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# NATIONAL ACADEMY OF SCIENCE AND TECHNOLOGY
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## ABSTRACTS of PAPERS
Presented during the
24th NAST Annual Scientific Meeting

*Enchancing Philippine Science and Technology Thru ICT*

10-11 July 2002

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Republic of the Philippines
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24th ASM: 10-11 July 2002; Manila Hotel
Videoconference: 3-5 July 2002; RCBC Tower, Manila;
University of San Carlos, Cebu City;
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# 24th ANNUAL SCIENTIFIC MEETING

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# PLENARY PAPERS

## ENHANCING PHILIPPINE SCIENCE AND TECHNOLOGY THRU ICT: AN OVERVIEW

**Martin G. Curley**

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This paper discusses how information and communication technologies can become pivotal tools for advancing Philippines Science and Technology. The paper discusses how ICT impacts the processes for advancing Science and Technology, while it also discusses the importance of improving digital literacy.

The emerging Peer-to-Peer computing model is briefly reviewed and examples of its opportunities for use in advancing science and technology are provided. The paper also discusses the Careerspace initiative in Europe for wide scale improvement ICT skills to improve European Competitiveness.

**Keywords**: ICT, digital literacy, careerspace, peer-to-peer computing model

## REIMAGING THE ROLE OF INFORMATION AND COMMUNICATION TECHNOLOGY IN PHILIPPINE EDUCATION REFORM

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This paper contrasts two approaches regarding the role of information and communication technology (ICT) in the reform of Philippine education. The "transmission" approach assumes that the appropriation of ICT will serve to improve the existing systems and processes of the educational system. In particular, ICT would enable the more efficient and effective transmission of knowledge to students. In contrast, the "transformative" approach assumes that the ICT provides opportunities for transforming the systems and processes of the educational system. For example, the use of ICT can lead to a transformation of the teaching-learning processes in ways that change the goals and the nature of the curriculum, that redefine the roles of the teacher and the student, and that

make the learning assessment activities more interactive, experiential, and authentic. Examples will be given to illustrate the characteristics of how ICT is used in education according to the two approaches. The paper argues that the transformative approach to ICT use will be more effective in bringing about more effective learning in students, particularly in helping students develop the higher level thinking skills that are required in a knowledge society. Thus, the transformative approach is more likely to produce graduates who will be more competitive and who can more effectively navigate the emerging global labor markets.

**Keywords:** ICT, education reform, transmission approach, transformative approach

## MEETING GLOBAL COMPETITIONS: FROM RESEARCH TO MARKET (THROUGH INDUSTRY CLUSTERING: A NEW MODEL OF GOVERNANCE)

**Academician Ceferino L. Follosco**

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The lackluster performance of our productivity efforts in government, private sector and the academe is reflected not only in our declining Philippine Competitiveness ranking globally, total factor and partial productivity indicators, but also in the lack of competitiveness of many of our export and domestic products and services, especially with the liberalization of trade, technology, finance and now, people.

The paper analyzes factors affecting productivity and competitiveness and cites the need to leapfrog, as simple productivity techniques are no longer adequate to catch up with our competitors. A proposed alternative is to focus on certain sectors, given our meager resources, constraints and advanced state of our competitors in basic infrastructure, technology, governance and even knowledge.

To achieve this, clustering as a model for Governance and Productivity is being pursued by government, academe and private sector due to so much resources wasted in the past on inadequate planning, poor implementation and lack of team work.

The paper also discusses the various programs prior to the adoption of clustering as a strategy and proceeds with the conduct of workshops in all regions of the country whose outputs are 79 Priority Clusters in all provinces. Weaknesses, strengths and opportunities are identified with do-able programs for each cluster.

These clusters are aligned with clusters prepared by national agencies like DTI,

DA, DOST, CHED, TESDA, etc.

Continuous improvements for the clusters are in process. For clustering to succeed, we must have good and dedicated leaders and champions in government, private sector and the academe who are knowledgeable about various cluster segments or sub-segments of the whole value chain from product development to marketing, including support industries and specialized cluster resources like infrastructure, technology, education, finance, taxation, and regulations, etc.

**Keywords**: industry clustering, Philippine competitiveness, governance

## MAKING PHILIPPINE BIOTECHNOLOGY COMPETITIVE

**Evelyn Mae Tecson-Mendoza[1] and Ida F. Dalmacio[2]**

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Biotechnology-based industries or bioindustries, with annual growth of up to 20% and higher, are one of the fastest growing industry sectors worldwide. Bioindustry includes companies involved in the R & D and manufacture of materials such as cell cultures, catalysts, genetic materials, immune response materials, biochemicals, enzymes, proteins and equipment used in biological and genetic research on humans, plants and animals. It also includes service organizations that perform consulting, testing and processing and storage of such products. This paper aims to analyze the rise of bioindustry in selected European and developing countries, briefly review the status of biotechnology and bioindustry in the Philippines and discuss possible strategies to spur the development of bioindustry in the country.

The United States leads in bioindustries generating US$20 billion in revenues and 437,000 jobs in 1999. UK and Germany hold the second and third spots. The following were noted to have contributed significantly to the development of bioindustries in Europe: (a) strong life science research in Universities and strong research partnerships and collaboration between and among universities and industry; (b) enabling policies by national and regional governments such as laws that provide huge financial grants to projects, establishment of bioparks or bioincubators, support start-ups, encourage academics to be entrepreneurs; (c) strategies such as clustering or networking especially at the regional level and (d) strong biotechnology industry organizations. Governments of Asian countries like Japan, China, India, Singapore and Taiwan are cited to have provided enormous

financial support to the development of biotechnology R & D and bioindustries.

While biotechnology was institutionalized in the country two decades ago, bioindustry is still largely undeveloped. Among biotechnologies developed locally, plant tissue culture of orchids and banana can be considered the most widely utilized at the commercial level. Others such as biopesticides, biofertilizers, industrial enzymes, amino acid production, vaccine production have not taken off for several reasons: lack of industry-academe partnerships/interactions; lack of facilities and support capital for piloting technologies; lack of IPR awareness and support.

To help spur the development of biotechnology in the country, the following recommendations are offered: (a) adoption of clustering management for R & D and commercialization at the regional and national levels; (b) establish an enabling environment that will provide financial support to selected projects up to commercialization, provide infrastructure and support facilities such as a biopark, provide incentives for start-up and venture companies, and encourage scientists and business management experts to go into bioindustries and develop intellectual property (IP) culture and innovation among scientists; and (c) careful selection and prioritization of local and foreign mature technologies for commercialization and R & D projects that have potential commercial outputs.

**Keywords**: biotechnology, bioindustry, cluster network, cluster management, biopark, bioincubator

# TECHNICAL SESSIONS/VIDEOCONFERENCE

## *AGRICULTURAL SCIENCES AND BIOLOGICAL SCIENCES*
## *(Technical Session)*

# COMPATIBILITY OF GMOs WITH SUSTAINABLE AGRICULTURE

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GMOs or genetically modified organisms offer opportunities to support sustainable agriculture. The GM technology can be harnessed so that crops rather than the farm environment are altered to suit their environment. Experience with GM crops shows promising trends. Recent studies indicate that GM crops substantially reduce pesticide use and incidence of pesticide poisoning in farms. Farmers rapidly adopted GM crops because of perceived economic benefits. Bt crops compared with application of pesticides promote more biodiversity. Herbicide tolerant crops reduce soil cultivation. The current practice of transferring a single trait into as many popular varieties as possible ensures crop diversity at the farm level. In the pipeline are GMOs being designed to grow better on existing environments with fewer or zero inputs. Naturally occurring microbes and viruses are being designed to help crops and aquaculture species fend off pathogens and pests without affecting other components of the ecosystem. However, public sector R & D must be fully supported to develop environment friendly crops suitable to stressed environments where most of our farmers practice and to ensure the safety of the GM technology. Public education and information in biotechnology must be enhanced to support biotechnology R & D and GM technology diffusion.

**Keywords**: GMOs, sustainable agriculture

## PERFECTLY NATURAL, INVARIABLY FATAL: BIOLOGY OF PRIONS

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Prions are infectious proteins believed to cause invariably fatal neurological damage in both humans and animals. There are presently no vaccines nor medicines that will prevent the disease, and no treatments are available to halt or mitigate this meat-borne disease. Although the number of affected individuals is low, remarkable attention has been directed towards prions because these agents are remarkably resistant to heat and chemical treatments. Standard decontamination procedures like UV irradiation and high temperatures have minimal effects on prion infectivity. Prions have a unique biology. The prion protein is a product of a cellular gene in the host organism. The normal protein is expressed in most cell types, but expression is predominant in the brain. Normal and infective proteins share the same amino acid sequence, but differ in their three-dimensional structures. The exact mode of replication of the infectious proteins is not yet fully elucidated, but present evidence indicate that normal proteins are converted to the infectious form. The molecular mechanism of such a conversion is believed to proceed via some form of protein-protein interaction.

**Keywords**: prions, protein-protein interaction

## PRION DISEASES IN ANIMALS

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Prion diseases refer to a group of invariably neurodegenerative diseases in human and animals also known as spongiform encephalopathies. These are caused by proteinaceous infectious particles that lack nucleic acid called ***prions.*** This paper is a review of those occurring in animals and human spongiform encephalopathies are excluded.

Those occurring in animals include scrapie or ovine spongiform encephalopathy, bovine spongiform encephalopathy (BSE), transmissible mink encephalopathy (TME), chronic wasting disease of mule deer and elk, and feline spongiform encephalopathy. These diseases share many characteristics of long incubation period (from months to years or decades), clinical course also lasts for weeks to years resulting to death and lesions for the most part, are restricted to the central nervous system. Changes include neuronal

degeneration with neuronal vacuolation (spongiform degeneration), reactive astrocytosis and often "amyloid plaque" formation. It has been recognized that variations exist for several of the spongiform encephalopathies as to disease incidence, breed and species susceptibility and incubation time. Except of scrapie and BSE, information on the other animal spongiform encephalopathies is wanting. The occurrence, host range, signs, histopathology, transmission and diagnosis especially for scrapie and BSE are presented and discussed. It has been suggested that BSE has resulted from ingestion by cattle of meat & bone from scrapie infected sheep. TME is also considered to have resulted by the same route. It is also believed that bovine to bovine transmission results from feeding with bovine meat and bone meal. Thus the ban on the use of meat and bone meal from ruminants has reduced the occurrence of BSE.

There is no direct evidence that any of the animal spongiform encephalopathies is transmissible to humans. However, cases of a new variant Creutzfeld-Jacob Disease (vCJD) which occurred in teenagers and young adults in Britain and France revealed lesions of neurologic changes not previously seen in CJD cases of adults in the United States, Australia or Japan. These changes (numerous amyloid plaques) are similar to those seen in macaques inoculated with bovine prions.

**Keywords**: prions, scrapie, bovine spongiform encephalopathy, BSE, amyloid plaque, vCJD

## THE PROMISE OF STEM CELL-BASED THERAPIES: AN UPDATE

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Stem cell-based therapies rely on the unique ability of stem cells to self-renew and to generate a number of specialized cell types. These characteristics offer the possibility of growing large numbers of cells in culture which can be used as replacement cells in damaged tissues or as a vehicle for delivering genes/drugs to specific tissues in the body, damaged tissues or as a vehicle for delivering genes/drugs to specific tissues in the body. Stem cell-based therapies, therefore, have the potential to cure diseases like diabetes, Parkinson's disease, myocardial infarction, and cancer. A number of sources of stem cells have been identified. These include the embryo, fetal tissues, umbilical cord blood and adult. Several methods have been developed to isolate, characterize and grow these cells in culture. Stem cells from the different sources have different characteristics and growth requirements in culture. Among these, stem cells from adult bone marrow are the most studied and most frequently used. Hematopoietic stem cells from adult bone marrow used in the clinical setting in the treatment of leukemias and lymphomas, in restoring blood and immune cells destroyed by chemotherapy, and in the treatment of some autoimmune diseases. More recently, hematopoietic stem cells have been tapped for use

in gene therapy. This has been met with a number of technical challenges involving gene delivery and appropriate gene expression within the cell. A better success rate is anticipated as more efficient methods of gene delivery are developed, alternative sources of stem cells are tested, and regulatory mechanisms involved in self-renewal are identified.

The development of stem cell-based therapy for a specific disease is premised on the idea that purified stem cells grown in culture can be directed to differentiate into a specific cell type prior to use. Different laboratories have shown that mouse stem cells can be directed to differentiate into neurons, heart muscle cells or pancreatic islet cells. The cells, once transplanted into the recipient must be able to survive, make the appropriate connections with the surrounding cells, and restore the function of the damaged tissue. In a rat model of Parkinson's disease transplantation of stem cell-derived neurons into the brain relieved symptoms associated with the disease. Parallel studies in humans with Parkinson's disease have been encouraging although with limited success. It appears that the stem cell source and the degree of differentiation of the developing neuron are important in determining the success of the stem cell transplantation.

Significant progress has been made in the development of stem cell-based therapies over the past decade. However, more studies are needed to determine the long-term effects of these therapies. In particular, areas that need to be addressed include the immunogenicity and safety of stem cell-derived transplants. Ethical issues involving the derivation and use of embryonic and fetal tissue stem cells also need to be resolved.

**Keywords**: stem cells, therapy, ethical issues

## POTENTIAL ROLE AND TASKS FOR THE HEALTH SECTOR IN THE GOVERNMENT RESPONSE PLAN TO TERRORISM

**Juan Pablo G. Nañagas**

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The study examines the potential contribution of the health sector (government and private practitioners/institutions) in a response plan to biological events. The preparation of the United States and the recommendation of the WHO are presented in summary form. Even if it is not a high profile target, the Philippines cannot afford to be unprepared. Short descriptions of biological agents that pose greater public health threat are given. The plan of various Philippine agencies and instrumentalities are examined and assessed as well as the involvement of the health sector in those plans. A short analysis of the capabilities of the health sector vis-a-vis its possible roles is presented. The study concludes with some recommendations for policy review and change and capability building that may help the country prepare for biological events.

**Keywords**: health sector, biological events, WHO, public health

## *AGRICULTURAL SCIENCES AND BIOLOGICAL SCIENCES (Videoconference)*

# BIOTERRORISM (BIOLOGICAL WARFARE SCARE: UNDERSTANDING WHAT IT IS AND WHAT IS NOT)

**Nina G. Barzaga**

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National Institutes of Health, University of the Philippines Manila

Following the September 11, 2001 terrorist attack on the World Trade Center and the Pentagon in the USA, Dr. Gro Harlem Brundtland, Director General of the World Health Organization issued the following statements:

"We must prepare for the possibility that people are deliberately harmed with biological or chemical agents, and that any deliberate use of agents such as anthrax or smallpox should be contained by an effective public health response."

The first step towards the so-called "preparedness" is understanding what this "Biological Warfare" is all about, how the threat relates to many other infectious diseases that have the great potential to spread internationally and quickly. This paper focuses on the frequently asked questions or FAQs that the World Health Organization and the Center for Communicable Disease Control try to address. These FAQs are the following:

1. Which agents are most likely to be used to create a deliberate outbreak?
2. How are these agents applied to create a deliberate outbreak?
3. How would governments find out that an attack had taken place?
4. What kind of monitoring system is in place for infectious disease outbreaks?

The tasks of the Global Outbreak Alert and Response Network will be explained.

5. What treatment is available?
6. Would mass vaccination be an option in the case of a disease outbreak?
7. Should people be vaccinated now as a prevention?
8. What should national governments be doing now?

Three of the biological agents most likely to be used as biological weapons will be discussed. These are anthrax, small pox and bubonic plague.

**Keywords**: bioterrorism, biological warfare, anthrax, small pox, bubonic plague

## *CHEMICAL, PHYSICAL AND MATHEMATICAL SCIENCES*

### THE STATUS OF PARALLEL COMPUTATION AND HIGH PEFORMANCE COMPUTING IN THE PHILIPPINES

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In technologically advanced countries, solving scientific and technological problems using computer modelling, simulation, and data analysis require supercomputers or high performance computing systems. Conventional supercomputers are very expensive and beyond the budgets of most university research groups especially in developing countries such as the Philippines. However, recent advances in cluster computing technology and parallel computation on Linux-based systems make the cost of supercomputing very low compared with conventional supercomputing platforms.

In the Philippines, a number of science and engineering departments in different universities have begun experimenting with Beowulf clusters or a pile of personal computers connected in parallel through a high-speed network. An example is the High Performance Computing Laboratory of the Ateneo de Manila University which built the AGILA High Performance Computing System intended for computational science and engineering (CSE) applications.

This paper provides an overview of parallel computation on Linux-based high performance clusters. It also discusses recent initiatives by several scientists and engineers engaged in parallel computation and high performance computing in the Philippines.

**Keywords**: parallel computation, supercomputing, high-performance computing, computational science and engineering, Beowulf cluster, AGILA HPCS.

### PERSPECTIVE ON INTERCONNECTION NETWORKS IN THE PHILIPPINES

**Denis F. Villorente**

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Advanced Science and Technology Institute (ASTI) , (DOST)
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Information networks, of which the Interuet is the best known and most popular,

are important and very strategic to a country's economy and its people. Competitive advantages are derived by those who have near instantaneous access to relevant information. Thus, a measure of the value of a network to its user is how well that network is interconnected with other networks and thus to the information resources available on them.

In this paper, we discuss the Philippine Internet from the perspective of its interconnectedness. We also offer some recommendations on interconnection of networks run by government, research and education institutions to improve the science and technology capability of the country.

**Keywords**: internet, information network

## BIOINFORMATICS: GENOMIC AND BEYOND

**Nina Rosario L. Rojas, Ph.D.**

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Bioinformatics tools play key roles in handling biological information at every stage of the research process.

- Scientists analyze existing data to formulate hypothesis, choose experimental targets, map experimental strategies and even design wet lab reagents such as DNA oligonucleotide primers.
- Computation is used in the wet lab as well, from computers that run scientific instruments to tools that gather and digitize data, such as from electrophoresis and microarray images.
- Computational methods are more commonly associated with data analysis. In many cases today, large amounts of experimental data must be stored, organized, and analyzed for patterns in the process of interpretation.
- Access to the databases and exchange of bioinformatics tools have also facilitated the validation of data and results, enhancing the peer review process that is key to the practice of science.

Genomics has received the greatest amount of attention because it has matured to the point of steadily providing genetic information to scientists all over the world. However, the organism is not just the product of genes but rather of the complex interplay between genes and the environment. Genes are turned on, off, and modulated in response to other signals, and mapping this dynamic state of gene function is a major challenge.

Based on the so-called central dogma of molecular biology, scientists have

turned their attention to gene expression through "transcriptomics," or the study of genes that are transcribed into RNA under particular conditions. DNA microarray technology is the major approach used in this area. Other scientists are deep into "proteomics," or studying the protein profile, protein structure and function, as well as predicting gene function through comparison with known those of known proteins. In addition, some researchers are addressing gene function by mapping out interactions between gene products, leading to what some people call the study of the "interactome."

The genome projects, such as that for the human genome, have led the explosion of information on many aspects of the organism. Bioinformatics, together with more efficient wet laboratory tools, have made that explosion possible. Both would be needed to understand more fully the workings of the organism living in its environment.

**Keywords**: biological information, genomics, human genome, bioinformatics

## BIOINFORMATICS FROM THE COMPUTATIONAL POINT OF VIEW

**John Paul C. Vergara, Ph.D.**

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Bioinformatics is a rapidly developing field that combines computer science and mathematics with the life sciences. The field has emerged from the necessity of acquiring, storing, and analyzing large amounts of biological data from medical, agricultural and scientific applications.

This talk will provide an overview of bioinformatics and review some problems and tools that are important in the sequencing and analysis of genomes. Among the problems discussed are those that deal with sequence alignment, genome comparison, phylogenetic tree reconstruction, and microarray technology. Some emphasis will be given on the often contrasting perspectives of the biologist and the computer scientist when it comes to approaching these problems.

**Keywords**: bioinformatics, genome analysis, microarray, sequence alignment

## *ENGINEERING SCIENCES AND TECHNOLOGY (Technical Session)*

### ICT ROAD MAP IN ENGINEERING - SOFTWARE

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A roadmap is a layout of paths or routes that exist or could exist in some particular geographical location. The word "roadmap" is popularly used a powerful metaphor for plannning science and technology resources. Road maps are usually developed by a group of experts using complex methods. Elements which will be needed to create an Information and Communication Technology Roadmap for Engineering will be presented. The use and development of engineering productivity software, as well as opportunities in embedded systems design will be considered.

**Keywords**: roadmap, engineering productivity software, metaphor

### ICT ROAD MAP IN THE PHILIPPINES: INFRASTRUCTURE

**Academician William T. Torres**

President, Mosaic Communications, Inc., The Peak Tower, Makati City
and Member, National Academy of Science and Technology

This presentation shall attempt to specify an information infrastructure - computer networks with associated ICT resources – to address the information and communication requirements of professionals and technicians involved in various engineering activities all over the Philippines. Whatever ICT resources are available today are difficult to access by and share among a large number of engineering practitioners. The Internet and the World Wide Web can be harnessed to overcome a lot of these difficulties; however, there is a need to build upon this basic layer of infrastructure, other layers (e.g., content and services) to facilitate the effective sharing of expensive ICT resources. The presentation shall also discuss ICT-related initiatives of the Information Technology and Electronic Commerce Council (ITECC) relevant to the topic.

**Keywords**: infrastructure, ICT resources, internet, world wide web

## ICT ROADMAP IN THE PHILIPPINES: THE ACADEME

**Academician Reynaldo B. Vea**

President, Mapua Institute of Technology, Muralla Street, Intramuros, Manila
and Member, National Academy of Science and Technology

A road map shows the links among various points in geographic space. ICT Road Map for Philippine technology schools would serve an analogous purpose.

Philippine technological schools continue to suffer from a severe paucity of resources. State schools pale in comparison with other schools in the region due to lack of government support or inability to raise tuition or other funds. So do private schools, which can provide quality education only up to the level that can be afforded or ill-afforded by its students. Just barely able to provide professional training to its students, Philippine technological schools cannot and have not made any significant dent in research, which by any measure, in the field of engineering, is an expensive undertaking. Thus in the landscape of local technological education there is yet no traveler labeled *"research school."* There are schools, however, that are good teaching schools - good enough to be the source of engineers to the world despite the great odds. The immediate challenge before ICT schools is to bring standards up to international levels – to have the graduates certificated to appropriate standards. Another challenge is to make the global connections with industry in order to produce the ICT professionals they need and demand.

**Keywords**: ICT roadmap, Philippine technological schools, ICT proffessionals

## *ENGINEERING SCIENCES AND TECHNOLOGY (Videoconference)*

## CONFRONTING GLOBAL CHALLENGES IN ENGINEERING

**Gerardo C. Ablaza Jr.**

President and CEO, Globe Telecom, Inc.
Globe Telecom Plaza, Mandaluyong City

Within the Globe Telecom, Inc. and our industry, we have seen many challenges that have far reaching implications for our competitiveness. Global trends in science and engineering can be discussed at a very high level.

Four global trends that have already reached popular headlines will have direct influence on our country: (a) nano scale technologies, (b) the rise of IP or the Internet Protocol, (c) genetics, (d) environmental engineering. Work on these fields has the potential to radically transform electronics, communications, medicine and our environment.

In telecommunications, the collapse of the dot-com craze and the severe debt burdens on telecommunications companies worldwide have led to sharply lower purchases of equipment as well as a dramatic slowdown in research. In our country, we have been fortunate that telecommunications has continued to be a key driver of economic growth, especially with the intense competition for customers among the GSM operators. The resulting pressure to grow networks and cover as much of the Philippines as possible has led to requirements for engineering resources, at the very least in radio, transmission and switching, but as importantly, in IT and systems integration fields. Today, this pressure to get and keep the best talent in electronics, communications and software engineering fields remains.

**Keywords**: nano technology, internet, genetics, environmental engineering, IT, systems integration

## CAPACITY BUILDING FOR ENGINEERS

**Academician Reynaldo B. Vea, Ph.D.**

President, Mapua Institute of Technology, Muralla Street, Intramuros, Manila
and Member, National Academy of Science and Technology

The professional life of an engineer should be one of continuous study, learning and honing.

Computers and networks have proven effective in the teaching and learning process. Simulation software and the Web have become tools for the efficient and quick interaction of teachers and students. The Web has also started to enable schools to share their libraries and other educational materials and even their faculty with other schools around the world. This has put in the hands of scholars an amazing wealth of knowledge and resources that enables them to become better students and teachers.

In an era of global outsourcing of engineering services it behooves all engineering schools to impart to its students the most advanced problem-solving methodologies and tools, including engineering software. After schooling, engineers depend, among others, on the colleagues in professional societies to keep up with developments in their fields. For capacity building our engineering societies must be thoroughly wired and able to help their members navigate electronically through the mass engineering data and information

available worldwide. This would ensure the use of the state-of-the-art in problem solving.

If heightening engineering R&D capability is among our objectives then ICT can play a natural role in capacity building. The internet has dramatically facilitated collaborative research work. Researchers can now share electronic fora that allow great number of enquiring minds to focus simultaneously on any given topic. Experiments could be set up, theories proposed and data reported very quickly. The lag time between conferences and publishing has simply evaporated.

ICT will be no panacea but it will be indispensable to engineering capacity building.

**Keywords**: ICT, capacity building, web

## ENHANCING PHILIPPINE ENGINEERING THROUGH ICT

**Academician William T. Torres, Ph.D.**

President, Mosaic Communications, Inc., The Peak Tower, Makati City
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Engineers have been using ICT mainly for communication, information processing and visualization. Their main tools are personal desktop and laptop computers and peripherals as well as application software that they themselves developed or they acquired from others. With the advent of computer networking, the Internet and the Word Wide Web, more sophisticated ICT tools have become available, including project management and decision support systems, knowledge integration and software that support complex engineering design processes. To be competitive in the market, Filipino engineers have to have access to these tools. But because they are quite expensive to acquire and to maintain, there is a need to create mechanism(s) to share them so that the costs can be distributed among many users.

This presentation will deal with how to enable the sharing of common ICT resources among Filipino engineers together with their suppliers, partners and clients over the Internet and the Word Wide Web.

**Keywords**: ICT, information processing, communication, visualization, internet, web

## *HEALTH SCIENCES*

### THE PHILIPPINE RESEARCH, EDUCATION, AND GOVERNMENT INFORMATION NETWORK (PREGINET)

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The Philippine Research, Education and Government Information Network (PREGINET) Project is an initiative of the Advanced Science and Technology Institute to establish a nationwide broadband research and education network. Funded by the Department of Science and Technology, PREGINET is expected to improve the science and technology infrastructure of the country by interconnecting research and education institutions which require such an infrastructure for applications related to distance education, telemedicine, bioinformatics, agriculture and earth monitoring, among others. PREGINET is also designed as a testbed for the development, testing, and deployment of next generation network technologies and services. The accomplishments, status and future plans for the project are discussed in this paper.

**Keywords**: network, PREGINET, information network

### STANDARDS FOR HEALTH INFORMATION IN THE PHILIPPINES

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Recognizing the important role information technology will play in the health care industry, the National Institutes of Health Manila (NIH) created the Computer Research and Information Technology for Health Program (CRIT). As its pioneering project, the CRIT moved to convene the major stakeholders in the industry and form a study group to determine standards for health information in the country. In particular, the study group aimed to formulate sets of recommendations for the standardized method of collection, storage, transmission, and dissemination of health data throughout the country.

This paper contains the recommendations of the Study Group. It will be divided into three major parts: the recommended standards for data elements, the recommended standards for data interchange, and the recommended coding systems and terminology.

This paper will be initially released as a draft that will be subsequently reviewed and criticized by stakeholders in the local healthcare industry.

New technologies have appeared since the publication of this paper in 1999. Specifically, the Extensible Markup Language (XML) specification by the W3C consortium provides a framework for interoperability that surpasses the current recommendation of this paper. It is the plan of the NIH-CRIT to revise the SHIP to integrate the benefits of XML before the end of 2002.

**Keywords:** health information, NIH-CRIT

## PROTECTING HEALTH DATA

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## UPDATES ON TELEMEDICINE

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The vision of the National Telehealth Center is to be the center of excellence for e-health and telemedicine in the Philippines. Major achievements in the past year include the development of the STRATEGIC PLAN for the NATIONAL TELEHEALTH CENTER, a teledermatology application, a teleradiology system, and design of the Community Teleservice Center. Major applications areas are teleconsultation, distance education, software application development. Teleconsultation includes the development of a videoconferencing setup, customized development of videoconferencing software, protocols and policies on standards in care over e-mail or Internet, data security and privacy standards. Distance education involves the development of distance education modules

using Internet technologies such as Flash and streaming audio and video. The Center also aims to conduct software application development based upon open source technologies, such as Linux, PHP, PostgreSQL, and Java. Applications to be developed include geographic information systems and clinical information systems. A landmark research in telemedicine and teledermatology in particular in the PGH and the Philippines was accomplished with the PGH Section of Dermatology. A teledermatology application was developed using Linux, PHP, and PostgreSQL. The study compares the diagnostic results from traditional face-to-face dermatology consult and teledermatology consultation using store-and-forward technology. It assesses the acceptability of this technology to patients and healthcare providers. The results shows hat teledermatology is an accurate tool for diagnosis of dermatologic conditions. Agreement is high between SAF and FTF diagnoses. This study also shows that health care providers are open to this new form of consultation. However, in contrast to findings in other countries, this study indicates that there seems to be hesitation on the part of the patients to use the technology. A similar application for a web-based teleradiology system was also developed with the Department of Radiology which compares store and forward technology with traditional negatoscope assessment. The design of a community teleservice center is being conducted with the cooperation of the Philippine Council on Health Research Development and the Department of Transportation and Communication

**Keywords**: e-health, telemedicine, videoconferencing, teledermatology, distance education

## *SOCIAL SCIENCES*
## *(Technical Session)*

### LINKING SOCIAL AND TECHNICAL SCIENCES IN FACILITATING LOCAL AGRICULTURAL INNOVATION

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With or without access to formal science, local people continuously innovate while managing their agricultural livelihood. However, agricultural science has demonstrated that it can contribute to livelihood improvement by developing and disseminating technologies relevant to local people's needs. This paper discusses the challenge facing

agricultural science in ensuring greater utilization of its research products. A particular issue examined is linking social and technical sciences to facilitate local agricultural innovation. Together with empirical examples from rootcrop research across Asia, the paper argues that technological interventions are inadequate for dealing with complex problem situations at the field level. It proposes participatory research as a platform for technical and social scientists to engage in joint learning with local farming communities.

**Keywords**: agricultural livelihood, local innovation, participatory research

## THE USE OF *WEALTH RANK* AS AN EXPLANATORY VARIABLE IN A MODEL OF CULTIVATION DECISIONS AMONG HOUSEHOLDS IN BUFFER ZONE COMMUNITIES

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This paper discusses an evaluation of wealth ranks generated by a wealth ranking exercise as an explanatory variable in econometric analysis of farm and household factors affecting cultivation decisions among forest buffer zone communities in the Upper Manupali Watershed, Bukidnon, Philippines. Wealth ranks improved the explanatory power of the model of cultivation decisions, but not the model of access. However, wealth – both in monetary terms and in the terms implied by the wealth ranks - was not a major determinant of buffer zone access and cultivation.

Wealth rank descriptors indicate that initiative, attitude and community relations were also significant determinants of a household's decision to make investments in farming. As a tool that builds on local people's own understanding of their own circumstances,the paper shows that wealth ranks present an opportunity for analytical tools to capture an elaborate on the socio-cultural dimensions of household decision-making.

**Keywords**: wealth rank, econometric analysis, socio-cultural dimension

## MEASURING SOCIAL CAPITAL IN AGRARIAN REFORM COMMUNITIES (ARC) AND NON ARC IN THE PHILIPPINES

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Social capital means different things to different people. At the conceptual level, the current debate stems from two issues: 1. Is social capital capital? 2. Is social capital social? Admittedly, economists and sociologists would have different perspectives of this concept rooted from the theoretical frame of their individual disciplines. Measuring social capital for development policy is thus dependent on how one perceives the concept to be.

