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PGIS News

Quarterly Update of the work and progress of the Postgraduate Institute of Science (PGIS), University of Peradeniya, SRI LANKA (also available at www.pgis.lk)

WORKSHOP ON ACTIVE TEACHING AND LEARNING APPROACHES IN SCIENCE (ATLAS)

Prof. Lakshman Dissanayake (Director, PGIS and Chairman, Board of Study in Science Education) addressing the inaugural session of the workshop held at the PGIS on September 11, 2003. (Seated L to R): Dr. S. Karunaratne (Workshop Coordinator & Secretary, Board of Study in Science Education), Prof. K. G. A. Goonasekera (Vice-Chancellor, University of Peradeniya), Dr. Mark Windale (Principal Resource Person, Sheffield Hallam University, UK) and Dr. A. A. S. Perera (Acting Dean, Faculty of Science, University of Peradeniya).

This workshop was the second in the series of workshops entitled "Active Teaching and Learning Approaches in Science (ATLAS)" conducted through the DFID Higher Education Link programme between the Postgraduate Institute of Science (PGIS) and Sheffield Hallam University (SHU) of the UK managed by the British Council. The workshop was held during September 11 – 13, 2003 at the PGIS, and was mainly conducted by Dr. Mark Windale of SHU with the assistance of Dr. Sunethra Karunaratne. There were 120 participants (75 junior secondary teachers and 45 PGIS students registered for M.Sc./M.Phil. degrees in Science Education) at the workshop. The development of process skills and experimental science is an important aspect of science education and has many issues relating to it, including the implications for curriculum planning, classroom management and, the assessment of student achievement. The workshop had the main objective of developing the individual process skills identified and defined by the new curriculum and managing and supporting experimental work through enabling questions and planning proformas, rather than by a recipe of instructions.

The workshop provided opportunities for secondary teachers to gain first-hand experience of many pragmatic approaches and exemplar activities designed to help students gain and develop process skills, help them through the experimental process without being giving a recipe to follow and, help teachers to integrate experimental work into the curriculum through highly motivating contexts.

Dr. Mark Windale conducting a workshop session.

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We shall be pleased to receive your comments, suggestions and contributions with a view to improving the quality of this newsletter. Correspondence and requests for copies of **PGIS *News*** should be addressed to Dr. N C Bandara – Editor:

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Prof. Lakshman Dissanayake, Senior Professor in Physics at the University of Peradeniya and the Chairman of the PGIS Board of Study in Science Education assumed duties as the new Director of the PGIS from July 1, 2003. The outgoing Director, Prof. K. Dahanayake, served the PGIS for six years. We wish him good luck in the years to come.

MESSAGE FROM THE NEW DIRECTOR OF PGIS

As the new Director of the PGIS, it gives me a great pleasure to send this message to "PGIS News", the quarterly update of the PGIS activities.

Since its establishment in 1996 as a national institute, academically affiliated to University of Peradeniya, the PGIS has provided postgraduate training to a large number of graduates leading to M.Sc., M.Phil. and Ph.D. degrees in science and technology related areas of national importance. In addition, a much greater number has received short-term training through workshops, short courses and research conferences. All these achievements have been possible primarily due to the cooperation extended by the members of the Faculty of Science at University of Peradeniya. PGIS still relies heavily on the laboratory facilities and equipment available at the Faculty of Science for conducting its research activities leading to postgraduate degrees. We also appreciate the support and facilities offered by other Faculties at Peradeniya, and other universities and institutions outside Peradeniya, to conduct our programmes successfully.

Although PGIS has performed well during the past seven years of existence, thanks to the able guidance and the commitment of my predecessors, there is much more to be achieved. Proposals have now been submitted for obtaining the much needed instrumentation facilities for the PGIS laboratories. A five-year Corporate Plan has just been finalized. Affiliations with other Centres of Excellence in other countries, joint research programmes and student/staff exchange programmes with foreign universities, and attracting foreign students to our programmes are some of the activities planned for the coming years.

Streamlining the conduct of on-going M.Sc. Programmes and initiating new M.Sc. Programmes of national importance, especially in areas such as Management Information Systems, Molecular Biology and Bioinformatics, Science and Technology Management, Computational Statistics and GIS and Remote Sensing are among some of the activities planned for 2004/2005.

As far as state funding is concerned, unlike during its first phase of existence from 1996 – 2003, the next phase of development of the PGIS is going to face some serious challenges. The government expects the Institute to be more and more self-reliant financially and to become competitive and completely self-reliant within the next few years. This demands careful and efficient planning in all our activities.

While facing these new challenges, we solicit the active and continued cooperation from all sectors concerned to make the PGIS a Centre of Excellence for postgraduate training and research in sciences in South Asia.

Prof. M A K Lakshman Dissanayake
B.Sc. (Ceylon), M.S., Ph.D. (Indiana, USA)
FNASSL, FIPSL
Director, Postgraduate Institute of Science
Chairman, PGIS Board of Study in Science Education
Chairman, Asian Physics Education Network (ASPEN)

31.12.2003

DEGREES AWARDED (APRIL – DECEMBER 2003)

Ph.D. & M.Phil. Research Degrees

	Name of Awardee	*Title of the Thesis*
Ph.D. **– Chemical Sciences**		
1.	U. S. K. Weliwegamage	Development of electroanalytical detection schemes for some selected pesticides
Ph.D. **– Physics**		
1.	K. Arulananthan	Hydrography, coastal water circulation and classification of Sri Lankan Lagoons
M.Phil. **– Chemical Sciences**		
1.	J. A. C. P. Jayasooriya	Chemistry and bioactivity of some Sri Lankan Menispermaceae and Rubiaceae
2.	A. M. Hafil	Development of amperometric sensors for detection of Cyhalothrin and Propanil
M.Phil. **– Physics**		
1.	P. A. R. D. Jayathilaka	Study of electrical conductivity and dielectric relaxation of PEO based composite polymer electrolytes and PAN based polymer electrolytes
M.Phil. **– Plant Sciences**		
1.	A. L. S. Dharmaparakrama	Characterization of accessions and reproductive biology of *Elettaria cardamomum* L. Maton in Sri Lanka
2.	C. Mahendranathan	Postharvest losses and induction of resistance in aubergine (*Solanum melongena*) against anthracnose caused by *Colletotrichum capsici*, using a weak pathogen, *Fusarium solani*
M.Phil. **– Zoological Sciences**		
1.	E. M. L. Ekanayake	Nest site fidelity and nesting behaviour of marine turtles in Rekawa turtle rookery
2.	K. C. Weerakoon	Status of insecticide resistance and resistance mechanisms in some of the rice insect pests and four of their predators

M.Sc. Degrees (*by course work with a research project of 3 – 6 months duration*)

	Name of Awardee	*Title of the Project*

M.Sc. – Analytical Chemistry

1.	T. W. A. W. Wijesinghe	Evaluation of water quality of Kelani river with empahsis on chrome leather tanning industrial effluents

M.Sc. – Applied Statistics

1.	J. A. N. C. K. Damayantha	Modelling drought condition in Hambantota district: A time series approach
2.	B. D. P. Gunewardene	Investigation of the link between school based assessment programme and the G.C.E. (A/L) results in combined mathematics
3.	E. W. K. J. B. Ehelepola	Strength of the global warming phenomenon in Kandy district.
4.	N. Fahmiya	Forecasting cow and buffalo milk production in Sri Lanka
5.	G. Bakeerathan	A concept of non-parametric procedure for testing homogeneity of variance and a non-parametric approach in testing higher order interactions
6.	R. N. Serasinghe	Comparison of stochastic and mathematical programming approaches used in measuring technical efficiency: illustrated by an efficiency analysis of cattle farming systems in up country wet zone of Sri Lanka

M.Sc. – Biodiversity Conservation Management

1.	B. V. P. Perera	A avifaunal diversity associated with different habitats in Wasgomuwa National Park
2.	R. M. W. S. Samaradiwakara	Comparative studies on biodiversity of logged and unlogged mahogany plantations in Kumbalpola, Sri Lanka

M.Sc. – Clinical Biochemistry

1.	B. H. K. R. Sugathadasa	Study of abnormal hemoglobins and thalassaemias in an anemic population
2.	E. M. S. D. Ekanayake	A study of renal function of a sample of patients on long-term diclofenac sodium for rheumatoid arthritis

M.Sc. – Computer Science

1.	S. Ravinthiran	Computerizing the monitoring and evaluation of teaching performance
2.	P. S. Palliyaguruge	A profiler for testing *Java* programmes (Profiler Agent and Graphical User Interface)

3.	A. K. Ranasinghe	Use of image enhancement techniques to assist diagnosis of heart enlargement
4.	K. S. Senthilkumar	Biomechanical movements of a humanoid robot and force analysis
5.	V. Thaneswaran	Applications of neural networks in electromagnetics: A survey
6.	N. S. Weerakoon	A profiler for testing *Java* programmes (Socket Server and the Analyser)
7.	K. M. T. N. Bandara	Detection of alveolar crestal bone loss and tooth length from a radiograph in dental practice using digital image processing
8.	J. B. Ekanayake	M16A1 Land mine detection using backpropagation neural network
9.	L. S. K. Perera	Image processing routines for an automated security system
10.	D. P. K. Sirisumana	Physical quality estimation of rice by image processing
11.	M. Wakkumbura	Measuring damages and colour regions in tree leaves using image processing techniques

