



University of Colombo
Sri Lanka
Annual Research Symposium 2016



Empowering Humanity: Challenges and Responses

PROCEEDINGS

11 - 22 October, 2016

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ANNUAL RESEARCH SYMPOSIUM 2016
UNIVERSITY OF COLOMBO

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UNIVERSITY OF COLOMBO, SRI LANKA

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'Buddhi Sarvathra Bhrajate'

Wisdom Enlightens

OUR VISION

A centre of excellence in the knowledge society

OUR MISSION

To be a benchmark setter in disseminating, creating and applying multi-disciplinary knowledge in the global presence producing human talents of high quality while upholding national values

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Message from the Vice-Chancellor
University of Colombo

Professor Lakshman Dissanayake



I am very happy to issue this message on the occasion of the Annual Research Symposium 2016 of the University of Colombo.

The state of the research-teaching nexus affects the quality of the education provided by universities. Research has a clear potential to make significant contributions to the quality of education. Therefore, universities have an obligation to make the research-teaching nexus as strong as possible. The Annual Research Symposium provides an opportunity for the sharing of knowledge created through research across disciplines.

This year, the theme of the Symposium is 'Empowering Humanity: Challenges and Responses'. Empowerment can be defined as a means of improving the quality of life and expanding the basis of human well-being. In short, empowerment can serve as a mechanism for effecting deep and broad-based social transformation.

Building the capacity of the world's people and social institutions to create a prosperous and just society will require a vast increase in the access to knowledge. This will entail approaches that facilitate the generation, application, and diffusion of knowledge at the local level. Rather than unquestioningly adopting "solutions" developed elsewhere, an emphasis on strengthening local capacity to generate, apply, and disseminate knowledge can help put into place an ongoing process of action and reflection; one which encourages respect of the existing knowledge base of a community, raises the community's confidence in its ability to devise, implement and assess solutions, and helps to systematize and expand local knowledge. If empowerment is to lead to social transformation, it must involve the ability to recognize the forces shaping one's social reality, to identify the possibilities and challenges presented by that reality, and to devise initiatives for the betterment of society.

The Annual Research Symposium of the University of Colombo has now become a regular feature in the University calendar and the large number of abstracts received this year by our academics and students shows the vibrant research culture in our university. I hope that the Annual Research Symposium 2016 will generate knowledge that will contribute to empower humanity.

While congratulating the presenters and thanking the organising committee, I wish the Annual Research Symposium 2016 of the University of Colombo all success.

Message from the Chairperson,
Annual Research Symposium 2016

Professor Marie Perera



On behalf of the Organising Committee, I warmly welcome you to the inaugural session and the technical sessions of the Annual Research Symposium of the University of Colombo, 2016. The Annual Research Symposium is a university - wide event which provides a platform to researchers of all disciplines to disseminate their findings, exchange knowledge and build partnerships. This year, the Symposium is held from 11th to 22nd October at the different Faculties and the Sri Palee Campus. While the overall theme of the Annual Research Symposium 2016 is 'Empowering Humanity: Challenges and Responses,' each Faculty has its own theme, which signifies its identity. About 220 abstracts are included in this year's Symposium after double-blind peer review, under the guidance of the Editorial Committee.

I am thankful to His Excellency Mr. Jörn Rohde, Ambassador of the Federal Republic of Germany to Sri Lanka, for gracing this occasion as our Chief Guest and Ms. Una McCauley, UN Resident Coordinator and UNDP Resident Representative in Sri Lanka for accepting our invitation as the Keynote Speaker for this year's Symposium. I thank the Vice-Chancellor, Senior Professor Lakshman Dissanayake for his guidance and support in organizing this event.

The success of any event depends ultimately on the people who have worked in planning and organizing it. I had an excellent team to help me in organising the Research Symposium 2016 and I thank them most sincerely.

Finally, I would like to congratulate all paper presenters and wish them all an enriching and enjoyable experience.

Introduction to the Chief Guest

H. E. Mr. Jörn Rohde

The Ambassador of the
Federal Republic of Germany to Sri Lanka



His Excellency Mr. Jörn Rohde assumed duties as the Ambassador of the Federal Republic of Germany to Sri Lanka in July 2016. Prior his appointment, Mr. Rohde served as the Consul General of the German Consulate General in Bangalore, India from 2013-2016.

Mr. Rohde obtained his Bachelor's Degree from Trent University, Canada and has studied Economics, Politics and Modern History. He has also obtained a Master's Degree from Freiburg University Germany and a Diploma in Advanced European Studies from the College of Europe Bruges, Belgium.

Mr. Rohde is an experienced diplomat who has held a number of key diplomatic positions since he joined the German Foreign Ministry in 1988: he has served at the Foreign Ministry South Asia Desk, Council of Europe Desk and has also been the Head of East Asia Division. He has also held the positions of Cultural Attaché to the German Embassy in Jakarta, Head of the German Delegation for EU Cultural Affairs Group, Deputy Consul General of the German Consulate General in Osaka and Deputy Head of Mission of the German Embassy in Ottawa.

In addition to his experience at the Foreign Ministry, Mr. Rohde has held key positions such as Political Advisor in the Bundestag (German Parliament), Deputy Head of Unit for Cabinet and Parliamentary Affairs and Senior Advisor of Forum of Federations, Ottawa.

Introduction to the Keynote Speaker

Ms. Una McCauley

UN Resident Coordinator and
UNDP Resident Representative in Sri Lanka



Ms. Una McCauley commenced her assignment as the Resident Coordinator for the United Nations and the Resident Representative for UNDP in Sri Lanka in August 2016.

Prior to her appointment, Ms. McCauley served as the UNICEF Representative for Sri Lanka. She was also the UNICEF Representative for Panama and Togo, and has worked at the UNICEF offices in South Sudan, Kenya, and Angola. Additionally, in South Sudan, she was the Operation Lifeline Sudan Protection Coordinator from 2003- 2005.

With close to 15 years of experience serving within the United Nations System and an additional seven years of experience working with children's NGOs in situations of armed conflict and transition, Ms. McCauley has been instrumental in developing policies and strategic frameworks on protection for programming in a number of countries and sub-regions.

A national of Ireland and the United Kingdom, Ms. McCauley has a Master's Degree in International Development from the University of London, and a Bachelor's Degree in Social Science and Science Research from the University of East London, and is undertaking a Master's Degree in Childhood and Youth Studies currently.

Ms. McCauley is the first female to hold the position of UN Resident Coordinator and UNDP Resident Representative in Sri Lanka.

Address by the Keynote Speaker

'Empowering humanity for the 2030 agenda - the role of the United Nations'

Ms. Una McCauley

Resident Coordinator – United Nations in Sri Lanka

Synopsis

The UN in Sri Lanka, for over sixty years, through its specialised agencies, funds, programmes and offices, has cultivated broad and wide ranging partnerships – with the Government, civil society, the broad NGO community, bilateral donors, academia and international financial institutions – to address a multitude of challenges, both in long term development, and during times of emergency.

The Global 2030 agenda and the Sustainable Development Goals provide an opportunity to look at development more holistically. They provide a framework for integrated planning beyond sector-based goals and targets, embedding principles of equality, social justice and sustainability across all sectors.

The UN in Sri Lanka has been refocusing its work to align itself with the evolving global and national development priorities. We have reviewed our UN Development Assistance Framework to enhance the UN's ability to deliver on national priorities, as well as the new global sustainable development agenda, as national SDG priorities become clearer and make the UN's work in Sri Lanka more relevant and effective.

We have scaled up our interventions to support the Government's peacebuilding, reconciliation and governance agendas, to tackle impacts of climate change, promote universal norms and values, localise the SDGs and engaged young people to be potential drivers of change in society.

Moving forward, the UN strives to support the Government of Sri Lanka to achieve sustainable and inclusive economic growth, with equitable access to quality social services and strengthened human capabilities. The UN in Sri Lanka will also begin contributing to the 'Big Data' revolution in Sri Lanka providing coherent technical assistance for evidenced based policy and planning.

Faculty of Arts
University of Colombo



***'Managing Transitions:
Sri Lanka Yesterday, Today and Tomorrow'***

Message from the Dean
Faculty of Arts



Professor Athula Ranasinghe

I am pleased to write this message for the Annual Research Symposium of the University of Colombo 2016, 'Empowering Humanity: Challenges and Responses'. This year, the International Research Symposium of the Faculty of Arts, IConarts 2016, has been organized together with the rest of the Faculties of the University where abstracts were called internally from academics and postgraduate students of the University. However, we at the Faculty of Arts decided to proceed with our usual practice of inviting abstracts from academics and postgraduate students from in and outside the University as well as from interested parties in the industry. We are pleased to see the interest taken by potential presenters from within and outside of Sri Lanka as well as the University.

The theme of IConarts 2016, 'Managing Transitions: Sri Lanka Yesterday, Today and Tomorrow' is a timely theme capable of capturing research conducted in many fields of social sciences and humanities. IConarts 2016 is an important annual event that highlights the research conducted by academic staff of the Faculty. This year, it would undoubtedly open up new opportunities for academics from different disciplines to exchange ideas and to establish inter-disciplinary links both at local and global levels.

I also would like to take this opportunity to welcome the keynote speaker, Professor Mohan Munasinghe, co-laureate of the 2007 Nobel Peace Prize and a versatile personality with inter-disciplinary expertise in economics, physics and climate change and the guest speaker our own Dr. Jayadeva Uyangoda, former professor of political science, University of Colombo.

The Vice-Chancellor of the University of Colombo is warmly thanked for the support rendered towards making this event a success. This academic endeavor is the result of the effort and commitment of many Faculty members. I would particularly like to acknowledge the effort put in by the Director of Studies of the Faculty of Arts, the organising committee, editorial and abstract committees who were responsible for the conference programme and the publication of abstracts. My staff in the Dean's office for logistical arrangements and the computer unit for technical support is thanked for their continued support. I would also like to extend my appreciation towards the sponsors of this event and also those who submitted abstracts for IConarts2016, without whose support this event would not have been possible.

I congratulate the presenters and wish them the very best in their future endeavors.

Faculty of Arts, University of Colombo
International Research Conference 2016 (IConArts2016)

*Managing Transitions:
Sri Lanka Yesterday, Today and Tomorrow*

12-13 October 2016

PROGRAMME

- 8.00 a.m. Registration**
- 9.00 a.m. National Anthem and Lighting of the Oil Lamp**
- 9.10 a.m. Welcome Address by Professor Athula Ranasinghe
Dean, Faculty of Arts**
- 9.20 a.m. Address by Professor Lakshman Dissanayake
Vice-Chancellor, University of Colombo**
- 9.30 a.m. Keynote Address:**
'Sustainability transition in Sri Lanka - Sustainomics, inclusive green growth, and the SDG'
- Professor Mohan Munasinghe**
Co-laureate of the 2007 Nobel Peace Prize
Economist, Physicist and Climate Specialist
- 10.00 a.m. Address by the Guest Speaker:**
'Research as Production of Knowledge: Challenges in Humanities and Social Science Scholarship in Sri Lanka'
- Dr. Jayadeva Uyangoda**
Former Professor in Political Science
University of Colombo
- 10.20 a.m. Vote of Thanks**
- 10.25 a.m. Tea**
- 11.00 a.m. Technical Sessions**

Introduction to the Keynote Speaker

Professor Mohan Munasinghe

Co-laureate of the 2007 Nobel Peace Prize

Economist, Physicist and Climate Specialist



Prof. Mohan Munasinghe is Founder Chairman of the Munasinghe Inst. of Development (MIND), Colombo, and Vice Chair of the UN Intergovernmental Panel on Climate Change (IPCC-AR4), who shared the 2007 Nobel Prize for Peace. He is also Distinguished Guest Professor at Peking University, China, and Honorary Senior Advisor to the Government of Sri Lanka

He has earned post-graduate degrees in engineering, physics and development economics from Cambridge University (UK), Massachusetts Institute of Technology (USA), and McGill University and Concordia University (Canada). Prof. Munasinghe has also received several honorary doctorates (*honoris causa*). Highlights from 40 years of distinguished public service include working as Senior Energy Advisor to the President of Sri Lanka, Advisor to the United States President's Council on Environmental Quality (PCEQ), and Senior Advisor/Manager, World Bank.

He has taught as Visiting Professor at several leading universities worldwide, and won many international prizes and medals for his research and its applications. Prof. Munasinghe has authored over 100 books and about three hundred technical papers on economics, sustainable development, climate change, power, energy, water resources, transport, environment, disasters, and information technology. He is a Fellow of several internationally recognized Academies of Science, and serves on the editorial boards of over a dozen professional journals.

Keynote Address

Sustainability transition in Sri Lanka - Sustainomics, inclusive green growth, and the SDG

Professor Mohan Munasinghe

Co-laureate of the 2007 Nobel Peace Prize
Economist, Physicist and Climate Specialist

Synopsis

This paper explains the global issues confronting humanity and suggests some practical options to address them. The specific problems that face Sri Lanka are discussed within the global context. Sri Lanka is at a critical point in her development as she moves into the middle income country category. The transition to a more sustainable growth path is one key challenge.

Globally, developmental problems such as poverty, inequality, hunger, disease, financial failures, environmental damage etc. are already formidable. Climate change is the ultimate risk multiplier, exacerbating all the other crises. Its worst impacts fall on the poor who are least responsible for the problem. Thus the world currently faces multiple economic, social, and environmental threats. Present trends could destabilize global society.

The most effective way forward requires us to simultaneously address multiple issues within an integrated sustainable development strategy, using the Sustainomics framework. Sustainomics recognizes four core principles. First is the practical, step-by-step approach of 'making development more sustainable' (MDMS) that empowers people to act now. Second, we need to harmonize the sustainable development triangle, through balanced and integrated analysis from three main perspectives: social, economic, and environmental. Third, the analysis must transcend conventional boundaries imposed by values, discipline, space, time, stakeholder viewpoints, and operability. Finally, sustainomics provides many practical tools.

Sustainable development is a broad and poorly defined goal which is not well understood by decision makers. Fortunately, an analysis applying the sustainomics framework shows us a practical path based on inclusive green growth that will help to make development more sustainable in a systematic manner. This approach leads to more efficient use of resources supported by green investments, social safety nets, good governance and rational price policies. The United Nations sustainable development goals (SDG) and 2030 Agenda provide a comprehensive platform to measure progress towards sustainability.

This methodology may be applied globally to reconcile climate change risk management and development aspirations. The resource efficient green growth path is shown as a “tunnel” that will help developing countries leapfrog towards sustainable development – learning from the mistakes of the rich countries. The relevance to Sri Lanka is explained.

The Sri Lanka 2030 vision should include the following goals:

Social: meet basic needs of all Sri Lankans especially the poor and vulnerable, ensuring peace, harmony, social justice and security.

Environmental: respect nature and contain Sri Lankan resource use within the sustainable capacity of the country.

Economic: build a prosperous economy that is resource-efficient, but respects critical environmental and social sustainability constraints.

Some practical national level applications include climate impacts on food security, agriculture, and water, macroeconomic policy adjustment, sustainable pricing policies, and renewable energy projects. Options are discussed to integrate adaptation and mitigation policies into sustainable development strategy.

We may conclude that although the issues are complex and serious, integrated solutions are available to address multiple sustainable development problems together, provided we begin immediately.

Faculty of Arts

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The singing (hu)man: gender in genres of English Christmas music

S. A. Abayasekara

Department of English, University of Colombo

It has been long suggested that religion shapes gender ideologies, and this study explores linguistic sexism in one of Sri Lanka's main religions, Christianity. Alongside feminist movements and increased female leadership in the church and other public Christian spheres, sexist language in the Bible has been substantially eliminated (e.g. King James Version – 1611 vs. New Living Translation - 2015). Similarly, liturgies and hymns have been tested for gender-inclusivity. However, sexism in English Christmas carols has neither been examined extensively nor revised. Using theories of Foucauldian feminism and popular religiosity in relation to language transition, this paper first examines whether linguistic sexism in carols exists. Secondly, based on affirmative evidence, it compares carols with contemporary Christmas songs (hereafter 'Christmas songs') to examine if language transitions in Christmas music have occurred across genre and time, and thereby, to consider the response of language to transitions in social ideologies and relations. 25 carols were randomly selected from 50 "Most loved Christmas hymns and carols". Next, 25 Christmas songs were randomly selected from the first 50 in "100 Greatest Contemporary Christmas Songs" using a random numbers table. Findings suggest that gender specification is significantly higher in carols (13th-19th century) as per a statistical t-test ($p < 0.05$). Moreover, while carols specifying gender contain linguistic sexism (M=88%, F=12%), Christmas songs doing so (1956-1998) contain considerably less (M=8%, F=0%). Interestingly, the content of Christmas songs is also observed as being overtly secular compared to the carols' content, which possibly correlates with increasing secularization and the commercialization of Christmas in many parts of the world including Sri Lanka, and with the relationship demonstrated between religiosity and gender role ideology. The study is considered a first step, which could be built upon by examining cultures in Sri Lanka outside the specific "Western", English-speaking one where this music is found.

Keywords: Sexism, language transitions, gender, carols, Christmas songs

Responding to changing student demographics in literature teaching

S. A. Abayasekara and D. Mendis

Department of English, University of Colombo

This paper details a pedagogical intervention in the form of writing workshops, designed to respond to changing demographics in students registering for courses leading to a degree in English. Although the minimal entry requirement (a pass in G.C.E. A/L English) remains the same, students seem to lack the English language proficiency and writing skills required to successfully engage with the content of introductory University courses, as evidenced by marks obtained for continuous assessments, and an inability or reluctance to participate in class discussions. To address this issue, a series of workshops was designed based on a needs analysis done with the students, and conducted over eight weeks. The workshop objective was to improve students' academic performance by promoting self-learning outside the classroom, combining pedagogical practices drawn from Content and Language Integrated Learning, Flipped Learning and English for Academic Purposes. Participants were required to write and peer review thesis statements, introductions and conclusions. Five students participated in the workshops while eight did not. A comparison of means shows that both groups record a drop in marks for a take-home essay over an in-class critical appreciation of a poem. The gap between the participants' and non-participants' marks narrows at the final examination, which indicates an improvement in the participants (the weaker group), possibly resulting from the workshops. While post-workshop feedback obtained from the participants was positive, the highest final grade obtained by a participant was a B- with the rest disappointingly being Cs. It is possible, however, that the results of the intervention will be more visible long-term – i.e., over the following semesters. Depending on the findings of such longitudinal observations, recommendations can be made as to whether the Department of English should continue offering such interventions to enhance learning, if students' entry level English proficiency levels do not improve in the future.

Keywords: English language proficiency, Flipped Learning, writing workshops

Health effects of elderly care-giving: A systematic review of the literature on primary caregivers' health

W.D.D.G. Abeywickrama

Department of Demography, University of Colombo

Primary caregivers play a predominant role in providing long-term care for the chronically ill and disabled elderly in developing countries such as Sri Lanka. Although the family unit has undergone many changes, it still remains the main source of care-giving in these countries. As the ageing population increases, the essentiality of primary caregivers has grown significantly, especially in developing countries where institutional care has fallen short of the demand. Although family care-giving can be a rewarding experience for many caregivers, it places these individuals at risk with regard to many social, financial and health factors. In the context of ageing, many studies focus on the elderly and their health. However, the care providers are also exposed to many health risks which need to be examined. This study explores existing literature on health effects of primary care-giving to the caregivers. Qualitative and quantitative peer-reviewed articles published from 2000-2015 were examined and fifteen papers that discuss primary care-giving experiences were reviewed. Health effects were considered under the sub-themes physical and mental health effects of care-giving. Findings reveal that caregivers provide intense care to elders while suffering from poor health conditions themselves. Care-giving causes physical and mental health problems such as cognitive-behavioral problems, difficulty in accomplishing activities of daily living or instrumental activities of daily living, chronic diseases including heart disease, cancer, diabetes and arthritis at nearly twice the rate of non-caregivers. Caregivers also suffer from increased rates of physical ailments including acid reflux, headaches, body pain and sleeping disorders. Considering mental health, higher levels of stress, anxiety and depression are common among caregivers than non-caregivers. Some studies also found a physical-psychological health link, which proposes that the mental health of caregivers influences their physical health. It was also seen that mostly female caregivers often jeopardized their own health when providing care. The analysis revealed that although the health effects of care-giving have been explored by many studies, less theoretical and empirical attention has been given to identify their health needs. Therefore, future research should focus on the different health needs of caregivers in order to implement appropriate interventions to minimize mental and physical health effects on primary caregivers.

Keywords: Care-giving, caregivers, physical and mental health effects

**Phraseological implications in the structural nativisation of South Asian Englishes:
Collocations of *rain* in Indian, Pakistani and Sri Lankan Englishes**

D. Algama

Department of Linguistics, Justus Liebig University Giessen, Germany

The area of collocations in Postcolonial varieties of English provides rich grounds for yet untapped linguistic research though they make for “naturalness and idiomaticity” (Mair 2007: 439). South Asian Englishes (SAEs), due to individual local and/or regional norms, would have their own collocations too (cf. Mair 2007: 450). This paper investigates the collocational properties of *rains* in Indian, Pakistani and Sri Lankan Englishes in comparison to British English (BrE) using the International Corpus of English – Britain, India and Sri Lanka components and Indian, Pakistani and Sri Lankan components of the South Asian Varieties of English (SAVE) corpus (Bernaisch et al., 2011) that consists of newspaper data. *Heavy rain* and *heavy rains*, along with other collocations of *rain* such as *monsoon rain*, *rainwater storage* occur more often in the SAEs, but not without indicating similarities and differences between the varieties. On the contrary, the British English data show an interesting disinclination to use the phrase *heavy rains* and Minimum Sensitivity and delta P scores indicate that *heavy* and *rains* are heavily inclined to occur together in the SAE data. Indeed *rains* in the plural form appears significantly more in SAE data as opposed to in BrE data. While this very obviously points to differences in the SAEs that are important in understanding them as their own established varieties of English, the features themselves point to more than influences from indigenous languages and perhaps to differences in conceptualizing an element that is a force of nature. While this itself is a shared feature across the three varieties of English, other collocations of *rain* and *rains* point towards differences in agriculture related approaches the three countries have between themselves.

Keywords: Sri Lankan English, Indian English, Pakistani English, South Asian Englishes, nativisation

**Attitudes of female youth on sexual and reproductive health and their needs:
A case of urban settlement communities in Colombo**

A.A. Anandi, E.L.S.J. Perera

Department of Demography, University of Colombo

Sexual and reproductive health plays a vital role for human beings and it refers to a state of complete physical, mental and social well-being in all matters relating to the reproductive system. The Cairo International Conference on Population and Development held in 1994 emphasized that every person has a right to have a satisfying and safe sex life, the capability to reproduce, and the freedom to decide if, when, and how often to do so. In many developing countries, it is extensively cited that female youth are more vulnerable to sexual and reproductive health. Literature on sexual and reproductive health has mainly focused on women in reproductive age in general, and there is still a vacuum of research on female youth, causes and consequences of their reproductive health issues. Therefore, this paper examines the attitudes of female youth on sexual and reproductive health and their needs in urban Sri Lanka. This study is based on a qualitative exploration and case studies were used to gather data. Study location is urban settlement communities in Central Colombo. Respondents were female youth who were aged 15-29 at the time of the interview. Fifteen case studies were done covering three age groups, namely 15- 19, 20-24 and 25-29 (5 cases from each group). Results reveal that female youth have negative attitudes on sexual and reproductive health related sources of information. Further, many of them had experienced risk behaviors, sexual relationships and premarital sex, which caused unintended pregnancy and childbearing. Majority of them were not satisfied with the knowledge and services that they had received regarding sexually transmitted infections and sexual and reproductive health. The results suggest that appropriate mechanisms need to be established in order to address sexual and reproductive health needs of female youth in urban low income communities.

Keywords: Attitudes of female youth, sexual and reproductive health, sexual and reproductive health needs

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Vesak as a platform for inter-faith dialogue: Sri Lanka's contribution through UNESCO

George I. H. Cooke

Department of International Relations, University of Colombo

Vesak, marking the birth, enlightenment and passing away of the Buddha, has been a day of significance for followers of Buddhist teachings for centuries. Sri Lanka is no stranger to this tradition. The country is also home to some of the other religions of the world, notably Christianity, Hinduism and Islam, and is exploring mechanisms for peace and reconciliation in the post conflict phase. The intrinsic pattern woven into the social fabric has resulted in a rich outlook with much potential for peace and stability. How then is this diversity being utilized? UNESCO, regarded by Jawaharlal Nehru as the 'conscience of the world' has provided a platform for nations to understand their differences, while celebrating their diversity. It was in this spirit that the Permanent Delegation of Sri Lanka to UNESCO highlighted inter-faith dialogue through the celebration of Vesak. The three-day event, initiated in 2013, has seen the involvement of persons and member states in which Buddhism is present, as well as those which have taken an interest in the platform that was provided to collaborate ideas, engage in discussion and eliminate differences in the pursuit of a common stance of peace and understanding. Thus the *raison d'etre* of the key symposium and many side events has been to invigorate comprehension of the commonalities in all religions, attempt to capture the essence of the message they bear and advocate their inculcation in our daily lives, all through the example and testimony of Buddhism. While noted on the international stage as a much needed exercise, the translation to the local level becomes imperative. This paper, using the experience of Vesak at UNESCO, would thus seek to:

- rationalize the need for interfaith dialogue, reflecting on the subject in Sri Lanka and
- explore its relevance in Sri Lanka's larger context of reconciliation

Keywords: Vesak, reconciliation, Inter-Faith Dialogue, UNESCO,

Determinants of elderly living arrangements: Evidence from the literature

H.D.A. Danapala

Department of Demography, University of Colombo

Population ageing affects not only the society, but also the aged. In this context, the living arrangements of the elderly are important as it directly connects to their wellbeing. Unlike in the traditional context of developing countries where the value system determines that the elderly live in extended families, today we observe many elderly living alone or only with the spouse. The overall objective of this paper is to examine the demographic and socio-economic determinants of elderly living arrangements in developing countries using the existing literature. This includes an analysis of qualitative studies published in electronic journals between 2000-2014, related to determinants of elderly living arrangements. Living arrangements were analyzed under demographic determinants and socio-economic determinants. The findings show that demographic factors such as age, gender, marital status and migration affect living arrangements; it is revealed that the proportion of elderly living alone decreases as they get older. Elderly women are more likely to live alone than elderly men, given that the majority are widowed due to higher female life expectancy. The findings further show that although elders are not usually involved in migration, their children's migration results in them living alone, with a spouse or relatives. Low fertility and childlessness result in similar living arrangements. From a socio-economic perspective, education of the elderly and living alone are positively related. Personal income or a pension can contribute positively towards the elderly living alone. Studies indicate that living arrangements are an important aspect of elderly well-being; some studies show that living alone can result in isolation and depression while living with one's spouse only is seen as the preferred arrangement from the point of view of happiness. The studies identify that different demographic and socio-economic determinants impact living arrangements and these in return affect elderly wellbeing.

Keywords: Living arrangements of the elderly, demographic and socio- economic determinants

Nuclearization and “responsibility to protect”: The case of India and Pakistan

K.S.C. de Silva

Department of Strategic Studies, General Sir John Kotelawala Defence University

States' possession of nuclear substances for security or energy purposes could carry safety risks to their own people as well as the people of neighbouring states. The idea of deterrence was more credible in a rigid bipolar system of international relations and now it appears to be an obsolete factor which could hardly guarantee peace for regions. This is particularly valid for South Asia with the increase of its nuclear activism. A nuclearized South Asia has become one of the most dangerous geographic areas in the contemporary global security architecture. It also possesses many unique features which influence the strategic decision making of nations. In this backdrop the responsibility of protecting the public from the dangers emanating from nuclear programmes lies mainly in the hands of nuclear states. This paper intends to analyse whether the South Asian nuclear states have the required strengths to ensure the safety of their respective nuclear programmes. The author questions the nuclear states' capability and desire to protect people of the region against the responsibility and the desire of the international community to intervene when the situation is not safe. The research problem is analysed by using primary and secondary data through the theoretical framework of Barry Buzan's securitization and Gareth Evans' work on nuclear weapons and the R2P concept. The author questions why the “Failed States Index” does not utilize the cases of insecurity that have resulted from the state nuclear programmes as an indicator of state failure. The author further argues about the gravity of the issues that could affect non-nuclear states by nuclear fallout. The author also highlights the importance of security cooperation of states to overcome nuclear threats.

Keywords: Nuclear stability, Failed States, responsibility to protect

Competitive sharing: Plural worship at major religious sites in Sri Lanka

P. de Silva

Department of Sociology, University of Colombo

Sacred sites that have long been shared by members of different religious communities and may even exhibit syncretic mixtures of the practices of both may come to be seized or destroyed by members of one of them in order to manifest dominance over the other (Hayden 2002: 205). The cultural ‘hegemony’ of post-colonial public religion has been one of the greatest banes to linguistic and religious minorities. Minority cultures have become invisible in a national culture increasingly dominated by a highly politicized and organized Sinhala-Buddhist polity. The politicisation of Buddhist culture is a significant aspect of the consolidation of the bi-polar ethno-racial-religious imagination in colonial and post-colonial Ceylon (Rajasingham 1999: 134). The famous multi-religious sacred sites of Katharagama in the south, Sri Pada in the central hills, Munneswaram in the north-west and Mannar in the west of the island are testimony to the co-existence of these two religions in Sri Lanka, in addition to the accommodation of Islam and Christianity. Though Sinhala Buddhist and Tamil Hindu linguistic communities have historically co-existed and shared a breadth of cultural and religious practices, they have emerged in the postcolonial period as opposed national communities. It is under this backdrop this paper will explain the nature of religious co-existence among Hindus and Buddhists and even other religious groups and their worship at one of the most popular pilgrimage sites, Sri Pada. I argue that such shared religious places are not merely promoting religious diversity and co-existence but also seized or waned such diverse religious practices under the hegemonic majoritarian religion and politics in (post) colonial Sri Lanka.