This paper will attempt to "demystify" measurement of social capital by illustrating estimation of an index that captures oth the economic (capital) and social aspects of social capital. Through a literature review, origins and evolution of the concept will be explored in reference to its impact or potential impact on poverty alleviation. The empirical exercise will be based on the study of agrarian reform communities (ARC) and a set of control non ARCs in the Philippines. The paper will try to point out future needs for research and methodology development in further understanding and quantifying social capital as a policy variable.

**Keywords**: social capital, agrarian reform

## PEASANT TYPES AND DEVELOPMENT ISSUES IN MINDANAO

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Bishop Prelate of Ipil

In this exploratory paper, we shall first discuss two sets of variables and their utility for classifying the peasantry. Then we can sketch out eight types of the Filipino peasant today. We shall end with some observations on development issues affecting Filipino peasants at the outset of the new century.

The first pair of variables related farm size to agricultural technology. Its unit

of analysis is the farm as a reproductive entity. The peasant is thus seen principally in terms of his "man-land" technological relationship. The focus is on the productivity issue in development.

The second pair of variables relates land tenure and access to support services such as credit and marketing. Its unit of analysis is the peasant as the tiller of the soil vis-a-vis landlords, government, and other intermediaries. The peasant is thus viewed primarily in terms of his "man-man" social relationships. The focus is on the equity issue in development.

Both man-land and man-man relationships constitute crucial dimensions in characterizing the types of Filipino peasants today. By juxtaposing the two pairs of variables, we can discern eight types.

**Keywords**: Filipino peasants, man-land, man-man, social relationships, farm size, agricultural technology, land tenure

## *SOCIAL SCIENCES*
## *(Videoconference)*

### BRINGING QUALITY EDUCATION RIGHT AT THE DOORSTEPS OF THE FILIPINO LEARNER: THE UP OPEN UNIVERSITY EXPERIENCE

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This paper begins with a description of the Philippine education pyramid as basis for the argument that distance education is a viable alternative delivery system for educational services to Filipino learners, then highlights the beginnings of distance education in the Philippines. The focus of the paper, however, is the UP Open University: its history organization and management, and its procedures in the development and delivery of courses and academic degree programs. The paper also discusses the various degree programs and nonformal courses offered, and a discussion of the UPOU experience over the last 7 years. The paper ends with a summary of lessons learned from this experience

**Keywords**: distance education, open university, education pyramid

# "FILIPINIANA ONLINE": KNOWLEDGE PRODUCTION THROUGH ICT

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The dynamism of knowledge production on the Internet is a critical reality that scholars, academicians. scientists & artists who are involved in the dissemination of knowledges and information must acknowledge if they want to continue to overdetermine the shape of their respective societies today. In terms of the humanities and social sciences, in particular, there are 29,910 websites on Philippine Culture which incessantly construct their own discourses on the Filipino and Philippine social practices. The Internet has a way of flattening out Philippine hierarchical discourses. Official pronouncements of the various branches of government, reports from ngos, articles from professional and private organizations are all equally accessible through the click of a mouse. No distinctions are made between private/personal and public; between commercial and academic; between official and informal; between US/UK European/Australian/Asian-based communities of Filipinos and those here; between knowledges and information, between fact and wild imaginings.

The Internet has truly democratized access to information & knowledges. Therefore, the Internet is an arena that we have to aggressively enter. Through the UP Open University, then under Chancellor Ma. Cristina Padolina, my Filipiniana Online Team of researchers,writers & multimedia artists constructed a course on Philippine Culture that was offered on the web as early as Second Semester,1999-2000. Accompanied by the **Filipiniana Reader** (a printed anthology of critical essays on Philippine Theater, Art, Literature & Popular Culture) and a **Filipiniana CD**, **Filipiniana Online** sought to contribute to the twin projects of nation-formation and identity-construction. To build a sense of "Filipino-hood" and a concept of nation that recognized the diasporic nature of Philippine Society was our political agenda. These goals were effected through the interactive structure of **Filipiniana Online** — i.e., threaded discussions facilitated by four specialists in each of the modules of Philippine Theater, Literature, Art & Popular Culture as well as a digital library that gave participants hyperlinks to other websites on Philippine Culture and History. Thus, its online nature, enabled participants from different Filipino communities here and abroad to participate in discussions and projects (i.e., the final requirement included the construction of websites, compact disks, VHS, papers on any of the topics that resulted from the discussions). **Filipiniana Online** is now a post-baccalaureate course called Cultural Studies 250 which shall again be offered in August 2002 through the UP Open University.

**Keywords**: internet, Philippine culture, interactive

# ICT INTERVENTION PROGRAMS IN SCIENCE EDUCATION

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This paper presents the various information communications technology programs implemented by the Science Education Institute (SEI). These programs are focused on the following concerns: developing the environment for learning, developing teachers' capability, developing ICT infrastructure, enhancing youth ICT competitiveness, web-based services, and international assessment. The following programs will be discussed: the Mobile IT Classrooms, Computer Literacy Program, ICT Learning Assisted Program, Development of Computer-Based Teaching (CBT) Modules, Intel Teach to the Future Program, Model ICT Learning Centers, Young Web Designers Competition, Computer Programming Competitions, STEDNET, and the Scholarship Administration System. The Philippine participation in the Second Information Technology Study in Education – Module 2 (SITES-M2) will likewise be discussed.

**Keywords**: ICT, science education, web-based services

# POSTER SESSION

## *AGRICULTURAL SCIENCES*

### ASD No. 1 PTERIDOPHYTES AS BIOINDICATORS OF FOREST CONDITIONS

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The Pteridophyte composition of different forest types namely: deciduous dipterocarp-oak forest (DOF); deciduous degraded, hardwood (teak) with bamboo forest (BBDF); and primary, seasonal, evergreen, hardwood forest (EGF) areas at Mae ampong Village, Chiang Mai Province, Thailand, was studied from March 1996 to February 1997 to determine the potential of Pteridophytes as bioindicators. Three subsites, i.e. extremely disturbed, half-disturbed, and less disturbed were established in each forest type. Species richness in EGF (27 spp.) was significantly higher than in the DOF (12 spp.) and BBDF (9 spp.). The species composition in DOF and BBDF was similar with a Sorensen's index of similarity of 0.43. Between subsites, species richness and composition in less disturbed evergreen forested areas were significantly lower and very different from the more disturbed subsites, while that in the two deciduous forests were not.

*Selaginella repanda* (Desv.) Spring, *S. ostenfeldii* Hieron., and *Cheilanthes tenuifolia* (Burm. f.) Sw. were the most dominant Pteridophyte in DOF; *S. repanda*, *Dryopteris cochleata* (D. Don) C. Chr., and *Anisocampium cumingianum* Presl in BBDF; *Dicranopteris linearis* (Burm. f.) Underw. var. linearis, *Blechnum orientale* L., and *Pteridium aquilinum* (L.) Kuhn spp. aquilinum var. wigbtianum in the disturbed EGF; and *Brainea insignis* (Hk.) J. Sm., *Thelypteris hirtisora* (C. Chr.) K. Iwats., and *Bolbitis virens* (Wall. ex Hk. & Grev.) Schott var. virens in relatively undisturbed EGF. These species were used to characterize the conditions of the different forests that were studied.

Since certain species of Pteridophytes could be used, as indicators of forest conditions, detailed forest studies is not necessary if rapid assessment is required.

**Keywords**: pteridophytes, bioindicators, forests, DOF, BBDF, EGF, species richness, similarity index

# ASD No. 2 RESPONSE IN ROOTED STEM CUTTINGS OF PHILIPPINE TEAK (*Tectona philippinensis* Benth. & Hook. ) TO BIOFERTILIZERS

**Yolina T. Castaneto[1] and Minda P. Follosco-Edmiston[2]**

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Propagation and proper fertilization treatment of seedlings in the nursery before outplanting need to be rigorously studied in the Philippine teak, Tectona philippinensis, primarily to save this endemic species. Its current global conservation status is classified as ENDEMIC by the 1997 International Union on Conservation of Nature (IUCN) Red List of Threatened Species and World List of Threatened Trees (Oldfield, et al., 1998; Walter and Gillet, 1998). Rooting of stem cuttings had been successfully achieved (Follosco-Edmiston, 2000), thus, the next step is to enhance the growth of seedlings using either bio- or inorganic fertilizers.

The study dealt with the use of commercially available biofertilizers. Treatments were carried out under nursery condition and the responses of seedlings were monitored using the parameters: height (cm), diameter at root collar (mm), root/shoot total dry weight (g), % dry matter, % inorganic matter, % organic matter, and % nitrogen. Among the parameters tested, significant differences were obtained on seedling height, diameter, % dry matter, % organic matter and % N. Height of rooted cuttings is found best with Biocore at 20 gram/seedling giving 36.06 cm over that of the control at 20.28 cm. Likewise, seedling height under a combination of Biocore + Mykovam was 25.30 cm. Seedling diameter at root collar was also affected by the application of biofertilizers. Biocore applied at 20 gram/seedling significantly yielded the biggest seedling diameter. Analysis of tissues also revealed significant differences in % dry matter, % organic and % nitrogen contents among different treatments. Mykovam-treated seedlings gave the highest (63%) dry matter content while Biocore-treated seedlings at 20 g, had the lowest (41%). Organic matter content was high (23.61%) under Biocore treatment at 20 g while Mykovam treatment yielded the lowest (19.83%) however, this is not significantly different with results obtained under Biocore at 10 g and the control treatment. Accumulation of % N had the same trend with those of the % organic matter found in the plant tissues.

Given the above responses of the rooted teak cuttings, it is therefore evident that the addition of biofertilizers, Mykovam and Biocore enhance the growth and survival of the Philippine teak in the nursery. Among all of the treatments, Biocore added at 20 g/seedling gave the best results.

**Keywords**: endemic, endangered, biofertilizers, cuttings, nursery

# ASD No. 3 ROOTING IN STEM CUTTINGS OF IPIL [*INTSIA BIJUGA* (COLEBROOKE) O. KUNTZE]

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Asexual propagation via rooting of cuttings is a recognized method of mass propagating exact copies of desirable plants for clonal plantation, reforestation and for commercial purposes. Ipil (*I. bijuga*; *Caesapineaceae*) is native to Southeast Asia and the islands of southwestern Pacific. A large tree, it reaches a height of 20 to 25 m and a diameter of 250 cm. It is one of the trees recommended for reforestation not only for its high quality timber but also because of the fact that it has been classified as ENDANGERED by the Convention on International Trade on Endangered Species of Wild Flora and Fauna, CITES (ERDB-DENR, 1993).

Cuttings with node numbers 1-3 (young) and 4-5 (mature) from the tip were obtained from 6 to 8 mo-old seedlings, soaked in 5% Benlate solution for 1 h and then subjected for 30 min to various treatments: 0.1% Superthrive, a vitamin-hormone preparation, 3 levels of IBA and NAA alone (500, 1500, 2000 ppm), and equal amounts of combined IBA and NAA (250, 500, 750, 1000 ppm). Cuttings were immediately planted in trays containing equal amounts of sterile coconut coir dust and river sand. Both treated and untreated cuttings responded favorably under misted condition in polyethylene enclosures. Rooting response at 50 d was manifested by emerging roots and mostly by adventitious roots with or without laterals. Survival of young and mature cuttings was high at 70 to 100% and their difference was not significant in all treatments. Absence of rooting in some young cuttings was observed in treatments where NAA was added at 500, 1500 and 2000 ppm while in mature cuttings, it was in treatments supplemented with 0.5% Superthrive, 1500 ppm IBA and 500 ppm NAA. Also, the absence of rooting in mature cuttings was significantly higher than in young cuttings. Although absence of rooting was observed in some young and mature cuttings, this was definitely much lower as compared with any of the following: formation of 1-2 adventitious roots without laterals, formation of 1-3 adventitious roots with laterals and profuse rooting. Formation of 1-2 roots without laterals in young cuttings was from 0 to 37% and reached 71% in mature cuttings; these are not significantly different. The different types of treatments and types of cuttings have significant effect on profuse rooting. In young cuttings, the highest (71 to 83%) in profuse rooting was observed in treatments with 1500 ppm IBA and with 500 ppm IBA + 500 ppm NAA while in mature cuttings, this was recorded in three treatments: with 2000 ppm IBA, with 250 ppm IBA + 250 ppm NAA, and 500 ppm IBA + 500 ppm NAA. The study indicates that young cuttings are better adapted to rooting than mature cuttings under any type of treatment. The production of roots by untreated cuttings indicate the economic potential of producing clones at the farmer level.

**Keywords**: stem cuttings, rooting, Superthrive, native, *Intsia bijuga*, indolebutyric acid (IBA), alpha-napththalene acetic acid (NAA)

# ASD No. 4 FACTORS CONTROLLING THE ALTITUDINAL VEGETATION AND LEAF SIZE ZONES ON MT. PULOG, CORDILLERA, NORTHERN LUZON

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An anomalous altitudinal vegetation and leaf size zonation pattern has been observed on Mt. Pulog, the highest mountain peak on Luzon Island in the Cordillera mountain range, Northern Luzon. The four unique altitudinal tree vegetation and leaf size zones on Mt. Pulog, are: Zone I, needle-leaved *Pinus* forest zone at 2000-2300 m a.s.l.; II, mixed needle-leaved *Pinus* and microphyllous evergreen broadleaved forest zone at 2300-2400 m a.s.l.; III, Microphyllous *Lithocarpus-Dacrycarpus-Syzygium-Leptospermum* forest zone at 2400-2600 m a.s.l.; and IV, mixed microphyllous *Clethra* and nanophyllous *Rhododendron* forest zone at 2600-2700 m a.s.l. This pattern is contrary to what is usually observed in the tropical mountains where mesophyllous dipterocarps occupy the lower zones and then followed by notophyllous, microphyllous and nanophyllous trees respectively with increasing altitudes. This poses a problem in the study of vegetation science especially to beginners. Therefore, in order to explain this confusing pattern, a combined literature and field investigations were done to determine the factors controlling this unique zonation. Reviews on historical geography and geology were critically examined and field ecological conditions were analyzed. Results indicate three major factors controlling the characteristics zonation pattern. They are as follows: (1) complex geological history of the Philippine coupled with the phytogeographical position of Mt. Pulog as transition region between the tropics and subtropics; (2) temperature; and (3) topography. The findings eliminate the confusion on the anomalous distribution pattern of vegetation and leaf size along altitudinal gradients on Mt. Pulog and hopefully there will no longer be hindrances in interpreting results and drawing conclusions in related studies. Other factors such as cloud cover, soil humidity and wind pattern may have influenced the unique zonation pattern as well, but experimental studies on these aspects are yet to be conducted.

**Keywords:** Mt. Pulog, altitudinal vegetation and leaf size zones, Cordillera mountain range, controlling factors, geological history, phytogeographical position, temperature, topography, tropics, subtropics

## ASD No. 5 GENERAL AND SPECIFIC COMBINING ABILITIES FOR MATURE WEIGHT AND EXTERNAL BODY MEASUREMENTS OF REGISTERED GOATS IN THE PHILIPPINES

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Data on mature weight (MWT) and external body measurements [i.e. body length (BL), heart girth (HG), midriff girth (MG), flank girth (FG), withers height (WH), head length (HL) and head width (HW)] of 1,315 goats listed in the Philippine Goat Breed Registry were analyzed using a linear mixed model that included the fixed effect of sex ($X_i$) and random effects of the sire breed ($S_j$), dam breed ($D_k$), and sire breed x dam breed interactions ($SD_{jk}$).

Estimates of general combining ability (GCA) were highest in the Boer (for MWT, HG, MG, FG, HL, and HW) and Saanen (for BL and WH). The lowest GCA estimates were found in the Native goats for all traits studied. Specific combining ability (SCA) was also computed based on the random interaction effects of the sire and dam breeds used in a specific cross.

The predicted mature weight in the Boer, Saanen, Nubian, and Native goats was 46.8 kg, 44.1 kg and 25.1 kg for bucks and 40.2 kg, 37.4 kg, 35.8 kg and 18.4 kg for does, respectively. External body measurements were greater in the Boer, Nubian, and Saanen cross NUxSA) was heaviest at 36.1 kg and 29.4 kg for bucks and does, respectively. Saanen x Native (SAxNA) goats had the lowest mature weight of 26.3 kg and 19.6 kg for bucks and does, repectively. The mature weights and body measurements in the higb grade Nubian (HGNUB) or "87.5% Nubian-12.5% Native", Nubian x Native (NUxNA), and Boer x Nubian (BOxNU) were intermediate to the NUxSA and SAxNA crosses.

Average heterosis, defined as the relative superiority of a mating combination over the mid parent values was -4.91%, -1.64%, -2.06%, -1.76%, -1.54%, -1.44%, -2.14% and -1.26% for MWT, BL, HG, MG, FG, WH, HL and HW, respectively. The low and negative heterosis values may imply that mature weight and external body measurements are traits strongly influenced by additive gene effects and that genetic improvement through selection within the breed may be a hetter strategy under Philippine conditions. The advantage of crosses over the native stock in terms of mature weight was highest in the HGNUB (49.58%), intermediate in NUxNA (18.79%), and least in SAxNA (5.73%). The average advantage over Native goats for external body measurements ranged from 9.24 to 23.98%, 5.10 to 10.49% and -9.10 to 6.28% in the HGNUB, NUxNA and SAxNA crosses, respectively.

**Keywords**: general combining abiligy (GCA), specific combining ability (SCA), goat, heterosis

## ASD No. 6 FISH SILAGE AS A REPLACEMENT FOR FISH MEAL AND UREA WITH SORGHUM AND ITALIAN RYEGRASS SILAGES AS A BASAL RATION FOR GROWING LAMB

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The uncontrolled rising price in imported fish meal and its subsequent shortage in the future necessitated the conduct of this investigation. Two studies were done to assess dietary manipulation of fish silage (FS) as a protein supplement and its comparison to fish meal (FM) and urea (UR) using sorghum silage (study 1) and Italian ryegrass silages (study 2) as a basal ration. In study 1, the molar propionate ratio, 4 hours after feeding, in lambs fed on the FS supplement was higher than the others ($P<0.05$), however, in study 2, it was largely reduced. The organic matter intake in the FS supplemented diet in study 2 remarkably improved while the digestibilities of crude protein and organic matter tended to be higher than the other protein supplements. An almost 100% increase in nitrogen balance was noted from lambs fed on the FS supplement in study 2 when compared to study 1. The energy balance of lambs fed on the FS supplement in study 2 was largely increased to 116.6 kJ/kgW$^{0.75}$/d against −213 kJ/kgW$^{0.75}$/d in study 1. The urinary purine derivative excretions and microbial nitrogen production of lambs fed on the FS supplement in study 2 were increased by almost 2-fold compared to study 1.

The above results suggest that dietary manipulation enhanced the feeding value of fish silage and is a potential protein supplement in lamb.

**Keywords** : Fish silage, energy balance, volatile fatty acid, purine derivatives,protein supplement.

## ASD No. 7 ALINANG WEED (*Cyperus iria* Linn.): A NEW POTENTIAL FIBER RESOURCE FOR PULP AND PAPER

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The potentials of Alinang (*Cyperus iria* Linn.), a naturally growing weed in the marsh areas, as raw material for the pulp and paper industry was evaluated using a modi-

fied pressure cooking method. The experiments were done in the laboratories of the Mariano Marcos State University, Batac, Ilocos Norte and The Forest Poducts Research and Development Institute, College, Laguna.

The usual pulping procedure was modified by cooking the samples for just two hours using an ordinary pressure cooker. The pulping treatments were: 16% $Na_2SO_3$ + 10% NaOH; 16% $Na_2SO_3$ + 10% $Na_2CO_3$ and 8% HCl. The produced pulps were bleached with a non-chlorine bleaching agent by using the two stages – 3% hydrogen peroxide process.

Samples cooked with 8 % HCl consistently produced the highest biomass constituents (40% cellulose, 37.3% hemicellulose, 34.7% lignin, and 32.7% hot water extractives). It also gave the highest unbleached (87.1%) and bleached (23.19%) pulp yield. However, the pulps produced from 16% $Na_2SO_3$ + 10 % NaOH and 16% $Na_2SO_3$ + 10% $Na_2CO_3$ treatments gave 10.30 - 10.56 mN.m$^2$/g tear index, 51.16 – 65.10 N.m/g tensile strength, 194.9 – 203.81 folding endurance and 5.56 – 6.55 Kpa.m$^2$/g burst index, which were much stronger than the HCl-treated pulps.s

Generally, the mechanical and physical properties of Alinang pulp faired well with the pulps produced from the traditional wood raw materials produced by conventional processes. Using the modified cooking method, Alinang gives a high strength pulp and can be produced at P 0.38/g pulp. It is much cheaper than the conventional soda cooking method using magabuyo, a hardwood species, giving a production cost of P 3.74/g pulp.

**Keywords:** Alinang, magabuyo, pulp, handmade paper, non wood fiber, conventional process

## ASD No. 8 DIVERSITY ANALYSIS OF CYTOPLASMIC MALE STERILE LINES OF RICE USING MICROSATELLITE MARKERS

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Cytoplasmic-genetic male sterile (CMS) system is considered to be highly important in a hybrid rice breeding program. Various CMS sources have been used in developing CMS lines, therefore, genetic similarities are possible. In developing superior hybrid rices there should be genetic diversity in CMS germplasm to increase the likelihood of identifying heterotic combinations. Molecular technology plays an important role in characterizing and clustering of large array of CMS used in hybrid rice breeding, since this would avoid repetition in the use of the same germplasm. Fifty CMS lines were

studied: 32 came from IRRI, 8 from PhilRice, 4 from Yunnan Agricultural University (YAU) and 6 from backcross nursery (BC ). IRRI CMS lines mostly belong to the CMS-WA types, while those from YAU are CMS-STB or CMS-ZTB types. Genetically pure seeds of each line were grown in seed box in the greenhouse. Leaf tissues from eight-week old plants were collected and extracted using the CTAB method. The CMS lines were assayed using microsatellite primers through polymerase chain reaction (PCR). Amplification products were separated using 5% denaturing polyacrylamide gel and polymorphism was detected using silver sequence DNA staining st. Initially, all of the 9 simple sequence repeats (SSRs) or microsatellite markers surveyed exhibited polymorphism. Use of SSR markers is efficient in characterizing and determining diversity in CMS lines. Further, markers unique to a specific CMS line may be used as diagnostic tool for identification.

**Keywords**: cytoplasmic male sterile lines (CMS), rice, PCR, SSR, diversity analysis

## ASD No. 9 GENETIC CHARACTERIZATION OF NEW TGMS RICE MATERIALS IN TERMS OF MOLECULAR DIVERSITY

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Thermosensitive genetic male sterility (TGMS) genes regulate the pollen fertility of the male sterile rice when subjected to different temperature regimes. This system is considered to be a more efficient alternative than the cytoplasmic male sterile (CMS) system for hybrid rice. Genetic and molecular characterization of all TGMS lines aids in identifying their diversity as to explore the possibilities of utilizing the most promising lines. Diversity of TGMS materials were evaluated using TGMS 1 and TGMS 6 (from Vietnam), TGMS 4, TGMS 5 and TGMS 11 (from China) and TGMS 13 (from IRRI) established both in Maligaya and Capintalan, Nueva Ecija. DNAs from individual plants were subjected to PCR analysis using Simple Sequence Repeats (SSR) or Microsatellite primers. Six TGMS lines were characterized using a total of 67 SSR markers from which 58 showed polymorphism.

Two groups were resolved from the cluster analysis of TGMS lines based on the handing patterns of the 58 SSR markers used. The first main group comprises of TGMS 1, TGMS 6 (Vietnam), TGMS 5 and TGMS 13 (from China and IRRI, respectively) which were genetically distant based on low similarity coefficient computed. The second group comprises of TGMS 4 and TGMS 11, both originating from China. SSR analysis indicates that the TGMS lines characterized are genetically diverse.

**Keywords**: TGMS, Diversity, Simple Sequence Repeats (SSR), markers, rice

## ASD No. 10 GENETIC DIVERSITY IN THREE SPECIES OF CHILI PEPPER CAPSICUM (SOLANACEAE) FROM SOUTHEAST ASIA BASED ON SDS-PAGE OF SEED PROTEINS

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Genetic diversity among three species of *Capsicum* collected from Southeast Asia, namely: *C. annuum* L., *C. chinense* Jacq., and *C. frutescens* L. was determined using SDS-PAGE of seed proteins. Twelve major protein bands were resolved, nine of which were monomorphic. Of the polymorphic bands, band 3 was the most common (18%), while band 7 was the least common (15%) of the accessions. Six banding patterns (BP) were exhibited by the three Capsicum species. BP 4 was the most common (63% of the total population). BP 1, found to be least common (1% of total population) was established to be specific to *C. chinense*, while BP 6, 7 and 13 were specific to *C. annuum*. No band pattern was specific to *C. frutescens*.

Frequency distribution yielded the geographic distribution of specific bands and band patterns. Specific protein bands and band patterns predominated in respective countries of origin. Band 1 predominated in Indonesia, Band 3 in the Philippines and Band 7 in Thailand. BP 1 and BP 7 predominated in the Philippines, BP 4 in Thailand and Indonesia, BP 5 and BP 13 in Thailand and BP 6 in Indonesia. Only BP 13 was not exhibited by the 17 accessions from the Philippines. Hence, the Philippines seem to have the highest diversity of banding patterns among the four Southeast Asian countries.

Similarity index (SI) values showed that interspecific variation is greater than intraspecific variation. Among the three species, *C. annuum* was observed to exhibit the highest intraspecific variation (93.2), with *C. frutescens* (96.7) next, while *C. chinense* has the lowest intraspecific variation (100.0). Based on the SI values and average linkage dendrogram, *C. annuum* was found to be most closely related to *C. frutescens*, while *C. chinense* is least closely related to *C. annuum* and *C. frutescens*. Thus, the SDS-PAGE protein profiles were able to determine the genetic diversity and divergence of the three *Capsicum* species.

**Keywords:** genetic diversity, *Capsicum* species, seed protein bands, SDS-PAGE, similarity index, inter-and intraspecific variation

## ASD No. 11 SELECTION, PROPAGATION, AND CULTIVATION OF *GRAMMATOPHYLLUM SCRIPTUM* (LINN.) BL.

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*Grammatophyllum scriptum* (Linn.) Bl is a robust, epiphytic, and indigenous Philippine orchid that bears colorful and attractive flowers in inflorescence reaching up to 2 meters long. A wide variety of flower types are available, and it is therefore necessary to select those which are acceptable for landscaping or as a flowering potted plant.

About three hundred flowering plants were observed *in situ* and in cultivation from different areas of the country from 1999 to 2001. Preliminary selections were made from these populations and a germplasm collection was established at the Orchid Nursery of the University of the Philippines Los Baños (UPLB). At present, there are about 80 plants of 48 accessions in various stage of development from ten provinces, namely: Cavite, Laguna, Quezon, Oriental Mindoro, Romblon, Albay, Camarines Sur, Nueva Vizcaya, Ifugao, and Agusan del Sur. The observed flowering periods of these plants were from December to August,. Four selected forms are presented and described based on their flower size, form, color, marks, and fragrance.

*In vitro* propagation of these selections were made through the inoculation of embryos excised from freshly harvested or stored green capsules and seeds from mature dehisced capsules in UPLB Orchid Nursery Germination Medium and reflasked in various types of differentiation media. Acclimatization of plantlets was performed in cooperation with growers in Cavite, Capiz Palawan and Negros Occidental. The required time for seedling production from inoculation is at least 14 months. Delayed reflasking of germinated protocorms can be done to program the plant propagation schedule. Established seedlings or divisions are planted with limited substrate in rigid plastic pots with custom made holes to allow profuse root and shoot growth. They are hanged, watered and fertilized in a well aerated area with 25% to 50% shading.

Results indicate favorable prospects of commercially producing the selected *Grammatophyllum scriptum* for the Philippine ornamental industry.

**Keywords**: *Grammatophyllum scriptum*, orchids, *in vitro* propagation, orchid cultivation, embryo culture, germplasm

## ASD No. 12 PYRAMIDING OF BACTERIAL LEAF BLIGHT (BLB) RESISTANCE INTO THERMO-SENSITIVE GENIC MALE STERILE (TGMS) LINES

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In addition to conventional breeding methods, molecular marker technology was utilized to improve efficiency and fast track the development of superior two-line rice hybrids. Since TGMS lines are susceptible to most Philippine races of BLB caused by *Xanthomonas oryzae pv oryzae (Xoo)*, introgression of resistance genes was deemed important. A pyramid of multiple resistance genes into promising TGMS lines can lead to a higher level of resistance to *Xoo* than using only a single gene. Furthermore, breakdown of BLB resistance would be delayed. Hence, crosses of TGMS x IRBB21 x IRBB4/7 were designed to incorporate the resistance genes into the TGMS lines. DNA marker-aided selection through Sequence Tagged Sites (STS) analysis was conducted to pyramid and identify three BLB resistance genes, *Xa4, Xa7,* and *Xa21* using the primers P3, MP1 and MP2, and Xa21, respectively on TGMS lines 1, 2, and 6. The potential BLB resistance donors used were IRBB21 AND IRBB4/7. $F_1$s of TGMS x IRBB 21 were crossed to IRBB4/7 and double cross progenies were tested for the presence of the genes. STS analysis on the progenies identified gene combinations of *Xa4/7* and *Xa4/21* on all three lines. However, only TGMS6 was identified to have *Xa4/7/21,* the gene combination of interest. Seeds of this cross were advanced to the next generation ($F_2$). Resistance of pyramid lines to BLB pathogen will be confirmed in the succeeding generations via race inoculation.

**Keywords**: TGMS, BLB resistance, STS analysis, pyramiding, markers

## ASD No. 13 YIELD AND RESISTANCE OF EGGPLANT ACCESSIONS/ VARIETIES AGAINST LEAFHOPPER, *AMRASCA BIGUTULLA* ISHIDA AND EGGPLANT BORER, *LEUCINODES ORBONALIS* GUENEE

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The resistance and yield responses of 11 eggplant accessions, 2 open-pollinated, 3 farmers' and 5 hybrids varieties against the two major pests of eggplant, *Leucinodes orbonalis* Guenee and *Amrasca bigutulla* Ishida were studied at Block A, Lot 10, Central

Experimental Station, Pili Drive.

Results showed that resistance responses of the tested entries were almost indirectly proportional to yield for the 20 varieties. Accession 300 is an exception since it had shown a comparative resistance against the two pests and still the yield was somewhat proportional to the high yielding ones. Black Ninja had an intermediate resistance responses to both pests, but it yielded higher compared to the other resistant entries. The remaining 4 hybrids had almost the same production as that of Black Ninja and also with intermediate resistance. Tolerance is the mechanism of resistance exhibited by the above stated high yielding varieties. Abar, a native from Nueva Ecija was found to be the most resistant against leafhopper infestation but susceptible to fruit borer infestation.

**Keywords**: Eggplant, *Solanum melongena*, eggplant leafhopper, *Amrasca biguttula*, eggplant borer, *Leucinodes orbonalis*, yield, resistance

## ASD No. 14 RESISTANCE OF NATIVE VARIETIES AND WILD RELATIVES OF EGGPLANT (*SOLANUM MELONGENA* L.) AGAINST THE LEAFHOPPER, *AMRASCA BIGUTTULA* ISHIDA AND EGGPLANT FRUIT/SHOOT BORER, *LEUCINODES ORBONALIS* GUENEE

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A total of ninety-nine eggplant genotypes were screened for field resistance to the leafhopper at vegetative and reproductive stages and resistance to the eggplant fruitborer at harvest time. The different eggplant accessions were planted at Block B Lot 12, IPB Demo Area, Central Experimental Station (CES), Pili Drive, UPLB.

Results shows that the native varieties Abar, SRO2 and Sinampedro were resistant to leafhopper but susceptible to fruit borer. Accession 544 white was most susceptible to leafhopper but resistant to fruit borer. Some wild relatives of eggplant that were resistant to both pests were Accessions 503, 566, 651, 671, 672 and 682.

Based on the results it was found out that the native and wild relatives of eggplant could be utilized as parent material for crop improvement or hybridization work.