M.Sc. – Industrial Chemistry

1.	M. G. V. Dhanapala	Use of diluted natural rubber centrifuged latex for pillow manufacture

M.Sc. – Industrial Mathematics

1.	E. M. G. W. M. B. Thalagune	Natural oscillations in approximately linear second order dynamic models
2.	S. Chandrakanth	Applications of graph colouring

M.Sc. – Science Education

1.	T. K. Amunugama	Making G.C.E. Advanced Level (A/L) physics more attractive through improved teaching at pre-G.C.E. (A/L) classes
2.	D. M. T. H. Dissanayake	Improving student understanding of introductory level Physics – Mechanics through computer – based interactive methods
3.	C. N. Jayasekera	Development of demonstration experiments for teaching Advanced Level electricity and magnetism
4.	P. K. Koralagama	Development of a study package for astronomy education
5.	P. Malavipathirana	Development of a conceptual and numerical question bank for the testing of students understanding in physics
6.	H. L. Hemanthi	Water quality in selected rural tanks in Matara district in relation to anthropogenic activities
7.	V. Panchalingam	A Study on the prevailing gaps in the chemistry knowledge between the G.C.E. O/L and the G.C.E. A/L

8.	W. R. D. M. U. Pushpalatha	An ecological study of grasslands at Horton Plains National Park
9.	K. P. S. B. Senanayake	A study on numerical problem solving ability of G.C.E. (A/L) students offering chemistry
10.	R. P. R. Subashini	Problems and perceptions of teachers and students on newly amended G.C.E. (A/L) agriculture syllabus
11.	I. S. Wattuhewa	Enhancement of learning through problem–based learning
12.	W. C. P. Wickramasinghe	Preparation of a supplementary book on 'Man and the Environment' (Unit 15) for G.C.E. (A/L) chemistry students
13.	D. P. Dhanasekera	A colour picture guide on fish and fishing gear required for G.C.E. (Advanced Level) Biology students

Postgraduate Diplomas (*by course work only*)

Diploma – Analytical Chemistry

1. K. M. P. S. A. Kusaladharma

Diploma – Applied Statistics

1. K. E. D. Perera
2. M. M. M. Rahmathulla

Diploma – Science Education

1. G. S. I. M. Perera
2. R. M. S. B. Rajasinghe

ABSTRACTS OF Ph.D./M.Phil. THESES

Ph.D. (Chemical Sciences)

Development of electroanalytical detection schemes for some selected pesticides

U. S. K. Weliwegamage, *Department of Chemistry, University of Peradeniya*

Pesticides are considered as priority environmental pollutants with risk of health hazards. Detection of pesticides by reliable means would therefore be an important early step in control of environmental pollution, biosphere conservation, and in avoiding intake of poisons and other health issues. Development of alternative, simple methodologies has drawn much attention due to limitations of currently used chromatographic and spectrometric methods. In this study, development of alternative methods for the detection of pesticides, based on electrochemical techniques, in particular cyclic voltammetry and amperometry, was attempted. Different types of electrodes were used with emphasis on the eletroactivity of pesticides under the influence of applied potentials.

The dithiocarbamate fungicide, thiram, was found to be electroactive at unmodified glassy carbon electrodes in aqueous medium. The electrochemical behavior of this compound was extensively studied using cyclic voltammetric experiments. The amperometric method, which was developed under optimized conditions; applied potential of +0.05 V and in the supporting electrolyte of pH 10 borate buffer, produced reproducible responses with a minimum detection limit of

1.0×10^{-8} mol dm^{-3}, based on the signal to noise ratio (S/N) of 3. This method was applied to quantify thiram in water leaches of a model soil bed, and in an agricultural bean seeds sample.

Some electrode processes are kinetically disfavored towards oxidation and/or reduction due to high over-potentials associated. This kinetic barrier could successfully be overcome by the selection of a suitable electrocatalytic scheme. Electrocatalysts are capable of catalyzing electrochemical processes, as they decrease the overpotential for oxidation/reduction. Use of both chemical and biological catalysts for the detection of pesticides is reported here.

A voltammetric biosensor, containing apple tissue (10% w/w) as the biological component, was able to detect thiram at levels as low as 1.0×10^{-6} mol dm^{-3}. During this process, the inhibition of the enzyme, polyphenol oxidase, present in apple tissue by thiram was observed. The response of the biosensor was optimum for a period of 2-3 weeks.

Transition metal oxides with variable oxidation states were found to be excellent electrocatalysts for many pesticides, if conditions such as electrolyte, working potential/potential range and the catalytic loading were optimized. The phenoxy acid herbicide, MCPA (4-chloro-2-methylphenoxyacetic acid), was detected at a catalytic carbon paste electrode, containing MnO_2 black powder (10% w/w). The amperometric sensor produced a minimum detection limit of 9.7×10^{-7} mol dm^{-3}, based on S/N = 3. This method was successfully applied to quantify the active ingredient in an old commercial formulation. The sensor showed a satisfactory lifetime of about 8 - 10 weeks. Cyclic voltammetric investigation revealed the possible interaction between Mn^{2+} and MCPA, according to the variations of solution electrochemistry of Mn^{2+} ions.

Another organochlorine herbicide propanil, was determined at a carbon paste electrode, constructed using 10% (w/w) CuO, with a minimum detection limit of 6.0×10^{-8} mol dm^{-3} (S/N = 3) amperometrically. The sensor response was optimum over a period of 6 - 7 weeks.

Metalloporphyrins are another group of electrocatalysts, used in the electrochemical reduction of organohalogens. The metallic electrodes; Pt and Au, together with glassy carbon electrodes, modified with 5,10,15,20-tetraphenylporphyrinatoiron(III) chloride [Fe(III)TPPC1] catalyzed the reduction of some organochlorine pesticides. In this case, it was found that the detection was more sensitive with metallic electrodes.

Glassy carbon electrodes modified with Fe(III)TPPCl were used for the detection of propanil in water, leached out from a model rice bed. Simple gravity column preconcentration could enhance the sensitivity of electrochemical detection. Such studies indicate the practical applicability of electroanalytical techniques in real sample analysis.

Supervisors: *Prof. Namal Priyantha (University of Peradeniya & PGIS)*
Dr. A. N. Navaratne (University of Peradeniya & PGIS)
Dr. Dimuthu Jayawickrama (University of Illionois, Urbana-Champaign, USA)

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## *Ph.D. (Physics)*

### Hydrography, coastal water circulation and classification of Sri Lankan lagoons

***K. Arulananthan,*** *NARA, Crow Island, Colombo 15.*

Large daily temperature variations and intermittent hypersalinity are features typical for shallow tropical and subtropical lagoons. We investigate these effects in relation to water exchange, based on data from three lagoons on the west coast of Sri Lanka: Negombo, Puttalam and Chilaw Lagoons.

Negambo Lagoon has an estuarine character with low but variable salinities. The lagoon is strongly choked with respect to the semidiurnal tide, because of a narrow and shallow inlet. Data from Negambo Lagoon includes both a one-year series of monthly hydrographical surveys (salinity and temperature) and a longer campaign, comprising high-resolution salinity, temperature and sea level data from various sites. Simultaneous series of high-resolution meteorological data from a weather mast, covering long-and short-wave radiation and data for calculation of turbulent heat fluxes were also obtained. Water exchange with the ocean was studied in relation to heat and freshwater input. The channel flux is a key factor. Salinity stratification, which promotes the exchange of properties, appears regularly. We found a difference in exchange between neap and spring but the difference was smaller than expected. The diurnal tide, which is more prominent during neap, promotes stratification, because of lower tidal velocities. Longer periods of in and outflow, in addition promotes more efficient frontal mixing. The diurnal temperature range is extreme (up to $8^0$C), but the mean temperature is only 0.5 - $1^0$C higher than that of the ocean. Estimates of heat exchange with the ocean and observations of surplus temperature of the lagoon indicate a net heat flux through the sea surface of 10 - 20 $Wm^{-2}$ only, for the period investigated. Observations and
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calculations based on weather mast data gave higher net flux, probably due to underestimate of the latent heat flux at low winds.

Measurements from the Puttalam Lagoon include monthly hydrographic surveys for a period of 2.5 years and high resolution salinity and sea level data from several sites, including current measurements at the inlet, Kalpity Narrow for a four month period. The Puttalam Lagoon is almost ten times larger and more open than the Negombo Lagoon. Because of poor water exchange and depths of 1 - 2 m only, the seasonal salinity variations become very large. In its inner parts, the salinities may reach 50 - 60 because of evaporation whereas the rain periods may lower the salinities to between 20 and 30. The residence times are between 40 - 100 days for exchange with the ocean but might be even longer. Water exchange within the lagoon takes place primarily during periods of slack water, when tidal mixing is weak and a gravitational circulation can be established. During periods of weak or non-existent horizontal gradients active estuarine circulation is uncommon and water exchange is slower, as indicated in our study. It means that frequent shifts from normal to hypersaline conditions bring down the long-term water exchange. The lagoon seems not to attain a steady state but the salinity continues to increase until the next rain season appears. In fact, it is possible that the salinity may increase indefinitely.

