantly lower than the EPA of the oxic control but was nonsignificantly lower than the EPA in the anoxic sediment without $H_2S$ incubation. Enzyme extract from cultured proteolytic bacteria incubated with increasing concentrations of $H_2S$, however, showed direct inhibition on EPA. The inhibitor constant obtained by method of Dixon plot was 20 mM. This indicates that though extracellular proteolytic enzymes could be directly inhibited by $H_2S$, they are less affected when contained in sediments. Furthermore, reooxidation of natural sediment originally containing $H_2S$ would more likely decrease its EPA indicating that strictly anaerobic bacteria are governing this important microbial process in sulfidic sediments.

**Keywords:** $H_2S$, extracellular proteolytic activity, marine sediments, anoxia, sulfate reduction, nitrogen cycling, fish farming, mariculture, aquaculture, redox potential

**BSD No. 19**

# EFFECTS OF ANTI-CD3 MONOCLONAL ANTIBODIES AND F(ab')$_2$ ON THE DOWN REGULATION AND INTERNALIZATION OF THE TCR/CD3 COMPLEX IN JURKAT CELLS

**Jonathan James T. Asprer, Maria Pamela C. David**
**Joyce Sarah A. Ibana and Gisela P. Concepcion**

Marine Science Institute, University of the Philippines Diliman

Targeting of the T cell receptor/CD3 (TCR/CD3) complex on human T cells with anti-CD3 monoclonal antibodies (mAbs) has been used in preventing acute graft rejection for more than twenty years. Anti-CD3-mediated immunosuppression involves various levels of interference with T cell clonal activation that vary from physical blocking of antigen receptors, prevention of signal transduction, receptor internalization and/or downregulation, to the induction of apoptosis of preactivated T cells. Despite its potency, anti-CD3 therapies involving whole mAbs may be limited due to a number of factors such as initial Fc-mediated cytokine release, non-selective T cell killing, and immunogenic tolerance, which leads to non-responsiveness to the immunosuppressive therapy. Immunogenic tolerance is associated with the extensive internalization and/or downregulation of the TCR/CD3 complex resulting from the non-dissociation of high affinity anti-CD3 mAbs. In this study, we attempt to demonstrate the advantages of anti-CD3 F(ab')$_2$ over the whole mAb based on differing degrees of internalization and downregulation resulting from the administration of each. Western blot analysis was used to monitor the expression of CD3 in Jurkat cells over different periods of exposure to saturating and non-saturating concentrations of anti-CD3 mAb and F(ab')$_2$. Internalization will be monitored using flow cytometry. The removal of the Fc would make the F(ab')$_2$ dissociate from the TCR/CD3 more easily than the mAb *in vivo*, and it is expected that this would translate to less internalization and downregulation, thereby minimizing immunogenic tolerance.

**Keywords:** anti-CD3, monoclonal antibodies, F(ab')$_2$, graft rejection

**BSD No. 20**

# GROWTH KINETICS OF *Oxytricha* sp. IN TWO CULTURE MEDIA AND ITS USE IN CYTOTOXICITY ASSAY

**Jonessa Ann S. Atienza[1,2] and Windell L. Rivera[1,2]**

[1]Institute of Biology, University of the Philippines, Diliman, 1101 Quezon City
biology@up.edu.ph
[2]Molecular Protozoology Laboratory, Natural Sciences Research Institute,
University of the Philippines Diliman, 1101 Quezon City
mpl.biology@up.edu.ph

Protozoans are ubiquitous organisms inhabiting aquatic, aerial, and terrestrial environments. Among those found in freshwater ponds is *Oxytricha* sp. which is a flexible, ellipsoid-bodied hypotrich that spends most of its time creeping on the substratum through its ventrally-located cirri. Clonal cultures of *Oxytricha* sp. were established and grown in two different media, namely, hay infusion and grass powder media where their growth kinetics were compared. It was found out that *Oxytricha* sp. exhibits better growth in grass powder medium than in the hay infusion medium with generation times of 13.2 hours and 21.1 hours, respectively. Range-finding toxicity test was also performed to determine the effects of a non-ionic surfactant, Triton X-100, on the behavior of this protozoan. The cells start to lyse when concentrations e" 50 ìg/mL were applied to the cultures. After a ten-minute exposure, no cells were found at the said concentrations. Moreover, the long-term toxicity effects of Triton X-100 were established through the cell count method and MTT assay. Through cell counting, $LC_{50}$ of the said surfactant was found to be at 14.07 ìg/mL. However, based on the MTT assay, $LC_{50}$ was 341.82 ìg/mL. Higher $LC_{50}$ based on the MTT assay suggests the persistence of mitochondrial dehydrogenase activity even after cell lysis.

**Keywords:** *Oxytricha* sp., cytotoxicity, growth, protozoans

**BSD No. 21**

# ANTIBODY AFFINITY AS A FUNCTION OF CHEMICAL REACTIVITY, STRUCTURAL PLASTICITY AND STABILITY

**Maria Pamela C. David, Jonathan James T. Asprer, Joyce Sarah A. Ibana, Eduardo A. Padlan and Gisela P. Concepcion**

Marine Science Institute, University of the Philippines
Diliman, 1101 Quezon City

Mutations introduced in antibody germline sequences as a result of somatic hypermutation could cause its derivatives to have an increased or decreased affinity for its target. Affinity maturation, however, favors the selection of the antibodies that exhibit increased affinity. In this study, we evaluate the effects of individual amino acid substitutions in relation to resultant chemical reactivities and affinities of selected sequences derived from a single germline. Physio-chemical properties, namely size, polarizability, polarity, charge, electrophilicity and electronegativity, are considered and taken in the context of its position in the antibody chain, as well as its exposure. Two-dimensional and three-dimensional modeling are also performed to further explain disparities in the affinities of sequences with very minimal differences in terms of replacement mutations. These, in turn, are correlated with the chemical properties of residues in the combining site, as well as the reorganizations that could be effected in this as a result of the presence of specific mutations.

**Keywords**: antibody affinity, mutation, chemical reactivity

**BSD No. 22**

# CHITOSAN ACETATE INDUCES CELL MIGRATION AND TUBE FORMATION OF BOVINE AORTIC ENDOTHELIAL CELLS *IN VITRO*

**Gloria de Castro-Bernas[1] and Takashi Okamoto[2]**

[1]Research Center for the Natural Sciences
University of Santo Tomas, España, Manila 1008, Philippines
email: gloria_bernas@yahoo.com

[2]Department of Molecular & Cellular Biology
Nagoya City University Graduate School of Medical Sciences
1-Kawasumi, Mizuho-cho, Mizuho-ku, Nagoya 467–8601, Japan
Email: tokamoto@med.nagoya-cu.ac.jp

Initial studies have shown that chitosan, a structural biopolymer composed of repeating units of â-(1–4)deacylated glucosamine can induce a dose-dependent neovascularization in 8-day old chicken chorioallantoic membrane. Western blot analysis of the CAM lysate showed an increased expression of PDGFR, greater than the positive control bFGF. No detectable expression was observed for PDGFR, PECAM (CD31) and Flt-1. Migration assay with bovine aortic endothelial cells (BAEC) using Boyden Chamber confirmed that in the presence of chitosan acetate in DMEM where fibroblast (293) cells (lower chamber) were grown, more BAEC migrated into the outer surface of the upper chamber. Immunoassay of the 293 supernate revealed an increase drelease of IL-8, a chemoattractant cytokine and an angiogenic factor. This finding supports the dose dependent tube formation observed with BAEC when grown on Matrigel Basement Membrane Matrix with chitosan acetate.

**Keywords:** neovascularization, cell migration, tube formation , chemoattractant

**BSD No. 23**

# CHEMOTHERAPEUTIC DRUG KILLS MACROPHAGES BY OVERSTIMULATION OF NO SYNTHASE

**Orestes Rafael L. Santos[1] and Sonia D. Jacinto[1]**

[1]Institute of Biology, University of the Philippines, Diliman, 1101 Quezon City
soniajac2002@yahoo.com

Macrophages participate in the body's defense system by phagocytosis of microorganisms that may cause diseases. Superoxide radicals and NO production are generally increased during this activity. Certain chemotherapeutic drugs against cancer have been reported to kill immune response cells. In an attempt to determine if chemotherapeutic drugs against cancer kill macrophages by overstimulating free radical production, peritoneal murine macrophages were treated with different concentrations of the anticancer drug Taxol. This drug, causes mitotic arrest by affecting the assembly and disassembly of microtubules in spindle fibers. Thus they act on actively dividing cells. Peritoneal macrophages however, are not dividing cells. Thus inhibition of cell proliferation brought about by this drug must be caused by another pathway. In this study, when macrophages were incubated with Taxol or with Taxol together with lipopolysaccharide (LPS), a bacterial endotoxin established to stimulate the cells, a significant increase of NO production was observed. LPS alone serving as positive control, elicited only 1.98 μM of NO while LPS with increasing concentrations of Taxol elicited a range from 1.9 to 9.8 μM of NO. Addition of $N^G$-Monomethyl L-arginine (L-NMMA), known to inhibit the activity of NO synthase, was observed to significantly lower the production of NO. With L-NMMA, the amount of NO produced ranged from 0.5 to 2.5 μM only. Direct cell viability count was done to determine if there is a correlation between cell viability and NO production. Cells treated with 100 μg/ml Taxol and LPS or with 100 μg/ml Taxol alone, showed 50% viability. Treatment with L-NMMA rescued cells from death with viability at the same drug concentration going up to 70%. This suggests that the chemotherapeutic drug enhances NO production which at extremely high level may cause death of the macrophages.

**Keywords:** macrophages, superoxide radicals, NO synthase, lipopolysaccharide, L-NMMA

BSD No. 24

# CHEMOPROTECTIVE EFFECTS OF *Amaranthus gracilis* AND *Beta vulgaris* ON SELECTED ORGANS OF TUMOR-INDUCED MICE

**Aileen Arguelles[1], Annabelle A. Herrera, and Irene Villaseñor[2]**

[1]Insitute of Biology, College of Science
University of the Philippines Diliman, 1101 Quezon City
[2]Institute of Chemistry, College of Science
University of the Philippines Diliman, 1101 Quezon City

To find possible cures for cancer, researches have been directed to the study of the possible uses of animal and plant extracts. This study was aimed at determining any protective effects of *Amaranthus gracilis* (spinach) and *Beta vulgaris* (beets) extracts on some organs, namely the skin, spleen, kidneys, and liver, of tumor-induced mice. Swiss Webster albino mice were treated previously with DBMA, croton oil, and spinach and beet extracts using three different protocols (one hour prior to croton oil application and five days before DMBA application, one hour prior to croton oil application only, and immediately after croton oil application). The mice that survived were further subjected to paraffin processing and histopathological analysis. The organs treated with spinach and beet extracts showed histodegeneration like the positive control but in varying degrees, depending on the protocol used. The kidneys, liver, and skin were protected by the extracts. The least damage was seen in the organs treated with extracts one hour prior to croton oil application and five days before DBMA application.

**Keywords:** *Amaranthus gracilis, Beta vulgaris*

**BSD No. 25**

# IMMUNOMODULATORY ACTIVITY OF MICE INJECTED WITH HYDROSOLUBLE EXTRACT OF *Chlorella pyrenoidosa*

**Carminda J. Pineda[1], Roan Michael M. Rogacion[1], Sylvia A. Sustento*[1]Prof. Lolita L. Cavinta*[1]**

[1]Department of Biology, College of Arts and Sciences
University of the Philippines Manila
[2]Department of Microbiology, College of Public Health
University of the Philippines Manila
cindy_pineda@hotmail.com

*Chlorella pyrenoidosa* is a unicellular green algae that is commonly researched for its therapeutic properties and is known to perform an immonumodulatory activity. An indicator of the presence of an immunomodulatory activity is phagocytosis. This experimental study was designed to test for the toxic properties of *Chlorella* and its ability to increase the phagocytic activity of macrophages. Also, it aimed to determine if the cytotoxicity of *Chlorella* and its effect on phagocytosis are dependent on exposure time to *Chlorella*. A hydrosoluble extract of *Chlorella pyrenoidosa* was injected intraperitoneally to mice. The control group was injected with distilled water. Mice were given different exposure times (one day, four days, eight days, and twelve days) to *Chlorella* and distilled water. The mice were sacrificed after their assigned exposure time. Macrophages were collected from the peritoneal cavity of the mice and were subjected to tests. To assess the cytotoxicity of the *Chlorella* extract, trypan blue exclusion test was done. Cytotoxicity was observed based on the percent viability of the macrophages. Regardless of exposure time, the values for percent viability obtained from the mice injected with *Chlorella* and distilled water were of the same range - 84.27% to 88.176%. Therefore, *Chlorella* showed no indication of cytotoxicity in all of the exposure times observed. Yeast assay was done to test for *Chlorella*'s effect on phagocytosis. *Chlorella*'s effect on phagocytosis was dependent on exposure time since *Chlorella* increased the phagocytic activity of the macrophages only on the exposure time of four days. On this exposure time, mice injected with *Chlorella* had an average percent phagocytosis of 61.81%. Those injected with distilled water had an average percent phagocytosis of 37.98%. The other exposure times showed no significant difference between the percent phagocytosis of mice injected with *Chlorella* and those injected with distilled water.

**Keywords**: *Chlorella pyrenoidosa*, hydrosoluble, phagocytosis, cytotoxicity

**BSD No. 26**

# TUMOR PROGRESSION AND IMMUNOLOCALIZATION OF MONOCLONAL ANTIBODY CC49 IN A BALB/C MOUSE MODEL

**Ronald Allan M. Panganiban[1], Jonathan James T. Asprer[2], Eloise L. Prieto[2], Zenaida P. Bojo[2], Joyce Sarah A. Ibana[1], Ameufina D. Santos[1], and Gisella P. Concepcion[2]**

[1]National Institute of Molecular Biology and Biotechnology
[2]Marine Science Insittute
University of the Philippines Diliman, 1101 Quezon City

Tumor-associated glycoprotein 72 (TAG-72) is an antigen widely expressed in human carcinomas. CC49 is a G1 allotype (IgG1) monoclonal antibody (Mab) highly reactive with TAG-72. In this study, the immunotherapeutic potential of MAb CC49 was assessed in a Balb/C mouse model. 4T1 murine mammary carcinoma cells expressing TAG-72 were injected subcutaneously into Balb/C mice to induce the formation of primary tumors, which were then allowed to metastasize to the different organs of the mice. In order to determine the immunolocalization and efficacy of CC49 in reducing the growth of primary tumors, biotinylted CC49 was injected intraperitoneally into the mice. Tumor progression was monitored by weighing the mice and measuring the volumes of primary tumors from the injection of 4T1 cells up to three weeks after MAb administration. From the data gathered in the tumor progression study, there is no evident reduction in tumor growth by CC49. immunohistochemical analysis is still being performed on the primary tumors and sample organs to determine the localization and binding of the biotinylated CC49.

**Keywords:** tumor progression, immunolocalization, TAG-72, CC49 carcinoma

**BSD No. 27**

# AGE-ASSOCIATED CHANGES IN THE QUANTITY OF $m_1$ MUSCARINIC ACETYLCHOLINE RECEPTORS (mAChR) IN THE HIPPOCAMPUS OF THE RAT BRAIN

**Diorella Anne C. Capco[1], Chloe Jean M. Mojica[2], and Thucydides L. Sahunga[1,2*]**

[1]Institute of Biology, University of the Philippines, Diliman, 1101 Quezon City
[2]Natural Sciences Research Institute, University of the Philippines, Diliman, 1101 Quezon City

Muscarinic acetylcholine receptors (mAChRs) mediate cholinergic transmission in the cortex and hippocampus and play a role in higher brain processes such as learning, memory, arousal and motor control. A heterogenous family of five genetically distinct mAChR subtypes is present in the brain ($m_1$, $m_2$, $m_3$, $m_4$ and $m_5$). All five mAChR genes are expressed in the hippocampus, and subtype-specific antibodies have enabled identification, quantification, and localization of the encoded proteins. In the hippocampus and several regions of neocortex in human brain, $m_1$ ranges from 35-60% of all mAChR binding sites. The objective of this study is to compare the quantity of $m_1$ mAChR subtype in the $CA_1$ region of rat hippocampus of different ages (young, mature and old). The presence of $m_1$ mAChR subtype in the hippocampus of the rat brain was investigated using SIGMA anti-muscarinic acetylcholine receptor ($M_1$) M-9808. Frozen sections of the hippocampus region at 4, 7 and 10 micrometer were obtained using a cryostat which were treated with $m_1$ receptor subtype antibody at concentrations of 1:1500 and 1:3000.

Results show positive labeling of $m_1$ mAChR subtype in the hippocampus which are dispersed in the different regions of the hippocampus proper. Comparing the relative quantity of $m_1$ mAChR subtype in the $CA_1$ region of the hippocampus, the result follows a normal curve where the brain of the mature rat manifests the greatest quantity of $m_1$ mAChR subtype. $m_1$ mAChR subtype is found to be more abundant in the entorhinal cortex and subiculum region than in the hippocampus proper and this may be due to the distribution of cholinergic cell groups and the pathway of acetylcholine in the brain. The characterization of receptor subtypes and their localization would be relevant in defining targets for the development of more effective and specific therapeutic drugs for neurological diseases.

**Keywords:** $m_1$ mAChR subtype, rat, rat brain, hippocampus, immunohistochemistry

**BSD No. 28**

# ANGIOGENIC PROPERTY OF *Aloe barbadensis* MILLER (ALOE VERA) LEAVES

**Marlon E. Mendoza[1] and Gloria C. Bernas Ph.D.[2]**

[1]College of Science, University of Santo Tomas
España Street, 1008 Manila
devouthirteen@yahoo.com
[2]Research Center for Natural Science,
University of Santo Tomas España Street, 1008 Manila
gloria bernas@yahoo.com

The sap from the leaves of Aloe vera (*Aloe barbadensis Miller*) is commonly used in wound treatment and induction of hair growth. To scientifically document these applications of Aloe vera, the present study aims to determine its potential angiogenic property using the chorioallantoic membrane assay (CAM). The sap of aloe vera leaves was extracted with different solvents such as water, methanol and ethyl acetate. Chicken eggs incubated for nine days were treated with dose dependent concentrations of the extracts. At the twelfth day of incubation CAM was harvested and viewed under the microscope at low power objective (4x). The ethyl acetate extract exhibited a potential stimulatory effect on angiogenesis, it showed an increase in blood vessel branching suggesting that it contains anigiogenic stimulant compounds. The dialyzed water extract showed that the inhibition of neovacularization decreased, implying the role of ions as angiogenic inhibitor. The methanol extract exhibited reduced number of branching on angiogenesis in the CAM assay indicating that this extract may contain compounds that inhibit angiogenesis. The angiogenic property of Aloe vera can be regarded either as an inducer which can be found in the ethyl acetate extract and as an inhibitor which can be found in water and methanol extracts.

**Keywords:** *angiogenesis, Aloe barbadensis Miller, chorioallantoic membrane assay*

**BSD No. 29**

# LOCAL PLANT CRUDE EXTRACTS WITH INHIBITORY ACTIVITY AGAINST EXTENDED-SPECTRUM BETA-LACTAMASE (ESBL)-PRODUCING *E. coli* AND *K. pneumoniae* AND OXACILLIN-RESISTANT (ORSA) *S. aureus*

**Bernard C. Silvala, Merlyn C. Cruz**

Angeles University, Angeles City
Email: bsilvala@yahoo.com

The use of herbal plants for medicinal treatment has been the most common option in the country, owing most to the wild-growing plants for their curing abilities. This study was conducted exploring the activities of our locally abundant plants such as the *Codiaeum variegatum, Hibiscus rosasinensis, Anona muricata and Imperata cylindrica.* The ability of each of these plants to inhibit the growth of some clinically significant bacteria such as *E.coli, K. pneumoniae* and *S. aureus* was done by single disk diffusion technique, using first the normally susceptible strains of these organisms. The plant extracts that were found to be highly active were further assayed against the confirmed multi-drug resistant extended-spectrum beta-lactamase (ESBL)-producing *E.coli* and *K. pneumoniae,* and further with the oxacillin-resistant *S. aureus* (previously known as MRSA). Also, potential synergy between these highly active plant extracts was determined by double-disk synergy technique (DDST), to be able to come up with new approach in the use of herbal plants, which may then help prevent possible development of resistance among these pathogenic strains.

Analysis of the bioconstituents of these plants by thin-layer chromatography revealed the presence of alkaloids, saponins, tannins, anthroquinones, higher alcohols, steroids and essential oils. Disk-diffusion assay of the plant extracts showed that all have inhibitory activity against *E. coli, K. pneumoniae* and *S. aureus.* Significantly, extracts of *Hibiscus rosasinensis, Anona muricata and Imperata cylindrical* were observed to be equally potent against ESBL-producing *E.coli* and *K. pneumoniae* and oxacillin-resistant *S. aureus,* with *Hibiscus rosasinensis noted to be the most active showing zones of inhibition ranging from 25 to 35 mm.* Further, possible synergy between plants was seen in double-disk synergy technique. No antagonistic activity has been noted.

**Keywords:** medicinal plants, *Codiaeum variegatum, Hibiscus rosasinensis, Anona muricata, Imperata cylindrica*

**BSD No. 30**

## IDENTIFICATION AND LOCALIZATION OF THREE mAChRs SUBTYPES IN RAT HIPPOCAMPUS USING IMMUNOHISTOCHEMISTRY

**Thucydides L. Salunga[1,2], and Chloe Jean M. Mojica[2]**

[1]Institute of Biology, University of the Philippines,
Diliman, 1101 Quezon City
[2]Natural Sciences Research Institute, University of the Philippines,
Diliman, 1101 Quezon City

The muscarinic acetylcholinergic receptors (mAChRs) and its subtypes belong to a large class of integral membrane glycoproteins that mediate cholinergic processes like learning, memory and attention. In this study, three antibodies against mAChR subtypes (m1, m3, and m4 subtypes) were used to identify and localize mAChRs in the rat hippocampus. Separate frozen sections of the hippocampal region at 4, 7 and 10 microns were obtained using a cryostat and were treated with the antibodies at two concentrations (1:1500 and 1:3000) using immunohistochemistry. Results show that only m1 mAChR subtype showed positive labeling in the hippocampus region with the presence of brown-stained cells while m3 and m4 mAChR subtypes both showed negative labeling with the presence of blue-stained cells. This indicates that m3 and m4 mAChR subtypes might not be synthesized nor transported in the hippocampus unlike the m1 mAChR subtype.

**Keywords:** rat, rat brain, hippocampus, mAChRs, immunohistochemistry

**BSD No. 31**

## MARINE NATURAL PRODUCTS THAT INDUCE APOPTOSIS IN THE MCF-7 BREAST CANCER CELL LINE

**Eloise L. Prieto, Andrea Roxanne J. Anas, Zenaida P. Bojo, Cyril D. Deaño, Dennis D. de Guzman, Gina C. Mangalindan, and Gisela P. Concepcion**

Marine Science Institute, University of the Philippines,
Diliman, 1101 Quezon City

The potential of marine resources in biomedical research has been recognized through the utilization of marine organisms as sources of novel compounds with significant pharmacologic activity. A number of novel natural

products have been purified from marine sponges and marine microorganisms. Cytotoxic studies of these compounds in the human breast cancer cell line MCF-7 revealed significant anticancer activity. To determine whether apoptosis is the mechanism behind the observed cytotoxic activities, cellular morphology, DNA fragmentation, and cell cycle analysis were done through Hoechst staining, DNA laddering assay, and flow cytometry, respectively. Results showed characteristic morphology and DNA fragmentation expected of apoptotic cells. Flow cytometry also showed an increase in the percentage of apoptotic cells. These support the hypothesis that apoptosis is the most likely mechanism behind the cytotoxic activities observed in some of these compounds.

**Keywords:** apoptosis, MCF-7, marine sponges, cytotoxic activities

**BSD No. 32**

## CHARACTERIZATION OF TUMOR-ASSOCIATED GLYCOPROTEIN, TAG-72, FROM HUMAN COLORECTAL CANCER TISSUES

**Mel Clark R. Taveros[1], Joyce Sarah A. Ibana[2], Maria Pamela C. David[2] Jonathan James T. Asprer[2], James Villanueva[1], and Gisella P. Concepcion[2]**

[1]Institute of Chemistry
[2]Marine Science Insittute, College of Science
University of the Philippines Diliman, 1101 Quezon City

Tumor-associated antigens sudh as (TAG-72) are studied, most particularly, because of their potential role in cancer immunodiagnosis and as target for various immunotherapeutic strategies. TAG-72 is a useful surface tumor marker and diagnostic molecule because it is expressed in a variety of malignant epithelial tumors but not in normal tissues. In order to develop a TAG-72-based cancer diagnostic kit, the isolation of the TAG-72, of optimal purity, is required. With a number of paraffinized block samples from two patients, the CC49 monoclonal antibody (Mab) reactive TAG-72 was detected employing immunohistochemical (IHC) staining diaminobenzidine (DAB) solution. Employing a heat extraction step, lysates containing TAG-72 in Tris-buffered saline (TBS) were prepared. Partial purification using a G75-Sephadex gel filtration column and preliminary detection through sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE) were done. The homogenates were further purified in a CNBr-activated CC92-Sepharose 4B affinity column. Western blotting showed positive lysate immunoactivity, signifying the presence of the antigenic

determinant TAG-72. This was further verified in an enzyme-linked immunosorbent assay, wherein a linear relationship of the log antigen concentration against absorbence at 410nm was obtained. Separation in SDS-PAGE is done prior to in-gel trypsin digestion of the high molecular weight band. On a separate aliquot of the purified samples, deglycosylation using periodate prior to trypsin digestion is done. Both digests will be analyzed by mass spectrometry necessary for possible peptide sequencing.