Keywords: Religion, co-existence, ethnicity, multi-religiousness

Stock price reaction to final dividend announcements and semi-strong form efficient market hypothesis: Evidence from Colombo Stock Exchange (CSE)

D.G. Dharmarathna¹ and C. Amarasekara²

¹*Sabaragamuwa University of Sri Lanka*

²*Economic Research Department, Central Bank of Sri Lanka*

Identifying the potential role of the stock market in the country's transition to an upper middle income economy, this study investigates the stock price reaction to the announcements of final dividend of the companies listed on the Colombo Stock Exchange (CSE), thereby providing a test of the semi-strong form efficient market hypothesis in the context of Sri Lanka. An event study methodology is used for this purpose. This study uses three common and widespread methods, namely, a Mean Adjusted Model, a Market-Adjusted Model, and a Market Model in generating abnormal returns during and around the time of announcement. The current analysis augments the said methods by incorporating stock volatility clustering and information asymmetric effects to the Market Model. The study is further extended with the application of volatility techniques in time series. The sample consists of 221 public announcements of final dividends in the CSE from 2008-2014. Overall results of stock price reaction to the final dividend announcements based on each model show a positive reaction for information subsequent to the final dividend announcements in CSE. It is consistent with the Information Content Theory. Further, the results show that the stock price reacts positively before and after the actual announcement of the information. This indicates that stock prices do not reflect publicly available information instantly and accurately. Therefore, the study supports the view that the behaviour of the Sri Lankan Share Market is inconsistent with the semi-strong form efficient market hypothesis. The results also indicate a significant difference between the Sri Lankan Share Market and other developed markets. The findings of the study could be of interest to all stakeholders of the share market, in particular, investors, corporate managers and regulatory agencies.

Keywords: Colombo stock exchange, event study methodology, information content theory, semi-strong form efficient market hypothesis

North-South Knowledge Division: Significance of global environmental governance

P.L.S. Dias

Department of International Relations, University of Colombo

The North-South divide is broadly considered as a socio economic and political divide. Generally, definitions of the Global North include the United States, Canada, Western Europe and developed parts of East Asia, and the Global South includes Africa, Latin America, developing Asia and the Middle East. Environmental governance refers to the processes of decision-making involved in the control and management of the environment and natural resources. Good environmental governance should reflect our best understanding of the structure, function, processes and variability that typify natural systems. Without this understanding, inappropriate decisions can be made with catastrophic environmental consequences, even with the best possible intentions. Knowledge divides between the North and the South result from the substantial difference in accumulated scientific knowledge within the two regions and their current unequal capacities for generating new knowledge. Air pollution is taken as an example to measure the North-South knowledge division within Environmental Governance. By interviewing experts and academics from selected North and South countries such as China, India, Nepal, Canada and New Zealand and analyzing data from different secondary and primary sources such as conventions, published articles etc., it can be identified that the inequalities between countries are pronounced in scientific and other research expenditure, lack of experts and policy makers. Also the South is less visible on the global governance agenda. This problem can be overcome by using several strategies. One strategy is strengthening the scientific and research community in the South, and encouraging the scientific and research community in the North to carry out more cooperation in research on the South. The other strategy entails changing how decision makers in global institutions deal with scientific knowledge, because most of the global institutions are dominated by Northern experts.

Keywords: North-South divide, global environmental governance, global institutions

Inadequacies in teacher awareness to address the learning disabled in primary education in Sri Lanka

S. Y. Dias

English Language Teaching Unit, University of Colombo

This study was conducted to assess teacher awareness on slow learners in selected primary schools. A typical class in the primary sector could include approximately six students considered as slow learners. Following the 1994 Salamanca Convention in promoting “Equity” and “Excellence” the researcher has examined how far these principles were being applied in primary education in Sri Lanka. One objective of this research was to identify and investigate mainstream teachers’ awareness of slow learners. The other was to study if teachers had adequate knowledge and skills to address challenges of educating slow learners with learning disabilities under the inclusive education policy. It adopts mixed methods and uses a probability sample. The main sample was 15 Grade 1 to 5 teachers from six primary schools and 11 administrators. Research instruments were literature surveys, focus group discussions, semi-structured interviews, questionnaires, and researcher observations. Findings revealed that 3 teachers were unaware of Dyslexia and Attention Deficient Hyperactivity Disorder (ADHD) as learning disabilities and one teacher had mentioned her inability to identify such students in class, and three teachers had refrained from answering. Majority of nine had expressed incapability of helping such students, one had declined to answer. Although the interviewed directors were aware that slow learners could include students with signs of Dyslexia or ADHD, out of the nine interviewed, only three principals acknowledged that slow learners could be learning disabled. In conclusion, majority of administrators and teachers did not seem to possess adequate knowledge and professional training to address the educational needs of such students, justifying the need for better education and training prior to administrative and teaching careers in mainstream schools. A limitation of this research was the narrow sample of six schools from one educational zone due to constraints on human resources, time and funds, leaving options for future research.

Keywords: Primary schools, inclusive education, mainstream teachers, slow learners, learning disabilities

Job satisfaction of executive level employees in the maritime sector in Sri Lanka

M.H.S. Dilrukshi and I.W. Rathnayake

Department of Economics, University of Colombo

Increased interdependence of countries causes rapid growth of international trade. This increases the demand for maritime workforces as two thirds of the world trade is shipped via sea. Given that successive Governments aim at developing Sri Lanka into a maritime hub capitalizing on the country's strategic locational advantage, greater contribution is likely to be expected from human resources in the maritime sector towards achieving the objective. It is within this context that job satisfaction of employees in the sector becomes vital for Sri Lanka. This study attempted to evaluate job satisfaction of employees in the maritime industry. It focused on the relative importance of determinants and their impact on the overall job satisfaction of employees in the sector. A sample survey was conducted among employees of the sector to gather primary data. Findings of the research suggest that the employees are satisfied with the general working conditions, but are not satisfied with their work place environment, or with their relationship with supervisors. The employees are neither satisfied nor dissatisfied with wages they earn and with their job security. Non-flexible scheduling of work, inconvenience in obtaining approval for leave, fewer opportunities for promotions, lack of recognition for work accomplished, inadequate openings to utilize employees' talents, lack of opportunity to acquire new skills, inadequate support for additional training and education, monotonous job responsibilities, insufficient independence and inadequate opportunities for periodic changes were identified as key issues found in maritime organizations negatively affecting job satisfaction of their employees.

Keywords: Maritime sector, job satisfaction and determinants, work environment

Trends and nature of youth unemployment: The case of Sri Lanka during 2006-2014

P. Dunusinghe

Department of Economics, University of Colombo

Youth unemployment has been one of the key development challenges faced by many developing countries including Sri Lanka. During the last decade, the government took a number of initiatives, such as recruiting unemployed graduates to the public service and reforming higher education and vocational education sectors, to combat youth unemployment. In the light of those policy interventions, this study aims to examine the trends and the nature of youth unemployment during 2006-2014. In addition to a detailed descriptive data analysis, a Logit regression analysis was employed in identifying the determinants of youth unemployment in Sri Lanka. The study extracted data from nationally representative labour force surveys (2006, 2010, 2014) conducted by the Department of Census and Statistics of Sri Lanka. The results suggest that educated youth unemployment has remained high during the study period, while, it has been much higher in the Northern Province compared to national averages. Moreover, compared to other groups, unemployment has been higher among educated-rural-females in all Northern Province districts and backward/remote districts such as Monaragala and Polonnaruwa. The Logit regression estimation brings out a number of interesting results. First, the probability of being unemployed increases along the education ladder reflecting a job market mismatch. Second, contrary to conventional wisdom, the estimated coefficient of vocational training suggests that unemployment remain higher among those who have received vocational training. Interestingly, the percentage of youth receiving vocational training has increased over the years, yet, about half of them have remained unemployed. Third, the ability to read and write in English increases the probability of being employed. Finally, compared to urban areas, unemployment has remained relatively higher among rural and estate youth. In the light of the above findings, it is required to carry out an in-depth study into the vocational education system to improve its relevance to present local and global labour market requirements.

Keywords: Youth Unemployment, Sri Lanka, vocational training, Logit Model

The role of social media in the social activism of youth in Sri Lanka

A. Fernando

Department of Sociology, University of Cambridge, United Kingdom

In events precipitated by the Arab Spring, “The Protester” was named Time magazine’s *Person of the Year* in 2011. These events generated much discussion regarding *digital, Facebook / Twitter revolutions, cyber campaigns* and activism. This research study is located at an interesting juncture of global literature and corroborates dialectic thinking regarding social media and social activism. Data were collected in Sri Lanka in the immediate transition of the presidential election in January 2015, as the presidential elections had stimulated excitement and participation among youth on social media. This study focused on the time period 2014-2015, involving discontents and dynamics in social media communication, e.g. the reporting of the Aluthgama violence, the *Wariyapola Kumarihamy* incident, Koslanda disaster, the Halal issue, student protests, the full face helmet protests and the presidential elections. Therefore, the objective of this study was to explore the role of social media in social activism and participation among urban youth in Sri Lanka. The sample constituted 358 online survey respondents and 20 semi-structured interviews with young, urban social media activists. Participants responded to an online survey shared on the social media platforms Facebook and Twitter. Social media activists were chosen through non-random, snowball sampling, based on varying degrees of involvement in the presidential elections 2015 and contribution to activism in different spheres of social media. The questions did not merely highlight political participation but emphasized activism in general social issues. The main findings support a dialectic relationship between social media and social activism, highlight diverse functions of social media, suggest a distinctive form of Sri Lankan social media that imbibes socio-cultural traits and asserts the potential of social media for youth empowerment. In conclusion, social media activism was identified as a positive factor to manage transitions for empowerment in Sri Lanka.

Keywords: Social media, social transitions, social activism, youth culture, social change

Export and economic growth nexus in Sri Lanka: A time series analysis

S.J. Francis¹ and K.W.K. Gimhani²

¹*Department of Economics, University of Colombo*

²*Department of Regional Science and Planning, Sanasa Campus Limited, Kegalle*

The export-led growth (ELG) hypothesis suggests that there is a strong positive linear relationship between a country's exports and economic growth. For many years, theoretical and empirical studies have examined the causal relationship between exports and economic growth and found that this relationship is one of interdependence rather than of unilateral causation. This paper intends to investigate the casual effects of the short and long run relationship between exports and economic growth and determine the recent trends, developments and obstacles regarding exports in Sri Lanka. Annual time series data on Gross Domestic Production, Export, Gross fixed capital formation, employment and inflation, which cover the period 1977–2015 have been used in this study. Data are taken from sources such as economic surveys of Sri Lanka, World Bank Reports, Central Bank Reports of Sri Lanka, UNCTAD (United Nations Conference on Trade and Development) Reports, and IMF reports. The main purpose of this study is to employ empirical econometrics time series analysis to export-led growth hypothesis for Sri Lanka by using ADF unit root test, Johansen Co-integration test, Vector Error Correction (VEC) modelling and Granger casualty test. Ordinary Least Square method (OLS) is used to estimate and explain the regression model of the study. The findings of this article reveal that exports promote economic growth, along with capital investment and employment in the short run and long-run in Sri Lanka. Our outcomes confirm the validity of export-led growth hypothesis for Sri Lanka. Hence trade liberalization indeed leads to higher economic growth.

Keywords: Export led growth, Sri Lanka economy, trade liberalization

Border cosmopolitanism in critical peace education

D. Golding

Department of Educational Research, Lancaster University, United Kingdom

This paper proposes a revision of the theoretical framework of critical peace education. The predominant conceptualization of this nascent field is currently based on secular cosmopolitan ethics. This paper problematizes that foundation by contextualizing the role of cosmopolitanism in the development of the modern/colonial system. Drawing from the works of Walter D. Mignolo, a critical border cosmopolitanism is suggested as a decolonizing framework for peace education. The paper concludes by exploring Freire's problem-posing education as an approach for critical peace education to critically deconstruct cosmopolitan discourses and center the lived experiences of participants on the peripheries of the modern/colonial system. Such an approach would enable a more critical and genuinely empowering peace education in Sri Lanka.

Keywords: Cosmopolitanism, critical peace education, critical pedagogy

**Transport connectivity issues of a rural setting:
A case study of appraising transport modal options**

T. L. Gunaruwan and M. H. S. Dilrukshi

Department of Economics, University of Colombo

Rural villagers face many challenges associated with accessibility and connectivity compared to urban communities. Constraints in rural transport infrastructure and services often limit their accessibility of necessary services. This paper examines this issue in the context of a rural village setting of Kalyanipura, Welioya, in the Mullaitivu District, a Sinhala village destroyed by the LTTE in 1984, which was re-settled after 2009. A survey was conducted in the village particularly focusing on mobility parameters. Transport costing and implicit opportunity cost threshold analyses enabled modal comparison for mobility provision. The results revealed that the villagers together would have to spend nearly Rs 75,000 per month to meet the monthly travel demand of 26,700 passenger kilometers if the motor bicycle mode was opted for, and would save approximately 1,558 person hours of travel time. Alternatively, 1,335 person hours could be saved at an aggregate monthly cost of Rs 37,400 if the bus option were to be used. Furthermore, it was revealed that bus option could be justified based on the opportunity value of an hour of time saved while the motor cycle option would not. Switching from bus to motor bicycle to save 225 hours per month would not be economically rational unless an hour of a Kalyanipura villager would be worth over Rs 167. In addition, income levels of the villagers were also found insufficient to bear the cost of owning and operating motor bicycles. Thus, the results enabled the conclusion that a public bus service by the Sri Lanka Transport Board (SLTB), strategically planned to minimize the cost to the operator, could solve the mobility problem of Kalyanipura village and could help its sustenance.

Keywords: Transport cost, value of time, connectivity, rural mobility, accessibility of services

**Capital deployment efficacy in Sri Lanka's road sector:
An empirical economic assessment**

T. L. Gunaruwan

Department of Economics, University of Colombo

The Sri Lankan Government spends a significant share of her capital budget on road infrastructure. Therefore, it is important to ensure efficiency of capital deployment in road sector projects. This research was undertaken with the objective of assessing capital efficacy in road development and appraising strategies to obtain maximum possible economic gains by way of institutionalising an appropriate public investment management mechanism. Road projects undertaken by the Road Development Authority over the period 2005-2012, covering an overwhelmingly large share of public sector spending on road sector, was examined. Real capital expenditure intensity per unit of surface area, the indicator used as the inverse of capital efficacy, was regressed against a selected set of “cost influencing factors” and significant determinants of capital intensity were identified. Project size, class of road, nature of terrain, funding mechanism and contract procurement process emerged as significant determinants with expected direction of influence, while surface technology and type of contractor failed to become significant. Funding projects through bilateral credit tied to contractors domiciled in lender countries without competitive bidding was found highly capital intensive, and thus inefficient in terms of capital deployment. The outcomes of the study recommends that public investments be executed to the maximum possible extent, through local contractors, and whenever foreign funding becomes necessary, to avoid contract negotiation with a pre-designated company without competitive bidding, as such modality would be prone to wastages, leakages, mismanagement and corruptive instincts. It is strongly recommended to institutionalise competitive procurement process through an effective mechanism for public investment planning, appraisal and implementation management to ensure public sector capital expenditure efficacy.

Keywords: Capital spending efficacy, public investment management, competitive procurement, road sector, Sri Lanka

**Contact between Sinhala and the Vedda language in Dambana:
A sociolinguistic analysis**

R. N. Harshani

Department of Sinhala, University of Colombo

The Vedda community of Sri Lanka is regarded as one of the oldest surviving indigenous communities of the world. They are a community with their own language and a cultural identity. The Vedda language has changed and evolved with the passage of time. According to Trask (1999) the speakers of any given language are almost always in some kind of contact with the speakers of one or more other languages, for any of several reasons. Accordingly the continuous contact of the ancient Vedda language with the Sinhala language has created a creolized version of the Vedda language. The objectives of this research was to find the changes due to language contact and to understand the connection between the two discourse communities of Vedda and Sinhalese. The study also attempted to identify the Vedda language as a Creole and find the sustainability of the Vedda language, as well as to document and preserve the words in Vedda language which are facing extinction. Data collection was undertaken at Kotabakiniya and Gurukumbura villages in Dambana. Natural conversations and participant observations were recorded in audio and reflective notes respectively. Around thirty different conversations were recorded and notes were taken with the informed consent of the participants. The recorded data was analyzed using qualitative data analysis methods. The data was transcribed to study the vocabulary, grammar, sounds and Sinhala borrowings of the Vedda language. It was possible to rationalize the significant impact of language contact on a minority language facing extinction and to preserve the data for future studies.

Keywords: Vedda language, Sinhala language, language contact, Dambana, Creole

Backward design in curriculum to improve students' English language abilities in frequently engaged activities

S. R. Ilangakoon

English Language Teaching Unit, University of Colombo

Richards (2013) categorizes curriculum design into “forward design”, “central design” and backward design”. The Common European Framework of Reference (CEFR), a recent example of backward design which commences with a specification of learning outcomes (2013), was used in developing university benchmarks for language teaching in Sri Lankan universities. However, students' views did not play a part in the formulation of these benchmarks. The objective of the current research is to carry out a needs analysis, a crucial part of the curriculum design, to identify student views on their current and aspired abilities in English and the areas in which they wish to be competent. It also looks at the written performance of students to identify their weaknesses. The study was carried out as a cross sectional study of Arts undergraduates at four different competency bands. The data were collected from the four competency groups through questionnaires administered to hundred students and by scrutinizing two hundred and twenty student writing samples. Questionnaire responses were analyzed using frequencies and cross tabulations in the software SPSS. Writing samples were manually coded for frequent errors. According to the findings, the following recommendations could be made. As the results of the Advanced Level and Ordinary Level English show a clear correspondence to the students' proficiency level, these results could be used for placing students at the different proficiency levels instead of undertaking the laborious task of administering a placement test. Students' speaking, writing and vocabulary should be further developed through the teaching programmes. Activities such as browsing websites, reading e-mails, reading instruction manuals, technical articles, filling forms, listening to news, taking notes at lectures, and reading news should be included in the course. Sentence word order, tenses, subject verb agreement, question formation, passive voice and possessive case need constant practice at different proficiency levels.

Keywords: Needs analysis, curriculum design, benchmarks, language proficiency

Demographic evolution of the Kaffir community in Sri Lanka

A.P.H.S. Jayarathne

Department of Demography, University of Colombo

The Kaffir community in Sri Lanka is small in number but has its own identity. They are the descendants of migrants from South African countries during the 16th century. Their settlements are concentrated in a few coastal areas in close proximity to Puttalam, Negombo and Trincomalee with the majority residing in the Puttalam District. The main objective of this study is to explore the evolution of the Kaffir community in Sri Lanka from a socio-demographic perspective. The literature reveals that although there has been anthropological, linguistic and socio-cultural research conducted on the Kaffir community in Sri Lanka, there is a vacuum of evidence on its demographic evolution. The study uses both primary and secondary data. The primary data were collected from the Puttalam District using interviewer administered questionnaires.. The study sample comprises of 112 Kaffirs who are aged 15 and above. Additionally, interviews and case studies were conducted. Census of Ceylon reports (1871-1921) have been utilized as secondary data sources. Results reveal the fertility, mortality, morbidity and migratory patterns that shaped the demographic evolution of the Kaffir community. The fertility condition has gradually declined while the mortality pattern is higher than the national average, particularly among males. Internal migration of Kaffirs in Sri Lanka is at a moderate level and international migration can be observed since 1990. Fertility and mortality patterns indicate that the Kaffir community is currently in their third phase of demographic transition. Predictions indicate a declining trend of the community and a possible extinction. Therefore, the current situation could have a considerable impact on their existence in the future.

Keywords: Kaffir community, demographic evolution, patterns

Buddhism against Religious Fundamentalism

S. Jingyu¹ and W. Hewamanage²

¹ *Department of Religious Studies, School of Philosophy, Wuhan University, China*

² *Department of Buddhist Studies, University of Colombo*

Religious peace and harmony is one of the noteworthy norms for the advancement of a multi-cultural society. In spite of the fact that the general exertion of every single world religion is to make a well-meaning world with people who have inward and external peace and amicability, there is sufficient proof of clashes in the name of religion in the modern as well as ancient history of the world. Although occasionally it has been named as holy war, struggles can be seen between great traditions as well as inside sub-traditions. Religious fundamentalism is the key cause which goes against peace and congruity between religions. Buddhism warns us to guard against the wrong view that ‘this alone is true, all else is false’ (*idamevasaccam moghamaññaṃ*) which will lead to religious fundamentalism. This paper reveals the Buddhist notion on the above view, demonstrating why this view is wrong and how this view paves the way to conflict. This wrong view can be seen spreading in doctrinal teachings, culture, society and even dialects. Along these lines, doctrinal teachings that were taught by one’s own religious instructor are considered as the unparalleled path to peace and harmony. Dialects which are used in holy messages are considered as sacred dialects and they can control followers to comprehend the ultimate truth of life and the world. The Buddhist viewpoint towards different religions and conversions demonstrates the Buddhist method which can be considered as the foundation for multi religious peace and amicability. There is no notion in Buddhism that promotes one teaching, one society, one culture or one dialect. Finally, this paper demonstrates how Buddhism helps in the advancement of religious peace and amicability in a multicultural society.

Keywords: Fundamentalism, peace and harmony, multi-culture, religion

Transition of Sri Lanka trade: Exchange rate effect on bilateral trade of Sri Lanka

N. Keembiyahetti¹ and A. Ranasinghe²

¹*Department of Economics, University of Ruhuna*

²*Department of Economics, University of Colombo*

Using quarterly data from 2000-Q1 to 2014-Q4, this study estimates the long-run cointegration relationships in Sri Lanka's bilateral real exports, bilateral real imports and bilateral trade balances held with its top 20 trading partners. The objective of this study is to evaluate how differently a given change in exchange rate affects the bilateral trade with Sri Lanka's major trading partners. We work on the key hypothesis that a given currency devaluation improves Sri Lanka's bilateral trade with some countries, and deteriorates with some other countries simultaneously, ultimately driving the overall trade balance into deficit. The findings revealed that depreciation / devaluation of Sri Lankan Rupee is likely to boost real exports to 7 countries namely USA, UK, India, Germany, Turkey, Netherland and China while the impact on the remaining 13 countries is insignificant. Those 7 countries share roughly about 51% of total exports of Sri Lanka. Essentially, it would be beneficial to switch the direction of trade towards those 7 countries, particularly towards India and China, when pressure is mounting to depreciate local currency. Sri Lanka has so far seized only a negligibly small portion of those two huge markets in the world. Although currency depreciation / devaluation is beneficial for Sri Lanka in the long-run, except for Hong Kong, South Korea, Thailand and Indonesia, for all other 16 countries, it was proven that an increase in domestic price level of Sri Lanka would cause a downfall in real exports driving trade balance into deficit. This sets a limit to currency devaluation as a policy tool. An improvement in the trade balance through currency devaluation is feasible, only if domestic price levels can be controlled.

Keywords: Sri Lanka, devaluation, trade balance, exchange rate, bilateral trade

**Ragging in Sri Lankan universities: A reverse play of violent domination of the rural
by the urban? A phenomenological reading**

K. Kusum Kumara

Department of Sociology, University of Colombo

Ragging of freshers has been a key component of the violence and intimidation prevailing in Sri Lankan universities. Student unions argue that the university constitutes a unique “sub-culture”; this is firmly institutionalized during the ragging. In recent times, ragging has met a serious challenge on a new front opened by its critics on the social media platform Facebook, and this provides the context for the present study. These criticisms have brought immense pressure on the students’ unions to take a clear public position on ragging which they are seen to be evading for political reasons. A positive outcome of these ideological confrontations on Facebook is an attempt at a theoretical explanation of ragging, based on the rural - urban disparity among undergraduates. This seemingly Fanonist explanation of the oppressed appropriating and imitating the culture of the oppressor (*Black Skin, White Masks*), in this case the Rural “oppressed” by the Urban in the outside world assuming the position of the oppressor of the Urban in the University, needs closer scrutiny. While this argument seems to uncritically subscribe to the notion of university “subculture”, it also dichotomises the rural and the urban in terms of stereotypical social values, ignoring the class factor within each sector. Equating the “violence” of urban exploitation and the dominance of the rural with that of ragging also needs to be critically analysed. This paper makes an attempt to develop such a theoretical discussion on ragging as a social activity from a phenomenological perspective. It will use an array of sources for qualitative data, including accounts of students and views of student activists, as expressed in the pages of Facebook. A specific focus of this study will be the theoretical examination of the notion of “subculture”, as presented by those who justify ragging.

Keywords: Ragging, Violence, Politics, Urban-Rural relationship, ‘Sub-culture’

Relative efficiency of Sri Lankan state universities: A data envelopment analysis (DEA) perspective on social science disciplines

N. Kurukulasoriya¹ and A. Ranasinghe²

¹*Department of Economics, University of Ruhuna,*

²*Department of Economics, University of Colombo*

Social science faculties usually enrol the bulk of the undergraduates in Sri Lankan state universities. However, the human capital production process of the social science stream is severely criticised in terms of productivity. Unemployment of graduates from the social science discipline has become a serious social problem in the country due to the low quality of undergraduate education to some extent. Performance of undergraduates is important since it is one of the integral components of institutional performance. Studies assessing undergraduate education process in the social science stream is hardly available. Accordingly, the current study aims at filling this knowledge gap to some extent by evaluating the efficiency of the process of human capital production in the social science Arts stream. Primary data were collected from 2,258 undergraduates who were following a special degree in Sociology, Geography, Political Science, Economics and Social Statistics. Relative efficiencies were derived using output oriented DEA models. The accumulated GPA was the output for DEA models while formal study hours, self-study hours, class size and percentage of senior academics in selected disciplines were the input. Empirical findings revealed inefficiency in social science disciplines as well as in particular institutions. However, a considerably high level of efficiency is maintained. Furthermore, Kruskal – Wallis tests revealed substantial and statistically significant efficiency variations among social sciences and institutions. In conclusion, at least 20 percent of improvement is possible for each of the disciplines and thus performance targets can be set. If this high overall efficiency is to be met, policy makers must revisit their higher education policies and reforms for the social science stream. Developing innovative and good quality methods of teaching, use of technological innovation in teaching and research and providing a better learning environment are some policy strategies to be established to maintain and improve the current level of efficiency. Use of objective GPA as an output of the DEA model is a major limitation of this study.

Keywords: Data envelopment analysis, relative efficiency, social sciences undergraduate education

Managing the transition period in Sri Lanka to omit illegal migration after 2009

D.A.E. Malavipathirana

Aitken Spence Travels, Colombo

With the end of civil war in 2009; Sri Lanka is now in its transition period where it should bridge the north-south divide. Sustainable social integration has also become the present government's prime objective. Numerous actions have been taken to ensure peace and security in the country, similarly to sustain development as a nation. Following the outbreak of *violent conflict between the Liberation Tigers of Tamil Eelam (LTTE) and the Sri Lankan state in 1983*, civilians feel insecure by facing confusions and misapprehensions during this transition period due to a lack of trust and understanding. As a result, the number of illegal migrants to European and Pacific nations from Sri Lanka gradually increases every year. The primary research question of this study is why Sri Lanka should understand the importance of managing the transition period to avoid illegal migration to other nations. The objective of this research was to understand the impact of discontent in the social integration process due to which members of the Sri Lankan Tamil community migrate illegally. The hypothesis of the research was that the prospects of managing the transition period will minimize illegal migrants from Sri Lanka to the world. The research is mainly based on secondary and qualitative data gathered and web sources. In analyzing the collected data it was found that most of the illegal migrants leave Sri Lanka not due to the insecurity or persecution they face as a minority in Sri Lanka but to have a better life than in Sri Lanka.

Keywords: Illegal migration, integration, managing transition

**Exchange rate and interest rate relationship in Sri Lanka:
An analysis of exchange rate channel of monetary policy**

S.N.K. Mallikahewa¹ and N.D.V. Sandaroo²

¹*Department of Economics, University of Colombo*

²*Department of Economics, University of Sri Jayawardhanapura*

This study examines the interest rate elasticity of exchange rate to analyze the effectiveness of exchange rate channel in the transmission mechanism of monetary policy in Sri Lanka during the period 1978 to 2015. A negative relationship between interest rate and exchange rate is expected in the theoretical background. An increase in interest rate of domestic currency leads to the appreciation of domestic currency against other foreign currencies. If the empirical situation differs from theoretical explanations, decision makers would not be able to make proper decisions to achieve macroeconomic targets in the economy. Monetary policy is conducted to achieve economic and price stability, and policy shocks transform to the economy through various transmission channels. A developing country like Sri Lanka prefers currency depreciation to increase export earnings and to reduce import expenditure to get a trade balance increasing exports and declining imports. Expansionary monetary policy results in currency depreciation, thus increasing net exports. A higher economic growth can be achieved with domestic currency depreciation. In an inflationary situation, contractionary monetary policy can reduce the aggregate demand with domestic currency appreciation. If a negative relationship does not exist between interest rate and exchange rate, the exchange rate transmission channel of monetary policy does not support to achieve the policy objectives. The study uses the variables Nominal exchange rate, interest rate on treasury bills, net exports and total external debt. Co-integration and Vector Error Correction tests are employed to find long run relationship and short term dynamics among the variables. The results proved the negative relationship between exchange rate and interest rate as expected, and all the variables are jointly significant. The negative and significant magnitude of interest rate sensitivity of exchange rate -0.18 shows the effectiveness of exchange rate channel of the transmission mechanism of monetary policy in Sri Lanka. Error correction term shows that, 27% of the disequilibrium (μ_{t-1}) in exchange rate is corrected towards long-run equilibrium by change in net exports, within a one year period.