**Keywords**: Eggplant, *Solanum melongena*, eggplant leafhopper, *Amrasca biguttula*, eggplant borer, *Leucinodes orbonalis*, resistance, native and wild relatives

## ASD No. 15 MOLECULAR TAGGING OF TGMS GENE USING NEW TGMS SOURCES OF RICE

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The discovery and application of the Thermosensitive Genic male sterility (TGMS) system has a great potential for revolutionizing hybrid seed production technology. Mapping of TGMS genes and the subsequent development of useful DNA markers will provide an efficient alternative approach in breeding superior heterotic rice hybrids through marker-aided selection. Five $F_1$ combinations were developed to map 3 unknown sources of TGMS genes, PRT 1 (Hanoi, Vietnam), PRT 2, (Hanoi, Vietnam) and PRT 4 (Guangxi, China). The $F_2$ populations generated using IR64 and PSBRc 34 (Burdagol) as tester varieties were established both in BSU and Maligaya, Nueva Ecija and were evaluated for pollen fertility/sterility.

Of the 108 Simple Sequence Repeats (SSR) or microsatellite markers surveyed, 85 were polymorphic and 19 were monomorphic. Polymorphic SSR markers were detected on a denaturing 5% polyacrylamide gel and silver sequence staining procedure. Sterile plants that were identified in each mappping population were analyzed using SSRs in order to identify potential molecular markers linked to the TGMS gene. For each population, several SSR markers were identified that were potentially linked to the TGMS trait. For populations 1, 2, 4, 5 and 6, the respective number of markers identified were 9, 18, 13, 9 and 10. These markers showed monomorphic bands for all sterile TGMS lines. However, due to limited number of DNA samples, confirmation for the absence of such bands in fertile $F_2$ samples was not conducted. The potential markers will then be used to map $F_2$ population for gene identification and further identify chromosome location such that the transfer of the TGMS gene into genetic backgrounds of rice will be facilitated.

Keywords: TGMS, Tagging, Simple sequence Repeats (SSR), markers, rice

## ASD No. 16 INDUCTION OF MULTIPLE SHOOTS AND INFLORESCENCE FROM EXCISED SHOOT TIPS AND NODAL SEGMENTS OF IN VITRO GERMINATED SEEDLINGS OF MAIZE INBRED LINES

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Plant regeneration from in vitro-cultured cells, tissues and organs is an important step towards genetic manipulation of plants. The plant materials to be used for tissue

culture should be morphogenetic and highly regenerable. The tissue culture requirements for plantlet regeneration via shoot organogenesis or somatic embryogenesis for different inbred lines of maize are being investigated. For multiple shoot induction, shoot tips and nodal segments excised from in vitro germinated seedlings of inbred lines Pi 23, Pi 17 and Pi 31 were cultured on MS medium supplemented with 30 g/L sucrose, 1mg/L NAA and 4 mg/L BAP. The incidence of multiple shoots obtained from shoot tips ranged from 54 to 100% and from nodal segments, 29 to 77%. Differentiation of inflorescence (ears) in vitro was observed on cultured shoot tips (21 to 57%) and nodal segments (100%) for inbred lines Pi 31 and Pi 23. The in vitro developed ears differentiated into shoots upon transfer to shoot regeneration medium. The multiple shoot and inflorescence differentiation can be an alternative plant regeneration system suitable for genetic manipulation of maize.

**Keywords:** Maize, multiple shoot induction, in vitro developed inflorescence

## ASD No. 17 A PROTOCOL FOR DOUBLED HAPLOID PLANT PRODUCTION FROM ANTHER CULTURE-DERIVED HAPLOID RICE PLANTS

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Increasing the proportion of doubled haploid (DH) to haploid (H) regenerants is one parameter that measures the efficiency of anther culture (AC). In our AC work for indica rice, H plant regeneration, on the average, is 50 % or more, depending on the genotype. We initiated DH plant production from young inflorescence of the H plants regenerated from the anthers of $F_1$ progenies of seven crosses for salt tolerance breeding. Young spikelets (<1 mm) were cultured in two callus induction media containing 10 $mgL^{-1}$ colchicine. One medium is supplemented with 2 $mgL^{-1}$ 2,4-Dichlorophenoxyacetic acid (2,4-D), while the other with 10 $mgL^{-1}$ phenylacetic acid (PAA). One batch of spikelets, plated in 2,4-D containing medium, was maintained in the dark for two weeks, sub-cultured in fresh induction medium without colchicine, and kept in the dark for another two weeks before transferring the calli formed in the regeneration medium. The other batch was maintained in the dark for four weeks. The third group of spikelets were cultured in PAA-enriched medium, maintained in the dark for two weeks, then transferred in the light, until plants regenerated without sub-culturing in the regeneration medium. The spikelets in 2,4-D medium and exposed to colchicine for two weeks formed calli in 22 to 26 days from plating. When transferred in the regeneration medium, the calli proliferated, but eventually turned necrotic and died. Those exposed to colchicine for four weeks in the dark turned brown. Plant regeneration was obtained from the spikelets of four of the seven genotypes

cultured in PAA and colchicine containing medium. Regeneration ranged from 0.6 to 8.1% with an average of 4.1 ± 3.2%. We regenerated 52 plantlets from 36 spikelets, of which 34 (65%) were H and 18 (35%) were putatively DH. We obtained 112 DH lines from these regenerants. The ploidy level of these materials will be verified through cytological examination.

**Keywords**: colchicine, 2,4-D, PAA, inflorescence

## ASD No. 18 INDUCTION OF SOMATIC EMBRYOGENESIS IN PEANUT (*Arachis hypogea* L.) AND SHOOT ORGANOGENESIS IN POLE SITAO (*Vigna unguiculata* var. sesquipedalis)

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Peanut (*Arachis hypogea* L.) and pole sitao (*Vigna unguiculata* var. sesquipedalis) are two of the priority leguminous crops in the Institute of Plant Breeding. In order to complement the conventional breeding for improved pest resistance and nutritional quality by plant biotechnology, tissue culture studies have been conducted to identify and develop suitable in vitro plant regeneration systems for the locally developed cultivars of peanut and pole sitao.

In peanut cultivars PSBPn 1 ('Biyaya 10') and PSBPn 2 ('Biyaya 12'), somatic embryos were induced directly from young leaf sections of in vitro-germinated seedlings cultured in agar-solidified MS-B5 basal medium with 50 g $L^{-1}$ sucrose and 40 to 80 mg $L^{-1}$ 2,4-dichlorophenoxyacetic acid (2,4-D). The transfer of the first two batches of somatic embryos in MS-B5 basal medium alone or with the addition of 1.0 mg $L^{-1}$ benzyladenine (BA) resulted in the maturation and germination of somatic embryos into green plantlets. Various stages of somatic embryo formation were identified and documented. Experiments on media requirements and culture conditions are currently being done to optimize the system for initiation, maturation and conversion of somatic embryos into complete plants. In pole sitao cv UPL PS 1 and UPL PS 2, cotyledon and cotyledonary node explants of in vitro-germinated seedlings were cultured in MS-B5 basal medium with 1.0 mg $L^{-1}$ BA based on the protocol developed for mungbean (Avenido and Hautea, 1990) and other Asiatic Vigna spp. (Avenido and Hattori, 1999). Preliminary observations revealed higher incidence of direct shoot organogenesis from the cultured cotyledon than in cotyledonary node explants, indicating a difference in the explants and/or tissue culture requirements of pole sitao to that of mungbean.

**Keywords:** cotyledon, cotyledonary node, grain legume, leaf explants, plant regeneration, peanut, pole sitao, shoot organogenesis, somatic embryogenesis, tissue culture

## ASD No. 19 DIRECT SHOOT ORGANO GENESIS FROM COTYLEDONARY NODE CULTURES OF MUNGBEAN AND OTHER ASIATIC *Vigna* spp.: NEW MARKER FOR SPECIES GROUPING WITHIN SUBGENUS *Ceratotropis* (Piper) Verdc.

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The subgenus Ceratotropis (Piper) Verdcourt of the complex genus Vigna is comprised of yellow-flowered cultivated species and their wild relatives, which are all of Asiatic origin. This includes mungbean (V. radiata {L.} Wilczek), blackgram (V. mungo {L}. Hepper), mothbean (V. aconitifolia {Jacq.} Marechal), adzukibean (V. angularis {Willd.} Ohwi & Ohashi) and ricebean (V. umbellata {Thunb.} Ohwi & Ohashi). Application of plant biotechnology to crop improvement programs has been limited by the recalcitrance of many Vigna species to in vitro culture. As the best alternative, the cotyledonary node (CN)-culture system developed originally for mungbean was found suitable for other Asiatic Vigna species (Avenido and Hattori, 1999). This system involved the use of MS salts, B5 vitamins, 3.0% sucrose and 1.0 mg $l^{-1}$ benzyladenine (BA) medium during seed germination (ie., BA-preconditioning) and subsequent CN culture. High frequency induction of shoot organogenesis for all epigeal species namely V. radiata, mungo, aconitifolia, subspecies radiata var. sublobata, mungo var. silvestris and in the hypogeal but allotetraploid glabrescens was obtained. In contrast, two other hypogeal species V. angularis and umbellata failed to initiate shoots from the nodes.

Histological studies were done to establish a) the effects of BA-preconditioning on mungbean seedlings and b) the basis for the observed species-dependent shoot organogenesis from the CN explants. BA-preconditioning induced bigger axillary shoots on germinating seedlings over the control (basal medium only). Subsequent histological observations of the CN explants from 4-d-old seedlings at d0 (explantation day), d4 and d8 (after explantation) revealed the formation of primary axillary shoots (pas) in both V. radiata and V. glabrescens followed by secondary axillary branching at d8. Further examination by scanning electron microscope (SEM) confirmed the presence of shoot buds in the explants at d0 in all the epigeal species namely *V. radiata*, *V. mungo* and *V. aconitifolia* together with the hypogeal but allotetraploid *V. glabrescens*. Consistently, these structures were absent in *V. angularis* and *V. umbellata*. These results provide conclusive evidences in support of the existing genomic grouping within subgenus Ceratotropis, which designates AA, $A_1A_1$ and $A_1A_1$/- to epigeal, hypogeal and the allotetraploid (digenomic) species, respectively. Therefore, the induction or non-induction of shoots directly from the nodes of cultured CN explants is a new and practical marker corresponding to the genomic grouping within the Asiatic Vigna species. For the first time, this differential in vitro regeneration response (i.e., response to BA) was attributed

to the inherent anatomical and developmental differences among the species, which would play a practical role in the effective choice of tissue culture protocol for biotechnology-assisted genetic improvement in different Vigna species.

**Keywords**: benzyladenine; cotyledonary node, histology, genus Vigna; plant regeneration, scanning electron microscopy, species relationships; subgenus *Ceratotropis*, taxonomy; tissue culture

## ASD No. 20 FREE-TRYPTOPHAN AND INDOLEACETIC ACID (IAA) IN RELATION TO ZINC NUTRITION IN HIGHER PLANTS

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Zinc plays a fundamental role in a variety of metabolic processes in plants. Functional aspects of zinc nutrition and possible effects of its deficiency have long been studied. This study aimed to clarify the role of zinc in relation to free-tryptophan and IAA in higher plants.

Inducement of zinc deficiency in radish seedlings was done following the culture solution technique. Growth measurement at harvest and zinc determination using atomic absorption spectrophotometer were done for the control (50 ppb Zn) and zinc-deficient plants (0 ppb Zn). Free-tryptophan was measured using high performance liquid chromatography (HPLC). Identification and quantification of IAA were done using the two-dimensional thin layer chromatography (TLC), gas chromatograpby-mass spectrometry (GC-MS) and gas chromatography (GC) analyses, respectively.

Plants grown under zinc-deficient condition had stunted growth and exhibited symptoms characteristics of zinc deficiency. Free tryptophan was found to accumulate in zinc-deficient plants as compared with the control plants with values of 0.02 and 0.01 mol/g f.w (fresh weight), respectively. TLC chromatogram showed that zinc-deficient plants gave the same *Rf* value and color reaction with that of the authentic IAA. GC-MS revealed that peaks of IAA from the zinc-deficient and control radish shoots coincided with the peak of authentic IAA. Quantitative estimation of IAA using GC in the zinc-deficient and control plant obtained similar results with value of 0.36 and 0.32 g/100g f.w., respectively.

Tryptophan being a precursor of IAA accumulated in zinc-deficient plants resulting to a normal level of IAA. Although IAA seemed to be normal in zinc-deficient plant, symptoms characteristics of zinc deficiency were observed. Results indicated that the growth of radish plants in relation to zinc nutrition is not solely controlled by the level of

IAA. It is also speculated that the IAA may not be biologically active or cannot promote growth in the absence of zinc.

**Keywords:** zinc nutrition, free-typtophan, indoleacetic acid (IAA)

## ASD No. 21 INCREASING THE YIELD OF GRAFTED TOMATOES THROUGH THE USE OF RAINSHELTER

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Growing tomatoes during the hot, wet month is concentrated in very small hilly areas. However with the introduction of grafted tomatoes with rain shelter , tomatoes can now be grown in the lowlands during rainy season.

An experiment was conducted to determine the influence of rain shelter on the yield of grafted tomatoes during the hot, wet months. One-month seedling of EG-203 an eggplant variety and H 7996 a tomato variety were grafted with Apollo and CHT 501 tomato varieties. The grafted tomatoes were transplanted on a raised bed provided with rain shelter and under open field. The rain shelter was made of iron pipes made into an arc 2.5 m high covered with NO. 32 mesh plastic nets.

Rain shelter significantly increased the survival of grafted tomatoes with an average of 73.6 compared with that from the open field of 49.3 percent. Furthermore grafted Apollo to EG-203 and H7996 register highly significant plant survival (95.8 and 87,5) when provided with rain shelter than grafted tomatoes from the open field (62.5 and 45.8). The same result was also obtained from grafted CHT 510. The plant survival with rain shelter was 91.6 and 75,0 vs. 87.5 and 54.1 percent, from the open field.

The overall effect of rain shelter on yield was highly significant. The yield increment due to the provision of rain shelter was 257 percent or an increase 6,7 t/ha. The yield of grafted tomatoes with rain shelter was 9.1 while from the open field was only 2.4 t/ha.

Rain shelter through the used of No. 32 mesh plastic nets reduced the impact of heavy rain which causes the dropping off of flowers during the rainy season. The increased in yield was mainly due to higher plant survival and significantly more number of fruits brought about by higher percentage of fruit setting.

**Keywords:** graft, rootstock, scion, rain shelter

## ASD No. 22 NITROGEN FERTILIZER EFFICIENCY IN WET DIRECT-SEEDED RICE USING $^{15}$N-LABELED UREA

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The increasing cost of rice production makes it imperative to focus on nitrogen efficiency to maximize the benefits derived from the applied and native nitrogen in the soil. A sizable portion of the inorganic nitrogen applied in rice is lost, thus proper timing and placement are necessary to minimize losses. This study was conducted to determine the nitrogen fertilizer efficiency in wet direct-seeded rice at different growth stages using $^{15}$N-labeled fertilizer.

PSB Rc28 was broadcast-seeded at 40 kg seeds/ha. $^{15}$N-labeled urea ws applied at 30 kg/ha basal, 40 kg/ha at 30 days after sowing (DAS), 60 kg/ha at panicle initiation (PI), and 20 kg/ha at flowering in microplots. Using the same rate, ordinary urea was applied in bigger plots for each application time.

There was low plant N uptake (8-10%) with basal N application. The fertilizer applied at 30 DAS was readily absorbed by the plant resulting in 38-38% recovery at 20 days after application. Twenty-eight percent of the basal and 26% of the fertilizer applied at 30 DAS remained in the soil. Most of the nitrogen taken up by the plant at the early stage of growth came from the native soil N. the lowest N recovery in the soil was noted at PI indicating high plant uptake.

The results imply that bulk of the rice nitrogen requirement should be applied at PI and flowering stage to attain higher nitrogen fertilizer efficiency. In wet direct-seeded rice, lower N must be applied at basal to 10 DAS to avoid high N losses.

**Keywords**: nitrogen fertilizer efficiency, $^{15}$N-labeled urea, direct-seeded

## ASD No. 23 EFFECT OF RICE ROOT-KNOT NEMATODE ON GROWTH AND YIELD OF ONION

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Root-knot disease of onion in the Philippines is caused by rice root-knot nematode, *Meloidogyne graminicola*. In rice, this pest causes yield reductions from 20-70%. Its effect on growth and yield of onion has not been established, hence this study. Seedlings

inoculated with different initial nematode densities (Pi) and field onions with different gall index rating were assessed. Pi = 10,000 J2 reduced seedling height, leaf weight, and depth of rooting of Yellow Granex. Onions transplanted at 55 days old had greater reduction in root weight and depth of rooting than those transplanted at 15 and 45 days old. Bulg diameter and weight of 55-day-old transplants were reduced by 17% and 41%, respectively, at Pi = 50. Onion yield of 45-day-old transplants was reduced by 20-28% at Pi = 100 while 15-day-old transplants were reduced at Pi = 1,000. In the field, 50-100% root galling caused 20% reduction in the buld diameter and 40% in bulb weight of Yellow Granex. Bulb weight of Red Creole was also reduced by 86%; Batanes, 59.5%; and Tanduyong, 31.4%. The number of aggregate bulbs of Tanduyong was also reduced by 48%.

**Keywords**: rice root-knot nematode, *Meloidogyne graminicola*, onion, yield loss

## ASD No. 24 NEMATICIDAL ACTIVITY OF SOME PLANT SPECIES AGAINST THE ROOT-KNOT NEMATODE, *Meloidogyne graminicola* AFFECTING BULB ONION (YELLOW GRANEX)

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Thirteen plant species showed high nematicidal activity against *Meloidogyne graminicola*. These were Mahogany (*Swetenia macrophylla*) , Marikit (*Calotropis gigantea*), Marigold (*Tagetes erecia*), Papaya (*Carica papaya*), Kuyot (*Dioscorea hispida*), Euphorbia (*Euphorbia heterophylla*), Asunting (*Casia alata*), Centrosema (*Centrosema pubescens*), Crotalaria (*Crotalaria incana*), Bagalunga (*Melia dubia*), Neem tree (*Azadirachta indica*), Makabuhai (*Tinospora rumphi*) and Buyo (*Piper beetle*). No galls were formed in the roots of rice seedling 35 days after inoculating the second stage larvae previously dipped in these extracts for 24 hours. Neem, Papaya, Euphorbia, and Kuyot were more potent than the rest because their extracts still showed very high activity even at 25 percent concentration. These four plant species regardless of form applied (powder, fresh extract and chopped leaves/tuber) significantly reduced the number of root galls and nematode density in the soil compared with the untreated control. The powdered form of Neem tree and Papaya were comparable and or better than the nematicide Mocap.

**Keywords**: Galls, root-knot, *Meloidogyne graminicola, Azadirachta indica, Euphorbia heterophylla, Corica papaya, Dioscorea hispida*, bulb onion, yellow granex, Mocap

## ASD NO. 25 CONVERTING BIOMASS WASTES INTO ORGANIC FERTILIZER USING MICROBIAL INOCULANT

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A sustainable recovery and recycling system for biomass wastes is a major concern of the country. The slow natural decomposition process and production of foul odor are among the problems in using biomass wastes as organic fertilizer. This study aimed to use microbial inoculant in enhancing the decomposition of biomass wastes and converting them into an organic fertilizer. A microbial inoculant (MI) was produced from carbonized rice hull, rice bran, and molasses inoculated with a mixture of effective and beneficial microorganisms (EMI). Biomass wastes recovered from kitchen garbage, grasses leaf droppings, crop residues, and tree trimmings were shredded and inoculated with MI. The results showed that MI decomposed the biomass wastes into organic fertilizer in 1-2 weeks and eliminated the foul odor emitted by the wastes in natural decomposition process. Moreover, the organic fertilizer produced from the decomposition of waste materials had higher nutrient content than chicken manure. Thus, the use of MI is better than the conventional composting process because the wastes undergo the fermentation-decomposition processes that reduce the processing time, with less foul odor, and minimal nutrient losses.

**Keywords**: biomass waste, crop residue, effective microorganisms, kitchen garbage, microbial inoculant, organic fertilizer, resource recycling system

## ASD NO. 26 BIO-ORGANIC FARMING FOR SUSTAINED CROP PRODUCTION IN THE ILOCOS

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A rice-based bio-organic farm was established in MMSU to create awareness and serve as a show window for bio-organic farming technologies. Technologies such as use of organic fertilizer, green manuring, biological pest control and the use of biological fertilizers were combined. All farm wastes were composted using Trichoderma harzianum as activator. Compost was applied at the rate of 1 t $ha^{-1}$. Chickeo manure was also incorporated in the farm. Indigo was used as green manure. Indigo seeds were broadcasted

during the last irrigation of the dry season crop at the rate of 10 kg seeds $ha^{-1}$. Bio-N, a microbial fertilizer, was mixed with rice seeds as inoculant at the rate of one pack per 20 kg seeds prior to seedbedding. There was no spraying of pesticides to enhance population of natural enemies.

After five years, yield of rice in the bio-organic farm was comparable with that of conventional farm due to the accumulation of organic matter in the soil which improved the texture, P and K content of the soil. Pest population was lower in the bio-organic farm because of a higher population of natural enemies.

Simultaneously, a survey was conducted to determine the problems and prospects of bio-organic farming in Ilocos. Results showed that utilization of the different bio-organic farming technologies was low due to the farmers' inadequate knowledge of the technologies and the inavailability of the inputs for the different technologies in the market. To address these problems, various trainings, technology demonstrations, field days, farmers' classes and radio interviews on the different bio-organic farming technology inputs available, a Memorandum of Agreement was forged between UPLB-BIOTECH and MMSU. MMSU markets and promotes various products of BIOTECH to the farmers which are primary inputs for the different bio-organic farming technologies.

**Keywords**: bio-organic farm, conventional farm, organic fertilizer, green manuring, biological pest control, biological fertilizer

## ASD No. 27 GENETIC DIVERSITY OF TWO NATURAL POPULATIONS OF *HISPODONTA* SP. (CHRYSOMELIDATE: COLEOPTERA), A NEW BANANA PEST RECORD IN THE PHILIPPINES

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The genetic diversity of two populations of *Hispodonta* sp. a new banana pest record in the Philippines was determined through morphometric analysis and SDS-PAGE. Samples of adult *Hispodonta* sp. were collected from May-it, Lucban, Quezon and Buyagan, La Trinidad, Benguet. A total of seven protein bands of high molecular weight were observed to be present in the Buyagan population, which produced three protein band patterns. These were BP-A with bands 1,2,3,4,5,6, and 7; BP-B with bands 1,2,4,6,7; and BP-C with bands 1,2,5,6,7. The Buyagan population had a similarity index (SI) of 86-100%. SDS-PAGE of the May-it population will show whether there is similarity in morphological and biochemical compositions of the two populations given the geographical

distance and environmental differences of the sampling locations..

**Keywords:** *Hispodonta* sp., genetic diversity, SDS-PAGE, similarity index, morphometric analysis, Benguet, Quezon

## ASD No. 28 *ANTHONOMUS SP.*, A NEW PEST OF DENDROBIUM ORCHIDS IN THE PHILIPPINES (COLEOPTERA: CURCULIONIDAE: ANTHONOMINAE

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The anthonomine group is known to be distributed world wide except for Australia. These are typically small, non-metallic snout beetles with long narrow snouts similar to Cylinidae. Moreover, they are considered pests of several crops from the Malvaceae including *Hibiscus* and *Abutilon*. This new pest of orchid from Davao del Sur and Davao City attacks both the local and imported Dendrobiums to the cotton boll weevil. It is similar *Anthonomus grandis* Boheman except for the semi-robust body, and the presence of 1 distinct spin on the profemora. It is small about 5.5 mm to 6.0 mm long ahd has a reddish brown color. The adults feed on succulent leaves. Eggs are laid in feeding pits near the rook stock of orchids. The larvae, on the other hand, feeds inside the stem until it eventually dries up the whole orchid stalk. Pupation takes place inside the stalky stem.

The bio-ecology and life history of this pest are being studied further.

Keywords: *Anthonomus sp.*, Dendrobium orchids, sweet beetles, profemora Cylinidae

## ASD No. 29 R&D ON COMMUNITY-BASED PRODUCTION AND UTILIZATION OF EGG PARASITOIDS FOR THE CONTROL OF MAJOR LEPIDOPTEROUS PEST OF CORN (COMPUTEC-CONLEP)

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Results of the on-farm research and outreach project implemented in Tarlac, Pangasinan, and Batangas showed significant reduction of corn pest when applied with

*Trichogramma evanescens* (Labios et al, 1966).

The egg parasitoids, Trichogramma spp. have been found to be effective against pest particularly corn borer and corn earworm and to lepidopterous pest of rice and vegetables. With the increase in production of major crops, pressure from lepidopterous pest also escalated. Coupled with the insufficient supply of egg parasitoids, the present needs of mass produced parasitoids by farmers for effective control of lepidopterous pest of corn is not satisfied.

The intended beneficiaries of tbis program are those who cannot avail of Trichogramma production from the government instrumentalities. Thus, this community-based production of Trichogramma will supplement the expected production shortfalls.

Two farmers multipurpose cooperative from Luzon namely: the Bacabac Primary Multipurpose Cooperative in Camiling, Tarlac and the Biba-Diwa Multipurpose Cooperative in Malasiqui, Pangasinan are the project partners. Trichogramma laboratory for each location were built and equipped. Key personnel from the cooperatives were trained on Trichogramma production. Project partners from state colleges and local governments units and the Department of Agriculture Regional Field Units 1 & 3 are also participating on project coordination and implementation.

Research managed trials in Camiling, Tarlac using calendar spraying of pest crops showed that the farmers practice plot gave a grain yield of 284 tons/hectare while the Trichogramma plots with three releases at a rate of 40,000 Tricbogramma per hectare had a yield of 2.55 tons/hectare. The untreated plots have the yield of 1.33 ton/hectare. On the otherhand, the Malasiqui, Pangasinan showed 1.64, 1.23 and 1.18 for Trichogramma, farmers practice and untreated plots, respectively.

Tbe program is on-going and more farmers expected to participate on the utilization of Trichogramma in their corn fields.

**Keywords**: Trichogramma, production, utilization, Camiling, Malasiqui, lepidopterous pest, corn borer, corn earworm, cooperative

## ASD No. 30 MUTABILITY OF ARTHROPOD PESTS OF AGRICULTURAL CROPS

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Arthropod pests of agricultural crops such as mites and insects exhibit genetic

plasticity or mutability of genotypes. These genetic flexibilities which are worldwide problems in crop production are the pesticide resistance and development of biotypes in varietal resistance. Pesticide resistance was initially detected in 1908 and at present, resistance to at least one pesticide has been recorded for over 500 arthropods. Biotypes which are threat to the stability of resistant crop varieties have been recognized in six (6) orders, 16 families, and 35 species of arthropods. Genetic mechanisms of pesticide resistance and biotype development are discussed.

**Keywords**: mutability, arthropod pests, pesticide resistance, biotype, varietal resistance

## ASD No. 31 POTENTIAL OF EARWIG, *Euborellia annulata* FOR FLOWER WEEVIL, *Amorphoidea lata* (Motsch.) CONTROL

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Flower weevil, *Amorphoidea lata* (Motsch.) is one of the destructive insect pests of cotton in the Philippines, causing yield reduction of 28-30% up to total crop failure when serious outbreak occurs especially in late planted cotton. Flower weevil has many naturally-occuring enemies or predators such as the earwigs *Euborellia annulata*. A field evaluation of *E. annulata* was conducted at the Cotton Research and Development Center, CODA, Batac, Ilocos Norte to determine the biology, predation efficiency and ability to suppress flower weevil in cotton areas using different densities of *E. annulata*.

Laboratory and field set-ups using plot barriers were done to determine the maximum predation efficiency of *E. annulata* and its ability in suppressing flower weevil population. There were three densities of *E. annulata* tested as follows: 9,000, 10,000, and 11,000 earwigs/ha.

Results in the laboratory showed that an adult *E. annulata* preyed a range of 16-35 flower weevil larvae per day. Female adult laid an average of 46.18± 9.49 eggs with 85.98% hatchability. The total life span of adult was 89.50 ±11.54 while the total life span from egg to death of adult was 121.50 ±11.86 days.

The maximum predation capacity of *E. annulata* during a 24-hr test period was 35 flower weevil larvae. After reaching this point, their consumption decreased. In the field, the average number of flower weevil larvae consumed by *E. annulata* ranged from 8.1 to 10.2 larvae per day. Likewise, the predation efficiency ranged from 20.44 to 23.15%.

A significant reduction of flower weevil number was observed in plots released with either densities of *E. annulata* as compared with the unreleased plot. Moreover, seedcotton yield was significantly higher by the release of the earwigs.

**Keywords**: flower weevil, earwig, predation, seedcotton

## ASD No. 32 INFLUENCE OF SELECTED PLANT SPECIES ON THE POPULATION OF PARASITIC NEMATODES OF SUGARCANE

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Selected plant species, marigold (*Tagetes erecta*), chichirica (*Cantharanthus roseus*), corn (*Zea mays*) and tomato (*Lycopersicon esculentum*) were intercropped with sugarcane in the screenhouse and in the field to determine their influence as non-host and host plants on the population dynamics of parasitic nematodes and growth and yield of sugarcane. Intercropping individually or a combination of non-host and host crops, with sugarcane, considerably decreased nematodes attacking sugarcane. Pratylenchus population in all the treatments were significantly lowered by the different selected plants. The beneficial effects of marigold as intercrop persisted until sugarcane maturity. Corn or tomato and in combination similarly provided control of the nematodes at the early growth of sugarcane but their efficacy declined as the sugarcane plants grew and developed roots and shoots and after their harvesting. The reduction in nematode population sustained by the intercrops at one-to four-month old sugarcane was reflected in the yield of cane and sugar. The dominant genera observed in both screenhouse and field experiments were Pratylenchus, Tylencorhynchus, Helicotylenchus and Rotylenchus. Less observed were Criconemella, Rotylenchus, Hemicycliophora, Hoplalaimus and Xiphinema. Growing non-host and host plants with sugarcane can therefore be utilized as an alternative management practice to augment the reduction of nematodes pathogenic to sugarcane. The host plants however, must be susceptible and attractive to the dominant nematode genera and harvested with their roots as trap crops to prevent rapid population build-up in the sugarcane rhizophere.

**Keywords**: sugarcane, intercrop, marigold, Tagetes erecta, non-host crops, parasitic nematodes

## ASD No. 33 THE RATE OF GROWTH OF *Oreochromis niloticus* REARED IN AQUARIA FED WITH COMPOUNDED FISH DIET OUT OF *Holothuria nigra* AND *Ipomea aquatica Torks*

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*Holothuria nigra*, a black spotted spiny sea cucumber and discarded by most inhabitants of the Camotes Island because of its unfavorable taste was used as a feed component together with kangkong (*Ipomea aquatica Torks*) to tilapia. The compounded pelletized feed consists of three ratios of sea cucumber and kangkong given to tilapia to determine which of the three ratios will give a better growth of tilapia in terms of body

weight, total length and body depth. The ratio means one part of sea cucumber is mixed with one part kangkong; 1:2 ratio means one part sea cucumber is mixed with two parts of kangkong and 2:1 means two parts sea cucumber are mixed with one part kangkong. The three ratios were pelletized and given to the tilapia.

This study used the Complete Randomized Design (CRD). There were four treatments in the study. Treatmeant 1 is the group fed with 1:1 ratio; Treatment 2 is the group fed with 1:2 ratio; Treatment 3 is the group fed with 2:1 ratio and Treatment 4 is the group fed with commercial feed as the control group.

Results show that the group feed with 2:1 (2 parts sea cucumber mixed with 1 kangkong) had longer total length, heavier body weight and greater body depth followed by the group fed with commercial feed. The third is 1:1 ratio and the fourth is 1:2 ratio.

Results further show that there were significant differences in weight, body depth and total length in favor of the 2:1 ratio over other treatments.