**Key words**: tumor-associated glycoprotein, TAG-72, colorectal cancer

**BSD No. 33**

## ISOLATION OF THEONELLAPEPTOLIDE ID FROM A BATANES SPONGE *Theonella* sp.

**Andrea Roxanne J. Anas[1], Leah G. Castillo[1], Gina C. Mangalindan[1], Nell O. Rodriguez[1], Sheila C. Samson[1], Zenaida P. Bojo[1], Anokha S. Ratnayake[2], Chris M. Ireland[2] and Gisela P. Concepcion[1]**

[1]Marine Science Institute, University of the Philippines
Diliman, 1101 Quezon City, Philippines
[2]Department of Medicinal Chemistry, University of Utah
Salt Lake City, Utah 84112, United States of America

The crude extract of a *Theonella* sp. sponge collected from Batanes, Philippines showed significant antitumor activity against human breast cancer cell lines MCF7 and SKBR3 and also anti-TB activity. This study aimed to isolate, purify and elucidate the compound(s) responsible for such activity. The sponge was extracted with methanol and subjected to a modified Kupchan solvent partitioning. The anti-TB activity and tumor cytotoxicity were concentrated in the chloroform fraction. The bioassay-guided isolation of the active compound from the chloroform fraction was performed by successive Sephadex LH-20 and C18 flash column chromatography and solvent partitioning. The off-white crystal showed an MIC of 1 μg/mL in MABA and an $IC_{50}$ of 6.49μg/mL in the MCF7 breast cancer cell line. The MS-ESI spectrum revealed a cluster around m/z 1421.7 and the melting point was determined to be 128°C. IR analysis showed the presence of carbonyl and amino groups distinctive of peptides. From the MS-MALDI spectrum the isolate was shown to contain two major peptides and four minor compounds. This was further purified by HPLC using a Phenomenex C18

column and a water:methanol gradient system. The major HPLC fraction was subjected to $^{1}$H-NMR and $^{13}$C-NMR spectroscopy and the molecular weight determined by MS-MALDI spectrometry. Spectroscopic data were comparable with those reported for Theonellapeptolide Id. The pure compound showed cytotoxicity in MCF7 and SKBR3 breast cancer cell lines at 5μg/mL with a fractional survival of 0.298 and 0.072, respectively.

**Keywords:** *Teonella*, antitumor, anti-TB, sponge

**BSD No. 34**

## THE MANOBO, HIGAUNON AND THE BADJAO LUMAD MALES: HOW DIFFERENT ARE THEY PHYSICALLY?

**Nathaniel L. Hepowit[1] and Cesar G. Demayo[2]**

[1]Mountain View College, Bukidnon
[2]Department of Biological Sciences
MSU-Iligan Institute of Technology, Iligan City

Variability among select male indigenous peoples specifically the Manobo of Pangantucan, Higaunons of Kalabugao and the sea dwellers, the Badjaos were assessed based on sixteen phenotypic traits, five (5) anthropometric measurements and seventeen (17) dermatoglyphic variables. Some distinct phenotypic traits were uniquely present in the groups. Short little finger was found present in the Higaunons and not in individuals from other tribes. The Manobos from Pangatucan did not have alleles for dimples; however half of the Higaunons in Kalabugao had dimples. Many recessive traits were observed expressed in frequency values higher than those of the dominant traits. This result was consistent with ethnohistorical and cultural practices of the indigenous peoples, of which they preferred endogamous marriages. Differences in anthropometric measurements were observed. Higaunons were found to have the greatest mean values of all anthropometric measurements. Differences between dermatoglyphic characters such as fingerprint traces, palmar loopings, triradius distribution, and certain complicated ridge-patterns were also observed. Unique loopings and whorls were also observed at the hypothenar region and Palm Area 1 of certain individuals. Homogeneity and heterogeneity of individuals in some variables provide better insights into the population structure and history of subdivision, which are consistent with the known ethnohistorical backgrounds of the populations.

**Keywords:** dermatoglyphic characters, anthropometric, Higaunon, Monobo, Badjao

**BSD No. 35**

# UNDERSTANDING DIFFERENCES BETWEEN MEN AND WOMEN: BODY MORPHOMETRICS, ASYMMETRY AND ATTRACTIVENESS

**Cesar G. Demayo, Lawrence Chabon and Mark Anthony J. Torres**

Department of Biological Sciences
MSU-Iligan Institute of Technology, Iligan City

For centuries, differences between men and women are socially defined. While there are obvious differences in the two sexes in gross morphology, very few studies have dwelled on specific body morphometric attributes, asymmetry and attractiveness. We investigated variations between sexes based on anthropometric measurements of the hand, foot, face, mendelian traits and fingerprints from 600 subjects (300 males and 300 females). Results showed that symmetry was higher for males than females for foot length, hand length, index finger, middle finger, little finger, ear length and position. Asymmetry from hand width and thumb length was higher in females than in males. There was a relationship between asymmetry and trait size in most characters evaluated. Based on face morphometrics, ear width, lip width and thickness, nose length, length from base of nose to tip, back of head to eye point, back of head to sidemost of the eye, length from top of head to eye, nose base to tip, frontmost of ear to eye point, neck base to tip of chin, and frontmost of ear to sidemost of the eye are significantly different between males and females. For Mendelian traits, men have higher frequency of dominant traits while females have higher frequencies of recessive traits. Alcoholism was prevalent among males while anemia was observed to be predominant among females. Many disorders like cleft palate, club foor, harelip and those suffering from leukemia were predominant in males while heart disease, hypertension, manic depression, schizophrenia and tuberculosis were predominant in females. This study also showed that attractiveness of either sex is not primarily associated with other body indices but on face features. Both sexes preferred asymmetric faces than symmetric ones although computer reconstruction of the original image of the face showed that symmetric faces are better looking than the original asymmetric face.

**Keywords:** body morphometrics, asymmetry, male, female

**BSD No. 36**

# CALCIUM CRYSTALS IN LEAVES OF SOME AMARANTHACEAE OF THE PHILIPPINES

**Vivian Tolentino, Michael Castro, Ralph Lasala and Vivian Panes**

Department of Biology, School of Science and Engineering
Ateneo de Manila University, Loyola Schools
Katipunan Road, 1108 Quezon City
Email: vtolentino@ateneo.edu

The family Amaranthaceae is a widely distributed family of herbs, shrubs or small trees comprising 65 genera and over 1,000 species. In the Philippines, there are about 12 genera and about 21 species which are widely distributed from Luzon to Mindanao. Some species are used as vegetables, as ornamentals, as medicinals, as common weeds and as excellent fodder-plants. Species have slightly astringent properties, others are diaphoretics and diuretics, though many have use in native practice as alteratives and as antidotes to snakebite. Crystals in plants may be a storage form of calcium when the availability of calcium increases in the soil. It is also suggested as defense mechanism against predators and could also be species specific. This study involved an investigation of the presence of crystals in leaves of 19 species and two varieties belonging to six genera of the family Amaranthaceae. Light microscopy studies was done using the BH-2 Olympus epifluorescent microscope and the CK10 Olympus inverted microscope equipped with camera. Histological techniques used were the modified clearing and paraffin techniques. Cleared and cross-sections of leaves showed the presence of three types of crystals- the flower-like druse crystals, geometric prismatic and sand crystals in 6 species namely: *Amaranthus caudatus, A. spinosus, A. tricolor, A. virides, Alternanthera amoena,* and *A. frutescens.* Ten species showed two types of crystals, the druse and prismatic in *Amaranthus gangeticus, Gomphrena celosiodes, G. glogosa, Alternanthera dentata, A. repens, A. versicolor, A. sp, Celosia argentea, Cyathula prostata, and Iresine herbstii.* Five species showed only one type - the prismatic crystals for the following species: *Celosia argentea "Castle Gould", C. cristata, C. cristata "purple", C. cristata "white" var.* and *Gomphrena sp.* Since the Amaranthaceae are considered economically important plants with its varying use as medicinal, nutritional, food and ornamentals, renewed interest in plant crystals specifically in the leaves is essential as it may serve as a tool or guide in recommending plants for medicine, and calcium as dietary supplement.

**Keywords:** crystals, calcium oxalate, druse, prismatic, sand crystals, Amaranthaceae

**BSD No. 37**

# GAMMA-IRRADIATED CARRAGEENAN AS A GROWTH PROMOTING AGENT IN *Pleurotus florida* (ANGEL MUSHROOM)

**Chitho Feliciano[1], Angelita Medalla[1], Dexter Galit[2], Sajit Santiago[2] and *Custer Deocaris[3,4]**

[1]Department of Biology, College of Arts and Sciences,
Rizal Technological University, Boni Avenue, Mandaluyong City
[2]Polytechnic University of the Philippines, Sta. Mesa, Manila
[3]Philippine Nuclear Research Institute, Commonwealth Avenue, Quezon City
[4]National Institute of Advanced Industrial Science and Technology (AIST), 1-1-1 Higashi, Tsukuba, Ibaraki 3058562, Japan
Email: custer_pnri@yahoo.com

Carrageenan, a leading Philippine export product, is a family of linear and highly sulfated marine polysaccharides. Recent radiation research on carrageenan suggest that its radiolytic products (or partially degraded species) can serve as potent growth-promoting agents on a number of plants, like *Oryza sativa*. We report that this growth phenomenon can be demonstrated also on *Pleurotus sajor caju* and *Pleurotus florida*, two popular favorite mushroom varieties, both *in vitro* and *in vivo*. This enhanced productivity from our pilot-scale mushroom production studies may be due to the accelerated rate of mycelial colonization of the substrate containing trace amounts of 100-kGy Irradiated kappa- and iota-carrageenan.

These promising results provide a new strategy for the mushroom industry to profitably promote its production by optimal use of radiation-modified substrates.

**Keywords:** Kappa-carrageenan, Iota-carrageenan, *Pleurotus florida*, Growth promoter

**BSD No. 38**

# DIRECT ACCLIMATIZATION OF *IN VITRO* CULTURED *GRAMMATOPHYLLUM SCRIPTUM* (ORCHIDACEAE)

**Carnette C. Palma, Rachel F. Madera, and Jovita A. Anit**

Plant Biotechnology Laboratory, Research and Development Center
Rizal Technological University, Boni Avenue, Mandaluyong City
Email: pblorchids_rtu@yahoo.com

Shortening the *in vitro* culture period and speeding the acclimatization process of a Philippine native orchid, *Grammatophylum scriptum* were explored. Response of *G. scriptum* protocorms ex *vitro* in closed systems to the difference of time of opening was specifically studied. *G. scriptum* protocorms directly planted on fern slabs (5cm x 5cm) were placed inside a sealed beverage plastic bottle (1.5 L) for 12 weeks. Set-ups were placed at random on compot beds under natural light. Caps were consequently opened at two weeks interval for 1 1/2 months and measurements were made on the 8th week thereafter. Protocorms grew and developed into green and sturdy plantlets. Shoot length, number of protocorms with shoots, number of protocorms, number of leaves per shoot and percent survival increased with time. The difference of values of these parameters except for the percent survival between 8th, 10th, and 12th weeks were computed to be not significant. This is attributed to the small opening made by the cap, which probably did not contribute a notable effect with a closed system. Hence, the results show that it is feasible for *G. scriptum* protocorms to grow and develop *ex vitro*. This will address the problem of the long *in vitro* residence. In addition, this promotes early hardening and minimizes acclimatization mortality.

**Keywords:** *Grammatophylum scriptum*, Philippine orchid, protocorms, direct acclimatization, *in vitro* residence, culture period, *ex vitro*, growth and development

**BSD No. 39**

## EMBRYOGENESIS AND ORGANOGENESIS OF *PHALAENOPSIS SP.* (ORCHIDACEAE)

**Lily L. Buquiran* and Jocelyn V. Patiano**

College of Arts and Sciences, Rizal Technological University
Boni Avenue, Mandaluyong City
pblorchids_rtu@yahoo.com

This study determined the concentration of plant hormones and kind of explant for the organogenesis and embryogenesis of *Phalaenopsis.* Different explants were cultured for sixteen (16) weeks (2 weeks-dark:14 weeks-light) on modified Knudson Formula C medium supplemented with different levels of NAA, BAP and combination of both. Callus and organ formations were achieved at 1-2 ppm NAA, 1-4 ppm BAP and of both. Shoot explants showed better response than leaf tip, root tip, root base and leaf base. On the other hand, some calli have developed from leaf tip failed to differentiate while others had leaf formation. No significant differences were found in the length of shoots among all treatments. 52% of shoot explants turned green while the rest were vitrified. This experiment also demonstrated that *Phalaenopsis* shoot explants could differentiate into full-developed shoots even without the presence of plant growth regulators. This may be attributed to the presence of meristematic tissues in shoots and the addition of hormones merely enhances organogenesis.

**Keywords:** *Phalaenopsis sp.* explants, Orchidaceae, embryogenesis, organogenesis, *in vitro* culture, modified Knudson Formula C medium

**BSD No. 40**

## DIRECTIONAL CLONING STRATEGY FOR THE CONSTRUCTION OF A PLANT GENE EXPRESSION VECTOR

**Marni E. Cueno and Antonio C. Laurena**

Biochemistry Laboratory, Institute of Plant Breeding, College of Agriculture
University of the Philippines Los Baños, College, 4031 Laguna

A full length chitinase gene was cloned from a Philippine strain *Serratia marcescens* considered as a bacterial entomopathogen. Chitinase is one of the main hydrolytic enzymes used by *Serratia* spp. during insect pathogenesis. For the prokaryotic chitinase gene to be expressed in eukaryotic systems such as

plants, a suitable plant expression cassette is very important. The expression cassette is based on a co-transformation system where the gene-of-interest (GOI) and the antibiotic selectable marker gene are physically separated. The chitinase gene from a TOPO cloning vector was transferred to a pGTVa expression vector using a directional cloning approach. Initially, the chitinase gene was re-amplified and cloned into the TOPO cloning vector. Specific restriction enzymes were used to cut specifically the chitinase gene and the pGTVa for directional ligation. The ligation product was transformed in *E. coli* and the plasmid minipreps verified for the presence of the chitinase gene. COLONY-PCR, molecular weight size and COLDSTART-PCR were used to verify the presence of chitinase gene. A directional strategy will fast-track the construction of a plant gene expression cassette and we are now ready to transfer the chitinase gene into corn in our effort to develop a transgenic corn with insect resistance to the Asiatic corn borer.

**Keywords:** directional cloning, chitinase, *Serratia marcescens*, expression cassette, corn borer

**BSD No. 41**

## ONTOLOGY AND ISOFORM DISCOVERY OF GENES INVOLVED\ IN FATTY ACID SYNTHESIS IN COCONUT (*Cocos nucifera* L.)

**Marni Eusebio Cueno[1]*, Rita P. Laude[2] Antonio C. Laurena[1] and Evelyn Mae T. Mendoza[1]**

[1]Institute of Plant Breeding , College of Agriculture
[2]Institute of Biological Science, College of Arts and Sciences,
University of the Philippines Los Baños, College, 4031 Laguna, Philippines

Coconut (*Cocos nucifera* L.) is the major export crop of the Philippines due to its vegetable oil which is rich in medium-chain fatty acids. Several genes are involved in fatty acid synthesis in coconut. Among them are: acyl-ACP thioesterase (TE), phosphatidic acid phosphatase (PAP), acyl carrier protein (ACP), acetyl CoA carboxylase (ACCase), lysophosphatidic acid acyl transferase (LPAAT) and ß-keto acyl (ACP) synthase 3 (KAS 3). To isolate and detect for the presence of isoforms of each gene at the 4,5 and 6 mo old coconut endosperms and to establish an ontological significance of the genes involved in fatty acid synthesis, the 3'RACE method was used.

For TE, two bands were detected in the 5 and 6 mo. old coconut endosperms. For PAP, three bands were detected in the 6 mo old coconut endosperm. For ACP, a single band was detected in the 4 mo old coconut endosperm. For ACCase, 2 bands from the 4 mo. old and 8 bands from the 6 mo old coconut endosperms. For LPAAT, 2 bands were detected in the 6 mo old coconut endosperm. For KAS 3, 2 bands were detected from the 5 and 6 mo old coconut endosperms.

The results obtained indicate the presence of each of the genes and their isoforms at varying ages of the coconut endosperm. Furthermore, the results obtained show an ontological pattern of significance in the expression of genes involved in fatty acid synthesis in coconut.

**Keywords:** coconut, medium chain fatty acid , isoform, RACE (Randomly Amplified cDNA Ends), fatty acid synthesis

**BSD No. 42**

## MOLECULAR ANALYSIS OF RESVERATROL SYNTHASE GENE IN PEANUT (*Arachis hypogaea* L.)

**Aileen N. Bayot[1] and Antonio C. Laurena[2]**

[1]National Institute of Molecular Biology and Biotechnology and
[2]Institute of Plant Breeding, College of Agriculture
University of the Philippines, Los Baños, College, 4031 Laguna

The transformation of resveratrol synthase (RS) into important crops has been an attractive option since it is the key enzyme in the synthesis of resveratrol (3, 4', 5-trihydroxystilbene), a stilbene phyoalexin that has anti-leukemic, antioxidant and chemopreventive properties. Therefore, the gene encoding the enzyme for resveratrol biosynthesis is a very important gene not only in agriculture but also in the field of health and medicine. The full length RS gene was isolated and cloned using genomic DNA from germinating seeds of peanut (*Arachis hypogaea* L.) by PCR. A 1.5 kb PCR product was generated using RS-specific primers. Multiple sequence alignment of the isolated genes showed that they have high similarity with each other and with known RS genes. Further analysis revealed the presence of two exons (exon 1: 180 bp and partial exon 2: 197 and 670 bp) and one intron (331 bp). The conserved MVSVSG and

RSMAI that flanked the RS gene were also evident based on the DNA sequence of RS. Approximately 150 bp of sequence data was missing due to limitations of PCR cycle sequencing and this missing region contain the highly conserved active site ($cys_{166}$) predicted to be involved in the condensing reaction of a polyketide synthase. Further sequencing using an internal primer should be done to obtain the full sequence of the isolated RS genes. Non-random differences in the nucleotide sequence alignment and in the partial restriction sites in both exons and introns were observed suggesting the presence of at least two RS genes in peanut. In conclusion, a full length and functional resveratrol synthase gene was cloned from peanut and we are now in the position to transfer this gene to important crops by genetic engineering. Stable expression of the RS gene in plants may lead to enhanced protection from microbial infections and increasing their nutraceutical value.

**Keywords**: molecular analysis, resveratrol synthase, peanut, nutraceutical value

**BSD No. 43**

## PARTIAL CHARACTERIZATION AND MOLECULAR CLONING OF SWEETPOTATO FEATHERY MOTTLE VIRUS (SPFMV)

**Lolita M. Dolores*, Gedeun N. Yebron and Mavi G. Colle**

Institute of Plant Breeding, College of Agriculture
University of the Philippines Los Baños, College, 4031 Laguna
lmd121552@yahoo.com

Sweetpotato feathery mottle virus ( SPFMV) has been identified as one of the most important constraints in sweetpotato production. The virus has been noted in large sweetpotato fields in Central Luzon. Spreading over most of the sweetpotato areas, it has led to substantial yield losses and the loss of an important variety called "Bureau".

Several SPFMV isolates have been characterized based on differential reactions to diagnostic hosts, *Ipomoea setosa* and *I. nil.* The virus was purified from mechanically inoculated *I. nil* using cesium chloride (Cscl) step gradient centrifugation giving a faint opalescent band near the bottom of the centrifuge tube. The virus yield ranged from 9-30 mg /kg with A 260nm/A280nm ratio of

around 1.2. The purified virus was infectious and exhibited flexuous rod particles typical of a potyvirus under an electron microscope.

Further characterization of the SPFMV isolates by reverse transcriptase polymerase chain reaction (RT PCR) of the purified virus resulted in the amplification of the coat protein gene of SPFMV using two sets of primers designed to amplify the partial and full length coat protein gene of SPFMV. The expected PCR product sizes of 400/bp and 1.0 kb for partial and full length CP, respectively were obtained and successfully cloned using the TOPO TA cloning kit of INVITROGEN.

Such results on the characterization and cloning of SPFMV would be very useful in illuminating its position within the potyvirus group. Moreover, information on the molecular aspects of the virus would help facilitate the development of rapid and sensitive techniques for virus detection and identification which are important in monitoring virus infection in the field.

**Keywords:** sweetpotato feathery mottle virus (SPFMV), potyvirus, cloning, purification, primers, coat protein gene (CP), reverse transcriptase polymerase chain reaction (RT PCR), sweetpotato.

**BSD No. 44**

## MOLECULAR MAPPING OF GRAIN QUALITY QUANTITATIVE TRAIT LOCI IN RICE (*Oryza sativa* L.) BY SELECTIVE GENOTYPING USING SIMPLE SEQUENCE REPEATS

**J.P. Mojica[1], M.S. Mendioro, M.S.[2]* and Z. Li[3]**

[1] Cavite State University
[2] Institute of Biological Sciences, College of Arts and Sciences, University of the Philippines Los Baños, College, 4031 Laguna
[3]International Rice Research Institute

Two advanced backcross inbred lines of rice (*Oryza sativa* L.), RF 52 (IR 64 x Karnal Local) and RF 57 (Teqing x Basmati) were characterized based on ten grain quality traits. Quantitative trait loci (QTL) controlling grain quality were also determined by selective genotyping using Simple Sequence Repeats. Sixty-nine putative QTLs controlling grain quality traits were detected, 42 for RF52 and 27 for RF 57. These QTLs are widely distributed over the 12 chromosomes of rice and together explains the phenotypic variation for the analyzed grain

quality traits in the two populations. QTLs for amylose content were located in chromosomes 3 and 5 (RF 52) and 8 (RF 57). Three QTLs each for gel consistency were identified in chromosomes 2 and 11 for the two crosses and the rest were identified in chromosomes 3,4,6 (RF 52) and 5 (RF 57). QTLs for gelatinization temperature were located in chromosomes 1,2,4 (RF52), 2 and 8 (RF 57); for aroma in 1,7,8 (RF 52), 9,10 and 11 (RF57); for cooked kernel length in 1,4,5,10 (RF 52), 2,5 7 and 12 (RF 57); for cooked kernel width in 5,6,7,8,10 11 (RF52) and 10 (RF 57); for cooked kernel length-width ratio in 5,6,7,8,10,11 (RF 52) and two in 7 and one in 12 (RF 57); for uncooked kernel length in 1,6,9,11,12 (RF 52), 2,5 and 10 (RF 57); for uncooked kernel width in 3,4,8,10,11 (RF52), 2,6,8 and 11 (RF 57); and for uncooked length-width ratio in 6,9 (RF 52) 2 and 6 (RF 57).

**Keywords:** quantitative trait loci, simple sequence repeats, grain quality, amylose, cooked kernel length and width

**BSD No. 45**

## DETERMINATION OF GENETIC VARIATION IN GINGER (ZINGIBERACEAE) THROUGH RAPD ANALYSIS OF THE CHLOROPLAST DNA (cpDNA)

**Beatrice Jane L. Ang and Remedios R. Roderos**

Institute of Biology, University of the Philippines,
Diliman, 1101 Quezon City

Chloroplast DNA (cpDNA) is oftenly used in the field of plant systematics. In this study, Ribulosebisphosphate carboxylase large sub-unit (rbcL) primers are used in the analysis of genetic differentiation of different ginger (Zingiberaceae) species through random amplification of polymorphic DNA (RAPD) of the isolated cpDNA. The genomic DNA from sixteen ginger species found in the University of the Philippines Diliman campus was initially extracted. Using polymerase chain reaction (PCR), rbcL primers were applied to amplify the rbcL gene in the cpDNA of each sample. Another cycle of PCR was then performed using RAPD primers to assess genetic diversity among the ginger species. Using cluster analysis, species having similar banding patterns are more closely related compared to those with varying patterns. A dendogram was also produced to aid in the assessment of the relationship among the ginger species.

**Keywords:** Zingiberaceae, ginger, phylogeny, ribulosebisphosphate carboxylase large sub-unit (rbcL), random amplification of polymorphic DNA (RAPD), chloroplast DNA (cpDNA)

## *CHEMICAL, MATHEMATICAL AND PHYSICAL SCIENCES*

**CMPSD No. 1**

### ISOLATION AND SCREENING FOR ANTI-PROTOZOAL ACTIVITY OF SOME NOVEL LECTINS

**Marla A. Endriga[1]*, Elmer-Rico E. Mojica[2], Florinia E. Merca[2], Marivic S. Lacsamana[2] and Custer C. Deocaris[3]**

[1]Institute of Biology, University of the Philippines, Diliman, Quezon City
[2] Institute of Chemistry, University of the Philippines, Los Banos, Laguna
[3] Biomedical Research Section, Philippine Nuclear Research Institute
Commonwealth Ave., Diliman, Quezon City
marlae@edsamail.com

Lectins represent a diverse class of non-enzymatic, sugar-binding proteins. Its bioactivities have been appreciated largely in the context of biological response modification, i.e. to amend host's defense system against infection and even cancer. Even much recently, some "dangerous" lectins, such as ricin from the castor plant, have been monitored for stockpiling under the BTWC regime. In this study, new lectins were isolated from *Schefflera odorata* ("lima-lima" plant) [mol. wt= 271 kDa], *Swietenia macrophylla* (king large leaf mahogany) [mol. wt= 295 kDa], *Lenzites sp.* (a mushroom) [mol. wt= 184 kDa]. Using modified microplate screens, these purified lectins were found to possess high cytotoxic activities against *Acantamoeba sp.* (a keratitis-causing amoeba) and *Tetrahymena pyriformis* (a ciliate). Since carbohydrate-lectin interactions in protozoans play important, yet broad roles in cell recognition, adherence, cell division among others, taken together, our results indicate that lectins may also be further exploited as potential chemotherapeutics against certain parasitic diseases.