Chilaw Lagoon is smaller than the other lagoons and more restricted. It has two long and narrow entrances, of which one is intermittently closed. It was investigated with tide gauges and salinity-temperature sensors at three sites during 1998. The lagoon is strongly affected by freshwater discharge during floods, when the sea level may rise high above the ocean level.

The salinity of all three lagoons is sensitive to human impact. Changes in freshwater input caused by irrigation or damming, may result in large salinity variations and be crucial to marine life. In Puttalam Lagoon the salinity may have increased by 5 – 10 psu since the 1960's and it is now well above the oceanic mean, because of a lower river discharge. Also Negombo Lagoon may be affected by reduced discharge. However, all lagoons are also influenced by normal climatic variations, where immediate changes in salinity due to heavy rainfall may reach several psu and the diurnal temperature variability due to sea surface heat flux is 3 - 5^0 C.

Supervisors: *Prof. Lars Rydberg (University of Gothenberg, Sweden)*
Prof. Ulf Cederlof (University of Gothenberg, Sweden)
Dr. R. P. U. Karunasiri (University of Peradeniya & PGIS)

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## *M.Phil. (Chemical Sciences)*

### Chemistry and bioactivity of some Sri Lankan Menispermaceae and Rubiaceae

***J. A. C. P. Jayasooriya****, Institute of Fundamental Studies, Kandy*

The first part of the thesis describes chemistry and bioactivity studies of the leaves of *Diploclisia glaucescens* of the family Menispermaceae. *Diploclisia glaucescens* is a creeper climbing up about twenty-five meters high and is totally glabrous. It is distributed in the mid-country regions of South India and Sri Lanka. It has been reported that the leaves of this plant are used to treat biliousness and venereal diseases.

Chromatographic separation of the ethyl acetate extract yielded three ecdysteroids low polar than 20-hydroxyecdysone, which is generally considered as the moulting hormone in insects. They were identified as makisterone A, dihydrorubrosterone and *epi*-pterosterone. This is the first report of dihydrorubrosterone and *epi*-pterosterone from the family Menispermaceae. Makisterone A has been previously reported from the seeds of *D. glaucescens*.

Chemical investigation of the n-hexane extract of the leaves of *Diploclisia glaucescens* furnished stigmasterol. Chromatographic separation of the methanol extract afforded two ecdysteroids, 20-hydroxyecdysone and a new ecdysteroid, 3-deoxy-1β-20-dihydroxyecdysone and three saponins, β-sitosterol-D-glucoside, 3-O-β-D-glucopyranosyl-(1→3)-β-D-glucopyranosyl-28-O-β-D-glucopyranosyloleanolic acid and 3-O-β-D-xylopyransosyl-(1→2)-β-D-glucopyranosyl-28-O-β-D-glucopyranosyloleanolic acid. Latter two triterpenoidal saponins are reported for the first time from the family Menispermaceae.

Structure elucidation of the isolates was mainly based on spectroscopic techniques such as NMR, HMBC, HMQC, H-H COSY, NOE, etc. and chemical methods such as acid hydrolysis, acetylation, etc.

All isolates were tested for their antifungal activity against *Cladosporium cladosporioides* using TLC bioautography method. None of them showed any activity.
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The second part of the thesis describes antimicrobial activity studies of thirteen Sri Lankan plant species of family Rubiaceae. Ninety solvent extracts (n-hexane, dichloromethane and methanol) obtained from the leaves and bark of thirteen Sri Lankan Rubiaceae plants; *Benkara malabarica*, *Canthium coromandelicum*, *Canthium dicoccoum*, *Haldina cordifolia*, *Ixora calycina*, *Morinda tinctoriya*, *Mussaenda frondosa*, *Psychotria gardneri*, *Psychotria nigra*, *Psychotria stenophylla*, *Saprosma foetens*, *Tarenna asiatica* and *Wendlandia bicuspidata* were tested for antibacterial activity against *Escherichia coli* (Gram-), *Micrococcus luteus* (Gram+), *Bacillus subtillis* (Gram+), *Bacillus cereus* (Gram+) and antifungal activity against *Saccharomyces cerevisiae*, *Ustilago maydis* and *Aspergillus niger* by Disk diffusion method.

Morinda tinctoriya, *Mussaenda frondosa*, *Psychotria gardneri* and *Psychotria stenophylla* displayed the widest spectrum of antibacterial activity.

Supervisors: *Dr. U. L. B. Jayasinghe (IFS & PGIS)*
Prof. B. M. R. Bandara (University of Peradeniya & PGIS)

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## *M.Phil. (Chemical Sciences)*

### Development of amperometric sensors for detection of Cyhalothrin and Propanil

***A. M. Hafil,*** *Department of Chemistry, University of Peradeniya*

An electrochemical oxidation of cyhalothrin, 3-(2-chloro-3,3,3-trifluro-1-propenyl)-2,2-dimethylcyclopropane carboxylic acid cyano(3-phenoxyphenyl) methyl ester which is an active ingredient of Grenade 5 EC insecticide was carried out at a bare glassy carbon electrode in an aqueous solution of 0.1 mol $dm^{-3}$ NaCl using cyclic voltammetric and amperometric techniques.

Cyhalothrin is a synthetic pyrethroid and the acute oral $LD_{50}$ value for male rats is 243 mg/kg. The solubility of cyhalothrin in water at 25 $^0$C is 0.004 mg/l. It is used to control *haematobia* irritants on cattle and lice.

Preliminary electrochemical characterizations were conducted by cyclic voltammetry and, which indicated that the oxidation of cyhalothrin occurred at + 0.72 V vs. SCE, and it is a completely irreversible system. The amperometric detection of cyhalothrin at bare glassy carbon electrode was interfered with noise level at the optimum potential + 0.80 V vs. SCE. The noisy signals could be successfully eliminated by using a thin coating by dipping with electro-inactive coating of stearic acid on top of the glassy carbon electrode surface at optimized potential of + 0.80 V vs. SCE, and it resulted in the reduction of the instrumental responses. Sensitivity of the sensor was estimated to be 0.0592 A $mol^{-1}$ $dm^3$ using calibration plot and, the linear dynamic range was found from $1.75 \times 10^{-6}$ to $1.40 \times 10^{-5}$ mol $dm^{-3}$. The lifetime of the sensor was found for at least ten days. The response time ($t_{90}$) was measured as 5.4 s. the sensor responded for very low concentration with the minimum detection limit of $1.75 \times 10^{-7}$ mol $dm^{-3}$ when signal to noise ratio is 3. The coefficient of variation (CV) was 1.72%.

Propanil (3,4-DPA), N- (3,4-dichlorophanyl) propanamide is a contact herbicide used in post emergence control of grasses (Echimochloa) and broad leaf weeds in rice and potato fields. It is toxic to most leaf plants (inhibit photosynthesis) and non - toxic to tolerance plants as such plant contains the enzyme aryl acylamidase, which can metabolize propanil into 3,4 – dichloroaniline (3,4-DCA) and propionic acid. 3,4-DCA is the primary residue of the propanil, which could exist in the environment through subsequent pathways and more toxic (chronic) than propanil. As a result of the application of propanil, its residues can get into the environment, which remain in the agricultural commodities and the foodstuffs. Furthermore, propanil is stable only in the pH range of 7 - 10 and it degrades under extreme pH conditions. In this study we specifically aimed at the residue analysis of propanil both in the commercial samples and as a residue in the rice grains through cost effective electroanalytical methods. The cyclic voltammetry is a basic electroanalytical technique and is used to study the electrochemical behavior of the propanil residues. Subsequently it was possible to develop the amperometric sensor to detect 3,4-DCA as the popanil residue.The steady-state amperometric measurements were obtained at stearic acid modified glassy carbons electrode in 0.1 mol $dm^{-3}$ phosphate buffer (pH = 7) at the optimized potential at + 0.70 V vs. SCE and, the amperometric calibration curves were obtained for 3,4 – DCA. The linear dynamic range for the sensor was from $1.0 \times 10^{-4}$ to $5.3 \times 10^{-3}$ mol $dm^{-3}$ and the sensitivity was obtained to be 0.005 A $dm^3$ $mol^{-1}$. The minimum detection limit of the sensor was $2.0 \times 10^{-5}$ mol $dm^{-3}$ at signal to noise ratio is 3.