Keywords: Exchange rate channel, transmission mechanism, interest rate coefficient of exchange rate, Co-integration test, Vector Error Correction Test

Re-migration intention among urban migrants in the Gampaha District

D.P.K. Manel

Department of Demography, University of Colombo

Literature on urban migration in Sri Lanka over the past decades has emphasized that migration plays a vital role in urban population dynamics. Since 1977, the Gampaha District of the Western Province has become a popular urban-ward migration destination and a significant proportion of young people have migrated for employment especially to the Free Trade Zones (FTZs). Many studies have focused on determinants of urban migration. However, research on re-migration intention of urban migrants seems inadequate. Therefore, this study aims to investigate the issues faced by urban migrants and factors that influence urban-ward migration and re-migration intentions. The study is based on quantitative and qualitative data gathered from selected urban communities in the Gampaha urban areas. Data were obtained from a sample survey using an interviewer administered questionnaire covering 400 migrant households. Qualitative information was gathered using in-depth interviews. Descriptive analysis and logistic regression were used for quantitative data while content analysis was used for the qualitative data. Findings revealed that the male-headed households were higher than their female counterparts. More than half of the respondents (60%) had only secondary or primary education. A higher percentage of more educated migrants had an intention to re-migrate due to disturbances faced in current urban living. Urban to urban migration (59.7%) was higher than rural to urban migration. Factors such as marriage, development programs, family reasons and respondents' age at migration were the major factors influencing urban migration. The qualitative analysis also found that inadequate social amenities and poor economic backgrounds lead to urban-ward migration. However, migrants intend to re-migrate in search of more comfortable livelihoods after experiencing negative consequences of migration. Findings suggest that improving physical infrastructure and human capital utilization and decentralizing public services and institutions in the rural contexts would reduce the negative consequences of urban-ward migration.

Keywords: Urban migration, households, re-migration

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The identification of geographical and human effects on the conservation of the Thalawila coastal wetland by using geospatial approaches

D.S. Matharaarachchi¹, M.S.P.M. Siriwardane² and R.N.P.Rathnayake³

¹*Department of Geography, University of Colombo*

²*GIS Solutions (Pvt) Ltd, Colombo*

³*Department of Teacher Education, National Institute of Education, Maharagama*

Wetlands are simply habitats with permanent or temporary accumulation of water associated with floral and faunal communities. Most of the wetlands in Sri Lanka are threatened by natural and human activities, and attention has been primarily given to the popular urban wetlands. “Estuaries and Mangroves” are categorized as “inter-connected coastal wetland” types. The daily tidal fluctuation and the intermediate salinity between salt and freshwater (brackish water) are main characteristics. The Thalawila wetland can be included in this category. It is located at the Kalpitiya peninsula in the Puttalam District. The main objective of the study is to identify the natural and human effects on this wetland and secondly, the identification of effects on the wetland from shoreline changing activities and the identification of human interactions by analyzing the land use pattern. To derive the first objective, spatial data sets were prepared using aerial photographs of 1956 and Landsat satellite Thematic Mapper, Enhanced Thematic Mapper Plus, Landsat8 images of 1980 to 2016. Normalize Differential Vegetation Index and Soil Adjusted Vegetation Index were used to differentiate the shoreline. Data was analyzed using Digital Shoreline Analysis System with ArcGIS 10.2. The second objective was derived using GeoEye images of 2016 by visual interpretation techniques. According to the results the shoreline change was detected as an erosion effect. From 1956 to 1980 (-4.8), 1981 -2000 (-5.95), and 2000 -2014 (-11) have occurred. Field observations detected a pattern of deaths of Mangroves due to shoreline changes. The land use analysis also reflects the human interaction. In conclusion, the Thalawila wetland is facing a vulnerable stage and the conservation process has to be accelerated as the erosion effect is getting worse with the human interaction.

Keywords: Coastal wetlands, shoreline change, human interaction, natural effects, conservation

The Dark Cave: Identification of speleomorphological features and formation

S.M.A.T. de S. Nandaseela, L. Manawadu and D.S.Matharaarachchi

Department of Geography, University of Colombo

Sri Lanka, being one of the Precambrian structures of the world, inherits many morpho dynamics in its formation and one focused area is speleomorphology which simply means cave morphology. Most of the caves in Sri Lanka are not profiled with details and also comes with a significant historical value. One cave system which could be found in Pelendakanda, Opanayaka is the Dark Cave with its local name “Endiri Lena”. According to legendary Ravana tales, people believe that once it may have been a small settlement. The main objective of this study is to profile the cave system of “Endiri Lena” and identify its morphodynamics. In order to achieve this objective, spatial data sets were prepared using both observation surveying and ground surveying techniques. “Total Stations” was used mainly to produce the relatively closest point and identify a morphological profile. AutoCAD and ArcGIS 10.1 were used to analyze data and create a profiling of the Dark Cave. Field observation and laboratory observation techniques were used for the identification of rock types and morphological features. According to the results, the main rock types were identified as Quartz along with calcium carbonate content. Foliation in the formation of rocks can be clearly identified as it was exfoliated when it weathered and collapsed. The cave has fallen rock layers weathered from the top and deposited at the bottom. The preliminary studies show that the actual bottom layer of the cave may lie at least 15 to 20 feet beneath the existing ground. The formation of the cave can be identified as a massive cavity with narrow paths. The cave tends to form horizontally within Pelendakanda at a slight gradient. The cave system clearly illustrates the formation and the geological structure of the region. It will provide more information of the geology as well as the morphology. The knowledge buried beneath the ground is equally important both geographically and historically. Therefore, protection and preservation of this knowledge should be given priority and further studies on this cave system should be conducted.

Keywords: Dark Cave, speleology, morphology, geology

The forming and un-forming of the ‘Mawanell’le’ Muslim consciousness in the aftermath of the Aluthgama riots

A. Niwas and S.Sumathy

Department of English, University of Peradeniya

This is a “limited ethnographic study” of the Muslim community of Mawanella undertaken during a specific period. Mawanella is a town situated in the Kegalle district of the Sabaragamuwa province, home to a sizeable Muslim population. Many of its residents believed that it could be a target of violence in the aftermath of a violent anti-Muslim riot which broke out in Aluthgama on 15th June 2014, following a rally organized by the Bodhu Bala Sena (BBS). This paper demonstrates that the riot triggered in the Mawanella Muslim community nascent and multiple forms of a national consciousness that one may find on par with the “imagined community” discussed by Benedict Anderson. A sense of collective consciousness emerged in facing the days immediately after the Aluthgama violence among the Muslims of Mawanella. However the ‘nation’ or the “imagined community” which surfaced in this situation contained within itself interruptions and fractions which is relatable to Homi Bhabha’s discussions on “disavowal” of the heterogeneity by a nation where contradictions are pushed to the periphery. Bhabha’s “disavowal” is applicable to those voices, spaces and notions that possess the danger of going ‘unnoticed’ in the narrative of the “collective consciousness” that emerged. This paper is a discursive study on spaces occupied by women, the role played by various associations, reactions of individuals: businessmen, youth, workers, those who move from place to place and other forces. Casual discussions, sharing of experiences, focus group discussions and formal interviews through which data was collected form the major analytical basis for the study. Theorization of the analysis comes through looking into relevant literatures. The accounting, the coming into consciousness; the narratives on journeys, movements and actions that the study found in the Mawanella Muslim community are “theoretical and political interventions” on the discourse of the hegemonic state and other hegemonies.

Keywords: “Imagined community”, collective consciousness, fault lines, narratives, “theoretical and political interventions”

**The unbalanced population structure in the neighbourhood of the
Export Processing Zones: A study of the Katunayake EPZ, Sri Lanka**

O. Perera

Department of Geography, University of Colombo

A high concentration of migrated workers to the Export Processing Zones (EPZs) has re-shaped the population structure of the particular region when compared to the population structure at national and district levels. In the attempt to explore the age and sex structure of the region where the Katunayake EPZ is located, this study employed national census data pertaining to the Katana Divisional Secretariat Division (DSD) at Grama Niladhari Divisions (GND) level for the year 2012. In this analysis, the GNDs were categorized into three tiers according to the proximity of the particular GND to the EPZ. Population distribution and population growth of the Katana DSD were also analysed to identify the unbalanced population structure in the Katana DSD. However, the influence of the methodological adjustments of the national census enumeration in 2012 on the research findings cannot be excluded. It reveals a population distribution with significant high concentrations in the first tier including the Evariwatta GND. Calculations of the average annual population growth rate between 2001 and 2012 reveal the highest but a minus population change in the first tier GNDs (-2.32%). The age pyramids illustrate that the percentage of the population belonging to the age group from 15 to 30 in the first tier GNDs outstripped significantly compared to the other age groups. Unusual sex ratios even below 50 females per 100 males were also reported for the first tier GNDs. While 23% of the male population belongs to the 20-24 age group, 38% of the female population belongs to the same age group. The distribution pattern of the 20-24 age group has shown a significant concentration in the first tier GNDs. It can be concluded that there is an unbalanced age and sex structure in the first tier GNDs compared to other GNDs in the Katana DSD, and that the inward flow of young male and female EPZ workers could have influenced this change.

Keywords: Export Processing Zones, population change, age structure, sex ratio

Writing war's end: The problem of the post-war narrative as a source for historical inquiry in Sri Lanka

D. M. Philip

Department of History, University of Colombo

After the end of the Sri Lankan Civil War in 2009, there emerged the post-war non-fictional narrative written by foreign journalists for a local and international English speaking audience. These texts reflect a nation in transition and effectively generate the interest of a global audience hungry for stories from the frontlines of the battle and its aftermath. The narratives, woven together through a series of stories, are called 'narrative accrual', and eventually construct a history or tradition of the period it is documenting (Bruner; 1991). Such texts are considered to be authentic representations of the war and post-war period and with the passing of time gain historical legitimacy. This paper critically analyses Samanth Subramaniam's *This Divided Island: Stories from the Sri Lankan War (2015)*, to understand the problematic nature of the post-war narrative as a source for historical inquiry. Firstly the author frames his narrative to re-affirm 'the East-West and Orient-Occident oppositions' (Prakash, 1990), which locate Third World war-torn countries as illustrative of endemic violence, ethnic nationalism and corruption. Alternatively, these narratives also function as counter narratives by providing a platform for silenced voices to come forth and recollect their sufferings at the hands of the Government of Sri Lanka or the Liberation Tigers of Tamil Eelam. Sinhalese nationalist discourse targets such narratives as being part of the larger international conspiracy to discredit Sri Lanka's human rights record and the victory it achieved at war's end. Similarly the author's use of fictional literary techniques both increases the power and appeal of the story while undermining its claims to truth and accuracy. As a result the post-war narrative becomes emblematic of two very different and competing popular ideological discourses. It ceases to represent the historical and instead lends itself more easily to the fictive instead of the real.

Keywords: Post-war narratives, history, historical source, truth, war

Challenges and prospects of youth migration of Sri Lanka

P.M.A.N. Pingama

Faculty of Management and Finance, University of Colombo

This study intends to understand the phenomenon of post-war youth migration in Sri Lanka. The study reviews migration literature and preliminary research findings in respondents' interviews. Many actors have taken many initiatives to create a better future for youth. This includes the provision of education, skill development, social inclusion, social equality and participatory development to shape the future of youths. But there is a significant segment of the youth population that is not satisfied with the available opportunities and choices within Sri Lanka. They are not convinced that a better and safer society has been provided for their future. In this research, the migration drivers and tendencies are examined and researched both from a theoretical and empirical point of view with a special focus on perspectives and causes for migration of youths of post-war Sri Lanka. The objectives of this study are to understand reasons for youth migration, basis of destination selection, forces and actors of such migration and expected future relationship with the home country. The research design is post-positivistic within the theoretical framework of the Social Exchange Theory. Many international migration theories have been proposed to assess and explain the underlying phenomena of international migration. However, international migration is a complex issue with multiple facets. One single theory may only explain a particular aspect of international migration. Conventional findings suggest that migration can be explained with Neo-classical Theory, Theory of Economics of Migration, Dual Market Theory, Social Capital Theory, Cumulative Causation Theory and Trans-nationalism. However, this study indicates that most young people migrate to different countries due to the perceived uncertainty of their future. This study makes a significant contribution to the existing practice and theory in International Migration of Youth Population of Sri Lanka. The paper concludes with propositions, preliminary findings and recommendations for future research on understanding the migration of youth.

Keywords: International youth migration, decision making, social exchange theory development

Rate of returns to education and uncertainty of investment in education in Sri Lanka

T.A.M. Pushpakumara and A. Ranasinghe

Department of Economics, University of Colombo

Labor market uncertainty has two components; *job uncertainty* and *wage uncertainty*. Job uncertainty refers to the risk of being unemployed and wage uncertainty refers to the risk of falling into low paid jobs. The main objective of this paper is to analyse wage uncertainty in Sri Lanka based on the Mincer Earning function. The earning function is estimated using Quantile Regression (QR) (Koenker and Bassett, 1978) method. Based on the results, the Marginal Rate of Returns (MRR) for schooling is estimated for different quantiles of the conditional earnings distribution for a given level of schooling. This allows us to identify variations of MRR for each level of schooling. A large and significant variation of MRR for education at a given level of schooling is the measurement of wage uncertainty. Using a gender dummy, the wage uncertainty was further decomposed by gender. Results show that, except for primary level, there is a significant difference of MRR for education between male and female. At primary level, both male and female workers have the same MRR. Male workers have a higher MRR for education than female workers at secondary (grades 8 to 10) and G.C.E (O/L). Females get higher returns to education at G.C.E (A/L) and above levels. Wage uncertainty varies with the level of education and gender. Compared to non-graduate workers, graduate workers face a higher degree of uncertainty. Among graduates, females face a higher degree of uncertainty than their male counterparts. This finding is consistent with findings on job-uncertainty. Incidence of unemployment is higher among graduates and women (Ranasinghe, 2014). In the presence of higher unemployment among graduates and women, it is anticipated that they tend to accept jobs with lower wage offers at least in the short-run, and therefore, wage uncertainty also tends to increase with job uncertainty.

Keywords: Rate of returns, wage uncertainty, quantile regression, Sri Lanka labor market

Dialects of Sri Lankan English: The impact of social change on language use

R.L.A.S. Rajapakse

Department of English, University of Colombo

Sri Lankan English (SLE) was the variety of English that took root in the country after it was introduced to the country by the British during colonial rule. The form of SLE that was governed by rules unique to it was the standard variety spoken by those who used it in the capacity of a first language. Along with the standard version, there also came into being deviant forms which developed with many people outside of the social circles to which the aforementioned first language speakers belonged beginning to speak it for various practical purposes. These non-standard variations of SLE are generally supposed to be spoken by those who use it in the capacity of a second language. Although definitions describing these variations have been proposed by scholars, they are grounded to a large extent on assumptions related to the social background which the speakers hail from. The definitions of variations of SLE also fail to capture the many socio-cultural transformations which have taken place in the society of Sri Lanka in the aftermath of Independence. The current study investigates factors related to the social background of a sample population and the ways in which they use SLE in daily life in order to explore the extent to which the transformations undergone by Sri Lankan society in the aftermath of independence would have impacted on and manifest themselves in SLE and the ways in which its contemporary speakers use it. The main objective of the study therefore is to attempt to produce definitions of SLE which go beyond limited understandings of language use which assume obvious links between the level of pronunciation competence of its speakers and their social background and are grounded in the contemporary social context.

Keywords: Sri Lankan English (SLE), Standard Sri Lankan English (SSLE), Non-standard Sri Lankan English, Categories (of Sri Lankan English)

An analysis of seasonal rainfall variability on paddy production in Sri Lanka

E. M. S. Ranasinghe¹ and C. S. De Silva²

¹*Department of Geography, University of Colombo*

²*Department of Agricultural and Plantation Engineering, The Open University of Sri Lanka*

In Sri Lanka, paddy farmers depend on a bi-annual pattern of rainfall in most parts of the country, leading to two cropping seasons; ‘*Maha*’ and ‘*Yala*’. It is now evident that island’s climate has undergone significant changes, to the extent that the right amount of rainfall is not received at the right time in the growing season (Wickramasinghe and Punyawardena, 2010), therefore it causes substantial damage to the paddy crop (De Costa, 2010). With this background, the study was aimed to analyze the correlation between seasonal rainfall and paddy production in Sri Lanka. Decadal scale seasonal rainfall data and paddy harvest data for *Yala* and *Maha* during the period of 1981-2010 for 23 administrative districts were considered for the study. Seasonal rainfall data and paddy harvest data were obtained from the Department of Meteorology and Department of Census and Statistics in Sri Lanka respectively. Simple linear regression method and the graphical method of scatterplots were applied for the study. According to the results revealed from the study, the overall picture shows that the rainfall-paddy correlation in the three climatic zones varies from decade to decade and also from district to district. During the *Yala* season, districts located in the lowland areas of the wet zone showed moderate to significant positive correlations in the decade 2001-2010, denoting that increased rainfall led to an increase in the harvest. However, no discernable correlations were found between seasonal rainfall and paddy harvest during the *Yala* season for most of the districts in the intermediate and the dry zone. In the wet zone, during the *Maha* season, positive correlation between the seasonal rainfall and the paddy harvest is relatively remarkable than the negative correlation between the two variables. In the dry zone areas, during the decades of 1991-2000 and 2001-2010 negative correlations between seasonal rainfall and paddy harvest were more marked than the positive correlations.

Keywords: Seasonal rainfall, paddy production, correlation, growing season, linear regression method

Legalization of the sex industry: A sociological study on the illegal status of the sex industry in Sri Lanka and its impact

B.G.I.M. Samarasinghe

Department of Sociology, University of Colombo

The major objective of this study is to understand the legal aspect of the sex industry in the Sri Lankan context. The main focus is on the practical situation of the legal aspects of the sex industry. Together with this, issues faced by sex workers within the illegalized professional setting and the barriers to legalize the sex industry in Sri Lanka will also be investigated. These are discussed in relation to Foucault's analysis of the relationship between power, body and knowledge and the concepts introduced by symbolic interactionism. This is a descriptive study, which collected qualitative data from two police divisions in Colombo by using in-depth interviews and non-participant observation techniques. Twenty five street sex workers were selected as respondents using the snow-ball sampling method. Data was analyzed through narrative analysis. Research findings show that there is a contradiction between the written legal facts and the practical position of both sex workers and legal parties. Sex workers become powerless when confronted by the legal officers and consequently generate illegal interactions with these officers which negatively affects the legal process. Sex workers use many strategic actions to escape from legal resistances such as providing tributes to legal parties. They are well organized to conduct this profession within the illegal context and they spend a huge amount of money to survive within the profession. Sex workers face many health issues, security issues, physical and psychological difficulties, problems created by clients such as harassment and payment problems based on the illegal conditions. Social, cultural, legal and religious influences highly control the sexuality and sexual relationships of Sri Lankans. Accepted sexual behaviours and its related ideas restrict this profession and sex workers in Sri Lanka. Therefore it is difficult to create a positive public notion about the sex industry.

Keywords: Sex workers, sex industry, legalization, illegal interactions, power

Analyzing the trends of land use changes in the Kurunegala MC area using remote sensing

R.M.S.S. Sanjeevani

*Department of Transport & Logistics Management, Faculty of Engineering,
University of Moratuwa*

Land use changes in urban areas is a crucial phenomenon in the developing world where Sri Lanka is experiencing a messy urbanization pattern characterizing urban sprawl and ribbon development according to World Bank, 2015. Remote sensing techniques provide easy access in identifying land use changes in a certain area. Many studies have been conducted to assess land use changes in mega cities like Colombo. But studies on land use changes in growing cities like Kurunegala is rare. It is timely important to identify trends and patterns of urban land use changes in these growing cities. This study focuses on identifying trends of land use changes in Kurunegala MC area from 1988 to 2015. Landsat images of 1988 (TM5), 1997(TM5), 2000(ETM 7), 2010 (TM5) and 2015 (OLI/TRIS 8) of study area were used for this study. Normalized Difference Vegetation Index (NDVI) and Normalized Difference Built-up Index (NDBI) were used as parameters to detect land use changes. ArcGIS 10 was used for calculating indices and results were mapped to identify patterns of land use changes. By 1988, only 39% of the MC area was covered by built-up area and 61% by non- built-up area. By 2015, the built-up area has increased up to 69% and non-built-up area has decreased up to 31%. It is clearly evident that the built-up area is increasing with the passage of time while the non-built-up area is decreasing. This growth of built-up areas seems to be followed by the road network of the area. On the other hand, vegetation cover has decreased from 68% to 28% by 2015 as the built-up area increased. These changes can be considered for urban land use and policy planning. Furthermore, these outcomes can be used for identifying environmentally critical areas in the region with regards to land use changes.

Keywords: Land use, NDBI, NDVI, ArcGIS 10, growing cities

**Morbidity and mortality of persons who migrate to Italy: A case study of the
Mahawewa Divisional Secretariat, Puttalam District**

V.P.N. Senadhi

Department of Demography, University of Colombo

Remittances sent by Sri Lankan international labour migrants contribute greatly to the Gross National Income of the country. International labour migration from Sri Lanka has increased since 1970 and a majority of Sri Lankans selected countries in the Gulf region as their destination. Since 1990, the European region has become a popular destination for Sri Lankan labour migrants and Italy is the most popular among the countries in the European Region for both legal and illegal migrants. Although a noticeable economic advancement has been achieved by persons who migrate to Italy, migration creates several problems, especially physical and mental health problems. The main objective of this study is to examine the impact of migration on persons who migrate to Italy on the morbidity and mortality of the migrants. The study is based on data collected from the migrant households of Mahawewa Divisional Secretariat (DS) Division in the Puttalam district using a mixed methods approach. Households were selected by using the snowball sampling method. Quantitative data was collected from 150 households using interviewer administered questionnaires and qualitative data was obtained through in-depth interviews and case studies. In addition, secondary data from different sources was used. The study reveals that migrants suffer from physical illnesses, mental illnesses and disabilities due to migration. Several deaths of migrants during migration or at the destination are also reported. Some migrants have returned due to illnesses. Age, sex and marital status of migrants, methods of migration, experiences that migrants faced while migrating, social, economic and environmental conditions at the destination countries, and duration of the stay at the destination have contributed to the morbidity conditions and mortality of migrants. In the long run, the morbidity and mortality conditions of these migrants affect themselves and their families.

Keywords: Italy, international labour migration, morbidity, mortality

Understanding and practicing ‘good governance’: An opinion survey of selected local politicians in the Western province

M. Senanayake and N. C. R. Silva

Department of Political Science and Public Policy, University of Colombo

The concept of good governance is in vogue in Sri Lanka mainly due to two reasons: 1. the post-war reconciliation process and 2. The Presidential election of 2015. Of these two reasons, the presidential election was more prominent. The present government in Sri Lanka was elected into office under the banner of good governance (*yahapalayanaya*) and anti-corruption. At the same time, good governance practices are essential in Sri Lanka due its plurality, the relatively successful impact on the developing economy and as a democratic polity. Hence the slogan of the newly appointed government opened up a new intellectual space to makes use of good governance practices in Sri Lanka. It provides an opportunity to discuss the role of the central government and local government authorities in relation to good governance and it`s practices. In this context this research will explore an answer to the following research question: Good governance is conceded as a key element of democratic rule. The central government continuously uses the theme of good governance as its mode of governance. Therefore, what are the roles, understanding and practices of good governance by the local level politicians and practitioners? Both primary and secondary data were used in this study. Primary data refers to information and evidence gathered through research from primary sources such as field research that includes surveys, interviews, discussions, observations and group discussions. A survey was conducted in three districts namely, Gampaha, Colombo and Kalutara. Secondary data was obtained from secondary sources such as published materials, newspapers, reports and existing research studies. According to the key findings, it was observed that the majority of the local level politicians and practitioners do not have at least a basic understanding of good governance and its practices. Secondly, a majority of the respondents think that these good governance practices interfere in developing their voter base, and finally this phrase becomes an empty signifier among them as a slogan that can be used in their election campaigns.

Keywords: Good governance, local governments, democracy

Geopolitics of China-Sri Lanka relations: Yesterday, today and tomorrow

A. Senevirathna

¹Department of Strategic Studies, General Sir John Kotelawala Defence University

China is a global power with future super power ambitions. Sri Lanka had strong bilateral relations with this giant Asian nation and was one of the first countries in the region to recognise the People's Republic of China after the Chinese revolution. Sri Lanka's relations with China became stronger; since then, the two countries have regularly exchanged high-level visits resulting in various bilateral agreements. Since the beginning of official diplomatic relations, China has provided economic, military and technical assistance in various fields to Sri Lanka. In recent times China has become the biggest investor in Sri Lanka with massive investments notably in maritime infrastructure and related projects. China has identified Sri Lanka as one of the most important positions in the proposed 21st Century Maritime Silk Route initiated by the Chinese government. This growing Chinese influence in Sri Lanka is closely watched by the world's superpower the United States and the regional hegemony India for obvious geopolitical reasons. It is evident that, both the United States and India are competing with China for supremacy in the Indian Ocean. Both India and the United States fear that Sri Lanka can become a strategic Chinese naval choke point in the future. Sri Lanka as a developing country is in need of Chinese investments for its future development goals. Therefore, China is an important factor in its foreign relations. This study attempts to identify the geopolitical interests of all three major powers on Sri Lanka and suggest how Sri Lanka can benefit from its geographical location by maintaining a strategic relationship with China without antagonising the other two major powers in the region.

Keywords: Geopolitics, super power, regional hegemony

Language and cultural transitions in *The Tempest*

S. Seneviratne

Department of English, University of Colombo

Although much has been written on language, culture, and colonialism in William Shakespeare's play *The Tempest*, the ambiguity surrounding the cultural and linguistic identities of the Italian duke and proto-coloniser Prospero and his 'subject' Caliban merits more study. Cultural identity is located in the complex relationship between language and culture in the play. This paper will suggest that the characters' relationship with language brings about their cultural transition, transforming them into cultural hybrids. It will consider how these cultural transitions complicate the colonial power structures in the play. The paper will examine Prospero's books as artefacts of European languages that deal with magic, and will pay attention to the implications of Caliban's acquisition of European languages. It is Prospero's engagement with the cultural hybridity encoded in his books that accords him power over the inhabitants of the enchanted island, while Caliban is contrastingly denied the power of European language due to his culturally transitional nature. The paper will also consider the role that the island plays in the characters' linguistic and cultural transitions. To provide a historical background for this discussion, the paper will look at texts by early modern European colonists, such as Thomas Hariot and Thomas Gates, to explore their growing sense of national identity and the idea of cultural power coded into them. It will compare and contrast this with the culturally hybrid identities of the play's characters. The paper will also pay attention to how *The Tempest* engages with early modern society's perception of 'Others'. For example, it will look at the alleged 'gabble' of Caliban's speech in relation to the inability of colonists such as Sebastian Cabot to understand the native peoples' languages, and it will consider Prospero's magic and his books in the light of King James I's *Daemonologie*, which denounced magic.

Keywords: Language, culture, hybridity, transition

Inorganic farming and the acceleration of groundwater nitrification in the Jaffna peninsula – Sri Lanka

S. Sivaramanan¹ and R.U.K. Piyadasa²

¹*Environmental Impact Assessment Division, Central Environmental Authority, Battaramulla*

²*Department of Geography, University of Colombo*

Groundwater nitrate levels in the Jaffna peninsula of Sri Lanka are well above the World Health Organization limit of 10 mg/L as NO₃⁻ as N. Ground water nitrate levels in agro-wells of Innuvil and Balaroadai depict high level of NO₃⁻ as N concentrations 27.65 mg/L and 25.06 mg/L respectively, whereas in Pavisaarupoonganicholai in Kondavil it is 9.95 mg/L as NO₃⁻ as N where vermicompost is being used. In Sanguvelli farm where strict compost farming is in practice, it is 8.18 mg/L as NO₃⁻ as N. Thus both agro-farms using organic means of nitrogen depicted NO₃⁻ as N concentrations below the WHO limit. Increased nitrate levels in ground water aquifers are observed in areas where intensive agriculture practices takes place, such as tobacco cultivations in Innuvil and Balaroadai. Innuvil and Balaroadai uses the highest level of Urea as 50 kg per 0.0625 acres or nitrogen loading of 322 kg/ha per crop resulting in ground water nitrate levels of 27.65 and 25.06 mg/L NO₃⁻ as N respectively. These results enabled us to find that use of inorganic fertilizer in agricultural farms contribute to the ground water nitrate issue; plants with high consumption of Urea such as tobacco fuels the problem. However, sampled agro-farms using organic means of nitrogen depicted NO₃⁻ as N concentrations below the WHO limit. Since aquifers in the peninsula are primarily porous shallow karstic Miocene limestone, they provide high levels of infiltration. If the current situation continues unabated, the public may suffer from harmful effects of nitrate toxicity. As a possible immediate solution, complete banning of high nitrate fertilizer consuming crops such as tobacco is recommended. This would improve the quality of the ground water.