**Keywords:** lectins, *Acantamoeba sp.*, *Tetrahymena pyriformis*

**CMPSD No. 2**

# SUPERCRITICAL CARBON DIOXIDE EXTRACTION OF LIPASE FROM GERMINATING COCONUT (*Cocos nucifera*)

**Dexton L. Omiter[1], Lydia M. Bajo[2] and Roberto M. Malaluan[2]**

[1]Department of Chemistry, College of Science and Mathematics,
[2]Department of Chemical Engineering Technology
[3]MSU-Iligan Institute of Technology, 9200 Iligan City

A new method of extracting partially purified lipase from haustorium of germinating coconut using supercritical carbon dioxide (SC-$CO_2$) is proposed. Using the Bradford method, the lipase extracted by SC-$CO_2$ revealed higher protein content, 6.5338 mg/ml, than the conventional method (phosphate buffer as extracting medium), 5.1837 mg/ml. In addition, the specific activity of SC-$CO_2$ lipase extract was higher, 21.2380 units/mg compared to conventional method lipase extract, 1.0619 units/mg.

The lipolytic activity of SC-$CO_2$ lipase extract is found to be significantly higher than the conventional method lipase extract in terms of incubation time, and is also observed to be not significantly different from the latter both in terms and temperature. Both extracts exhibited maximum lipolytic activity at a pH of 7.0 and a temperature of 40°C while their incubation time was 30 minutes.

High-Performance Liquid Chromatography (HPLC) showed that the SC-$CO_2$ lipase extract has a broader activity compared to that of lipase extracted from the conventional method. The free fatty acids in coconut oil that were hydrolyzed by the partially purified SC-$CO_2$ lipase extract were caprylic, capric, lauric, palmitic, stearic, and oleic acid. Lauric acid was the major fatty acid hydrolyzed of all fatty acids liberated.

**Keywords:** supercritical carbon dioxide, Bradford method, lipolytic, High Performance Liquid Chromatography

CMPSD No. 3

# ISOLATION AND PURIFICATION OF THE OIL-BODY PROTEIN, OLEOSIN FROM COCONUT (*Cocos nucifera* L.) ENDOSPERM

**Ellen S. Regalado, Antonio C. Laurena and Evelyn Mae T. Mendoza***

Biochemistry Laboratory, Institute of Plant Breeding
University of the Philippines Los Baños, College, 4031 Laguna
*Corresponding Author; Email: emtm@laguna.net

The oil body of plant seeds contains a triacylglycerol matrix surrounded by a monolayer of phospholipids embedded with a unique class of proteins called oleosins. These are small, largely hydrophobic and alkaline proteins that have been suggested to play roles in stabilization of oil bodies and receptor binding of lipase during triacylglycerol mobilization. Due to our interest in abundant seed proteins in coconut, we investigated the proteins associated with the oil bodies of *C. nucifera*. In this study, we describe the isolation of oleosin from the oil bodies of coconut and its characterization. Endosperm from mature coconut was ground in liquid nitrogen and subjected to repeated salt washing, floatation centrifugation through sucrose density gradients, and washing with chaotropic buffer containing urea resulting in a nearly homogeneous preparation of oil bodies, from which oleosin was extracted using diethyl ether. Sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE) showed an abundant protein with an approximate molecular weight of 14,400 that was retained after repeated washing with KCl and urea. This band was transferred to a PVDF membrane by Western blotting, cut, subjected to N-terminal sequencing. Results indicated the presence of more than one protein sequence, which could be isoforms that were inseparable by the conventional SDS-PAGE.

Oil body proteins were also resolved by SDS-PAGE using tricine as trailing ion, two-dimensional electrophoresis (2DE) using a chaotropic mixture of urea and thiourea in the solubilization buffer, fast protein liquid chromatography (FPLC) through a size-exclusion and ion-exchange column. These methods, however, still resulted in one band of 14,400 molecular weight with an isoelectric pH of 9.

This study was funded by the Department of Science and Technology – Philippine Council for Agriculture and Natural Resources Research and Development and the University of the Philippines Los Baños.

**Keywords**: triacylglycerol, *Cocos nucifera*, SDS-PAGE, 2DE, FPLC

**CMPSD No. 4**

# MOLECULAR CLONING OF THE OLEOSIN GENE FROM THE COCONUT (*Cocos nucifera*) ENDOSPERM

**Ellen S. Regalado, Jorge Gil C. Angeles, Antonio C. Laurena and Evelyn Mae Tecson-Mendoza***

Biochemistry Laboratory, Institute of Plant Breeding,
College of Agriculture, University of the Philippines
Los Baños, College, 4031 Laguna
Email: emtm@laguna.net

Oleosins are a unique class of hydrophobic proteins found in the oil bodies of diverse organisms. In plants, they are most abundant in the lipid-storing bodies of seeds comprising up to 8% of the total seed protein. In this study, we report the cloning of coconut oleosin cDNAs and the characterization of their nucleotide sequences.

A gene-specific primer was designed based on the conserved sequence of known oleosin genes. Using this, two gene isoforms coding for oleosin were isolated from the total mRNA of a six month after pollination-old coconut using reverse transcription-polymerase chain reaction (RT-PCR) with molecular sizes of approximately 500 (ole500+) and 300 (ole300) base pairs. These isoforms were ligated into the pGEMT® Easy Vector and maintained in *E. coli* DH5a cells.

Sequences of the six clones analyzed reveal that these are distinct and homologous to published oleosin gene sequences. The homology of the five ole500 sequences range between 60%-99.4% among each other and averages at 91%. These sequences show an average homology of 91% with the oil palm (*Elaies guineensis)* oleosin OPZE1A gene (Accession No. AF273023.1). The sequence for the ole300 clone is 96% homologous to the rice (*Oryza sativa*) 16 kDa oleosin isoform R16 gene. (Accession No. AF022148.1). The deduced amino acid sequences of these cDNAs were found to contain the conserved oleosin domain when searched against known oleosin proteins.

By Southern blot analysis, the ole500 cDNA was found to have two copies in the coconut genome. These results indicate the isolation of oleosin cDNA sequences which could be present as multiple copies in the coconut genome.

The analysis of the sequences of the oleosin gene and its putative isoforms will provide the molecular basis for constructing vectors that will carry important hydrophobic proteins and designer oils in future genetic engineering studies and in studies to isolate sequences regulating the oleosin gene expression.

This study was funded by the Department of the Science and Technology – Philippine Council for Agriculture and Natural Resources Research and Development and the University of the Philippines Los Baños.

**Keywords:** oleosin, coconut, Cocos nucifera, isoforms, CDNA sequence

**CMPSD No. 5**

## REMOVAL OF HEAVY METALS IN WASTEWATER USING BARKS OF INDUSTRIAL TREE PLANTATION SPECIES (ITPS)

**Jennifer P. Tamayo[1] and Maxima E. Flavier[2]**

[1]Forest Products Research and Development Institute
(FPRDI)-DOST, College, Laguna
[2]Institute of Chemistry, University of the Philippines
Los Baños, College, 4031 Laguna

The use of barks as adsorbent of heavy metals in industrial wastewater will help in disposing the waste generated from the processing of logs, as well s provide alternative source of cheaper adsorbents for wastewater treatment. Tree plantations in the Philippines generate large volumes of waste whose utilization is often limited.

Eight ITPS barks, namely: *Acacia mangium, Eucalyptus deglupta, Eucalyptus camaldulensis, Paraserianthes falcataria, Endospermum peltatum, Anthocephalus chinensis, Samanea saman and Gmelina arborea* were shaken with a prepared mixture of metal solutions of lead [Pb(II)], copper [Cu(II)], chromium [Cr(VI)] and zinc [(Zn(II)]. The removal efficiency of these barks ranged from 14 to 64% for Cu(II), 32 to 61% for Cr(VI), 18 to 94% for Pb(II) and 10 to 50% for Zn(II). Likewise, wastewater from a galvanizing plant was tested and results showed that removal efficiency ranged from 61 to 81% for Cu(II), 83 to 90% for

Cr(VI), 96 to 100% for Pb(II) and 20 to 49% for Zn(II). A simulated column test conducted prior to the actual adsorption test using wastewater from the galvanizing plant showed that *E. peltatum* bark became saturated with heavy metals after six hours of contact with wastewater.

Barks of *E. camaldulensis, E. peltatum* and *G. arborea* were loaded in the wastewater treatment plant for 24 hours for maximum uptake of heavy metals. The amount of the adsorbed Zn(II) ranged from 4.72 to 4.95 mg/g bark.

**Keywords:** heavy metals, barks, tree plantation

**CMPSD No. 6**

## PHYSICOCHEMICAL PROPERTIES OF SEED GUM FROM PARADISE FLOWER PLANT *(Caesalpinia pulcherim a Linn.)*

**Jennifer Aguada and Rochelle Ellasus***

Lyceum Northwestern University, Tapuac district, Dagupan City
darlingruzel@yahoo.com

The physicochemical properties such as moisture content, total ash, acid-insoluble residue, proteins, density, starch, pH, viscosity of gum derived from seeds of Paradise Flower Plant *(Caesalpinia pulcherima Linn.)* were determined. Stability tests such as boiling point and freezing point were also done on the gum samples. Results were compared to the properties of Guar gum.

Two varieties, namely; red-flowered and yellow-flowered Paradise Flower plant (Caballero) were used in the study. Fully mature seeds with brown seed coat and nearly mature seeds with greenish-brown seed coat were utilized.

Results of the analysis revealed the following values were moisture content, 10.5-12.94%, total ash 1.45-1.84, acid insoluble residue 3.89-4.88%, density 0.946-0.959 g/m, pH 5.52-5.53, viuscosity 3020-3416 cps, protein 4.20%, boiling point 89.33-89.67°C, freezing point 15.33-17.33°C. Gum content was calculated by subtracting from 100 the sum of the other specific tests. The gum extracted from different Caballero pods averaged 73.6% for fully mature red, 72.7% for fully mature yellow, 69.0% for nearly mature red, and 69.2% for nearly mature yellow.

Predatory capacity of local population of *Mesocyclops* species were evaluated, for the first time in the Philippines, as biological control of *Aedes aegypti* (L.) mosquitoes. Under laboratory condition, *Mesocyclops* attacked the mosquito first instar larvae by the tail, side and head. Mean of first instar larvae consumed by *M. aspericornis* and *M. ogunnus* were 23.96 and 15.00 respectively. Analysis of variance showed that there was a highly significant difference between the mean number of first instar mosquito larvae consumed by *M. spericornis* and *M. ogunnus* which indicated that *M. aspericornis* is a more efficient predator of dengue mosquito larvae.

Larvitrap Index, Larval Density Index, and Larvitrap Density Index of Estero de Tanque showed that *Aedes aegypti* (65%) and *Aedes albopictus* (35%) were present in the area. House Index, Container Index and Breteau Index revealed that the area was sensitive for transmission of dengue. *Aedes* mosquitoes bred in indoor and outdoor containers such as plant vases, drums, used automobile tires, and plastic containers. KAP survey revealed that residents had insufficient information on dengue etiology, breeding sites, and biting habits of dengue mosquitoes.

Results of small scale field trials showed that the mean number of surviving larvae in experimental drums was 63.10 and 202.95 in control drums. T-test of means indicated that there was a significant difference between the mean number of surviving larvae in the drums with and without *M. aspericornis*. Findings indicated that *M. aspericornis* females are good biological control agents for they destroyed/consumed about two thirds of the wild, dengue mosquito larvae population.

**Keywords:** copepods, *Mesocyclops, Aedis aegypti,* dengue, mosqiotoes, biological control

Results show that gum from fully mature seeds from red or yellow-flowered Caballero have similar physico-chemical properties to the Guar gum while gum from nearly mature seeds failed the standard of moisture content, total ash and acid-insoluble residue. Gum from fully mature seeds of both varieties yielded cosmetic and medicated emulsions with qualities such as appearance, texture, washability and spreadability, similar to those of the commercial preparations.

These results point out the possibility of utilizing the Paradise Flower Plant seeds for production of gum whose adhesive and stabilizing properties are very much needed in cosmetic and pharmaceutical world.

**Keywords:** gum, physico-chemical properties, caballero

**CMPSD No. 7**

## ANALYSIS OF ALDEHYDES FROM EMISSIONS OF A DIESEL ENGINE USING DIESEL-COCONUT METHYL ESTER FUEL BLENDS

**Fabian M. Dayrit[1], Andre Morte[2], Antonio Doroliat[3], Mishael Fernandez[2] and Jenny Mae Perez[2]**

[1] Chemistry Department and [2] Environmental Science Department
Ateneo de Manila University, Loyola Heights, Quezon City
[3] Mechanical Engineering Department, Adamson University, Manila

Methylated esters from various vegetable oils have been used as additive to diesel fuel in order to improve their emissions. Although overall improvement in diesel emissions is observed, particular concern has been raised regarding the presence of various aldehydes in the emissions. In the Philippines, the use of coconut methyl esters (CME) is being supported by the government. This study, therefore, was conducted in order to determine the amount of formaldehyde and acetaldehyde that is emitted by a diesel engine using different CME-diesel fuel blends.

Emission samples were collected from a Kubota diesel engine using a dilution system. Electrical loads were applied to simulate actual conditions. The

following diesel-CME blends were tested: 100:0, 99:1, 98:2, 95:5, 80:20, 60:40 and 0:100. Emission samples were derivatized using O-(2,3,4,5,6-pentafluorobenzyl)hydroxylamine (PFBHA), and injected into a gas chromatogram/mass spectrometer (GC/MS).

Results showed that formaldehyde and acetaldehyde emissions were lowest when 100% CME was used. Acetaldehyde emissions were highest when using the 2% CME blend. It was also found that aldehyde emissions were highest when the engine was at idle, and lowest under maximum load.

The identification of other components in the emissions from diesel-CME blends will be presented.

**Keywords:** Emissions from diesel-coconut methyl ester blends, formaldehyde, acetyaldehyde, PFBHA

**CMPSD No. 8**

## IDENTIFICATION OF THE MAJOR ORGANIC EMISSION FROM A TWO-STROKE MOTORCYCLE ENGINE

**Fabian M. Dayrit[1]*, Mishael D. Fernandez[2], Janice L. Lao[2], Jeany Mae Perez[2] and Edward T. Chainani[1]**

[1]Department of Chemistry and [2]Department of Environmental Science
Ateneo de Manila University, Loyola Heights, 1108 Quezon City
fdayrit@ateneo.edu

The volatile organic compounds (VOCs) and condensable fraction of emissions from a 2-stroke motorcycle using 8:1 gasoline:oil mixture were collected by solid phase microextraction (SPME) and dichloromethane (DCM) extraction, respectively, and then analyzed by gas chromatography-mass spectrometry (GC-MS). The VOC emission closely resembled the profile of the gasoline used indicating that much of the VOCs was unburnt gasoline. The condensable fraction, on the other hand, contained a large number of high molecular weight components which probably come from the oil that was used with the fuel.

**Keywords:** motorcycle emissions; volatile organic compounds; condensable emissions; gas chromatography-mass spectrometry

**CMPSD No. 9**

# PACKAGING FILM FROM CARRAGEENAN

**Annabelle V. Briones, Wilhelmina O. Ambal, Romulo R. Estrella, Rolando Pangilinan, Carlos J. De Vera, Raymund L. Pacis, Ner Rodriguez, Merle A. Villanueva, and Quintiliano M. Montevirgen**

Industrial Technology and Development Institute
Department of Science and Technology, General Santos Avenue,
Bicutan, Taguig, 1631 Metro Manila

A water-soluble, edible film was produced from carrageenan for packaging of spices used in instant noodles, casing for sausages and ham including wrapper for candies, frozen meat, vegetables and fruits.

The film is composed mainly of carrageenan. The physicochemical properties of the film are as follows: Thickness (mm) 0.062 ± 0.004 to 0.112 ± 0.007; Tensile strength (kg/mm²) 1.4465 to 3.875 ± 0.2 ; Breaking factor (kg/mm) - 0.241± 0.075 to 0.563 ± 0.05; Elongation (%) - 106 ± 0.56 to 187.3 ± 7.3; Tear strength (kg/mm) - 214 ± 1.1 to 3.053 ± 0.31; Elastic modulus - 0.006 to 0.0365; Degree of decomposition - 109.0 to 115.4 °C; and Moisture content (%) - 13.0 to 19.0.

Stability studies showed that carrageenan film when used as wrapper for candies and spices including casing for 'longanisa' did not produce any loss of product during six months of storage. There was also no significant change observed in saturation solubility.

Carrageenan film is a good packaging material for food. It is edible, water-soluble and does not generate garbage or waste. It is also an environment-friendly product.

**Keywords:** carrageenan, packaging film, physico-chemical properties

**CMPSD No. 10**

# A STUDY ON The Thermal INTRAMOLECULAR Cyclization OF 2-AMINOBIPHENYL

**Evelyn C. Creencia[1]* and Takaaki Horaguchi[2]**

[1]Department of Chemistry, College of Science and Mathematics
MSU-Iligan Institute of Technology, 9200 Iligan City
csm-ecc@sulat.msuiit.edu.ph
[2]Department of Chemistry, Faculty of Science
Niigata University, Ikarashi, Niigata 950-2181, Japan

A large number of pharmaceutical products are heterocyclic in nature and so there is considerable interest in the synthesis and properties of these systems. Many synthetic routes for nitrogen-containing heterocycles are available, however, thermal intramolecular cyclization reaction of 2-aminobiphenyl to yield carbazole, is investigated in this research.

Previous studies showed that no appreciable cyclization of 2-aminobiphenyl occurs when the reaction tube is packed with non-catalytic glass beads. The use of catalysts such as CaO, molecular sieve and zeolite as well as changes in reaction temperatures gave revealing results.

The results of the study showed that CaO, zeolite, and molecular sieve are good catalysts for the thermal intramolecular cyclization of 2-aminobiphenyl, resulting to 100% conversion of the starting material to product, with the highest percent yield of carbazole obtained at a reaction temperature of 500°C.

**Keywords:** heterocycles, thermal cyclization, catalysts, carbazole

**CMPSD No. 11**

# DEVELOPMENT OF METAL STRESSED *Pseudomonas aeruginosa* AND *Saccharomyces cerevisiae* AS BIOLOGICAL MODIFIER OF A CARBON PASTE ELECTRODE FOR VOLTAMMETRIC-BASED LEAD SENSOR

**Custer C. Deocaris[1], Kristine O. Enriquez[2], Jecylfah M. Dayanan[2], and Elmer Rico E. Mojica[3]**

[1]Philippine Nuclear Research Institute, Commonwealth Avenue, Diliman, Quezon City
[2]Rizal Technological University, Boni Avenue, Mandaluyong City
[3] Institute of Chemistry, University of the Philippines, Los Baños, Laguna

The use of metal stressed *Pseudomonas aeruginosa* and *Saccharomyces cerevisiae* was investigated for its feasibility as a biological modifier of a voltammetric-based heavy metal biosensor, particularly lead. Pretreatment of the microorganisms were carried out by culturing the microorganism with the idea that the organisms will develop metal binding proteins to survive the harsh condition. After 48 hours of conditioning, microbial biomass was harvested and incorporated in a carbon paste electrode. Optimum conditions for Pb (II) analysis including the effect of pH, accumulation time, deposition potential, supporting electrolyte and lead concentration was investigated by differential pulse adsorptive stripping voltammetry (DPAdSV). Regeneration of electrode surface is done by dipping the used electrodes in 0.1 M EDTA for 10 minutes. Determination of Pb (II) from laboratory waste sample with the "yeast-trode" and "*Pseudomonas*-trode" by DPAdSV was comparable with the results using atomic absorption spectroscopy (AAS). By exploiting principles of biotechnology and electrochemistry, the yeast-trode and *Pseudomonas*-trode are cost-effective biosensor that can be configured for rapid environmental monitoring of water samples.

**Keywords**: *Pseudomonas aeruginosa, Saccharomyces cerevisiae,* biological modifier

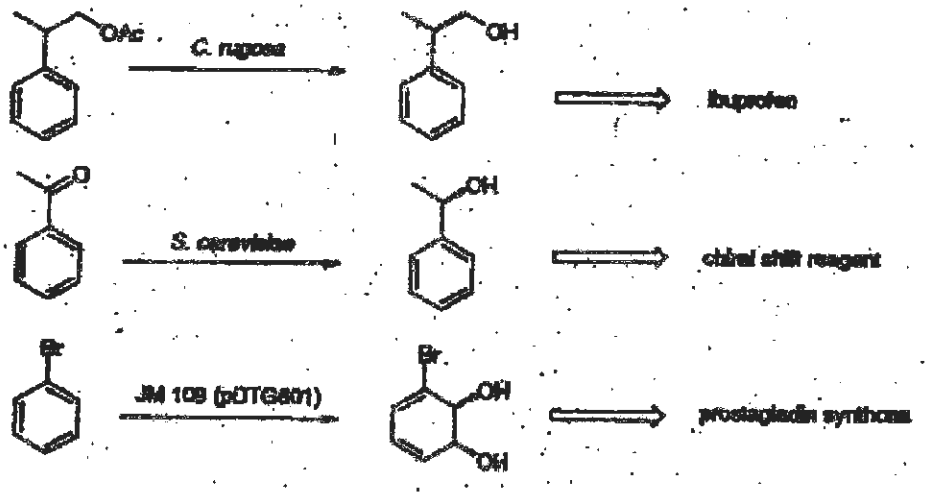
CMPSD No. 12

# BIOCATALYSIS AS AN IMPORTANT TOOL IN THE SYNTHESIS OF PHARMACEUTICALS

**Mary Ann A. Endoma**

Institute of Chemistry, University of the Philippines
Diliman, 1101 Quezon City

Recently, there has been an increased interest in the preparation of pharmaceuticals in an enantiomerically pure form. It was found that only one of the two possible enantiomers is actually beneficial in its use as a drug while the other enantiomer is inactive or may even show lethal effects. One of the ways to prepare an enantiomerically pure product is to begin the synthesis with enantiomerically pure starting material. In the preparation of enantiomerically pure material, a technique called biocatalysis is applied. In this presentation, several biocatalytic processes will be illustrated with specific examples. The biotransformations employed are hydrolysis of esters with lipases, reduction of ketones with yeast, and dihydroxylation of aromatics with recombinant bacteria.




**Keywords:** biocatalysis, synthesis, pharmaceuticals, enantiomer, biotransformation

**CMPSD No. 13**

# DETERMINATION OF THE CORRELATION FACTOR BETWEEN TOXICITY CHARACTERISTIC LEACHING PROCEDURE (TCLP) AND ELUTION LEACHING PROCEDURE (ELP) RESULTS IN TESTING THE LEACHABILITY OF HAZARDOUS WASTES OF A PHILIPPINE GEOTHERMAL PLANT

**M.J. Apañada, J.A. Jardiolin and Anna Marie Hufemia***

Department of Environmental Science, Ateneo de Manila University
Loyola Heights, 1108 Quezon City, Philippines
Email: ahufemia@ateneo.edu

The Toxicity Characteristic Leaching Procedure (TCLP) is the leaching test adopted in the Philippines to determine the toxicity of hazardous wastes. A new law, however, would require industries to characterize hazardous wastes using Elution Leaching Procedure (ELP). This study was conducted to establish any correlation factor that would convert TCLP to ELP results to assist geothermal power plants in complying with the new regulations on hazardous waste management.

Geothermal scales and sludge collected from four different points of one geothermal power plant were subjected to TCLP and ELP extraction and filtration processes. The presence of cadmium (Cd), chromium (Cr), and lead (Pb) in the supernatant liquid were analyzed using Atomic Absorption Spectroscopy. The concentration values of Cd, Cr, and Pb were statistically treated to determine how the TCLP values correlated with ELP values, specifically for each metal.

Different concentration values were obtained from the TCLP and ELP runs. Initial experimental runs have indicated specific correlation factors for each of the characterized hazardous substances. The correlation factor to convert TCLP values to ELP values for Cd, Cr and Pb are 1.0093, 1.9924, and 0.08314, respectively. Further experimental runs are to be undertaken to test the validity and consistency of the correlation factor.

This research marked the first time that ELP was employed to determine the toxicity of Philippine geothermal wastes. The study has shown that a correlation factor between TCLP and ELP results could be established. These results would provide essential scientific basis for the formulation and implementation of the Philippine Hazardous and Radioactive Wastes Management Act of 2003.