**Keywords**: *Holothuria nigra, Ipomea aquatica Torks, Oreochramis niloticus*, aquaria

## *BIOLOGICAL SCIENCES*

### BSD No. 1 AN ASSESSMENT OF THE FOOD COMPONENTS OF FISHES THRIVING IN COASTAL WATERS NEAR A MINING SITE

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Paracale in Camarines Norte is one of the oldest mining sites in the country and is well known for its gold panning activities. Effluents from such activities may contaminate the surrounding aquatic environment and affect the biota and productivity of the waters. The feeding preferences of fishes living in the coastal waters near a mining site were assessed to see the productivity of the waters. But analysis is believed to be important in gathering information on the complexity of the habitat as shown by the diet of many fish species. Determination of food composition was done using Number and Occurrence/ Frequency Method of Hynes and Rank Method of Pollard. The number method shows the precentage of the total number of individuals of a food item over the total number of individuals of all food items; the occurrence method shows the number of stomachs in

which each food type occurred and expressed as a percentage of the total number of stomachs examined; for the rank method, the different food types in each stomach were ranked in order of preponderance according to their relative volume. Nine (9) species belonging to 5 families were caught in the area, namely: Family Labridae (*C. diagrammus*, *H. trimaculetus*, *T. lunare*); Family Lethrinidae (*L. lentjan*); Family Lutjanidae (*L. lutjanus*); Family Parapercidae (*P. polyopthalma*) and Family Serranidae (*C. argus, C. pachycentron, E. fasciatus*). Results showed they fed on a number of food organisms. Stomach content analysis revealed the presence of plant debris, microalga, fish eggs, polychaete worms, gatropods, nauplii, copepods, shrimps, crabs, and fish in varying percentages. Shrimps were the most important food component of fishes caught in the area.

**Keywords**: fish, feeding preferences, gut analysis, coastal waters, mining activity

## BSD No. 2 METAZOAN PARASITES FROM THE GILLS AND GUT OF *Auxis thazard* (Lacepede) FROM BALAYAN BAY, BATANGAS

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The frigate tuna, *Auxis thazard* (Lacepede), locally called tulingan, is one of six fishes that form the basis of the Philippine tuna fishing industry. The present study investigates the occurrence of metazoan parasites in the gills and gut of this fish from Balayan Bay, Batangas. Twelve specimens from the bay, obtained monthly from October 2000 to February 2001, were examined using the methods of Velasquez (1975). Mean fork length of the 60 specimens was 27.3 5.0 cm. Only the copepod *Caligus* sp. was recovered from the gills; monthly prevalence of infection (mpi) ranged from 0 to 33.3%. From the gut, three species of acanthocephalans were found; *Rhadinorhynchus* sp. and *Echinorhynchus* spp. with mpi ranging from 33.3 to 100%. Also found were larval nematodes with mpi of 33.3% to 50%. Monthly values of intensity of infection for each parasite species were low (<10). Both prevalence and intensity of infection tended to be higher in bigger-sized hosts.

**Keywords**: *Auxis thazard*, tuna, parasites, fish, *Caligus, Rhadinorhynchus, Echinorhynchus*

## BSD No. 3 THE UNIQUE MORPHOLOGICAL FEATURES OF ADULT FEMALE LAC INSECTS AND THE PHYLOGENETIC RELATIONSHIPS OF THE FAMILY KERRIIDAE WITH OTHER SCALE INSECTS (COCCOIDEA, HEMIPTERA)

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Adult female lac insects (Hemiptera: Coccoidea: Kerriidae) belonging to the genera *Austrotachardia*, *Kerria* and *Paratachardina* were examined using both scanning electron and light microscopy. Morphological features that are considered unique to the family Kerriidae like the anal tubercle, dorsal spine, post-oral lobes, brachia and brachial plates and the canellae were studied in detail. SEM images of most of these structures, previously thought as not homologous to any other character of scale insects, reveal that they are modifications and therefore homologues of lecanoid structures. Subsequent phylogenetic analyses utilizing morphological data showed the monophyly of the lecanoid families and a probable sister-group relationship between the Kerriidae and the soft scale family Coccidae. The same trend is also confirmed by similar analyses performed by colleagues overseas utilizing molecular (SSU RNA) data.

Keywords: Lac insects, Scale insects, Soft scales, Kerriidae, Coccoidae, Coccidae, morphology, phylogeny, SEM, *Austrotachardia*, *Kerria*, *Paratachardina*

## BSD No. 4 STICK INSECTS (PHASMATODEA) FROM MOUNT BANAHAO DE LUCBAN AND TAYABAS, QUEZON PROVINCE: CAMOUFLAGED FEATURES OF TERRESTRIAL ARTHROPOD BIODIVERSITY

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This is the second paper in a series featuring the insect biodiversity of Mount Banahao de Lucban, Quezon Province, Philippines. Collections from the adjacent area of Mount Banahaw in Tayabas have been included. Five species of stick insects

(Phasmatodea) were identified, namely, *Aretaon echinatus* (Stal), *Eubulides igorrote* Rehn & Rehn, *Lonchodes* sp., *Orthomeria pandora* (Westwood) and *Stenobremus* sp. A previous record of *Hoploclonia fratercula* Rehn & Rehn is also reviewed. These insects, being camouflaged among the vegetation of rainforests and secondary growth, are among the least noticed creatures. The existence of at least five species collected within a short study period of only two years and in limited sites on the mountain reserve, suggest that there may be more species awaiting discovery. As such, stick insects may be good examples of terrestrial arthropods, which, in spite of being the most diverse group of organisms, are continuously disregarded in biodiversity documentation and studies. this makes the picture of biological diversity and its conservation grossly skewed towards plants and vertebrate wildlife like birds, mammals and reptiles. Stick insects reflect the fact that terrestrial arthropod biodiversity should be given more positive attitude and consideration in the Philippines and worldwide.

**Keywords:** Stick insects, Phasmatodea, terrestrial arthropod biodiversity, walking sticks, **Mount Banahaw**

## BSD. No. 5 DRAGONFLIES OF CAMIGUIN ISLAND AND OF ILIGAN CITY STREAMS AND ITS ENVIRONS

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Studies on Odonatans especially the dragonflies of the Philippines are still in its infancy stage. For several decades, very few researches have dwelt in the area of dragonfly diversity. This study was therefore conducted to determine diversity within, between, and among populations of dragonflies collected in three streams and an islet in Camiguin Island and four different streams of Iligan city and its environs. Dragonflies were collected using sweep nets and stored using standard techniques of preserving and storing insects for systematics studies. Individual samples were identified based on characters of the wings, thorax and distinct structures to identify species. Results showed variability within, between, and among populations of dragonflies as shown by Shannon-Weaver Index. New genera were identified – three were endemic each for Suarez, Mimbalut, and Aya-aya and one for Dalipuga stream. Samples collected in Camiguin Island were found to be present in Iligan City indicating that geographic distance was not a major factor for the variations observed among the populations. Many individuals were suspected of belonging to new species and are still being investigated to confirm the results.

**Keywords:** dragonflies, Shannon-Weaver Index

## BSD. No. 6 BENTHIC INSECT FAUNA OF SUBIC BAY FOREST RESERVE STREAMS

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In most freshwater ecosystem, larval insects such as mayflies, trueflies (*Chironomidae* and *Chaoboridae*), caddisflies and the odonates dominate a benthic macro-invertebrate community. These organisms provide an excellent tool for biodiversity and ecological assessments. The return of the Subic Bay Naval Base to the Philippine government in 1992 paved the way towards the study of this biologically unexplored Forest Reserve. This study hopes to provide information on the freshwater benthic insects of selected streams of the present Subic Bay Forest Reserve (SBFR). Insect fauna was characterized in terms of their taxonomic richness, diversity and density.

Five streams within the SBFR were selected. In each stream, three 100 m segment were established and sampled for freshwater benthic insects during dry season (January and February 2001) and during wet season (June and July 2001). A total of 57 families of insect taxa were recorded and identified. Majorities are odonates (dragonflies and damselflies nymphs) followed by aquatic beetles (Coleoptera), blackflies (Diptera) and mayflies (Ephemeropterans). The most diverse and abundant group were recorded in Tinalignan River whereas Ilanin River has the least number of insect taxa recorded.

SBFR streams, small as they are, is relatively diverse and rich in freshwater benthic insects. This suggests that SBFR streams include a diversity of habitats that need to be protected from any alterations/degradation that may be brought by the fast pace of industrialization in SBFR.

**Keywords**: Subic bay forest reserve, freshwater benthic macro-invertebrates, biodiversity

## BSD. No. 7 MORPHOMETRICS AND CYTOGENETICS OF THE MALE ORIENTAL FRUIT FLY, BACTROCERA DORSALIS (HENDEL)

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Length measurements of the five abdominal characters that are associated with reproduction in 50 males oriental fruit fly, Bactrocera dorsalis (Hendel), namely: pygofer,

subgenital plate, aedeagus, paramere and connective, were examined and statistically compared. Varying length dimensions ranged from 0.27 to 0.36 mm., majority of which exhibited 0.30 mm length in the pygofer (38%), subgenital plate (36%), aedeagus (34%) and paramere (30%). Parameter ratio was determined to express the shape of the structure. Seven male B. dorsalis exhibited perfect proportion (1: 1 : 1 : 1 : 1) with respect to the five abdominal characters examined. Friedman's test on morphometrics indicated that the distribution of the length of abdominal characters was the same across 50 repeated measures.

Cytogenetic analysis of the testicular cells of B. dorsalis revealed that meiosis was normal in all cells observed, consisting of sequential reductional and equational divisions. The average meiotic index of male B. dorsalis was 51.37%. Karyotype analysis of diakinesis chromosomes revealed that the diploid chromosome number of B. dorsalis was 2n = 12, consisting of five pairs of monocentric autosomes and one pair of heteromorphic sex chromosomes (XY). Average relative lengths of chromosomes ranged from 0.049 - 0.112. Analysis of variance of chromosomes' relative lengths showed insignificant difference among the individuals of sympatric local population of male B. dorsalis.

**Keywords**: morphometrics, cytogenetics, male *oriental fruit fly*, Bactrocera dorsalis *(Hendel)*

## BSD. No. 8 HEMOCYTE AND ISOZYME ANALYSES OF POPULATIONS OF THE EUROPEAN HONEYBEE, *Apis mellifera Linnaeus*, REARED IN AGRICULTURAL, FORESTED AND INDUSTRIAL AREAS

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The effect on the hemocytes and isozymes in populations of European honeybees, Apis mellifera Linnaeus, reared in three different Laguna areas, namely: agricultural (Calauan), forested (College of Forestry and Natural Resources), and industrial (Canlubang) were determined via microscopic observations and electrophoresis, respectively. Hemocyte analysis showed that prohemocytes and granulocytes were dominant in A. mellifera. No significant difference was observed in the total hemocyte counts (THC's) in honeybees among different areas except in the unmanaged colonies after transport. Significant differences exist between the frequencies of prohemocyte and granulocytes (DHC's) in the control populations (before transport), however, there was an increase in prohemocytes in the experimental group (after transport) especially in the unmanaged honeybee colonies in Canlubang. On the other hand, analysis of isozymes such as alkaline phosphatase (ALPH), acid phosphatase (ACPH), and malic enzyme (ME) revealed their polymorphism in all the honeybee populations studied suggesting that the type of area can affect the

genotype and gene frequencies. Comparison of the genetic frequencies of honeybees from different areas showed that the highest genetic identity before and after transport was 1.1014 and 0.6426, respectively, both of which were the values for the colonies in Canlubang and Forestry. The lowest values obtained before and after transport was 0.4013 and 0.2251, which were both exhibited by the colonies in Canlubang and in Calauan. No significant differences were observed between the managed and unmanaged populations of honeybees. The high genetic identity values suggest that the populations of honeybees were still genetically similar despite the transports and rearings in three different areas.

**Keywords**: hemocytes, isozymes, prohemocytes, granulocytes, honeybees, Apis mellifera (Linnaeus)

## BSD. No. 9 THE *IN VITRO* ACTIVITY OF AMIKACIN AND CEFUROXIME ALONE AND IN COMBINATION AGAINST EXTENDED-SPECTRUM BETA-LACTAMASE (ESBL)-PRODUCING *ESCHERICHIA COLI* AND *KLEBSIELLA PNEUMONIAE*

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It has been noted that clinical isolates of *E. coli* and *K. pneumoniae* are now becoming resistant to most beta-lactam drugs due to the production of extended-spectrum beta-lactamase (ESBL) enzyme. Their emergence poses a threat on the field of antibiotic therapy. As an immediate response, a preliminary experimental study on the combined effectiveness of amikacin and cefuroxime against these organisms was conducted.

Forty two clinical isolates of *E. coli* and *K. pneumoniae* suspected for ESBL-production (those resistant to any one of the 3rd generation cephalosporins or to either aztreonam or cefpodoxime) from patients admitted at Angeles University Medical Center within October - March 1999, 11 isolates (4 *E. coli* and 7 *K. pneumoniae*) were detected positive for ESBL production by double-disk synergy test. The minimum inhibitory concentrations (MIC) of amikacinand cefuroxime for these were determined by agar dilution method. Time-kill synergy test was performed to evaluate the combined killing activities of amikacin and cefuroxime at three concentrations: one dilution below, above and equivalent to the drugs' MICs. Viable counts were determined at 0,6,12 and 24 hr.

MIC determination showed that the organisms were susceptible to amikacin at 32-64 ug/mL and to cefuroxime at 32-128 ug/mL. For 73% of the isolates (8 out of 11) in all concentrations considered, the rate of killing increased by 2 $\log_{10}$ after 24 hrs with the combination in comparison with the more active drug alone.

The results showed that synergy exists between amikacin and cefuroxime having greater bactericidal acitivity when used in combination than when used alone.

**Keywords**: antibiotic, resistance, beta-lactamase, time-kill, synergy

## BSD. No. 10 NUTRACEUTICAL POTENTIAL OF *Collybia*

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This study explored the potential Collybia, a mushroom endemic to Nueva Ecija, as a nutraceutical product. It studied the effects of Collybia extract on some hematological properties and growth of mice.

White mice were given extract of *Collybia* as drinks for 30 days. Control group of mice were given distilled water. Hematological properties and gain in weight were assessed and compared after 30 days.

Results showed that mice given *Collybia* extract had significantly decreased bleeding time, increased hemoglobin and hematocrit and neutrophil count. Likewise, they were significantly heavier compared to the control mice. The results of the study imply that *Collybia* can enhance blood clotting, red blood cell production as well as growth. Based on these results, *Collybia* extract is a potential nutraceutical product as a vitamin and growth promoter and could be tapped as source of active ingredients for drug development.

**Keywords:** *Collybia*, mushroom, nutraceutical

## BSD. No. 11 BLOOD CHOLESTEROL LEVEL OF MICE AS INFLUENCED BY MUSHROOM EXTRACTS

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This preliminary study determined the effect of different Philippine mushroom extracts on the blood cholesterol level of mice.

White mice were fed high fast diet and given crude mushroom extract. The extracts tested were those of *Pleurotus*, *Auricularia*, *Agaricus*, *Ganoderma*, *Volvariella* and *Lentinus*. A group of control mice was fed commercial diet and distilled water and another group with high fat diet and distilled water. The blood cholesterol level of mice was analyzed after a month of feeding.

Results revealed that mice given high fat diet had significantly higher blood cholesterol level compared to those given commercial diet. All mice fed high fat diet and given mushroom extracts, regardless of species, had significantly lower blood cholesterol

level compared to those given distilled water.

Based on the results, mushroom extracts can lower blood cholesterol level of mice.

**Keywords**: mushrooms, nutraceutical blood cholesterol

## BSD. No. 12 SORBITOL-COCONUT WATER AGAR MEDIUM FOR THE INITIAL ISOLATION OF *Escherichia coli* O157:H7

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Sorbitol-coconut water agar (SCWA) is a less expensive culture medium developed for the presumptive identification of food-borne Escherichia coli O157:H7, an emerging virulent infection that causes hemolytic uremic syndrome, and sometimes death to patients infected with it. Prompt diagnosis is needed for proper and immediate treatment. The developed medium harnesses the impressive amounts of major nutritional substances in coconut water necessary for the growth of microorganisms.

The performance of SCWA and the standard medium Sorbitol-MacConkey Agar (SMAC) was determined on stool specimens and diverse food samples spiked with various concentrations of E. coli 0157:H7. Results showed that the detection limit of both SCWA and SMAC was not significant at 3-4 cfu/mL of sample. The specificity rates of SCWA and SMAC were not significant (T test) at 86.67% and 85%, respectively; the sensitivity rates were, likewise, not significant: 55% and 50% at a low inoculum level (3-4 cfu/25 ml), 68.33% and 85% at a medium level (30-40 cfu/ml), and 83.33% and 85% at a high level (300-400 cfu/ml). Results indicated that SCWA was as sensitive and as specific as SMAC. The growth rates of E. coli 0157:H7 on SCWA and SMAC were also not significant from 30 minutes to 24 hrs.

Results indicated that despite the lack of supplementary components — peptone, sodium chloride and bile salts — the high nutritional content of coconut water would be enough to provide the substances necessary for the growth of E. coli O157:H7. The developed SCWA and the standard SMAC exhibited comparable performance, growth rates, sensitivity and specificity rates. Furthermore, the cost of this novel medium is 70% lower than SMAC. This study adds another important use to coconut.

**Keywords**: sorbitol, coconut water, E. coli O157:H7, Sorbitol-Coconut Water Agar, Sorbitol-MacConkey Agar, food samples, stool samples, sensitivity rate, specificity rate, growth rate

## BSD. No. 13 *IN VIVO* BIOLOGICAL ACTIVITY OF ATIS (*Anona squamosa* Linn.) CRUDE EXTRACT ON DUCK EMBRYOS

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Biological activities of Anona squamosa were observed in three-day old duck embryos showing angiogenic/ antiangiogenic and teratogenic/antiteratogenic potentials.

*A.squamosa* leaves were homogenized; resulting homogenate was subjected to rotary evaporation and the concentrated crude extract was lyophilized for 36 hours. Obtained crystalline powdered extract was dissolved in PBS buffer. Varying concentrations of A. squamosa extract solutions were introduced to the test embryos by injecting through a modified window to the air space of the egg. Negative and positive controls were made using Phosphate Buffered Saline (pH 7.2) and retinoic acid (Sigma), respectively. After a week of incubation at 37°C, the eggs were opened and morphological characters of the embryos were observed.

The 8 µg/ml extract manifested an antiteratogenic property through angiogenetic action.

Concentrations 9, 10, 20, and 30 µg/ml exhibited teratogenicity through inhibition of angiogenesis or blood vessel formation.

**Keywords**: *Anona squamosa*, angiogenic, anti-angiogenic, teratogenic, antiteratogenic

## BSD. No. 14 ANTI-HEPATOTOXIC POTENTIAL OF *Spirulina platensis*

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*Spirulina* is microscopic blue-green algae, which are often found in warm alkaline volcanic lakes. The algae contain essential nutrients like beta-carotene, phycocyanin, polysaccharide, sulfolipid, gamma linolenic acid, vitamin B complex, iron, magnesium, and trace minerals that help protect the human body by enhancing its immune system. It is also reported to reduce the hepatotoxicity in rats caused by carbontetrachloride and R- (+) pulegone administration. The effectivity of *Spirulina platensis* as an anti-hepatotoxic agent was investigated in this study by looking into the liver histology of ICR

strain mice exposed to cyclophosphamide treatment. Cyclophosphamide is a known chemotherapeutic agent. The drug is an alkylating agent and is known to cause cytotoxicity. It reacts with oxygenases and cytochrome P-450 causing formation of metabolites such as phosphoramide mustard, $HN_2$ and acrolein, which alkylate with DNA. The following treatment groups were made to establish *Spirulina*'s anti-hepatotoxicity, namely: cyclophosphamide-treated, *Spirulina*-treated, and *Spirulina*-cyclophosphamide-treated groups. Tissues were fixed in Bouin's fluid and processed for paraffin sectioning. Light microscopy studies revealed extravasation of blood was evident in liver tissues of mice that received the cyclophosphamide drug. Mice given with *Spirulina* prior to drug treatment showed an improvement over the ones that did not receive *Spirulina* at all.

**Keywords**: algae, *Spirulina*, anti-hepatotoxic, mice, histology, liver

## BSD. No. 15 PROPHYLACTIC AND ANTIMICROBIAL PROPERTIES OF BREAST MILK: FACT OR MYTH?

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Breast milk was once the only known milk for infants but it has largely been replaced by a great variety of commercial milk formulas, each claiming superiority over the others. More recently, the World Health Organization (WHO) has urged mothers to go back to breast-feeding. As a contribution to the Philippine government's efforts to this end, we did both laboratory experiments and surveys to obtain concrete indicators supporting the health claims concerning breast milk.

Samples of human breast milk were collected and tested for antimicrobial properties against four potentially pathogenic bacterial isolates. A replicated disc diffusion assay was used to evaluate the extent of the antimicrobial activity of the milk samples. Questionnaires with 30 carefully drafted questions were randomly distributed to 37 respondents, mothers with at least one child either breast-fed or bottle-fed for at least the first six months of life. The prophylactic values of breast milk and milk formula were compared using five commonly encountered childhood diseases as indicators. The index of prophylactic value of breast milk was also computed for each of the five diseases.

All milk samples significantly showed antimicrobial action on all test organisms. Breast milk also showed a higher prophylactic value either specifically for each disease, or generally when taken as a whole, compared to milk formula. Computed indices of prophylactic value revealed that breast milk surpassed milk formula the most in preventing the occurrence of diarrhea.

Based on our results, we conclude that the general health claims concerning breast milk can be scientifically supported. Breast milk has both desirable antimicrobial activities and prophylactic properties against a number of infections commonly affecting children. The lesser incidence of breast cancer in breast-feeding mothers should be an added incentive to all nursing women.

**Keywords**: breast milk, antimicrobial, prophylactic value, index of prophylactic value, diarrhea, breast cancer

## BSD, No. 16 *GANODERMA* EXTRACTS: POTENTIAL SOURCES OF IMMUNE RESPONSE MODIFIERS RIGHT IN OUR BACKYARDS

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Immune response modifiers also known as immunomodulators are a group of bioactive substances that modulate the activity of the immune system. Because the immune system ultimately determines the individual's state of health or disease, global search for immunomodulators for pharmaceutical application has never been so active as today. We tested for the presence of potential immunomodulators from the extracts of *Ganoderma applanatum*, a common bracket fungus that may grow right in anyone's backyard.

*Ganoderma applanatum* growing on a trunk of a tree was collected from the suburb of Iligan City. Crude extract was obtained using a rotavapor apparatus with methanol as solvent. Fifteen white rats of approximately the same size were used as experimental animals which were equally and randomly divided into five groups regardless of sex. Total and differential white blood cell counts were used as immune response indicators. Treatments consisted of a combination of either azathioprine/prednisone, *Aspergillus niger*, *Klebsiella pneumoniae*, or *Staphylococcus aureus* cell suspension, plus crude *Ganoderma* extract. Blood samples were obtained three hours after administration of azathioprine/prednisone and the microbial inocula, and three hours after administration of the crude extract.

Results showed that the crude *Ganoderma* extract contains active components with potential immunomodulatory properties. Observed effects include the overriding of the immunosuppressive action of azathioprine/prednisone, and neutralization of the effects of the presence of microbial cells by the immune system of the rats. The effect of the crude extract on differential count is not very clear and is currently undergoing a thorough investigation.

**Keywords**: immune response modifiers, immunomodulators, cellular effectors, *Ganoderma applanatum*, azathioprine, prednisone, *Aspergillus niger*, *Klebsiella pneumoniae*, *Staphylococcus aureus*, immunosuppresant

## BSD. No. 17 ANTITERATOGENIC AND ANTIANGIOGENIC POTENTIALS OF *Hibiscus rosa sinensis* ON THE DUCK EMBRYO

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*Hibiscus rosa sinensis*, more commonly known as "gumamela" or "Chinarose", is well-known for its wide range of medicinal purposes such as a cure for boils and wounds, as a hair dye. It is also known to cure menstrual disorders and improve sexual charkas. This study used *H. rosa sinensis* flowers to identify the antiteratogenic as well as its antiangiogenic actions on 3-day and 7-day old duck embryos.

Flowers were homogenized, concentrated, then, lyophilized for 36 hours. Extract was dissolved in PBS buffer. *H. rosa sinensis* extract solutions were administered in varying concentrations to the test embryos by injecting to the air space of the egg. After a week of incubation at 37°C, the eggs were opened and morphological characters of the embryos were observed.

Based on the results obtained, it was found that *H. rosa sinensis* crude extracts may have an antiteratogenic activity at higher concentrations and administered at an early stage. On the other hand, it appeared that the crude extracts might be teratogenic when it was combined with retinoic acid, a known teratogen, and when administered at a later stage.

**Keywords**: *Hibiscus rosa sinensis*, antiangiogenic, antiteratogenic, teratogen

## BSD. No. 18 STUDY OF POLYMORPHIC DNA MARKERS IN PHILIPPINE *Entamoeba histolytica* ISOLATES

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We report the application of polymorphic DNA markers used to identify and characterize isolates of Entamoeba histolytica. It is important that a means of identifying

isolates of E. histolytica be developed, since only a fraction of isolataes cause disease.

DNA taken from Philippine isolates of E. histolytica were collected from reference strains and cultured trophozoites, amebic liver abscess patients, and residents of the Elsie Gaches Village and the Baseco Compound. Extracted DNAs from cultured strains were screened using P11-P12 locus and subjected to PCR amplification using different polymorphic loci (SREHP, HSP 1-2 and Locus 5-6).

DNAs extracted from cysts were also screened using P11-P12 and subjected only to Locus 5-6 amplification, since only the latter adequately amplified stool derived DNA.

Trophozoite DNA patterns showed a marked diversity among isolates, with one Philippine isolate being completely different from previous strains. High prevalences of E. histolytica were found in both Elsie Gaches and Baseco, and we were able to amplify Locus 5-6 from stool derived DNA. Amebic liver aspirates had a 50% prevalence for E. histolytica, while Elsie Gaches and Baseco had high prevalences of 88.6% and 24.07%, respectively. Elsie Gaches village had more varied samples than Baseco in terms of the number of polymorphisms.

Isolates of Entamoeba histolytica are significantly different from each other due to polymorphisms in patterns produced by different loci, providing a means for determining intraspecific variation within isolates. These polymorphisms are widespread even within small demographic areas. Populations that have high rates of infection with the parasite are more likely to have fewer isolates. SREHP and Locus 5-6 are invaluable for studying the epidemiology of E. histolytica in different regions. More polymorphic DNA markers are needed to fully differentiate isolates of E. histolytica.

**Keywords**: Entamoeba histolytica, SREHP, Locus 5-6, polymorphism, pathogenicity, Philippine isolates.

## BSD. No. 19 ASSESSMENT OF GENETIC DIVERSITY AMONG FILIPINOS FROM DIFFERENT REGIONS OF THE PHILIPPINES USING SDS-PAGE PROTEIN PROFILE

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SDS-PAGE of 107 adult Filipinos from different regions of the Philippines was done to assess their genetic diversity and identify a possible biochemical marker for Filipinos in a region. No significant differences were noted in the amount of protein among Filipinos from different regions. A total of 14 major bands and 36 protein band patterns were resolved. There was no variation in major protein bands found in positions

3, 4, 6, 7, 8, 9, 10 and 11 which exhibited 100% occurrence, although differences were noted in protein band position 1, 2, 5, 12, 13, and 14 in addition to the observed differences in relative intensity of staining. The total protein band patterns revealed similarities and distinct differences among individuals from different geographic origin. The data show an existence of protein band pattern specific to an individual in a region or exclusive to a group of individuals in a particular location. BP 2, 9 and 31 were observed only in Laguna and absent in other groups. Likewise, BP 17 and 18 were identified only among individuals in Quezon Province.

A dendrogram of the different total protein band patterns shows the extent of differences of relatedness among them. The variations observed in the SDS protein band patterns possibly indicate substantial differences in amino acid composition and differences in the genetic make-up of individuals in the populations.

**Keywords**: SDS-PAGE, dendrogram, genetic diversity

## BSD. No. 20 THE GENETIC BASIS OF ABNORMAL LEVELS OF SERUM CREATININE AMONG FILIPINOS IN LOS BAÑOS, LAGUNA

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The epidemiology, inheritance pattern and enzyme variabilities of Filipinos from Los Baños, Laguna with abnormal levels of serum creatinine were determined. Sex ratio of 1.4 males: 1.0 female indicates that males are more predisposed to the abnormality. The 40-50 age group had the highest frequency of cases, followed by the 60 years old group, thus, the abnormality is age-dependent. The number of cases increased from 1997-2001. Pedigree analysis did not fit to any one inheritance pattern but a heterogenous group. Serum from 80 normal and abnormal individuals, nine years old and above, subjected to starch-gel electrophoresis showed a total of 11 presumptive loci present for the three enzymes (acid phosphatase, esterase and malate dehydrogenase). All loci were controlled by two alleles and majority exhibited slow and fast moving bands, except for ACPH-1, EST-3 and MDH-2 which also showed moderate moving bands. All loci of those with normal serum creatinine levels, were polymorphic (100%). Those with abnormally high levels of serum creatinine were polymorphic for most loci (81.82%) ACPH-4 and EST-4, were monomorphic for the S and F alleles, respectively. All loci and their corresponding genotypes were significantly different between normal and abnormal individuals for the three enzymes tested except ACPH-1, F/F genotype of ACPH-3, MDH-2 and F/F genotype of MDH-3. The average number of alleles for the three enzymes tested was 2 alleles, and heterozygosity was higher in the abnormal group (36.06%) as compared to the normal individuals (21.51%).

**Keywords**: serum creatinine, epidemiology, enzymes, starch gel electrophoresis isozymes, creatinine, heterozygous, dehydrogenases

## BSD. No. 21 CYTOGENETICS OF *VANDA LAMELLATA* LINDL. VAR. CALAYANA

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*Vanda lamellata* Lindl. is an orchid species native to the Philippines which is a potential parent in breeding for exotic hybrids. Unknown yet about the species is its cytogenetics, thus, this study. Chromosome number, morphology and behavior in Carnoy's fixed anther meiocytes and root tip cells of *V. lamellata* Lindl. var. Calayana were determined using acetocarmine squash technique. All cells at diakinesis have 11 bivalents with each univalent slightly far apart from each other. The different stages of meiosis showed normal chromosome behavior except in Anaphase I with a low frequency (0.22%) of the total cells exhibiting bridge and laggards. Pollen fertility was high (97.07%). Meristematic cells from the root tips also manifested normal mitosis with an average mitotic index of 75.5% Karyotype of pro-metaphase cells established a diploid chromosome number of 2n = 38. Because of the uniform small sizes of the chromosomes whose mean relative length range from 0.036 to 0.072, the karyotype is classified as symmetrical consisting of S type chromosomes.

**Keywords**: cytogenetics, chromosome number, karyotype, chromosome behavior, meiocytes, mitosis, *Vanda lamellata* Lindl. var. Calayana

## BSD. No. 22 APPLICATION OF RAPD MARKERS IN THE STUDY OF FAMILY *ZINGIBERACEAE*

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Taxonomic delineation in family Zingiberaceae is difficult because of their short-lived flowers compounded by the lack of helpful vegetative characters. Isozyme studies have revealed variations that can possibly be used to differentiate taxa up to the species level. In this study, the use of random amplified polymorphic DNA (RAPD) markers was investigated to determine if they can be utilized to distinguish between samples belonging to the same species, same genus, or different genera. Six arbitrary decamers were used to amplify DNA from seven samples of Zingiberaceae spp. RAPD profiles were analyzed using cluster analysis with UPGMA as the clustering method and Jaccard's Coefficient as

the binary measure. The resulting dendrogram groups the two Zingiber officinale accessions together, with a Zingiber species joining at a greater distance. Likewise, the two Curcuma samples together formed a separate clade to which a suspected Curcuma accession clustered farther on. *Z. purpureum*, however, which was expected to group with the other Zingiber samples clustered last. These results suggest that interspecific and generic differences exhibited through the RAPD profiles can separate samples belonging to different species as well as those from different genera. Also, there appears to be sufficient interspecific RAPD variation to differentiate conspecific samples, and at the same time, enough similarities to group them together – similarities that can potentially be used as markers for species level identification.