Keywords: Groundwater, nitrification, Jaffna, inorganic fertilizer

Knowledge and attitudes towards menopause: Experience of post-menopausal women in Urban Settlement Communities, Colombo

S.A.Y.N. Subasinghe and E.L.S.J. Perera

Department of Demography, University of Colombo

Women's health concerns extend over the life cycle and are not limited to a particular stage or age of their lives. Literature on women's health problems has mostly focused on women in reproductive age. There is lack of research on post-menopausal health related experience of women, especially in the context of increase in female life expectancy (79 years) in Sri Lanka. Menopausal aged women who live in low income urban settlement contexts are more vulnerable to health risk. Therefore, the main objective of this paper is to examine the post-menopausal experience of women and their knowledge and attitudes on menopause. The study uses qualitative data gathered through case studies and cases were selected purposively. Women who were age fifty and above, having experienced one year or more years without menstruation were selected. The results show that many of the respondents had misconceptions with regard to menopause and menopause related health issues. Women who had experienced early menopause believed that it was due to delivery of child birth by a caesarean, low level of hemoglobin, and other health problems. It was found that almost all women in this community had experienced their menopause before age 40 and it was related with their low level of economic background and poverty. The findings further revealed that they had not communicated with anyone about menopause related health issues. Both positive and negative perceptions on menopause were found. Some women viewed it as a stage which involves a sense of freedom and gave her additional strength to carry out more productive work in their day-to-day life while others have discoursed about their physical health problems and psychological stress experienced during the post-menopausal life. These findings suggest that special attention needs to be given to enhance post-menopausal health education among women in urban settlements.

Keywords: Menopause, post-menopausal women, knowledge, attitudes

**‘Two homes, refugees in both’: Transitions and resettlement – the case of the
Northern Muslims in Sri Lanka**

E. Surenthiraraj and N. de Mel

Department of English, University of Colombo

This paper discusses the experiences of Northern Muslims expelled by the LTTE from their homes in 1990 to analyze how displacement, return and resettlement become both constitutive of, and constituted by the exceptionalities that characterize post-war transitions. In particular it is interested in how categories of ‘refugee’ ‘home’, ‘origins’, ‘return’ and ‘resettlement’ are defined and contested during transitional periods in order to understand better the work of transitions, their impact on war victim subjectivities, and thereby societal empowerment and transformation. Through a discourse analysis of in-depth interviews with internally displaced Northern Muslims and the juxtaposition of their narratives with the Framework of the Ministry of Resettlement (2013), and the report of the Citizens Commission on the Expulsion of Muslims from the Northern Province by the LTTE (2012), the paper interrogates the metanarratives, typologies and temporalities underpinning both transitional policy frameworks and IDP narratives. Key questions asked are: How do Northern Muslims articulate their experience of displacement? How do resettlement frameworks categorize IDPs and by doing so, define/authorize their experience; and why do transitional policy frameworks often flatten displacement to a bounded, time-barred experience, and what is the implication of this for communities who experience protracted displacement? The paper draws on discourse analysis, memory studies, and narrative inquiry for its theoretical approaches and methods. It is informed by fieldwork carried out in Palavi, Puttalam and Colombo where in-depth qualitative interviews with key Northern Muslim informants took place. Interview questions focused on three broad themes: what home means, conflict-related events, and perspectives on sharing memories. The paper argues that the experiences of Northern Muslims displaced for over 25 years in Sri Lanka point to how we need to re-think the terms commonly used to define and understand their condition(s). As with transitions, displacement is an extra-ordinary situation and constitutes an experience through which others are comprehended. As such it constitutes a rich site for investigating post-war transitions, transformation and empowerment.

Keywords: Northern Muslims of Sri Lanka, displacement, resettlement, transitional policy frameworks

**Re-imagining the city: Linguistic framing of space in the Western Region Megapolis
Planning Project**

R. T. Surenthiraraj

English Language Teaching Unit, University of Colombo

The planning of cityscapes has long been considered a space of valuable influence and insight since it offers a perspective on how physical space is imagined and brought into being. Crucial to this transferring of ideas from thought to process is the role of language that acts as the medium through which words and labels are utilised to organise space. Recognising the state as a dominant actor in organising urban space, this study's main focus will be to critique the methods by which the state exercises power over space through the manipulation of language's ability to frame space. The proposed Western Region Megapolis project was introduced to Sri Lanka by the current government as a 'solution' to the burgeoning problems arising from 'unplanned development' in the western region of the country. Framed mainly within developmental and economic narratives, this project proposes to redesign the region's physical allocation of space and spatial resources in order to enhance the country's ability to meet its development goals. Although this project has been critiqued through economic and policy-oriented approaches, this study aims to offer a different perspective by utilising a discourse analysis approach to the study of how state power affects the planning and re-imagining of space. It primarily focuses on the textual analysis of the official documents made available to the public, as these documents offer an insight into the state's framing of ideas and articulation of thought. Although the focus on official documents only limits the scope of this study, this approach serves to generate further discussion that is needed to critique the state's power in articulating and framing urban space in Sri Lanka.

Keywords: Language, development, urbanisation, Megapolis

Protecting the poor from the growing debt trap: Evidence from Northern Sri Lanka

P. Suthaharan and M. Guganeshan

Department of Economics, University of Colombo

Increasing credit to households not only erodes the earning potential of the targeted population, but also makes them far from promoting progress resulting in greater poverty, exclusion and dependence. Globally, there has been much research on excessive credits, which results in negative impacts on the economic, livelihood and even psychological aspect of the borrowers, affecting the quality of life. The impact of this is more harmful among low-income poor households, and studies point out that the original intention of credit for rural empowerment has diminished over time. Within the last five years indebtedness has sharply increased within the Northern Region as the growth of average debt per family rose from Rs. 52,000 to Rs. 194,000. In addition, the number of financial institutions per 100,000 people in the North has doubled in the same period, which is even more than in the Western Province. Easy credit is available even without any security to buy anything from consumer durables, motorcycles and homes to agricultural equipment. Most importantly, excessive loans are obtained by people for their day-to-day consumption. Thus, the borrowed money is hardly being used for any economically viable activity, resulting in difficulty to repay. In this paper, we seek to explicate the recent trend of excessive credit in the Northern Province and the underlying impact that it has created on the livelihoods of the rural poor through secondary research and qualitative focus group discussions. The study also attempts to shed light on women's empowerment, new job creation, and livelihood development within the context of credit growth, which ideally should have improved these indicators. This paper highlights the measures that should be taken by policy makers to protect low income populations from the debt trap, such as the need for national strategies to improve financial literacy of citizens through financial education and appropriate financial consumer protection measures.

Keywords: Rural empowerment, microfinance, financial literacy, credit growth, rural economy

Factors that contribute to a failure in utilizing assessment-driven learning in TESL in the Sri Lankan higher education context

K.K.S.G. Sylva

English Language Teaching Unit, University of Colombo

Assessment-driven learning is a widely supported method in adult education. Seen to increase learner motivation, it is also helpful in aligning objectives, content, and assessment in order to make teaching more effective. This study looks at why this formula for success may not be working for ESL in the local university context, as one of the persistent criticisms of the ESL programmes in local universities is that they do not equip the learner to use English competently despite the fact that students successfully complete English language courses offered by these institutions. What is the nature of assessments used in the English-language teaching programmes in three selected local universities? Do they adhere to the principles of assessment-driven learning in adult education (including type of assessment, grading criteria and validity/reliability of assessment)? If so, why may they be failing to support learners to reach competency goals that the courses aim for? This study uses information gathered through a survey and interviews with selected teachers and programme designers at three selected institutions, documentary evidence, and teaching-journal entries maintained by the researcher. A qualitative study, it uses thematic analysis as the means of analysing the findings. The focus and weightage allocation of assessments, a focus on summative assessments as opposed to formative feedback, and institutional by-laws that limit assessment practices are seen to be major contributing factors that result in the present mismatch between competencies perceived to have been achieved and competencies as demonstrated in use. There are other contributing factors such as a limited number of contact hours and ESP/EAP versus General English (GE) focus that determine this outcome as well. In conclusion, the study poses the question as to whether this situation calls for a transformation in thinking of assessment practices in order to transition to a system that supports the goals of the TESL enterprise within local higher education institutions.

Keywords: Assessment-driven learning, summative assessment, feedback

Media Platforming for empowering returnees within their own communities

C. S. Thangaraja

Journalism Unit, University of Colombo

‘Returnee’ is a term that is used by the international community to identify a person who was a refugee and recently returned to his / her country of origin. At present, the issue of returnees is considered a severe crisis throughout the world. Therefore, most countries focus a great deal of attention on returnees and set out laws and policies in this regard. The term acknowledges that returnees are in need of certain assistance, protection and empowerment because returning to a country of origin should mark the end of personal suffering and displacement and a return to normal life. ‘Empowerment’ is a process through which women and men in disadvantaged positions increase their access to knowledge, resources and decision-making power, and raise their awareness of participation in their communities, in order to reach a level of control over their own environment. Media plays a vital role in empowering people in contemporary society. Therefore, the concept of ‘Communication for Empowerment’ is recognized around the world. Communication for empowerment is a methodology that provides information to the disempowered and marginalized groups at the focus of media support. Information is particularly important for groups that are at risk. This study is based on a research carried out for 06 months from January to June 2016. The methodology adopted in this study is content analysis. The analysis focused on the thematic content of news materials, the extent to which that coverage was favorable, unfavorable or neutral, and the way in which the returnees’ themes were reported in Sinhala newspapers published during the said period along with its contextual framing. In this paper I argue that print media do not provide a considerable space for the issue of returnees in Sri Lanka. There are limited media opportunities to highlight returnee communities’ issues, although it is seen as an essential component of a media empowerment process.

Keywords: Returnees, Empowerment, Print Media, Media Platform

**Multiplicity of religion and conflicting religious truth claims:
A search for co-existence and cooperation**

A. Tilakaratne

Department of Buddhist Studies, University of Colombo

It is a truism to say that religions differ from each other although there are broad similarities and commonly shared ‘family resemblances’ among them. Historical self-perception of religions has been no different from this for the birth of any new religion has been perceived by both opponents and proponents as denial or improvement upon the earlier religion/s. The history of religion worldwide has been beset with varying degrees of violence. It is popularly believed that the differences among religions mentioned above have been the main reason for religious conflicts, and consequently it has been further held, particularly more recently, that if religious differences are removed or interpreted as really non-existent or as only seemingly existent, then religious conflicts will be over, ending one of the most serious problems human society has been facing for the last three millennia. There are a number of scholars who have defended the alleged one-ness of all religions. I will refer to a few classical examples such as Rudolf Otto (*The Idea of the Holy*, 1950), W.T. Stace (*Mysticism and Philosophy*, 1960) and John Hick (*An Interpretation of Religion*, 1989) upon whose views the popular belief under discussion has been maintained. This paper will examine this popular belief in which there are two claims: (i) All religions in some fundamental sense are the same, and (ii) it is the perceived differences of religions that cause conflicts and violence between and among religions. I will argue that these claims are false, and that it is not the fact that religions are different from one another, but the dogmatism usually associated with religious beliefs that causes trouble.

Keywords: Multiplicity of religion, religious truth claims, religious conflicts, religious dogmatism

Intergenerational wealth transfers: Understanding the changing pattern of the relationship between elderly parents and their adult offspring

K.D.M.S.K. Weeratunga

Department of Demography, University of Colombo

Among other issues related to ageing, wealth transfers between elderly parents and their adult offspring have become an important concern in developing countries including Sri Lanka. Sri Lankan elderly have traditionally been almost totally dependent on family support. A key policy question is whether the transition from traditional to modern family has changed the direction of the intergenerational wealth transfers. The conceptual framework of this study is based largely on the work of Caldwell (1982) and Hugo (1997) as they focus upon the changes in the intergenerational transfers of wealth and its implications for ageing. The main objective of this study is to examine the changing pattern of wealth transfers between parents and their offspring in Sri Lankan society. It further examines different dimensions of these wealth transfers. The study used a mixed methodology based on surveys of 300 elderly households and 150 control households in the Galle district and a wide range of quantitative and qualitative information from both primary and secondary sources. This study found a transition in the wealth transfers over the years from its traditional standing to the present modern status in Sri Lanka, because of the changing mode of production, education and influence of the western life style. It is apparent from this analysis that parents in the modern family setting provide more wealth towards their offspring until they become economically independent. Hence, the wealth transfers from parents to offspring during their life course are more than what was observed during the traditional family setting where wealth transfers were upward towards parents from offspring. However, admiration for aged people has not changed over the years. A large proportion of parents still expect support from their offspring in their old age but the majority have not received the support expected and the wellbeing of those elderly will probably deteriorate.

Keywords: Ageing, elderly parents, adult offspring, intergenerational transfers, relationship

A study on sustainability of water resource consumption practices in the hotel sector in the city of Colombo

W.A.W.P. Wijayalath

Department of Geography, University of Colombo

The tourism industry in Sri Lanka shares a substantial amount of Gross Domestic Product and predicts an immense expansion within a short time period. It generates income through consumption of goods and services by tourists, the taxes levied on related businesses, and from opportunities for employment in service industries, such as transportation, hotel accommodation, bars, entertainment venues, spas and resorts. The tourism industry highly depends on the natural environment and its resources, especially on water resources. Sri Lanka has witnessed a significant growth in the arrival of tourists from around the world. This the demand for water resources has also increased in this process. It is, therefore, imperative that the hotel sector pays adequate attention to the importance of water conservation, since water consumption per guest in a hotel can be around three times that of the average consumption of a person staying at home. In this scenario, the relationship between the tourism industry and water resources becomes a key area of concern for sustainable tourism development. The objective of this study is to identify and analysis the sustainable water resources consumption practices used by hotels in the city of Colombo. The study is based on the hotels registered with the Sri Lanka Tourism Development Authority (SLTDA) in the city of Colombo. The categorization of tourist accommodation units of the SLTDA includes tourist hotels, guest houses, bed and breakfast units, restaurants, boutique villas, and establishments that offer water sports. Among these only the hotels are considered for the present study. The study is based on secondary data collected from SLTDA and the Greenish Sri Lanka Hotels (GSLH) Project and the analysis based on statistical records of the SLTDA and GSLH project.

Keywords: Sustainability, water resources, tourism

Ethnic differences in desired spacing fertility behavior: A case study of the Maradana Grama Niladhari Division, Colombo District

D.M.S.G. Wijerathna

Department of Demography, University of Colombo

Fertility is one of the major demographic components connected to various socio-economic and other demographic factors. Fertility behavior directly affects changes of fertility levels, trends and patterns. There are three main behavioral patterns related to fertility, namely starting, spacing and stopping behavior. Differences in fertility are related to socio-economic and demographic factors such as ethnicity, religion, geographical area, education, etc. The literature finds that spacing and stopping fertility behaviors affect fertility control. Spacing is considered a significant behavioral factor related to fertility behaviour. This study mainly focuses on identifying the desired spacing fertility behaviour among married women of different ethnic groups. The study used both qualitative and quantitative methods to collect data. The sample includes 150 married women who are in the age group 15-29 (birth cohort 1985-1999), representing Sinhala, Tamil and Muslim ethnic groups. The study area was Maradana Grama Niladhari Division in the Colombo District. Purposive sampling technique was adopted in selecting the sample. This study found that, the total number of expected children, total number of expected children in addition to first child, number of expected girls and boys, desired gap between (spacing) births of children and expected contraceptive use for spacing behavior are key demographic factors affecting expected spacing fertility behavior. It is revealed that women who are in the 1985-1999 birth cohort expected longer birth spacing between children. A majority of the women in all three ethnic groups have limited their expected fertility to two children. This study further highlights that interrelationship between all ethnic communities directly influences spacing fertility behavior. Although a significant variation exists in ethnic fertility at the national level, this study does not show marked variation of spacing fertility behavior by ethnicity.

Keywords: Fertility, spacing fertility behavior, ethnicity, desired fertility

Faculty of Education

University of Colombo



'Improving Teacher Education'

Message from the Dean Faculty of Education

Professor Manjula Vidanapathirana



I am pleased to present the proceedings of the Annual Research Symposium of the Faculty of Education for 2016. This year, the theme selected by the Faculty of Education is 'Improving Teacher Education'. Teacher education in the 21st century has many challenges, and ideally, teachers of the future together with their students should strive to create a better world for humanity.

The Annual Research Symposium is an opportunity for academic staff and research students to showcase their research and to get to know each other's research strengths. The Symposium has continued to encourage the interaction of research students and developing academics with the more established academic community.

This year's thematic Keynote Address is delivered by Dr. S. B. Ekanayake who is a renowned education specialist, highly acknowledged in both Sri Lanka and abroad. I am grateful to Dr. Ekanayake for accepting our invitation to share his knowledge and experience of being a teacher educator for over four decades.

I wish to express my gratitude to the Faculty symposium committee and the reviewers for their hard work. My appreciation is extended to the organising committee at the University level for all the support given to us. The symposium would not be possible if not for the willingness of the presenters to share their research findings. I congratulate all the presenters and hope that we will be able to engage in fruitful interaction, dialogue, knowledge-exchange and knowledge-creation towards the development of education in Sri Lanka.

**Faculty of Education, University of Colombo
Annual Research Symposium 2016**

Improving Teacher Education

13 October 2016

PROGRAMME

8.30 am - 9.30 am	Registration & Tea
9.30 am - 9.40 am	Opening Ceremony
9.40 am - 9.45 am	Welcome Address by Professor Manjula Vidanapathirana Dean, Faculty of Education
9.45 am - 10.00 am	Address by the Chief Guest Senior Professor Lakshman Dissanayake Vice-Chancellor, University of Colombo
10.00 am -10.40 am	Keynote Address by Dr. S.B. Ekanayake CEO, Association for Educational Research and Development, Former Basic Education Advisor, UNESCO/UNHCR, Central Asia
10.40 am - 10.50 am	Vote of Thanks by Mr. Jude Nonis Chairperson, Faculty of Education Annual Research Symposium
11.00 am - 12.30 pm	Research Presentation Session I (Parallel Sessions)
12.30 pm - 1.30 pm	Lunch
01.30 pm - 3.00 pm	Research Presentation Session II (Parallel Sessions)
03.00 pm - 3.30 pm	Tea

Introduction to the Keynote Speaker

Dr. S.B. Ekanayake

*CEO, Association for Educational Research and Development,
Former Basic Education Advisor, UNESCO/UNHCR, Central Asia*



Dr. S.B. Ekanayake was the Basic Education Advisor to UNESCO/UNHCR in Central Asia from 1994 to 2002 and he has been the Technical Advisor to GTZ in the largest refugee education project in the world in 2003. He also served as Advisor to the CIDA refugee education project in Pakistan during the same year. He was the Director of the Non-Formal and Technical Education Department at the National Institute of Education in Sri Lanka and he is currently the CEO of the Association for Educational Research and Development in Sri Lanka. He has published over a hundred research papers in reputed journals, on varied themes such as rural development, teacher education and refugee issues, and written thirty books. His contributions to education at both national and international level are significant.

Dr. Ekanayake has authored *School Based Action Research for Educational Development* (2014) and *Education of the Poor and Powerless* (2013). In addition, he has undertaken an action research study on Human Resource Development for graduates in Sri Lanka, in collaboration with three Sri Lankan universities. He has also served as a Consultant at the Centre for the Study of Human Rights, University of Colombo from 1993 to 1994.

His achievements at international level are also significant: He has experience as a researcher for the South Pacific Bureau of Education on policies related to sector-wide approach for education in Sri Lanka and as a member of the international team of policy researchers for UNESCO Institute of Education, Hamburg, on 'Innovations in Adult Education'. In addition to the above, he has served as a Consultant for the Royal Government of Bhutan and UNICEF on the development of primary education policy in 2002, and in 2011, he has been a Consultant on policy guidelines for UNESCO, Vietnam on Disaster Risk Management for schools.

Keynote Address

Good Practices Leading to Ownership of Learning (GPLOL): Learner Teacher Relationships

Dr. S.B. Ekanayake

CEO, Association for Educational Research and Development,
Former Basic Education Advisor, UNESCO/UNHCR, Central Asia

Good Practices (GP) enable us to facilitate creative solutions and strategies for changes. At the heart of this practice, influencing the nature of interventions and strategies developed, is the interaction between the teacher and the learner/student. The dynamics between these two are vital for establishing the learning processes. Should it be merely the reinforcement of the traditional T/P relationship or is it an interaction by a particular sensitivity, sense of responsibility, and efficient strategies or are there any other factors that determine this relationship? The global perspective *vis-a-vis* sustainability also becomes imperative in the current contexts and futuristic demands.

The case studies (to be presented at the session) that I have cited provide a variety of relationships, but in all a common thread related to 'self-esteem', generating self-confidence, 'initiating inter-learning', 'learning from the people', 'owning learning' and the 'desire to bring about a change', seemingly, are critical elements. The pedagogical principles that emerged from the examples cited in my presentation relate to *a)* generating interaction between all stakeholders in the activity and *b)* learning is not centred around a few/group but creates many learners and many teachers. This has created a notion that the teacher is not the only source of knowledge, that teaching-learning is a shared responsibility and that the teacher has an understanding about the limits of possibilities within a given space of time and resources. There are no vertical lines in seeking knowledge. On the contrary, horizontal processes prevail in seeking and providing knowledge enabling the ownership of learning by the learner.

Faculty of Education

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**The predictive validity of the grade five scholarship examination:
A study based on the successful entry to the B.Ed programme**

C. Chandrakumara

Department of Educational Psychology, University of Colombo

The Grade 5 Scholarship Examination (G5SE) in General Education aims at identifying students with high potential or academic abilities at the end of primary education to provide them equitable opportunities to further develop as an investment towards future citizenship. Therefore, it is necessary that the above examination should have high predictive validity. The study investigated the relationship between G5SE and measures of academic performance of the undergraduates who are selected for Bachelor of Education (B.Ed) from undergraduates of the Faculty of Arts, University of Colombo in order to assess the predictive validity of G5SE. The competition to get admission to the B.Ed programme of the Faculty of Education is very high as the placements offered are limited. If the G5SE has predictive validity it should have a high validity score in relation to the selection for B.Ed. 103 final year B.Ed undergraduates of Sinhala, Tamil and English media were selected using purposeful random sampling method. The measures of academic performance and student beliefs were considered in estimating predictive validity. The results revealed that only 16.5% of the sample had passed the G5SE. The correlation coefficient with GCE (O/L) was 0.551 and GCE (A/L) was 0.024. The significance is not high and seems to get reduced across the two examinations. The non-significant correlations show that the predictive validity of G5SE is not high. 43.7% of B.Ed undergraduates believed that G5SE results did not have an impact on their education. Although this study was done with a limited focus the overall non-significance is worthy of researching further as there is a controversy on the need to hold G5SE in the country by policy makers, teachers, principals, parents, educational psychologists and students.

Keywords: Predictive Validity, Grade 5 Scholarship Examination, BEd undergraduates

**Challenges in the incorporation of soft skills into the Bachelor of Education course:
Lecturers' perspectives**

S.S. Dahanayake

Department of Humanities Education, University of Colombo

The issue of unemployment among graduates is associated with the notion that graduates have not adequately acquired soft skills during their studies at university. Sri Lankan universities have to produce students with certain attributes that are relevant for the global market. One of the efforts undertaken to enhance the employability of university graduates is through the inculcation of soft skills in them. In order to fulfill this objective, the Faculty of Education has undertaken to develop the soft skills of Bachelor of Education (B.Ed) undergraduates by incorporating soft skills into curriculum. The main focus of this paper is to examine the challenges faced by lecturers in the incorporation of soft skills in the B.Ed curriculum. Ten University lecturers from the Faculty of Education, University of Colombo constitute the sample. Data gathered from questionnaire and interviews were analyzed qualitatively according to identified themes. Findings of the study are that majority of the lecturers were agreeable to the incorporation of soft skills in the curriculum through an embedded model. They agree that presentation, field work, brainstorming, questioning techniques and corporative learning are modes that can be incorporated into development of soft skills. However, the lack of awareness of students on the necessity of developing soft skills and the large number of students in a classroom have been identified as a major challenges for the incorporation of soft skills in the curriculum. Therefore, it is necessary to conduct awareness programmes for the undergraduates on the importance of developing soft skills in order to obtain employment and find suitable methods to incorporate soft skills in the curriculum of B.Ed undergraduates.

Keywords: Soft skills, Bachelor of Education, Curriculum

An action research: Bridging the gap between the intended and implemented secondary level mathematics curriculum in bilingual educational contexts in Sri Lanka

D. Keppetigoda¹ and W. Chandradasa²

¹ *Department of Research and Development, National Institute of Education, Sri Lanka*

² *Faculty of Education, University of Colombo*

According to the education policy in Sri Lanka, it is not possible to produce two separate curricula for the monolingual and bilingual streams separately although needs of bilingual teachers and students differ significantly. A research was undertaken to study this aspect in two separate but highly interconnected studies: study -1 and study-2. The study -1 of the research was conducted to investigate the nature of the implementation of the Secondary Level Mathematics Curriculum (SLMC) in Sri Lankan Bilingual Education (BE) context. It was revealed that there are varying degrees of adherence of the curricular materials to the selected BE model. However, the analysis of the bilingual classroom learning teaching situations revealed that teachers use of curricular materials were limited to planning lessons, practicing exercises and in assessment tasks etc. When there is no separate curricular materials available for the BE, teachers should be operating in an analytical way to conduct more fruitful mathematics lessons in bilingual classrooms. However, there exists a gap between ‘what should be’ and ‘what exactly is happening in the classroom learning teaching events’. The way of bridging this gap was investigated through an action research. It was found that teachers’ professional development should be linked so that intended and implemented curriculum can be effectively bound as a coherent whole in promoting BE in the country. For that purpose, teachers’ professional development programmes must be planned adopting a bottom up approach rather than the traditional top down teacher professional development programmes. Thereby teachers can be best supported by understanding their real problems, suggesting mutual way of solving problems when practicing teachers and professionals work collaboratively.

Keywords: Action research, CLIL, Mathematics, Intended curriculum, Implemented curriculum

The status of the use of translanguaging as a technique in teaching Science in bilingual classes

S.A. Kularathne¹ and M. Perera²

¹*Teacher Centre Yakarawaththe, Kuliyaipitiya*

²*Department of Humanities Education, University of Colombo*

Bilingual Education is in progress in secondary grades in Sri Lankan schools since 2002. The recommended practice in Sri Lankan Bilingual Education is to teach a few selected subjects in English while the rest of the subjects is taught in the first language. Second language proficiency of the learner is crucial in studying the content in the bilingual curriculum as abstract concepts are incorporated into the subjects prescribed. Two questionnaires administered to bilingual teachers and second language teachers teaching in bilingual classes reveal that the learner's second language proficiency is not adequate in comprehending the content full of abstractions. Inadequate second language proficiency of the bilingual learners has resulted in some students shifting from bilingual to monolingual medium. In other contexts (Garcia, Flores & Woodley, 2015) translanguaging is used as a strategy to ignite bilingual learners' language learning repertoire. According to Garcia, (2011, p.1) it is the ability the bilinguals have to select features strategically from many language to form one linguistic repertoire to communicate effectively. Based on the data collected through an ongoing study, this paper examines the status of the use of translanguaging in teaching science in secondary grades in 22 schools selected for an in depth study. Classroom observations revealed that three basic approaches in teaching content: use of English only, use of L1 mostly with the occasional use of English and using code switching, code mixing and translating when delivering the content. Translanguaging is not a practice in the sample studied. It is recommended that bilingual teachers and second language teachers should be trained to use translanguaging in teaching content in bilingual education. Textbooks also should be redesigned to accommodate translanguaging.

Keywords: Translanguaging, bilingual education, code switching, code mixing

Garcia, Flores & Woodley. (2015) Constructing in between spaces to do bilingualism: a tale of two high schools in one city. In Cenoz & Gorter (Ed) *Multilingual education between language learning and translanguaging* (pp198-221). Cambridge University press.

García, O. (2011). Theorizing translanguaging for educators. In C. Celic & K. Seltzer, *Translanguaging: A CUNY-NYSIEB guide for educators*, 1-6.

**Bilingual education policies and practice in Sri Lanka and its impact on the
Bachelor of Education undergraduates in the university**

E. S. Neranjani

Department of Humanities Education, University of Colombo

This study was conducted with the objectives of examining the policies on Bilingual Medium Education (BME) in Sri Lanka and the nature of its practice in the state schools in order to identify the impact of BME on the English Language Proficiency (ELP) level of Bachelor of Education (B.Ed) bilingual medium undergraduates in a state University in Sri Lanka. The collection of data was two fold: a field survey and a library survey by surveying documents related to BME and by conducting interviews, classroom observations as well as by administering a test and a questionnaire. Data were analyzed using qualitative and quantitative methods. This study revealed that one main aim of introducing BME in schools was to give opportunity for all the students in Sri Lanka to develop ELP but this has not been successful mainly due to teacher shortage. Faculty of Education has a responsibility to produce teachers to address the teacher shortage in the BME, but none of the B.Ed students in the sample have studied in bilingual medium at school and in the first two years of the course, they study only one subject in English. All the students scored below 50 out of 100 for the ELP test administered to them. According to the students, the ELP course offered by the university was useful but not adequate for them to learn the content in English. They expressed their need for support in the development of subject-specific academic language skills. Further, all of them stated that studying the content in English helped them to develop their ELP. Therefore it is necessary to develop the ELP of B.Ed undergraduates simultaneously with their content knowledge because one of their main tasks as teachers would be to help students develop ELP in school through the content.