***Supervisor:*** *Dr. A. N. Navaratne (University of Peradeniya & PGIS)*
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M.Phil. (Physics)

Study of electrical conductivity and dielectric relaxation of PEO based composite polymer electrolytes and PAN based polymer electrolytes

P. A. R. D. Jayathilaka, *Department of Physics, University of Peradeniya*

Solid polymer electrolytes are formed by complexing an ionic salt with a solid polymer. These solid polymer electrolyte membranes have received much attention in the recent past due to the possibility of using them in novel nano-technological commercial applications. These systems show somewhat high ionic conductivity, which make them potentially important as electrolytes in high energy density rechargeable batteries. This thesis focuses on several important factors such as ionic conductivity, dielectric relaxation and thermal properties, which control the ion transport mechanism and conductivity enhancement mechanism in poly(ethylene oxide), PEO, based composite electrolytes and poly(acrylonitrile), PAN, based gel electrolytes.

In the case of PEO systems, Lithium bis(triflouromethanesulfone)imide (LiTFSI), Lithium triflouromethanesulfonate (LiTf), and Copper(II)triflouromethanesulfonate ($CuTf_2$), have been used as the complexing salt to prepare the polymer electrolytes. PEO – LiTFSI, PEO – LiTf, PEO – $CuTf_2$, have been chosen for this work. For composite electrolytes, four different sizes (< 10 μm, 37 nm, 10 – 20 nm, 5.8 nm) and four different types (acidic, basic, neutral, weak acidic) of alumina were used as ceramic fillers.

In all three composite polymer electrolytes, the ionic conductivity has enhanced considerably due to the incorporation of alumina filler grains. In the case of PEO - LiTFSI – Al_2O_3 composite electrolyte, incorporating four different types of alumina grains, the results show that the filler particles do not interact directly with PEO chains and the degree of conductivity enhancement depends on the nature of the filler surface group and decreases as acidic > basic > neutral > weak acidic. Transient bonding with H^+ and O^{2-} groups on alumina grain surface via Lewis acid–base type interactions appear to facilitate ionic motion by providing additional sites for ionic migration.

For the system, PEO – LiTf, out of the four different sizes of alumina fillers used, nano–porous alumina filler particles with pore size 5.8 nm have shown the highest conductivity increment. Further more, the conductivity versus filler concentration curves exhibit two conductivity maxima for filler grains with < 10 μm, 37 nm, and 10 – 20 nm grain size. The conductivity increase appears to be consistent with the idea that Lewis acid-base type interactions of ionic species with surface groups on alumina grains are responsible for the enhanced conductivity.

For the system, PAN / LiTFSI / EC / PC with 15.39 wt.% PAN / 2.56 wt.% LiTFSI / 82.05 wt.% EC+PC has shown the highest conductivity. The PAN polymer matrix appears to play a positive role in the ionic transport mechanism of the gel electrolyte rather than acting merely as an inert host.

Supervisors: *Prof. M. A. K. L. Dissanayake (PGIS & University of Peradeniya)*
Prof. B. –E. Mellander (Chalmers University, Gothenburg, Sweden)

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## *M.Phil. (Plant Sciences)*

### Characterization of accessions and reproductive biology of *Elettaria cardamomum* L. Maton in Sri Lanka

***A. L. S. Dharmaparakrama****, Department of Botany, University of Peradeniya*

Cardamom [*Elettaria cardamomum* L. Maton, family Zingiberaceae] belonging to Malabar, Vashukka, and Mysore types were studied under different agro-ecological conditions viz., wet zone, low country 1 (WL1) (> 2500 mm rainfall, < 150 m elevation, 30 $^0$C under a rubber canopy), intermediate zone, up country 1 (IU1) (> 2000 mm rainfall, >1000 m elevation, 24 $^0$C under a forest canopy) and intermediate zone, mid country 3 (IM3) (1000 - 2000 mm rainfall, 350 m elevation, 28 $^0$C under 50% shade, polythene net).

Results revealed that the capsule size and shape, panicle angle and inter-nodal length and texture of leaflet are the inherited characters. Number of capsules harvested per year per clump in the Mysore and Vashukka types in the IU1 region was 2071, 1016, 1183, 1051, 1061, from Ec 201, Ec 300, Ec 301, Ec 401, and Ec 700 respectively, whereas it was 534, 572, and 593 from the Malabar type accessions Ec 100, Ec 101 and Ec102 and 641 from Ec 400 of the Vashukka type, which performed best in the WL1 region.
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Well-distributed rainfall was the best condition for clump development. Four suckers and four panicles were produced alternatively on opposite sides of a pseudostem. Early sucker development was observed at WL1. The first sucker developed after 5 - 6 months age; the 2nd, 3rd and 4th suckers on a pseudostem were activated after 9 - 10, 10 - 12 and 18 - 19 months age. A maximum of 6 generations of daughter suckers were observed in a matured clump at a time.

Early maturity (15 months) and early death (36 months) of pseudostems were recorded at WL1 whereas that at IU1 was 40 months. At WL1, the first panicle on pseudostems was observed after 5 - 25 months. The 2nd, 3rd and 4th panicles on pseudostems were observed after 5 - 7 months, 14 - 16 months and 18 - 20 months respectively after the first panicle emerged irrespective of the type of cardamom. Considering the age of the individual pseudostems of a matured clump, the first panicle emerged at 8 months, while 2nd, 3rd and 4th panicles emerged respectively at 12-14, 16-18, 24-26 month ages in the Malabar type accession WL1. Late first panicle initiation (9 months) was observed at IU1 and IM3 regions. Capsules were taken 90 - 100 days for its maturity at WL1 and 95 - 105 days at IM3 and IU1 regions.

The optimum shade for cardamom is 50%. Under more than 70% shade, the clumps were tall and big but with few pseudostems (<10) per clump, the leaflets were dark green, the panicles were fewer and the yield was low. Under less than 50% shade, the clumps were short and thin but with many pseudostems, curved or dried and yellowish leaflets, few, short and thin panicles with low yield.

Differences in flower morphology may have some effect on yield in different eco-regions. Anthesis commenced before 4.00 a.m. and peaked at 5.00 - 5.30 a.m. Anthers dehiscence peaked between 6.00 - 8.00 a.m. and was completed before 11.00 a.m. stigma receptivity commenced before 6.00 a.m., was best between 7.00 and 9.00 a.m. and decreased after 12 noon to a nil at 6.00 p.m. Pollen grains were of two different sizes (35.31 µm ± 9.2, and 44.93 µm ± 9.8). The Malabar type had smaller pollen grains. They were highly stainable (> 75%) and had a high percent of germination under a wide range of sugar concentrations (16 - 18%). Self-pollinated flowers expressed the lowest (< 5.8%) fruit set. Pollination within a clump or accession was 10.7 to 15.4% fruit set and within a type 21.3 – 26.2%. The best cropping system is a mixture of accessions at least from the same type of cardamom.

Supervisors: *Prof. I. A. U. N. Gunatilleke (University of Peradeniya & PGIS)*
Prof. C. V. S. Gunatilleke (University of Peradeniya & PGIS)

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## *M.Phil. (Plant Sciences)*

### Postharvest losses and induction of resistance in aubergine (*Solanum melongena*) against anthracnose caused by *Colletotrichum capsici*, using a weak pathogen, *Fusarium solani*

***C. Mahendranathan,*** *Department of Botany, Eastern University of Sri Lanka*

A market survey conducted in Kandy area in the central province of Sri Lanka, revealed that approximately 19% losses occur in aubergines at the market and several factors including improper handling practices, fungal diseases, insect damage and physiological disorders contribute to the loss. Anthracnose caused by *Colletotrichum capsici* was identified as a major postharvest disease in aubergine and *Phomophsis* rot and *Fusarium* rot were also encountered during the survey. Investigations were conducted to examine the possibility of inducing resistance in aubergine against anthracnose disease using a relatively weaker pathogen, *Fusarium solani*, and establish the mechanism involved in induction of resistance. Anthracnose disease is currently controlled by application of fungicides. Enhancement or induction of natural resistance mechanisms could have a potential for controlling postharvest diseases in fruits and serve as an alternative approach for fungicides.

*C. capsici* develops anthracnose lesions in both wounded and unwounded aubergines and the lesion development was observed to be faster in the wounded fruit. *F. solani*, however, caused lesions only when the fruits were inoculated after wounding and not in intact fruits. *C. capsici* is a more aggressive pathogen in aubergine than *F. solani*. Treatment of unwounded sites with conidia of *F. solani*, at least two days prior to inoculation with *C. capsici* delayed anthracnose development by six days, compared to controls, treated with sterile distilled water. Co-inoculation with conidia of both fungi did not slow down *C. capsici* rotting.

The growth of neither *C. capsici* nor *F. solani* was affected on agar medium. Also *in vitro* germination studies on a mixed preparation of conidia of the two fungi indicated that germination of conidia or appressoria formation of *C. capsici* was not
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affected by the presence of conidia of *F. solani*. These observations confirmed that *F. solani* has no antagonistic effect on *C. capsici*.