**Keywords**: genetic variation, RAPD, Zingiberaceae

## BSD. No. 23 POPULATION GENETIC ANALYSIS OF *ARIUS MANILENSIS* FROM LAGUNA DE BAY USING PCR-RFLP MITOCHONDRIAL DNA NADH 5/6 REGION

**Gay Pauline G. Padilla[1], V.D. Monje[1], Z.U. Basiao[2], A.D. Santos[1]**

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The kanduli (Arius manilensis) is one of four native Arius species inhabiting Laguna de Bay. The kanduli is an important commercial fish in the region and is being targeted for farming by SEAFDEC. Despite its economic importance there is very limited biological data on the kanduli and no information regarding its stock structure. In this study, analysis of the mitochondrial DNA (mtDNA) polymerase chain reaction restriction fragment length polymorphism (PCR-RFLP) on three populations of kanduli in Laguna de Bay were investigated. Twenty samples each from the Western bay, Central bay and Southern bay were collected for analysis. The mtDNA NADH 5/6 (ND 5/6) region was PCR amplified and analyzed with 10 restriction enzymes. Three endonucleases (Hap II, Hinf I and Hha I) had restriction sites in the ND 5/6 region. Polymorphism was observed with the RFLP pattern generated by Hinf I. Only two different haplotypes were observed, which probably indicates the decline in the genetic diversity of the population. This finding correlates with the observation that the kanduli population in the lake is diminishing.

**Keywords**: PCR-RFLP, Mitochondrial DNA, Population Genetics, Arius Manilensis

## BSD. No. 24 DETECTING MORPHOLOGICALLY ABNORMAL HATCHERY-BRED MILKFISH (*Chanos chanos Forsskal*) WITH DIRECTLY AMPLIFIED LENGTH POLYMORPHISMS IN DNA

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Milkfish (*Chanos chanos* Forsskal) is an important aquaculture commodity in the Philippines. Efforts are being made to develop hatchery-breeding techniques, but high incidences of morphological abnormalities observed in hatchery-bred fish have hampered these efforts. A new PCR technique, called Directly Amplified Length Polymorphisms (DALP), was used to develop genetic markers to screen against abnormal individuals. Two DALP primers, DALP 2-21 and 2-31 (both modifications of the M13 sequencing primer), were used to screen three sample populations: hatchery-bred normal, hatchery-bred abnormal, and wild type. Preliminary results show that the DALP 2-21 primer is able to amplify two polymorphisms differentiating abnormal from normal populations. The first polymorphism is approximately 500kb in size and found only in abnormal individuals, while the second is 400kb and found only in normal populations. These initial results seem to indicate the potential of using this technique in populatinn and genetic studies of milkfish.

**Keywords**: milkfish, PCR, DALP, genetic markers, primers

## BSD. No. 25 ASSESSING DIFFERENT PROTOCOLS OF DNA EXTRACTION FROM *Bacillus* ISOLATES FOR PCR AND HYBRIDIZATION

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Efficient DNA extraction is crucial for the development of a rapid procedure for screening of bacterial isolates that posses commercially important enzymes. In this study, different protocols for the extraction of *Bacillus subtilis* and *Bacillus pumilus* DNA namely modified Li *et al*., ROSE, lysozyme digestion, Nucleospin Tissue Kit, boiling, cryofreeze-heart shock, and zinc-induced DNA sedimentation were performed. The suitability of the extracted DNA for PCR and DNA hybridization-based detection of protease genes was tested. All protocols could generate DNA template from *Bacillus* useful for PCR except the ROSE method. However, the ROSE procedure was found to be the most rapid and cost-effective among the protocols suitable for DNA hybridization.

**Keywords**: DNA extractiou, bacterial isolates, *Bacillus subtilis*, *Bacillus pumilus*, ROSE method

## BSD. No. 26 ELECTROSTATIC ATTRACTION PROMOTES THE FORMATION OF A RECOMBINANT BISPECIFIC ANTIBODY

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A typical antibody molecule is a homodimer stabilized by disulfide bonds between the two heavy chains. In order to produce a bispecific antibody (bsAb) with the Fc region, a heterodimer must form. Past strategies towards the construction of BsAbs include chemical crosslinking and use of polypeptide linkers. The latest reported innovation involves the use of knobs-into-holes engineering where a large amino acid is designed to fit into a smaller one within the antibody's Fc region. We constructed a humanized bispecific antitumor antibody such that oppositely charged amino acids were introduced in the CH3 region of each of the 2 different monomers. Each monomer targets a different tumor antigen that is associated with a wide range of cancer types. Molecular biology techniques were employed to introduce the antibody into a baculovirus expression vector. SF9 insect cells were transfected with the final gene construct and the expressed products analyzed using ELISA and western blot. For controls, transfection was also done using a non-engineered counterpart of the bispecific construct as well as those encoding for monospecific antibodies. Results show that heterodimerization of the antibody is enhanced by electrostatic attraction between chains. This bispecific heterodimer, besides being a potential anticancer molecule, may serve as a model for the generation of other multispecific antibodies against human cancers and other infectious diseases.

**Keywords**: bispecific antibody, electrostatic attraction, cancer, baculovirus expression system

## BSD. No. 27 THE ACONITASE MECHANISM OF GENE REGULATION: A COMMON THEME IN DIVERSE BIOCHEMICAL PATHWAYS

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The aconitase family consists of proteins with highly conserved cysteine residues required for the formation of an iron-sulfur cluster. This [4Fe-4S] cluster forms a cubane structure which dictates the catalytic function of aconitases. Protein sequence alignment

of several diverse enzymes revealed the presence of these conserved amino acid residues.

We have recently cloned and sequenced the first homoaconitase gene from Penicillium chrysogenum by complementation. The gene sequence was then compared with other homologues in world-wide databases using the tools of bioinformatics and a powerful software in molecular biology called DNASTAR. Aside from having the iron-sulfur cluster characteristic of the aconitase family of proteins, the homoaconitase structure surprisingly showed the presence of putative RNA-binding domains which are found in other aconitases, the first to be reported. The protein sequence of the homoaconitase encoded by our cloned gene was also checked using the sequence of the iron-responsive element-binding protein (IRE-BP), one of the aconitases exhibiting an RNA-binding capacity and serving as a model for post-transcriptional regulation. Although involved in diverse biochemical pathways, the catalytic mechanism shown by aconitases is strikingly similar involving a two-step stereospecific isomerization.

We have previously shown through gene regulation studies that homoaconitase regulates at least two other genes in the a-aminoadipate pathway of lysine biosynthesis. We now propose a novel regulatory mechanism for homoaconitase through RNA-binding similar to the IRE-BP regulation in addition to its biosynthetic function in lysine biusynthesis. This proposal is strongly supported by evidence obtained through studies in functional genomics.

We consider these results to be highly significant because an important generalization regarding gene regulation mediated by the various aconitase proteins is emerging for the first time. Though structurally similar, these proteins catalyze metabolically diverse and vital biochemical pathways necessary for the survival of the various organisms in which they function.

**Keywords**: aconitase, iron-sulfur cluster, bioinformatics, complementation, aconitase, homoaconitase, a-aminoadipate, Penicillium chrysogenum, RNA-binding, IRE-BP, functional genomics

## BSD. No. 28 CLONING AND PARTIAL CHARACTERIZATION OF PUTATIVE ACYL-ACP THIOESTERASE GENE IN COCONUT (Cocos nucifera L.)

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Three cloning strategies were employed to identify the putative acyl-ACP thioesterase gene specific for medium chain fatty acids in coconut. The RT-PCR strategy was able to generate a 1.59 kb DNA fragment that contains a highly conserved amino acid region, DRFPDW which is also present in the other plant thioesterase. This 1.59 kb PCR

fragment (obtained using THIO 1 and THIO 2 as gene specificprimers for PCR) is not the full -length cDNA and the strategy to extend the 5' and 3' end of the partial cDNA was to employ 5' RACE and 3' RACE, respectively. A 460 bp PCR fragment was generated by 3' RACE but no PCR fragment was generated at the 5' end due to technical difficulties. With cDNA library, the full-length thioesterase gene was isolated by a modified colony PCR screening method using gene specific primers. Based on PCR screening of the coconut cDNA library, a similar 460 bp fragment was also produced from plasmids 47 and 48 which suggests that these two plasmids contain the full-length sequence Results of this study set the groundwork for the identification of genes playing important roles in the fatty acid synthesis of coconut.

**Keywords**: cDNA, RACE, RT-PCR, THIO, acyl-ACP

## BSD. No. 29 ISOLATION AND CHARACTERIZATION OF PHENOLOXIDASE FROM RHINOCEROS BEETLE (*Oryctes rhinoceros*)

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The rhinoceros beetle (*Oryctes rhinoceros*) is the most destructive pest of coconut (*Cocos nucifera*), an important agricultural commodity. This common insect pest synthesizes phenoloxidase, an enzyme known to play a major role in insect immunity particularly in defense against pathogens, wound healing, cuticular tanning and sclerotization. Thus, a better understanding of phenoloxidase and its inhibitions may aid in the development of strategies to control insect infestation.

Since there has no report yet on phenoloxidase in coconut rhinoceros beetle, we first characterized the optimum assay conditions for this enzyme using different substrates and activators at various pH, incubation time, and temperature. Phenoloxidase was also purified using various chromatographic techniques. Homogeneous preparation of phenoloxidase was subjected to SDS-PAGE, blotted and PVDF membrane and was submitted for N-terminal amino acid sequence analysis.

**Keywords**: phenoloxidase, *Oryctes rhinoceros*, chromatography

## *CHEMICAL, PHYSICAL AND MATHEMATICAL SCIENCES*

### CMPSD No. 1 HYBRID 'SINTA' PAPAYA (*Carica papaya*) RIPENING FRUIT EXHIBITS UNIQUE ACC SYNTHASE 1 GENES

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Five ripening-related ACC synthase cDNAs have been cloned from 80% ripe papaya cv. Sinta by reverse transcription-PCR using Ole primers. The DNA sequences show that the clones contain the ACC synthase active site and four amino acid residues invariant among ACC synthases and aminotransferases. Southern blot analysis indicates that all five clones came from only one gene existing as a single copy in the papaya genome. Sequence analysis indicates that all five isoforms arise from a single gene through alternative splicing mechanisms. Clone 2 is the longest transcript and contains all common exons and three alternative exons. Clones 3 and 4 contain common exons and one alternative exon each, while clone 1 contains only the common exons. All the alternative exons are present in the N-terminal of the gene. Clone 5 was shown to be due to cloning artifacts and not a unique cDNA fragment, thus, there are only four isoforms of ACC synthase mRNA. Sinta ACC synthase cDNAs were of the *capaccs* 1 type and are most closely related to AJ277160, a 1.4 kb *capaccs* 1-type DNA from Eksotika papaya. No *capaccs* 2-type genes were cloned from Sinta. This is the first report of alternative splicing in ACC synthase genes.

**Keywords**: Sinta, ACC synthase, DNA sequence

### CMPSD No. 2 COMPUTATIONAL ANALYSIS OF CATION-π INTERACTIONS IN CRY PROTEINS OF *Bacillus thuringiensis*

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Cation-π interaction is increasingly recognized as an important non-covalent interaction in structural biology. It is thought to be important in protein stability, molecular interaction, and other biological functions. An energy-based algorithm was adopted to

identify significant cation-π pairs in Cry proteins from *Bacillus thuringiensis*. Four Cry proteins (Cry1Aa, Cry2A, Cry3A, and Cry3B) with known three-dimensional structures were analyzed for the presence of cation-π interactions. Results show that energetically significant cation-π pairs exist in the molecular structure of the Cry proteins. Cry2A and Cry1Aa had the highest and lowest number of cation-π pairs, respectively. Majority of the energetically significant cation-π pairs in Cry1Aa (83.3%) and Cry2A (84.6%) was of intradomain location but not in Cry3A (54.5%) and Cry3B (44.4%). Domain II of Cry2A contained the highest number of intradomain cation-π interaction represented by arginine and phenylalanine, arginine and tyrosine, and arginine and tryptophan pairs. Among the Cry proteins examined, only Cry1Aa do not have cation-π interactions in domain III and that lysine was not involved in cation-π pairings anywhere in the structure of Cry1Aa. The strongest cation-π pair was observed between lysine 209 and phenylalanine 206 in domain I of Cry3A with the electrostatic component of the binding energy, $E_{tot}$ = -7.79 kcal/mol.

**Keywords**: cation-π interaction, *Bacillus thuringiensis*, Cry proteins

## CMPSD No. 3 CLONING AND CHARACTERIZATION OF THE GENE ENCODING GLYCERALDEHYDE-3-PHOSPHATE DEHYDROGENASE IN COCONUT (*Cocos nucifera* L.)

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RT-PCR strategy was employed to clone the gene encoding glyceraldehyde-3-phosphate dehydrogenase (gap) in coconut using a gene specific 20-mer primer pair. The sense primer has a 45.3°C melting temperature (Tm) and 50% GC content. The antisense primer, on the other hand, has 48.3°C Tm, 50% GC and a repeat in it. Using a modified Invitrogen's one-step TOPO-TA Cloning Kit, the 845 bp PCR product was inserted into a TOPO vector and was used in the transformation of *E. coli* DH5α. Two positive clones were sequenced (H3 and H23). The partial cDNA sequence of H3 clone (designated as cocogapC1) contained 669 nucleotides with an ORF encoding 222 amino acids, corresponding a 24.4Kda polypeptide. Sequence alignment revealed that it has 72.9% nucleotide sequence homology and a 95.6% amino acid homology with those from other plant species' gap genes. On the other hand, the partial cDNA sequence of H23 clone (designated as cocogapC2) is composed of only 649 nucleotides with an ORF that encoded a polypeptide of 216 amino acid with 24.2KDa molecular weight. Alignment with other plant gap sequences showed that it has a 72.6% nucleotide sequence homology and 95.9%

amino acid homology. Regions associated with the metabolite function of NAD-gap were noted on both cocogapC1 and C2 deduced amino acid sequences. These regions include the putative NAD-binding domain from Thr-3 to Ala-114 and the putative catalytic-binding domain from Val-115 to Val-173. Alignment of the nucleotide and amino acid sequences of cocogapC1 and C2 revealed percent identities < 95%, (89.1% and 72.5%, respectively) thus, strongly suggesting that cocogapC1 and C2 are isoforms of the gene encoding glyceraldehyde-3-phosphate dehydrogenase.

**Keywords**: cloning, glyceradehyde-3-phosphate dehydrogenase, RT-PCR, isozymes, coconut

## CMPSD No. 4 THE PURIFICATION OF AN ENANTIOSELECTIVE MOLD LIPASE AND THE CLONING OF ITS GENE

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An *Aspergillus niger* exolipase was purified via sequential ultrafiltration and ion-exchange chromatography. The SDS-PAGE profile revealed the presence of two bands while the native gel, a single band. The two-step protocol has resulted in a 27-fold increase in purity. The purified extract was found to be predominantly S(+)-enantioselective in the hydrolysis of the racemic mixture of a model compound of an aryl butyl ester after HPLC analysis of the hydrolysates using a chiral column. The enzyme was characterized to have optimum activity at neutral pH and at 30-35°C.

Alignments of related fungal lipases revealed the presence of a conserved region, which facilitated the identification of a gene specific primer, together with oligo dT as the other primer, for reverse transcription-polymerase chain reaction (RT-PCR). The reaction produced a fragment, which after cloning and sequencing revealed a putative lipase encoding segment.

The transformant bearing the RT-PCR produet was grown in liquid culture and evaluated to express lipase, a fusion protein, with an activity of 0.83 U/mL, detected after 24 h, not found in *A. niger* culture.

**Keywords:** lipase, enantioselective, *Aspergillus niger*

## CMPSD No. 5 PURIFICATION AND PARTIAL CHARACTERIZATION OF A LECTIN FROM THE LEAVES OF *Pithecellobium dulce* (Roxb.) Benth

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Lectins are sugar-binding proteins or glycoproteins of non-immune origin that can precipitate glycoconjugates and agglutinate cells. They have been proven to be powerful tools in biological, biochemical and medical research. This study reports the purification and partial characterization of a lectin in the leaves of *Pithecellobium dulce* (Roxb.) Benth.

The leaf lectin was extracted using 0.02 M phosphate buffered saline (pH 7.2) and purified using sequential ammonium sulfate fractionation and gel filtration on Sephadex G-200. The native lectin exhibited a molecular mass of about 79 kD on gel filtration using Sephadex G-200. SDS-PAGE revealed two protein bands with molecular masses estimated to be 66 and 45 kD, respectively. It showed hemagglutinating activity toward human erythrocytes from all blood types and animal erythrocytes such as calf, carabao, goat, rabbit and swine. The native lectin was found to be a glycoprotein containing 18.9% total sugars.

The results presented indicate the potential of the leaves of *Pithecellobium dulce* (Roxb.) Benth. as a readily available and cheap source of lectins.

**Keywords**: lectin, glycoprotein

## CMPSD No. 6 ANTITUBERCULAR COUMARIN FROM THE FRUIT JUICE OF *Morinda Citrifolia*

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Ethnobotanical study of Degener reported that Hawaiians use a concoction called aumiki awa, prepared using the fruit of *Morinda citrifolia* (noni) as a component, to treat tuberculosis. Noni is unique because it is associated with many healing properties that characterize claims for its efficacy while only a few investigations have been conducted to scientifically validate these claims. To date, only one group has investigated the antitubercular potential of this plant.

This present study subjected the fruit juice of a Philippine collection of this plant to *in vitro* assay against *Mycobacterium tuberculosis* H37Rv, the causative organism of tuberculosis. Results showed that it possesses 82% inhibitory activity against the test organism at 100 ug/mL concentration while its $CHCl_3$ fraction exhibited 100% inhibition at the same concentration. Purification of this $CHCl_3$ fraction through stepwise normal phase gravity column chromatography using $CHCl_3$ and EtOAc as mobile phase yielded white needle-like crystals. Through a combination of melting point and spectral analysis (ultraviolet: $^1H$, $^{13}C$, gradient enhanced heteronuclear single quantum coherence and heteronuclear multiple bond correlation nuclear magnetic resonance spectroscopy; and mass spectrometry) and comparison with published data, it was identified as a coumarin. We report its first isolation in *M. citrifolia* and present the spectral data, structure and antitubercular activity of this compound.

**Keywords**: tuberculosis, *Morinda citrifolia*, noni, *in vitro*, *Mycobacterium tuberculosis* H37Rv, melting point, spectral analysis, coumarin

## CMPSD No. 7 PHYSICO-CHEMICAL PROPERTIES OF N,O-CARBOXYMETHYL CHITOSAN AND ITS USE AS A COATING TO EXTEND THE SHELF-LIFE OF MANGOES (*Mangifera indica* L.)

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N,O-carboxymetbyl chitosan (NOCC) was prepared by mercerization and etherification. The product was film forming and had the following characteristics: percent solubles – 53.6%, degree of substitution (DS) – 0.45, molecular weight – $6.76 \times 10^5$ and degree of polymerization (DP) – 355,789. The prepared NOCC was used as a coating for shelf-life extension of mangoes. Physicochemical changes in the coated mangoes were monitored during storage while titratable acidity, total soluble solids and pH were measured on the first and last day of storage. The NOCC-coated mangoes showed an increase in titratable acidity and a decrease in total soluble solids, pH as well as least weight loss, shriveling and softening. The coating containing one percent carboxymethyl chitosan plus additives retained skin greenness of mangoes. Incidence of disease and infection was low in the coated fruits indicating the potential of NOCC as an antimicrobial agent against anthracnose disease. These results indicated that NOCC may be used as coating for storage life extension of mangoes.

**Keywords**: N,O-carboxymethyl chitosan, chitosan, coating

## CMPSD No. 8 COMPARISON OF TWO ELISA-BASED SCREENING AND MINICOLUMN TEST KITS WITH LIQUID CHROMATOGRAPHY FOR THE DETERMINATION OF AFLATOXINS IN CORN: A PRELIMINARY REPORT

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Two enzyme-linked immunosorbent assay (ELISA)-based screening and a developed minicolumn test kits performance were compared with a quantitative method for aflatoxin determination in corn. The samples analyzed included one set of artificially-contaminated corn containing different aflatoxin levels (0, 10, 20 and 50 µg aflatoxin $B_1$/ kg sample), and a set of naturally-contaminated corn samples containing similar aflatoxin levels. Data of the analysis with each test kit were evaluated and compared with the liquid chromatography data of the test samples. Results showed that both the two ELISA-based test kits gave positive responses of 71% and the "lahar" minicolumn test kit, 83.3%. The performance of the locally-developed aflatoxin test kit which utilizes a "lahar" minicolumn is comparable to that of the commercial test kits.

**Keywords**: ELISA, minicolumn, aflatoxins, liquid chromatography

## CMPSD No. 9 ANALYSIS OF AMYLOSE CONTENT OF NINE (9) TRADITIONAL BASMATI RICE VARIETIES CULTIVATED UNDER PHILIPPINE CONDITIONS

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Basmati rice cultivars have their origin in India and Pakistan. They are characterized by long slender grain, strong aroma, and intermediate amylose content.

Amylose content (AC) is one of the grain quality characters that vary from country

to country. This study was undertaken to determine the effect of Philippine conditions on the amylose content of nine (9) introduced Basmati rice cultivars that were planted in the experimental field at Central Luzon State University, Nueva Ecija during the wet season of 2001.

Percent AC (%AC) was determined using an Autoanalyzer following the method developed by Juliano (1971) with modifications. Results indicated that eight (8) out of nine (9) cultivars had low AC while only one (1) had intermediate amylose content.

**Keywords**: Basmati cultivar, amylose content, Philippine conditions

## CMPSD No. 10 REVIEW OF VALUABLES FOR AMYLOSE CONTENT ANALYSIS OF MILLED RICE

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Amylose and amylopectin are anhydroglucose units that are the major components of rice grains. Amylose content is one of the determinants for cooking and eating qualities of rice, thus, its value is a crucial indicator of rice grain quality.

Iodine staining method developed by Juliano (1971) is the widely accepted procedure for routine quantification of amylose in milled rice. It is also the protocol approved by the Rice Technical Working Group of the National Seed Industry Council, Department of Agriculture. Using this method, a preliminary test on different brand combinations and different defatting procedures was undertaken in the Analytical Services Laboratory of PhilRice. The test showed that alteration of results may come from factors such as the brand of amylose and amylopectin standards, brand combinations for amylose and amylopectin mixtures, and the defatting procedure for standard checks (IR8, IR24, IR29, IR64).

**Keywords**: amylose, amylopectin, iodine staining method

## CMPSD No. 11 SURFACE STUDIES AND BIOMIMETIC PROPERTIES OF A PIEZOELECTRIC CAFFEINE SENSOR BASED ON MOLECULARLY IMPRINTED POLYMER

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The measurement of caffeine is important in water quality monitoring, since it could be used as a marker for human fecal contamination in surface waters. In this study, the feasibility of a piezoelectric quartz caffeine sensor based on molecularly imprinted polymer (MIP) was explored.

The MIP was prepared by co-polymerization of methacrylic acid and ethyleneglycol dimethacrylate with caffeine as the template molecule, chloroform as the solvent and azobisisobutyronitrile as the initiator followed by Soxhlet extraction of caffeine using methanol-acetic acid. The caffeine sensor was devised by spin-coating onto one side of the 10 MHz AT-cut quartz crystal the MIP suspension in cyanoacrylate ester-tetrahydrofuran (6:2:1 w/w/v) solution. The coated crystal set in a fabricated cell with its electrode connected to a Pierce oscillator circuitry and a frequency counter was used for measurement of resonant frequency of the quartz when it was in contact with the solution. The sensor exhibited a linear relationship between frequency shift and caffeine concentration in the range of $1 \times 10^{0}$ up to 1 mg/mL. It has a sensitivity of about 61 Hz/ln (cone..mgmL$^{-1}$).

Surface studies using SEM and XPS were conducted in order to elucidate the imprinting of the caffeine molecule. The SEM micrograph and XPS spectra confirmed the removal of caffeine by Soxhlet extraction in the imprinting process and the rebinding of caffeine to the MIP during the sensing process.

**Keywords**: caffeine, piezoelectric sensor, molecularly imprinted polymer

## CMPSD No. 12 ON THE INTRAMOLECULAR DISSOCIATION PATHWAYS OF $FCOOCH_2CH_2^+$ IN THE GAS PHASE: A DFT STUDY 1. ENOL PATH

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A ground-state intramolecular gas-phase dissociation pathway of ethyl

fluoroformyl radical cation ($FCOOCH_2CH_3^{\cdot}$) is uncovered using conventional *ab initio* and density functional molecular orbital theory calculations. Geometries are optimized using the 6-31G* basis set. Electron correlation is incorporated by optimizing the geometries at the MP2 and B3LYP levels using the 6-31G** basis set. Stationary points are characterized by frequency calculation at the same level of theory and basis set except for MP2 where only HF/6-31G* corrections were applied. In a so-called enol path, the α-distonic radical cation undergoes a barrierless isomerization to a more stable γ-distonic enol form $FC^{\cdot}(OH)OCH_2CH_2$. This is followed by a rate-determining self-induced cleavage of the ester linkage yielding $FCOOH + C_2H_4^{\cdot}$ in the second step of an Ei scheme which is at the same time the first step of an E1 β-elimination mechanism. The enol pathway is terminatted by a slow elimination of a proton from $C_2H_4^{\cdot}$ by FCOOH which acts as a base. The above conclusions are drawn from the results of density functional (UB3LYP/6-31g**) calculations as the conventional *ab initia* treatment [UHF/6-31G* and UMP2(Full)/6-31G**//UHF/6-31G*] gave erroneous energetics due to heavy spin-contamination of the wave function.

**Keywords**: enthyl fluoroformate, distonic radical cation, density functional theory, spin contamination, fluoroformic acid, *ab initio*, molecular orbital theory, reaction mechanism, Ei, E1

**Acronyms**: DFT - Density Functional Theory; MP2(Full) - Moller-Plesset correlation energy correction truncated at the 2nd order with all electrons included; B3LYP - Beckes Three Parameter Hybrid Method using the correlation functional of Lee, Yang and Parr; HF - Hartree-Fock (theory)

## CMPSD No. 13 BROMIDE-SELECTIVE ELECTRODE BASED ON CONDUCTING POLYANILINE (PAn)

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Monitoring of inorganic anions in water samples is essential in order to determine if their level is within the allowable limit for human consumption. Hence, this study is aimed towards the development of a low cost $Br^-$-selective electrode using conducting PAn.

Galvanostatic polymerization (0.45 mA) of aniline (An), onto a Pt wire (0.25

$cm^2$) for 15 minutes in a solution containing 2:1 mole ratio of An monomer and NaBr, was carried out to devise the sensor. It presented the following figures of merit: a sub-Nernstian response time of – 48.6 mV/pBr ; a good linearity of 0.998 ($r^2$) from $10^{-1}$-$10^{-2}$ M Br⁻ at an average response time of ~2 minutes at 3 replicates (RSD=3.61%).

The electrochemical, surface and elemental properties of PAn were likewise characterized via cyclic voltammetry (CV), Scanning Electron Microscopy (SEM) and X-ray Photoelectron Spectroscopy (XPS), respectively.

The Br⁻-selective electrode showed a promising response; however, various parameters are still under investigation for better performance enhancement.

**Keywords**: polyaniline, conducting polymer, Br⁻, CV, SEM, XPS

## CMPSD No. 14 COMPUTER ELUCIDATION OF CHEMICAL REACTION MECHANISMS USING STOCHASTIC AND MOLECULAR ORBITAL METHODS

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Computer elucidation of chemical reaction mechanisms may be done using stochastic and molecular orbital (MO) methods. The stochastic (Monte Carlo) method is usually applied to gas phase reactions consisting of several elementary steps. The molecular collision corresponding to each elementary step is simulated by picks of two sets of random numbers in the computer; one set selects the time interval between collisions and the other set picks the elementary step. The mechanism of the overall reaction is obtained in terms of the number of passes through each step, which in turn depends on the rate constant. The MO method involves computation of heats of formation ($\Delta H_f$) and frontier molecular orbitals (FMO's) of reactants, possible intermediaries and products of the reaction; however, mechanistic evaluation is at best semi-quantitative.

The hydrogen-iodine reaction ($H_2 + I_2 \longrightarrow 2HI$) was computer-simulated using the stochastic algorithm of Gillespie (1976). Plots of the number of molecules of $H_2$, $I_2$, HI, I and H vs. time (with specified initial numbers of reactant molecules) were prepared from the computer simulations at the following temperatures (in K) : 737.9, 721.0, 710.3, 666.7, 633.2, 520.1, 480.7 and 417.9. The equilibrium constant ($K_{eq}$) was calculated at each temperature; all except one of the calculated $K_{eq}$ values agreed with the literature values within 0.5%. The calculated heat of the reaction, which was obtained from the van't Hoff plot, was -12.1 kJ; the literature value is -9.5kJ.

The number of passes in the elementary steps composing the bimolecular, atomic and termolecular mechanisms were determined; the dissociation step for $I_2$ was predominant at all temperatures. Among the three probable mechanisms for the formation of HI (excluding the dissociation of $I_2$), the greatest contribution to the overall reaction came from the bimolecular step and was followed by the atomic and then the termolecular mechanisms.

The PM3 semi-empirical method was used to calculate the total and binding energies, $\Delta H_1$ values, dipole moments and FMO's of the intermediates and oligomeric products of the glucose-glycine Maillard reaction. FMO calculations on the probable intermediates showed differences in the $\Delta H_1$ values among the neutral form of the Schiff base, its enol forms, and the Amadori compound. The equilibrium constants were calculated for the following steps:

$$\text{Schiff base} \overset{K_1}{\rightleftharpoons} \text{1,2 enol form} \overset{K_2}{\rightleftharpoons} \text{Amadori compound} \overset{K_3}{\rightleftharpoons} \text{2,3 enol form}$$

namely $K_1 = 29$, $K_2 = 4.2 \times 10^3$ and $K_3 = 45.3 \times 10^{-6}$.

The HOMO-LUMO energy gaps for the reactions among glucose, glycine and the Amadori compound were compared and showed that dimerization of the Amadori compound is the favored reaction. The cyclic and the non-cyclic forms of the dimeric product of the Amadori compound were also evaluated; further polymerization by the non-cyclic form rather than the cyclic form was prefered. Other six carbon products from the glucose-glycine Maillard reaction was examined. Based on the calculated $\Delta H_1$ values of polymerization was favored while ring formation was disfavored.

**Keywords**: computer elucidation, chemical reaction mechanisms, molecular orbital methods, stochastic method, glucose, glycine, Amadori compound

## CMPSD No. 15 ALL-SOLID-STATE POTENTIOMETRIC SENSOR FOR IODIDE BASED ON A MIXED AgI/$Ag_2S$ - EPOXY MEMBRANE

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An all-solid-state approach to potentiometric sensor introduces technologically appealing features. The absence of the internal solution simplifies the design and allows this type of sensor to be used at any position. An all-solid-state potentiometric sensor for iodide was developed through the dispersion of mixed silver salts into an epoxy to produce a rigid and robust membrane. The sensing membrane consists of co-precipitated AgI and $Ag_2S$ salts mixed with an Araldite epoxy mixture in a 6:1 w/w silver salt:epoxy

ratio. The sensor showed very good response characteristics to iodide ions as exhibited by its Nernstian response (m= -60.587 mV/log [I⁻]) and perfect correlation (r=1.000). The sensor's dynamic range spans 4.5 orders of magnitude with a low practical limit of detection at –6.5 log $a_{I^-}$. The sensor's response is highly repeatable, reproducible and highly selective for iodide ions even in the presence of $10^{-3}$ M [$Cl^-$] as shown by its very low selectivity coefficient (Kij=2 x $10^{-4}$). Application of this iodide sensor includes the following: 1) the determination and monitoring of iodide in foods (e.g. iodized salts) and 2) as a cyanide sensor since preliminary studies showed that the sensor is also selective to cyanide ions.