**Keywords:** TCLP, ELP, hazardous wastes, geothermal waste

CMPSD No. 14

# RECOVERY OF RARE EARTH ELEMENTS FROM BEACH SAND IN PALAWAN

**Christina A. Petrache, Gabriel P. Santos Jr., Lourdes G. Fernandez, Marilyn K. Castillo, Estrellita U. Tabora, Socorro P. Intoy and Rolando Y. Reyes**

Nuclear Materials Research Group, Atomic Research Division,
Philippine Nuclear Research Institute, Diliman, Quezon City, Philippines
email: cpetrach@yahoo.com

Allanite, a ***sorosilicate*** mineral containing rare earths, thorium and uranium, was found to occur in beach sand from Ombo, San Vicente, northern Palawan. Rare earths or rare earth elements (REE) are high value commodities used in high-technology applications, i.e., electronic and optoelectronic, state-of-the art magnetics, electric and electric-hybrid automobiles, fuel cells and auxiliary power units, computers, rechargeable batteries, aerospace applications including reflective coatings, anti-reflective coatings, electromagnetic interference (EMI) and radio frequency interference (RFI) shielding, magnetic resonance imaging (MRI) instruments and more. This preliminary study describes a metallurgical process initiated at the Philippine Nuclear Research Institute (PNRI) and partially funded by the Philippine Council for Advanced Science and Technology Research and Development (PCASTRD) with the objective of extracting, recovering and producing REE oxides from allanite in the beach sand. The highlight of this experiment is the development of a recovery process to produce relatively pure REE earth oxides, a pioneering work in the country.

**Keywords:** rare earths, rare earth elements, allanite, sorosilicate, uranium, thorium, rare earth oxides

**CMPSD No. 15**

# SILICA GELS FROM RICE HULL: STRUCTURE, COMPOSITION AND WATER VAPOR ADSORPTION BEHAVIOR

**Leni. L. Quirit[1] and Elma C. Llaguno[2]**

[1]Institute of Chemistry and Natural Sciences Research Institute,
University of the Philippines, Diliman, 1101 Quezon City
[2]Institute of Chemistry, University of the Philippines,
Diliman, 1101 Quezon City

Silica gels prepared from rice hull were found to have properties comparable to two commercial silica gels and a silica gel prepared by the Industrial Technology Development Institute (ITDI), in terms of chemical and amorphous structure, surface area, desiccant characteristics and heats of adsorption. These properties were determined from infrared and x-ray diffraction spectra and from water vapor adsorption measurements. Microstructure comparison by electron microscopy showed greater uniformity in particle size and distribution for the rice hull silica gels. The acid treated rice hull gels may have potential as chromatographic material, based on less x-ray fluorescence detected elemental impurities, compared to the commercial and ITDI gels. The economic advantage of preparing silica gels (and other silica products) from rice hull could be considerable if the rice hull ash is obtained from properly designed burners using rice hull as a renewable energy source. Aside from production of cheap energy and silica products, the process will contribute to agricultural waste utilization and pollution abatement through reduction of emissions from the current practice of open field burning of rice hull.

**Keywords:** FTIR, rice hull, SEM, silica gel, XRD, XRF, water vapor adsorption

Research supported by the Department of Agriculture Bureau of Agricultural Research (DA BAR)

CMPSD No. 16

# WATER SUBSTITUTION BY PYRIDINE IN COBALT (III)-SUBSTITUTED KEGGIN AND DAWSON TYPE HETEROPOLYANIONS

**Joseph L. Samonte**

De La Salle University-Dasmarinas, Dasmarinas, Cavite
nsdjls@dasma.dlsu.edu.ph

Incorporation of transition metal cations in octahedral binding sites on the surface of lacunary heteropolyanions results in formation of complexes that bear many similarities to metal complexes of macrocyclic ligands like metalloporphyrins. Transition metal complexes of heteropolyanions then are considered purely inorganic analogs of porphyrins. The advantages in using them to study substitution reactions instead of metalloporphyrins are that they are robust in nature and their oxidation states can be easily manipulated.

The main objective of this research is to compare the rate of water substitution by pyridine in transition metal complexes of heteropolyanions such as $[a_1\text{-}P_2W_{17}Co^{III}(H_2O)O_{61}]^{7-}$, $[a_2\text{-}P_2W_{17}Co^{III}(H_2O)O_{61}]^{7-}$, and $[a\text{-}SiW_{11}Co^{III}(H_2O)O_{39}]^{5-}$ under specified conditions. About 0.002 M solutions of the heteropolyanions in 0.1M sodium acetate buffer, pH 4.7 in 1M sodium perchlorate were prepared. These solutions were oxidized electrochemically at +1200 mV. The resulting reaction mixtures then were mixed with excess pyridine. In order to monitor the formation of the pyridine complex, the absorbance of the mixture at 626 nm was recorded for a period of 4 hours.

The observed first order rate constants for the substitution reactions were $[a_1\text{-}P_2W_{17}Co^{III}(H_2O)O_{61}]^{7-}$ ($3.0 \times 10^{-2}$/sec) > $[a\text{-}SiW_{11}Co^{III}(H_2O)O_{39}]^{5-}$ ($4.7 \times 10^{-4}$/sec) > $[a_2\text{-}P_2W_{17}Co^{III}(H_2O)O_{61}]^{7-}$ ($3.7 \times 10^{-4}$/sec). Substitution of water by pyridine in the heteropolyanions studied was found to proceed using a dissociative mechanism. Also, steric strain argument used to explain why the substitution rate constant in $[a_1\text{-}P_2W_{17}Co^{III}(H_2O)O_{61}]^{7-}$ was 80 X larger than in $[a_2\text{-}P_2W_{17}Co^{III}(H_2O)O_{61}]^{7-}$ despite the similarity in their charges and structure.

**Keywords:** heteropolyanions, pyridine, substitution, Keggin, Dawson

**CMPSD No. 17**

# PERFORMANCE TESTING OF SMALL PLASTIC SCINTILLATOR TILES FOR THE GLOBAL LINEAR COLLIDER (GLC) ELECTROMAGNETIC CALORIMETER

**R.L. Reserva[1], E.P. Jacosalem[1], H.c. Goac1[1], J.L. Dagondong[1], R.S. Solidum1[1], R.M. Teriol[1], A. Lintasan[1], A.L.C. Sanchez[2], H. Miyata[2], and A.M. Bacala[1]**

[1]High Energy Physics Laboratory, MSU-IIT, 9200 Iligan City
[2]High Energy Physics Laboratory, Niigata University, Niigata 950-2181, Japan

A bench test is presently conducted on the small NE102A plastic scintillator tile with a sensitive area of 4 cm x 4 cm and a thickness of 1 cm for the proposed Asian Global Collider (GLC) to determine the spectra of scintillator emiision S(ε) at all points on the tile, wavelength shifting (WLS) fiber absorption (Faε) and fiber emission (Fe(ε).

The tile-fiber technique is employed in this study to facilitate the collection of the incident photon. Two scintillator tiles are fixed on top of the plastic bench with a collimated $^{90}$Sr â-beam of source on an xy-axis moving platform. The photons hitting the scintillator are read out through wavelength shifting (WLS) fiber which is inserted into the plastic scintillator tile. The WLS fiber from each tile is connected to the PMT and is then channeled to an array of electronic modules and CAMAC for ADC measurement.

In this study, initial results of the bench test showed a very good light yield as observed in the oscilloscope. Photon peak and pedestal counts from ADC count distribution will soon be explored.

**Keywords:** Wavelength Shifting (WLS), plastic scintillator, CAMAC

**CMPSD No. 18**

# COMPUTER SIMULATION OF THE STANDARD MODEL PROCESS $e^+e^- \to l^+l^-$ AT THE PROPOSED GLOBAL LINER COLLIDER (GLC)

**I.C. Vicente[1]*, D.C. Arogancia[1], A.M. Bacala[1], C. Paliso[2], A. Miyamoto[3]**

[1]Department of Physics-MSU-Iligan Institute of Technology, 9200 Iligan City
[2]National Institute of Physics, University of the Philippines
Diliman, 1101 Quezon City
[3]KEK High Energy Accelerator Research Organization, Tsukuba, Japan

The performance of the 3-T detector in measuring selected observables in the Standard Model process e+e- $\mu^+\mu^-$ at the proposed Asian Global Linear Collider (GLC) is being investigated by computer simulation in this study.

The center-of-mass energy is set initially at 500 GeV which is later increased to 1 TeV and 1.5 TeV. Electron-positron collisions inside the GLC detector are analyzed using the JLC Study Framework (JSF) and the PhysSim libraries. Event generation is done using the PYTHIA Monte Carlo generator while the JSF Quick Simulator (QuickSim) is used for detector simulation.

Data gathered from the generation and simulation of events are used to formulate event selection criteria for precision calculation of desired observables (forward-backward asymmetry ratio, etc.) in the above-mentioned process. The results of this study are then compared to results of known previous studies for verification. These will be useful in setting new parameters of the GLC detector for future operations.

**Keywords:** Standard Model, Global Linear Collider, JLC Study Framework (JSF)

**CMPSD No. 19**

# GROWTH OF Y-DOPED Bi-2212 SINGLE CRYSTALS

**Hanna P. Rillera, R. D. Sioson, Roland V. Sarmago**

Condensed Matter Physics Laboratory, National Institute of Physics,
University of the Philippines, Diliman, 1101 Quezon City
hannah678@yahoo.com

Superconducting single crystals of Bi-2212 doped with Yttrium were successfully grown by melting powder precursors of nominal composition $Bi_2Sr_2Ca_{0.9}Y_{0.1}Cu_2O_{8+y}$. The crystals were grown in an $Al_2O_3$ boat. The problem of incongruent melting of the Bi-2212 phase was solved by bringing the powder precursors to a temperature sufficient to melt it but not too high so as to destroy the Bi-2212 phase. Melting at 950°C for 5 hours followed by slow cooling to 880°C resulted in the melting of the charge near the surface, forming a thin layer of crystals, which were easily cleaved mechanically. The composition of the crystals was analyzed using Energy dispersive x-ray incident on smooth, defect-free and impurity free surfaces. Cation ratios of approximately Bi:Sr:Ca:Y:Cu::2.27: 1.92: 0.80: 0.34: 2.00, normalized to Cu = 2.00, were obtained. DC resistivity measurements revealed Tc ~ 80K. Morphology of the sample was investigated through SEM. The single crystals have a thin plate-like shape with sizes ~2 x 3 $mm^2$. The surfaces are smooth with dark luster. Layered growth behavior was also observed by focusing near the edges of the sample. These observations macroscopically reflect the layered structure of Y-doped Bi-2212 crystals. X-ray diffraction patterns showed (00*l*) peaks, indicating that the c-axis of the unit cells is normal to the surface of the crystal. This also enabled calculation of the c-lattice parameter and it was found to be 30.58Å. This value is less than the c-parameter of an undoped Bi-2212 single crystal where c= 30.77 Å. This slight reduction of c-parameter further supports the successful incorporation of Yttrium into the Bi-2212 crystal because this suggests the alteration of the crystal structure due to doping.

**Keywords:** superconductors, doping, single crystals, Bi-2212

**CMPSD No. 20**

# HIGHLY TEXTURED $Bi_2Sr_2CaCu_2O_{8+d}$ FILM SYNTHESIS UNTO SILVER SUBSTRATES BY ELECTROPHORETIC DEPOSITION

**R. Sarmiento, A.H. Manuel, and Roland V. Sarmago**

Condensed Matter Physics Laboratory, National Institute of Physics
University of the Philippines, Diliman, 1101 Quezon City
rsarmiento@nip.upd..edu.ph

Highly textured films of $Bi_2Sr_2CaCu_2O_{8+d}$ on silver substrates were synthesized using an electrophoretic deposition process (EPD). The powders were initially pre-reacted using solid state reaction before deposition unto high purity silver sheets. The powders were milled then placed in an ethanol colloidal suspension with a ratio of 0.5g/L. A deposition voltage of 100 V/cm and a deposition time of 60 and 90 seconds were implemented. The deposited films were subjected to a short sintering time of 1.5 H at 870 °C in order to reduce film porosity and allow vacancy diffusion of the grains. X-ray diffraction (XRD) analysis shows significant peaks oriented along the c-axis. From the XRD pattern the c-axis parameters of the films were computed. It was observed that the films have a high relative intensity ratio between (0 0 l) and non (0 0 l) peaks. Surface image analysis shows that a reduction of crystallographic misorientations of the deposited particles has occurred. Plate-like particles were observed oriented parallel to the plane of the substrate indicating grain alignment along the c-axis plane. C-axis orientation and grain alignment indicates texturing of the deposited films.

**Keywords:** Electrophoretic Deposition, BSCCO/Ag Films, Textured Films

**CMPSD No. 21**

# THE MACARTHUR-WILSON AND MONOMOLECULAR VOLUMETRIC MODELS FOR SATURATED FLUIDS AND GASES

**Derick Erl P. Sumalapao**

Department of Physical Sciences and Mathematics,
College of Arts and Sciences, University of the Philippines Manila
derickearl@yahoo.com

Volumetric equations are very important in the study of thermodynamics. In power generation, such as steam power plant and refrigeration cycles, which take into account the thermodynamic properties of water and steam, volumetric equation is needed to relate the volumetric properties of water and steam in computing the thermal and mechanical properties of the system. It allows for the computation of work, thermal efficiency, energy, and heat rate.

It is a must then that volumetric properties of gases and fluids be predicted as accurate as possible to achieve accurate computation of the different thermodynamic properties. This study is one such effort. It covers the examination and comparison of the Macarthur-Wilson model and the Monomolecular model aimed at determining which model is more viable in capturing the volumetric behavior of saturated fluids and gases. For testing purposes, the thermodynamic property tables of saturated liquid ammonia and water were used.

Most of the nonlinear models would require the presence of parameters that are to be estimated in the model. In estimating the parameters of the models, the classic NLIN (nonlinear) procedure of SAS (Statistical Analysis System) and the Gauss-Newton Method were employed.

Comparison was made based on the proscribed set of criteria, such as p-values, $R^2$, sum of squares residuals and $s^2$. The Macarthur-Wilson model and Monomolecular model unquestionably have a better model fit to the randomly chosen volumetric properties tables of saturated liquids. The study found out that the Monomolecular model is the more viable model in determining the thermodynamic property values of saturated liquid ammonia and water.

**Keywords:** Macarthur-Wilson Model, Monomolecular Model, Saturated Liquids, NLIN procedure, Gauss-Newton Method.

**CMPSD No. 22**

## PHASE TRANSITIONS OF A SQUARE LATTICE ISING MODEL

**Harry H. Lim, Jericho B. Omagbon*,**
**Dennis C. Arogancia, and Jingle B. Magallanes**

Department of Physics
MSU-Iligan Institute of Technology, 9200 Iligan City

Ising model is used in studying thermodynamic properties, such as magnetization, magnetic susceptibility and specific heat capacity, of a ferromagnetic substance having strong anisotropy in one direction. Monte Carlo simulation was used to analyze first-order and second order phase transitions. Starting from a uniform configuration of spins, the temperature was then increased to 10K. The magnetization, energy, magnetic susceptibility and specific heat capacity were plotted with respect to temperature and the second-order phase transition is analyzed from these plots.

Simulation results showed that the plot for magnetic susceptibility versus temperature and specific heat capacity versus temperature has a peak at Tc. At the thermodynamic limit the plot would diverge at infinity. Meanwhile, first-order phase transition was analyzed by noting the hysteresis formed as the system was subjected to increasing and decreasing magnetic field, typically from −10 to 10 Oersted. The hysteresis loop was obtained by plotting the applied field versus the magnetization. At T<Tc, specifically at T=1K, there occurs a first-order phase transition as evident from an abrupt change of magnetization from 1 to −1 A/m. At T>Tc, specifically at T=5K, no first-order transition has occurred.

**Keywords:** Ising Model, Ferromagnetic, Monte Carlo, square lattice, magnetization, specific heat capacity, magnetic susceptibility, energy, hysteresis

**CMPSD No. 23**

# LOW-FIELD AC SUSCEPTIBILITY BEHAVIOR OF Pb-DOPED Bi-2223

**S. Pigaroa, D. Ramos Jr., R. V. Sarmago**

Condensed Matter Physics Laboratory, National Institute of Physics,
University of the Philippines, Diliman, 1101 Quezon City

The study of low field AC susceptibility is of considerable interest, since it provides crucial information on the response mechanism of superconductor to the externally applied electric and magnetic field. In the case of Bi-2223, we were mainly interested in studies on the nature of its AC losses mechanism.

Samples were grown using Pb-doped Bi-2212, $Ca_2CuO_3$ and CuO. X-ray diffraction pattern was measured and most of the observed peaks correspond to the Bi-2223 phase. This indicates the growth of Bi-2223 phase as a dominant phase. Weak impurity peaks from Bi-2212 intergrowth phases is also observed in XRD pattern. AC susceptibility measurements have been performed at varying field by using magnetic inductance bridge setup.

From AC susceptibility measurement, the transition width is ranged from 15K to 20K. At transition temperature a double-peak curve in the lower applied field was observed in imaginary part of AC susceptibility. This double peak curve is due to the presence of bulk and intergranular material. The peak near Tc is attributed to the intragrain transition that corresponds to hysteretic losses. While the second peak is attributed to intergranular shielding current that gives rise to the dissipation. A steep upturn at lower temperature is also observed at lower field.

When field is increased, the double peak curve collapses into a single-peak curve. And this peak shifts to lower temperature. The shifting of this peak is due the creation of energy barrier impeding flux penetration to the volume of superconductor brought by increasing applied field. Moreover, the steep upturn gradually vanishes with increasing applied field.

The resulting behaviors were relatively well described by eddy currents generated by Faraday effect. Also, low field AC susceptibility can be used as a simple test to distinguish between an intragranular or intergranular transition.

**Keywords**: AC susceptibility, BSCCO, superconductivity

**CMPSD No. 24**

# ON CYCLE DERIVATIVES OF COMPLETE GRAPHS, COMPLETE BIPARTITE GRAPHS, AND OTHER GRAPHS

**Romulo C. Guerrero [1] and Jude John S. Maña Sr.***

[1] Department of Mathematics, College of Science and Mathematics
MSU-Iligan Institute of Technology, 9200 Iligan City
romy1325@yahoo.com
*MSU, Lopez Jaena, Misamis Occidental
judesr7@yahoo.com

An edge joining two non-consecutive vertices of a cycle is called a chord. A cycle in a graph is called a *prime cycle* (also called *induced cycle)* if it is chordless. The *(first)cycle derivative* (or, *cycle derivative*, for short) of a graph $G$, denoted by $G_g$, is obtained by treating the prime cycles of the graph $G$ as vertices of $G_g$ and where two vertices are adjacent if and only if they are prime cycles with a common edge. Here, we consider the cycle derivatives of fans $F_n$, wheels $W_n$, complete graphs $K_n$, ladder $P_2 \times P_n$, helm $H_n$, and the complete bipartite graph $K_{2,n}$. Among the main results generated are the following:

1. (a) $F_n' = P_{n-1}$ for $n \geq 2$.

   (b) $(P_2 \times P_n)' = P_{n-1}$.

   (c) $W_n' = W_n$, where $n \geq 3$.

   (d) $H_n' = W_n$.

2. $K_n'$ is $3(n-3)$-regular. Furthermore, $K_n'$ is a hamiltonian graph for $n = 4, 5$ only.

3. $K_n'$ is eulerian if and only if n is odd, $n \geq 3$.

4. $K_n'$ is a regular eulerian graph, for $n \geq 2$.

5. Let $n \geq 3$. Then $K_{2,n}$ is a hamiltonian graph for $n = 3, 4, 5, 6$.

**Keywords**: prime or induced cycle, cycle derivative, regular graph, hamiltonian, eulerian

**CMPSD No. 25**

# SUPERPOSITION OF INTERGRANULAR AND INTRAGRANULAR LOSSES TO THE AC HARMONIC SUSCEPTIBILITIES OF BULK YBCO

**Jessica Pauline C. Afalla, Ma. Veronica Sibayan-Torralba, Roland V. Sarmago**

National Institute of Physics, University of the Philippines,
Diliman, 1101 Quezon City
Condensed Matter Physics Laboratory, Superconductor Group

AC harmonic susceptibilities ($c_n'$ and $c_n''$ with n=2 to n=7) of a superconducting YBCO bulk sample, having a critical temperature ($T_c$) of 89K, were experimentally obtained through a mutual inductance bridge set-up. While models predict the generation of even harmonics only in the presence of a DC field superimposed on an AC field, data show both odd and even harmonic responses under purely AC magnetic fields. Harmonic responses were measured at constant excitation frequencies of 200Hz, 800Hz and 12800Hz and constant field amplitudes of 0.13mT, 1.84mT and 3.64mT.

The harmonic response, manifested as an oscillation from positive to negative values, exhibits strong field amplitude and frequency dependence. Both the magnitude and number of oscillations increase with an increase in either the amplitude or the frequency of the applied AC field. In general, however, the pattern of oscillation of a particular $c_n'$ and $c_n''$ is not actually distinct and may change with field amplitude and frequency.

Previous studies in the laboratory have confirmed the direct link between harmonic generation and intergranular and intragranular losses. The shapes of the harmonic responses would depend on the contribution of each loss. The data for the harmonic response can be accounted for by considering that the superposition of such contributions may vary, with a strong dependence on frequency and applied field, therefore giving rise to the different shapes of the harmonic response. To support this argument, the behavior of the intergranular and intragranular loss peaks in the out-of-phase fundamental susceptibility will also be closely inspected.

**Keywords:** YBCO, Harmonic Susceptibility, Even Harmonics, AC Susceptibility

**CMPSD No. 26**

# ON THE GEODETIC COVERS AND GEODETIC BASES OF THE COMPOSITION $G[K_m]$

**Gilbert B. Cagaanan[1] and Sergio R. Canoy Jr.[2]**

[1]Related Subjects Department, School of Engineering Technology
[2]Department of Mathematics, College of Science and Mathematics
MSU - Iligan Institute of Technology, 9200 Iligan City
csm-src@sulat.msuiit.edu.ph ; set-gbc@sulat.msuiit.edu.ph

Given a connected graph $G$ and two vertices $u$ and $v$ in $G$, $I_G[u, v]$ denotes the set of vertices consisting of $u$, $v$ and all vertices lying on some $u-v$ geodesic of $G$. A subset $S$ of $V(G)$ is called a geodetic cover of $G$ if $I_G[S] = V(G)$, where $I_G[S] = \bigcup_{u,v \in S} I_G[u, v]$. A geodetic cover of minimum cardinality is called a geodetic basis. In this paper, we give the geodetic covers and geodetic bases of the composition of a connected graph and a complete graph.

The major results obtained in this study are the following:

(1) Let $G$ and $H$ be connected graphs with $H$ a complete graph. Then $g(G[H]) = 2$ if and only if either $g(G) = 2$ and $H = K_1$ or $G = K_1$ and $H = K_2$.
(2) Let $G$ be a connected graph, $A$ a geodetic cover of $G$ and $B$ a $GIC$ set with respect to $A$. Then $Ex(G[K_m]) \cup [(B \setminus Ex(G)) \times \{v_0\}] \cup [(A \setminus B) \times V(K_m)]$ is a geodetic cover of $G[K_m]$ for every $v_0 \in V(K_m)$.
(3) Let $G$ be a connected graph and $T_f$ a geodetic cover of $G[K_m]$. Then $T_f$ is a geodetic cover of $G$ and there exists a $GIC$ set $B$ with respect to $T_f$ such that $T = Ex(G[K_m]) \cup [(T_f \setminus B) \times V(K_m)] \cup \{(u, v) \in T : u \in B \setminus Ex(G), v \in V(K_m)\}$.
(4) Let $G$ be a connected graph. Then $g(G[K_m]) = (m - 1)|Ex(G)| + \min L$, where $L = \{m|A| - (m - 1)|B| : A$ is a geodetic cover in $G$ and $B$ is a maximum $GIC$ set with respect to $A\}$.
(5) Let $G$ be a connected graph and $A$ a geodetic basis that is a $GIC$ set in $G$. Then $Ex(G[K_m]) \cup [(A \setminus Ex(G)) \times \{v_0\}]$ is a geodetic basis of $G[K_m]$ for every $v_0 \in V(K_m)$.
(6) Let $G$ be a connected graph. If $G$ has a geodetic basis that is a $GIC$ set in $G$, then $g(G[K_m]) = g(G) + (m - 1)|Ex(G)|$. In particular, if $G$ has no extreme vertices, then $g(G[K_m]) = g(G)$.

**Keywords:** composition, convex set, geodetic basis, geodetic cover, geodetic number

---

[†]Research supported in part by the PCASTRD-DOST

**CMPSD No. 27**

# ON THE HULL SETS AND HULL NUMBER OF THE CARTESIAN PRODUCT OF GRAPHS

**Gilbert B. Cagaanan[1] and Sergio R. Canoy Jr.[2]**

[1]Related Subjects Department, School of Engineering Technology
[2]Department of Mathematics, College of Science and Mathematics
MSU - Iligan Institute of Technology, 9200 Iligan City
csm-src@sulat.msuiit.edu.ph; set-gbc@sulat.msuiit.edu.ph

Let $G$ be a connected graph, $V(G)$ the vertex set of $G$ and $d_G(u, v)$ the length of a shortest path connecting vertices $u$ and $v$ in $G$. The couple $(V(G), d_G)$ is a metric space on $V(G)$. Any $u - v$ path of length $d_G(u, v)$ is called a $u - v$ geodesic.

A subset $C$ of $V(G)$ is convex if for every two vertices $u, v \in C$, the vertex set of every $u - v$ geodesic is contained in $C$. If $u$ and $v$ are in $V(G)$, then the set $I_G[u, v]$ is the set of vertices consisting of $u$, $v$ and all vertices lying on a $u - v$ geodesic of $G$. If $C \setminus V(G)$, then the union of all sets $I_G[u, v]$ for $u, v \in C$ is denoted by $I_G[C]$. A set $C$ is convex in $G$ if $I_G[C] = C$. The convex hull of a subset $C$ of $V(G)$ is defined as the smallest convex set in $G$ containing $C$. A subset $C$ of $V(G)$ is a hull set in $G$ if the convex hull of $C$ is $V(G)$. The cardinality of a minimum hull set in $G$ is called the hull number of $G$. The hull number of the Cartesian product of a nontrivial connected graph and $K_2$ was shown by Chartrand, et al.