Ethyl acetate extracts of peel tissue obtained from aubergines two days after inoculation with conidia of *C. capsici* or *F. solani* when bioassayed on TLC plates with either *C. capsici* or *Cladosporium cladosporioides* showed one prominent antifungal zone at R_f 0.70 and not in healthy tissue showing that the aubergine tissue accumulates phytoalexin/s in response to inoculation by either pathogen. Inoculation of aubergines with either pathogen after wounding resulted in accumulation of more phytoalexin than the fruit inoculated without wounding. In both, the amount of phytoalexin increased progressively with the increase of incubation period after inoculation. The amount of phytoalexin accumulated in fruit tissue inoculated with *F. solani* was significantly greater at all incubation periods than in the tissue obtained from fruits inoculated with *C. capsici*. It shows that the pre-inoculation of aubergines with *F. solani* results in grater phytoalexin accumulation, which is sufficient to prevent the lesion development by *C. capsici. F. solani* appears to be a more effective elicitor of host natural resistance than *C. capsici*.

To purify phytoalexins, 50 g of tissue inoculated with *F. solani* were extracted and the extract was fractionated by flash chromatography. Two compounds with antifungal properties were obtained in pure form. The major compound that accounts for the most antifungal activity was identified as lubimin.

It can be concluded that natural resistance in aubergines against *C. capsici* could be induced using a weaker pathogen, *F. solani* and phytoalexin accumulation appears to be one of the mechanisms of induced resistance.

Supervisor: *Prof. N. K. B. Adikaram (University of Peradeniya & PGIS)*

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## *M.Phil. (Zoological Sciences)*

### Nest site fidelity and nesting behaviour of marine turtles in Rekawa turtle rookery

***E. M. L. Ekanayake,*** *Department of Zoology, University of Peradeniya*

There are seven species of marine turtles living in the world and five of them come to nest in Sri Lanka. They are green turtle (*Chelonia mydas*), loggerhead (*Caretta caretta*), hawksbill (*Eretmochelys imbricata*), olive ridley (*Lepidochelys olivacea*), and leatherback (*Dermochelys coriacea*). This study was carried out in Rekawa turtle rookery, a two-kilometer stretch of beach in the southern Sri Lanka. All the turtle species nesting in Sri Lanka nested at Rekawa study site during the period of this study. Studies were carried out on all five species with more emphasis on the most frequent species, the green turtles.

The total time taken for the nesting process of all five species in Rekawa was similar to the observations made in other parts of the world while green turtles have taken the longest duration. The percentage time for the each activity was calculated. The average egg count, egg weight and egg diameter was calculated. The nesting was observed throughout the year with a peak season from March to July. Ninety six percent of the turtles nested at Rekawa beach were green turtles.

The turtles selected different locations for nesting on the beach. In some places there were several nesting, while in other areas only a few nesting were observed. It was observed that the distance to the vegetation from the nests was also varied. The green turtles show a high degree of nest site fidelity and 75% of them came back to re-nest on the same site. The average number of nests in a single nesting season for the green turtles was 4.1 (SE = 0.1) with a minimum of one and a maximum of 12 nesting.

On the basis of temperature dependent sex determination (TSD) the sex ratio of the hatchling green turtle on the Rekawa beach was 71% females: 29% males (7:3). This study revealed that there was no correlation between the number of nesting turtles and the lunar cycles as well as the tidal level.

***Supervisors:*** *Mr. K. B. Ranawana (University of Peradeniya & PGIS)*
*Dr. S. Wijekoon (University of Peradeniya & PGIS)*
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M.Phil. (Zoological Sciences)

Status of insecticide resistance and resistance mechanisms in some of the rice insect pests and four of their predators

K. C. Weerakoon, *Department of Zoology, University of Peradeniya*

Insecticide resistance and the underlying resistance mechanisms were studied in five rice insect pests (brown planthopper *Nilaparvata lugens*; green leafhopper *Nephotettix virescens*; paddy bug *Leptocorisa oratorius*; white leafhopper *Cofana spectra* and white-backed planthopper *Sogatella furcifera*), and four of their predators (lady-bird beetle *Micraspis discolor*; ground beetle *Ophionea indica*; mired bug C*ytorhinus lividipennis* and spider *Tetragnatha* sp.) insects were collected from the rice fields at Batalagoda, Kurunegala district (intermediate zone) and Angunakolapalassa, Hambanthota district (dry zone) of Sri Lanka from August 1999 to January 2002. Insects were subjected to insecticide bioassays with dimethoate and chlorpurifos (organophosphates), permethrin (a pyrethroid) and carbosulfan and BPMC (carbamates). A fixed dosage of 3500 µg/g DDT and 4400 µg/g malathion was used to assess the DDT and malathion tolerance. Bioassays were carried out by topical application method. Log-probit mortality lines and LD_{50}/LD_{90} values were obtained for each insecticide except for malathion and DDT, for all the species. For malathion and DDT percentage mortalities were recorded.

N. lugens collected from both sites showed high resistance to permethrin. *L. oratorius* population at Angunakolapalassa was resistant to carbosulfan compared to Batalagoda population. *L. oratorius*, *M. discolors* and *Tetragnatha* sp. populations at Angunakolapalassa were susceptible to permethrin compared to Batalagoda populations and *Tetragnatha* sp. population was susceptible to chlorpyrifos resistance at Angunakolapalassa. Others showed similar resistance level at both study areas. In general, most of the species tested from Batalagoda and Angunakolapalassa had lower tolerance for malathion although some species showed higher tolerance for DDT. To measure the carboxylesterase activity two substrates α/β naphthyl acetate and p-nitrophenyl acetate were used. Highest carboxylesterase activity with the substrate pNPA was present in *S. furcifera* (mean specific activity= 1.91 µmol/min/mg). Lowest activity was found in *L. oratorius* (mean specific activity= 0.02 µmol/min/mg). Native polyacrylamide gel electrophoresis was used to resolve carboxylesterase isoenzymes. No elevated carboxylesterase bands were found in *O. indica*. The major mechanism of insecticide resistance of rice insect pests and predators was elevated carboxylesterases. Malathion metabolism studies showed the absences of malathion carboxylesterases in all the species. Glutathione S-transferase activities were high in *O. indica* (mean specific activity= 0.55 µmol/min/mg) and very low in *Tetragnatha* sp. (mean specific activity= 0.11 µmol/min/mg). Presence of high oxidase concentrations were detected in *M. discolor* (mean oxidase concentration = 3.82 units) and *Tetragnatha* sp. (mean oxidase concentration = 8.75 units). Inhibition of the organophosphate and carbamate targetsite acetylcholinesterase (AChE) with propoxur and paraoxon showed that AChEs of *S. furcifera*, *Tetragnatha* sp.and *C. lividipennis* populations are not sensitive to these insecticides. High activity of carboxylesterases and altered acetylcholinesterases were correlated with high resistance to organophosphates and carbamates. High levels of glutathione S-transferaes activity had provided high resistance to organochlorines and high oxidase concentrations were correlated with pyrethroid resistance.

Supervisors: *Prof. S. H. P. P. Karunaratne (University of Peradeniya & PGIS)*
Dr. G. K. Manuweera (Office of the Pesticide Registrar, Peradeniya)

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## *FOREIGN VISITORS (APRIL - DECEMBER 2003)*

- *Dr. Jeremy Russell-Smith, Park & Wildlife Commission, Northern Territories, Australia*
- *Ian Bally, Queensland Department of Primary Industries, Mureeba, Queensland, Australia*
- *Dr. Ananda Gunawardena, School of Computer Science, Carnegie Mellon University, Pittsburgh, USA*
- *Dr. Sunil Ratnayake, Food Science Programme, Department of Chemistry, University of Auckland, New Zealand*
- *Prof. Gerhard Glatzel, Head, Institute of Forest Ecology & Dean, Forestry at Universitaet fuer Bodenkultur, Vienna, Austria*
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- *Peter Dietze, Control Engineering Expert from Germany*
- *Prof. J.-L. Souquet, INPG, University of Grenoble, France*
- *Prof. A. Kulkarni, IIT Mumbai, India*
- *Dr. David Burslem, Department of Plant and Soil Science, University of Aberdeen, UK*
- *Prof. Karl-Heinz Wyrwoll, University of Western Australia*
- *Mr. R. Mehta, Apollo Hospitals, Colombo*
- *Prof. Mark Ashton, School of Forestry and Environmental Studies, University of Yale, USA*
- *Prof. Ryuzo Yokoyama, JICA/AIT*
- *Dr. Lal Samarakoon, JAXA/AIT*
- *Dr. Prima, Iwate University, Japan*
- *Dr. J. Horrocks, Visiting Medical Physicist, UK*