**Keywords**: all-solid-state potentiometric sensor, rigid membrane, iodide sensor

## CMPSD No. 16 DIMENSION OF POWERS OF SOME GRAPHS

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A *unit graph* in the Euclidean $n$-space $R^n$ is a graph whose vertices are points in $R^n$ and every pair of adjacent vertices $x, y$ satisfy $|x - y| = 1$ where $|x - y|$ denotes the Euclidean distance between $x$ and $y$. The smallest nonnegative integer $n$ for which a graph $G$ is a unit graph in $R^n$ is called the *dimension* of $G$, denoted by $dim(G)$.

Let $G$ be a graph, $k$ a positive integer. The *kth power* of $G$, denoted $G^k$, is the graph having the same vertex-set as $G$ with vertices $x, y$ adjacent in $G^k$ whenever $1 \le d_G(x,y) \le k$, where $d_G(x, y)$ denotes the distance between $x$ and $y$ in $G$.

This research study seeks to determine the dimension of the powers of some graphs. Among the major results obtained are the following:

1. *If $d(G)$ denotes the diameter of a connected graph $G$ of order $n>1$, then*

$$dim\,(G^{d(G)}) = n - 1.$$

2. *If $G$ is a connected graph of order $n > 1$, and $1 \le k < d(G)$, then*

$$dim(G) \le dim(G^k) \le dim(G^{k+1}) \le n - 1.$$

3. *Let $1 \le k \le n - 1$ and let $P_n$ be the path of order $n > 1$. Then*

$dim\left(P_n{}^k\right) = k$ *if* $k = 1, 2, n - 2,$ *or* $n - 1$. *If* $n \ge 6$ *and* $3 \le k \le n-3$, *then* $k \le dim\left(P_n{}^k\right) \le k + 1$.

4. *Let $C_n$ be the cycle of order $n$. Then* $dim\left(C_n^{\lfloor n/2 \rfloor}\right) = n-1$, $dim\left(C_{2k}^{k-1}\right) = k$ *and* $k \le dim\left(C_n^{k}\right) \le n - \lfloor n/2 \rfloor$ *when* $2 \le k < \lfloor n/2 \rfloor$.

5. *If $G$ is either the fan $F_n$ or the wheel $W_n$ of order $n+1$, then* $dim\left(G^2\right) = n$.

**Keywords**: unit graph, dimension, power of a graph

## CMPSD No. 17 ON THE NUMBER OF INDUCED CYCLES IN THE COMPLEMENT OF GRAPHS

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Let $G = (V(G), E(G))$ be a graph. The *number of induced cycles* in $G$, denoted by $ic(G)$, is the number of cycle-inducing subsets of $V(G)$. The *complement* of $G$, denoted by $\overline{G}$, has $V(G)$ as its vertex set, but two vertices are adjacent in $\overline{G}$ if and only if they are not adjacent in $G$. This paper studies the number of induced cycles in the complement of graphs. It particularly considers the complement of cycle $C_n$, generalized wheel $W_{m,n}$, path $P_n$, generalized fan $F_{m,n}$, and trees.

An explicit formula for $ic(\overline{C}_n)$ in terms of $n$ is established. This formula is useful in determining $ic(\overline{G})$, where $G$ is a graph which has an induced cycle as a subgraph. Its usefulness is demonstrated in counting the number of induced cycles in the complement of generalized wheels.

An exact expression for $ic(\overline{P}_n)$ in terms of $n$ is found. This expression aids in deriving $ic(\overline{G})$, where $G$ is a graph which has an induced path as a subgraph. Its importance is shown in finding the number of induced cycles in the complement of generalized fans.

Let $T$ be a tree. This paper characterizes the existence of 4-cycles in $\overline{T}$. It shows that $\overline{T}$ has no induced cycle of length greater than 4. Finally, it gives some lower and upper bounds for $ic(\overline{T})$ in terms of order, stability number and maximum degree of $T$.

**Keywords**: graph, complement, cycle, induced cycle, generalized wheel, path, generalized fan, and tree

## CMPSD No. 18 DETERMINING COMMUTATIVITY AND NILPOTENCY OF A FINITE GROUP FROM ITS ORDER

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If a finite group contains a prime number of elements, then the group is cyclic, and hence unique up to isomorphism. Are these other integers for which the only groups of these orders are cyclic? The answer is yes; and a characterization is given by the following: Every group of the order N is cyclic if and only if $N= p_1p_2 \dots p_r$, where $p_i$ are distinct primes and pi does not divide $p_j - 1$ for all i,j. Surprisingly this result can be extended to obtain analogous theorems characterizing those integers N for which every group of order N is abelian or nilpotent. In this paper we present elementary proofs of these analogues, suing the structure of the maximal subgroups of the group and their embedding in the whole group to obtain a contradiction by counting arguments.

**Keywords**: finite group, group order, classification, cyclic group, abelian group, nilpotent group, Euler phi-function, maximal subgroups

## CMPSD No. 19 THE $SH_1$ INTEGRAL IN A LOCALLY CONVEX TOPOLOGICAL VECTOR SPACE

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Recently, the author defined the Henstock integral of a function which takes its values in a topological vector space. Henstock integrability of a function $f : [a,b] \to X$, where $X$ is a complete topological vector space, had been shown to be equivalent to the existence of a function $F: [a,b] \to X$ satisfying the condition that for every neighborhood $U$ of the zero vector $\theta$, there exists a positive function $\delta$ on $[a,b]$ such that if $P = \{([x_{i-1},x_i];t_i) : 1 \le i \le n\}$ is a $\delta$-fine tagged partition of $[a,b]$, there exist open sets $U_1, U_2, \dots, U_n$ with $\sum_{i=1}^{n} U_i \subseteq U$ such that $F(x_i) - F(x_{i-1}) - (x_i - x_{i-1})f(t_i) \in U_i$ for all $i$. If we impose further that the open sets $U_i$ are neighborhoods of the zero vector $\theta$, then the corresponding integral is called the strongly Henstock integral.

In this study, we considered a locally convex topological vector space and defined the $SH_1$ integral. This integral is obtained by imposing the additional condition the open sets $U_i$ mentioned above are multiples of the open set $U$. It is shown that the $SH_1$ integral of a function, if it exists, is unique. Other results obtained included linearity of the integral, and the integrability on the subintervals. Further, it is shown that for Banach-valued

functions, the $SH_f$ integral is equivalent to the HL integral defined by Cao.

**Keywords**: topological, vector, locally, convex, Henstock, $SH_f$-integral, Banach

## CMPSD No. 20 ON GRAPHS WHICH INDUCE THE EXCLUDED POINT TOPOLOGY

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Let $\tau$ be a topology on a finite nonempty set $X$. A natural way of constructing a graph $G$ with vertex set $V(G) = X$ is given as follows: For each pair of distinct elements $x$ and $y$ of $X$, $[x,y] \in E(G)$ (the edge set of $G$) if and only if $U \cap V \neq \varnothing$ for all open sets $U$ and $V$ with $x \in U$ and $y \in V$. In other words, two distinct elements $x$ and $y$ of $X$ are non-adjacent if and only if there exist disjoint open sets $U$ and $V$ such that $x \in U$ and $y \in V$. This kind of construction was introduced by Diesto and Gervacio.

Interestingly, a topological space can be constructed from given a graph $G = (V(G),E(G))$. Indeed, a topology can be generated because the family consisting of sets $F(A) = V(G)\backslash N(A)$, where $N(A) = A \cup \{x \in V(G): [x,a] \in E(G) \text{ for some } a \in A\}$, and $A$ is subset of $V(G)$, forms a base for some topology on $V(G)$. This unique topology, denoted by $\tau(G)$, is referred to as the topology induced by the graph $G$.

In this study, we showed that for some restrictions on the order, the star and the wheel graphs both induce the excluded point topology. Furthermore, the study had come up with following main results:

(1) If $G$ is a graph of order $n \geq 4$, then $\tau(G)$ is an excluded set topology on $V(G)$ if and only if the following conditions hold:

(*a*) there exists a nonempty proper subset $A$ of $V(G)$ such that $[p,x] \in E(G)$ for every $x \in V(G)\backslash\{p\}$ implies that $p \in A$; and

(*b*) for each pair of vertices $x, y \in V(G)\backslash\{p\}$ with $[x,y] \in E(G)$, there exist $z \in A_y$ and $w \in A_x$ such that $[x,z], [y,w] \in E(G)$, where $A_y = \{s : s \quad , y \text{ and } [s,y] \notin E(G)\}$.

(2) The induced topology $\tau(G)$ is an excluded point topology on $V(G)$ if and only if the following conditions are satisfied:

(*a*) there exists exactly one vertex $p \in V(G)$ such that $[p,x] \in E(G)$ for every $x \in V(G)\backslash\{p\}$; and

• (b) for each pair of vertices $x, y \in V(G)\backslash\{p\}$ with $[x,y] \in E(G)$, there exist $z \in A_1$ and $w \in A_x$ such that $[x,z], [y,w] \in E(G)$.

**Keywords:** graph, vertex, star, wheel, topology, base, excluded

## CMPSD No. 21 ON THE MCSHANE INTEGRAL IN TOPOLOGICAL VECTOR SPACE

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The Lebesgue integral has been considered by a lot of mathematicians as the official or standard integral in mathematical research. This integral overcomes some of the defects of the Riemann integral. However, the problem with Lebesgue's integral is that it is not easy to understand. One has to master a considerable amount of measure theory before he can fully understand it. Also, such an integral does not inherit the naturalness of the Riemann integral.

In the late 1960's, E.J. McShane defined a Riemann-type integral and proved that this integral is equivalent to the Lebesgue integral. As a Riemann-type integral, it is simpler to handle than the Lebesgue integral. Further, his integral does not involve concepts such as s-algebras and measures. Several extensions of the McShane integral had been done. Gordon extended the definition to Banach-valued functions. Recently, Canoy also extended the definitions to functions with values in a ranked countably normed spaces.

In this study, we defined the McShane integral for functions with values in a topological vector space (TVS). Among others, this study generated results concerning the Cauchy test for integrabilty, integrability of the continuous functions, linearity of the integral, integrability on a subinterval, and additive property on subintervals.

Furthermore, since Banach spaces are topological spaces, this study showed that the TVS version and the Banach version of the McShane integral are indeed equivalent whenever the space under consideration is Banach space.

**Keywords:** topological, vector, Banach, McShane, integral, function

## CMPSD No. 22 WHICH DISCONNECTED GRAPHS POSSESS THE EULERIAN PROPERTY π ?

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Let $G$ be a simple graph with nonempty edge-set. The line graph of $G$, denoted by $L(G)$, is the graph whose vertices are the edges of $G$ and where two vertices of $L(G)$ are adjacent whenever the corresponding edges have a common vertex in $G$. The graphs denoted by $L^2(G)$ and $L^3(G)$ are the line graphs of $L(G)$ and $L^2(G)$, respectively. We say that a graph $G$ is Eulerian if it has a spanning closed walk that traverses each edge of $G$ exactly once. A simple graph G possesses the Eulerian property π if $L^3(G)$ is Eulerian but $L^2(G)$ is not.

For simple connected graphs, Uy showed that a graph possesses property π if and only if $G$ is a path of order 4. Apparently, such a result for connected graphs does not hold for disconnected graphs. Thus, an interesting and natural question to ask is: Which disconnected graphs possess the Eulerian property π? This research study aims to give an explicit answer to the question being posed. Specifically, we shall characterize all graphs $G$ which carry property π, that is, those disconnected graphs $G$ such that $L^3(G)$ is Eulerian but $L^2(G)$ is not.

As main result of the paper, the following characterization was obtained:

(*) Let $G$ be a disconnected graph with $k+1$ components ($k \geq 1$). Then $G$ possesses the Eulerian property π if and only if $G$ is equal (isomorphic) to one of the following graphs:

(a) $P_1 \cup P_{s(1)} \cup \ldots \cup P_{s(k)}$, where $1 \leq s(i) \leq 3$ for all $i = 1, 2, \ldots k$;
(b) $C_n \cup P_{s(1)} \cup \ldots \cup P_{s(k)}$, where $1 \leq s(i) \leq 3$ for all $i = 1, 2, \ldots k$ and at least one component is $P_{s(i)} = P_3$; and
(c) $H \cup P_{s(1)} \cup \ldots \cup P_{s(k)}$, where $1 \leq s(i) \leq 3$ for all $i = 1, 2, \ldots k$, $H$ is of order at least 4, the degrees of the vertices of $L(H)$ are of the same parity, and at least one $P_{s(i)} = P_3$.

**Keywords:** graph, disconnected, component, line graph, Eulerian

## CMPSD No. 23 ON THE EXISTENCE OF NON-ASSOCIATIVE FLEXIBLE DIVISION ALGEBRAS OF DIMENSION *n=10*

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An algebra $A$ is a division algebra if given $a,b \in A$ with $ab = 0$, then either $a = 0$ or $b = 0$, i.e., $A$ has no zero divisors. The real numbers $R$, the complex numbers $C$, and the quartenions $H$ exhaust all the associative division algebras over the real numbers (Frobenius, 1878). If the associativity requirement is dropped, the only additional division algebra over the real numbers is the octonions $O$ (Boot-Milnor, 1957). The dimensions of these algebras are 1,2,4, and 8, respectively. Using the Cayley-Dickson process, the quartenions can be obtained from the complex numbers and the octonions from the quartenions. Subsequent application of this doubling process will result to higher-dimensional algebras that has zero divisors and hence not division algebras. $R,C,H$, and $O$ are the only normed division algebras (Hurwitz, 1898). Moreover, they are the only alternative division algebras (Zorn, 1930). Although they are not the only division algebras, it was independently proved by Kervaire and Bott-Milnor (1958) that all division algebras have dimension 1,2,4, or 8. However, this paper will show that there exist 10-dimensional non-associative division algebras with multiplicative inverses and containing $R,C$, and $H$ as its sub-algebras. Moreover, embedded in this algebra is a loop that has inverse property, flexible and alternative.

**Keywords**: Alternatively, flexibility property, inverse property, non-associativity, norm, division, algebra, zero divisors

## CMPSD No. 24 NON-ASSOCIATIVE FINITE LOOPS: POSSIBLE APPLICATION S IN THEORETICAL PHYSICS

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It has been well noted that many physical systems have symmetries that are naturally described by associative mathematical structures like groups. Thus, the theories of atomic structure and of elementary parties make use of several group theoretic ideas in their mathematical formulations.

So far, non-associative mathematical structures like finite loops and quasigroups have played a limited role on science. However, such structures are beginning to show

great promise in formulating some of the most difficult problems of contemporary physics particularly in the study of elementary particles (quarks, string theory, unified field theories, etc.). The main "point of entry" of such non-associative structures in physics has been through what is known as the octonions (or Cayley numbers) which is the only non-associative real division algebra. The octonion units form a non-associative finite inverted loop of order 16 that is embedded in the octonion algebra. This algebra is now being used in such fields as quantum electrodynamics and related theories.

Lately, several classes of finite loops of small order have attracted the attention of certain theoretical physicists. These are the nobn-associative loops of orders 5 and 6, which have been found to define loop algebras that satisfy the Jacobi identity. Such algebras are also called Lie Algebras and these are known to be very useful in formulating physical theories.

Two of the loops in question are ($L_{5}$,*) of order 6 whichwe have been studying in connection with our program to develop the theory of Non-associative Finite Invertible Loops (NAFILS). Our analysis says that the loops ($L_{5}$,* and ($L_{6}$,*) are the first members of two families (the ODD and EVEN families) of NAFILs. In particular, ($L_{5}$,*) is a non-abelian simple NAFIL while ($L_{6}$,*) is an abelian simple NAFIL. These two loops have interesting structures that are being considered as challenges for possible applications in physics. This paper aims to present our analysis of the structure of these interesting loops.

**Keywords**: finite loops, non-associative, Jacobi identity, Lie algebra, NAFILs, particle physics

## CMPSD No. 25 CHARACTERIZATION OF NAFIL LOOPS OF ORDERS 5, 6, AND 7 (ABELIAN)

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This paper deals with the characterization of non-associative finite invertible loops (NAFIL) of small order n=5, 6,and 7 (abelian). In particular, it corrects and completes the results of an earlier attempt to characterize these loops using the software FINITAS.

In a previous study done at PUP in 1996, all non-isomorphic NAFIL loops of orders n = 5, 6, and 7 (abelian) were determined using the program ICONSTRUCT. These loops were characterized using Version 1.0 of the software FINITAS but the results were incomplete. Because of several problems encountered in this initial study, we undertook a program to validate and complete the determination and characterization of these loops.

Accordingly, we again determined in 1999 all non-isomorphic NAFIL loops of orders n= 5, 6, and 7 using a more powerful software system (SEM-SAT0) in collaboration with Prof. H. Zhang of the University of Iowa. This new determination validated the results obtained by ICONSTRUCT and at the same time completed the generation of all non-abelian NAFILS of order n = 7. having validated the generated NAFILs, we then characterized these loops again in 2001 using Version 1.1X or FINITAS. This updated version of FINITAS has vastly greater analytical capabilities that enabled us, finally, to sufficiently characterize all NAFIL loops of orders n = 5, 6, and 7 (abelian).

**Keywords**: NAFIL loops, non-isomorphic characterization, FINITAS

## CMPSD No. 26 CHARACTERIZATION OF PLAIN NAFIL LOOPS OF ORDER 7

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In a previous study done at PUP in 2001, all non-isomorphic NAFIL loops of order n = 7 were determined using a powerful software system (SEM-SATO) in collaboration with Prof. H. Zhang of the University of Iowa. This new determination completed the generation of all non-abelian NAFILs of order 7, which were not completely determined in an earlier study in 1999 using the program CONSTRUCT.

Having generated all NAFILs of order 7, we determined in 2001 the loops of this order with only one (1) self-inverse element. In particular, we were interested in those loops with no non-trivial subsystems called *plain* (or non-composite). The result of this study showed that out of 681 NAFIL loops of order 7 with one self-inverse element, 646 are ***plain*** while 35 are composite.

| Type of NAFIL | Total Number | No. of Plain | No. of Composite |
|---|---|---|---|
| Abelian | 16 | 8 (all w/prop) | 8 (all w/prop) |
| Non-abelian | 665 | 638 (8 w/prop) | 27 (22 w/prop) |
| Total | 681 | 646 | 35 |

This paper deals with the characterization of the 646 ***plain*** *NAFIL loops* (8 abelian and 638 non-abelian) of order 7. This characterization involved determination of the

basic properties of these loops using the latest version of the software ***FINITAS***. Using a characterization scheme developed in a previous study, we organized the data and showed that these loops can be ***sufficiently characterized*** in terms of their basic properties.

**Keywords**: *NAFIL*, loops, non-isomorphic, characterization, *FINITAS*, non-isomorphic

## CMPSD No. 27 CONDUCTIVITY OF THE SEMICONDUCTING $BF_4^-$ - DOPE POLYTHIOPHENE FILM

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Organic conducting polymers like polythiophene (PT) and its derivatives have gained much attention nowadays due to their promising applications both fundamentally and technologically. It is the controllable conductivity of these polymers that interest most of the researchers. The characteristic behavior of the resistivity and conductivity of the electrochemically prepared PT film sample is investigated in this paper.

Tetraflonroborate ( $BF_4^-$ ) - doped polythiophene film sample was synthesized electrochemically in a two - electrode polymerization cell. The Indium Tin Oxide (ITO) and platinum electrodes were used in the beaker type polymerization cell as the working and the counter electrodes respectively. The electrolyte used was 1.575 M thiophene/ 1.800 M $LiBF_4^-$ in dehydrated acetonitrile (MeCN). The polymerization voltage was set at 20.0 volts at -2°C. The stamp voltage, time and the current during polymerization accompanied with doping as well as the dedoping of the PT polymer were recorded. The oxygen concentration in the cell was monitored. The electropolymerization was carried out under nitrogen gas atmosphere. The temperature dependence of the conductivity was also performed. At room temperature, the conductivity was measured employing the standard four-probe technique.

The electropolymerization yielded a compact and non-powdery greenish PT film sample. This 284 micron - thick green film can easily be peeled off from the indium tin oxide (ITO) substrate. The room temperature conductivity along the surface of the film was found to be $3.0 \times 10^{-3}$ S / cm. This conductivity signifies the semiconducting property

of this film. The remarkable linear temperature dependence of the conductivity was observed. This dependence obeys $T^{-n}$ with n = 1 and suggests two - dimensional variable - range hopping of the conduction mechanism in the polymeric film

**Keywords**: electropolymerization, polythiophene, four-probe technique

## CMPSD No. 28 THE RADIATION DETECTION CHARACTERISTICS OF THE SEMICONDUCTING POLYTHIOPHENE FILM

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Since the discovery of the conducting polyacetylene (PA) with the introduction of the appropriate dopant, scientific researches on the fundamental and practical applications of organic conducting polymeris systems like polythiphene, have gained considerable interests to the scientific community. In spite of the fact that the promising applications of PT are widely studied nowadays, there are only few reports on the fabrication of radiation sensors. The present study mainly focuses on the photon response of the polymeric film sample of PT which is electrochemically polymerized in an acetonitrite containing dopant anion polymerization cell. The characteristics radiation detection of this film was specifically investigated.

Polythiophene film sample was prepared via anodic electropolymerization of thiophene in an indium tin oxide (ITO) evaporated glass substract inside a two-electrode polymerization cell set at 20 volts and -2.0°C. The already $BF_4^-$ doped PT film was dedoped potentiostically at -30 volts at the same temperature. A strip of the PT film sample was cut, and the fabrication of a radiation sensor sample out of this strip followed. As initial characterization, the sensor is electrically characterized by performing the Current-Voltage (I-V) measurement. The signal was then observed from the oscilloscope as the sensor was irradiated with Nd:YAG Laser. The final systematic characterization was done via on-line data acquisition using Nuclear Instrument Module (NIM) and the Computer Automated Measurement And Control (CAMAC) modules to perform analog-to-digital conversion (ADC) test.

The PT sensor exhibited ohmic behavior at room temperature when I-V measurement was done. The evident signals from the PT sensor when irradiated with Nd:YAG Laser could be observed. These signals showed a rise time that ranges from

$10^{-9}$ - $10^{-6}$ seconds. These were signals that could be processed for sensor calibration. At room temperature, this sensor showed a characteristic resolution of less than 25% when illuminated with Nd:YAG laser operating at 532 nm wavelength, 5Hz frequency and low intensity. The evident plateau exhibited by the signal-to-noise S / N ratio vs Bias Voltage curve, indicates the stable charge collection during irradiation. It has an operating voltage of 325 Volts as a radiation sensor.

**Keywords**: organic polymers, polythiophene, electropolymerization, NIM & CAMAC, ADC

## CMPSD No. 29 SUPERCONDUCTING PROPERTIES OF LEAD-DOPED BSCCO GLASS CERAMICS

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This paper reports on the preparation of high $T_c$ BPbSCCO superconducting ceramics prepared by melt-quench-anneal technique as well as the growth of the high $T_c$ superconducting phase of the BPbSCCO ceramics in a certain range of composition.

Lead doped BSCCO ceramics with stoichiometric composition of $Bi_{1.6}Pb_{0.4}Sr_2Ca_{n-1}Cu_nO_y$ with n = 2.0, 2.5, 3.0 and 3.5 are investigated in this study. The lead doped BSCCO samples are characterized by X-ray Diffractometry (XRD), and Scanning Electron Microscopy (SEM). The temperature dependence of resistance of some samples are also measured by means of r-T (resistivity vs temperature) and c-T (magnetic susceptibility vs temperature) tests.

The XRD results show that the peaks attributed to the high-$T_c$ phase changed in its intensity as n is increased, wherein it coincided with increased Ca and Cu which facilitated the growth of the high-$T_c$ phase.

$T_c$ results (r-T and c-T measurements) indicate that an excess of Cu element which is inferred as a deviation from the nominal composition of the high $T_c$ phase caused a degredation of the superconducting property although the high $T_c$ phase formation is enhanced as seen from the XRD results.

SEM analysis show that the sample for n = 3.0 having the higher $T_c$ of 106K has advanced crystal growth as compared to the samples for n = 2.0, 2.5 and 3.5. The crystallites are more pronounced in n = 3.0 as compared to the other samples. The plate-like grains in the samples for n= 2.5 and 3.5 are more dense and seem like they just nucleated. This may explain the low $T_c$ results for n = 2.5 and 3.5.

**Keywords**: superconducting ceramic, SEM, XRD

# CMPSD No. 30 AC MAGNETIC SUSCEPTIBILITY OF YBCO: FREQUENCY AND MAGNETIC FIELD DEPENDENCE

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Studies on linear and nonlinear AC susceptibility provide much insight into the loss mechanism and flux dynamics of high-temperature superconductors (HTS). The imaginary part of the complex AC susceptibility in particular is a direct measure of AC losses, the study which provides information on the critical state of the superconducting material. In the present paper, the imaginary susceptibility of YBCO was investigated by doing AC magnetic susceptibility measurements using a Mutual Inductance Bridge (MIB) setup on sintered YBCO for various applied magnetic fields ranging from 0.2mT to 2.0mT and excitation frequencies ranging from 110Hz to 1800Hz.

The out-of-phase signal obtained has two distinctly observed peaks. A sharp peak was found in the vicinity of the critical temperature $T_c$ and is observed to sharpen as it shifts to higher temperatures with increasing excitation frequency. It sharpens but remains fixed in position in temperature with increasing applied magnetic field. This peak near $T_c$ is attributed to the hysteric behavior of the superconductor and is expected to be frequency-dependent.

A broad peak was found at a lower temperature and is observed to broaden as it shifts to lower temperature with increasing applied magnetic field. It sharpens but remains fixed in position in temperature with increasing frequency. This peak is attributed to energy loss due to intergranular shielding currents. The shifting of this peak to lower temperatures is attributed to the increased flux threading in the porous regions of the sample brought by the increase in the applied magnetic field. It is not expected to be frequency-dependent.

The results obtained verify that the hysteresis loss peak and the intergranular loss peak are driven by different mechanisms, as they respond differently on frequency and field. This implies that one should be able to obtain two peaks in the imaginary susceptibility of a granular superconductor.

**Keywords**: YBCO, hysteresis loss peak, intergranular loss peak, AC magnetic susceptibility, superconductor

## CMPSD No. 31 EFFECTS OF SINTERING TEMPERATURE, AMBIENT ATMOSPHERE AND TIME ON THE MICROSTRUCTURE AND SUPERCONDUCTIVITY OF BULK $MgB_2$

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We have previously shown that compaction and sintering of commercial magnesium diboride ($MgB_2$) powder at temperatures below 800°C is promising for preparation of bulk superconducting $MgB_2$. In this work, we report on the effects of sintering temperature, ambient atmosphere and time on the superconductivity and microstructure of bulk $MgB_2$. Superconductivity of the pellets were determined from de resisitivity and ac magnetic susceptibility measurements while the microstructure was derived from scanning electron microscopy (SEM). For both Ar and vacuum atmosphere, we found that increasing the sintering temperature enhances the superconductivity of the pellets. This is manifested by a higher superconducting transition temperature, $T_c$, and a narrower transition width, $\Delta T$. The optimum sintering temperature being 750°C. However, $T_c$ is higher and $\Delta T$ is narrower for pellets sintered under Ar atmosphere. On the other hand, increasing the sintering time reduces $T_c$ and broadens $\Delta T$. These effects on the superconductivity were closely related to the changes on the surface morphology of the pellets as observed from SEM.

**Keywords**: magnesium diboride, sintering temperature, sintering atmosphere, sintering time

## CMPSD No. 32 SIMULTANEOUS MEASUREMENTS OF COSMIC RAY FLUX

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Cosmic rays are highly energetic particles of extra-terrestrial origins. These form part of the natural radioactivity experienced by humans and recent experiments have shown that cosmic rays also affect the subtle performance of electronic logic memories in computers.

Real-time measurements of cosmic ray flux at sea level in Iligan City and

Zamboanga City are simultaneously taken in preparation for a Mindanao-wide mapping of cosmic ray flux. The cosmic ray detector used in each location is a vertical stack of two 8" x 8" x 1/2" plastic scintillators, 100 cm apart, each optically coupled to a 2" diameter photomultiplier tube. The anode signals from each plactic scintillator detector will pass through nuclear intrumentation modules (NIM) among which are: the discriminator, variable delay, scaler and coincidence module. Measurements are taken at these places simultaneously for a period of several months and for several hours each during the day and night to observe any nighttime and daytime variations in the cosmic ray flux. Collected data are analyzed using standard statistical methods. Results are then compared with the first measurement of cosmic ray flux at sea level in Iligan City which was done by E. Ninofranco in 1999. Using a similar array of plastic scintillator detectors and NIM electronic module assembly. Ninofranco measured the average cosmic ray flux to be equal to 10.52  0.43 particles/min and further noted that this was the same during day or night. His measurements were shown to be consistent with internationally-accepted values and also consistent with Monte Carlo simulation of the experiment.

It has been predictedd that at sea level the cosmic ray flux is constant at fixed latitudes. A Third World Academy of Sciences funding is being awaited to start the mapping of the cosmic ray flux throughout the whole island of Mindanao by simultaneous measurements of cosmic radiation at 5 different locations of the island.

**Keywords**: cosmic ray flux, scintillation detectors, NIM instrumentation modules, Monte Carlo simulation

## CMPSD No. 33 STUDY ON THE CHAMBER PERFORMANCE OF THE JLC-CDC BABY CHAMBER

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JLC (Joint Linear Collider) is a proposed e+e- linear collider to be built in Japan, which is expected to discover and determine the properties of the Higgs boson. One of its components is the Central Drift Chamber (CDC), which will determine the information of the tracked particles. A small test chamber called the baby chamber was fabricated with the same jet cell structure as the 4.6 m-long test drift chamber, which is constructed with the current design of the CDC, in order to carry out beam tests on basic chamber performance including efficiency, spatial resolution and two-track separation capability. A software has been developed to analyze the beam test data to study the performance of this chamber by optimizing chamber parameters to obtain maximum performance. The data used in this study was taken during the beam test using the electron-positron pairs

produced by bremsstrahlung photons from the internal target of REFER (Relativistic Electron Facility for Education and Researches) in Hiroshima University, Japan. By computer analyses of the beam test data, the obtain wire efficiency of above 96% over the entire drift length of 5 cm. Also, the spatial resolution of the central sense wire of the first cell is below 85 mm when the drift length is less than 3.0 cm. These results are in good agreement with the result obtained using the 4.6 m-long test drift chamber. In studying two-track separation capability, the two-track separation efficiency is plotted against two-hit distance and we found out that the test chamber can separate two-tracks which are separated by 2mm or less by 70%. Further fine tuning of parameters must be done in order to achieve the performance goals of the drift chamber.

**Keywords:** Higgs boson, Joint Linear Collider (JLC), Central Drift Chamber (CDC), baby chamber, JLC Study Framework (JSF), efficiency, spatial resolution, two-track separation, drift length, two-hit distance

## CMPSD No. 34 ENHANCEMENT OF THE $Bi_2Sr_2Ca_2Cu_3O_{10+}d$ PHASE IN Bi-Sr-Ca-Cu-O FILMS GROWN VIA LIQUID PHASE EPITAXY

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The successful growth of single phase $Bi_2Sr_2Ca_2Cu_3O_{10+}d$ (Bi2223) has never been demonstrated. Instead, inter-growth of the various Bi-Sr-Ca-Cu-O (BSCCO) phases is observed. In this work, the growth and annealing parameters needed to increase the volume fraction of the Bi2223 phase in BSCCO films is investigated. In particular, the composition of the melt and the annealing temperatures are varied while the volume fraction of Bi2223 is derived from high-resolution X-ray Diffraction (XRD). Surface morphology of the grown films was studied using Scanning Electron Microscope (SEM) while their superconductivity was confirmed through DC resistivity measurements. We found that the use of non-stoichiometric melts (with excess Ca and Cu atoms) increases the Bi2223 volume fraction. However, excess Sr atom in the melt is seen to decrease the Bi2223 volume fraction. Moreover, annealing the as-grown films at 840 °C to 860 °C is seen to further increase the volume fraction of Bi2223 as reported by other groups. From dc resistivity measurements, the transition attributed to the Bi2223 phase increases as the volume fraction of Bi2223 increases. These results indicate that excess Ca and Cu atoms are needed to induce Bi2223 phase formation.