Keywords: Bilingual Medium Education, English Language Proficiency, Bachelor of Education

CLIL in secondary science revised curriculum: A mirage?

N.A.L.A. Nettikumara and M.V. Vidanapathirana

Faculty of Education, University of Colombo

There has been a growing interest for incorporating CLIL (Content and Language Integrated Learning) methodology to the Sri Lankan national education system. CLIL refers to situations where subjects, or parts of subjects, are taught through a foreign language with dual-focused aims, namely the learning of content, and the simultaneous learning of a foreign language. Introduction of CLIL to the Bilingual education in Sri Lanka has been from 2013. Do Coyle's 4C model has been recognized as an appropriate model to the Sri Lankan bilingual context. The main objective of this study is to analyze how far the curriculum revision in 2015 has facilitated incorporation of the 4 Cs model to the bilingual context. This qualitative study was conducted to understand the nature of CLIL in revised curriculum materials and the ways bilingual science teachers integrate CLIL aspects in the classroom settings. The sample consisted of 10 bilingual science teachers in Negombo Education Zone. Methods adopted were analyses of the textbooks, teacher instruction manuals and classroom observations across one school term using checklists, questionnaires and semi-structured interviews. Analysis of science textbooks and teacher instruction manuals revealed that of the Do Coyle's 4Cs, emphases of content and cognition components are evident while the communication component is less visible. Integration of culture is mainly attempted through homework assignments. Observations of 30 lessons revealed that the textbook language deters students' conceptual understanding. The teachers in the sample lacked sufficient knowledge of strategies of integration of language. They attempted mainly to deliver the subject knowledge with code switching which was hardly based on CLIL theoretical aspects. It can be concluded that though CLIL was adopted at the policy level, CLIL has yet to be incorporated into the curriculum, and the teachers have to be equipped sufficiently with the CLIL integrating skills.

Keywords: CLIL, secondary science curriculum, integration of language, teacher development, 4C model

The use of information and communication technology during the teaching practices of student teachers

P.K.J.E. Nonis

Department of Science & Technology Education, University of Colombo

Information Communication Technology (ICT) is grounded in all aspects of School Education. Realizing the immense importance of teachers in equipping students with ICT literacy that meets the demand of the 21st century Education, the Faculty of Education has introduced ICT as a subject for the Bachelor of Education (B.Ed) and Post Graduate Diploma in Education (PGDE) programmes. The present study was done to assess the level of ICT integration in lesson plan implementation by the PGDE full time and part time teachers during their teaching practicum (TP). Data were collected from 60 lesson observations using an observational schedule. Fifteen questionnaires were administered to 15 teachers and interviews were held with 20 teachers. It was noted that majority of the lessons were delivered without incorporating a single ICT device by the PGDE teachers during their second phase of TP. Only the ICT subject teachers delivered lessons by incorporating ICT during their TP. Majority of the teachers could not give reasons as to why they did not incorporate ICT during their TP. Some pointed out that the nature of the subject, unavailability of ICT resources were the main reasons not to incorporate ICT in their lessons. It was revealed that all teachers had a basic ICT literacy gained from various sources before TP was carried out. Though an objective of teaching ICT in the PGDE course is ICT application after completing PGDE by the teachers, the study showed that student teachers continue to use traditional techniques rather than ICT integrated lesson delivery during their classroom practices.

Keywords: Teaching Practice, ICT integration, lesson observation, professional teacher

English language textbooks for primary grades: A scaffold for developing writing skills?

M. Perera

Department of Humanities Education, University of Colombo

Public examination and National Assessment results in Sri Lanka confirm that Second Language students' writing skills are generally weak. According to the G.C.E. O/L Examination - 2012 English Language Evaluation Report, students have performed badly on all the writing tasks. National Assessment of Grade four students 2015 confirms that writing and grammar are the weakest skills of the students. Since basic grammar is expected to be taught in the primary classes it is assumed that a good foundation has not been laid in the primary classes. Therefore, there was a need to find out whether the primary English language textbooks provide adequate opportunities to develop these skills. In this study the syllabuses of grades 3, 4, and 5 were analysed to identify the writing skills students are expected to achieve. A sample of fifty essays of grade four students were analysed to find out how far they have acquired the skills identified in the syllabus. Finally, the grade three Pupil's book and Workbook were examined to find out how far they provide opportunities for the development of the identified skills. A sample of ten teachers were interviewed to gather their views on the textbooks and the training they have received regarding the use of the textbook and teaching writing skills. The analysis of the students' writing samples revealed that 70 % of the students lacked the basic knowledge of grammar. The documentary analysis of the syllabuses and the textbooks revealed that there is a mismatch between the expected skills to be taught and the activities provided in the textbook. The teachers were of the view that they have not been provided with adequate guidance to teach the writing skills and the textbooks do not provide adequate opportunities to teach basic writing skills. Therefore, there is a need to revise the textbooks and strengthen professional development of teachers.

Keywords: Primary grades, English language textbooks, writing skills, teacher training, textbook analysis

Evaluation Report (2013). G.C.E. (O/L) Examination 2012 English Language. Department of Examinations: Sri Lanka.

National Education Research and Evaluation Centre (NEREC) 2015. National Assessment of Achievement of students completing grade 4 in 2014 Colombo: Sri Lanka

**Assessment and Intervention on students with Dyslexia:
A Case study of a student support unit of a school in Sri Lanka**

E. Randeniya

Department of Educational Psychology, University of Colombo

According to the world declaration of 'Education for all', every child, including children with Dyslexia has a right to Education. In alignment with this, studies have been carried out in many countries on the education of Dyslexic students but only a very few studies have been conducted in Sri Lanka. Therefore, the aim of this study is to investigate the assessment and intervention methods that the student support unit of a selected school has used for Dyslexic children. Under the Qualitative research paradigm the student support unit of a school was selected as the unit of the case study. The multi stage approach was adopted to select the purposive sample of three Dyslexic students at the primary level. In depth interviews, observations, documentary analysis and tape recorder have been used as techniques of data collection. Themes generated were used for analysis and interpretation. Dyslexic students of the sample had been screened at 3 levels of assessment: 1) Low achievement at the classroom level test (below 30 Marks); 2) The assessment test at the student support unit; 3) Screening test at the National Institute of Education. Findings from observations revealed some key difficulties of the students associated with rhyming words, consonant sounds, reading comprehension, figure ground discrimination, memory and understanding some concepts such as tall and short; top and bottom; left and right. Some of the Intervention methods adopted by the teachers were teaching methodologies, reinforcement and parental awareness programs. Further research in the area is required in order to assess the appropriateness of these assessment and interventions for Dyslexic students.

Keywords: Assessment, Intervention, Dyslexia, Case study

Pre-service teachers' perceptions towards constructively aligned curriculum practices

D.V.K. P. Seneviratne

Department of Science & Technology Education, University of Colombo

Constructive Alignment (CA) has emerged as a globally accepted classroom instructional practice which teachers can effectively apply to align objectives, activities, and assessment. In Sri Lanka, almost all pre-service teacher education programmes consist of standalone course units with regard to these three components. However, a well programmed special training on CA has not yet been given to pre-service teachers. Therefore, this study attempted to determine the level currently perceived by the pre-service teachers in constructive alignment and find out the perceived challenges in relation to the planning three key components of CA and related teaching skills. The purposively selected sample consisted of 100 pre-service teachers, 81 Sinhala medium and 19 English medium from the Faculty of Education, University of Colombo. A descriptive research design was used in this study with questionnaires and documentary reviews. Findings from comprehensive evaluation on CA revealed that the perceived levels in identifying the specific learning outcomes of the objectives and in aligning learning teaching activities were fairly satisfactory. The lowest perceived level was reported in aligning assessment to the learning outcomes. The challenges faced in aligning components of CA were high in percentages among the pre-service teachers of English medium. The most challenging element for both groups was aligning the assessment with the intended learning outcomes. The perceived skills in constructing the knowledge in sequence and assessment among English medium group were comparatively low. The results also revealed that majority of pre-service teachers lacked educational knowledge related to preparing assessment tools to be aligned with the intended learning outcomes of the lessons. Further research in the area is required for improving the abilities in key components of CA for the pre-service teacher education programmes of Sri Lanka.

Keywords: Pre-service teachers, constructive alignment, perceptions, challenges, teaching skills

**An intercultural journey through four skills: Embedding intercultural competence
in English language teacher training curriculum and the impact of it on
classroom teaching**

S. R. Tennekoon¹ and W.M. Pragnadarsane²

¹*National College of Education, Pasdunrata*

²*Department of Science and Technology, University of Colombo*

Handling students coming from diverse cultural and linguistic backgrounds is a core skill underlying any curriculum that deals with training of foreign language teachers. Nevertheless it often limits itself to the developing of language skills of the prospective teachers. Thus, developing intercultural competence of the language teachers has become a totally neglected aspect of language teacher education in Sri Lanka and elsewhere in the world. This paper deals with an attempt of a teacher educator seeking to develop intercultural competence of her student teacher population by including intercultural materials in the curriculum meant to develop four language skills of prospective English language teachers and trying to assess the impact of it on their teaching behaviours. The author describes her experiences with a small sample of twelve student teachers who underwent a training period at a National College of Education meant to train prospective teachers of English. These student teachers learnt the four skills of English language, i.e. listening, speaking, reading and writing through a specially designed intercultural syllabus which was designed with the idea of changing their ethnocentric cultural perceptions. The impact of the intervention was assessed by using a specially devised observation checklist to observe the lessons taught by the student teachers who participated in the programme. The findings revealed that there is a significant change in the classroom teaching of the sample population when compared with their previous teaching encounters.

Keywords: Intercultural competence, culturally and linguistically diverse students

A study of multicultural practice in secondary schools with multicultural background

L.N.P. Wedikandage

Department of Social Science Education, University of Colombo

In Sri Lanka after 30 years of civil war, multicultural education is being seen as important to help change students' attitudes towards different ethnic and religious groups. Therefore, the major aim of this study was to investigate the views of students and staff about the multicultural policies and practices in Sinhala-medium secondary schools with multicultural backgrounds. The sample of the study comprised of 321 students, 116 teachers and five principals from five Sinhala-medium schools. In addition four policy makers also contributed to the study. Research findings show that overall, the majority of Sinhala students across the five schools have limited language competence in relation to students from other ethnic groups. Therefore, there needs to be serious consideration of how to ensure equity in language competence among all students. At the same time, teachers in these multicultural schools wanted language training to build a good intercultural relationship between teachers and students. It is important to consider ways to provide opportunities to multicultural educational training for teachers. The research has highlighted a degree of need for training in counseling in multicultural needs. Counselors and teachers did not have the knowledge and skills required to provide cross-cultural counseling. Therefore, both teachers and counselors need proper training. The research makes clear how extra/co-curricular activities are important to promote social cohesion in Sri Lanka. The key findings indicated that the majority of Sinhala and Tamil students were engaged in the school activities but Muslim students less so. How to increase the participation rate of Muslim students in the co-curricular activities should be considered carefully. In addition, all five schools had a variety of extra-curricular activities that were designed for minority ethnic groups. This is a good example for other multicultural schools in Sri Lanka.

Keywords: Multicultural education, Intercultural relationship, Cross-cultural counselling, Social cohesion

Faculty of Graduate Studies University of Colombo



*'Sustainable Development for National
Reconciliation'*

Message from the Dean
Faculty of Graduate Studies

Professor Nayani Melegoda



The Faculty of Graduate Studies (FGS), University of Colombo offers a total of 30 postgraduate degree programmes catering to the sustainable development of Sri Lanka. They have all been designed fulfilling the requirements of the Sri Lanka Qualifications Framework. We use the official link language in Sri Lanka, English, as the primary language of study in postgraduate education. The students on our doctoral program carry out their research as part of an international academic community, contributing to the University's Annual Research Symposium as well as other research conferences locally and internationally.

The Faculty of Graduate Studies theme for the Annual Research Symposium 2016 is 'Sustainable Development for National Reconciliation'. Keeping to the vision of the FGS which is to foster excellence, creativity and innovation in graduate education of Sri Lanka, the mission of the Faculty is to provide advanced knowledge at postgraduate level and create human capital for growth and development. Therefore, at the 2016 FGS Research Symposium, we believe that we shall constructively contribute to addresses the challenges Sri Lanka will face in the 21st Century. All research papers presented at this symposium are closely linked to education and stand in close contact with society.

**Faculty of Graduate Studies (FGS), University of Colombo
Annual Research Symposium 2016**

Sustainable Development for National Reconciliation
14 October 2016

PROGRAMME

1.30 p.m. - 2.00 p.m.	Arrival of Guests and Registration
2.00 p.m. - 2.05 p.m.	Inauguration: Lighting of the Oil Lamp, National Anthem
2.05 p.m. - 2.10 p.m.	Welcome Address by Professor Nayani Melegoda Dean, Faculty of Graduate Studies
2.10 p.m. - 2.20 p.m.	Address by the Chief Guest Senior Professor Lakshman Dissanayake Vice-Chancellor, University of Colombo
2.20 p.m. - 2.25 p.m.	Address by the Guest of Honour Hon. Eran Wickramaratne Deputy Minister of Public Enterprise Development Ministry of Public Enterprise Development
2.30 p.m. - 3.00 p.m.	Keynote Speech by Dr. Kavita A. Sharma President, South Asian University, New Delhi
3.00 p.m. - 3.05 p.m.	Vote of Thanks by Dr. Achala Jayatilleke Director of Studies, FGS
3.05 p.m. - 3.30 p.m.	Refreshments
3.30 p.m. - 5.30 p.m.	Panel Presentations
6.00 p.m. - 9.00 p.m.	Conference Dinner

Introduction to the Keynote Speaker

Dr. Kavita A. Sharma

*President, South Asian University
New Delhi, India*



Dr. Kavita A. Sharma is the President of the South Asian University. An accomplished academician, Dr. Kavita A. Sharma has been an active contributor to the cause of higher education. She has published a number of books including *The Windmills of the Mind* (2006) *Internationalisation of Education: An aspect of India's Foreign Relations* (2008), *Sixty Years of University Grants Commission: Establishment, Growth and Evolution* (2013), and *Hindu College: A People's Movement* (2014). Her research papers on a wide range of topics, including higher education, language, immigration and identity, culture and women, have made their ways into many reputed national and international publications.

Dr. Sharma holds a Ph.D. Degree in English from the University of Delhi and an LLM degree from the University of British Columbia, Canada. A Fulbright Scholar, she was conferred the Indira Gandhi Sadbhavana Award by the National Integration and Economic Council in 2005. Dr. Sharma had also been an Honorary Visiting Lecturer at Tokyo's Women's Christian College and University of Indonesia. She is associated with many professional organisations including the English Association, Indian Association of Canadian Studies, Indian Law Institute and Indian History Congress. She has been the Founder President of the Parents' Forum for Meaningful Education.

Keynote Address

Role of Education in Sustainable Development and National Reconciliation

Dr. Kavita A. Sharma

President, South Asian University

New Delhi, India

Synopsis

The presentation will discuss the role of education in achieving the Sustainable Development Goals (SDG) that were enunciated after the Millennium Development Goals (MDGs) in 2015. These are set out in Transforming Our World: The 2030 Agenda for Sustainable Development. In addition to continuing the work that began with the MDGs, the new goals seek comprehensive responses to several critical issues as they make a bold determination to ensure that no one is left behind.

That Education is the key factor was recognized by the UN when it declared 2004-2015 the decade of Education for Sustainable Development. Education for all has always been an integral part of the sustainable agenda. The World Summit on Sustainable Development (WSSD) in 2002 adopted the Johannesburg Plan of Implementation (JPOI) which reaffirmed the MDG of achieving Universal Primary Education by 2015 and the goal of the Dakar Framework of Action on Education for All to eliminate gender disparity by 2005 in primary and secondary education and at all levels by 2015. There is also a growing realization that only quality education can enable sustainable development. The Muscat Agreement adopted at the Global Education for All Meeting (GEM) in 2014 and the proposal for Sustainable Development Goals (SDGs) developed by the Open Working Group of the UN General Assembly on SDGs (OWG) also emphasized education for sustainable development. Hence Goal 4 of the Sustainable Development Goals is "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all." Broadly speaking this translates into the following:

acquiring skills of creative and critical thinking, communication, conflict management, problem solving, project assessment and the ability to take part and contribute to the life of society.

being respectful of the Earth and life in all its diversity.

promoting democracy in society without exclusion and working towards peace.

The world is beset with conflict in spite of the establishment of the United Nations after the Second World War to save humanity from the scourge of war. These conflicts are still ongoing. Even a cursory look at the Middle East, parts of Africa, the Indian subcontinent and elsewhere shows that conflicts are both internal and external. These have exacerbated the problem of unequal distribution of resources and services creating a cycle of conflict. These conflicts have caused vast destruction and massive displacement of people. As a result the world is today facing a huge refugee crisis. Movement to another part of the world only worsens the situation of most as they live in below subsistence level conditions with minimal of housing, education, and health care. The unthinking exploitation of nature and unequal distribution of consumption and use of natural resources have led to both natural and man-made disasters; almost 90% are because of climate change. These too have led to destruction and displacement. Unequal levels of development and historical factors have led to poverty, hunger and disease in certain parts of the world that have added to the woes of the people.

Goal 4 is said to hold the key to the SDGs pertaining to economic growth, livelihood, health care, social inclusion and ecological sustainability. These are at the heart of sustainable development that are sought to be achieved through transformation of the world as the title of the document of SDGs suggests. However, such a transformation is not possible without transforming individuals. Comprehensive responses are sought to several critical issues like conflict, reconstruction and reconciliation, inclusive economic growth arising through social cohesion, and prevention of degradation of the environment to secure it for future generations among others. Underlying all these goals is really the upholding of human dignity even in the worst of times. This cannot be brought about without the transformation of the individual which alone can translate into transformation of communities and nations. The people,

their mindsets and attitudes are the key. Such a transformation can only be brought about by education because it alone has a transformative potential.

Education, however, can be a double-edged sword. It can lead to peace or it can increase conflict. The four pillars of education are access, equity, expansion and relevance and quality. These are interlinked and a weakness in any one of these factors can increase both internal and external conflict. The issues pertain to curriculum, language, pedagogy apart from discriminatory or insufficient access and quality. The question arises whether in dealing with these challenges, the community has to be placed in the primary position, and if so how, and to what extent. The presentation will look at the nature of various conflicts in our times, including displacement, and see how education has to be consciously provided in a way that it leads to peace.

Faculty of Graduate Studies

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Rights of elders as human rights: Global best practices for legal and social policy reforms in Sri Lanka

C.S. Abeysekera

Faculty of Graduate Studies, University of Colombo

Elders are a special group with diverse requirements of social, legal and development standards. The standard of protection for the special groups in a legal system reflects the success of Legal, Social and Development strategies of a state. Therefore, what is the best adoptable model to be introduced to the legal system of Sri Lanka to upgrade the standards of social and development policies towards the Elder of Sri Lanka?

Maintaining the Globally Accepted Standards of Human Rights is the best solution to be introduced to the legal and social development policies in Sri Lanka to upgrade the standard of living of Elders in Sri Lanka

To develop an effective legal policy framework to establish the Rights of Elders as Human Rights according to the Globally Accepted Standards and Practices to overcome the exiting legal, social and development barriers towards the elders in Sri Lanka and to suggest the policy makers to incorporate the findings and suggestions of the research in their future legal reforms. This research will be based on empirical evidence and qualitative data. Library and internet resources survey will be used for legal and policy data. Case studies, interviews, focus group discussions and open ended questioners will be used as a research strategy for empirical inquiries.

Legal, social and development policies towards elders in global context, impact of the global factors on existing legal and social policy standards, United Nations approach to upgrade the rights of elders as human rights, factors affect the standards of rights of elders in Sri Lanka, and suggestions to improve the existing legal and social protection standards in Sri Lanka will be discussed as findings.

Keywords: Rights of Elders, Human Rights, Legal policies, Social Policies, International Standards

Governance in the Maldives: Discrepancies in Current Practices in Relation to Constitutional Provisions and International Norms

H. Afeef¹ and K. Amirthalingam²

¹ *Faculty of Graduate Studies, University of Colombo*

² *Department of Economics, University of Colombo*

The stability of any nation depends on how the community of the nation is governed. Even though “governance” is as old as human history, the concept of “Good governance” evolved in the late 1980s through a development discussion held by The World Bank, where the debate was focused on the role of government in the development process. World Bank defines governance as the manner in which power is exercised in the management of a country’s economic and social resources (World Bank, 2016). Constitutional reform could be one of the basic steps in promoting good governance. Maldives has shown its struggle towards establishing a comprehensive constitution for its people from 1932 when it had its first constitution. The current constitution which was last amended in 2008, focuses mainly on different characteristics of good governance such as separation of powers, checks and balances and protection of rights. In spite of having a sound constitution in place, Maldives seems to be experiencing a lot of social and political upheavals. This paper focuses on analyzing the process of governance in the Maldives with regard to its constitutional provisions. The major characteristics of good governance as defined by the United Nations Development Programme (1997), quoted in IFAD (1999) are identified and relevant provisions from the Maldivian constitution are discussed. A comparative analysis of relevant provisions in the constitution with main characteristics of good governance is done in the light of current social and political issues in the country. The results of this study reveal that the major obstacle for the Maldives in ensuring good governance is that in practice, powers are not separated well and the government is influencing the decisions made by the parliament as well as the judiciary and other independent institutions. This presents great challenges to the practice of the rule of law as required for good governance practices.

Keywords: Governance, Justice, Constitutions, Accountability, Human Rights

Knowledge Networks for Flood Resilience: A Case of Public Administration Officers of Ratnapura

N. Ahangama¹ and R. Prasanna²

¹*Faculty of Graduate Studies, University of Colombo*

²*Joint Centre for Disaster Research, Massey University, New Zealand*

After the massive destruction in the Tsunami of 2004, to unify Disaster Risk Management (DRM) efforts in the country, a National DRM Framework (NDRMF) was established. The NDRMF introduced a DRM action plans for each district to strengthen disaster resilience through district secretariats and divisional secretariats. Beside aforesaid developments, the recent Roanu Cyclone (May 2016) saw significant socio-economic damage and delays in knowledge transfer within instituted disaster stakeholder networks. These circumstances reignited the need for re-strategizing knowledge exchange within disaster stakeholder networks. Hence, this paper examines the disaster knowledge exchange in the networks of Public Administration Officers (PAO) of Ratnapura district and divisional secretariat, and recognizes the impact of these networks on flood resilience.

Interpretive case study research design and grounded theory data analysis methods were used to guide data collection and analysis. Data was collected through semi-structured face-to-face interviews of nine PAOs. The Glaserian strand of Grounded theory was closely followed to analyze audio recorded interviews through a constant comparison method using a three-phased (open, selective and theoretical) coding mechanism. Data revealed that PAOs were accustomed to practice standard DRM processes with less emotional disturbances when facing a disaster. They were remarkably calm in the way they handled delegated tasks during a flood due to two reasons. First, most PAOs believed that vulnerable communities know how to counteract as floods occur regularly during monsoons. Secondly, PAOs trusted that community and donors carry an unbelievable level of reciprocity immediately after a disaster. The clear delegation of tasks and responsibilities in PAOs' networks has made them well focused on the assigned task. Despite their positive perceptions, data revealed the flowed middle-up-down knowledge transfer in these knowledge networks, which significantly influenced disaster resilience negatively in the context.

Keywords: Disaster Risk Management, Grounded theory, Knowledge Networks, Resilience

Path to Liberation: Buddhist Ideology towards the Concept of Human Rights

B.P.A. Amarasinghe¹ and K. Konasinghe²

¹ *Faculty of Law, South Asian University, New Delhi, India*

² *Department of Public and International Law, University of Colombo*

Orthodox belief on Human Rights in modern day has been a more Eurocentric one which glorifies the contributions made by Western thinkers since classical epoch up to Enlightenment in 17th century. Though such beliefs are partially true, this paper intends to trace the Buddhist notion of Human Rights which has not been widely discussed in academia. Two Millenniums ago the Buddha had affirmed and demonstrated the biological unity of humankind in a discourse called “Vasettha Sutta” In this extraordinary discourse, the Buddha has aptly shown that there are no marks to indicate that humans are subdivided into separate species. In this research paper, the authors essentially try to point out how the Buddhist idea on Human Rights has been entirely different and more progressive from the more individualistic approach of the West. In Judaeo-Christian tradition, the origin of the human race –the patrix, to be precise was a solitary male, Adam. This axiom aspired Europeans to subjugate, colonize and exploit the labour of non-white people. In Buddha’s teaching there is a space for every aspect of Human Rights, especially the rationale of Buddhist idea on Rights seems to be more altruistic For instance the duties of an employer towards his employees, as indicated by Buddha amounts to be the first social charter on workers’ rights. The perennial significance of the principles on workers’ rights laid down in the Sigalovada Sutta can be appreciated if compared with those contained in Article 23 of UDHR. In Agganna Sutta Buddha concluded that “Human beings are not different from one another. They are equal, not unequal. This is in accordance with Dhamma”. This paper will further discuss the relevance of understanding Buddhist ideology towards the concept of Human Rights.

Keywords: Eurocentric, Human Rights, Buddhism, Workers Rights, Judaeo-Christian tradition

Benchmarking Performance of Environmental Sustainability Management of Garment Factories in Sri Lanka

S.A. Amaratunga¹ and S.A. Norbert²

¹*Faculty of Graduate Studies, University of Colombo*

²*Department of Geography, University of Colombo*

In 2002, textile and apparel manufacturing accounted for US\$400 billion in global exports, representing 6% of world trade. This value is projected to reach US\$1700 billion by 2025. Total global production of chemical and natural fiber is around 48 million tons, with cotton being the highest covering an area equal to Italy. Despite its significant contribution to the global market, the industry has been highly criticized for unsustainable manufacturing practices. While the apparel industry has initiated a number of significant sustainability best practices, a lack of an established standard or measurement tool to benchmark environmental sustainability performance has been one of the major impediments to evaluate environmental performance. One main objective was to identify the key contributing factors that could contribute to benchmarking environmental sustainability performance in the apparel sector. Key contributing factors are the areas that have the highest impact to the environment in a typical apparel manufacturing process. The second objective was to identify a framework of indicators that could be used at a typical apparel cut & sew facility. Indicators are used to identify monitor and report on key trends while enabling a solid foundation of collecting accurate data. Indicators allow an organization to customize data points linking it to their core business and are also flexible enough to continuously improve over multiple iterations. The results reveal four key contributing factors, namely; energy, water, waste and emissions that determine the benchmarking of environmental sustainability performance. It also developed a framework consisting of 24 indicators that could be used as a checklist customized to the apparel sector in Sri Lanka. The proposed framework can be used to benchmark and integrate environmental sustainability best practices into corporate sustainability strategies and also as a checklist in the process of benchmarking environmental sustainability performance.

Keywords: Environmental, Sustainability, Development, Management, Benchmark

The Prevalence and Impact of Bullying in the Workplace: An Integrated Literature Review

D.L.N.P. Amarawickrama

Faculty of Graduate Studies, University of Colombo

Many claim that bullying is a major destructive factor that undermines the smooth working environment. The systematic study of workplace bullying has continued to grow since Scandinavia investigation into school bullying started in the 1970s by Olweus. A concise definition for workplace bullying is hard to find but it is summed up well as “persistent, offensive, abusive, intimidating, malicious or insulting behavior, abuse of power or unfair penal sanctions which makes the recipient feel upset, threatened, humiliated or vulnerable, undermines their self- confidence and which may cause them to suffer stress”. The research problem “How bullying was interpreted and discussed in the literature” will be addressed in this paper. The study aims to review bullying literature thematically in order to highlight common aspects of the bullying definitions, its impact and to identify the cross cultural differences and the gaps in the literature. Several studies have investigated the health consequences of the individuals who have been victimized and substantiated by workplace bullying. Studies have revealed that victims are more likely to be under stress and suffer from stress-related symptoms, such as decreased productivity, decreased satisfaction and increased absenteeism and in extreme cases, either the bully or the target resorts to homicide or suicide. Studies have shown that not only the target of bully but also bystanders, suffer when someone is bullied in the workplace. Among socio- demographic variables, gender appears to be the most widely studied variable. However, results from empirical studies on gender and bullying are inconsistent. Studies revealed that age is a significant factor where bullies are older than victims. As researches on prominent areas such as workers’ response to bullying behavior, workplace environmental factors, gender differences in bullying behavior, were conducted in many parts of the world, it is worth investigating this phenomenon in the context of Sri Lanka.

Keywords: Bullying, workplace bullying, workers’ health, individual’s performance, organizational performance.

Modern Feudalism: an Unwritten Story in the Discourse of Land Rights and Reconciliation in Sri Lanka

K. Ariyaratne and C. A. N. Galhena

Faculty of Graduate Studies, University of Colombo

Access to land in the war affected areas, especially in the North and East, has been a very controversial and politically sensitive issue. It is necessary for any government to consider seriously the matters of vulnerabilities and needs of affected communities, complying with legal obligations and international and domestic human rights standards. However, the discussions on land rights in the context of post war reconciliation has been always centred and circled around the issue of land encroachment by military in the North and East.

This paper intends to contribute to the discussion of post war land rights in a different perspective, which is based on a case study arising from a research conducted from 2014 to 2015, in Wanathavilluwa in Puttlam District in the North West of Sri Lanka. Wanathavilluwa, is dwelt by communities who were displaced during the war and gradually returned to their home lands and have become a class of labourers within the village, forming a modern feudalistic society. The research took the form of an ethnographic study which was mainly focused on qualitative data collection. It included one to one in depth interviews with people from several sectors or groups, taking into account the range of social, economic, ethnic and political differences of the village, focused group discussions and observations.