In this paper, we give the hull number of the Cartesian product of any two connected graphs. Among others, we obtained the following main results:

(1) Let $G$ and $H$ be connected graphs and $C \setminus V(G \times H)$. If $C_f$ and $C_s$ are hull sets in $G$ and $H$, respectively, then $C$ is a hull set in $G \times H$.
(2) Let $G \times H$ be a connected graph and $C \setminus V(G \times H)$ a hull set in $G \times H$. Then $C_f$ and $C_s$ are hull sets in $G$ and $H$, respectively.
(3) Let $G$ and $H$ be connected graphs. If $A$ and $B$ are minimum hull sets in $G$ and $H$, respectively, then there exists $C \setminus V(G \times H)$ such that $C$ is a minimum hull set in $G \times H$ and $|C| = \max\{|A|, |B|\}$.
(4) Let $G$ and $H$ be two connected graphs. Then $h(G \times H) = \max\{h(G), h(H)\}$.

**Keywords:** Cartesian product, convex hull, convex set, hull number, hull set

[†]Research supported in part by PCASTRD-DOST

**CMPSD No. 28**

# ON THE EDGE COVERING OF GRAPHS

**Rosalio G. Artes and Sergio R. Canoy, Jr***

Department of Mathematics
MSU-IIT, Iligan City 9200, Philippines
csm-src@sulat.msuiit.edu.ph

An edge in a graph $G$ is said to *cover* the vertices with which it is incident. A subset $U$ of $E(G)$ is an *edge cover* of $G$ if for each vertex $v \in V(G)$ there is an edge in $U$ which covers $v$. The *edge covering number* of a graph $G$ without isolated vertices is given by

$$e_c(G) = \min\{\,|U| : U \text{ is an edge cover of } G\,\}.$$

This study seeks to determine the edge covering number of some graphs. Among the major results obtained in this are the following:

1. If $H$ is a spanning subgraph of $G$ both of which without isolated vertices, then $e_c(H) \geq e_c(G)$
2. If $H$ is an induced subgraph of $G$ both of which without isolated vertices, then $e_c(H) \leq e_c(G)$
3. Let $G$ and $H$ be graphs of orders m and n respectively such that $e_c(G)$ and $e_c(H)$ exist. Then

$$e_c(G+H) \leq e_c(G) + e_c(H).$$

4. Let $G$ and $H$ be graphs of order $n$ and $m$, respectively. such that $e_c(G)$ and $e_c(H)$ exist. Then

$$e_c(G \times H) \leq m(n - e_c G) + e_c(H)(n - 2(n - e_c G))$$

5. Let $G$ and $H$ be graphs without isolated vertices. Then .

$$e_c(G \times H) \leq \min\{e_c(G)\,|V(H)|, e_c(H)\,|V(G)|\}$$

6. Let $G$ and $H$ be graphs of order n and m respectively such that $e_c(G)$ and $e_c(H)$ exist. Then

$$e_c(G[H]) \leq m(n - e_c G) + e_c(H)(n - 2(n - e_c G))$$

7. Let $G$ and $H$ be graphs without isolated vertices. Then

$$e_c(G[H]) \le e_c(G)|V(H)| \text{ and } e_c(G[H]) \le e_c(H)|V(G)|$$

8. Let $G$ be a graph of order $n$ without isolated vertices. If $G$ contains a spanning path, then $e_c(G) = \lceil n/2 \rceil$.

.9. Let $G$ be a nontrivial connected graph. Then $e_c(G) = |E(G)|$ if and only if $G$ is the star $K_{1,|E(G)|}$.

**Keywords:** edge cover, edge covering number, sum, Cartesian product, composition, spanning

**CMPSD No. 29**

## ANOTHER LOOK AT THE CONVEXITY IN GRAPHS

**Ladznar Laja and Sergio R. Canoy, Jr.***

Department of Mathematics
MSU-Tawi-Tawi, Tawi-Tawi, Sulu
Department of Mathematics
MSU-IIT, Iligan City 9200, Philippines
csm-src@sulat.msuiit.edu.ph

The concept of convexity in graphs is discussed in the book by Buckley and Harary. This concept was also investigated by Harary and Nieminen. For a nontrivial connected graph G, Chartrand, Wall and Zhang defined the convexity number of G, denoted by con(G), as the maximum cardinality of a proper convex set in G; that is,

$$\text{con}(G) = \max \{ |C| : C \text{ is convex in } G \text{ and } C \subset V(G) \}.$$

A convex set C in G with $|C| = \text{con}(G)$ is called a maximum convex set. The concepts of convex set and convexity number were also investigated recently by Canoy and Garces. They characterized convex sets in the join, composition, and the Cartesian product of two connected graphs and then determined their respective convexity.

In this paper, we characterize the convex sets in the corona of graphs, the conjunction of graphs, and in the graphs obtained from the complete graph by deletion of proper complete sub-graphs. Further, we determine their corresponding convexity numbers and the convexity numbers of the wheel, generalized wheel, and the gluing of some graphs.

**Keywords:** graph, convex, maximum convex set, convexity number, corona, conjunction

**CMPSD No. 30**

# ON CONVEX BASIC GRAPHS

**Sergio R. Canoy, Jr. and Severino V. Gervacio***

Department of Mathematics
MSU-IIT, Iligan City 9200, Philippines
csm-src@sulat.msuiit.edu.ph

Department of Mathematics
De La Salle University, Taft Avenue, Manila
gervacios@dlsu.edu.ph

Given a connected graph G, the distance d(x,y) is defined as the length of a shortest path connecting vertices x and y of G. Any x-y path of length d(x,y) is called an x-y geodesic. A subset C of V(G) is convex if for every pair of vertices x, y in C, the vertex set of every x-y geodesic is contained in C. The cardinality of a maximum convex proper subset of V(G) is called the convexity number of G and is denoted by con(G).

A graph G is convex basic if the convex subsets of the vertex set V(G) of G are all trivial, that is, either a empty, a singleton, a doubleton that forms an edge, or V(G). In this paper we give some characterizations of the convex basic graphs. Specifically, we will relate convex basic graphs with the concept of convexity number of a graph. Convex basic graphs resulting from the sum, composition, and Cartesian product of graphs are also characterized. Furthermore, in this study we show that for any positive integer p the set of all connected graphs with independence number p contains only a finite number of convex basic graphs and an infinite number of non-convex basic graphs.

**Keywords:** graph, convex, geodesic, convexity number, convex basic, independence number

**CMPSD No. 31**

# ON THE STRUCTURE OF THE SEDENION AND OCTONION LOOPS

**Raoul E. Cawagas*, **Sheree Ann Gutierrez, Emerson L Catalan, Shane Ganiron, Gerylyn M.Ganioco, Edna Lyn Victoria, Arriane M. Plegaria, Raphael E. Estores, Melvin J. Terrenal**

*SciTech R&D Center, **College of Science
Polytechnic University of the Philippines, Sta. Mesa, Manila

The sedenion loop $S_L$ is the loop of order n = 32 generated by the 16 basis elements of the sedenion algebra $S$. This real algebra $S$ is the Cayley-Dickson double of the octonion algebra $O$ (or Cayley numbers). It contains the octonions, quaternions, and complex numbers as subalgebras and as such it has a rich structure that is beginning to find numerous applications in both pure and applied mathematics as well as in theoretical physics. Because of this, several studies are now being undertaken to determine its properties and its relations to other mathematical structures.

This paper deals with the determination of the subsystem structure of the sedenion loop $S_L$ (using the software FINITAS) which contains the octonion loop $O_L$ of order m =16 as a subsystem. The result of this study has shown that $S_L$ has exactly 67 subsystems all of which are normal. Of these 15 are non-abelian NAFILs of order 16 (8 are isomorphic to $O_L$ and 7 to a new NAFIL loop), 35 groups of order 8 (isomorphic to the quaternion group), 15 groups of order 4 (isomorphic to the cyclic group of order 4), one group of order 2 (isomorphic to the cyclic group of order 2), and one of order 1 (the trivial group).

A very important finding is our ***discovery*** of a previously unidentified NAFIL (Non-Associative Finite Invertible Loop) of order 16. This loop has almost all of the properties of the octonion loop except that it does not satisfy the Moufang identity. Thus, we have called it the "pseudo-octonion loop." Its role within the sedenion algebra has been shown to be associated with the existence of its zero-divisors. ***This is a very significant contribution to the development of loop theory and non-associative algebras.***

**Keywords:** sedenion loop, sedenion algebra, octonion algebra, Non-Associated Finite Invertible Loop

**CMPSD No. 32**

# SPECIAL ISOTOPES OF THE CYCLIC GROUP $C_N$ AND THEIR USE IN THE CONSTRUCTION OF CERTAIN FACTORABLE GROUPS, LOOPS, AND QUASIGROUPS

**Raoul E. Cawagas[1]*, Valerie T. Hufano[2], Avgil P. Megino[2], Jadd Onasis C. Rabaya[2], Cinderella R. Zulueta[2]**

[1]SciTech R&D Center, [2]College of Science,
Polytechnic University of the Philippines, Sta. Mesa, Manila

The ***Cayley table*** of a finite group, loop, or quasigroup is a ***Latin square***. If we subject such a Latin square to a permutation of its rows, its columns, or its symbols (or any combination of the three operations) we obtain another Latin square called an ***isotope***. Thus, starting from a given Latin square, we can produce other Latin squares which are isotopes of the original one. These isotopes form an ***equivalence class***; and any one of these isotopes can be chosen as a representative of the class.

An analysis of the Cayley tables of composite groups of small order shows that most of them are built up of Latin square blocks that are isotopes of the ***cyclic group*** $C_n$ of order n. This is true, for instance, of the dihedral and dicyclic groups.

This study is concerned with the determination of certain special isotopes of the cyclic group $C_n$ of order n and their properties (using the software FINITAS) with the aim of compiling a library of such isotopes in the form of ***Latin square blocks.*** Using a method based on the ***block product method*** of constructing factorable finite algebras, we show how various finite groups, loops, and quasigroups can be constructed using such Latin square blocks. Moreover, we also show how the properties of these blocks determine the properties of the constructed systems. As an important example, we construct the octonion loop $O_L$ of order m = 16 using blocks belonging to the class of isotopes of the cyclic group $C_4$ of order 4.

**Keywords**: *Cayley table,* finite group, quasigroup, *Latin square*

**CMPSD No. 33**

## MEASURING DEVELOPMENTAL INSTABILITY IN DRAGONFLIES

**Mark Anthony J. Torres and Cesar G. Demayo**

Department of Biological Sciences
MSU-Iligan Institute of Technology

Developmental stability can be sensitive indicator of the physiological state of individuals in natural populations. As such, it has potential as indicator of environmental stress, and is inexpensive and easily measured. Dragonflies are indicators of environmental health as they are common inhabitants of freshwater streams, rivers, and other places where water can be found to lay their eggs and the development of nymphs under water. Development of nymphs can be affected by environmental stress and developmental stability is expressed by measuring fluctuating asymmetry (FA), the variance in random deviations from perfect bilateral symmetry. In these insects FA in wing cell characters have different "windows of opportunity" in relation to environmental stress.

Visualizing FA in this species of organisms involved the use of scatter plots of right side versus left sides of wing venational characters. Frequency distributions of wing character asymmetry (R-L) were employed to show whether the characters were asymmetric around zero. Kurtosis test statistics were employed to detect deviations of frequency distributions from normality in the direction of platykurtosis (broad-peaked or bimodal) and leptokutosis (narrow-peaked and long-tailed). This was done to detect the presence of antisymmetry. Significance tests for difference between the right and left sides of wing venational characters through ANOVA of |R-L| variation was also done. Scatter plots of trait FA |R-L| versus trait size among the eight species of dragonflies was plotted to detect size-dependency of FA levels. Several FA measures were employed including mean trait asymmetry [mean(R-L)], [mean(|R-L|)/((R+L)/2] and [mean|R-L|/mean((R+L)/2], between-sides variance [var(R-L)] and average sum of mean squared deviations from symmetry ("(R-L)$^2$/N).

Results showed that wing venational characters of the eight species of dragonflies were asymmetric around zero and the frequencies of the deviation from symmetry for each character (R-L) were normally distributed as shown by the kurtosis test statistics. Not all characters showed significant deviations from symmetry and FA levels differed between and among the characters

considered. The results also indicated size-dependent trait FA with higher character asymmetry in *N. palliata*, which has higher meristic counts compared to the other species. Differences in FA levels between agricultural and natural populations of dragonflies were also observed indicating that FA can explain developmental instabilities, character-specific homeostasis and organism-wide homeostasis and can be utilized in investigating effects of environmental stress to living organisms.

**Keywords:** physiological state, fluctuating asymmetry, , deviations, ANOVA, dragonflies, homeostasis

**CMPSD No. 34**

## SOLVING HARD COMPUTATIONAL PROBLEMS BY *IN SILICO* MOLECULAR CATALYSIS

**Jaderick P. Pabico[1]*, Elmer Rico-E. Mojica[2], Jose Rene L. Micor[2] Alejandro Q. Nato Jr.[3] and Custer C. Deocaris[3]**

[1] Institute of Computer Science and [2] Institute of Chemistry,
College of Arts and Sciences
University of the Philippines Los Banos, College 4031, Laguna, Philippines
[3] Nuclear Biotechnology Laboratory, Philippine Nuclear Research Institute
Department of Science and Technology, 1101 Quezon City, Philippines
jadepabico@yahoo.com

Enormously difficult computational tasks are now hallmarks of several newly emerged disciplines such as molecular genetics (genomics), information technology among others. The combinatoric nature of solutions varies with operand complexities and grows exponentially with the size of the problem thus making it impossible to draw solutions within a reasonable time frame. This paper describes a computational approach inspired by molecular catalysis. A distributed stochastic algorithm simulates reaction systems wherein molecules (data) and the interactions (reactions) among them are driven by an algorithm. Tested by solving in tandem with deterministic algorithms, this novel method was demonstrated to have superior processing rate for the combinatronics of radiation hybrid (RH) mapping of the human genome, finding the Hamiltonian cycle of the traveling salesman and resource retrieval in the world wide web.

**Keywords:** combinatorial problems, metaheuristics, radiation hybrid mapping, traveling salesman

**CMPSD No. 35**

# CHARACTERIZATION OF NON-ABELIAN NAFIL LOOPS OF ORDER 7

**Eric Ramos*Josephine A. Tolentino, Jay-R A. Manamam, Rafael Alejandre, Jan Jade S. Fernandez, Raoul E. Cawagas**

SciTech R&D Center, Polytechnic University of the Philippines, Sta. Mesa, Manila

A non-associative finite invertible loop (NAFIL) is a loop in which every element has a unique two-sided inverse. NAFIL loops form a class that includes the familiar Moufang, Bol, and IP loops with many applications in both pure and applied mathematics as well as in theoretical physics.

In 1999, all non-isomorphic NAFIL loops of orders 5, 6, and 7 were determined for the first time by PUP researchers using the program SEM/SATO in collaboration with Prof. Hantao Zhang of the University of Iowa, U.S.A. The result of this determination showed that: there is exactly one NAFIL of order 5 (non-abelian), 33 of order 6 (7 abelian and 26 non-abelian), and 2,333 of order 7 (16 abelian and 2,317 non-abelian).

The NAFIL loops of orders 5, 6, and 7 (abelian) were then characterized in 2001 using the software FINITAS Version 1.1X. Because of the limitations of Version 1.1X of FINITAS, the 2,317 non-abelian NAFIL loops of order 7 were not successfully characterized.

This paper deals with the characterization of all non-abelian NAFIL loops of order 7 (using the latest version of the software FINITAS V1.1) in terms of their *Basic Properties* and *Special Properties*.

**Keywords:** NAFIL, non-isometric loop, non-Abelian

**CMPSD No. 36**

# VERTEX COVER OF THE PRODUCT AND SUM OF GRAPHS

**Joselito A. Uy* and Lopito C. Eguia****

*Department of Mathematics, MSU-Iligan Institute of Technology,
9200 Iligan City
**Department of Mathematics and Statistics,
University of Southern Mindanao, Kabacan, Cotabato

Let $G$ be a graph. A set $U$ of vertices in $G$ is a *vertex cover* of $G$ if every edge in $G$ is incident with a vertex in $U$. The *vertex covering number* of $G$. denoted by $\alpha(G)$, is given by $\alpha(G) = \min\{|U| : U \text{ is a vertex cover of } G\}$. The vertex covering number of the product of two graphs is at least equal to the product of the order of one of the graphs and the vertex covering number of the other graph. For the planar grid $P_m \times P_n$, the prism $C_m \times P_n$, and the $n$-cube $Q_n$, we have

$$\alpha(P_m \times P_n) = \lfloor mn/2 \rfloor,\ \alpha(C_m \times P_n) = n\lceil m/2 \rceil,\ \text{and } \alpha(Q_n) = 2^{n-1}.$$

If $G_1, G_2, \ldots, G_m$ are graphs of orders $n_1, n_2, \ldots, n_m$, respectively, then

$$\alpha\left(\sum_{i=1}^{m} G_i\right) = \sum_{i=1}^{m} \alpha(G_i) + \sum_{i=1}^{m} [n_i - \alpha(G_i)] - \max\{n_i - \alpha(G_i)\}_{i=1}^{m}.$$

In particular, $\alpha(K(p_1, p_2, \ldots, p_n)) = \sum_{i=1}^{n} p_i - \max\{p_1, p_2, \ldots, p_n\}$

for the complete $n$-partite graph $K(p_1, p_2, \ldots, p_n)$.

**Keywords**: vector cover, vector covering number, product of graphs, sum of graphs

## *ENGINEERING SCIENCES AND TECHNOLOGY*

**ESTD No. 1**

# DEVELOPMENT OF COMPUTER-BASED MATHEMATICAL MODELS FOR ESTIMATING GROUNDWATER RECHARGE IN SHALLOW AQUIFERS

**Nathaniel R. Alibuyog*[1] and Victor B. Ella[2]**

[1]Department of Agricultural Engineering, College of Agriculture and Forestry
Mariano Marcos State University, Batac, 2906 Ilocos Norte
e-mail: natzalibuyog@yahoo.com
[2]Land and Water Resources Division, Institute of Agricultural Engineering
College of Engineering and Agro-Industrial Technology
University of the Philippines Los Baños, College, 4031 Laguna

Increased reliance on groundwater necessitates improved aquifer management. Quantification of the rate of groundwater recharge is an important step for efficient and sustainable groundwater resource management. This study was carried out to develop mathematical models for estimating groundwater recharge based on the concept of a leaking bucket and groundwater level fluctuation and to evaluate the applicability of these two models in simulating groundwater recharge. The mathematical formulations of the two models were programmed in Visual Basic to provide a user-friendly platform of the two models. The two models were calibrated and validated using years with adequate groundwater data from shallow aquifer.

Simulation results showed that both models exhibit adequate capability to simulate groundwater recharge in shallow aquifers. During the four-year simulation period, the leaking bucket model adequately replicated the observed groundwater level data in the area with an overall coefficient of model efficiency of 77%. Groundwater recharge estimates ranged from 426 mm to 668 mm and 234 mm to 400 mm using the leaking bucket and groundwater level fluctuation model, respectively, constituting approximately 23% to 41% and 14% to 26% of the annual rainfall in the area, respectively. The groundwater recharge estimates of the two models were significantly different ($p<0.001^{**}$) but they were significantly correlated ($r=0.972^{*}$), indicating consistency in results.

**Keywords**: Groundwater level fluctuation model, groundwater recharge, leaking bucket model, modeling, shallow aquifer

**ESTD No. 2**

# DEVELOPMENT OF LOW-FIRE PARIAN PORCELAIN USING ILOCOS NORTE RAW MATERIALS

**Ben Ezra P. Apollo* and Marie Fe Galacgac**

Department of Ceramic Engineering
College of Engineering, Mariano Marcos State University
2906 Batac, Ilocos Norte
Email: bepa_mmsu@hotmail.com

Parian porcelain is a vitrified whiteware characterized by extreme translucency giving the appearance of marble. Its principal raw material is feldspar constituting up to 90% of the batch and it has no silica quartz.

A binary formulation study using Pasuquin feldspar and Pasaleng white clay was conducted to develop Parian porcelain. Pasuquin feldspar was beneficiated through magnetic separation while Pasaleng white clay was elutriated to remove unwanted impurities. Chemical analysis of the beneficiated raw materials was done.

The test specimens were formed by slip casting and were oven dried at 110 °C. The dried specimens were bisque fired at 900 °C. A borosilicate glaze was applied to the bisque specimen through dipping and then glost fired at 1000-1200 °C.

Physical analysis, particularly castability, shrinkage, water absorption, porosity, modulus of rupture, degree of vitrification, translucency, and color showed that a body formulation consisting of a mixture of 75% Pasuquin feldspar, 21% Pasaleng white clay, 4% Calcium carbonate and 0.1% Cobalt sulfate glost fired at 1150 °C results in properties comparable to that of an ideal soft porcelain.

Bench scale production was conducted to validate the results of the development study. Results showed that the developed technology to produce Parian porcelain can be replicated as the product exhibit consistently the same physical properties.

**Keywords:** porcelain, Parian, low-fire, beneficiation, ceramics, Ilocos raw materials, glaze, slip casting

**ESTD No. 3**

# REGENERATION OF USED TRANSFORMER OIL BY ADSORPTION USING ACTIVATED CARBON

**Myra G. Borines, Robyn Joy C. Alcanzare, Rex B. Demafelis Sixto A. Valencia, Jovita L. Movillon and Henry R. Libit**

Department of Chemical Engineering
CEAT-University of the Philippines Los Baños, College, 4031 Laguna

The performance of transformer oil as insulator is greatly affected by relatively small amounts of impurities. Replacement with fresh oil is necessary even though degradation of the oil is minimal. In the Philippines, prolonged storage is the only option for disposal of used transformer oil. In South Luzon alone, estimated amount of 3750 cu meters of used transformer oil is being disposed annually. Recycling of transformer oil is therefore a good option because the waste oil is still in good quality.

The effectiveness of activated carbon as an adsorbent for the regeneration of used transformer oil was investigated. The effects of agitation rates (100, 150, and 200 rpm) and temperatures (30°C, 40°C, and 50°C) on the reduction of coloring matter and carboxylic acids were determined. Insulating property (dielectric breakdown voltage) of the treated used-transformer oil and untreated oil was analyzed.

Percentage removal of carboxylic acids increased from 43.44% to 93.14% with increase in agitation rates from 100 rpm, to 200 rpm. Adsorption rate constants ($hr^{-1}$) were found to be higher at faster agitation rates with 0.0533, 0.0981, and 0.986 at agitation rates of 100 rpm, 150 rpm and 200 rpm, respectively. Pore diffusion constants at agitation rates of 100 rpm, 150 rpm and 200 rpm were 0.00137, 0.002658, and 0.006767, respectively.

Increase in temperature does not favor the adsorption of carboxylic acids and coloring matter. A decrease in the removal of carboxylic acid from 69.05% at 30°C to 37.5% at 50°C was observed. The rate of adsorption also decreased with increase in temperature from 30°C to 50°C.

The insulating capacity of used transformer oil was greatly enhanced after treatment with activated carbon. Percentage increase in dielectric breakdown voltage reached up to 66.12% and 81.4% at temperatures of 30 °C and 50 °C, respectively.

**Keywords:** transformer oil, oil, activated carbon, carboxylic acids

**ESTD No. 4**

# ORGANIC BUILDER: A JAVA PROGRAM THAT DISPLAYS THE 3-D MOLECULAR STRUCTURE OF AN ORGANIC COMPOUND GIVEN ITS I.U.P.A.C. NAME

**Richard Bryann Chua*, Ma. Sheila Magboo, Noel Quiming**

University of the Philippines Manila
Email: richard_bryann.chua@up.edu.ph

Nomenclature is one of the difficult topics to understand in organic chemistry. To help students understand this better, OrganicBuilder was developed to aid them. This was developed using the Java programming language. It uses a deterministic finite automaton (D.F.A.) in determining whether the organic compound name input is a valid International Union of Pure and Applied Chemistry (I.U.P.A.C.) name. At the same time the name is being checked, information is also being gathered about the compound such as whether it is an alkane, alkene or alkyne, the number of carbon present and the type of bond present between two atoms. After all the required information has been gathered, the ball-and-stick model of the organic compound input is displayed and all the relevant information such as the bond length and bond angle is also incorporated into the model. The user is free to rotate and move the model so he can clearly visualize the molecular structure from any angle. The module for displaying the molecular model was developed with the Java 3D Application Programming Interface (A.P.I.). With this software, the students can understand nomenclature better by showing the model of a particular organic compound from just its I.U.P.A.C. name input.

**Keywords:** nomenclature, model, ball-and-stick model, D.F.A., Java, Java 3D API

**ESTD No. 5**

# A COMPARATIVE STUDY OF SELECTED COMMERCIAL STRUCTURAL CLAY BRICKS IN VIGAN CITY, ILOCOS SUR AND IN SAN NICOLAS, AND PAOAY, ILOCOS NORTE USING S. E. M.

**Rodrigo V. Dejeto**

Department of Ceramic Engineering, College of Engineering
Mariano Marcos State University, 2906 Batac, Ilocos Norte
Email: rod_dejeto@yahoo.com

Ilocos Sur and Ilocos Norte are among the provinces in Northern Philippines known for time-honored manufacturing of structural clay bricks.