**Keywords**: phase enhancement, $Bi_2Sr_2Ca_2Cu_3O_{10+}d$ , BSCCO, annealing

## CMPSD No. 35 GROWTH OF SINGLE-PHASE, C-AXIS ORIENTED $Bi_2Sr_2CaCu_2O_{8+d}$ (Bi-2212) SUPERCONDUCTING THIN FILMS VIA LIQUID PHASE EPITAXY (LPE) FROM STOICHIOMETRIC AND NON-STOICHIOMETRIC MELTS

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The growth of high-quality superconducting thin films is necessary to develop superconducting devices. Although liquid phase epitaxial growth of Bi-2212 has been demonstrated, the growth of Bi-2212 films from non-stoichiometric melts has not been extensively pursued. In this work, we report on the successful growth of homogenous, single-phase, c-axis oriented Bi-2212 superconducting thin films via LPE from stoichiometric and non-stoichiometric melts on single crystalline magnesium oxide (MgO) and polycrystalline aluminum oxide (Al2O3) substrates. Preferential orientation and phase purity of the grown films were determined through high-resolution x-ray diffraction (XRD) while the surface morphology was obtained from scanning electron microscopy (SEM). DC resistivity measurements confirmed the superconductivity of the grown films with Tc = 75-85 K. From XRD, we found that the as-grown films from stoichiometric melts had no preferential orientation but subsequent annealing at 840-860°C in oxygen ($O_2$) atmosphere converted the non- (00l) peaks to (00l) peaks. For the as-grown films from non-stoichiometric melts, XRD shows both Bi-2201 and Bi-2212 peaks but annealing at 840-860°C in $O_2$ converted the Bi-2201 peaks to Bi-2212 peaks with some increase in XRD peak intensity. SEM shows complete coverage of the substrate and the granular nature of the films. These results show excess Ca and Cu atoms contribute to Bi-2212 growth.

**Keywords:** Liquid phase epitaxy, Bi-2212 thin films, superconductivity

## CMPSD No. 36 MAGNETIC RESPONSE OF GRANULAR HIGH-TC SUPERCONDUCTORS

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The magnetization of a granular superconductor was examined by approximating

multiply connected superconducting grains as a superconducting circular disk with a concentric hole. In the presence of an external applied dc magnetic field, the disk generates current flow along its perimeter due to the diamagnetic nature of the superconductor. Current along the boundaries is constant since it is equal to the intragranular shielding current. The magnitude of the current must be such that no magnetic flux penetrates the material.

In the presence of an applied sinusoidal ac magnetic field, current along the boundaries must screen magnetic flux from the sample. At the same time, due to the varying magnetic field, current out-of-phase with the applied magnetic field resulting from Faraday's law is generated. Moreover, the Faraday current keeps magnetic flux through the hole constant.

Energy loss is associated with this type of response by the sample. It is manifested by a magnetization out-ofp-phase with the applied field. Experimentally, magnetization is observed via ac susceptibility measurements. Out-of-phase ac susceptibility versus temperature shows a peak associated with sample granularity. This phenomenon is a result of the temperature dependent shielding current and Faraday current.

**Keywords:** magnetization, ac susceptibility

## *ENGINEERING SCIENCES AND TECHNOLOGY*

### ESTD No. 1 STUDY AND IMPLEMENTATION OF AN ASYNCHRONOUS TRANSFER MODE SWITCH SIMULATOR FOR THE DYNAMICALLY RECONFIGURABLE COMPUTING PLATFORM

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Reconfigurable computing systems are those computing platforms whose architecture can be modified by the software to suit the application at hand. The idea behind the Reconfigurable Processing Unit (RPU) is that, the fastest version of any program calculation is one in which a computer chip has been designed to perform that specific calculation only. With the advent of the flexible hardware, as new ways of solving problems arise, the RPU optimizes the computation power by implementing the calculation directly into a custom computer chip.

The study aimed to simulate an asynchronous transfer mode (ATM) switch based on the queuing system implemented on the reconfigurable processor.

The ATM switch was studied by creating a model of the switching element based on the queuing system. The components of the model were described using LOLA, an object-oriented logic description language. The approach in making the simulator was based on the mapping of the model of a physical system onto a reconfigurable computing system. A 16x16 ATM switch was made by forming two stages where each of the stage contain four (4) basic switching elements and interconnecting the stages by a Banyan Network. Routing of the connections was done using the XACT 6000 series software. A dynamically reconfigurable Field Programmable Gate Array (FPGA) like the 6200 RPU of XILINX was used to implement the simulator.

The study showed that dynamically reconfigurable RPU could be efficiently used for the simulation of the ATM switch that is based on the queuing system.

**Keywords**: dynamically reconfigurable computing platform, field programmable gate arrays, queuing system, asynchronous transfer mode switch, banyan network

## ESTD No. 2 A CELLULAR AUTOMATA-BASED STUDY OF VEHICULAR TRAFFIC DYNAMICS

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Cellular automata (CA) belong to a class of mathematical systems characterized by discreteness, determinism, local interaction and an inherently parallel form of evolution. This in study, we present a CA model of vehicular traffic dynamics based on the work of Nagel and Schreckenberg. We also review fundamental mathematical and computational aspects of one-dimensional and two-dimensional CA. Using Mathematica, a computer algebra system, we produce simulation results that are in agreement with data obtained from classical models of vehicular traffic.

We note the following results: (a) Simulations using the CA model produces speed versus density and flux versus density relationships that are similar to those obtained using the classical theory of vehicular traffic dynamics; (b) At a certain density level, increasing the maximum velocity have little effect in improving the flux or average speed of the system; (c) Increasing the randomization parameter decreases the flux and average speed of the system; (d) Introducing vehicles with lower maximum velocity also reduces the average speed but has little effect on the flux of the system.

**Keywords**: cellular automata, vehicular traffic dynamics, modeling and simulation, complex systems, Mathematica

# ESTD No. 3 NOVEL PPEI-$Ca^{2+}$ FLOCCULANT SYSTEM FOR SCAVENGING MERCURIC IONS FROM AQUEOUS SOLUTIONS

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Removal of toxic mercuric ($Hg^{2+}$) ions from aqueous solutions by a novel heavy metal flocculant was conducted. Treatment of $Hg^{2+}$-containing wastewaters is one application specifically targeted by this technique. The heart of the process is a hybrid soluble heavy metal chelating phosphonomethylated-polyethyleneimine (PPEI) polymer, which precipitates in the presence of $Ca^{2+}$ ions. The branched structure of the PPEI, with its numerous amine ligands, contributes to the formation of strong coordinate bonds with $Hg^{2+}$. The phosphonate section provides the polymer with the required flocculation property in the presence of $Ca^{2+}$ ions. Synthesis of fully functionalized PPEI was initially conducted following the Mannich reaction where phosphonate groups from phosphorous acid is introduced into a PEI polymer. The flocculation ability of purified PPEI in combination with $Ca^{2+}$ ion for $Hg^{2+}$ was then evaluated. The optimum pH and scavenging ability of the PPEI-$Ca^{2+}$ flocculant system were the parameters primarily evaluated. The degree of phosphonate substitution in PEI was analyzed using a Perkin-Elmer Elemental Analyzer (Model 2044 CHN). Phosphorus content of PPEI as well as the heavy metal concentrations of solutions were determined by a Seiko Inductively Coupled Argon Plasma Spectrophotometer (Model SII SPS 3000S). Synthesis results indicated a close to 100% functionalization of PEI with phosphonate groups. This indicates the high efficiency of the modification process. Flocculation experiments showed that considerable floc formation accompanying $Hg^{2+}$ sequestration occurs even at low initial $Hg^{2+}$ concentration. Optimum $Hg^{2+}$ removal occurs at basic pH where maximum precipitation of the PPEI-$Ca^{2+}$-$Hg^{2+}$ complex occurs. Under this condition, the process is capable of scavenging $Hg^{2+}$ ions to less than 3 ppb, which is below the disposal standard limit for $Hg^{2+}$-containing wastewaters of 5 ppb. To summarize, a simple, rapid and effective method for $Hg^{2+}$ scavenging from aqueous solutions by a novel PPEI-$Ca^{2+}$ flocculant system was established in this work.

**Keywords**: calcium; chelation; flocculation; mercuric ion; phosphonomethylated-PEI; wastewater treatment; phosphonate

## ESTD No. 4 OPTIMIZATION OF SUPERCRITICAL CARBON DIOXIDE EXTRACTION OF THE ESSENTIAL OIL PF PHILIPPINE *Cananga odorata* Hook Fil et. Thomson FLOWERS BY RESPONSE SURFACE METHODOLOGY

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Essential oil was extracted from the flowers of Philippine Cananga odorata var. genuine grown in Pala-o, Iligan City by supercritical carbon dioxide (SC-$CO_2$).

A statistical experimental design, first order $2^3$ factorial, was used to investigate the effects of three independent variables (pressure, temperature, and flow rate of $CO_2$ on % oil yield (w/w), % linalool (v/v) and % benzyl benzoate (v/v) on the extracted oil. Three corresponding response equations were generated for values of pressure (80-100 bar), temperature (35-50°C) and flow rate of $CO_2$ (1-4 mL/min). Optimum oil yield (8.479%) was obtained under the following SC- $CO_2$ extraction operating conditions (98.61 bar, 39.58°C, 2.99 mL/min). This oil yield is much higher compared to the oil yield from hydrosteam distillation which is 2-2.25% (v/w). The extracted oil passed the 2nd grade quality except for its acid value (26.2794) which is too high for the given standard specification of less than three.

Gas chromatography was performed on the ilang-ilang oil extracted by SC-$CO_2$ extraction, laboratory, and commercial scale hydrosteam distillation. Degradation products were observed in the hydrosteam distillation. The linalool to benzyl benzoate ratio showed that the oil quality of the sample from Anao, Tarlac (0.658) is superior to that from Pala-o, Iligan City (0.583) perhaps due to the agroclimatic origin of the plant trees.

**Keywords**: Cananga odorata,carbon dioxide extraction, essential oil gas chromatography

## ESTD No. 5 FED-BATCH PRODUCTION OF METHYL ESTERS FROM COCONUT OIL

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The Philippines is a major producer of coconut oil with exports of 1,080,913 metric tons and a domestic consumption of 464,000 metric tons in 1997. However, since

the oil is an agricultural product it usually has a low price in the international market. Greater revenues can be obtained if most of our coconut oil is transformed into higher value oleochemicals locally before being exported. Among these oleochemicals, the methyl esters are the most promising.

The study was part of research on improving the traditional batch process of producing methyl esters from coconut oil. The process tested was fed-batch and the parameters investigated were (1) coconut oil temperature, (2) oil flowrate, (3) percent of catalyst (NaOH), and (4) ratio of methanol to coconut oil.

The fed-batch process involved the gradual addition of coconut oil into a reactor vessel containing a boiling solution of methanol and NaOH. The highest yield of 96.662 % was obtained at 2:1 methanol to oil ratio, 0.50% NaOH, one hour reaction time, 200 g/L oil flowrate, and oil temperature of 27.5°C.

Statistical analysis of yields showed that the oil temperature and flowrate have no significant effect. Comparison between fed-batch, batch with reflux, and batch with stirring for 30 minutes reaction time and similar reaction conditions of 2:1 methanol to oil ratio, and 0.5% NaOH were performed. Statistical analysis (a = 5%) showed that the yield of methyl esters using the two types of batch processes gave no significant difference. However, the yield from the fed-batch process was found out to be significantly higher. The fed-batch process is therefore more efficient than batch process since greater yield is produced for the same conditions. This result could be due to the faster rate of reaction of the fed-batch process. This result shows that simply switching to a fed-batch process instead of a batch process in the production of methyl esters would make the reaction go to completion faster.

**Keywords**: coconut oil, methyl esters, batch process, fed-batch process

## ESTD No. 6 CORRELATION STUDIES ON PERCENTAGE UTILIZATION OF SELECTED SUGARCANE VARIETIES AND SUGAR RECOVERY AT DIFFERENT MILLING DISTRICTS FOR FIVE CROP YEARS

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Yield parameters like 50-kg sugar per tone cane $\left[\frac{\text{Lkg}}{\text{tc}}\right]$ and 50-kg sugar per hectare $\left[\frac{\text{Lkg}}{\text{Ha}}\right]$ are determined by several factors including efficiencies of both farm and factory operations. The facto ry performance, measured in terms of pol extraction (E), actual boiling house recovery ($BHR_{actual}$) and over-all recovery (OR), may be affected by the cane varieties being processed.

This study generally aimed to correlate percentage utilization of cane varieties in different sugar factories in the Philippines with respect to sugar recovery expressed in E, $BHR_{actual}$ and OR.

Major varieties with high percentage utilization like Phil 56226, Phil 58260, Phil 6553, Phil 6607, Phil 6723, Phil 7495, Phil 7779, Phil 8013, Phil 8093, Phil 8477, Phil 8361, Phil 8585, Phil 7544 and VMC varieties were correlated with sugar recovery (E, $BHR_{actual}$, OR) of ten (10) sugar factories using statistical mean-linear regression. The same procedure was applied in the factory performance in the regional level (Luzon, Visayas and Mindanao).

In one factory, there was a strong and positive correlation between factory performance and % utilization of Phil 6607. In another sugar factory using VMC varieties, there was a strong positive linear relationship between E and OR, and a very strong positive linear relationship with $BHR_{actual}$. In other factories studied, a strong correlation was also shown. However, % utilization of Phil 56-226 is moderately correlated with OR, moderately, inversely related with E and weakly related with $BHR_{actual}$.

In the analysis of regional performance, the Phil varieties gave the highest performance, in Luzon. For Eastern Visayas, Panay, Negros and Mindanao, the varieties Phil 6607, VMC and a mixture of other varieties showed a direct correlation between % utilization and OR. One factory in the Eastern Visayas region had the best performance in terms of parameters investigated.

Results showed conclusive trends for specific varieties and region, especially in the Eastern Visayas. For other regions, the poorly correlated parameters tend to confirm some on-site observations in some milling districts with respect to actual use of identifiable cane varieties.

**Keywords:** sugarcane, yield parameters, sugar recovery

## ESTD No. 7 ENZYMATIC EXTRACTION OF RICE BRAN OIL

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The Philippines harvested 11, 923, 000 metric tons of rough rice in 1999. Milling of this rice produced large quantities of rice bran which is mostly used as animal feed. However, studies have shown that rice bran has an oil content ranging from 15-22%. This oil is composed mostly of unsaturated fatty acids and is different from coconut oil which is saturated. The availability and continued supply of rice bran in our country should make it an ideal alternative local source of oil.

The study determined the effect of using enzymes on the aqueous extraction of rice bran oil. The factors investigated were type of enzyme (cellulase, pectinase, cellulase-pectinase combination), enzyme concentration (0%, 2%, 4%), temperature (30°C and 45°C), solvent (hexane) addition before recovery, and dry heat pretreatment.

The rice bran was sieved and heat treated at 100°C for 5 minutes. Sets of 50 g of bran were then mixed with 150 ml enzyme solution in conical flasks. These were incubated in a shaker for 6 hours at the temperature being tested. Control set-ups were done using distilled water.

Results showed that higher temperature and enzyme concentration produced an increase in oil recovery (a = 5%) when solvent was used to recover the oil. At 30°C, the highest yield was observed with the cellulase-pectinase combination at 77.5% recovery, followed by pectinase with 60% and then cellulase with 50.1%, all at 4% enzyme concentration. For the effect of temperature, both cellulase and pectinase gave higher yields of 79.24% and 61.96%, respectively, at 45° than at 30°C. The data obtained when no hexane was used after enzymatic extraction shows that the use of enzymes was not significantly different with that of the control.

The use of thermal pretreatment appears to have no significant effect on the enhancement of oil recovery when solvent was not used.

The study indicates that cellulase and pectinase increases the extractability of rice bran oil by hexane. However, simple aqueous enzymatic extraction gives low recovery and this may be because the oil dissolves poorly in water.

**Keywords:** rice bran, rice bran oil, enzymatic extraction, pectinase, cellulase

## ESTD No. 8 PARAMETRIC AND KINETIC ANALYSIS OF THE ACID HYDROLYSIS OF COPRA MEAL

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The typical mass composition of copra meal is 43 - 45% carbohydrates, 19-20% protein, 10-11% oil and 12% crude fiber. Its high carbohydrate and protein content merits its consideration as a major source of food, feed or industrial material. In the Philippines, copra meal is mainly used as livestock feed but this is not

efficient since the high fiber content of copra meal decreases its digestibility.

The breakdown of copra meal has been generally achieved by acid hydrolysis but the effect of various parameters on the yield of sugars has not been completely determined. This study investigated the effect of (1) copra meal pretreatment (no pretreatment, defatted, delignified), (2) concentration of aqueous HCl (5%, 20%, 36% HCl by mass), and (3) reaction temperature (room temperature, 45°C, 60°).

Five grams of copra meal (no pretreatment, defatted, delignified) were placed in a 250-ml erlenmeyer flask. The acid was added and the contents of the flask were mechanically stirred. Samples were taken at 1-hr intervals and their acidity and reducing sugar content were analyzed.

The results showed that pretreating the meal had no significant effect on the overall production of the sugars. The acid concentration significantly affected the production of reducing sugars. The yield of reducing sugars for the 36%, 20%, and 5% acid concentrations were 0.17 (g sugar/g copra meal), 0.15, and 0.093, respectively. This corresponds to fractional conversions of 0.64 for the 36% acid, 0.58 for the 20%, and 0.35 for the 5%.

A kinetic study was done based on the proposed mechanism which treats the hydrolysis as a pseudo homogeneous catalyzed reaction that is first order with respect to both the polysaccharide and the acid catalyst. The equation used for the rate of reaction was $-\ln(1 - X_a) = k_{observed}\, t$, where $X_a$ is the fractional conversion, $k_{observed}$ is the observed specific reaction rate, and t is the reaction time.

The $k_{observed}$ for 36%, 20%, and 5% were 0.1191 $h^{-1}$, 0.0954, and 0.0410, respectively. Results showed that the uncatalyzed reaction was insignificant so the $k_{observed} = k_2 Cc$, where $k_2$ is the specific rate constant of the catalyzed reaction, and Cc is the concentration of the HCl. Linear regression of the $k_{observed}$ for the different acid concentrations gave a $k_2$ of 0.0078 (L/mol-h). The effect of temperature on the $k_{observed}$ for 5% acid concentration was determined. For 30°C, 45°C, and 60°C, the were 0.041 , 0.0518, and 0.3614, respectively.

The results showed that copra meal can be significantly converted into simple sugars by acid hydrolysis using 5 % HCl (aq) and 60°C.

Copra meal is the ground residue obtained after the extraction of oil from dried coconut meat. In 1997, Philippine copra meal production reached 508, 565 tons.

**Keywords**: copra meal, mannan, reducing sugars, acid hydrolysis, kinetics

# ESTD No. 9 ADSORPTION OF REACTIVE PROCION RED AND BASIC MALACHITE GREEN DYES FROM SIMULATED TEXTILE MILL EFFLUENT USING ACTIVATED CARBON FROM COCONUT SHELL

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It is estimated that of the 450,000 tons of dye produced worldwide, 9,000 tons (2%) are discharged in effluent from manufacturing operations while about 40,000 tons (9%) are discharged in effluent from the coloration industries.

Dyed wastewater in the textile industry is characteristically high in both organic contents and color. Moreover, these textile wastewaters are generally high in biochemical oxygen demand (BOD), chemical oxygen demand (COD), and total solids that could alter the condition of receiving streams causing pollution.

This study aims to investigate the effectiveness of activated carbon from coconut shell as an adsorbent.

The general objective of this study was to determine the adsorption characteristics of two dyes namely, Basic Malachite Green and Reactive Procion Red dyes on activated carbon from coconut shell.

The order (n) and specific rate constant (k) of adsorption of Basic Malachite Green (BMG) and Reactive Procion Red (RPR) dyes on activated carbon (AC) from coconut shell of mesh 78 and 30 were investigated. The maximum adsorptive capacity of AC for each dye was determined.

The adsorption rates of both dyes followed first order of reaction with adsorption rate constants of 0.142 $min^{-1}$ (mesh 30) and 0.222 $min^{-1}$ (mesh 78) for BMG dye and 0.0441 $min^{-1}$ (mesh 30) and 0.0223 $min^{-1}$ (mesh 78) for RPR dye. The adsorption isotherm for BMG dye fitted to Langmuir isotherm with maximum adsorptive capacities of 243.902 mg/g (mesh 30) and 250.273 mg/g (mesh 78). The adsorption isotherm for RPR dye did not fit in Langmuir and Freundlich isotherm.

**Keywords**: textile wastewater, dyes, activated charcoal, coconut

# ESTD No. 10 EEFECT OF MIXED CULTURE ACTIVATOR ON THE DECOLORIZATION AND COD REDUCTION OR DISTILLERY SLOPS

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Distillery slops is a voluminous and highly pollutive residue produced by an ethyl alcohol plant. Its deep dark brown color and high BOD (20,000 to 120,000 mg/liter) necessitate proper treatment prior to its discharge to a receiving stream. In this study, a mixed culture activator composed of different species of bacteria and fungi and different types of enzymes was utilized.

The decolorization and COD removal capacity of a mixed culture activator on distillery slops was studied via aerobic process. Dilution alone resulted to 30. 84%, 76.80%, 90.81%, 92.17% and 94.80% color reductions for 1:1, 1:5, 1:10, 1:15, and 1:20 dilutions respectively. One-liter samples were treated with 5,10, and 20 grams of the activator for seven days. Results have shown that the maximum decolorization and COD reduction were obtained at 1:15 dilution with 15 grams of the activator. Decolorization was maximum at 99.34% color reduction with corresponding COD reduction at 85.5%. This optimum condition was achieved in five days. After the fifth day the color and other parameters (i.e. turbidity and TDS) intensified probably due to the death of microbial population.

The optimum dosage of the activator at the optimum dilution was further investigated by varying the pH and temperature. The pH was adjusted to 6, 7, 8, 9 and 10 with addition of $H_2SO_4$ or NAOH solutions. Decolorization was achieved at pH 8 with a reduction of 6.61% compared to 1070 PCU which was obtained upon treatment with the MCA alone. For the other pH settings, color further intensified. Thus, it could be surmised that the microorganisms and enzymes present in the activator have their maximum decolorization activities at pH 8. The COD of the wastewater decreased at all pHs and the maximum removal of 14.29% was obtained at pH 8 compared to 31,710 mg/l obtained upon treatment with MCA alone.

The optimum effect of temperature on the decolorization and COD reduction was observed at 30°C. The result can probably be explained by the performance of the mixed culture activator at this temperature setting.

**Keywords**: distillery slops, decolorization, dilution, culture activator

## ESTD No. 11 LEADLESS GLAZE FORMULATION (LOW FIRING) ULTILIZING LOCAL RAW MATERIAL FOR RED CLAY BODY

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Despite the abundance of local materials for glaze purposes, the ceramic industry still relies on imported raw materials. Lead oxide (litharge and red lead) is one component in making low fired glaze batch for ceramic body, which is costly and presents the risk of lead poisoning.

The study was focused on the leadless low fired glaze slip utilizing local raw materials such as rice hull ash and calcined "tumedted" limestone with the addition of commercial oxide soda ash, to determine the suitability of these materials as alternative replacement and supplement for imported raw glaze materials.

Three local clays were used as test samples in the experiment: Nanguyudan red clay in Paoay, Macayepyep red clay in Banna and Tapao red clay in Sinait. The glaze batch was based on the empirical formula $0.85\ Na_2O\ 0.15\ CaO\ 1.1\ SiO_2$ . The prepared glaze batch formulation (three glaze slip formulation) was fired at 1050°C.

Results show that the formulated glaze exhibit a glassy phase appearance in the test bodies of the sample local red clay bodies. Some defects were evident in the test samples but these gave a unique artistic surface appearance.

**Keywords**: slip glaze, local red clays, solid casting, leadless glaze formulation

## ESTD No. 12 ENERGY AUDITING OF THE BRICK AND POTTERY INDUSTRY IN ILOCOS NORTE

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The ceramic industry of Ilocos Norte revolves primarily on the manufacture of bricks for the construction industry and pottery (i.e. earthen cooking pots, stoves and flowerpots). All of these are fired and vitrified with the use of fuelwood and similar fuel materials like bamboo.

The study determined the sources, quantity and cost of fuels used in the firing of the ceramic products.

The use of bamboo and straw as a fuel is very common in the firing of bricks. The cost varies depending on the source. A limited use of fuelwood was also observed. The source of the fuel is from the province. Bamboo stumps were usually used in the firing process. The consumption varies depending upon the firing system; however, the open firing consumes the most fuel per fired product.

For the pottery industry, open firing is also practiced despite the presence of a kiln designed by the Industrial Technology and Development Institute. All systems use fuelwood and limited quantities of bamboo which does not exceed 10%. In terms of efficiency, the ITDI kiln is the most efficient which reduces the fuelwood use by as much as 50%.

The ceramic industry in Ilocos Norte is largely dependent on the fuelwood source in the province. However, there is no evidence of the cutting of big trees for fuel, but rather the harvesting of branches for fuelwood is practiced.

**Keywords**: bricks, ceramic, energy, fuelwood, kiln, pottery

## ESTD No. 13 DESIGN AND DEVELOPMENT OF A MECHANIZED PRECISION SEEDER FOR HYBRID RICE PRODUCTION

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To date, the country's food security depends primarily on its ability to achieve rice self-sufficiency to cope with its increasing population. The utilization of hybrid rice technology has been eyed as the major agricultural program of the government towards rice self-sufficiency.

Manually transplanted hybrid rice at 1 to 2 seedlings per hill increases the rice yield of farmers by at least 15%. However, crop establishment is labor-intensive and there is an acute shortage of labor during transplanting. Hence, a precision seeder (laboratory model) was developed and evaluated. The seeder has a singulated metering mechanism that could meter-out hybrid seeds ranging from 1 to 4 seeds per hill with a row and hill spacing of 20 cm and 20–30 cm, respectively. Further modification is being undertaken to improve the mechanism. Fabrication is simple and some parts are recycled materials that would substantially reduce the cost of manufacturing.

A mechanized precision seeder will accelerate and intensify the utilization of hybrid rice technology.

**Keywords**: hybrid rice technology, precision seeder, singulated metering mechanism

## ESTD No. 14 ADAPTATION OF THE HAND TRACTOR-DRAWN PADDY SEEDER IN SELECTED AREAS IN THE PHILIPPINES

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A paddy seeder was designed and developed to mechanize direct seeding operations in medium and large farms, where hand tractors are commonly used for land preparation and other farm-related operations.

The paddy seeder is equipped with six (6) cylindrical hoppers and a furrower assembly that can seed 12 rows in every pass. It has a very simple drum-metering device to regulate the amount of seeds to be sown.

Adaptation trials were conducted in selected areas (Aliaga, Nueva Ecija; Valencia, Bukidnon and Pigcauayan, North Cotabato) in the Philippines for its acceptance and verify the performance at different soil condition.

Field-testing of the paddy seeder showed that field capacity range from 3-5 ha/day and an average field efficiency of 69 percent. The dimension of the paddy field, characteristics of the soil and number of operators affected capacity. Field efficiency largely decreases as the area of the field increases.

Also, it was observed that seed and labor requirements are lesser than other crop establishment methods. The used of the hand tractor-drawn paddy seeder is moderately easy based on feedback from farmer-cooperators. However, the paddy seeder could perform well up to 20 cm depth of hardpan. Beyond this depth, operation is difficult or not possible. Moreover, it is not suitable in Bukidnon and North Cotabato because farmers used floating tillers for land preparation. Economic analysis revealed that the used of hand tractor-drawn paddy seeder is feasible for farmers having at least 4 hectares.

**Keywords**: paddy seeder, drum-metering, cylindrical hopper, furrower assembly

# ESTD No. 15 ANTHROPOGENIC IMPACTS ON AQUATIC AND TERRESTRIAL ENVIRONMENTS IN THE LA MESA WATERSHED

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The La Mesa Watershed, the remaining forest in Metro Manila has an area of 27 km.$^2$ where one of the reservoirs of water for Metro Manila residents is located. The watershed experienced various management interventions coupled with the presence of illegal occupants that resulted in the decline of the forest cover and increased sedimentation rates and nutrients in the river system. This research aims to establish baseline data in the reforested area and streams of the watershed., This research will also assess the impacts of various land uses on the soil and water quality in the area including that of the biotic components.

The impact of reforestation and agricultural activities had no significant difference on the soil quality (soil pH, organic matter and phosphate) of the watershed. Potassium though was found to be significant which can be attributed to the presence of feldspar in the parent rock material. The streams in the area were shallow (0.03-0.28 m) with a relatively slow flow (0.89-3.73 m/s) and short-term variations in nutrient availability such as sulfate, nitrates and phosphate. Phosphate concentration was relatively higher in all sampling sites compared. The streams were poorly sorted and characteristic of a gravel bed type. There was a significant difference in the stream, sediment nutrient concentration across all streams having the highest concentration of total nitrogen, total organic carbon and sulfates. Twenty-three taxa of macroinvertibrates were identified and using the Belgian Biotic Index (BBI) in the stream sediments indicative of a good water quality including that of the phytoplankton consumption were all positive for fecal coliform contamination.

The data gathered from this research can help in watershed management and stream restoration plan to maximize the contribution of the streams to the reservoir.

**Keywords**: La Mesa Watershed, water quality, rivers, sediments, phytoplankton, benthic organisms, soil quality, nutrients

## *HEALTH SCIENCES*

### HSD No. 1 DEVELOPMENT OF AN IMMUNOFLUORESCENCE ANTIBODY TEST FOR THE DETECTION OF ANTI-*Cryptosporidium parvum* ANTIBODIES IN HUMAN SERUM SAMPLES

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An Immunofluorescence Antibody Test (IFAT) for the detection of anti-*Cryptosporidium* antibodies in serum samples was developed to make diagnosis of cryptosporidiosis less expensive, faster, and easier.

The dilutions of the blocking solution, serum sample, mouse anti-human MAb, and washing solution were tested for optimal fluorescence under both positive and negative sera. Antigen obtained through immunomagnetic separation and the use of anti-human IgG was also tested. Fifty-nine samples from the Pediatric Ward and Cancer Institute of the Philippine General Hospital were tested for seropositivity using the developed technique.

The optimal dilutions determined were goat serum diluted 1:3 in PBS for blocking solution, serum diluted 1:5 in blocking solution, mouse anti-human MAb diluted 1:50 in blocking solution, and 0.05% Tween-20 in PBS for washing solution. Using purified oocysts as antigen was also found to significantly decrease errors in observation of fluorescence. Multivalent mouse anti-human MAb were more effective in detecting positive sera than anti-human IgG. Among the fifty-nine samples from the Philippine General Hospital 27% were seropositive using this technique. Intense fluorescence results most probably from sera in patients about 32-60 days past infection. Those with low titers associated with an infection past more than 60 days constituted 36% of the population. Among the females, 30% were seropositive and among the males, 24% were seropositive. This procedure revealed high antibody titers in asymptomatic cases, which indicates a high occurrence of *C. parvum* infection and could be carriers.

This IFAT may be used to assess and treat members of communities suspected to be a site of a cryptosporidiosis outbreak to prevent reinfection through untreated carriers. Also, it may be used as an epidemiological tool to evaluate the hygienic practices and water cleanliness of an area.

**Keywords**: *Cryptosporidium parvum*, Immunofluorescence Antibody Test (IFAT), diagnosis, epidemiology, seropositivity, oocysts, monoclonal antibodies.

## HSD No. 2 IMMUNOFLOURESCENCE ASSAY IN THE DIAGNOSIS OF DENGUE VIRUS INFECTIONS: A PRELIMINARY STUDY

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Dengue fever and dengue hemorrhagic fever (DF/DHF) are among the most common infectious diseases transmitted by the mosquito vector *Aedes aegypti*, in both tropical and subtropical regions. This study provides initial data on the application of buffy coat and the monoclonal antibodies generated against dengue virus prepared at RBD-SLMC, the confirmation of dengue infection by Immunoflourescence assay (IFA).