M.Sc. PROGRAMMES COMMENCED DURING APRIL - DECEMBER 2003

M.Sc. Programme	***Board of Study***	***Coordinators***	***No. of Students***
Industrial Chemistry	*Chemical Sciences*	*Dr. A Wickramasinghe, Department of Chemistry & Dr. P Karunaratne, Department of Chemical Engineering, University of Peradeniya*	*8*
Medical Physics	*Physics*	*Dr. P. Ekanayake, Department of Physics, Dr. L. Watawana, Nuclear Medicine Unit & Dr. B. Hewawitharana, Department of Medicine, University of Peradeniya and Dr. S. Wattegama, Clinical Oncologist, General Hospital, Kandy*	*9*
Plant Sciences	*Plant Sciences*	*Dr. S Madawala Weerasinghe, Department of Botany, University of Peradeniya*	*20*
Analytical Chemistry	*Chemical Sciences*	*Dr. A. Bandara, Department of Chemistry, University of Peradeniya*	*24*
Computer Science	*Statistics & Computer Science*	*Dr. A. Perera, Department of Mathematics, University of Peradeniya*	*45*

NEW M.SC. PROGRAMMES PLANNED FOR 2004

M.Sc. Programme	Board of Study
Computational Statistics	*Statistics and Computer Science*
Management Information Systems	*Statistics and Computer Science*
Science & Technology Management	*Science Education*
Molecular Biology and Bio-informatics	*Biochemistry and Molecular Biology*
GIS and Remote Sensing	*Earth Sciences*

M.SC. PROGRAMMES OFFERED BY THE PGIS

- *Analytical Chemistry*
- *Applied Statistics*
- *Biodiversity Conservation Management*
- *Chemical Ecology and Pesticide Chemistry*
- *Clinical Biochemistry*
- *Computer Science*
- *Engineering Geology and Hydrogeology*
- *Environmental Science*
- *Experimental Biotechnology*
- *Fish and Wildlife Management*
- *Gemmology/Industrial Minerals*
- *Industrial Chemistry*
- *Industrial Mathematics*
- *Medical Physics*
- *Oceanography*
- *Parasitology*
- *Physics of Materials*
- *Plant Sciences*
- *Postharvest Technology of Fruits and Vegetables*
- *Science Education*

PGIS entertains applications from Sri Lankan and foreign students for admission to its M.Sc., M.Phil. and Ph.D. programmes. For details, please visit our website: http://www.pgis.lk.

We appreciate the services by Mr. Dhammika Welhenge, Corporate Safety and Environment Manager, Unilever Ceylon Ltd. in conducting the course module on "Industrial Safety" for the M.Sc. programme in Industrial Chemistry 2003. Sponsorship by Unilever Ceylon Ltd., Colombo is gratefully acknowledged.

PUBLIC LECTURES AND SEMINARS
PRESENTED AT THE PGIS DURING APRIL - DECEMBER 2003

Title of the Seminar	*Presenter's Name & Affiliation*	*Date*
Inventory of Medicinal Plants of Sri Lanka: Some Interesting Analyses	*Dr. Jeremy Russell-Smith* *Park & Wildlife Commission, Northern Territories, Australia*	*June 10*
Australian Mango Production and Breeding Programme	*Ian Bally* *Queensland Department of Primary Industries Mureeba, Queensland, Australia*	*June 11*
Latest Trends in Smart e-Learning Technologies	*Dr. Ananda Gunawardena* *School of Computer Science, Carnegie Mellon University, Pittsburgh, USA*	*June 23*
Recombinant Thermoenzymes: A Biocatalyst for Industries' & 'Physico-chemical Properties of Buttercup Squash	*Dr. Sunil Ratnayake* *Food Science Programme, Department of Chemistry University of Auckland, New Zealand*	*July 15*
A Brief History of Forest use in Central Europe	*Prof. Gerhard Glatzel* *Head, Institute of Forest Ecology &* *Dean, Forestry at Universitaet fuer Bodenkultur Vienna, Austria*	*August 6*
The Controversy about CO_2, Climate and Energy	*Peter Dietze* *Control Engineering Expert from Germany*	*October 29*
Maintenance of Tropical Forest Diversity: The Plots Thicken	*Dr. David Burslem* *Department of Plant and Soil Science University of Aberdeen, UK*	*December 4*
Rehabilitation of Abandoned Agricultural Lands: Comparison Across Tropical Wet Forest Biomes	*Prof. Mark Ashton* *School of Forestry and Environmental Studies University of Yale, USA*	*December 19*
Remote Sensing and GIS	*Prof. Ryuzo Yokoyama, JICA/AIT* *Dr. Lal Samarakoon, JAXA/AIT* *Dr. Prima, Iwate University, Japan*	*December 24*

WORKSHOPS (WS) AND SHORT COURSES (SC) CONDUCTED DURING APRIL - DECEMBER 2003

Event	***Co-ordinator/s (Board/s of Study)***	***Period***	***No. of Participants***
Short Course Buffet on Computer Applications & Statistics (SC)	Mr. R. Weerasekara (*Statistics & Computer Science*)	May 9 - 11	56
Computer Mathematics for University Academic Staff (SC)	Dr. A.A.I. Perera Dr. C. J. Jayawardane (*Mathematics*)	Aug. 9 - 11	11
Active Teaching & Learning Approaches in Science (WS)	Dr. S. Karunaratne (*Science Education*)	Sep. 11 – 13	120
Scientific Writing (WS)	Dr. N.C. Bandara (*PGIS*)	Oct. 17	77
Advanced Organic Chemistry (SC)	Dr. L. Jayasinghe (*Chemical Sciences*)	Oct., 2003 to Feb., 2004	20
Development and Maintenance of Web Applications in Commerce (WS)	Dr. S. Kodituwakku (*Statistics & Computer Science*)	Nov. 1 - 2	29
Active Teaching & Learning Approaches in Science (WS)	Dr. S. Karunaratne (*Science Education*)	Dec. 1 - 5	78

SHORT COURSE BUFFET ON COMPUTER APPLICATIONS & STATISTICS

"Being on the cutting edge of technology is no longer a luxury, it's a necessity"

Mr. Roshan Weerasekera, Course Cordinator addressing the inaugural session of the Short Course Buffet held at the PGIS on May 9, 2003. (Seated L to R): Prof. R. O. Thattil (Director, PGIA), Prof. K. Dahanayake (Director, PGIS) and Dr. K. M. Liyanage (Chairman, PGIS Board of Study in Statistics & Computer Science).

The Board of Study in Statistics and Computer Science of the PGIS organized a workshop on Computer Applications and Statistics during May 9 - 11, 2003. More than 50 participants including university academics, medical doctors, researchers, officers from commercial enterprises, etc. attended the programme.

During last couple of decades information technology has permeated to every corner of the society, and there is no doubt that our daily lives are significantly affected by this revolution. This is true in our professional disciplines, workplaces, schools/universities, domestic/leisure activities, etc. Having this in mind, the Board of study in Statistics and Computer Science organized the Short Course Buffet on Computer Applications and Statistics.

Buffet consisted of the following 12 course modules related to Statistics and Computer Applications: *Add 'color' to your presentation using computer; Assemble your own computer in 4 hours; Convert your computer into an intelligent machine; Trend lines and Simple curve fitting; Forecast profits in your business; How to become a better researcher; How to conduct a nationwide survey efficiently; How to conduct case-control studies in Medicine; Decision making using Statistics; Comparison of two random samples of data; Basic skills for analyzing quality related data; How to network your computer.*

The 12 course modules were offered in six sessions by conducting two parallel sessions throughout the programme during the three days. The resource persons for the workshop were drawn from the Faculty of Agriculture, Faculty of Science, Faculty of Engineering and Information Technology Center of the University of Peradeniya.

Each participant was asked to complete an evaluation form for each course module. Most of the participants evaluated the programme as very useful and requested follow-up courses in the future.

Coordinator: Roshan Weerasekera

SHORT COURSE ON COMPUTER MATHEMATICS FOR UNIVERSITY ACADEMIC STAFF

Dr. Shelton Perera, Chairman of the PGIS Board of Study in Mathematics addressing the inaugural session of the Short Course on Computer Mathematics held at the PGIS on August 9, 2003. (Seated L to R): Prof. V. Kumar (Dean, Faculty of Science), Prof. M. A. K. L. Dissanayake (Director, PGIS) and Dr. A. A. I. Perera (Course Coordinator & Secretary, Board of Study in Mathematics).

A three-day workshop on computer mathematics was successfully organized by the Board of Study in Mathematics from 9th – 11th August 2003. The main objective of the workshop was to provide Mathematics Teachers with an adequate knowledge in basic computer skills specially oriented towards Mathematical packages.

There were 11 participants drawn from universities and private schools.

The resource persons from the University of Peradeniya, University of Colombo and University of Kelaniya conducted courses in MathLab, Mathematica, Lingo and document preparation using LaTex. Prof. David Clay, a Fulbright professor from United States conducted a course on Web Page Designing.

Coordinators: Dr. A. A. I. Perera & Dr. C. J. Jayawardana

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3rd WORKSHOP ON ACTIVE TEACHING AND LEARNING APPROACHES IN SCIENCE (ATLAS) FOR JUNIOR SECONDARY TEACHERS

Dr. Mark Windale in a discussion with a group of participants of the ATLAS workshop held at the PGIS during December 1 – 5, 2003.