Locally manufactured commercial structural clay bricks (CSCB) were collected from selected local manufacturers in Vigan City, Ilocos Sur and in San Nicolas, and Paoay, Ilocos Norte.

The CSCB samples were broken along their traverse flat surfaces. The freshly fractured surfaces and the microstructure were then examined using JSM-35C Scanning Electron Microscope (SEM) with setting at 20 to 25 KV and the spot magnification of 1000X mag. SEM photomicrographs were taken and evaluated.

Results show that the CSCB of Vigan City, Ilocos Sur have evidences of open pores, microcracks and compact granulated particles at varying locations. In comparison, the CSCB of San Nicolas, and Paoay, Ilocos Norte photomicrographs reveal nodular, varnish-like surfaces, clayey masses and conchoidal to uneven or earthly fractures. The different microstructures captured by SEM were attributed to the types of raw materials used, methods of forming and firing.

**Keywords:** structural clay bricks, microstructures

**ESTD No. 6**

# FORMULATION OF CERAMIC GLAZES USING INDIGENOUS CERAMIC RAW MATERIALS FOUND IN ILOCOS REGION

**Rodrigo V. Dejeto**

Department of Ceramic Engineering, College of Engineering
Mariano Marcos State University, 2906 Batac, Ilocos Norte
rod_dejeto@yahoo.com

Glazes were formulated using tri-axial diagram based on ideal glaze formulation with 15% Clay (Lubbot, Batac Clay), 30% Flint (Pasuquin Red Silica, Calacal Asbestine and Lahar), 55% Fluxes (Tumeditedted, Batac limestone, banana leaves ash, wood ash, BaCO3, ZnO and red lead) by weight, and varies into 14 different glaze formulations.

The mixtures were ground and mixed with sufficient amount of water in 1:1 water: glaze composition ratio and aged for several days. The formulated glaze slip was applied to earthenware bodies (70% Lubbot, Batac Clay and 30% Lahar), both mono and fired bodies.

The Limberg Blue electric furnace was used with settings at 24.21°C/min ramping rate ($r_1$) until 456°C and dwelling time ($d_1$) of 120min. The firing temperatures were 1000°C, 1050°C and 1100°C respectively with 8.99°C/min ramping rate ($r_2$) and dwelling time ($d_2$) of 90 min.

Results show that a firing temperature at 1000°C produced underfired and pre-matured glazes. The presence of pin holes, bursting and crawling was evident. On the other hand, glazes fired at 1050°C and 1100°C yielded satisfactory results basically for those glaze formulations with 30% lahar and produced glossy, bright and transparent glazes with minimal glaze defects.

**Keywords:** ceramic glazes, indigenous, tri-axial diagram, firing

**ESTD No. 7**

# BIOAUGMENTATION OF TRICKLING FILTER FOR DOMESTIC WASTEWATER TREATMENT

**Rex B. Demafelis, Bayani M. Espiritu, Ronald R. Navarro, Renacel P. Promentilla and Aldrin B. Bellen**

Department of Chemical Engineering
CEAT-University of the Philippines Los Baños, College, Laguna

Biological treatment is widely used to remove biologically degradable substances in wastewater. It also partially or completely stabilizes such substances. Trickling filter is a biological waste treatment process which is considered as a secondary treatment facility mainly used to remove organic matter present in wastewater. On the other hand, bioaugmentation, that is, applying selectively adopted microbial cultures tailored to a specific contaminant, in an existing biological system, has been one of the progressive developments in wastewater engineering.

Three bioaugmentation applications were conducted by applying the inoculant on the filter media. The amount of inoculant was about 102g (2% of the bed contact volume). Corresponding percent COD removals were determined every four hours for the first 12 hours and every 12 hours there after. When the removal approached the efficiency observed (~55%) at conventional operation, the inoculant was reapplied

For all applications, a maximum treatment efficiency of at least 70% was established within 4 to 8 hours after the inoculant has been applied and has reached about 55% after 36-48 hours of application. After 24 hours, removal of almost 60% was observed indicating that the inoculant still had a considerable effect on the treatment efficiency. The optimum-dosing interval was therefore taken after 36 hours of application and that beyond this period it was necessary to reapply the inoculant to achieve the maximum treatment efficiency of at least 70%.

Varying COD removals of at least 50% for a range of COD loading rate of 1.56 to 1.81 kg/m$^3$h were observed for conventional operation subjected at nearly the same volumetric flowrate. Likewise, the bioaugmented process achieved treatment efficiencies of at least 70% fluctuating at the COD loading rate range of 1.39 to 1.79kg/m$^3$h. The experimental data available provided insufficient evidence that for a particular range of COD loading rate for both the

conventional and bioaugmented trickling filter processes, the increase in organic load significantly dictated the change in treatment efficiency. The data were then pooled to arrive at a maximum 54.19% COD removal achieved by the conventional operation regardless of the differences in organic load, provided however that this load does not exceed 2.00 kg/m³h. Given the same condition, this efficiency was improved to 71.93% when bioaugmentation was applied. When the COD loading rate was increased beyond 2.00 kg/m³h, both processes exhibited decreasing efficiencies until the facility approached equilibrium COD that was the minimum percentage or fraction of the influent COD the filter could treat. The minimum fractional COD removal established by conventional operation at 0.22 was improved by bioaugmentation to 0.28. This entails that with the application of the inoculant, the facility could handle higher organic load or stronger wastewater strength.

**Keywords:** bioaugmentation, trickling filter, biological treatment, wastewater

**ESTD No. 8**

## DEVELOPMENT OF CONTROLLED RELEASE FERTILIZERS FOR THE LAHAR AFFECTED AREAS AND COARSE TEXTURED SOILS

**L. G. Dominguez[1], J.L. Pondevida*[1], C. P. Aganon*[2], M. B. Carandang*[1] U. Cargado*[1], A. G. Mactal*[2], H. A. Matulac*[1] & R. B. Baaco*[1]**

[1]Industrial Technology Development Institute, CMD Bldg., DOST Complex Gen. Santos Avenue, Bicutan, Taguig, 1631 Metro Manila
[2]Central Luzon State University, Science City of Muñoz,, Nueva Ecija

The lahar-affected area in Central Luzon requires heavy application of chemical fertilizers in order to regain its productivity. Heavy application of fertilizers is necessary to overcome the heavy losses due to leaching. Therefore, a controlled-release fertilizer (CRF) is an excellent alternative for conventional and soluble fertilizers.

Controlled release fertilizers (CRF) developed are coated urea, coated di-ammonium phosphate (DAP), coated potassium chloride (KCl) and coated complete or nitrogen (N), phosphorus (P), potassium (K). Coated Urea contains 37-38% N; Coated KCl contains 42-55% $K_2O$; Coated DAP contains 14% N and 30% $P_2O_5$ and Coated complete fertilizer contains 15% N, 13% $P_2O_5$ and 18% $K_2O$.

The sources of major nutrients are conventional fertilizers such as urea, muriate of potash and di-ammonium phosphate. Conventional fertilizers were granulated with soil conditioner and binder. The pre-coated granules were coated with used "strofoam" materials" by the botom spray coating fluidized bed apparatus.

The study on coating process explores appropriate operating conditions, different coating solutions, concentration and amount of coating solutions. The operating conditions such as flow rate of coating solution, the velocity of fluidizing air, coating temperature, drying time and coating technique had been established.

Coated products were subjected to dissolution tests at different temperatures to determine the duration of nutrient release. The release period attained at ambient temperature (30-37°C) ranged from 90 to 100 days and faster nutrient release rate were observed at temperatures 50° and 70°C.

A cheaper controlled release fertilizer that costs about P30-52/kg was developed compared to the commercial CRF that costs P176-192/kg.

The initial result of efficacy test of the CRF products in lahar affected areas planted to rice, tomato and onion reveals a 77-92% fertilizer efficiency and increased crop yield.

**Keywords:** controlled-release fertilizer, conventional fertilizer, bottom spray coating fluidized bed, dissolution test, efficacy test

**ESTD No. 9**

## COLOR REMOVAL OF DISTILLERY BIODIGESTER EFFLUENT BY FLOCCULATION USING MALUNGGAY (*Moringa oleiferea*) SEED EXTRACT

**Ronald R. Navarro, Angeli Guillermo and Fidel Rey P. Nayve Jr.**

Department of Chemical Engineering
CEAT-University of the Philippines Los Baños, College, 4031 Laguna

Distillery biodigester effluent is a pollution problem in the Philippines today because of its extremely high BOD content and dark color. The residual brownish color is attributed to polymeric pigments, collectively known as melanoidin. Existing methods of coagulation, flocculation, and sedimentation

with the aid of inorganic coagulants such as aluminum sulfate and ferric salts to decolorize the effluent may be inappropriate for our local distilleries because of their high cost in addition to the inherent sludge-handling problem. In this work therefore, the ability of an inexpensive substitute coagulant derived from malunggay seeds (*Moringa oleifera*) for treatment was evaluated. The malunggay seeds contain water-soluble proteins with an overall positive charge that make it act similarly to inorganic coagulants in coagulating negatively charged melanoidin polymers by the mechanism of charge neutralization.

Coagulant solutions were prepared by mixing a measured amount of dried and pulverized malunggay seeds with distilled water and then allowing the mixture to stand for 30 minutes. The resulting mixture was then filtered and the filtrate was collected and used for coagulation experiments. Results showed that addition of malunggay seed extract in the distillery slops resulted in the formation of brownish flocs and the subsequent decolorization of the filtrate. The coagulant dosage and initial pH of the distillery slops affected the decolorization efficiency. In general, the pH determines the charge speciation of both melanoidin and the coagulating proteins in malunggay extract, thus, affecting treatment performance. At the existing pH of the distillery slops (pH 8) and a coagulant dosage of approximately 2.5% (w/v malunggay seeds), decolorization was found to be 83%. This result is comparable with that of existing treatment processes utilizing inorganic coagulants but at a much lower cost. Furthermore, flocs formed by this method are more safe to handle due to their purely organic content, which allows for their possible use as feeds and fertilizer components.

**Keywords:** distillery slops, *Moringa oleifera*, coagulation, wastewater treatment

**ESTD No. 10**

# VIRTUAL CLASSROOM IN GENERAL CHEMISTRY

**M. S. A. Magboo *, N. Quiming, A. P. Munar, J. C., Hubac, R. U. Reyes**

Department of Physical Sciences and Mathematics
College of Arts and Sciences, University of the Philippines Manila
Email: nelyndron@vasia.com

The traditional mode of learning characterized by a typical classroom setting wherein the teacher explains in front of students who, at the same time, take down notes, is an effective way of imparting knowledge to students. However, with the advancement in information technology (IT), learning can be greatly improved. Incorporation of IT in the classroom can make learning of difficult subjects such as General Chemistry more interactive and enjoyable. Thus, at the College of Arts and Sciences, University of the Philippines Manila, two units from the Department of Physical Sciences and Mathematics (DPSM), namely, the Mathematics and Computing Sciences Unit, and the Chemistry Unit, collaborated in order to create a working online lecture guide in General Chemistry. This project was entitled Virtual Classroom in General Chemistry.

Virtual Classroom in General Chemistry was intended not to replace but only to supplement the traditional mode of learning. It is already a working system whose contents are authored by a General Chemistry teacher from the DPSM Chemistry Unit. Its syllabus is based on the current Chemistry Module of the Natural Sciences I (NAT SCI I) subject offered at the University of the Philippines Manila hence contains a comprehensive set of topics that should be included in any General Chemistry course. It features a table of contents, introduction to each topic, subtopics, and associated illustrations and animations. Any General Chemistry teacher who is subscribed to the system can adopt the syllabus provided by the author and expound on the concepts by allowing him to upload additional supplementary learning files and exam questions especially made for his set of students. It also has an email feature to help sustain student-teacher communication even outside the classroom. Students can likewise browse and download lectures, and assess their understanding by allowing them to take exams then view their exam scores online.

The project's website is at http://csdev.cas.upm.edu.ph/virtual.

**Keywords:** distance learning, virtual classroom

**ESTD No. 11**

# FLOCCULATION OF COPPER(II) FROM WASTEWATER BY POLYELECTROLYTE COMPLEX FORMATION OF *Rhizobium sp.*. EXOPOLYSACCHARIDE (EPS) AND MALUNGGAY SEED EXTRACT

**Alex V. Anonas[1], Ronald R. Navarro[1], Estella Paner[2] and Fidel Rey P. Nayve Jr.[2]**

[1]Department of Chemical Engineering
[2]National Institute of Molecular Biology and Biotechnology (BIOTECH)
University of the Philippines Los Baños, College, Laguna, Philippines

Accumulation of toxic heavy metals in the environment greatly threatens public health. Conventional heavy metal removal techniques are greatly expensive and potentially risky due to hazardous by-products generation.

In this work, the potential of *Rhizobium sp.* (BJVR-12) exopolysaccharide (EPS) in combination with cationic polyelectrolytes derived from malunggay (*Moringa oleifera*) seed extract for $Cu^{2+}$ removal by polyelectrolyte complex formation was investigated. Qualitative evaluation of the process revealed that malunggay seed extract enhanced the flocculation of EPS-heavy metal complex. Results showed that heavy metal removal was influenced by the EPS/malunggay extract ratio and pH. Copper removal was most significant at pH 5. For synthetic wastewater, maximum $Cu^{2+}$ removal efficiency was 0.417 mg EPS/mg malunggay seed extract. Likewise, maximum $Cu^{2+}$ sequestration was 0.556 mg EPS/mg malunggay seed extract for actual wastewater sample. At optimum EPS/ malunggay seed extract mass ratio, the COD of the filtrate was found minimum.

Using these operating parameters, close to 100% $Cu^{2+}$ removal was achieved for both synthetic and actual wastewaters with increasing EPS concentration. Effluent regulatory standards for pH and residual copper concentration were met. Furthermore, flocs were firm and the supernatant was clear and easily filterable. The maximum adsorption capacity (Langmuir approximation) for EPS on synthetic wastewater was 48.3 mg $Cu^{2+}$/g EPS and 62.5 mg $Cu^{2+}$/g EPS for actual wastewater with stability constants of 0.42 and 0.36 L/mg for synthetic and actual wastewater, respectively.

**Keywords:** Copper(II); exopolysaccharide (EPS); flocculation; polyelectrolyte; wastewater treatment

**ESTD No. 12**

# MINERAL IDENTIFICATION OF SELECTED ILOCOS NORTE CERAMIC RAW MATERIAL DEPOSITS USING THEIR INTERNAL MICROSTRUCTURE

**Dionesio C. Pondoc**

Department of Materials Science and Engineering, College of Engineering
Mariano Marcos State University, Batac, 2906 Ilocos Norte
Email: dcpdondon@digitelone.com

The vast deposits of non-metallic minerals in Ilocos Norte like clay and feldspar are potential raw materials for the production of good quality ceramic products. To enhance the utilization of these clay and feldspar deposits, their mineralogical component should be identified.

Mineral identification of some selected Ilocos Norte ceramic raw material deposits was conducted by taking photomicrographs of their internal microstructure using JEOL JSM-35C Scanning Electron Microscope (SEM). The samples investigated in this study were white clay (from Pagudpud and Solsona) and feldspar (from Pasuquin) deposits. Representative test specimens in the form of powder (passing 200 mesh screen) from the samples were prepared. Each specimen was mounted in an 8 mm diameter copper metal holder by scattering the powder on one side with double sided adhesive tape and was coated with gold-palladium by ion sputtering method. Photomicrographs obtained from the sample of each material were carefully evaluated as regard to their internal microstructure and compared with the standard reference data on mineralogy for the identification of their mineral constituents.

Based on the comparative evaluation study, the mineral constituent in the clay samples were identified to be mostly of kaolinite and halloysite type of clay mineral together with quartz as the impurity. For the feldspar sample, the abundant presence of albite and orthoclase type of feldspar mineral together with free quartz was determined. Thus, clay and feldspar samples were found to be suitable for use in the production of ceramic white ware and fireclay refractory.

**Keywords:** Scanning Electron Microscope (SEM), mineral constituent, photomicrograph, internal microstructure

**ESTD No. 13**

# PHOSPHORIC ACID ACTIVATION OF CORNCOBS

**Sixto A. Valencia, Jovita L. Movillon, Myra G. Borines and Ariz C. Lorenzana**

**Department of Chemical Engineering**
**CEAT-University of the Philippines Los Baños, College, Laguna**

The purpose of this study was to determine if activated carbon from corncobs using phosphoric acid, has an acceptable quality that can be used in simple industrial processes.

The adsorption characteristics of untreated and chemically activated corncobs using 25% and 50% phosphoric acid at impregnation times of 2, 4 and 6 hours, were investigated. Electron micrographs of the raw, charred, untreated and chemically treated activated corncobs and their corresponding pore sizes and iodine number, were evaluated.

Micrographs showed that the activated corncobs treated with phosphoric acid produced larger pores. The treatment increased the adsorptive capacity of the activated corncobs. The iodine number of the untreated sample, activated corncobs treated with 25% and 50% phosphoric acid, were 373.64 mg/g, 557.22 mg/g and 664.51 mg/g, respectively. Increase in the impregnation time of activated corncobs soaked in 50% phosphoric acid also increased the iodine number with values of 572.49 mg/g, 620.02 mg/g and 664.51 mg/g for 2 hours, 4 hours and 6 hours, respectively.

The maximum adsorptive capacities of the activated corncobs for decolorizing basic methylene blue dye were also determined. The highest color removal occurred with the activated corncobs soaked for 6 hours in 50% $H_3PO_4$, and the lowest for the untreated corncobs. As the treatment concentration and soaking time was increased, the activated corncobs produced became more efficient in removing colorants from the dye solution.

**Keywords:** activated charcoal, corncob, adsorptive capacities, basic methylene blue dye

**ESTD No. 13**

# IMPACT AND COMPRESSION RESSITANCE OF YOUNG COCONUT

**A. Pascua[1], K. F. Yaptenco*[2], E. K. Peralta[1]**

[1]Agriculture and Bio-Process Division, Institute of Agricultural Engineering, College of Engineering and Agro-Industrial Technology, University of the Philippines Los Baños, Laguna 4031.
[2]Postharvest Horticulture Training and Research Center, College of Agriculture, University of the Philippines Los Baños, Laguna 4031; Email phtrc@laguna.com

Young coconut is consumed in many hotels and restaurants, and is being exported in minimally processed form. During processing, the green peel is removed and the exposed husk is carved to enhance its visual appeal. Mishandling can cause bruising of the husk, reducing the quality of the product and increasing rejects during processing. The study aimed to determine threshold levels for impact and compression stress of young coconut for different impact surfaces, drop heights and static loading patterns. Threshold values for two impact surfaces (compact soil and concrete) were determined for different drop heights (15 – 120 cm). Compression resistance of whole samples was determined by creep test using different static loads (75 – 225 kg) and compression times (3, 6, 9 hr). Drop tests on soil and concrete surfaces showed that drop height had the greatest effect on both bruise depth and volume. Bruising developed to a greater degree in samples dropped on concrete, with incidence of 100% regardless of height. Bruising incidence for samples dropped on soil increased with height. Setting the acceptable bruise depth to 1 cm, the allowable drop height for compact soil was 40 cm. Drop heights greater than 15 cm onto concrete produced bruises greater than 1 cm in depth. Bruise volume and depth were highly correlated with drop height for samples dropped on concrete ($r^2 > 0.93$). Correlation was lower ($r^2 > 0.54$) for samples dropped on soil, possibly due to variations in compaction. Permanent deformation was significantly related to static load and exposure time ($r^2 = 0.82$). The greatest deformation of 4 mm was observed after 9 hrs of exposure with a load of 225 kg. Impact stress produced deeper bruising compared to compression; hence greater care must be taken during harvesting and handling to reduce injury.

**Keywords**: impact, compression, threshold, bruising, young coconut

## *HEALTH SCIENCES*

HSD No. 1

# CHARACTERIZATION OF PLAQUE-PURIFIED DENGUE VIRUSES AS REAGENTS FOR IgM CAPTURE ELISA

**Corazon C. Buerano[1,2], Joanna Marie Guerra[1], Carol Z. Tanig[2], Joyce D. Reyes[2] Deu John M. Cruz[2], Ronald R. Matias[1,2], and Filipinas F. Natividad[2]**

[1]Institute of Biology, University of the Philippines, Diliman
[2]Research and Biotechnology Division, St. Luke's Medical Center, E. Rodriguez Blvd, Quezon City

Dengue virus antigen is one of the key reagents for IgM-capture ELISA, a method which is now widely used for detection of dengue infection. However, since this reagent is not commercially available, the laboratory where the test is done, has to produce the antigen in-house. In our laboratory, 11 plaque-purified dengue virus isolates - four DEN-1, four DEN-2 and three DEN-3 - were evaluated for their potential as antigen reagents. Dengue viruses were isolated by inoculating infected culture fluids into host *Aedes albopictus* C6/36 cells. The isolated viruses were serotyped by Reverse Transcription-Polymerase Chain Reaction. To produce the antigens, infected cells were maintained in Minimum Essential Medium with 2% fetal bovine serum and incubated at 28°C until the 12th day post inoculation. Evaluation of the antigens was done by 3 different methods: (1) determination of antigen titer by antigen sandwich ELISA, (2) monitoring of the presence of infectious virus particles by infectivity assay, and (3) construction of growth curves. Results showed that the peak of antigen production was on day 7 post-inoculation for DEN-1 isolates, day 6 for DEN-2 isolates, on day 12 for one Dengue 2 and all DEN-3 isolates. Highest titers were obtained for DEN-3 followed by DEN-2. This information helps determine the schedule of culture fluid collection, and which assay antigen is most useful for IgM-capture ELISA.

**Keywords**: Dengue virus, IgM capture ELISA, Plaque-purified viruses, antigen production, infectivity assay, growth curves

**HSD No. 2**

# ANTIMICROBIAL EFFECTS OF β-MONOGLYCERIDE FROM COCONUT OIL AND ITS POTENTIAL IN THE TREATMENT OF URINARY TRACT INFECTIONS

**Abigail P. Bantoc[1], Evangeline P. Capul[1],Prof. Sylvia A. Sustento*[1] Arsenia B. Sapin*[2], Fides Z. Tambalo*[2],Dr. Jose L. Diaz*[3]**

[1]Department of Biology, College of Arts and Sciences, University of the Philippines Manila, vanjcapul@yahoo.com
[2]National Institute of Molecular Biology and Biotechnology (BIOTECH) University of the Philippines Los Baòos
[3]Veterinary Inspections Board, City of Manila

β-monoglyceride (β-MG) is a macromolecule synthesized from coconut oil, freeze-dried BIOTECH lipase, and n-butyl alcohol. This research was conducted to determine the inhibitory effect of b-monoglyceride on the growth of *Proteus vulgaris, Enterococcus faecalis,* and *Candida albicans,* microorganisms which cause urinary tract infections (UTI), as well as to compare β-MG to that of commercially-available antibiotics namely Amoxicillin and Co-trimoxazole (Bactrim). It was also performed to assess the potential use of b-monoglycerides in the treatment of UTI in dogs. The antimicrobial assay using the broth dilution method was employed. It involved optical density determination and comparison with McFarland standards which gave an estimate of the microbial growth. A viable plate count employing the Miles and Mizrah method was performed. To test the potential of â-monoglyceride as a medication for the UTI, the *in vivo* section of this research involved the case study of dogs with UTI. These dogs were subcutaneously injected with β-MG given in 10 mg/kg dosage for five days. The effect of β-MG on the dogs was evaluated through White Blood Cell (WBC) count and urinalysis. The Minimum Inhibitory Concentration (MIC) was between 10 and 25 ppm for *P. vulgaris,* between 125 and 150 ppm for *E. faecalis,* and between 6000 and 8000 ppm for *C. albicans.* The Minimum Lethal Concentration (MLC) was 25 ppm for *P. vulgaris,* 150 ppm for *E. faecalis,* and 8000 ppm for *C. albicans.* For *P. vulgaris* and *E. faecalis,* there was 100% kill at 150 ppm β-MG, while 94.70% kill was the highest value achieved when treated with 500 ppm Amoxicillin and Bactrim. â-monoglyceride caused a decrease in the bacterial count from the urine samples and achieved a 43.65% decrease in the WBC count of the dogs with UTI. Therefore, â-monoglyceride is a potential antimicrobial agent against various pathogenic microorganisms which cause UTI.

**Keywords:** β-monoglyceride, β-MG, coconut oil, antimicrobial, urinary tract infections

HSD No. 3

# DIAGNOSING PULMONARY EMBOLISM USING ARTIFICIAL NEURAL NETWORKS

J. Y. Catanaoan[1], V. P. C. Magboo *[1,2]

[1] Department of Physical Sciences and Mathematics, College of Arts and Sciences,
University of the Philippines Manila
Email: nelyndron@vasia.com
[2] Department of Nuclear Medicine, St. Luke's Medical Center

Pulmonary Embolism (PE), an obstruction of pulmonary blood flow to the distal lung is a life-threatening condition causing chest pain and difficulty of breathing. Hence, prompt diagnosis is necessary so to render medical attention immediately. The standard way of diagnosing PE is through Lung Scintigraphy analyzed by Nuclear Medicine physicians. An expert system using artificial neural network (ANN) is created to diagnose PE with its probability based on Prospective Investigation of Pulmonary Embolism Diagnosis (PIOPED). A set of patients who underwent lung scan due to PE formed the training group while another set of patients formed the test group. None of the training group scans was included in the test group. The training group was trained by ANN using the back propagation method and Delta Rule while the test group was used to measure the performance of the expert system. All scans were examined independently by one expert nuclear medicine physician based on PIOPED criteria. The expert system is a standalone application with user-friendly interface. It shows all the 8 standard projections of lung scan. White spots and hot spots are detected and effectively reduced in the images to warrant more accurate diagnosis. Spaces around the lung images are also removed ensuring proper alignment of the ventilation and perfusion images to the template. Likewise, the system is able to quantify the mismatched between the ventilation and perfusion images. Based on the evaluation of the test group, the system is able to match the diagnosis of the expert physician by 80 %. The expert system can be used as a temporary substitute when there are no immediate help from expert physicians. It can also be used as a teaching tool by resident doctors training in radiology or nuclear medicine and is not meant to replace the expert physicians diagnosis.