Buffy coat was taken from the centrifuged whole blood of the suspected dengue patients from San Lazaro Hospital. Cells from the buffy coat were stained with monoclonal antibodies against dengue and visualized by FITC-conjugated anti-mouse antibody. Furthermore, plasma and/or RNA extracted from the plasma were used as template in an RT-PCR method for the amplification and detection of dengue viral genome. Plasma was also inoculated to C6/36 *Aedes albopictus* cell lines and after two weeks post-infection the culture fluid was again used for sandwich ELISA to detect dengue virus.

Twenty-five percent (25%) of thirty-eight (38) samples out of 152 were positive for dengue virus using monoclonal antibodies and buffy coat. The results were correlated with other methods such as RT-PCR, antigen sandwich ELISA, and virus isolation method using C6/36 *Aedes albopictus*.

Immunoflourescence using monoclonal antibodies and buffy coat is shown to be a faster way of detecting dengue virus compared with conventional methods.

**Keywords**: Buffy coat, dengue virus, Immunoflourescence assay, RT-PCR, sandwich ELISA

## HSD No. 3 IDENTIFICATION OF NEURALIZING MONOCLONAL ANTIBODIES AGAINST DENGUE VIRUSES

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Identification of dengue virus neutralizing monoclonal antibodies is essential for

developing potential anti-dengue therapeutic agents. In this study, a panel of monoclones was generated and antibodies produced were characterized for their ability to neutralize the dengue virus.

Ascitic fluids containing high titers of monoclonal antibodies were obtained from BALB/c mice previously injected with hybridoma cells. The ascitic fluids were titrated and screened for their neutralizing activity agains the four dengue virus serotypes using Plaque Reduction Neutralization Test (PRNT) and Tetrazolium Dye Reduction (MTT) Assay. Serial dilution of the monoclones were mixed for one hour at 37° C with a known dengue virus titer. The mixtures were inoculated into LLcMK$_2$, either in 35 mm petri dishes or 96-well microtiter plates.

Using the MTT assay, three monoclonal antibodiesm 12D11/7E11, 12D11/9F5 and 12D11/10C3 that were earlier shown to be reactive to the four dengue serotypes by enzyme linked immunosorbent assay inhibited the growth of two isolates of dengue virus serotype 1,22St-12A and 9D-36, up to dilutions of 5000.

The monoclonal antibodies used in this study were found to inhibit dengue virus multiplication hence have neutralizing properties. These may be used to identify and characterize epitopes on the surface of dengue viruses that are essential for virus infection. Such information is vital in the development of effective treatments or vaccines against dengue virus.

**Keywords**: monoclonal antibodies, dengue virus, neutralizing antibody, plaque reduction neutralization test, MTT assay, anti-viral

## HSD No. 4 CHROMATOGRAPHIC ANALYSIS OF SHABU AND ECSTASY IN URINE SAMPLES

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Currently, there is an increasing drug problem brought about by the illegal use of shabu and ecstasy. This study meets the need to develop a more sensitive and accurate method of detecting these dangerous drugs in biological fluids.

Three chromatographic methods, Thin Layer Chromatography (TLC), High Performance Liquid Chromatography (HPLC) and Gas Chromatography-Mass Spectrometry (GCMS), were developed to detect shabu and ecstasy in urine samples.

For TLC, the extract of both drugs was chromatographed in ethyl acetate/methanol

water using the Toxilab system. In the HPLC analysis, an Alusphere column was used with acetonitrile and phosphate buffer at pH10 as mobile phase with detection at 215 nm. And prior to GC/MS analysis, the drug extract was derivatized using MSTFA under nitrogen gas. Electron impact was used as the ionization mode.

For TLC method using the Toxilab system, both drugs have the same $R_f$ at 0.23 but by using different developing solutions shabu and ecstasy could be differentiated. The HLPC method developed could separate and quantitate the two drugs. Shabu had an average retention time of 9.9 min while ecstasy was at 7.5 min. The GCMS analysis gave the retention time of 6.31 min for shabu and 10.14 min for ecstasy. As a confirmation technique, the diagnostic ions used for shabu were m/z 91, 130, 206 while m/z 130, 250 was utilized for ecstasy. Linear response for both drugs was in the concentration range of 250 to 1000 ng/ml.

The chromatographic methods developed could be used for the routine hospital screening and confirmation of shabu and ecstasy in urine.

**Keywords:** shabu, ecstasy, chromatographic analysis. urine samples, dangerous drugs

## HSD No. 5 LABORATORY DIAGNOSIS OF CENTRAL NERVOUS SYSTEM VIRAL INFECTIONS BY POLYMERASE CHAIN REACTION

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Research, epidemiological studies and laboratory analysis of viral diseases of the central nervous system have been few in the Philippines. Thus, most of the clinically suspected viral encephalitis or meningitis cases are treated without etiological laboratory confirmation. This study was done to show the presence of some human herpesviruses, such as herpes simplex viruses 1 and 2, varicella zoster virus, cytomegalovirus, and Eipstein Barr viruses 1 and 2, in cerebrospinal fluid samples taken from Filipino patients diagnosed with viral encephalitis or similarly related conditions.

The Polymerase Chain Reaction technique has provided a highly sensitive and

specific method of directly detecting the viral genome in an infected sample, such as cerebrospinal fluid. In this study, viral DNA was extracted from CSF by enzymatic digestion with proteinase K, followed by phenol-chloroform extraction and washing with ethanol. PCR was performed for each of the following viruses at varying conditions: HSV-1 and 2 with a target sequence from the glycoprotein D gene of 271 bp, VZV with a target sequence from Gene 29 of 200 bp. CMV with a target sequence from the major immediate early gene of 435 bp, and EBV with a target sequence from the EBNA-3C gene of 153 bp for type 1, and 246 by for type 2.

Out of 234 samples analyzed, 9 were HSV-1, 7 were HSV-2, and one contained both HSV-1 and 2. Out of 213 samples examined, 8 were co-infections in varying combination of HSV 1 and 2, EBV1 and 2 and VZV. Out of 213 samples, two were VZV and out of 128 samples, 60 were EBV 1 and all EBV 2 were co-infected with another virus. All in all 31 samples were infected with more than one virus.

The laboratory diagnosis of CNS viral diseases has been facilitated by PCR. IT has been shown to be a rapid, sensitive, and specific enough to be used as a frontline test for the detection of viral DNA in CSF, eliminating the need for difficult to obtain, expensive, and highly invasive brain biopsy which is the gold standard.

**Keywords**: Central nervous system, cerebrospinal fluid, Herpes simplex virus, Varicella zoster virus, Epstein-Barr virus, Polymerase Chain Reaction

## HSD No. 6 PRE-CLINICAL EVALUATION OF SAFETY OF A POTENTIAL DNA VACCINE AGAINST MALARIA

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DNA vaccines represent a novel method of vaccination, and are extremely promising for application and development in developing, tropical countries like the Philippines. However, like all technologies, there are risks associated with the use of DNA vaccines. These risks include possible integration of the DNA vaccine into the host genome, and immunopathology and histopathology due to the vaccine. We have constructed a putative DNA vaccine for malaria (VR12MM1), and we have performed a pre-clinical evaluation of this vaccine in mice.

DNA vaccines were prepared by overlap extension Polymerase Chain Reaction (PCR) to create the multi-epitope insert, and by recombinant DNA technology to create the recombinant plasmid, the DNA vaccine. Safety was determined by employing a PCR assay to assess persistence of the DNA vaccine in tissues of immunized mice, and to

determine possible integration of the vaccine plasmid into the mouse genome by homologous recombination. Histo-pathological analysis was also conducted on tissues from immunized animals.

Plasmids were not found to persist in immunized animals for more than a week, and no integrated vaccine sequences were found in the mouse genome. No significant adverse effects of vaccination were found by histopathological analysis.

**Keywords**: DNA vaccine, safety, malaria, integration, homologous recombination, PCR, histopathology

## HSD No. 7 EFFICACY OF *Mycobacterium vaccae* AS AN UMMUNOTHERAPEUTIC AGENT IN THE MANAGEMENT OF PULMONARY TUBERCULOSIS

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Patients who consulted at the TB Clinic of the Section of Infectious Diseases, Department of Medicine, UP-PGH and the Quezon Institute from January 1993 to June 1997 with microbiologically proven pulmonary tuberculosis based on a positive AFB smear and culture were included in the study. A total of 78 patients were classified as a multi-drug resistant TB or complicated TB. Both of the susceptible and multi-drug resistant tuberculosis were randomly assigned to either the immunotherapy (given an intradermal injection of Mycobacterium vaccae) of the non-immunotherapy group (without the intradermal injection of *Mycobacterium vaccae*).

Using the time for sputum conversion to negativity in weeks as primary outcome, all of the patients were followed-up. Results show that for the susceptible or uncomplicated tuberculosis, there is an earlier conversion of sputum smear and culture to negativity in patients given the immunotherapy as compared to those who did not receive immunotherapy (51.16% vs. 40.00% at two weeks respectively). Conversion rates, however, became comparable by the 12th week of chemotherapy (90.70% vs. 88.57% respectively).

Secondary parameters of weight gain were likewise higher for the Immunotherapy Group as compared to the Non-Immunotherapy Group. For the multi-drug resistant or complicated cases, the mean time for sputum conversion was also compared between immunotherapy and the non-immunotherapy group. Utilizing the Kruskal-Wallis one way analysis of variance, there was statistical significance. When we analyzed the effect of

resistance to each drug on time for sputum conversion to negativity utilizing the chi-square, only etambutol and pyrazinamide were shown to have significance. This means that immunotherapy had a more beneficial effect on earlier sputum conversion when the resistance was to ethambutol or pyrazinamide.

These results demonstrated the potential usefulness of *Mycobacterium vaccae* as an immunotherapeutic agent in the management of both susceptible *M. tuberculosis* or uncomplicated PTB and complicated or multi-drug resistant cases. The addition of Mycobacterium vaccae at one to two weeks after initiation of chemotherapy may lead to earlier sputum negativity by both smear and culture.

**Keywords**: susceptible, multi-drug resistant, tuberculosis, immunotherapy, Mycobacterium vaccae, sputum smear and culture

## HSD NO. 8 THE *flaA* GENE WHICH CONFERS PARTIAL PROTECTION IN MICE AGAINST *Helicobacter pylori* IS DETECTED BY PCR IN PHILIPPINE STRAINS OF *H. pyroli*

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The flagella of *Helicobacter pylori*, a bacterium which causes chronic gastritis, is considered as one of the principal virulence factors of this human pathogen. The *flaA* gene is the gene which encodes the major glagellin in the flagellar sheath of *H. pylori*. It was recently discovered in the US that generic immunization using fla A gene confers partial protection against H. pylori in mice.

The objective of this study was to determine by PCR the presence of the *flaA* gene in *H. pylori* strains isolated from gastric biopsies of Filipino patients diagnosed to have various gastroduodenal diseases at St. Luke's Medical Center.

*H. pylori* strains were isolated, cultured and purified from gastric biopsies of 20 patients suffering from different gastroduodenal diseases. Two patients were suffering from dyspepsia, seven with gastric ulcers, seven with duodenal ulcers, two were diagnosed with aphthous ulcers and two patients with both duodenal ulcers and gastric ulcers. Presence of the *flaA* gene was detected by PCR using the *flaA* primers (forward TTCTATCGGCTCTACCAC and reverse CTGACCGCCATTGACCAT) with a PCR product of 500 bp. The cycling conditions were: 95°C for 5 min, and 30 cycles of 95°C for 1 min, 52°C for 1 min and 72°C for 1 min. A final extension step of 72°C for 10 min was performed.

Out of 20 *H. pylori* strains, 10 were positive for the *flaA* gene: 4 from patients with gastric ulcers, one each from aphthous ulcer, both gastric and duodenal ulcer and dyspepsia.

The results demonstrate that the *flaA* gene could be detected by PCR from some Philippines strains of *H. pylori*. The flaA gene could be isolated and tested as a possible DNA vaccine against *H. pylori*.

**Keywords**: *Helicobacter pylori*, gastroduodenal diseases, chronic gastritis, *flaA* gene, PCR

## HSD No. 9 CHARACTERIZATION OF THE BIOLOGICAL ACTIVITIES OF A 50-Kd PROTEIN PURIFIED FROM *Tinospora rumphii* Boerl

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*Tinospora rumphii* Boerl, locally known as *makabuhay*, is one of the most common plants being used for various ailments. To characterize the biological activities of the plant, its antimicrobial, hamagglutinating, immunodulating, cytotoxic and apoptosis-inducing properties were investigated.

All experiments were carried out using a purified 50-kD protein from the methanol extract of *Tinospora*. Nitric oxide (NO) production was measured by a microplate assay based on Griess reaction. Hemagglutination (HA) assay was done using human blood types A, B, O and rabbit erythrocytes. A cell culture-based cytotoxicity system had been employed using HT-29 (human colon cancer cell line) and vero (monkey kidney epithelial) cells. Cell survival was measured by using the microculture-MTT assay. *In vitro* antimicrobial activity against *Escherichia coli*, *Staphylococcus aureus*, *Staphylococcus epidermidis* and *Pseudamonas aaeruginosa* was determined by the agar disk diffusion method. Apoptosis was detected by fluorescence microscopy after staining the cells (HT-29, BHK and vero) with acridine orange and ethidium bromide.

*In vitro* screening of the plant extract indicated a dose-dependent cytotoxicity for both the vero cells and HT-29 cell line. Results showed that the plant extract stimulated NO release from lipopolysaccharide-activated macrophages. In the antimicrobial screening, the extract demonstrated a strong activity against the Gram (+) bacteria (*S. aureus* and *S. epidermidis*). The extract had a 32 HA units using human blood types A, B, O and rabbit

erythrocytes. The apoptosis assay resulted to a dose-dependent apotosis-inducing activity for the HT-29, BHK and vero cell lines.

*Tinospora* shows a multiplicity of biological activities. Further work on *Tinospora* should focus on the therapeutic potential of these activities.

**Keywords**: *Tinospora rumphii* Boerl, immunomodulating activity, *in vitro* cytotoxicity, antimicrobial, hemagglutination property, apoptosis

## HSD No. 10 BIOLOGICAL PHENOTYPES OF PLAQUE-PURIFIED DENGUE VIRUSES

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Dengue fever/Dengue hemorrhagic fever outbreaks have been associated with the presence of two or more co-circulating virus serotypes. In this study, the biological phenotype of plaque purified dengue viruses is described.

Dengue viruses were detected and isolated by inoculating patient sera to C6/36 *Aedes albopictus* cell lines. Amplified dengue viruses in the culture were purified by plaque assay. The viruses were inoculated into $LLcMK_2$ (monkey kidney cells) in 35 mm petri disbes. Progeny viruses arising from a single infectious virion were recovered from areas of cell lysis also known as plaques. The method was repeated three times. Dengue serotype was confirmed by R-PCR using type-specific primers. Plaque size and morphology as well as virus titer were also noted.

From 49 dengue virus isolates, 16 were successfully plaque purified. Among them, four were DEN-1, eight were DEN-2, three were DEN-3, and one was DEN-4. Plaque morphology was described based on size and shape. It was observed that small plaques (0.3 to 2mm) showed complete cell lysis from the foci to the periphery, while medium (2.1 to 3.2 mm) and large plaques (>3.2 mm) were characterized by complete cell lysis at the foci and incomplete lysis at the periphery. Both small and medium-sized plaques were observed in all dengue serotypes except for one variant of DEN 2 that exhibited a large plaque size (4 mm). Virus titer ranged from $1 \times 10^3$ to $2 \times 10^7$ PFU/ml.

Dengue viruses purified in this study exhibited differences in plaque morphology and infectivity titers. No correlation was observed between plaque size and virus titer.

Virus growth kinetics is currently being correlated with both plaque morphology and size.

**Keywords**: dengue virus, plaque assay technique, virus purification

## HSD NO. 11 PHYTOCHEMICAL SCREENING OF AN ACCLAIMED HERBAL MEDICINE AGAINST TAGULABAY

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In pursuance of its responsibility to provide adequate and accessible health car to the Filipinos, the use of Philippine traditional and herbal medicines as an alternative cure to common illnesses is being promoted by the Department of Health together with local government units(3). Extract from boiled male Karamay (*Cicca acida* Linn.) leaves was claimed by town folks in Nueva Ecija to be an effective cure for *Tagulabay*, an illness characterized by isolated skin rashes, itchiness and reddening of eyes and skin. Phytochemical screening of the crude extract was done for the preliminary screening of active components that may be responsible for the acclaimed medicinal property. Phytochemical tests revealed that male karamay leaves contain saponins and tannins, both of which are known to have anti-inflammatory properties (1,2).

The anti-bacterial and anti-fungal properties and cytotoxic activity was explored further to determine other possible applications of the putative herbal remedy. However, preliminary tests showed that the extract has no anti-fungal nor an anti-microbial property and is toxic to brine shrimp.

**Keywords**: phytochemical screening, cytotoxic activity

## HSD No. 12 DETECTION OF bcr-abl GENE FUSION BY GTG BANDING AND RT-PCR IN FILIPINO PATIENTS WITH CML

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Chronic myelogenous leukemia (CML) is a hematologic malignancy that is generally characterized by a reciprocal translocation between chromosomes 9 (9q34) and 22 (22q11). This structural aberration results in the formation of an abnormally short chromosome 22 (Ph or Philadelphia chromosome) where the fusion of the genes *bcr* and *abl* is mapped. In this study, cytogenic and molecular techniques were compared in the detection of gene fusion in CML.

Twenty-nine Filipinos clinically diagnosed with CML were studied. Peripheral blood samples or bone marrow aspirates from each patient were cultured. Chromosomes were stained following the GTG (G-bands by Trypsin Using Giemsa) method. Cytogenetic analysis was made following the ISCN (International System for Human Cytogenetic Nomenclature) 1995. Molecular studies were carried out by RT-PCR (reverse transcription – polymerase chain reaction) using G, α , F and A primers.

Cytogenetic analyses revealed the presence of the Ph chromosome in 17 patients. The RT-PCR technique detected the *bcr-abl* gene fusion in 28 patients, 15 had b3a2 gene fusion, 7 were of the b2a2 type of gene fusion and 7 had both types of gene fusion. The detection rate of the RT-PCR technique (96%) is very much higher than that of the cytogenetic method (38%).

Thus, RT-PCR proved to be more sensitive in detecting the *bcr-abl* gene fusion in CML. This technique greatly improves the accuracy and efficiency of the diagnosis of CML.

**Keywords**: chronic myelogenous leukemia, hematologic malignancy, *bcr-abl* gene fusion, Philiadelphia chromosome, GTG-banding, RT-PCR

## *SOCIAL SCIENCES*

### SSD No. 1 WOMEN AND ACADEMIC EXCELLENCE IN MEDICINE

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Across cultures and generations, physicians have always been accorded the highest occupational prestige among the professionals. This is because of their recognized rationality and expertise on matters related to health and disease. Physicians go through a most rigid and competitive training before society confers them this prestigious title.

This paper is serendipitous finding of an earlier dissertation that investigated on how physicians are socialized professionally in a medical center. In the process, it was able to describe the nature of medical education that posed important concerns on gender studies.

The researcher did a participant observation of daily activities in all clinical settings at the University of the Philippines-Philippine General Hospital Medical Center. Interviews of key informants, review of secondary data and accomplishment of questionnaire were done.

The study reveals that the whole pattern of medical education from the basic to the clinical science studies and eventually internship and residency training, is essentially gender-free and in fact inconsiderate of the inherent characteristics of women pursuing medicine. Working on the objective of harnessing excellence among students, this medical center imposes a curriculum that makes everybody meet certain criteria regardless of gender-related circumstances like menstruation, pregnancy, breast-feeding or motherhood in general. Women pursuing medicine are expected to perform and compete using the same general rules and criteria to be retained in the roll. While this particular pattern is commendable and assures society of clinically competent supply of future doctors, it should also be recognized that outside the medical center where they train, these women assume the traditional multiple roles expected of them. In their homes and families, communities and other social institutions like schools of their children, they are the mothers, the wives, the community leaders, etc. while also training to be good physicians. The paper raised the irony of training women to become doctors in a gender-free medical center yet they live in a heavily gender-biased society.

**Keywords**: medical education, gender-related circumstances, traditional multiple roles

## SSD No. 2 ATTRIBUTES OF STUDENT ATTRITION IN THE COLLEGES OF ALLIED MEDICAL PROFESSIONS AND DENTISTRY, UNIVERSITY OF THE PHILIPPINES MANILA

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In two recent studies in the University of the Philippines Manila (UPM), the Colleges of Allied Medical Professions (CAMP) and Dentistry (CD) were identified to have the highest attrition rates. This present study aims to respond to the recommendations of these studies. It aimed to determine the student attrition trends in CAMP and CD within the last seven years; explain the causes of attrition according to the perceptions of students who did not finish their degree programs in CAMP and CD, selected faculty members and administrators and based on these trends, describe the strengths and weaknesses of the two colleges' academic programs.

Student data on admission and graduation, catalogues, bulletins and minutes of meetings were analyzed. Respondents were obtained from an accessible population identified according to records. Primary data were obtained from interviews of key informants, focus group discussions with selected faculty members and administrators and student-accomplished questionnaire. Student records were analyzed using percentages, ratios and proportions. Qualitative data were analyzed descriptively.

Student attrition is pronounced and massive in the Doctor of Dental Medicine (DDM), Bachelor of Science in Occupational Therapy (BSOT), and Bachelor of Science in Physical Therapy (BSPT). It ranges from 66.67 to 100 percent in the DDM program for the last seven years. More than percent of dentistry proper students belonging to these batches did not graduate even after the terminal year of nine years. The BSOT program posed an attrition of from 57.58 to 89.65 percent. More than 50 percent of the students did not complete the program after the sixth year. The BSPT program on the other hand, showed a range of from 56.86 to 73.47 percent. At least 30 percent from each batch remained unfinished with the degree after the maximum residence. The Bachelor of Science in Speech Pathology (BSSP) has also high attrition rate from 22.22 to 94.44 percent although the trend goes down sharply after the fifth and sixth years. The pattern shows clearly that all programs in both colleges hardly graduate students within the prescribed periods of study.

Student attrition is primarily attributed to academic, student and external variables. Academic factors reveal problems and discrepancies among the formal, operational and hidden curricula of the four academic programs. Faculty members lament that students in this generation are no longer as hardworking as they used to and that they generally have poor attitudes toward their academic pursuit. Students admit their inability to meet the high expectations of their colleges. However, they also expressed that they were not given

the appropriate learning environment during their residence. Furthermore, all groups of respondents also reported that external factors typical of an urban community also affect student attrition.

The study concludes that the academic programs of CAMP and CD are both carrying out the tradition of excellence in their courses. Faculty members, and the entire institutions impress this on their students and the latter are cognizant of the consequences if they fail to meet the standards. It was also realized that these very standards depend so much on the individual faculty members, policies and resources of the colleges and to a certain degree are instrumental in making students lose their track. Hence causing student attrition. As attrition is found to be pronounced in all programs studied and in all year levels, serious reviews of policies standards are recommended.

**Keywords**: student attrition, attrition rate, learning environment

## SSD NO. 3 REVISITING THE LIGAWASAN MARSHLAND IN MINDANAO: AN INDIGENOUS RESOURCE MANAGEMENT SYSTEM STUDY TOWARDS SUSTAINABILITY

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The Ligawasan Marshland covering an area of 288,000 hectares is important to hundreds of thousands of Magindanaw Bangsamoro fisher-farmers whose basic means of livelihood are wild fishing and traditional rice farming. This study evaluates the indigenous resource management system and indigenous laws in fishing and rice farming and the effects to the sustainability of the marshland.

Most of the fisher-farmers practiced traditional fishing and farming beliefs/rituals which promoted sustainability since giving respect to the marshland as sacred deters overexploitation. In terms of indigenous laws, ban on electric and chemical fishing and fry catching are strictly enforced. A peaceful coexistence is preserved between the heads of barangays and traditional religious leaders and the Bangsamoro mujahideen leaders to enable them to work in unity amidst some diversity. An exclusive open access and rights to control only among Magindanawn Bangsamoro is observed which shows their control over accessibility and utilization of the marshland.

Aquatic wildlife remains abundant in the marshland to include species of fish, crustaceans, mollusks, and other aquatic organisms with economic value. Values obtained on the physico-chemical properties (DO – 4.67 gm/L; pH – 6.99; water turbidity –

53.30 cm; DS – 136.04 mg/L) of the marshland were within the normal range indicating the area remains an ideal habitat for fish and other aquatic resources.

The overall sustainability level (using ecological soundness, cultural acceptability, social justice, economic viability and technological appropriateness dimensions) of the marshland was rated moderate with a mean rating of 75.06. This indicates that the marshland has gained some degree of degradation due to the occurrence of natural calamities and centuries of utilization of the area by the fishers-farmers.

Based on the findings, a sustainability framework is put forward to strike a balance between the socio-economic, bio-physical environment and indigenous resource management system and laws to enhance sustainability of the Ligawasan Marshland.

**Keywords:** indigenous resource management system, indigenous laws, sustainability

## SSD NO. 4 COMMUNICATING INDIGENOUS AGROFOREST KNOWLEDGE AND PRACTICES: THE CASE OF THE BUGKALOTS

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This study was an attempt to understand the tribal community life of the Bugkalots particularly their indigenous knowledge systems (IKS) and communication patterns as conduits to environmental sustainability.

The study used ethnographic techniques of participant observation, informal interviews, and group discussion to gather data on IKS and communication behavior of Bugkalots.

The Bugkalots were then the most fierced headhunting tribe in the Philippines. They were subsistence farmers with "uma" or agroforest farming as their primary source of income.

The agroforest farming practices of the Bugkalots conform to the integral system type of swidden agriculture. The Bugkalots were able to sustain their livelihood through agroforestry and yet maintain biodiversity of the forest. Their land use and cultural management practices help maintain the stability of tbe system as they minimal soil cultivation, herbal and faunal fumigation and fertilization.

The Bugkalots have a rich form of indigenous communication system. The traditional beliefs, practices and other cultural processes that accompany their farming

activities helped establish a strong social relationship among members of the communities. Through this relationsbip, a kind of informal networks evolved where information flow in the community was at relatively faster rate. They have indigenous communication channels like "apgad" and "upug" which are used in encouraging their young to preserve, maintain and use the IK they have inherited from their forefathers. Through verbal interactions coupled with practical applications, coaching and imitation, the traditional knowledge and practices of the Bugkalots have evolved through time until now.

The indigenous agroforest practices of the Bugkalots contributed to the sustainability of their farming systems and declare the importance of IKS in achieving sustainable development. Moreover, communication through indigenous social exchange is an effective mechanism to empower, unite and involve local communities in the process of conserving and preserving the environment, IK and cultural heritage.

**Keywords:** indigenous knowledge systems, agroforest farming systems, communication systems

## SSD No. 5 SIGNIFICANCE OF SWEETPOTATO ENTERPRISE IN THE LIVELIHOOD SYSTEM IN CENTRAL LUZON

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Sweetpotato enterprise is an economic activity which does not only include growing and producing sweetpotato. It involves a number of activities and players such as stakeholders, producers and users. This study reveals the reasons of households in engaging in sweetpotato enterprise, the extent by which the enterprise contributed to their economic condition and the problems encountered by them.

The respondents in the study were 114 households from Bagac, Bataan, Moncada and Paniqui in Tarlac, and Bayambang, Pangasinan. Likewise, the operation of the starch factory in Sta. Maria, Pangasinan was also studied.

Income from sweetpotato production is not only realized from roots but also from seedpieces which are used as planting materials. Income from production of seedpieces averaged P 9,920/ha while persons involved in trading caroed P400 to 16,000/ha. The

wide range of income is attributed to the elaborate marketing channel consisting of tipsters, agents, haulers, traders, wholesalers and retailers. A similar channel exists in the marketing of roots.

Sweetpotato root production is intended for commercial purposes rather than domestic use. Varieties used by growers are dictated by the requirement of traders. Traders most of the time control the prices of sweetpotato especially during peak harvest months while agents/small traders control the price during lean harvest time. Traders derive income from marketing of sweetpotato ranging from P4000 to P23,000/ha.

The mean contribution of sweetpotato to family income was 26%, the highest among the income sources. Aside from the cash contribution to family income, sweetpotato saves cost on food and feed by about 10 to 30% and 30 to 70%, respectively.

Sweetpotato enterprise is presently threatened by: (a) increasing insect pests and disease problems, (b) limited supply of clean planting materials, (c) uncertainty of the operation of the starch factory and (d) fluctuating demand for fresh roots in the fresh market.

Institutional and support services have to be strengthened and provided adequately to counteract these threats.

**Keywords**: sweetpotato, starch, seedpieces, marketing

## SSD No. 6 HOMEGARDEN AS A HOUSEHOLD COPING STRATEGY: A VIEW FROM THE POLICY ENVIRONMENT

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Adaptation, coping, and strategy are concepts with a common denominator. These are dictated by change, which can bring about adjustments. However, these concepts vary due to the element of time. As argued by Davies (1993), coping and adaptation are distinct from that of strategy in the sense that the former are short term-oriented (safety-net mechanisms) while the latter is a response developed over time (which becomes permanent as it integrates in the culture or tradition). Coping is synonymous with what is referred to as 'adaptive strategy' (Gladwin and Butler1984:208) where people develop patterns or processes to cope with or adapt to changing environment.

Households depend on traditional forms of activities, which are proved viable and stable. The diverse production strategy in the homegardens, utilizing different micro

niches ensures much of the households' daily food requirement. Homegardens might not be as lucrative as commercial farming but their significance in satisfying material (food and income) and non-material (satisfaction among managers of these domains) needs is an important point to reckon with.

In pushing for the continuity and improvement of this food production system, external support like policy environment is critical. Households' entitlement to their land becomes difficult because of conflicting views on pronouncements. This relates to the issue of institutional mandate. Complicating the issue is the strong demand of household communities of their indigenous rights like ancestral land and domain claims.

The *emics* and *etics* of land tenure attempts to provide a reconciling point for understanding the analysis of the policy on land tenure in Baguio City. From the emic view, one understands culturally defined norms on land ownership as well as the role of this resource among the natives. A grasp of the outsider's notion, on the one hand, like definitions of land ownership by government agencies such as the Department of Environment and Natural Resources, Department of Agrarian Reform and the National Commission of Indigenous Peoples Rights is significant for evaluating the objectives of their policies. By looking at these two variables, the relationship as well as the extent of the policy sub-system's consideration of people's view is determined. This in turn becomes relevant in identifying areas for the promotion of a sustainable development of homegardening.

**Keywords**: households, homegardens, coping strategy, policy, and land tenure

## SSD No. 7 TRADITIONAL WEATHER FORECASTING METHODS IN ILOCOS NORTE

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Weather forecasting is vital in optimizing agricultural production, increasing profitability, and in decreasing risk. Weatherwise folks in Ilocos Norte still rely on weather lore in predicting the weather and to them, these tend to be indispensable.

Weatherwise folks, aged 60 and above, from selected barangays of 17 towns of Ilocos Norte were interviewed using a structured interview schedule. All the respondents rely on the signs of nature in predicting the weather. They claim that when ants come in and out of their caves carrying some food, or numerous earthworms are coming out from soil and swarm of dragonflies fly low, there is a downpour of rain. The unusual chirping and migration of birds such as Himalayan swiftlet, lesser caucal, plaintive cuckoo, or

heron; the unusual behavior of dogs, frogs, and honeybees usually predict an upcoming rain, typhoon or bad weather. When physic nut, bangkal and siniguelas fruits ripen early or shed the onset of rainy season is near. Meanwhile, a long parallel band of feathery clouds and moon with ring would indicate an upcoming rain and if seawater evaporation is visible and high seawaves are observed, bad weather is coming.

Respondents said that these weather lore were formulated out of necessity and repeated observations made them realize that these are reliable. This is the reason why they still rely on these indicators more than the weather information from Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) as these are not location-specific. Moreover, the rural folks had no formal schooling this cannot appreciate technical terms.

Literatures concur that these lore have scientific explanations. As such, they could be important bases for farmers in planning agricultural operations and for fishermen on their fishing activities and thus, an important supplement to the services of PAGASA.

**Keywords**: weather lore, weatherwise folks, forecasting, traditional