While acknowledging that the post-independence land policies of Sri Lanka may have created complexities of ethnic formations in villages this research elaborates how the loss of lands by original inhabitants has changed the social formation of the village and analyses how the displacement has created new economic strata within the social formation of a border village. Most importantly, the authors wish to emphasise the importance of tailor-made approaches in such peripheral cases in land development policies of the government, and the reconciliation process at large.

Keywords: Land rights, post war, violence, reconciliation

Rehabilitation of Prisoners: A Case Study of Pallekala Open Prison (POP) In Sri Lanka

M.S. Asees

Faculty of Graduate Studies, University of Colombo

The aim of this paper is to explore the rehabilitation of prisoners in Sri Lanka. A special focus will be given to the Pallekala Open Prison (POP). It has been 64 years since the POP was established. Since then it has been rehabilitating hundreds of prisoners annually. It is reported that currently there are over 600 convicted prisoners in POP. Most of them spend their last five years in this prison, in other words they spend one-fourth of their sentence and with at least three years more to serve. Prisoners go through a series of rehabilitation processes at various levels. It is noted that there are five major vocational trainings provided to the prisoners: (1) Motor mechanism (2) House wiring (3) Carpentering (4) Computer and (5) Masonry & Plumbing. Apart from these vocational trainings there are some psychological (counselling) and religious activities also concurrently conducted by the POP. The main research question of this study is to explore the weaknesses of present rehabilitation system and suggest an alternative method. The followings are the objectives of this research: (1) Identify the weaknesses of present rehabilitation system and (2) Propose alternative solutions which can improve the present system. This research will be mix of qualitative and quantitative method. The author has visited POP and conducted interviews with both prisoners and officers. Both primary and secondary data will be used for this research. Although the POP has been promoting rehabilitation among the prisoners, a lack of focus has been given to the welfare services. Further, prisoners do not have proper and regular psychological treatments which is very important for them to cope with trauma. Reading and writing should be given first priority where the prisoners can learn something new and develop their skills in the future. Finally there should be a road map for the prisoners which can improve their livelihood even after they are released from the camp.

Keywords: Pallekala Open Prison (POP), Prisoners, Rehabilitation and Vocational Training

Peacebuilding and Insurgency in Nigeria: Theoretical analysis of Plato's *Republic*

I.M. Biu and M. Dafi

Faculty of Graduate Studies, University of Colombo

The political and socio-economic stability of Nigeria is important to Africa and beyond. Thus the transition from military government to civilian democratic government on May 29th, 1999 was historic and full of “great expectations” and ramifications. Hence, ‘legitimate’ demands and claims, which were hitherto restrained and denied under the military government, have featured with increased tension and threats to the corporate existence of the Nigeria nation-state. Amongst such issues are the demand for Islamic Sharia system of government in northern Nigeria and the demand for resource control within the Niger Delta region. This has put the character of the Nigerian state to test with demands gravitating towards outright violence. The Boko Haram insurgency has come to be one of the negative fall-outs in Nigeria. Since 2009 and beside a loaded timeline of almost daily events of armed attacks within the north, Nigeria had gradually lost her territorial sovereignty of parts of the north-eastern geo-political zone with the armed forces and related state security apparatus losing several battles to this home-grown terrorist group. The argument of this paper is developed within a theoretical analysis of Plato’s political philosophy, *The Republic*, a critical study of the ancient city-states interrogated within the Nigerian context of peacebuilding. In non-conventional warfare, this paper posits that the peacebuilding approaches in conflict transformation must find roots in the sources and causes that trigger group grievances and invariably social movements that portends negative outcomes. To this end, this paper further analyses Plato’s proposition of specialization to meet society’s needs and justice as a bond which holds society together. Relying on secondary documents, this paper argues that Nigeria can end insurgency if we undo the culture of incompetence and mediocrity within the political class and the public/civil service with restorative and retributive justice addressed.

Keywords: Peacebuilding, Insurgency, Plato's Republic, Restorative and Retributive justice

Re-introducing a Bicameral Legislature in Post-War Sri Lanka

V. Caldera

Center for the Study of Human Rights, University of Colombo

Despite the conclusion of hostilities in 2009, the ethnic conflict in Sri Lanka has not yet come to a close. In order to ensure a transition to post-conflict society, effective political reforms in the post-war context must be guaranteed. Sri Lanka has had a history of democratic experiments, especially with constitution making since before independence was granted. However, the failure of these experiments explains the continuing conflict and inability to reach a political solution. Constitutional reform has played a central part in political debates locally. However, it has revolved around concepts such as devolution of power and human rights. Concerns for the establishment of a bicameral legislature – i.e. a legislature composed of two houses – did not appear as prominently. This has created an opportunity to research and open this dialogue. The study focuses on the critical theme of a bicameral legislature, its presence in the Soulbury Constitution (1945), its absence thereafter, and why it is required today. The research aims to renew the dialogue on institutional democratization and make suitable suggestions for the post-war constitutional reform process initiated in the post-Jan-8 (2015) era. The study is based on a literature review utilizing data gathered through archival documents. This information is analyzed in comparison to the experiences of India, South Africa and the USA while analyzing the lessons to be learnt from them. The research is complemented through the qualitative analysis of specialized interviews with selected personnel of various backgrounds. The interviews are analyzed thematically based on grounded theory to capture the following premises: 1. 1946 – 1972 reforms, 2. Post-1972 reforms, 3. Post-war reforms, 4. Comparative analysis of international experiences. The findings show that the establishment of a second chamber will ensure the long-term political reform process by ensuring institutional democratization, thereby laying the foundation towards achieving a lasting political solution.

Keywords: Bicameral legislature, post-war, Sri Lanka, democratization

The Changing Face of the Eelam Struggle: Post-LTTE Mobilization of the Sri Lankan Tamil Diaspora

M. A. Cassim

Research Scholar affiliated to Faculty of Graduate Studies, University of Colombo

This research explores the evolution of the mobilisation of the Sri Lankan Tamil Diaspora after the termination of the LTTE conflict and up until 2016. This study was explorative in nature due to paucity of studies in this area. A theoretical space shared between constructivism, liberalism and realism was used to conceptualise the problem. Political opportunity model was used to test the mobilisation of the Sri Lankan Tamil diaspora. In-depth interviews were conducted to examine the identity creation of the diaspora, while observations and newspaper articles were used to establish the interplay between the diaspora, the host country and homeland. Critical discourse analysis and document analysis were used for analysis of the data. The key reason for the change in diaspora's mobilisation was found to be not so much the domestic and foreign policies adopted by the post-conflict governments in Sri Lanka, as the defeat of the LTTE, which effectively allowed the full spectrum of voices in the diaspora to surface. Furthermore, as the interest of the Sri Lankan Tamil diaspora is primarily contingent on achieving political autonomy in the Sri Lankan state apparatus, their homeland engagement is greatly regulated by the local Tamil polity. This study revealed that the TNA, through which the diaspora engages with Sri Lanka, displays a tendency to not view them as domestic actors, in a bid to maintain their monopoly as an exclusive Tamil political actor. Another key finding of this study is the interplay between the Sri Lankan Tamils and the diaspora. While the diaspora needs their homeland kin for legitimacy and direction, the local kin on the other hand, particularly the political elite, act as political entrepreneurs by using the diaspora as a leverage to compensate their weakness in exercising political power, borne by their numerical minority in Sri Lanka.

Keywords: Diaspora, Sri Lankan Tamil Diaspora, Eelam Struggle, Post-conflict

Regionalism, Sovereignty and Small States: Understanding the Ramifications of BREXIT

G. I. H. Cooke

Department of International Relations, University of Colombo

Regional integration has been sought after by states seeking enhanced economic opportunities, avenues for diversification and a greater degree of involvement in regional and global politics. Regionalism affords such prospects for all thus making the pursuit attractive and worthy of emulation. The effort exerted and the opportunities available by entering into regional arrangements generates more, than being absent from such bodies. Thus small states find solace amid regional heavy weights, or are afforded a degree of equality.

The 2016 British Referendum supposedly gave the British freedom over their future. The aim of the 'BREXIT' camp was to safeguard British sovereignty and ensure its preservation thereby trouncing dictates from Brussels, which were supposedly compromising all things British. Whilst it would have been suffice to say that sovereignty had won the day, the enigma remains. With the revelation of the majority opinion, particularly in England and Wales, the stakes for independence in Scotland rose as did those for Irish unity.

Did sovereignty win? Was it safeguarded or has it been further threatened? How has the ensuing action by British leaders impacted the EU and its own journey towards a matured form of integration? More relevant is the fresh debate over the possibility of making regionalism work, as the global model of integration encounters its greatest challenge. The repercussions have threatened the very opportunity it aimed to provide. Regionalism, once considered a platform of opportunity, contends now with a label of instability.

The paper, based on qualitative data, would examine secondary sources and would draw on two areas. The theoretical aspect would be derived from publications while the component on BREXIT would be based on statements and reportage. This paper aims to examine the relationship that small states enjoy vis-à-vis regional bodies and hence their contribution to regionalism, taking note of the ramifications on the scope of such bodies following the 2016 British referendum.

Keywords: Regionalism, Sovereignty, Small States, BREXIT, Sri Lanka

Challenges and Prospects of Sri Lankan Tea Industry: Policy Analysis with a Simulation

M.W.A. De Silva¹ and N.S. Cooray²

¹*Faculty of Graduate Studies, University of Colombo*

²*International University of Japan*

Tea is the largest agrarian industry in Sri Lanka and provides direct and indirect employment to 1.5 million people. Over the last four decades, tea production increased by 60% and due to this high growth, productivity has contributed to 72 %. Tea cultivation occupies 11% of the agricultural lands in Sri Lanka and the majority belongs to the small holding sector. At present tea contributes 0.9 % of country's GDP even though it shows a declining trend. Tea exports accounted for 71% of total agricultural exports in 2005 and decreased into 60% in 2013. The tea industry is directly affected by government policies such as tea replanting subsidy, new planting subsidy, fertilizer subsidy and tea export policies etc. Factors such as high cost of production and considerable extents of uneconomic tea with rapidly declining yield badly affected the tea industry. Limited area expansion and climate changes are also expected to have a significant impact on tea production. Dominants of the tea cultivation areas together with tea production, and tea prices have shifted from high elevations to low elevations over the last three decades. According to the author's knowledge there is no comprehensive quantitative study done to investigate or quantify the impact of government policies such as subsidy, tax, and exchange on production, yield, area cultivation, prices, and exports. It is also important to see the impact of environmental factors such as rainfall and temperature. Given this background, the current research objectives are: (1) to critically examine current situation of the tea industry; (2) to construct a comprehensive econometric model and use it for policy simulation with a view to quantify the impact of those policies; and (3) to propose effective policies to overcome the challenges and explore potentials. To achieve these objectives, the current research uses both qualitative and quantitative approaches.

Keywords: Tea Production, Simulation, Area, Yield, Government Subsidy Schemes.

Determinants of Household-Level Cooking Energy: Evidence from Sri Lanka

P. Dunusinghe

Department of Economics, University of Colombo

Over the past few decades, households, especially in developing countries, have been encouraged to switch into ‘clean energy’, such as LP Gas and Electricity, since ‘traditional bio-mass’ (such as fuelwood and saw dust) use causes serious health hazards due to indoor air pollution. However, climate change concerns and improvements in indoor bio-mass burning technology in recent years have compelled policy makers to revisit this policy decision. It is now argued that ‘modern bio-mass applications’ not only lead to cleanness but also assure greenness. In the context of this new-found interest in ‘modern bio-mass’, this paper attempts to look into the determinants of household-level cooking energy in Sri Lanka. This paper makes use of the nationally representative Household Income & Expenditure survey of 2012/13 and employs Multinomial Logit model in exploring the determinants of household-level cooking energy. The Energy Ladder Hypothesis (Heltberg, 2005) argues that households graduate from ‘traditional bio-mass’ to ‘clean energy’ when they move up in the socio-economic ladder. In contrary, ‘Fuel Stacking’ model (Masera *et. al.*, 2000) postulates that households tend to use an ‘energy-mix’ regardless of socio-economic status of households.

Our Multinomial Regression results are in line with the Energy Ladder Hypothesis, higher socio-economic status, indicated by education, income, assets ownership, increases the probability in favor of using ‘clean energy’. It is found that relatively poor households, living in rural and estate, most likely to use bio-mass as cooking energy. Evidence suggest many households opt for an energy mix as postulated by ‘energy staking’ model. At present, use of ‘modern bio-mass’ is hardly visible at household level in Sri Lanka due to unavailability of improved bio-mass products, such as wood pellets and chips, and improved indoor burning technology. Addressing these issues is imperative if Sri Lanka is to encourage the use of ‘modern bio-mass’ use, given its multiple benefits, at household level.

Keywords: Bio-mass, Fuelwood, Cooking Energy, Multinomial Model, Sri Lanka

Corporate Social Responsibility in Local Value Chains: A Case Study of Lucky Lanka

B.A.N. Eranda¹ and N. Abeysekera²

¹*Faculty of Graduate Studies, University of Colombo*

²*The Open University of Sri Lanka*

The creation of a collaborative strategy on Corporate Social Responsibility (CSR) is beneficial for all the stakeholders in the value chain. The objective of this paper is to explore how a local Sri Lankan company, Lucky Lanka can benefit suppliers and distributors by practicing CSR in its value chain. Since this company has several years of experience working systematically with CSR in its local value chain, it has been selected as a single case study for this research. Data collection is completed through in-depth semi-structured interviews with top management, suppliers, distributors and employees.

Findings reveal that the top management support is the key to successfully implement CSR with suppliers and distributors. Top management supports stakeholders through conducting training programs on positive thinking and entrepreneurship development. The long-term contracts developed with stakeholders and regular meeting with them are also the key factors for succeeding CSR initiatives. The CSR programs aim at suppliers by the form of training programs contributed to enhance their income and knowledge in cattle farming and also improved their quality of life. Distributors were also able to enhance business operations by following the training programs conducted under the CSR programs. Distributors learnt how to manage a business in a competitive environment and achieved a phenomenal expansion of businesses. These CSR programs are the key to undertake ethical practices at the distributors' end which improved the lives of their employees.

The identification of strategic issues important for both the organization and stakeholders is the key determinant of CSR success. Further, organization needs to maintain a closer relationship with its stakeholders in undertaking CSR initiatives. The practice of CSR in local value chains requires CSR to be embedded within the entire organization including top management to lower supervisory level.

Keywords: CSR, Value chain, Stakeholders, Strategy, Lucky Lanka

Determinants of Paddy Production in Sri Lanka: An Econometric Analysis

S.R. Ginige¹ and N.S. Cooray²

¹*Faculty of Graduate Studies, University of Colombo*

²*International University of Japan, Japan*

Paddy provides the staple food and occupies around 27% of the total agricultural lands in Sri Lanka. The paddy sector provides livelihood opportunities for more than 1.8 million farmers, where more than 30% of the total labor force is directly or indirectly involved. Rice is the principal contributor of the rural economy as the majority of rural households are engaged in the production of rice as their main source of livelihood. It is projected that the demand for rice will increase more than 1.1% per year due to population growth in Sri Lanka and to meet the demand, the rice production should grow at the rate of 2.9 % per year. Increasing the cropping intensity and national average yield are the options available to achieve these targets. Due to the limitations of availability of agricultural lands, the only logical solution is to improve yield levels. Since independence, all governments had the main objective of achieving self-sufficiency in rice, and to improve the paddy sector, they implemented several policies to achieve that goal such as fertilizer subsidy, guaranteed price etc. The impact of those policies vary among paddy cultivation districts and therefore it is important for policy makers to undertake a comprehensive study, taking regional variation into consideration. As far as the author is aware, there is no comprehensive quantitative study done so far, taking regional variation into consideration. Therefore, the objectives of the current research are: (1) to critically examine challenges and potentials of the paddy sector, (2) to construct an econometric model taking long time series district wise data, (3) to use the model for policy analysis, and (4) to propose effective policies. To achieve these objectives, the current research mainly uses quantitative approaches by constructing simulation models using a set of simultaneous equations for estimating paddy supply and demand.

Keywords: Fertilizer subsidy, yield, area, paddy/rice sector

Ontology based Methodology for Functional Test Case Extraction in Building Software Applications

K.S.A.W. Gunawardena¹, K.Y. Bandara² and N. Kodikara³

¹ Faculty of Computing, SLIIT

² Research and Development - CTO Office, Openet Telecom, Ireland

³ School of Computing, University of Colombo, Sri Lanka

Delivering software with appropriate quality to avoid cost overrun is a huge challenge in the current competitive market. The testing contributes directly towards achieving quality in software. The determination of the testing scope happens during the test-designing phase of testing life cycle. However, test designing happens manually and heavily depends on the person who does the test design. Designing all explicitly and implicitly related test cases out of requirements is a challenge for a test designer. This paper presents a summary of an ontology-based solution that encapsulates a methodology for an automated functional test case extraction while minimising the dependency of the test expert involved

The solution is two-fold: first, an ontology-based requirements model is designed from base requirements whereas the second part is building a test cases extraction methodology, which aims at deriving test cases automatically from the ontology-based model. A set of algorithms working along with a set of operators would be constructed to extract test cases from ontology specification. A new ontology engineer role is introduced who will manually construct an ontology model using existing tools such as *Protégé*. To evaluate the successfulness of the solution, it would be tested against set of industrial projects by comparing the solution against manual approach. The following formulae describe how the solution is measured against the manual approach.

$TC_{extraction} = Total\ Test\ Cases\ generated\ from\ Ontology\ model$

$TC_{Manual} = Total\ Test\ Cases\ constructed\ manually$

$\Delta_1 = TC_{extraction} - TC_{Manual}$

What needs to be proved is $\Delta_1 > 0$, across multiple set of industrial projects. A qualitative feedback can also be solicited from each project team to evaluate quality of the test cases generated through Ontology model by ontology engineer compared against test cases generated manually by their project team.

Keywords: Ontology, Test Cases, Software, Requirements Model, Methodology

Key Determinants of Urban Residential Land Price: Value of Natural Amenity

T .P. S. R. Guruge¹, I.A. Surige¹, U. K. Jayasinghe-Mudalige¹ and D. Weerakoon²

¹*Department of Agribusiness Management, Wayamba University of Sri Lanka,*

²*Department of Zoology, University of Colombo*

Residential lands are always demanded according to basic human needs. The land prices depend on the physical factors as well as the environmental factors. The natural environment has a substantial impact on the land value as that can contribute fundamentally to the quality of urban life, which has been largely ignored due to lack of valid and reliable information. Identifying the land price determinants and their contribution will help to policymakers, property developers and buyers to initiate more accurate bid values that avoid price exploitation in land markets. On this understanding, study attempted to work out the key determinants of urban residential land prices. The Negombo urban area was selected for this study as there is a clearly defined natural environment, i.e. lagoon with good scenic view and a property market with sufficiently large number of players, which will minimize the potential market and policy failures through competition. The primary data were gathered by means of a structured questionnaire-based survey of property developers involved with 100 plots selected randomly. These 100 plots were grouped in 10 specific land sites that were situated apart from each other and available for sale during the first quarter of 2016. Primary data were analyzed using linear form of Hedonic Function. The outcome of study indicates that eight key determinants, including the number of access points to the land, distance to main bus route, school, hospital, supermarket and main drainage system and distance to lagoon and lagoon view have a significant impact on land prices of Negombo. This study further indicates that the presence of the lagoon view increases the market price by Rs. 11,090 per perch compared to a similar property without lagoon view. This demonstrates the importance of taking into account the environmental aspects in property development to make an efficient property market.

Keywords: Hedonic function, Land price, Property markets, Urban residential area, Value of natural amenity

The Role of Multiple Stakeholders in Promoting Psychosocial Well-being of Parentless School Going Adolescents (PSGAs) in Northern Province-Sri Lanka

S. Hariharathamotharan¹, D. Abyesinghe² and S. Jeevasuthan³

¹ *Faculty of Graduate Studies, University of Colombo*

² *Department of Sociology, University of Colombo*

³ *Department of Sociology, University of Jaffna*

Psychosocial care comprises the psychological and social supportive care for a PSGA and his/her stakeholders. In this study, PSGAs are taken to be school going adolescents in the age group of 12-18 years, and those who have lost both parents due to the war. However, it is noticeable that multi-stakeholders play a crucial role in promoting the psychosocial well-being of the PSGAs in the Northern Province of Sri Lanka, which is discussed before looking into the causes and consequences of the psychosocial impacts of the war. Therefore, this scientific study will be scrutinizing the role of multiple stakeholders who are largely responsible for the psychosocial wellbeing of the PSGAs in the Northern Province. To contextualize the study, the theory of the Ecology of Human Development was employed to identify the different systems by which the professionals interact in their practice. An Interpretative Phenomenological Approach with a purposive sampling method was adopted and a small sample size consisting of 25 respondents was chosen as its data collecting methodology depending on minimum structure and maximum depth. To establish a clear understanding of the respondents' experiences pertaining to the main objective, in-depth interviews were carried out with multiple stakeholders including case managers (6), probation officers (6), a probation commissioner and caretakers (6), and PSGAs (6). The findings revealed that the multiple stakeholders had to deliver several tasks including provision of basic needs such as legal and medical support, counseling and social support amid several difficult situations. The assistance provided by other government and non-government organizations was not effectively controlled. Many of the activities of the stakeholders depend on complicated partnerships as the present partnerships fall short of good coordination. The partnerships have to be carefully developed following open discussions with the partners according to the new agenda and its goals.

Keywords: Post-war context, Parentless School Going Adolescents (PSGAs), multiple stakeholders, psychosocial well-being

Democratisation of Knowledge: A Clarion Call for a More Benevolent Copyright Regime in Sri Lanka

S. M. Jayasinghe

Research Scholar affiliated to Faculty of Graduate Studies, University of Colombo

Copyright law, premised on reward-based theories as well as incentive-based theories, has from its beginning facilitated the creation of private markets in copyright protected works. This practice has encouraged the creators and authors, and has thereby contributed immensely to the expansion of human knowledge. However, this has also paved the way for certain fundamental issues in the sphere of human rights as affordable access to works essential for human-development such as educational materials is affected by unduly strong copyright laws. This research seeks to expose such fetters on “democratization of knowledge” embedded in the legal system itself and suggests the ways in which the copyright regime of Sri Lanka can be adapted to promote distributive justice.

Sri Lanka’s Intellectual Property Act No. 36 of 2003, despite the country’s crucial need to educate the masses, has not made the optimal use of fair use exceptions allowed by the international law, envisaged in the Berne Convention, the TRIPS Agreement and WIPO Copyright Treaties. The analysis of this paper focuses on the inadequate and burdensome fair use exceptions, provided in the Intellectual Property Act of Sri Lanka and their effect on public libraries, distance education and self-learning. The paper also contains a comparison of Sri Lanka’s stature with that of other jurisdictions and throws light on the lessons to be learnt from the experiences like Google Books case by which even the commercial entities were allowed to create databases, which may be used for non-commercial research purposes in USA; as it is unsettling that the people in Sri Lanka who are far less able to afford to buy certain works are not allowed that type of flexibilities. The methodology for this research involved Primary and Secondary Sources, Literature Review and semi-structured interviews with the stakeholders.

Keywords: Copyright Law, Fair Use, Access to Knowledge, Right to Education.

Environmental Governance: A Conceptual Inquisition of Definitions

P. Jayawardena

Department of International Relations, University of Colombo

The protection of the environment is a crucial urgency at present, as the world is moving into an era of rapid industrialization, without considering major environmental problems. Despite environment being the most important part in human life ever since history, the attention on the responsibility to preserve the environment was delayed centuries, surprisingly. It was only after 1960s that the environment was paid conscious attention. After that environment received more attention with the emergence of modern environmentalism and it brought a wave of popular concern about environmental issues. The governments which had the authority to make and implement decisions, led the process.

Hence the researcher attempted to look at the conceptual development of Environmental Governance. The research problem of this paper “is the definition of Environmental Governance competent enough to address the prevailing environmental issues and to reveal the actual conditions of the field of environment?” The objective of the research was to examine the competency of the current definition to address the actual issues and conditions of the environmental governance. The hypothesis of the research is that the definition for the Environmental Governance is not yet developed enough to walk simultaneously with the contemporary global governance realities. Findings justify the argument and reveals that the current definition does not provide an adequate explanation for the environmental governance. It also shows that the environmental governance should be seen not as static but as a constant process. The role of non-state actors are yet to be accepted by the dominant state actors regarding the matter. The research mainly used qualitative research methods while collecting both primary and secondary data.

Keywords: Environmental Governance, Global Governance, Inclusive Approach, Multilateral Approach, Non-State Actors.

From Causal Analysis to Coxian Critical Analysis: Methodology of an International Relations study on Postwar Peacebuilding in Sri Lanka

R.C. Jirasinghe

Faculty of Graduate Studies, University of Colombo

Theory and methodology are interlinked. A research problem explored from a problem-solving theoretical framework will adopt a positivist methodology, while research that critically engages with its subject will turn to “hermeneutics and *Ideologiekritik*”¹. This paper discusses the Coxian² theoretical framework in international relations (IR) and its ability to enable a methodological shift from a positivist methodology that uses causal inference methods to critical methodology using methods such as critical discourse analysis and tacit knowledge.³ It also discusses the role of Causal Process Observation (CPO)⁴ as an analytical tool in IR case study research. The paper explores the application of the Coxian IR theoretical framework for the analysis of the interaction between the International Community (IC) and Government of Sri Lanka (GoSL) from 2009 to 2015, over peacebuilding, which called for a two-stage methodological process of analysis in a single case study. The first stage appropriated positivist methodology for drawing causal inferences through CPO of the interaction between the IC and the GoSL. The second stage required critical methodology that explored the epistemological framework within which the research problem occurred.

Keywords: Coxian critical theory, peacebuilding, causal process observation, postwar, Sri Lanka

¹ Devetak, R. (2005, p.41) in Devetak, R. (2005). *Critical Theory*. In Burchill, S., Linklater, A., Devetak, R., Donnely, J. Paterson, M., Reus-Smit, C., True, J. (Eds), *Theories of International Relations* (3rd Ed), (pp. 137-159). Hampshire and New York: Plagrave and MacMillan.

² Cox, R.W. (1981). Social Forces, States and World Orders: Beyond International Relations Theory. *Millennium Journal of International Studies*, 10(2), 126 -155. Retrieved July 27, 2015. DOI: 10.1177/03058298810100020501.

³ See Schouten, P. (2009). Theory Talk #37: Robert Cox on World Orders, Historical Change, and the Purpose of Theory in International Relations. *Theory Talks*. <http://www.theorytalks.org/2010/03/theory-talk-37.html>

⁴ See Bennett, A. (2004). Case Study Methods: Design, Use, and Comparative Advantages. In Sprinz, D.F. & Yael W-N. (eds), *Models, Numbers, and Cases: Methods for Studying International Relations*, pp. 19-55. Ann Arbor: The University of Michigan Press.

Foreign Policy Analysis: China-Sri Lanka Relations

H. Kandaudahewa

Department of International Relations, University of Colombo

The proposed research will focus on the analysis of China-Sri Lanka (Sino-Lanka) relations during present context. Establishment of ‘Good Governance’ after January 2015 Sri Lankan Presidential election created the foreign policy turned over in Sri Lanka. During the presidential campaign, the joint opposition candidate, the former Health Minister under Rajapaksa cabinet, heavily criticized Chinese presence in several Sri Lankan development projects, specifically the ‘Colombo Port City’ project. Implementing the joint opposition campaign promise to halt and review the ‘Port City’ project damaged the bilateral relations between two nations and the Chinese government objection over further Chinese investment has threatened the Sri Lankan development progress. On the other hand, Indian interest over ‘Port City’ created the ‘interest’ conflict in IOR between two Asian rivals. President Sirisena faced a political dilemma between India and China during his first year since China continuously pressured to start ‘Port City’ and other development projects they intended.

The main objectives of this paper are to evaluate the Sri Lanka-China relations focusing on the present context while focusing on Chinese Defence and Strategic interest in Asian power balance. Through that, an understanding on Chinese Soft Power utilization in the Asian region and influence on policy making is also examined. The main research problem is centred on why Chinese strategic and defence interests has had varied influence on Sino-Lanka relations in the present context, and the central research problem will help to underpin the direction of the research.

As primary data collection, selected public records such as treaties/agreements, Hansard reports, autobiographies, selected decision makers will be used to examine the research context. Likewise, secondary sources such as journal/ newspaper/ magazine articles, academic books, biographies, monographs and web sources will be utilized to articulate existing literature in the field of study.

Keywords: China, Sri Lanka, Soft Power, Mega projects, Good Governance

Reconciliation of Human Machine Intelligence to Moderate the Near Future Machine Induce War Crimes and Violation of International Humanitarian Law

K.G.L.K. Kapugama

Research Scholar affiliated to Faculty of Graduate Studies, University of Colombo

Multifaceted elaborations of various studies could cover almost all the aspects in the world. It is true that human cognition in reasoning or in any other aspect can be enhanced with the rational utilization of Artificial Intelligence. The researcher intends to emphasize the importance of restructuring the existing system of law to suit future challenges. The writer intends to explain the impact of Artificial Intelligence on future human existence and impacts on conflicts in days to come. In this paper, the writer discuss the automation of intelligent artefacts and the intelligent behaviour of such programmes which will be a dire threat to the human existence. He also emphasizes a risk mitigation process of the future machine intelligence.