**Keywords:** artificial neural networks, expert system, lung scan, pulmonary embolism

HSD No. 4

# THE VALIDITY OF A POLYMERASE CHAIN REACTION ASSAY IN THE DETECTION OF *MYCOBACTERIUM TUBERCULOSIS* IN LIVER BIOPSY SPECIMENS OF CHILDREN

**Josie Grace V. Causing[1], Alicia Cornista[2], Jose Maria Avila[4], Francisco Narciso[3], Filipinas Natividad[2], Germana V. Gregorio[1]***

[1]Department of Pediatrics, University of the Philippines-College of Medicine and Institute of Child Health, National Institutes of Health, University of the Philippines-Manila,
[2]Research and Biotechnology Division and [3]Institute of Pathology St Luke's Medical, Quezon City, Philippines
[4]Department of Pathology, College of Medicine, University of the Philippines-Manila

Childhood hepatic tuberculosis remains a diagnostic dilemma as conventional bacteriologic methods has a low sensitivity for detection of *Mycobacterium tuberculosis.*

This study was done to determine the validity of a PCR assay of the IS6110 gene and 38kDa protein to detect *M. tuberculosis* in liver biopsy specimens of children.

Eighty consecutive children admitted for percutaneous liver biopsy for various indications were included in the study. Patients were divided into those with hepatic tuberculosis (n=12) and those with other liver disorders (n=68). Liver biopsy specimens obtained underwent acid-fast stain and culture, histopathology and PCR assay using the IS6110 gene and 38kDa protein.

The sensitivity of the PCR of the IS6110 gene and the 38kDa protein in detecting *M. tuberculosis* in liver biopsy samples was 50% and 8%, respectively; specificity was 47% and 81%, respectively. Our study shows that the PCR assay using both the IS6110 gene and the 38kDa protein has a low sensitivity and specificity for the detection of *M. tuberculosis* in liver biopsy specimens of children. Thus, it could not be used as a diagnostic tool for childhood hepatic tuberculosis.

**Key words:** Acid-fast bacilli, granuloma, caseation necrosis, hepatic TB

**HSD No. 5**

# THE IMPACT OF DISEASE DATABASE SYSTEMS ON THE MOLECULAR DIAGNOSTIC SERVICES DEVELOPED AT ST. LUKE'S MEDICAL CENTER, PHILIPPINES

**Ma. Luisa G. Daroy, Ronald R. Matias, Blanquita B. de Guzman, Cynthia A. Mapua, Marissa C. Buhat, Alicia S. Cornista, Ma. Theresse G. Alonzo, Joyce D. Reyes, and Filipinas F. Natividad**

Research and Biotechnology Division
St. Luke's Medical Center, Quezon City

Advanced laboratory testing for various infectious diseases, such as dengue, hepatitis B and C, tuberculosis, Japanese encephalitis, herpes simplex encephalitis and meningitis is offered only at St. Luke's Medical Center in the Philippines. The Research and Biotechnology Division has developed molecular diagnostic tests for the detection, identification, and monitoring of different pathogens in a wide range of biological specimens by Polymerase Chain Reaction, Reverse Transcription-PCR, and IgM-capture ELISA. Samples include serum, cerebrospinal fluid, sputum, pleural fluid, gastric aspirates, ocular fluid, synovial fluid, bone marrow and liver biopsies taken from patients from various hospitals in the Philippines.

A comprehensive database for each infectious disease is maintained containing a description of the specimen, pertinent patient information, clinical data provided by the doctor, the initial and final diagnoses, laboratory test results and pathogen identification. These disease information systems are vital instruments not only for efficient record-keeping and data retrieval, but also:

- Enable valuable epidemiological tracking of the disease, especially its geographical location, seasonality and yearly trends, the prevalent strains, and the age and sex of the affected population.
- Provide the necessary information needed for monitoring the effectiveness of applied therapy or drug treatment on eliminating the pathogen load.
- Facilitate research advances by enabling correlations between molecular data and clinical indicators, and biostatistical analysis to be made.
- Make available periodic data summaries as guide to clinicians, health researchers and government officials in their practice, research and policy-making.

**Keywords**: Molecular diagnostics, Disease databases, Infectious diseases, Polymerase Chain Reaction

**HSD No. 6**

# EXISTENCE OF *HELICOBACTER PYLORI* IN THE ORAL CAVITY OF FILIPINO PATIENTS WITH GASTRODUODENAL DISEASES

**Blanquita B. de Guzman[1], Ian Homer Cua[2], Loricanne B. Angeles[1], Ma. Luisa S. Gonzales[1], *H. pylori* Study Group[1,2], Edgardo M. Bondoc[2] and Filipinas F. Natividad[1]**

[1]Research and Biotechnology Division and [2]Institute of Digestive Diseases, St. Luke's Medical Center, Quezon City.

*Helicobacter pylori*, a Gram-negative, spiral-shaped microaerophilic bacterium is correlated with the development of various gastroduodenal diseases such as gastritis, gastric and duodenal ulcers, gastric carcinoma and MALT lymphoma. It has been demonstrated that eradication of *H. pylori* by antibacterial therapy resulted in the treatment of *H. pylori* – associated gastroduodenal diseases. However, the route of infection by *H. pylori* has not been established. Researchers have suggested that the oral-oral route would be the most probable mode of transmission.

The objective of this study was to determine the existence of *H. pylori* in the oral cavity of Filipino patients in order to test the hypothesis of transmission by an oral route. A total of 54 patients (28 males and 26 females) of the Institute of Digestive Diseases, St. Luke's Medical Center were enrolled in the study. Endoscopic diagnosis showed that 38 patients have gastritis, 8 with gastric ulcers and 8 with duodenal ulcers. Saliva samples were collected from the enrolled patients prior to endoscopy. Biopsy samples were also taken both from the antrum and corpus. Cytotoxin genotypes were determined by PCR using both biopsy and saliva samples. All saliva and gastric biopsies were positive for *H. pylori* using 16S rRNA gene. *cagA* gene was detected in 80% of patients from both saliva and corporal biopsies and 74% of patients from both saliva and antral biopsies. Predominant *vacA* genotype is s1a/m1 in both saliva and gastric biopsies with 30% observed agreement in saliva and corporal biopsies and 52% agreement in both saliva and antral biopsies.

Our study has provided evidence of the presence of *H. pylori* in the oral cavity of Filipino patients with gastroduodenal diseases. This shows that there is a possibility of an oral transmission of the infection. Moreover, different strains may exist in the stomach and saliva of patients.

**Keywords**: *Helicobacter pylori*, gastroduodenal diseases, biopsies, vacA genotypes, cagA gene, 16s RNA

**HSD No. 7**

# SIMULTANEOUS DETECTION USING MISMATCH AMPLIFICATION MUTATION ASSAY (MAMA)-MULTIPLEX PCR, AND CHARACTERIZATION OF ENTEROHEMORRHAGIC AND ENTEROPATHOGENIC *Escherichia coli*

**Frederick B. dela Cruz,[1] Glenn G. Oyong,[1,4] Ronald R. Matias,[1,3] and Edgardo M. Bondoc[2]**

[1]Research and Biotechnology Division, and [2]Institute of Digestive Diseases
St. Luke's Medical Center, Quezon City
[3]Institute of Biology, College of Science, University of the Philippines,
Diliman, 1101 Quezon City
[4]Graduate School, College of Science, De La Salle University, Taft Ave., Manila

A total of 45 diarrheagenic *E. coli* isolates from three different hospitals in Metro Manila were screened for EHEC-associated genes using mismatch amplification mutation assay (MAMA)-multiplex PCR. The multiplex (pentavalent) PCR amplifies a region of the *stx1*, *stx2*, *uidA*+93 (transversion mutation marker for *E. coli* O157:H7/H-), *ehxA*, and *eaef*× (also present in EPEC O55:H7 ), respectively. Based on PCR results, 3 isolates were identified as EHEC and 4 belong to the O55:H7 EPEC group. One of the EHEC isolates, PGH36 (*uidA*+93 positive), was validated as *E. coli* O157:H7 by latex agglutination. Subsequent assay for sorbitol fermentation and glucuronidase (GUD) expression reveal that PGH36 is a phenotypic variant (sorbitol fermentation and GUD positive). Other than these phenotypic tests, the multiplex PCR-positive isolates were also assayed for enterohemolysis and sensitivity to 9 antimicrobial agents. All 3 EHEC demonstrated EHEC-specific enterohemolytic patterns on sheep-blood agar plates while majority of the isolates were sensitive to most of the antimicrobials tested.

The relative pathogenicity of the local multiplex PCR-positive isolates was also investigated by performing standard in vivo and in vitro cytotoxicity assays. Intraperitoneally injected C3HeJ mice ($10^8$ CFU/mice) showed 100% death rate for four of the isolates (3 EHEC and 1 EPEC), and 33 to 83% for the remaining 3 EPEC. In vitro cytotoxicity assay using three cell lines - Vero, HT-29 colon cancer and human fibroblast cells reveals cytotoxic response using spent medium crude toxin concentrates indicating the production of a cytotoxin other than shiga-like toxins.

**Keywords**: *Escherichia coli*, Enteropathogenic, Enterohemorrhagic, Shiga-toxin, Mismatch amplification mutation assay (MAMA), diarrhea, multiplex PCR

**HSD No. 8**

# DIABETES AND BODY MORPHOMETRICS: A CASE STUDY OF A MARANAO MUSLIM CLAN

**Carima Usman, Cesar G. Demayo and Mark Anthony J. Torres**

Department of Biological Sciences
MSU-Iligan Institute of Technology

Diabetes is a global health problem of enormous magnitude. By the year 2010, global projections are that there will be a 2-fold increase in diabetes to over 200 million worldwide. Many are afflicted with the disease especially in newly industrialized nations and among minorities in developed countries. Studies involving ethnic groups especially those practicing consanguineous marriages are good sources of information in determining relationships of the disease with genetics, body morphometrics including height, weight, facial, dermatoglyphics and digits measurements. Several families with known diabetic members of a Muslim Maranao clan from Marawi City, Lanao del Sur were included in the study. Pedigree analysis was done to determine inheritance of the disease. Blood glucose analysis was also performed for confirmation if the individuals perceived to have diabetes are really afflicted with the disease. Results showed close associations between body morphometrics and the disease. Diet and genetics were observed to be the major factors of the high prevalence of the disease in the clan.

**Keywords**: diabetes, pedigree analysis, genetics

**HSD No. 9**

# INACTIVATION OF A ROGUE p53 MUTATION USING siRNA REVERSES RESISTANCE TO CHEMOTHERAPEUTIC AGENTS IN BREAST TUMOR CELLS

**Custer C. Deocaris[1,2]*, Renu Wadwa[2], Masayuki Sano[2]**
**Sunil C. Kaul[2] and Kazunari Taira[2]**

[1]Philippine Nuclear Research Institute (PNRI), Department of Science and Technology
Commonwealth Avenue, Quezon City, Philippines
[2]National Institute of Advanced Industrial Science and Technology (AIST)
1-1-1 Higashi, Tsukuba, Ibaraki 3058562, Japan
Email: custer_pnri@yahoo.com

The guardian of the genome, *p53*, is considered as the most frequently mutated gene in all human cancers, and its mutation paradoxically leads to an insidious resistance to anti-cancer drug treatments observed in most clinically aggressive tumors. Because majority of the mutations are missense, localized in specific "hotspots", and have a trans-dominant effect on the wild-type allele, here, we demonstrate the ability of mutant homing of siRNAs (small inhibiting RNAs) to inactivate a point mutation and normalize *p53* pathways in breast tumor cells. The effect of suppression of the mutant *p53* leads to the reversal of cellular resistance to specific anti-cancer agents via the down-regulation of the multiple drug resistance gene (*MDR1*). Therefore, the combination of *p53*-targeted siRNAs and standard chemotherapeutic drugs would provide an attractive personalized combination therapy that optimally utilizes data on drug action and the genetic information of the patient's tumor.

**Keywords:** p53, small inhibiting RNAs, breast cancer therapy, MDR1

**HSD No. 10**

# MUTATION DETECTION IN MISMATCH REPAIR GENES OF A FILIPINO FAMILY WITH HNPCC (HEREDITARY NONPOLYPOSIS COLORECTAL CANCER)

**Ana Barbara S. Evangelista [1], Ma. Luisa D. Enriquez, PhD [1,2], and EdGardo M. Bondoc MD [3]**

[1]De La Salle University, Manila [2] Research and Biotechnology Division
[3] Institute of Digestive Diseases, St. Luke's Medical Center, Quezon City

Hereditary nonpolyposis colorectal cancer (HNPCC) is an autosomal dominant inherited cancer predisposition caused by mutation in one or more of the six mismatch repair (MMR) genes (hMLH1, hMSH2, hMLH3, hMSH6, hPMS1 and hPMS2). These genes encode for proteins that ensure fidelity of DNA replication. Mutation in one or more of these genes result in instability of the microsatellite repeats, also known as microsatellite instability (MSI). In recent years, different methods of mutation detection have been developed in order to identify individuals prone to HNPCC.

In this study, peripheral blood samples were collected from members of a family with history of colon cancer in three generations. DNA was isolated using phenol-chloroform extraction method. Appropriate PCR primers were then used to amplify the different exons of the hMLH1 gene and the amplified products were subjected to dHPLC for mutation screening. The type of mutation present in each exon was determined by DNA sequencing. Mutations in exons 15 and 16 of the hMLH1 gene have been commonly reported in other Asian countries such as Japan and Korea. However, our initial results show that these regions appear to be normal in our Filipino family. Result of mutation screening by dHPLC revealed a mutation in exon 4 of the same gene.

**Keywords**: Hereditary nonpolyposis colorectal cancer, autosomal dominant, mismatch repair genes, exons, dHPLC, DNA sequencing. HMLHI gene, PCR

**HSD No. 11**

## DUCK EMBRYOGENESIS: EFFECTS OF 3 PLANT EXTRACTS

**Anabelle A. Herrera* and Nicelle Sernadilla**

Institute of Biology, College of Science
University of the Philippines Diliman, 1101 Quezon City

Three medicinal plants commonly used in treating a variety of diseases are *Annona squamosa, Hibiscus rasa-sinensis* and *Sarcandra glabra.* Using light microscopy and scanning electron microscopy, this study investigated the individual activities, as well as antireratogenic potential against the known teratogen, retinoic acid, of different concentrations of their methanol extracts on the basis of their effects on the chondrogenesis and myogenesis in the limbs of a 3-day old duck embryos. The limbs were subjected to fixation, dehydration, paraffin embedding, serial section, hydration, and staining with hematoxin and eosin, before they were mounted on slides. Standard SEM protocol was used for scanning electron microscopy. Based on histological grading, it was found that *A. squamosa* has an inhibiting activity on myogenesis. *S. globra* proved to induce myogenesis and to diminish chondrogenic cells at 50 micrograms/milliliter dosage. Only H. *rosa-sinensis* exhibited slight antiteratogenecity when combined with retinoic acid. More studies should be done to further test the activities of the three extracts in the duck chondrogenesis and myogenesis.

**Keywords:** Annona squamosa, Hebiscus rosa-sinensis, Sarcandra glabra, retinoic acid antiteratogenesis

**HSD No. 12**

# EFFECTIVENESS OF PEDIAH.E.A.R.T (HOLISTIC EDUCATION AGAINST RHEUMATIC THREATS) ON THE HEALTH STATUS OF RHD PATIENTS

**Riza G. Lasconia,* Sherilyn F. Lim, Ma. Feliciana T. Reyes, Michelle N. Tumbokon, Zenaida C. Fojas, Eva Teodora T. Sison, Maria Romina G. Aldea, Carmelita A. Naral, Maria Linda G. Buhat**

Philippine Heart Center, East Avenue, Quezon City, Philippines
Email: rgl_jan20@yahoo.com, evesison2000@yahoo.com

Today, about 12 million people are currently affected by rheumatic heart disease (RHD), many requiring repeated hospitalization, or often, unaffordable heart surgery in the next 5 to 20 years.

This 4-month study sought to investigate the effectiveness of a holistic health educational program - "PediaH.E.A.R.T. (Holistic Education Against Rheumatic Threats)" in improving the health status of adolescent outpatients aged 12 -19 with RHD.

Utilizing a randomized clinical trial, 35 patients for the intervention group received a 3-hour teaching program, twice a month. Topics were the heart and circulatory system; the nature of RHD, its medical and surgical management for the first session; and diet, exercise, hygiene and coping with illness for the second session. The control group (n=35 patients) received routine health teachings.

Outcome measures of health status included variables of health-related quality of life (physical, social and emotional health and general health perceptions); functional capacity tested subjectively through the Specific Activity Scale (SAS) and objectively through the 6-Minute Walk Test (6-MWT). These were assessed at baseline, one and two months.

Results showed that at 2nd evaluation, there was a significant difference in all health status components: health-related quality of life ($p=0.000$), SAS functional classification ($p=0.000$) and 6-MWT ($p=0.030$).

Findings suggest that through implementation of a holistic health educational program, the health status of adolescent RHD patients may improve. In the long run, awareness of these young people to the fact that worst complications can be prevented through self-management, is a cost-effective strategy not only for the health care system but also for the Filipino society as we ensure future productivity among these young adolescents.

**Keywords:** patient education, rheumatic heart disease, health status measures

**HSD No. 13**

# DENTAL REGISTRY

**M. S. A. Magboo *[1] V. P. Magboo[1], C. Aquino [1], E. Magalong [1], P. Dizon [1]**
**L. Tenmatay [1], C. Atienza [2], M. Sunico [2]**

[1] Department of Physical Sciences and Mathematics
College of Arts and Sciences, and
[2]College of Dentistry, University of the Philippines Manila
Email: nelyndron@vasia.com

With the recent integration of information technology in the health sector, dental health care should not be limited to treating patient using only using only dental instruments and devices. An emerging discipline called Dental Informatics combines computer technology with dentistry in order to improve delivery of oral health care. At the University of the Philippines Manila, the College of Dentistry together with the College of Arts and Sciences created a working prototype entitled "Dental Patient Registry" which aims to capture patient data related to dental practice. It is currently being used already at the College of Dentistry. Dental Patient Registry (DPR) integrates patient medical and dental history, soft tissue examination, oral examination, diagnosis, treatment plan and service record. DPR consists of five modules namely 1) Medical and Dental History, 2) Soft Tissue Examination, 3) Tooth Chart, 4) Problem List Worksheet and 5) Query Module. The modules are integrated with each other, thus, data from Soft Tissue and Tooth Chart Modules for instance is reflected in the Problem List Worksheet. New fields are added in the Problem List Worksheet to incorporate additional comments. Finally treatment performed and associated service fees are clearly indicated in the Service Record. The Query Module is another feature aimed to support research. It outputs patient records matching a specific criteria. DPR is a web-based application designed to be run on server and accessed in a number of terminals by dental students and faculty. Security, patient confidentiality, data integrity and easy retrieval of records have been incorporated in the design of DPR. DPR is an example of a collaborative project aimed at integrating information technology with dental practice.

**Keywords:** Dental Registry, Dental Informatics

**HSD No. 14**

# PHILIPPINE MEDICINAL PLANTS INFORMATION SYSTEM

**M. S. A. Magboo *[1], V. P. Magboo[1], A. Regadio[2], F. V. C. Sevilla III[1] and J. R. Lardizabal[1]**

[1] Department of Physical Sciences and Mathematics,
College of Arts and Sciences
[2] College of Pharmacy, University of the Philippines Manila
Email: nelyndron@yasia.com

The Philippine Medicinal Plants Information System (PMPIS) is an output of the collaboration between two colleges from the University of the Philippines Manila: the College of Arts and Sciences and College of Pharmacy. PMPIS was conceived in order to provide an online catalog of indigenous medicinal plant information with focus on their parts, bioactivities and constituents. PMPIS is an open-source web-based database system developed under a Debian/Linux environment using a Zope web application server, PostgreSQL database and MedPlants Zope Product free software that is written in Python. Registered students and other researchers are allowed to contribute 1) core plant information which includes family, genus, species and attributed taxonomist, 2) common names with an associated language or dialect, 3) plant images, 4) plant part, bioactivity, and consitutent information including references and abstract. The submitted entries are subsequently screened by a panel of experts from the College of Pharmacy acting as content administrators. Hence, the entire content of the PMPIS database is the responsibility of the College of Pharmacy. PMPIS aims to lessen the time spent on gathering plant information by providing a search engine based on plant name, plant part, bioactivity and constituent or a combination of these. PMPIS however does not contain information about preparation, compounding or dispensing of medicinal plants.

The PMPIS website is already working, however, students at the College of Pharmacy still needs to test the system and populate it with read data until such time that it may be ready for public launching as a nationwide repository of medicinal plants information.

Since PMPIS is an open-source software, it has a potential of being built upon, developed and maintained by a loosely-knit community of other free software developers.

**Keywords:** medicinal plants, plant biochemical constituents, plant bioactivity, open-source software

**HSD No. 15**

## REPORTING AND QUERYING NOTIFIABLE DISEASES VIA SMS

**M. F. Marcelo and M. S. A. Magboo***
Department of Physical Sciences and Mathematics,
College of Arts and Sciences, University of the Philippines Manila
e-mail: nelyndron@vasia.com

Health surveillance is an important monitoring tool. It involves regular collection, analysis, interpretation, and dissemination of health information that should be done immediately so that authorities can plan health programs effectively. However, several factors such as geography, transportation and weather delay the delivery of reports hence relevant data such as notifiable diseases report do not reach the city health offices immediately. Thus, it takes some time before a solution is implemented to prevent outbreaks. As a response to this problem, the Online Notifiable Diseases Information Gateway was created. It has two major components: 1) sending and querying notifiable diseases via short messaging service (SMS) to support barangay field health orkers and 2) viewing notifiable diseases report via the internet to support the barangay health officials at the provincial and city levels and the Department of Health (DOH).

SMS technology enables barangay field health workers to immediately send a report on notifiable diseases such as measles and diphtheria directly to the database thus if a specific disease reach the threshold set by the epidemiologist, an SMS alert is automatically sent to barangay health officials at the city and provincial levels. Also, barangay field health workers can query total number of cases of a specific disease on a given location; list of locations where a specific disease occurred, etc. again via SMS. At the barangay, city and provincial health offices, health officials as well as the DOH, may view online the breakdown of frequency of disease by age and by gender; daily, weekly, monthly and yearly notifiable diseases report; percentage of increase of cases of a specific disease this year and the previous year; etc.

The use of wireless technology to deliver clinical information is very useful as almost everyone has access to cellular phones. Although there is a charge per text message, this is still cheaper compared to paper delivery and is a better alternative for field health workers where internet access is not possible. As reports are submitted without delay, faster analysis of data can be done. The online component on the other hand helps provide a better view of the notifiable diseases report as these cannot be viewed well via SMS.

**Keywords**: health monitoring, health surveillance, SMS, wireless technology, online health information systems

**HSD No. 16**

# BIOINFORMATICS AND DATA MANAGEMENT: A KEY COMPONENT IN BIOMEDICAL RESEARCH AT ST. LUKE'S MEDICAL CENTER, PHILIPPINES

**Cynthia A. Mapúa**

Research and Biotechnology Division, St. Luke's Medical Center,
279 E. Rodriguez Sr. Blvd., Quezon City 1102, Philippines
Email: camapua@stluke.com.ph

Bioinformatics plays a crucial role in the post-genomic era, revolutionalizing biomedical research and impacting medical research. The main function of the Bioinformatics and Data Management Section (BDMS) of the Research and Biotechnology Division (RBD) at St. Luke's Medical Center is to develop computerized knowledge systems of raw clinical and laboratory data as well as the interpretation and deduction of results. It oversees data management systems for medical genetics/molecular researches on infectious and non-infectious diseases.

Since 1995, RBD has spearheaded the establishment of computerized databases in SLMC starting with data banks on dengue infections, stroke and colorectal cancer. New, ongoing projects are the Cardiovascular Disease Information System, Head and Neck Tumor Information System, Liver Diseases Databank, and databanks for breast cancer, ophthalmology, and reproductive endocrinology and infertility. Other databases on CNS infections, tuberculosis, and thalassemia have been created as well. The data banks store patient information on sociodemography, medical history and physical findings, laboratory and molecular diagnostic findings, therapy, and follow-up status. Data validation rules were incorporated in the systems to facilitate encoding and minimize errors in data entry.

Composed of basic scientists, an epidemiologist, a biostatistician, and technical support staff, the BDMS has capabilities to analyze raw DNA data using DNAsis, access and retrieve DNA sequence data from public databases via the internet, design and analyze oligonucleotide primers using OLIGO v.4, and compare DNA sequence data with published sequences using BLAST. It has various softwares for the statistical analysis of the data. It has helped clinicians and scientists generate quality research studies in elucidating the etiological, epidemiological, pathophysiological and molecular pathogenesis of diseases, in determining survival and disease-free rates of the patients, and in comparing the efficacy of different treatment modalities. Numerous studies have been generated from the databanks, some of which garnered awards.