Through the DFID Higher Education Link (HEL) programme between the Postgraduate Institute of Science (PGIS) and Sheffield Hallam University (SHU) of UK managed by the British Council, the 3rd ATLAS workshop was conducted from December 1-5, 2003 at PGIS for 78 junior secondary teachers. The principal resource person was Dr. Mark Windale from SHU. This was a writing workshop in which the participants had to develop curriculum materials. It was a totally new experience and a challenging task for the participants. The participants were divided into eight groups, and each group selected a topic of their interest covering the grade 7 - 11 syllabus. At first, they had a brain storming session to plan what kind of activities to be included in the curriculum materials. In developing the plans, they had to use what they have learnt in previous two workshops such as active reading, active writing, games, simulations and investigation activities. The participants found

that it was very difficult to select appropriate activities and the order to present a particular scientific concept. All the eight groups presented their plans to the whole group. The comments and suggestions received were appreciated and helped the participants to do modifications to the original plan.

By the end of the last day, eight "topic packs" were developed which will be edited before use by the teachers back in their schools. The workshop was an enormous success and, really did help to develop the capacity of the participants to write curriculum materials adopting the active teaching and learning approaches.

Coordinator: Dr. S. Karunaratne

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WORKSHOP ON SCIENTIFIC WRITING

PGIS organized a one-day workshop on Scientific Writing for PGIS students registered for M.Sc., M.Phil. & Ph.D. degrees. It was held on October 17, 2003 at the PGIS auditorium and 77 PGIS students participated in the workshop.

The workshop consisted of lectures/discussions on various aspects of postgraduate theses writing. The topics covered at the workshop were: *Scientific Writing - Structure/layout of a thesis, Problems in Thesis Writing – Sri Lankan Situation, Title & Abstract, Introduction & Bibliography, Computer Aided Literature Survey, Experimental/Materials and Methods and Results, Interpretation & Conclusion.* Professors B. M. R. Bandara, M. A. Careem, K. Dahanayake, M. A. K. L. Dissanayake, J. Edirisinghe & O. A. Ileperuma (Faculty of Science) and Dr. P. M. K. Alahakoon (Faculty of Agriculture), University of Peradeniya served as resource persons.

Coordinator: Dr. N. C. Bandara

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POSTGRADUATE CERTIFICATE COURSE IN ADVANCED ORGANIC CHEMISTRY

The Board of Study in Chemical Sciences initiated a Postgraduate Certificate Course in Advanced Organic Chemistry to facilitate the compulsory four credit requirements of postgraduate lecture courses for students registered for M.Phil. and Ph.D. Degrees at the PGIS and to give an opportunity to acquire competence in Advanced Organic Chemistry for others who are interested.

The course consists of five modules: *Biosynthesis and Biomolecules (15hr); Advanced Spectroscopy (15 hr); Organic Synthesis (15 hr); Structure, Reactivity and Stereochemistry (15 hr); Seminar presentation*.

Twenty students are following this course. The course commenced on October 18, 2003 and is held during weekends. It is scheduled to conclude in February 2004.

Coordinator: Dr. L. Jayasinghe

WORKSHOP ON DEVELOPMENT AND MAINTENANCE OF WEB APPLICATIONS IN COMMERCE AND EDUCATION

Prof. David Clay, the Principal Resource Person of the workshop with participants during a session at the PGIS Computer Unit.

The growth of the World-Wide Web (WWW or simply Web) today is simply phenomenal. Each day, thousands more people gain access to the Internet. Easy retrieval of electronic information in conjunction with the multimedia capabilities of Web browsers, such as Netscape and Internet explorer, has led to information explosion.

Although web application is not new for developed countries, it is relatively new for developing countries including Sri Lanka. For instance, except electronic banking, very few web applications are used for business and educational purposes in Sri Lanka. Both industry and educational institutions still have to learn more about web applications and e-Commerce. In order to expose personnel from industry and educational institutes to new developments in web-based applications, Postgraduate Institute of Science, University of Peradeniya conducted a workshop on "Development and maintenance of web applications in Commerce and Education " during November 1 – 2, 2003.

Prof. David Clay, Florida Institute of Technology, USA was the key resource person of the workshop. Prof. David Clay has wide experience in the development of web-based applications and the support technologies. He shared his knowledge and experience with the participants.

Some of the main features of the workshop were: (a) web-based applications to support government and industry for more efficient exchange of information in commercial transactions (b) familiarization of personnel from organizations which are not currently taking advantage of the potential of web applications with the development issues that must be addresses when considering an entry onto the information superhighway (c) identifying the specific components needed to build and deploy web applications so that personnel may evaluate the suitability of current IT resources for future web applications (d) outlining of the changes necessary for an organization to shift from a paper based IT culture to a more accessible and economical digital IT culture which requires more technical skills from the employees.

According to the feedback received, this workshop was very successful. Participants requested to continue this activity by organizing more workshops on this topic.

Coordinator: Dr. S. R. Kodituwakku

EUROPEAN COMMISSION ASIA - LINK PROGRAMME

Prof. I. A. U. N. Gunatilake

A grant proposal submitted jointly by the University of Aberdeen, UK in collaboration with the University of Peradeniya through the Postgraduate Institute of Science, and the University of BOKU, Vienna, Austria towards 'Development of Human Resource Capacity for Teaching and Research on Restoration of Degraded Tropical Ecosystems' was successfully funded for a period of three years from 01 May 2003.

The primary objective of this project is to develop the capacity of the three partner Higher Education institutions to undertake the research and training activities required to understand and reverse damaging environmental and social impacts of ecosystem degradation resulting from anthropogenic activities in Sri Lanka. The three major components are the following: (i) To develop human resource capacity for research restoration of degraded tropical lands in Sri Lanka through integrated training programmes for postgraduate students, and junior and senior faculty of the three participating institutions, (ii) the scientific objectives being (a) to understand the mechanisms that constrain successional development of vegetation on degraded grasslands and (b) soil carbon sequestration of major vegetation types in the mid-country of Sri Lanka and (c) the patterns of resource use and socially acceptable methodologies for uptake of restoration techniques by communities living adjacent to degraded grassland and *Pinus* plantations, (iii) the dissemination objectives are to develop communications strategy that will involve dissemination of knowledge and experience of ecological restoration techniques to local communities, undergraduates and postgraduates in the three partner institutions, as well as the wider national and international academic communities.

Under this project, two Sri Lankan graduates, Ms. A. M.T. Gunaratne (at Aberdeen University) and Mr. A.L. S. Dharmaparakrama (at University of BOKU, Vienna) have registered for split Ph.D. training in which fieldwork is being conducted in Sri Lanka. A third European graduate Ms. Corrine Fisher, registered at and partially funded by the Aberdeen University for her Ph.D. is conducting her field research in social forestry in Sri Lanka.

Three technical workshops designed to exchange experience and upgrade skills of postgraduate students and junior and senior faculty, of the partner institutions in (i) techniques in ecological research on below-ground processes (at Aberdeen - 2003), (ii) modern techniques in plant physiological ecology (in BOKU, Vienna - 2004), and (iii) research methods for rural resource restoration (at Peradeniya - 2005) are included in this project.

In addition, nine placements for postgraduate M.Sc./M.Phil. students (six EU and three Sri Lankan) to conduct short-term research projects at an alternative partner institution and learning support for nominated M.Sc./M.Phil. courses at the Postgraduate Institute of Science, University of Peradeniya are also funded through the project.

This project was built upon the initial collaborative research and training project on the 'Introduction of analytical techniques in plant and soil science for adaptive research towards restoration and efficient management of the degraded natural forests in Sri Lanka' between the Department of Botany at University of

Peradeniya and the Department of Plant and Soil Sciences at University of Aberdeen carried out over a period of three years from 2000 - 2002 under the Higher Education Link Programme of the British Council. A Memorandum of Understanding has been signed between the University of Peradeniya and University of Aberdeen to facilitate these academic activities. Necessary approval for the conduct of research and training has been obtained from the University of Peradeniya and the Department of Forest Conservation and the three Ph.D. students have initiated their field research in Sri Lanka with the exchange of faculty already underway.

The project co-ordinators are Dr. David Burslem (Aberdeen), Prof. Nimal Gunatilleke (Peradeniya) and Prof. Gerhard Glatzel (Vienna, BOKU) while Prof. Savitri Gunatilleke and Dr. Kushan Tennakoon, Dr. Sumedha Madawela Weeasinghe and Dr. Herath Gunatilake (Peradeniya University) and Dr. Gamini Seneviratne (IFS, Kandy) are the other participating scientists from Sri Lanka.

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BRITISH COUNCIL HIGHER EDUCATION LINK PROGRAMME

Dr. S. Karunaratne

The DFID Higher Education Link (HEL) programme between the Postgraduate Institute of Science (PGIS) and Sheffield Hallam University (SHU) of UK is managed by the British Council. Activities of this link started in March 2002. The link title is, "An intervention of science teachers through public awareness programmes in natural sciences, energy, environment in the reduction of poverty." The first year of the link mainly spent on public awareness activities to encourage public in using solar energy as an alternative energy source. Dr. I. M. Dharmadasa from SHU delivered lectures on solar energy applications at University of Peradeniya, PGIS and at the Faculty of Engineering. In addition he also conducted lectures at Mawanella and Kurunegala for public and school children. Two exhibitions were also held at the university and at Mawanella to display solar panels and their applications.