According to the literature available in this field, many authors have put forward their concern or thoughts to address a dire future emergence of machine intelligence. Some researchers explain systems to understand or represent types of knowledge such as cases; rules and arguments and then how to reason with them such as manipulate precedents, to apply and inference with rules and tailor arguments to facts. A special focus was given to lethal autonomous weapon systems and its future threat to the human world. However the writer attempts to suggests to the academia and policy makers to restructure the existing legal framework to ensure human rights in days to come.

Keywords: Artificial Intelligence, Machine learning, Robots, IHL, LAWS

Peace Building through Female Empowerment: Lessons for Sri Lanka

C.S. Karunaratne

Research Scholar affiliated to Faculty of Graduate Studies, University of Colombo

Gender perspectives in peace building have been internationally recognized. CEDAW and a series of UN Security Council Resolutions starting with Resolution 1325 have recognized the necessity to include women as equal and full participants in peace processes. However, the Sri Lankan experience demonstrates that women have limited access to peace building processes and little representation in decision making bodies. Sri Lanka is a historically patriarchal society and the conflict had a disproportionate impact on women. Although the contribution by women to the national peace building process has been multiple, several obstacles hinder them from realizing their full potential. Amongst them- cultural stereotyping, ineffective institutional mechanisms, difficulties in accessing the justice system, hostile political culture, problems of standing out due to lower social ladder, poverty, ignorance, sexual and gender based violence (SGBV) and disregard for human rights are pivotal. This paper analyzes how the role of a woman should be navigated from the *passive victim status* to *active participant status* in the post-armed conflict environs so as to achieve effective reconciliation. In doing so, the author investigates how female empowerment would assist national peace building processes; whether Sri Lankan process has embodied a gender perspective as its international obligations demand and what lessons Sri Lanka can learn from the international experience. The research finds that Sri Lanka has recognized women only as victims- widowed, displaced, abused and traumatized - but not as active participants in peace building. Effective reconciliation addresses both retrospective and prospective issues. While examining the gendered nature of violations that took place during the conflict, it furthers protection and promotion of civil-political as well as socio-economic-cultural rights of women in post-armed conflict. Female empowerment resulting thereby in turn leads to sustained and lasting peace. Thus the paper finds that there exists an interconnection between empowerment and reconciliation. Unless for inclusive reconciliation attempts, female rights may not be fully realized and without such realization, sustainable peace may not be possible.

Keywords: Gender, Peace Building, Reconciliation, Female Empowerment

Contribution from Domestically Grown Forest Plants and Their Parts to the National Economy: Present Trends and Future Possibilities

P.M. Kiriella

Research Scholar affiliated to Faculty of Graduate Studies, University of Colombo

Plant Domestication refers to an evolutionary process that occurs when humans cultivate wild plants, also modifying them genetically. Over time, people have made several changes to the characteristics of plants such as wheat, corn and etc. to make them more suitable for human use. Sri Lanka also domesticated many Forest Plants during the past. However there have been recent cases where certain plants have been over exploited from Natural Forests for Illegal Exportation. There is a great potential that such economically important plants grown as plantation crops and be subjected to value addition before exporting.

The prime objective of the study was to identify how the exportation of domestically grown Forest Plants and their parts contribute to the improvement of the National Economy and the present trends and future possibilities. The additional objectives were to analyze the present Illegal Forest Plant Exportation and impacts of value addition.

The results revealed that there is a strong relationship between the Total export value of Forest Product and Total value of Agricultural Exports as the Pearson correlation coefficient is 0.985. Sri Lanka's Forestry Sector Exportation is still heavily dependent on the Agricultural Exports and if the export value of Forest Product is improved with Value Addition, it could lead to an accelerated increment in the National Income of the country. According to the results of the Expert Opinion Survey, it was revealed that the current rules and regulations of Exportation of Forest plants need to be revised. Domestication of Forest Plants and their parts is a better solution to minimize the forest harvesting. Case Studies revealed that the support from the Government for Value addition is minimal and the Illegal Exportation has increased during the past two decades mostly in Sandalwood, Wallapatta, Ebony and Kothalahimbatu to India, Japan, China and USA.

Keywords: Domestically grown forest plants, Forest Plant Exportation, Illegal Forest Plant Exportation, National Income, and Value Addition.

Civil Military Relations in Pakistan: The Role of Pakistan Army in Internal Politics

S. Kodithuwakku

Faculty of Graduate Studies, University of Colombo

Military is as old as the institution of state. It is one of the most vital, organized and hierarchical of all human institutions. Army is regarded as groups of men equipped and trained for the purpose of conducting warfare and protecting the independence and sovereignty of the country. Throughout the history, the character and purposes of an Army has varied with the social and political aspects of individual nations. In some cases, armies were used to conquer and rule, whilst in others they have fought for patriotism and freedom.

The Pakistan Army has dominated national politics during the 20th Century, playing an active and often decisive role in domestic politics and seeing as a legitimate extension of their professional role as well as being an important element of the fate of the nation. Pakistan Army remains at the top social tier and is respected as a professional and patriotic organization even to date.

Therefore this research highlights the causes of intervention of military in Pakistan politics, its socio-political effects, with a brief analysis on the future of civil military relations in Pakistan. Further, this study intends to analyze a brief overview of civil military relations in Pakistan and it will analyze future civil military relations. The archival study would deal with a wider range of primary and secondary sources which draw the Defense Ministry of Pakistan, scholars of academia. Therefore, mainly, this research would follow a Qualitative research method. Moreover, this research would conclude with an assessment of the Civil Military Relations in Pakistan: The Role of Pakistan Army in Internal Politics.

Keywords: Civil Military, Intervention, Pakistan, Armed Forces, Domestic Politics

The Significance of a Maritime Domain Awareness Centre in Sri Lanka

S.A.C.R. Kulatunga

Research Scholar affiliated to Faculty of Graduate Studies, University of Colombo

In this paper, the writer attempts to identify a structure for a Maritime Domain Awareness Centre in Sri Lanka. Maritime Domain is basically a situational awareness of the maritime environment. This can be achieved by collecting maritime intelligence and surveillance data from maritime environments and disseminating in to relevant security components to conduct prompt maritime operations. This centre will be the core unit of gathering information and dissemination into civil and military maritime security components. The writer is interested in identifying the structure of a Maritime Domain Awareness Centre (MDAC). This centre will share information with MDA centres of other countries in the world. This will be helpful to share maritime intelligence and surveillance around the world and to counter transnational security issues. Sri Lankan key military maritime security affiliates are Navy, Coast Guard, Air force, and the civil maritime affiliates are Port Authority, Custom, Department of Immigration and Emigration and Department of Fishery. Sri Lanka is more vulnerable to non-traditional security issues such as drug trafficking, gun running, terrorism, piracy, armed robbery, poaching, marine pollution, human smuggling, illegal transfer of items and IUU (Illegal Unregulated and Unreported) fishing activities.

My research problem highlights that the nonexistence of a Maritime Domain Awareness Centre in Sri Lanka leads to difficulties when sharing intelligence and surveillance with regional maritime security components. This puzzling issue is highlighted in the significance of establishing a Maritime Domain Awareness. The objective of this paper is drawing attention to the nonexistence of a MDA centre in Sri Lanka. The researcher has selected qualitative research methods in collecting data from secondary sources; further the researcher will forward data with his personal observation. This paper will highlight the naval contribution and initiative to the maritime domain in Sri Lanka.

Keywords: Security, Intelligence, Surveillance, transnational security issues, Maritime Domain Awareness

Psychological Barriers of Underprivileged Rural Customers in Adapting to Formal Financial System: A Study in a Selected DS Division of Kurunegala District

D.A.T. Kumari

Research Scholar affiliated to Faculty of Graduate Studies, University of Colombo

Financial inclusion or inclusive financing is the delivery of financial services at affordable costs to sections of disadvantaged and low-income segments of society. In the Global Financial Development Report 2014, financial inclusion is defined as the proportion of individuals and firms that use financial services. Therefore financial inclusion helps vulnerable groups such as low income groups, weaker sections, etc., to increase income, acquire capital, manage risk and work their way out of poverty through secure savings, appropriately priced credit and insurance products, and payment services. According to previous literature, psychological barriers such as attitudes and motivation become more significant for reducing customer adaptation towards formal financial system.

Though researchers have investigated about this issue in different socio economic contexts, very limited studies have been carried out to explore the different psychological barriers of poor communities for their financial inclusion in local contexts. Therefore, the present study mainly focuses on exploring the impact those barriers for the willingness of poor communities in adopting formal financial system. As most of previous studies had adopted quantitative methods, the present study was designed as quantitative research based on the survey method. The sample for this study was drawn from rural poor customers from the 05 DS division of Kurunegala District. Altogether 400 questionnaires were distributed and 378 completed questionnaires were taken in for final analysis. Cronbach's Alpha values of each construct confirmed that a good interring reliability exists with the data. Exploratory factor analysis was adopted to identify main psychological barriers and regression analysis was used for testing hypotheses.

The findings revealed that psychological barriers play vital role in discouraging rural poor people for adapting to formal financial system. Further, the researcher noted that attitude towards documentations, friendliness of employees and perceived inconvenience become major psychological barriers for the financial inclusion. Finally, the researcher provides some suggestions for eliminating the psychological barriers of rural poor in adapting to formal financial systems.

Keywords: Financial inclusion, rural poor, Psychological barriers, Formal financial system

The Audit Expectations Gap and the Role of Audit Education: Evidence from Sri Lanka

J.S. Kumari¹, A.R.Ajward² and K.G.S. Kehelwatenna³

¹ *Department of Accounting, Rajarata University of Sri Lanka*

² *Department of Accounting, University of Sri Jayewardenepura*

³ *Department of Accounting, University of Colombo*

The value of a financial statement audit relies on society having confidence in the audit concept and function. The difference between the actual performance of auditors and society's expectations regarding their services known as the 'Audit Expectation-Performance Gap' (AEG). The criticism of auditors and even litigation against auditors for failing to meet society's expectations is clearly harmful to the accounting and auditing professions. Researchers have identified a number of means for reducing AEG including the audit education at universities and professional courses. In the Sri Lankan context, although there are few extant studies that have explored the AEG, with the significant changes in audit regulations, the issue has reemerged. Furthermore, there is a dearth of studies on the effect of the audit education on AEG in the Sri Lankan context. Thus, the present study attempts to first explore the status of the AEG, and then to examine the effect of audit education at universities and other professional institutions on the AEG, in the Sri Lankan context. A positivist approach was adopted and a structured questionnaire survey was performed involving 100 practicing auditors and 300 undergraduate students of a national university. The structured questionnaire listed 30 duties of auditors as identified by Porter (1993), and the opinions of the respondents were obtained as to whether such duties are auditors' existing duties, the level of auditors' performance of these duties, and whether such duties should be performed by the auditors (i.e., three dimensions). In order to test the effect of audit education on the AEG, selected students were divided into three groups, and the independent sample t-test was used to test the differences of opinions among the groups. The findings indicated a significant difference between students who had not followed an audit course and the auditors on the opinions about auditors' existing duties. Further, a significant difference was also noted between students who had followed only a basic auditing course and auditors for both auditors' existing duties and the duties that auditors should perform. These findings indicate the existence of an AEG. However, there was no significant difference found between students who had followed an advanced auditing course and auditors with regard to all three dimensions of auditors' duties, leading to the disappearance of an AEG, which infers that audit education could minimize the AEG. Overall, the findings indicate the existence of an AEG and that audit education had an effect in reducing the AEG in Sri Lanka, which is also consistent with the findings of the extant studies. These findings are expected to have significant educational policy implications for the future.

Keywords: Audit Education, Audit Expectations Gap, Duties of auditors, Porter Model (1993)

Impact of Urbanization on Land-use Change and Aquaponics as a Potential Option for Food Supplement in Kathmandu Valley, Nepal

S.M. Maharjan and U.R. Khadka

Research Scholars affiliated to Faculty of Graduate Studies, University of Colombo

Urbanization has become a ubiquitous phenomenon. The urban population in Nepal was accounted to be 27% in 2014, with an 8% growth rate. Kathmandu Valley is the major urban area with an annual population growth rate of 5.11%. Between 1990 and 2012, due to the increase in the population in the valley, the built-up area has increased from 38 km² to 119 km² and agricultural land has decreased from 421 km² to 342 km². Further, approximately 6000 hectares of arable land in the valley have been estimated to be converted into built-up area in each 2020 and 2030 decades. This change in land use has drastically changed the urban morphology. As a result, the valley has been facing severe environmental crises like water shortage, inadequate sanitation, and decreased food access to the urban poor. However, this has also provided agro-market opportunities leading to a shift from traditional subsistence farming to the commercial state-of-the-art agriculture with drip irrigation. In the current context of shrinking agriculture land and expanding built-up areas, the various options of productions ought to be sought. In the present study, an attempt has been made to assess the potential of producing supplementary food for future urbanites in the built-up areas using an aquaponic (aquaculture plus hydroponics) system. For the purpose, a media filled system was opted with hog plum (*Choerospondias axillaries*) seeds as growing media in which catfish (*Clarias batrachus*) and Indian spinach (*Basella alba*) were simultaneously grown respectively for 90 and 40 days. In catfish, the mean weight gain and percent weight gain were found respectively to be 65.8 g and 2191.67%. Similarly, in spinach, the mean fresh biomass reached 47.27 g from 0.45 g seedling with weight gain 10,400%. This suggests the possibility of aquaponics for urban food supplement. Further, a detailed study on a large scale system is required for evaluating the cost-benefit, and commercial potentiality.

Keywords: Aquaculture, catfish, hog plum, hydroponics, Indian spinach

The Significance of Environmental Governance towards Sustainable Integration of Refugees: A Case Study on the Influx of Boat Refugees in Australia between 2010-2015

D.A.E. Malavipathirana

Research Scholar affiliated to Faculty of Graduate Studies, University of Colombo

The debate on “environmental governance” was born with the emergence of the concept of “sustainability” which challenges the growth of population against the availability of limited resources. Refugee crisis centralizes the global and regional population thus affecting the ecology and environmental sustainability. However, Australia’s “stop the boat policy” could reduce the number of boat refugees. With the massive refugee crisis in 2015, Australia decided to host 13,750 Syrian and Iraqi refugees in their country, causing threat to the stability of the limited resources in their natural environment. Australia established several environmental policies such as - urban footprint, reforms to the immigration programs, establishment of the sustainability commission, alignment of economic activities with ecological and social realities and strategies policy development, not only focusing on reducing the migrant population but also implementing efficient water use policies and proper housing plans to assist integration of boat refugees to the community in an environmentally healthy manner.

In this context, this research mainly attempted to find answers for the research question of why Australia should implement new environmental governance tools to sustain, while integrating boat refugees into the society. The objective of this research was to understand the importance of managing refugees to ensure environmental sustainability of the country during crisis. The hypothesis of the research was that the neoliberal environmental governance possesses a considerable impact on environmental sustainability due to the increase of refugees. The author mainly based findings on secondary and qualitative data in data collection and web sources. In analyzing the collected data, the author found that Australia need not reject genuine boat refugees at their cross borders to secure their environmental governance but must revise their environmental policies.

Keywords: Environmental Governance, Sustainability, Refugee Integration.

Peace Research for Peacebuilding: A Case study of Sri Lanka

N. Melegoda

Faculty of Graduate Studies, University of Colombo

In Sri Lanka, the end of the war in 2009 resulted in peace in the country after nearly 30 years of prolonged civil war. Categorized as a protracted, intra - state conflict, Peacebuilding in the country began before the end of war, and between the short ceasefire periods that existed during the conflict. These efforts were recorded as attempts for Negotiated Peace Agreements, Liberal Peacebuilding, Hybrid Peacebuilding to name a few. The term Peacebuilding referred to in many varied scholarly terms each with its specific definition can be traced to Peace research that has been carried out in many academic institutions around the world. The objective of this paper is to highlight Western centers of Peace research focusing on Liberal Peacebuilding model and other Centers that differ from that model in Asia.

First and foremost, the research recognizes that many scholars and research organizations in Sri Lanka have carried out peace research invaluable for peacebuilding in Sri Lanka. Among them is the International Center for Ethnic Studies (ICES) and their several studies for example “From War to Peace: People’s perceptions from North and East.” But the focus of this research was to find international peace research data and models that can be used constructively for Peacebuilding in Sri Lanka.

This research was done using qualitative research method, using web browsers such as Google Scholar. The conclusion of the paper is that several centers of excellence on peace research have carried out extensive case studies on Sri Lanka focusing on sustainable peacebuilding in Sri Lanka. The models that are advocated differ in the West and in Asia. Thus, the Peace research that is available can be adopted to style the peacebuilding model to suit the local context in Sri Lanka. The details of the studies and centers are outlined in the paper.

Keywords: Peace research, Liberal Peacebuilding, Local context, Sri Lanka, Asia

**Heavy Metal Concentrations in Fish Muscle Tissues of Grey Mullet (*Mugil cephalus*)
Obtained From Negombo Estuary in Sri Lanka**

B.R.C Mendis¹, M.M.M. Najim² and H.M.P. Kithsiri¹

¹*National Aquatic Resources Research and Development Agency*

²*South Eastern University of Sri Lanka*

Negombo estuary is used by the local community for fishery resources in the Western Province in Sri Lanka. Nevertheless it is becoming polluted with chemicals from various sources. The objectives of this study were to determine the levels of five heavy metals viz, lead, cadmium, mercury, copper and zinc. For this study, fish samples were collected from four main locations of Negombo estuary as Pitipana, Munnakkaraya, Duwa and Katunayake sites. Sampling sites was done during the one year study period from January to December 2015. The levels of fish tissue metals were analyzed employing standard methods. Therefore, the levels of Hg metals were analysed by cold vapour atomic absorption spectrophotometer. Whereas the other metals were analysed by flame furnace atomic absorption spectrophotometer. The results revealed that the average concentration of metals Pb, Cd, Hg, Cu and Zn in fish tissue were 0.04 to 0.07 mg/kg; 0.03 to 0.04 mg/kg; 0.24 to 0.41 mg/kg; 0.352 to 0.378 mg/kg and 3.32 to 5.82 mg/kg respectively. The result showed that mean concentration of Pb and Hg levels in fish tissue exceeded the maximum levels in food for human consumption specified by international standards limits. Hence, in the Pitipana, Duwa, Munnakkaraya and Katuayake areas highest values indicated the discharge of sewage and dumping of solid waste from households and other anthropogenic activities and accelerating sedimentation. Large amounts of wastewater containing organic pollutants and various processes of chemicals are released to these sites. The results indicated that heavy consumption of *Mugil cephalus* from Negombo estuary especially from Duwa and Munnakkaraya may pose a health hazard to consumers.

Keywords: Heavy metals, Fish tissue, Mugil cephalus, Health hazard

Effect of Heavy Metal Contamination of Water in Negombo Estuary, Sri Lanka

B.R.C Mendis¹, M.M.M. Najim² and H.M.P. Kithsiri¹

¹*National Aquatic Resources Research and Development Agency, Colombo*

²*South Eastern University of Sri Lanka*

The main sources of heavy metals into the Negombo estuary are thought to be industrial effluents and domestic solid waste inputs. The present study was carried out to assess the contamination levels of heavy metals in water at Negombo estuary, with the objectives to determine spatial and temporal variations of heavy metal levels of cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), and zinc (Zn) in water. Samplings at selected sites were done during a one year study period from January to December 2015. Heavy metal levels in water were analyzed employing standards methods. The results revealed that concentrations of Cd, Pb, Cr, Cu, and Zn in water were below the threshold standard levels and below the proposed tolerance limits for the discharge of industrial wastewater quality standards of Central Environmental Authority of Sri Lanka. The findings were important as the study indicates the seasonal variations of presence of heavy metals in the estuary water and which probably links to anthropogenic activities. The seasonality in the heavy metal levels of water was observed with a peak period from May/ June and October and November, which apparently coincided with the intermonsoon periods of the island.

Keywords: Heavy metals, Water quality, Anthropogenic influence

Socio-Psychological Factors Influencing the Self Harming Behavior of Youth

P.V.N.U. Pallegangoda

Faculty of Graduate Studies, University of Colombo

Self-harm is recognized as a major public health problem worldwide. Sri Lanka has recorded nearly 48 suicides per 100,000 persons in 1995 (Levi et al., 2003). It is a leading cause of injury in Sri Lanka. However, the cases of suicide are not statistically reviewed and information about the epidemiology of such cases are important for policy-making. The overall objective of this study is to examine the Socio-psychological factors that influence the self-harming behavior of youth. This research used a qualitative approach and a minor quantitative aspect, which was done based on Kanthale Hospital. The study utilized three patients and seven resource personnel comprising medical officers and patients' relations. Primary data were collected in the form of in-depth interview. It was found that majority of attempts were between 15-29 years and a greater part of attempts were impulsive by interpersonal relationship complications existed within those who were in a lower socio-economic level. Some were subjected to poverty, verbal/physical abuse and/or drug/ alcohol abuse. Some female individuals attempted to self-harm with the purpose of aborting. The intentions of suicide, attempted in the majority were to communicate distress or escape from emotional pain. Self-harming is a result of the series of problems and long term stress. The conclusion is that a greater part of the young individuals who attempted to self-harm fit into a socially deprived population that has undergone continuous emotional pain, drug abuse and addiction or due to poor interpersonal and social relationship.

Keywords: Socio-psychological, Self-harm, suicides

The Subjective Well-being of Married Women in and Out of the Workforce in Sri Lanka

A.S. Panditharatne

Faculty of Graduate Studies, University of Colombo

This study investigates the socio-economic factors associated with the subjective well-being or happiness of married women in Sri Lanka. It looks at whether going to work, in addition to their other care-giving responsibilities, makes married working women happier than those who do not engage in market work. While the study of subjective well-being in Sri Lanka has only just begun, the subjective well-being of married Sri Lankan women in and out of the labour force has not been studied before. However, this is an important area for research because Sri Lanka's future growth depends critically on more women engaging in market work, as demographic changes tighten the labour market. Female labour force participation in Sri Lanka is one of the lowest in the world and married women report the lowest participation rates. Role theory is used to identify the impact of assuming multiple roles on women's subjective well-being, particularly when women take on employment in addition to the care giving roles they almost invariably play, as daughters, wives, daughters-in-law and mothers. This study is based on data collected through a cross sectional household survey of 889 married respondents between the ages of 20- 60 years, from 845 households living in rural (308 respondents) and urban (581 respondents) locations in Panadura. Findings indicates that the vast majority of married Sri Lankan women are indeed happy and that being employed, in addition to their other care-giving responsibilities, significantly lowers married working women's subjective well-being compared to homemakers. Being healthy, happily married, well appreciated, having children who are doing well in life, being able to achieve childhood goals, and being able to easily manage monthly expenses, all seem to be factors that contribute to a married woman's happiness; whereas women who feel that they are burdened with domestic duties seems relatively unhappy.

Keywords: Subjective well-being, roles, women, work, homemakers

Corruption during Transition: An Experience from the Case of Local Governance and Local Public Service Delivery in Nepal

K.R. Panta

Research Scholar affiliated to Faculty of Graduate Studies, University of Colombo

Nepal has been undergoing transition and political instability since 2001. During this period of 16 years, Nepal has faced a severe armed conflict launched as the Maoist civil war (1996-2006) and frequent movements and other obstacles along with the dissolution of constitution assembly-I and the unofficial economic blockade by India in 2015/16. Though the phase of constitutional monarchy and multiparty democracy were replaced by a federal republic system of governance since 2008 and the new federal republic constitution was promulgated in September 2015, so many legal provisions have yet to be settled. Since 2002, there has been no local election, creating the vacuum of elected representative in 3973 local government bodies. Theoretically, the lack of transparency, accountability, and existence of elite capture, ambiguity etc. contribute directly or indirectly to corruption which impedes the efficient public service delivery at local level. These phenomena further degrade the quality of and people's trust on local public services. Likewise, they reduce the importance of different theories of competitive local governments. The conditions prevail more effectively during transition and political instability. This paper, as part of a doctoral thesis, focuses on the local dynamics of the problem of elite capture and corruption at local level in Nepal, observed during political instability and transition, when there was poor accountability of local governments in the absence of elected representative since 2002. The paper tries to examine their effect on the local public service delivery during that period, using survey data and secondary information.

Keywords: Decentralization, corruption, public service delivery, poverty, local government

Case of Regular and Irregular Youth Migrants

P.M.A.N. Pingama

Faculty of Management and Finance, University of Colombo

This conceptual paper is to understand the phenomenon of youth migration of Sri Lanka. The study reviews migration literature and preliminary research finding on respondents' interviews. Many actors have taken many initiatives to create a better future for youth. This include provision of education, skill development, social inclusion, social equality and participatory development to shape the future of youths. But there is a significant segment of the youth population who are not satisfied about the available opportunities and choices within Sri Lanka. They are not convinced of a better and safer society for their future. In this research, the migration drivers and tendencies are examined and researched both from a theoretical and empirical point of view with a special importance to perspectives and causes for migration of youths of Sri Lanka. The research problem is 'why do youth migrate to different countries in spite of opportunities in the home country?' Objectives of this study are to understand reasons for youth migration, basis of destination selection, forces and actors of such migration and expected future relationship with home country. The research design is Post Positivist within the theoretical framework of Social Exchange Theory. Many international migration theories have been proposed to assess and explain the underlying phenomena of international migration. However, international migration is a complex issue with multiple facets. One single theory may only explain a particular aspect of international migration. Conventional findings suggests that migration can be explained with Neo-classical Theory, Theory of Economics of Migration, Dual Market Theory, Social Capital Theory, Cumulative Causation Theory and Transnationalism. However, this study indicates that most youth migrate to different countries due to a perceived uncertainty placed upon their future. This study makes major contributions to the existing practice and theory in International Migration of Youth Population of Sri Lanka. The paper concludes with propositions, preliminary findings and recommendations for future research on understanding migration of youth.

Keywords: International Migration, Youth, Decision Making, Social Exchange Theory, Development.

The Impact of Employee Recognition on Organizational Commitment of Operational Workers in Large Scale Apparel Industry in Colombo District

K.G.C.C. Piyasena

Research Scholar affiliated to Faculty of Graduate Studies, University of Colombo

Among the major issues faced by the apparel sector in Sri Lanka, the low level of commitment of the operational level workers becomes a momentous issue. This issue is significant to shrink competitive advantages from the local markets as well as global markets. There are numerous research studies which highlight the different reasons for the low level of commitment of these workers. In proportion to them, one of the significant factors which affects operational workers' unrest is lack of employee recognition. Employee recognition becomes a vital factor to determine the long term service period of employees as well as high commitment. However, there is no empirical evidence to show the impact of employee recognition on the organizational commitment of the operational workers in this sector. Then, the objective of the study is to find out the impact of employee recognition on the organizational commitment of the operational workers in the apparel sector. 250 operational workers were selected as the sample of the study using random sampling method from large scale apparel companies in the Colombo District. Data was collected from a structured questionnaire and analyzed using bivariate analysis. There is a strong positive relationship between employee recognition and normative commitment. However, the relationship between employee recognition and continuance and affective commitments were recorded as an average positive relationship. As the results of the simple regression analysis, employee recognition had a positive impact on the employee commitment. The conclusion made based on the findings can be derived as follows: management of the apparel companies has to consider employee recognition as an important factor to determine their organizational commitment. Different strategies relating to enhance employee recognition should be strategically implemented to gain the highest level of employee commitment.

Keywords: Employee Recognition, Organizational Commitment, Affective Commitment, Continuance Commitment, Normative Commitment

**Intellectual Capital, Corporate Performance and Competitive Advantage:
Listed Companies in Sri Lanka**

M.A.C.H. Piyathilake

Faculty of Graduate Studies, University of Colombo

In the new knowledge based economic environment, intangibles play a vital role as a base for sustainable competitive advantage in companies. So it is not reasonable only to consider tangible resources to value corporate performance. Intellectual Capital (IC) creates value as an intangible asset on corporate performance to gain competitive advantage for stakeholders in changing technology. Hence the conventional, historical accounting methods are not sufficient for valuing IC to represent the true picture and it is needed in depth, comprehensive studies for IC for the benefits of companies. Thus, IC should not only be disclosed and measured correctly, but the informative yields also should be used effectively.

The aim of the study is to analyze the effect of IC on corporate performance of top listed companies in Sri Lanka based on market capitalization and competitive advantage, further the study is novel, which will test the perception and significant differences on the perceptions among stakeholders to measure IC.

There are very few studies in the context of Sri Lanka on IC, and the ones available have mainly focused on disclosure practices of reporting of IC, and one study was found relating to the impact of IC on corporate performance. It is observed that there is no research which considers IC on competitive advantage and stakeholders' perception on IC. A pilot survey was conducted to identify the practicability. Although generally-accepted accounting standards confine most IC is being recognized in financial statements, stakeholders still grasp the invisible value of IC. So it is important to address the field especially in Sri Lankan context to fill the gap.

From the study it is expected that new developments will be evident in the field of study and therefore, it is argued that more comprehensive empirical evidence is needed to measure the IC of a developing country like Sri Lanka.