**Keywords**: bioinformatics, data management, biomedical research

**HSD No. 17**

# THE ST. LUKE'S DENGUE SERUM AND DATA BANKS: ADVANCING DENGUE RESEARCH IN THE PHILIPPINES

**Filipinas F. Natividad**

Research and Biotechnology Division
St. Luke's Medical Center, Quezon City, Philippines

Since the start of its Dengue Research Program in 1995, St. Luke's Medical Center has established a local repository center for the storage and maintenance of over 8000 serum samples obtained from dengue patients all over the Philippines. The Dengue Serum Bank, as it is called, serves as a valuable resource for research work on dengue virus and dengue infections in the Philippines.

Data from samples in the serum bank include the following:

- Patient socio-demographic information which includes history of travel
- Medical history
- Physical examination findings including all signs and symptoms
- Laboratory test results such as CBC, IgM-capture ELISA, RT-PCR, cytokine, antiplatelet IgG, Fibrinogen Degradation Products (FDP), chest radiographs
- Serotyping of virus isolates
- DNA sequences of dengue viral genes
- The clinical and the final diagnosis of dengue

All these information are kept as an electronic data compilation known as the Dengue Data Bank, accessible through the Data Information and Bioinformatics Section of the Research and Biotechnology Division.

With these available resources and access to data, basic and clinical researches have been done or are ongoing. These include research on the development of front-line diagnostics for dengue, development of diagnostic reagents for dengue detection, determination of annual rates of dengue serotypes, and sequencing of selected dengue genes, Clinical researches include studies on thrombocytopenia, the role of platelet-associated IgG and pathophysiology of dengue infections. One of the major projects is the national dengue surveillance program in collaboration with the Department of Health.

**Keywords:** dengue, serum bank, data bank, repository, electronic data compilation

**HSD No. 18**

# SEQUENCE ANALYSIS OF THE ENVELOPE GENE FROM PHILIPPINE DENGUE-1 ISOLATES

**Philippe Noriel Q. Pascua[1]*, Xerxes Morgan R. Lozada[1], Jhoe Anthony R. Alfon[1], Ronald R. Matias[1,2] and Filipinas F. Natividad[1]**

[1]Research and Biotechnology Division, St. Luke's Medical Center, 279 E. Rodriguez Sr. Blvd, Cathedral Heights, Quezon City, 1102
[2]Institute of Biology, University of the Philippines

The dengue virus is a positive single-stranded RNA virus belonging to the family Flaviviridae and consists of four serotypes. All 4 serotypes can cause mild dengue fever or severe dengue hemorrhagic fever. The viral genome is made up genes encoding for 3 structural and 7 nonstructural proteins, typical of the Flavivirus.

The envelope gene, one of the structural genes, is made up of 1485 nucleotides and codes for the envelope protein which is found on the surface membrane of the dengue virus. The envelope protein is composed of 495 amino acids and binds to the host cell receptor prior to viral entry into the cell. Mutations in the envelope gene may affect viral infectivity. DNA sequence analysis is a useful method to investigate any sequence change in the gene.

The envelope gene of Dengue-1 isolates of different years, 1995 (1), 1999 (2), 2001(1) and 2002 (6) were amplified, cloned and sequenced. Sequence data were compared with the sequences of 1974, 1989 and 2002 Philippine isolates deposited at Genbank. Analysis of the raw sequence data with DNAsis v3.6 software showed that there were more silent mutations observed than missense mutations. This indicates selection pressure being applied to virus genome. In a span of 28 years (1974 - 2002), only 0.2% - 0.5% missense mutations were found to occur among the 1485 nucleotides of the envelope gene. However, no significant changes were observed in the structure of the envelope protein in these isolates. Phylogenetic analysis suggests that current dengue-1 isolates originate from earlier isolates and that outbreaks due to Dengue-1 are not derived from imported infections.

Ten dengue-1 envelope gene sequences were submitted to Genbank and assigned accession numbers in October 2003.

**Keywords**: Dengue virus, envelope gene, mutation, clone, DNA sequence analysis, phylogenetic analysis

**HSD No. 19**

# CHROMATOGRAPHIC PROFILING OF METABOLIC DISORDERS

**Ma. Cristina B.Portilla[1], Princess S. Galvez[1], Cherrie B. Pascual [1,2]**

[1]Research and Biotechnology Division, St. Luke's Medical Center
279 E. Rodriguez Sr. Blvd, Cathedral Heights, 1102 Quezon City
[2] Institute of Chemistry, University of the Philippines,
Diliman, 1101 Quezon City

Inborn errors of metabolism cause hundreds of different diseases. Each disease is individually rare but collectively account for a significant portion of illness, particularly in children. Metabolic disorders are usually caused by defects in enzymes involved in the biochemical pathways. To prevent metabolic disorders, correct diagnoses must be made. Metabolic profiling consists of a variety of biochemical and physiological tests to diagnose metabolic disorders which could be characterized by the excretion of excess or deficient amounts of organic and amino acids in biological samples. The presence of organic acids and amino acids not normally present in biological samples is also indicative of metabolic disorders.

Two chromatographic techniques were utilized in the profiling of metabolic disorders. Gas Chromatography with Mass Spectrometry (GC/MS) was utilized for analysis of organic acids in urine. Prior to GC/MS analysis, organic acids in urine samples were isolated through oximation, extraction and derivatization steps. The derivatized acids were then analyzed using the Finnigan Trace GC 2000 coupled with a GCQ GC/MS system operated with an Xcalibur software. A computerized library search was used to identify the urinary organic acids. Analysis of amino acids in plasma or urine samples was carried out by Shimadzu Amino Acid Analyzer using post column derivatization with o-phthaldialdehyde and fluorescence detection. Chromatographic profiles of urine samples from healthy and sick individuals were compared.

This study will contribute to the development of proper screening of metabolic disorders in the Philippines particularly for children to avoid early death and for them to live normal lives.

**Keywords:** metabolic disorder, metabolic profiling, GCMS, HPLC, amino acid organic acids

**HSD No. 20**

# EFFECTS OF OPEN AND CLOSED STERNOTOMY DRESSING ON WOUND HEALING AMONG CABG PATIENTS

**Jimmy B. Bersamin, Ramon A. Rueda*, Catherine R. Casas, Liza Ruth Pagaddu, Elsbeth E. Conlu, Jean Calimag, Marietta A. Velasco, Susan M. Umali, Maria Romina G. Aldea Eva Teodora T. Sison*, Carmencita A. Lingan, Maria Linda G. Buhat**

Philippine Heart Center, East Avenue, Quezon City
Email: evesison2000@yahoo.com

The purpose of the study was to determine the effects of open and closed sternotomy dressing on wound healing of patients who underwent coronary artery bypass graft (CABG).

The study utilized randomized controlled trial. The sample comprised a total of 64 subjects who had undergone uncomplicated CABG and admitted to a surgical intensive care unit of the Philippine Heart Center from August to November 2003. Block randomization was done to categorize the subjects into control group (closed dressing) and study group (open dressing). At POD 2, initial assessment of the wound was done. The control group received daily dry, sterile gauze dressing on the sternotomy wound, while the study group received no dressing on the sternotomy wound. . Wound characteristics such as serous exudates, erythema, purulent exudates, and separation of deep tissue were measured from Post Operative Day (POD) 2 to POD 6. At POD 6, additional criteria such as use of additional antibiotics, drainage under local anesthesia, debridement under general anesthesia, isolation of bacteria, and prolonged hospital stay were reviewed. Degree of wound healing was calculated by adding score points from wound characteristics and additional criteria. The study utilized Mann-Whitney U-test, Wilcoxon Paired Signed Ranked Test, and T-test for the statistical treatment.

There was a steady improvement of serous exudates for both groups, on the other hand, erythema was observed to occur at higher percentage among the closed dressing group. However, there was no significant difference between the control and study group based on daily wound characteristics from POD 2 to POD 6. Use of additional antibiotics was noted to be more common among the control group. Based on total wound scores, all subjects in the open dressing group obtained satisfactory wound healing, while 7

subjects from the closed dressing group were observed to have disturbances in wound healing.

The outcome of the study opened up critical implications for wound care. Wound exposure promotes effective wound healing. Therefore, instituting a cost-effective sternotomy dressing regimen to CABG patients is essential to post-operative wound management.

**Keywords:** sternotomy dressing, coronary artery bypass graft, CABG, dressing regimen

**HSD No. 21**

## POINT MUTATION IN THE ENDOTHELIAL NITRIC OXIDE SYNTHASE ('NOS) GENE ASSOCIATED WITH NON-INSULIN-DEPENDENT DIABETES MELLITUS (NIDDM) IN FILIPINO PATIENTS

**Rhodora R. Santos[1], Ma. Luisa G. Daroy[1], Ronald R. Matias[1,3], Philippe Noriel Pascua[1], Michael Vincent S. Mendoza[1], Ricardo Fernando[2], and Filipinas F. Natividad[1]**

[1]Research and Biotechnology Division and [2]Department of Medicine
St. Luke's Medical Center, Quezon City 1102
[3]Institute of Biology, University of the Philippines Diliman

Non-insulin dependent diabetes mellitus (NIDDM) of Type II diabetes mellitus is a heterogenous, multifactorial disease characterized by impaired glucose metabolism due to insulin resistance. Recent studies showed that mutations of the endothelial nitric oxide synthase ('NOS) gene are associated with an increased risk for progression to diabetic neuropathy in NIDDM, and that the expression of 'NOS is reduced in subjects with impaired glucose metabolism. Polymorphism in the 'NOS gene may therefore serve as a possible genetic marker for NIDDM.

This study involves the identification of a G to T substitution at position 894 in the 'NOS coding sequence, corresponding to a change from Glu to Asp at codon 298, that removes a Ban II restriction site in the DNA sequence. This is the only polymorphism identified to date that changes the 'NOS protein sequence, leading to speculation that genetic variation at this site may alter 'NOS activity or regulation.

Genomic DNA was prepared from peripheral blood lymphocytes using standard techniques. A 248 bp product of the ¹NOS coding region was amplified from the genomic DNA by Polymerase Chain Reaction (PCR). The PCR product were digested with Ban II and resolved on 8% polyacrylamide gels. Depending on whether G or T is found in position 894, one band corresponds to TT, two bands correspond to GG and three bands may be found corresponding to GT genotypes, respectively.

A total of 133 diabetic subjects and 79 normal individuals were tested. Of the diabetic group, 77 (58%) carried the GG genotype, 53 (40%) had the GT genotype and 3 (2.3%) had the TT genotype. Among the normal subjects, a similar pattern was observed: 57 (72%) were of GG genotype, 21 (27%) GT and 1 (1.3%) had the TT genoytpe. These results show that a G to T substitution was more likely to occur in diabetic subjects (56%) compared to the normal group (22%).

**Keywords:** (NIDDM) Non-Insulin Dependent Diabetes Mellitus, (¹NOS) Endothelial nitric oxide gene, (RFLP) Restriction Fragment Length Polymorphism, Mutation, Polymorphism

**HSD No. 22**

## A FIVE-YEAR (1996-2000) SURVEY OF THE PREVALENCE OF CANCER CASES IN ILIGAN CITY, PHILIPPINES, BASED ON HOSPITAL RECORDS

**Apolinario A. Alicante[1] and Franco G. Teves[2]**

[1] College of Agriculture, Mindanao State University,
Marawi City, Philippines
[2] College of Science and Mathematics, MSU-Iligan Institute of Technology,
9200 Iligan City, Philippines

An on-going comprehensive study on cancer is being undertaken in Iligan City, one of the highly industrialized cities in Southern Philippines. Partial data on four types of carcinomas, namely, breast, ovarian, lung, and skin were obtained from 1996 to 2000 from four main hospitals in Iligan City. Although, a significant number of cancer cases were not reflected in hospital records based on personal communications from individual medical practitioners, the data revealed a very wide gap in the incidence of ovarian

cancer cases (240%) over the other three types. This may still reflect the correct picture if all unreported cancer cases have been included. In the five-year study, 48 cases of breast cancer, 183 cases of ovarian cancer, 45 cases of lung cancer, and 36 cases of skin cancer, or a total of 312 cases, have been reported based on hospital records. Close to 75% of the reported cases were women, a serious problem in women's health and welfare in Iligan City. Apparently, most of the cases excluded from the gathered data either consisted of individuals who could not afford hospitalization, or who sought treatment in Cebu or Manila, where better diagnostic and treatment facilities are available, for those who could afford.

We are currently investigating more recent reports from the Iligan City Health Office, on increased incidence of breast cancer in a particular group of women, public school teachers belonging to the 25 to 45 years age group. Conservative estimate reveals that one out of ten (1:10) women belonging to this group is positive for breast cancer. We are suspecting chronic exposure to some environmental carcinogens prevalent in Iligan City as the predisposing factor in cancer development in susceptible individuals. Gender studies, particularly on women's health concerns, must be seriously considered, given the significant role of women in the social and economic life of the city.

**Keywords:** cancer, incidence, environmental carcinogens

**HSD No. 23**

## AFLATOXIN IN ENVIRONMENTAL TOBACCO SMOKE (ETS): POTENTIAL LINK TO INCREASED INCIDENCE OF CANCER AND EMERGING AND RE-EMERGING INFECTIOUS DISEASES

**Aple L. Cuartero, Rene J. Dagoc and Franco G. Teves**

Department of Biological Sciences, College of Science and Mathematics
MSU-Iligan Institute of Technology, 9200 Iligan City, Philippines

In this study, we report the presence of aflatoxin in commercial cigarettes and its imminent entry into the human body by inhalation, a pioneering study in the Philippines based on literature search.

Samples of three popular brands of commercial cigarettes were analyzed using the Veratoxä Aflatoxin System kit (Glenwood Technologies International, Inc.). Aflatoxin content of the processed samples ranging from 0.5 to 4.0 ppb,

was measured by a competitive direct enzyme-linked immunosorbent assay (CD-ELISA), a highly sensitive and accurate procedure based on the manufacturer's instructions. Aflatoxin is very heat-stable, is 200 times more potent than benzopyrene as a carcinogen, and has been shown to be fully carried over to the resulting environmental tobacco smoke (ETS). Chronic exposure of the general population to aflatoxin-containing ETS is a common occurrence locally and globally because of the high percentage of smokers worldwide. In concert with low levels of aflatoxin in foodstuff, inhaled aflatoxin could be a major factor adversely affecting the immune system because this toxin is also known to be a strong immunosuppressant aside from being a potent carcinogen.

**Keywords:** aflatoxin, carcinogen, immunosuppressant, ETS, CD-ELISA

## *SOCIAL SCIENCES*

**SSD No. 1**

### SUSTAINING THE SAMPAGUITA FLOWER/GARLAND LIVELIHOOD SYSTEM IN PERI-URBAN METRO MANILA

**Mario Navasero[1], Marcela Navasero[2], Constancio de Guzman[3], Cristina Bajet[4], and Raul Boncodin[*5]**

[1]National Crop Protection Center (NCPC), College of Agriculture
University of the Philippines Los Baños (UPLB-CA), College, 4031Laguna
[2]Plant Pest Clinic, Department of Plant Pathology,
UPLB-CA, College, 4031Laguna
[3]Department of Horticulture, UPLB-CA, College, 4031Laguna
[4]NCPC, UPLB-CA, College, 4031 Laguna
[5]International Potato Center – Users' Perspectives With Agricultural Research and Development Network and CGIAR Urban Harvest Program
(CIP-UPWARD/Urban Harvest)
Elvira Tan Hall, PCARRD Complex, Los Baños, 4030 Laguna
Email: cip-manila@cgiar.org

Sampaguita *(Jasminum sambac)* flower production, garland making and marketing are traditional livelihood activities within and around Metro Manila. A collaborative, interdisciplinary research initiated in 2001 sought to: (1) assess

the sampaguita livelihood systems in peri-urban Metro Manila, (2) identify key problems and opportunities for sustainable flower production and garland-making, and (3) develop and introduce appropriate technologies based on the priority problems and opportunities.

Survey results indicated that the sampaguita livelihood system extends from urban marketing centers in Metro Manila to rural production areas in Pampanga and Quezon. It involves eight livelihood actors: farmers, flower pickers, flower suppliers, fiber cleaners, flower vendors, garland-making contractors, garland makers, and garland sellers. Farmers had the highest estimated annual incomes at P238,800. San Pedro, Laguna represents the peri-urban nexus of the entire livelihood system, being the major center for flower trading and garland-making.

Socio-technical assessment identified two priority concerns:
(1) Heavy pesticide use during peak production season, with two-thirds of respondents sprayed every 1-2 days, and 97% of them spraying less than 24 hours before harvesting. Skin allergy, vomiting, dizziness, headache and itchiness were reported by sampaguita workers. Laboratory analysis detected malathion and diazinon residues for 100% and 92% of samples respectively.
(2) Declining flower productivity of old plants, whose average age was estimated at17 years. Farmers dislike replanting because of temporary loss of income while waiting for the new plants to mature.

The project's current two-pronged research and development intervention for peri-urban sampaguita livelihood includes: 1) participatory on-farm trials to compare farmer's and introduced pest management practices, as initial step in the development of IPM anchored on correct pest diagnosis and appropriate pesticides; and 2) horticultural evaluation of an exotic sampaguita variety, as initial step in promoting varietal diversity, encouraging replanting in old sampaguita farms, and stimulating market demand for new products.

**Keywords:** urban agriculture, sampaguita, livelihood system analysis, integrated pest management

**SSD No. 2**

# EFFECTS OF PRUNING AND BAGGING TECHNOLOGIES ON PRODUCTIVITY AND COST IN MANGO PRODUCTION IN SELECTED AREAS IN THE PHILIPPINES

**Maria Excelsis M. Orden, Aurora S. Paderes, Jocelyn L. Aveno, and Analou L. Santos**

Central Luzon State University, Science City of Munoz,
3119 Nueva Ecija, Philippines
Email: maexcelsis@yahoo.com

A total of 332 mango producers in selected major producing areas in Luzon, Visayas and Mindanao interviewed to analyze the impacts of pruning and bagging technologies on fruit quality, reduction in the use of chemicals, change in pest management cost structure, effects on productivity, and net income over pest management cost. Insect pests of mango are controlled using chemicals of different active ingredients ranging from CAT 2 to CAT 4. Pruning reduced the volume and cost of chemicals. It has decreasing effect on the cost of pest management as indicated by the estimated cost function. Pruning is a yield increasing technology based on Cobb-Douglas production function. Technically with pruning, there could be better light penetration, and pest and diseases could be reduced by destroying unproductive and damaged branches. Bagging protects mango from insect pests. It reduced the number of sprayings by two times, resulting in lower volume and cost of chemical control. But, bagging is relatively costly, hence it did not significantly reduce the cost of pest management. Bagging numerically increased yield, resulted in higher proportion of harvest sold to exporters in Luzon, not to mention in other two areas. In view thereof, net revenue above pest management cost of bagging adopters in Luzon was numerically higher than the non-adopters by about P500 per tree; not significant though, but a big opportunity cost among small farmers with limited capital in production. Bagging could have long-term benefits to the environment and the "mango-eating" public due to reduction in the use of chemicals. If bagging is practiced predominantly, the danger of environmental pollution and accumulation of the ill-effects of inorganically sprayed chemicals on the health of workers, households members and consumers could be minimized.

**Keywords:** pruning, bagging, mango, Cobb-Douglas production function, cost function

**SSD No. 3**

# PESTICIDE REGULATION AND FARMERS' EDUCATION ON RICE PRODUCTION IN NUEVA ECIJA, PHILIPPINES: AN ECONOMIC ANALYSIS

**Maria Excelsis M. Orden*[1] and Isabelita M. Pabuayon[2]**

[1]Central Luzon State University, Science City of Munoz,
3119 Nueva Ecija, Philippines
Email: maexcelsis@yahoo.com
[2]University of the Philippines Los Banos, College, 4031 Laguna, Philippines

The effects of regulatory program for pesticides and farmers' education through Farmers' Field School (FFS) on the pattern of pesticide use from 1990s to 2000 at the macro level and farm level using IRRI-PhilRice data were determined.

Insecticide use in the country has generally been increasing as indicated by rising imports and sales. Government tariff and pricing policies reduced the disincentive to use chemicals in agricultural production based on decreasing implicit tariff; but provided higher potential incentive to domestic formulation based on increasing effective protection rate. Nevertheless, the government appeared to have been successful in minimizing the availability and use of extremely hazardous chemicals in favor of least toxic ones through regulation.

At the farm level, regulation changed the pattern of pesticide use of farmers; from monocrotophos and endosulfan to other chemicals of lower toxicity, but entailed higher volume to compensate for potency loss to attain the equivalent pest control. Farmers' education as a complementary policy reduced pesticide use because of better understanding of insects' threshold level. The aggregate cost of material inputs and net income above material cost of farmers were not reduced significantly. But if net income could be improved through appropriate input and pricing policies there could be incentive to continually adopt IPM technology rather than chemical control. In the long run, this could result in healthier population and safer environment. The favorable impact of education on yield tends to be cumulative based on the estimated bio-economic and Cobb-Douglas production functions. Through time, farmers gained more knowledge and better understanding of the dynamics of the ecosystem that improved their decision-making to enhance yield.

In view of the positive impact of farmers' education on continued use of harmful chemicals, the government needs to strengthen its efforts to educate more farmers from other areas and in other crops on IPM technology through FFS.

**Keywords**: pesticide use, pesticide regulation, farmers' field school, bio-economic production function, Cobb-Douglas production function

**SSD No. 4**

## A FARMER-PARTICIPATORY APPROACH IN THE ADAPTATION AND ADOPTION OF CONTROLLED IRRIGATION FOR WATER-SAVING: A CASE STUDY IN CANAREM, VICTORIA, TARLAC, PHILIPPINES

**Flor G. Palis[1], P.A.A. Cenas[1*], B.A.M. Bouman[2], M. Hossain[1], R.M. Lampayan[2], A.T. Lactaoen[3], T.M. Norte[3], V.R. Vicmudo[3], and G.T. Castillo[4]**

[1]Social Sciences Division, [2]Crop Soil and Water Division
International Rice Research Institute (IRRI),
DAPO Box 7777, Metro Manila, Philippines
[3] National Irrigation Administration, Groundwater,
Irrigation System Reactivation Project
Tarlac, Philippines, and [4]Consultant, IRRI

With the current problem of water scarcity, a water saving technology called controlled irrigation or alternate wet and drying technique was tested for farmers' adaptation and eventual adoption using a farmer participatory approach. This technology can increase irrigation efficiency, water distribution equity, and farmers' income through the reduction of irrigation costs. The study was conducted in Canarem, Victoria, Tarlac among members of P38 Irrigation Service Cooperative (ISC) to explore various factors that would insure adoption of this water saving technology. Preliminary results showed group size, area size, irrigation cost, transparency in the management of irrigation service cooperative, strong leadership, and institutional factors such as cohesive partnership among National Irrigation System, local government, and ISCs are major factors for feasible implementation and farmers' adoption.

**Keywords:** controlled irrigation, alternative wet and drying technique, water-saving

**SSD No. 5**

# POPULATION DATA OF THE 15 PHILIPPINE REGIONAL CENTERS AT FIVE STR MARKERS: A LOOK INTO OUR GENETIC HISTORY

**M.M. Tan, G.C. Calacal, F.C. Delfin, K.A. Tabbada, M.P. Tan, J.C. Ferreon, H.B. Perdigon, Saturnina C. Halos, and Ma. Corazon A. De Ungria**

DNA Analysis Laboratory, Natural Sciences Research Institute
University of the Philippines, Diliman, Quezon City, Philippines

The Philippine archipelago lies at a crossroads between mainland Asia and Oceania and is thought to have served as a link between these two regions. Many groups in the Philippines share cultural affinities with both Polynesia and Asia. The geographical barriers presented by an archipelago have given rise to subpopulations with their own language, culture and religion. We study 15 regional populations in the Philippines using five Short Tandem Repeat (STR) markers –HUMvWA, HUMF13A01, HUMFES/FPS, HUMFOLP23 and D8S306– to analyze population relationships and dispersals among groups.

Blood or buccal swab samples (N=1,362) were obtained from 15 urban regional centers and processed as previously described. Frequencies were determined using the gene count method. Chi-square homogeneity tests were performed using Popgene software. Co-ancestry distance and dendograms were generated using GDA software ver 1.1.

Cp-ancestry coefficient values (Fst) range from 0-0.1, indicating low overall genetic diversity among Philippine urban groups. However, chi-square tests show that the Philippine population is not homogenous at three markers (HUMF13A01, HUMFES/FPS and HUMFOLP23). Analysis of 15 region using UPGMA revealed two main clusters (A and B), with cluster B subdividing into B1 and B2; Region 6 is an outlier.

Clustering of regions is consistent with their geographical location and predominant language. Los Fst values support the presence of an initial core group that peopled the Philippines; interactions of this core population with other Asian groups may have resulted in the genetic variations and heterogeneity of modern Philippine regional populations. This is particularly important when interpreting data of multi-center studies on relationships between Filipinos and different Asian groups. Northern Philippine groups more interactions with Taiwan and China, while southern regions have stronger ties to Indonesia and Malaysia. Further work to expand the number of DNA markers studies and compare Philippine populations with other Asian populations is underway.

**Keywords:** Philippines, short tandem repeat, population studies, co-ancestry coefficient, Fst