From the second half of the first year, teacher training activities were started. Dr. Mark Windale from SHU conducted three workshops at PGIS and one workshop at the British Council, Colombo and another workshop at the National Institute of Education, Maharagama on Active Teaching and Learning Approaches in Science (ATLAS) for junior secondary teachers. The teachers really appreciated and enjoyed the experience at all these workshops and, found it very useful, particularly the hands-on experience of the activities. Developing curriculum materials for their own teaching using ATLAS was a challenging task for the participants, but at the end they enjoyed the activity and felt quite satisfied and requested to organize more and more workshops of that nature. They also requested to have the programme island-wide. From the PGIS, the link coordinator, Dr. Sunethra Karunaratne, former director, Prof. Kapila Dahanayake and two MSc in Science Education graduates who have shown the best performance in two batches—Mrs. Ashoka Abeykoon Menike and Mrs. Udeni Pushpalatha Ratnayake made visits to SHU to learn more about ATLAS and to attend the annual meeting of the Association for Science Education (ASE). It is clear that the ATLAS programme addresses the current needs and priorities of science education in the country.

UNIVERSITY – INDUSTRY LINKS

USE OF BLAST FREEZING TO EXTEND STORAGE LIFE OF MINIMALLY PROCESSED VEGETABLES

Mr. V. Rathnabharathie and Dr. C. Abayasekara

Compared to meats and fruits, preparation of CERTAIN vegetables for cooking has been more time consuming and troublesome. The demand in the household and catering industry for convenient, ready-to-use, minimally processed fresh vegetables containing only natural ingredients is rapidly increasing. During minimal processing, vegetables may be cleaned, peeled, cut, sliced, packed or processed by any means short of killing the tissues. Minimally processed fresh produce is generally stored and marketed under refrigeration, therefore retains flavor, aroma and nutritional value. However, maintaining their freshness and microbiological quality over a substantial period of time has become a challenging task. Unlike fruits, most vegetables are more perishable because the acidity is not considerably high. To overcome this, the industry has now turned to minimally processed frozen vegetable products with longer storage life and freshness.

Freezing is lowering of temperature below zero Celsius and reduces the speed of different enzyme catalyzed reactions, ripening, senescence and microbial functions. Materials that have been frozen can be kept in frozen storage for longer times, without adverse quality losses such as undesirable color, flavor and texture.

Blast freezing was shown to be an excellent technology to extend the storage life of minimal processed young jak fruit (`polos', *Artocarpus heterophyllus*). Rapid freezing causes lesser damage to cells than conventional freezing and does not permit enzymes and substrates to mix preventing undesirable effects such as browning. Young jak fruits free of mechanical or insect damage were selected, washed with chlorinated water (200 ppm) to remove dust, debris and surface microbes. Fruits were peeled and cut into uniform-sized pieces and immediately placed in 5% citric acid solution to prevent browning. After about 5 minutes, the pieces were removed and

Blast Frozen Polos

Blast Frozen Breadfruit

allowed to dry and vacuum packed in nylon-mixed, low density polyethylene films. The packs were subjected to rapid freezing in a front loading air blast freezer at -29^{o}C. Rapid freezing at sub-zero temperatures is costly, therefore optimum freezing time was determined. Blast freezing of young jak fruit retains quality and allows storage for over three months. Blast frozen jak fruit samples were analysed for ash, moisture content, browning and organoleptic properties (hedonic test) and compared with slow frozen or freshly cut pieces. The results showed that blast freezing does not affect any of these parameters significantly. Microbiological quality tests revealed that the produce is free of coliforms, *Shigella* or *Salmonella.* Among enzymes that could deteriorate vegetables, peroxidase is the most heat stable enzyme that causes off flavors, discoloration and textural

damages. Blanching (scalding vegetables in boiling water for 2 minutes or steam for 7 minutes) is a process to overcome enzyme action and the time of blanching is determined taking the inactivation time of peroxidase enzyme. Blanching prior to blast freezing of `polos' caused the development of poor colour (pale) and texture. Therefore blanching was not suitable for `polos'. It also revealed that vacuum packing retained young jak fruit quality better than normal packing. The cost of 1 kg of blast frozen `polos' was estimated to be Rs. 31/= at village level where the raw material and labour are relatively inexpensive. However, at commercial level in the city the cost was somewhat higher about Rs. 89/= per kg as the raw material and labour are costly. The blast freezing technology was successfully applied to several other local vegetables including tapioca, kiriala, bread fruit, mature jak fruit and drumsticks.

There is little or no effort on research and development on freezing of vegetables in Sri Lanka, particularly for indigenous vegetables. Since indigenous vegetables have a greater demand in the Middle East, the Maldive Islands and Europe with a large Asian expatriate community, frozen vegetable products will have a good potential in the export market.

**Varuna Rathnabharathie was a student enrolled under the Master of Science programme in Postharvest Technology of fruits & Vegetable and this account is based on his M.Sc. research project carried out under the supervision of **Dr. (Mrs.) Charmalie Abayasekara, Department of Botany, University of Peradeniya.* *He gratefully acknowledges the assistance extended by Mr. Shanthi Wijesinghe, Consolidated Business Systems Ltd., Boralasgamuwa and Professor A Bamunuarachchi, Sri Jayawardenapura University.*

FORTHCOMING EVENTS

- *Short Course on GIS and its Applications* *(January 8 – 16, 2004)*
- *Commencement of the following M.Sc. programmes:*
  - *Applied Statistics* *(March 6, 2004)*
  - *Industrial Mathematics* *(March 6, 2004)*
  - *Science Education* *(March 6, 2004)*
  - *Physics of Materials* *(April, 2004)*
- *Workshop on Applied Biology for A/L Teachers* *(April, 2004)*
- *Workshop on Scientific Writing* *(April, 2004)*
- *Workshop on Geomorphology* *(May, 2004)*
- *International Statistical Conference on* "Visions of Futuristic Statistical Methodologies" *(December 28 – 30, 2004)*

INTERNATIONAL STATISTICAL CONFERENCE: VISIONS OF FUTURISTIC STATISTICAL METHODOLOGIES

28 – 30 December 2004, Peradeniya

The Board of Study in Statistics and Computer Science of the PGIS and the Department of Statistics and Computer Science of the Faculty of Science, University of Peradeniya are now making arrangements to host the above international conference to be held at the PGIS during 28 – 30 December 2004. The primary purpose of the conference is to bring together statisticians from the developed and developing countries to present their latest research findings and to interact and exchange ideas. The conference will feature both **invited** and **contributed papers**.

ORGANIZERS

Basil M de Silva, *RMIT University, Melbourne, **AUSTRALIA***
Nitis Mukhopadhyay, *University of Connecticut, Strros, **USA***
Tim B. Swartz, *Simon Fraser University, BC, **CANADA*** &
S. Ganesalingam, *Massey University, **NEW ZEALAND***

CALL FOR PAPERS

Prospective participants are invited to attend this three-day international conference, which would cover topics in all areas of statistics, probability, and their applications.

INVITED SPEAKERS

The programme would include a number of internationally renowned "plenary speakers" and "invited speakers" who are in the forefront of statistical education, research, and practice.

CONTRIBUTED PAPERS

Contributed papers are welcome from the international and local statistics community, but their inclusion in the programme will be subject to notification of acceptance by the Program Committee.

PAPER SUBMISSION

Full-length manuscripts must be submitted for refereeing on or before **30 April, 2004** via email to Basil M de Silva (desilva@rmit.edu.au).

CONFERENCE PROCEEDINGS

A special "*Conference Proceedings*" volume will be published, and a selected set of papers of high standard may be considered for publication in a special issue of a peer-reviewed international journal. A *Book of Abstracts* of all presentations will be available at the conference.

REGISTRATION FEE

Category	***If paid before 31 Aug. 2004***	***If paid after 31 Aug. 2004***
Participants	*Rs. 3000/-*	*Rs. 4000/-*
Students	*Rs. 1500/-*	*Rs. 2000/-*

The registration fee covers participation in technical sessions, conference proceedings, welcome reception, conference banquet and lunches/refreshments during the conference**.**

IMPORTANT DATES

Preliminary registration - 31 Jan. 2004
Deadline for submission of manuscript
together with the registration fee – ***30 April 2004***
(Manuscripts without registration fees will not be considered)
Notification of acceptance - 30 July 2004
Last day for registration
with early-bird discount - 31 Aug. 2004
Deadline for submission of final manuscript – 31 Aug. 2004

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FOR FURTHER INFORMATION
Please contact Pushpa Wijekoon: pushpaw@pdn.ac.lk
PGIS Website: www.pgis.lk

FOR DETAILS & PRE-REGISTRATION
Visit the conference website:
http://www.st.rmit.edu.au/~desilva/conference/slstat.htm