Keywords: Sri Lanka, Intellectual capital, corporate performance, competitive advantage, and value creation

**Noise and Inter-religious Conflict in Colonial Ceylon: a Contemporary Minority
Protestant Christian Perspective for Peacebuilding**

P. Mihindukulasuriya

Faculty of Graduate Studies, University of Colombo

Public religious celebrations and ‘tom-tom’ beatings in particular were a major source of legal contention and, not infrequently, mob violence between Buddhist, Hindu, Roman Catholic, and Muslim religious communities in Sri Lanka during the period 1880 – 1920. In the process of the general acrimony and communal power struggles that were, in one sense, caused by, and then arbitrated by the British colonial state, traditional prerogatives were replaced by new civic codes based on Anglo-centric notions of noise, religious worship and urbanity. These socio-cultural norms and their prescriptive municipal regulations attempted to enforce a liberal egalitarianism that was only partially effective in enshrining group rights in the colonial multicultural space. The fact that this endeavour did not fully enable the internalization of an egalitarian multiculturalism in the popular civic consciousness is amply demonstrated by the persistent current of ethno-religious tensions that persist to this day. This paper recognizes a hitherto overlooked minority Protestant Christian perspective which emerged during that period of inter-religious contestation regarding ritual noise-making. These contemporary voices advocated an emic and indigenist approach to religious noise-making based on the ethical principle of reciprocal equivalence, as undergirded by the biblical ‘Golden Rule’. Examples for these attempts towards peacebuilding and rights recognition are derived from the judicial ruling of Paul E. Peiris in the Gampola Perahera Case, the correspondence of F. Booth Tucker to Lord Grey following the anti-Coast Moor Pogrom of 1915, and Charles E. Corea’s statement on drumming at the Dalada Maligawa. The discursive engagement with these socio-historically located sentiments is facilitated by drawing on political philosopher Charles Taylor’s insights on multiculturalism and rights recognition.

Keywords: religious conflict, ritual noise-making, multiculturalism, rights recognition, peacebuilding.

Effects of Relational Qualities on Transaction Costs of Smallholder Vegetable Farmers in Sri Lanka: A case of Attampitiya Agricultural Division in Uva Province

H.M.S. Priyanath¹ and S.P. Premaratne²

¹*Department of Economics and Statistics, Sabaragamuwa University of Sri Lanka*

²*Department of Economics, University of Colombo*

Smallholder farmers fail to govern their Transaction Costs (TC) using either ‘market’ or ‘hierarchy’ due to several limitations. Instead, they develop informal relationships with exchange partners and use such relationships to govern their TC. Results depend upon the qualities of relationship (i.e. inter-personal trust and relational norms) between them. However, there is no adequate empirical evidences how relational qualities affect the TC. Therefore, this study examined the effects of relational qualities on TC particularly Smallholder Vegetable Farmers (SVFs) in Sri Lanka. The study collected data from 100 SVFs using simple random sampling method from a sample frame of 1468 SVFs in *Attampitiya* Agricultural Division in the *Uva* Province. A pre-tested structural questionnaire was employed for data collection. Data was analyzed using Partial Least Square - Structural Equation Modeling.

Empirical results showed that relational qualities between exchange partners and SVFs has a significant impact on mitigating TC accepting 16 hypotheses out of 18. Path coefficients of inter-personal trust ($\beta = -0.25$), information exchange ($\beta = -0.16$), solidarity ($\beta = -0.21$), role of integrity ($\beta = -0.22$) and flexibility ($\beta = -0.13$) have negative significant relationship with TC. The results further revealed that relational qualities mitigates opportunism of exchange partners. Path coefficients of inter-personal trust ($\beta = -0.15$), information exchange ($\beta = -0.22$), solidarity ($\beta = -0.31$), flexibility ($\beta = -0.11$), reciprocity ($\beta = -0.11$) and role of integrity ($\beta = -0.33$) have significant negative correlation with opportunism. Similarly, path coefficients of inter-personal trust ($\beta = -0.19$), information exchange ($\beta = -0.10$), solidarity ($\beta = -0.24$), and flexibility ($\beta = -0.14$) and uncertainty demonstrate significant negative relationships. Thus, the study provides valuable insights for SVFs to improve their performance by strengthening relational qualities to minimize TC.

Keywords: Inter-personal Trust, Opportunism, Relational Norms, Smallholder Farmers, Transaction Costs

Higher Education at Crossroads: Challenges for State Universities

A. Ranasinghe ¹ and R. Logendra ²

¹*Department of Economics, University of Colombo*

²*Faculty of Arts, University of Colombo*

It is reported that around 60 percent of Arts graduates and 20 percent of other graduates graduated in 2009 were never employed within 3 years following their graduation.

Researchers and policy makers insist on incorporating soft skills to the curricula as a remedy for this problem. Through a literature review it is observed that there is no consensus about it. Whether it is a successful strategy, what types of soft skills to be incorporated and definitions of some soft skills are still subject to debate. The efficacy of this strategy is also questioned.

However, there is a consensus among researchers and policy makers that universities should have a systematic intervention to improve soft skills of their graduates. Using a sample survey of 40 private sector establishments recruiting graduates it was observed that the key attributes required by the private sector are Communication Skills, Team work ability, Adaptability and Problem Solving and Analytical Abilities. A sample survey of undergraduates of the University of Colombo shows that the attribute gap that universities are required to fill seems to be very high. It is also noteworthy that certain basic soft skills such as IT and English would be better incorporated in to the school curriculum.

Basic skills enabling a person to engage in self-learning should be imparted in their childhood. Incorporation of employable attributes cannot simply be left for universities. It is a collective responsibility of parents, schools, universities as well as industries which will employ the graduates in future.

It is interesting to note that female undergraduates are relatively better in initial endowment of employable attributes. However, in the labor market they are at disadvantageous situation. Narrowly focused attitudes towards employment can be considered as supply side factors contributing to this problem.

Keywords: Graduate Unemployment, Employability of Graduates, Graduate Attributes, Arts and Social Science Graduates

Contemporary South Asia from the Theoretical Lens of Realism

M.D.K.I. Ranasinghe

Faculty of Graduate Studies, University of Colombo

South Asia is the least integrated region in the world its rapid socio-economic and political transformations has made it pertinent to rethink of South Asia, specially the role of South Asian Association for Regional Cooperation (SAARC). Many SAARC members have signed bilateral trade agreements despite the SAARC agreement on multilateral trade within SAARC. Political and social hostilities between member states are gradually increasing and hampering the regional cooperation. Role of India as emerging superpower in the regional and influence of “outside political and economic interests” within the region have become prominent determinants of the nature of international relations within the region. While there is a divergence of scholarly opinions and policy making debates on the region, less attention has been paid to re-look at the South Asia from a major theoretical lens in international politics. In this scheme of understanding, realism is the ideal theoretical base to analyze inter and intra political and economic relations in South Asia.

Given this complexity, this paper primarily examines what implications can be drawn from realist theoretical propositions in explaining the regional cooperation in contemporary South Asia. Particularly, the study focused on the concept of anarchy and the major emphasize has been given to the economic cooperation in the region. Further, strategic games between South Asian member states have developed with the use of Battle of sexes, Chicken race games and Prisoner’s dilemma. It proves that choosing a neo liberalist cooperation strategy is better for every player in the region.

Keywords: Realism, Liberalism, Anarchy, Cooperation, SAARC

Space for Women's Voice in Peace Building in Sri Lanka After 2009

A. Samarakoon

Research Scholar affiliated to Faculty of Graduate Studies, University of Colombo

The Civil war in Sri Lanka came to an end in 2009, costing over 40,000 civilian lives and resulting in major destruction of private and public property. At the end of the civil war, the government of Sri Lanka promised peace through the passing of amendments to the constitution, initiating reforms to institutions and ensuring human rights and freedom for civilians

Contemporary peace in Sri Lanka has been questioned in the research examining the narratives of the Vanni Women. This research aims to produce new knowledge on feminist perspectives on peace, analysing a dualistic situation of the reality and the imagination of peace in the voice of the Vanni women. In addition, the research is intended to understand the gender lines in the feminist discourse of peace. How has peace been perceived by the war affected Vanni Tamil women in Sri Lanka after 2009? What are the constraints on peace in the narratives of the Vanni Tamil women?

The primary data have been collected from the thirty-nine Vanni Tamil women in Mullativu and Killinochchi, four civil organizations in Kilinochchi and one in Jaffna, five Tamil intellectuals in Jaffna. The empirical data have been collected through the semi- structured interview guidelines and four focus group discussions. The research is based on qualitative data and the narrative analysis has been utilized in constructing the argument by synthesizing empirical and theoretical data.

The public space for peace building discourse has been subjected to gender and ethnic politics. The Vanni women's voice for peace has been limited in the public space due to the gender based super/subordination dichotomy, feminization of violence, structural ignorance of avoiding violence, the connection of the minimal role of the state in eliminating the root causes of violence and the increasing masculine violence in the domestic sphere.

Keywords: Civil war, Feminism, Peace, Vanni Tamils and Violence

Economic Empowerment of ex-LTTE Members: A Way Forward to Sustainable Development for National Reconciliation

S.P.V.K. Senadheera

Research Scholar affiliated to Faculty of Graduate Studies, University of Colombo

A successful rehabilitation process should aim at reconciliation among all communities leading to lasting peace in a country. It is the process of re-building the lives of the aggrieved parties. Thus, it is mandatory to address all issues that led individuals to taking up arms against the government. Obviously, many individuals joined the LTTE were driven to that point due to serious economic and social issues they were faced with.

Re-building the lives of almost 12000 ex-LTTE combatants has been a challenge for the Sri Lankan Government. A study of a sample group of sixty (60) ex-LTTE combatants from the Mullaitive area, now 'rehabilitated', has revealed that they, at the time of study, were either un-employed or were engaged in work that's not related to the vocational training received as part of their rehabilitation process. The study further shows that the youth continue to face serious economic and social issues, thereby doubting the success of the Government's rehabilitation programme. The data collection was done through a questionnaire and other secondary sources. A descriptive analysis was done to ascertain findings and develop recommendations.

Thus, it is important to re-tune the post-rehabilitation measures adopted by the Government so that it would bring about both long and short term benefits. The short-term priority should be to economically strengthening each individual in the immediate aftermath of rehabilitation while the long-term priority should address the root causes that led to conflict. Post-rehabilitation support extend to those rehabilitated is also important to achieve sustainable peace and reconciliation.

This paper examines the social and economic issues presently faced by the 'rehabilitated' ex-LTTE combatants and examines whether the Government's policies and rehabilitation programmes have enabled economic empowerment as well as the social and ideological transformation of those rehabilitated. It proposes changes required to be made to the present post-rehabilitation approaches.

Keywords: Reconciliation, ex-LTTE combatants, Sri Lankan government, Economic empowerment, Ideological transformation

Location Decisions of Foreign Direct Investments: Evidence from Sri Lanka

J. Sewwandi¹ and P. Dunusinghe²

¹ *Faculty of Graduate Studies, University of Colombo*

² *Department of Economics, University of Colombo*

Foreign Direct Investment (FDI) is often viewed as a catalyst to economic growth and development due to its contributions to technological advancement, export promotion, productivity improvement, and rural development. What determines FDI inflows to a country? More importantly, what factors are considered by a foreign investor in choosing a location in a given territory? The objective of this study is to answer those questions in the context of Sri Lanka. In order to achieve above objective, a sample of firms was selected using stratified sampling technique where stratification is administered to cover all districts, three production sectors, and both 100 per cent foreign and Joint Ventures. Data were collected during through an emailed questionnaire survey with a sample of 219 firms, of which only 102 firms responded to the questionnaire posted.

The Factor Analysis indicated the presence of five components, with different set of factors, influencing investors' decisions in locating their subsidiaries in Sri Lanka, namely; business environment, performance of the domestic economy, trade, investment, and political relationships with the host country, potentials in the domestic market, political stability.

The Logit regression results reveal that the factors such as firms past investment experience and reliable energy supply significantly influence in favor of locating FDI subsidiaries in urban areas compared to rural areas. In contrary, factors such as level of infrastructure development in rural areas and access to raw material significantly increase the probability in favor of locating subsidiaries in rural areas. Our results remind policy makers the importance of a healthier business environment, well-developed infrastructure facilities, and enhanced trade and investment openness in attracting FDI into the country. Moreover, setting up new regional industrial zones on the basis of regional differences in comparative advantages, uninterrupted power supply, and conducive business environment are vital in attracting foreign investors to rural areas.

Keywords: Foreign Direct Investment, Locational Decisions, Factor Analysis, Logit Model, Sri Lanka

Community Policing: Moving from Dystopia to Utopia or a Realistic Proposition to Human Friendly Police Service

S. Siger¹ and K. Konasinghe²

¹ *Faculty of Graduate Studies, University of Colombo*

² *Department of Public & International Law, University of Colombo*

Community policing is an organizational strategy that promises a new partnership between the public and the Police. It is based on the principle that both the Police and the community must work together to recognize, prioritize and resolve current issues prevailing in a particular society with the goal of improving overall quality of life in the area. In a comparative analysis with its application in the European Union, this paper attempts to recognize the challenges and prospects of implementing the community policing system in Sri Lanka.

In view of this, a comprehensive literature review has been conducted to identify what methods that European Union adopts in the community policing system and the difficulties that Sri Lanka experiences in implementing the same. Two questionnaires have been circulated among Police officers and community members of the Galle district to discover the response of both parties towards this system.

The secondary data that has been collected from books, magazines, theories, methods and World Wide Web are also associated to arrive at constructive conclusions.

In this research, the hypothesis has been tested for its validity using world famous statistical software named IBM SPSS 20. As per the test results, it is proven that the selected hypothesis “there is a positive correlation between the absence of community policing and the increased rate of crimes and violation of human rights within the communities of the Galle District” is proven with significance. Finally, valuable recommendations have been made for the Sri Lanka Police to take appropriate action to implement community policing system safeguarding the human rights of the people.

Keywords: Community, Policing System, Implement, Friendly, Realistic Proposition

A Comparative Clinical Study of the Unani Compound Medical Preparation for Antilipidaemic Activity with Special Reference to the Modern Drug Atorvastatin

M.A.A. Sirajudeen¹, B.M. Nageeb¹, R.P. Illeperuma² and I.H. Thajudeen³

¹*Institute of Indigenous Medicine, University of Colombo*

²*Faculty of Allied Health Science, University of Peradeniya*

³*Ashraf Memorial Hospital, Kalmunai*

Dyslipidaemia is a metabolic disorder. It is a common problem in the global community. The aim of the study is to evaluate the lipid lowering efficacy of the Unani compound medical preparation, to compare its lipid lowering effect with a modern drug Atorvastatin and to evaluate the enhancement of lipid lowering activity when combined with Atorvastatin in Hyperlipidaemic patients. 180 patients were enrolled from the years 2014-2016, after approval from the Ethical Committee of the Institute of Indigenous Medicine, University of Colombo. Inclusion criteria: serum cholesterol above 200mg/dl. 30 - 60 years, both Male and Female. Cardiac, liver, renal, thyroid disorders, diabetes mellitus (Type-1), malignant hypertension and Pregnant and lactating mothers were excluded. The sample size was randomized into three groups A, B and C. Each group has 60 patients. In group 'A' received Unani compound test drug powdered form 5 g. Morning and Evening with warm water. Group 'B' cases received Atorvastatin 10 mg tablet daily oral as a standard control. Group C was taking Atorvastatin 10 mg tablet daily oral and with Unani compound test drug, powdered form 5 g. morning and evening with warm water for 3 Months. A follow-up was done in 45 days. Diagnostic criteria: By Performa and Lipid profile test. Data were analysed by using an appropriate statistical method SPSS 16.0 for windows. Differences will be considered to be statistically significant at $P < 0.05$ level. Good clinical response of the drug in Group A, B and C, the mean reduction of serum cholesterol 61.44 mg/dl, 85.1 mg/dl and 58.85 mg/dl. All the groups have exhibited significant hypolipidaemic activities. But better activities of hypolipidaemic were observed in group A and B than group C. However, further multi central and multi-national investigations with a larger sample size are still needed to get better results.

Keywords: Dyslipidaemia, Hyperlipidemia, Hyperlipoproteinaemia, Lipid profile and Atorvastatin

Employment Aspirations of Post Conflict Youth in North, North Central and Eastern Provinces of Sri Lanka: A Literature and Survey Combined Analysis

S. T. Thrikawala and S. Rajapakse

Research Scholars affiliated to Faculty of Graduate Studies, University of Colombo

The end of the conflict in Sri Lanka marked the space and need for rebuilding civilian life through a comprehensive reconciliation process. It is imperative that youth, as an important demographic cohort of the population be considered as a main focus in post-conflict rebuilding and reconciliation of Sri Lanka, as 'youth' are not only passive victims of violence and conflict, but rather a contributive agent that makes it absolutely necessary to define their role for sustainable peace within a post-conflict set up. Employment is the key method of increasing the productive engagement of youth in the development of a country.

In Sri Lanka, the districts which suffered from prolonged conflict recorded comparatively higher unemployment rates. Based on the hypothesis that existing youth perspectives were a contributing factor towards unemployment and under-employment, this paper attempts to explore youth aspirations on employment in the provinces most affected by the direct violence of the conflict. Through a thematic analysis of the aspirations as identified by the participating youth in terms of employment and their life goals and a descriptive statistical analysis of the participants' understanding of the resources available for increasing their employability this study aims to make substantial recommendations to ensure the active contribution of youth in reconciliation leading to sustainable peace.

The study employs a meta-analysis of existing literature combined with a complementing survey study carried out as a part of this research. 161 youth (80 Male 81 Female) from 21 villages across Jaffna, Vavuniya, Ampara, Anuradhapura and Polonnaruwa Districts participated in the survey. The sample of participants was selected using a convenient sampling method captured through grassroot level Community Based Organizations and local government entities.

Keywords: Youth; unemployment; post-conflict; peace building; sustainable peace

Integrating m-learning in Higher Education

P. A. Warusavitarana and K. Lokuge

Research Scholars affiliated to Faculty of Graduate Studies, University of Colombo

This paper will discuss how mobile phones motivate students' learning in higher educational institutes. The usage of mobile phones has created drastic changes in the lifestyles of youngsters. Today, many teenagers are holders of mobile phones irrespectively of their income level due to the low cost and the rapid developments of technological devices. Few people around the world have regarded mobile learning as a core pedagogical activity in higher education institutions. Students widely use mobile devices to send short messages and view web pages in between lectures. Therefore, mobile phones are considered to be an effective educational platform that connects with internet to access resources and learning activities anytime and anywhere. Modern methods and teaching techniques enable the learner to become more interested, interactive and flexible.

The concepts of mobile learning relates to the mobility of the technology, learner and learning processes. Mobile learning is an innovative learning approach applied universally to make the learner contented. Although the mobile phone has been an aid to learning activities such as delivery of lectures and assignments, presently it is not the primary approach of delivery in higher education. However educators are enthusiastic to introduce innovative approaches to overcome the low academic achievements of students.

The application of m-learning was tested for one semester with fifty nine students. The focus group interviews were carried out to validate the online survey results. The study revealed that m-learning increased learner engagement and interation. The paper concludes that the development of technology and innovative teaching stimulate learning.

Keywords: Mobile learning, teaching approaches, Technology, Learner and Higher education.

Education: A Tool for Sustainable Peace in Sri Lanka

N. Wijegoonawardana

Department of History, University of Colombo

An analysis of studies conducted in the past decade shows an increased interest in the implications of certain portals of education on conflict (Bush and Salterelli 2000; Smith and Vaux 2003; Buckland 2004; Davies 2004; and Tawil and Harley 2004) and puts forward a number of propositions, all warning about the importance of how education is provided. The perception of education as a medium for social and cultural values to be stored and transferred from generation to generation, may depend on the values in question conversing negative stereotypes or encouraging behaviors that condone violence or the creation of conflict.

This study will be conducted with special focus on the Sri Lankan case and the research encompasses three primary objectives: the first being to provide evidence on the role of education in peacebuilding based on academic programming and an evaluation of literature; the second is to create a discussion on how education can be effective towards peacebuilding and finally the examination of how education interventions and programming can play a stronger role in the peacebuilding architecture.

Transformation is an important concept within Lederach's work and the concept regarding the transformation of conflict and the relationships between conflicting parties strives to be important for peacebuilding definitions and practice. Therefore, this study will examine the early theoretical work on peacebuilding and focus its attention towards the current international definitions upon which the international peacebuilding architecture rests. The methodology evaluates academic and programming literature scrutinizing the prevailing evidence established on the role of education in peacebuilding as well as to identify knowledge gaps. The conclusion and findings contribute towards the use of education for sustainable peace-building in Sri Lanka.

Keywords: Education, Peacebuilding, Conflict, Affected Society and Sustainable Peace

Compliance of Treated Wastewater Quality in Unclassified Tourist Hotels: A Case Study of Selected Hotels in Gampaha District

W.R.L. Wijesekra¹ and M.M.M. Najim²

¹ *Faculty of Graduate Studies, University of Colombo*

² *South Eastern University of Sri Lanka*

The discharge of hotel wastewater untreated or partially treated leads to severe adverse environmental impacts. These impacts are controlled through Environmental Protection License (EPL) procedure. It annually evaluates the quality compliance of Treated Wastewater (TW) with the disposal norms except in case of a complaint of none compliance. The problem is whether the quality compliance shown in the EPL renewal process remains unchanged throughout the hotel operation. This study evaluates the TW quality compliance with the disposal standard of tolerance limits for discharge of industrial wastewater in to inland surface waters, in a selected sample of unclassified tourist hotels in Gampaha district. A sample of 6 unclassified tourist hotels was selected based on the tourist hotels registered under unclassified tourist accommodation category in the Sri Lanka Tourism Development Authority and the CEA, Gampaha. The TW was collected and analyzed for pH, COD, BOD and TSS to assess its quality. The same parameters of TW samples collected from the selected hotels at the time of EPL renewal was also extracted from the laboratory analytical reports submitted to the CEA. Analysis of research data reveals a 100% quality compliance of TW in terms of pH, COD, BOD and TSS of the selected sample of hotels at the time of EPL renewal whereas 50% of the selected hotels are complied only with pH and COD, 25% are complied only with BOD and TSS, at the time of field sample collection. Further analysis of TW quality data of individual hotels reveals a 0% compliance of selected pollution parameters in a hotel, 25% compliance in two hotels and 75% compliance in a hotel. This reflects that the TW quality in terms of selected parameters of the selected sample of unclassified tourist hotels in Gampaha District does not continued to comply with the respective disposal standard even though the quality compliance was met at EPL renewal.

Keywords: Wastewater, treatment, compliance, disposal standards.

An Approach to Understanding the Determinants of Chinese Outbound Direct Investment in Sri Lanka

S. Yan

Faculty of Graduate Studies, University of Colombo

Over the years since 2008, the Chinese ODI experienced over 50% growth in Sri Lanka from USD 9 million in 2008 to USD 77 million in 2013. This figure is significant considering it against the total volume of FDI reached Sri Lanka during the same period, and in per capita term, it was phenomenally higher than that of the other countries of South Asia. Hence, Chinese state-owned enterprises have played a major role.

The aim of the research is to investigate the determinants of Chinese ODI in Sri Lanka and to establish an appropriate theoretical framework for it. OLI paradigm has considered being most appropriate in helping to understand the determinants of Chinese ODI in Sri Lanka. This theory expressed ownership advantages, internalisation advantages and the location advantages motivate ODI. However, the application of Competitive Advantage a la OLI paradigm alone seems was not sufficient.

The study has, through qualitative semi-structured methods of inquiry, been investigating the functionalities of major Chinese ODI companies in Sri Lanka. Examination of the data and information procured from various pertinent sources reveal that the role of the state of China is significant in determining Chinese ODI in Sri Lanka which Chinese firms were given significant benefits with comprehend easy loans, tax benefits/exemptions and other advantages. Therefore, the research seeks to amalgamate OLI paradigm with Institutional Theory.

The research findings affirm that Chinese SOEs invest in Sri Lanka were not motivated solely by firm competitive advantage. For them, the desire by the state to realise its strategic advantages was an overriding issue. However, when it concerns the private sector institutions the situation was different. In most of the instances these firms were not capable of realising competitive advantage in investment. However, the benefits allocated for them through “go out policy” were sizeable enough to upset the costs incurred due to competitive disadvantage they experienced.

Keywords: Chinese Outbound Direct Investment; OLI paradigm; Institutional approach

Promoting Micro Enterprises in Post Conflict Communities: Case Studies from the Northern Province of Sri Lanka

A. Yoosuf¹ and S.P. Premaratne²

¹*Faculty of Graduate Studies, University of Colombo*

²*Department of Economics, University of Colombo*

Literature on peace building and reconciliation emphasizes the need for stakeholders in all levels of society to be engaged. Policy makers strategically employ micro entrepreneurship, to economically empower post-conflict communities. Researchers in entrepreneurship have identified 'networking' as important for success.

Entrepreneurs lack finance, entrepreneurial competence, marketing, government support and technology. In post conflict regions they also face isolation, division, prejudice, polarization and mistrust. Will these entrepreneurs be willing to work together if they perceive the economic benefits? This paper examines the development of business and social linkages between entrepreneurs in Northern Sri Lanka.

The objective of the paper is to identify whether micro entrepreneurs in post conflict communities use their social and business linkages to promote their enterprises. The case study method is used for the study and covers all five districts of the Northern Province. Findings indicate that a majority have commenced after the war as people attempt to regain their livelihoods. The income and investment levels remain low, but they show initiative and commitment to grow. Social relationships are high as opposed to their business linkages that are comparatively low. They depend on networks within their village for obtaining inputs and marketing their products/services. They are active in social and cultural events but hesitant to join business networks. The paper examines five entrepreneurs supported with business development services to expand their markets and collaborate with each other to implement joint activities to develop their enterprises.

The understanding of how entrepreneurs collaborate with each other would contribute to the identification of strategies to promote mutually beneficial networks.

Keywords: Micro enterprises, Northern Province, peace building, marketing, government

Faculty of Law
University of Colombo



*'Empowering Humanity:
Challenges and Legal Responses'*

Message from the Dean
Faculty of Law

Ms. Indira Nanayakkara



Universities are regarded as centres of excellence, and the primary purpose of all research, teaching and learning that is conducted within the university must have the central focus of empowering humanity. A university that fails to achieve this goal would rapidly cease to become relevant. Therefore I am both privileged and proud to pen this message on the occasion of the Annual Research Symposium of the University of Colombo, which attempts to analyse the challenges facing universities in this paramount task of empowering humanity, while considering the responses that are available or should be taken.

From the perspective of the Faculty of Law, our academics have as their primary goal, the consideration of legal responses that could be made in order to empower humanity. These include a wide range of interventions that empower citizens at various levels and in diverse relationships, which include contracts between companies, rights and obligations between the citizen and the state, and private relationships between individuals themselves.

The Faculty of Law looks forward to this annual event, at which the academics share their research with the legal community. The insights they receive help them to raise the standard of review, and aid in producing cutting-edge research that provides the base for law reform.

I wish to thank all those who contributed in various ways to make this event a reality and I wish the presenters, discussants and participants a fruitful time at their respective sessions. I trust that the research presented will help us as the premier higher education institution in this country, to empower the great human potential we have in order to reach great heights.

**Faculty of Law, University of Colombo
Annual Research Symposium 2016**

22 October 2016
Ceylon Room, Faculty of Law

PROGRAMME

8.30 a.m	Registration
9.00 a.m	Lighting of the Oil Lamp
9.05 a.m	Welcome Address by Ms.W.I. Nanayakkara Dean, Faculty of Law
9.10 a.m	Address by Senior Professor Lakshman Dissanayake Vice-Chancellor, University of Colombo
9.15 a.m	Introduction of the Keynote Speaker
9.25 a.m	Address by the Keynote Speaker, Mr. R Venkatramani Senior Advocate- Supreme Court of India and Member of Law Commission of India
10.10 a.m	Vote of Thanks
10.15 a.m	Tea Break
10.45 a.m	Session I (Parallel Sessions of the Departments of Commercial Law, Department of Private & Comparative Law and Department of Public & International Law)
12.30 p.m	Lunch
1.30 p.m	Session II (Parallel Sessions of the Departments of Commercial Law, Department of Private & Comparative Law and Department of Public & International Law)
4.00 p.m	Closing of Sessions

Introduction to the Keynote Speaker



Mr. R. Venkatramani

*Senior Advocate- Supreme Court of India
Member of the Law Commission of India*

Mr. R. Venkatramani, Senior Advocate for the Government of India in the Supreme Court, was appointed a Member of the Law Commission of India in 2010 and has been appearing for the State of Tamil Nadu as a Special Senior Counsel for the past 12 years. He is also a Special Senior Counsel for the State of Andhra Pradesh. Consulted by Ministries as Special Counsel, he has acted as Standing Counsel for various Universities and Public Sector Corporations. He was a Counsel for the Supreme Court in matters pertaining to the employees of the Court and was a co-opted member of the Expert Group constituted by the Ministry of Minority Affairs to examine and determine the structure and functions of an Equal Opportunity Commission.

In 2001, Mr. Venkatramani was invited to speak at a workshop jointly organised by the United Nations High Commissioner for Human Rights and the International Commission of Jurists, held in Geneva, and designed to submit a report to the Human Rights Commission on the Optional Protocol to the International Covenant on Economic, Social and Cultural Rights (ICESCR). On request by the International Court of Justice (ICJ), he has coordinated with ICJ's activities in the Afro-Asian region, particularly pertaining to ICESCR. He is also associated with the International Working Group engaged in drafting an Instrument on the Right to Food, since 2002, following an International Conference held in Berlin; and in 2008, he was involved in the Nepalese Constitution drafting and experience sharing exercise.

He is an invited Member of the Ethics Committee of the Indian Council for Medical Research and member cum office bearer of several Lawyers' Associations. He is a life Member of the Indian Society of International Law. Resource person of the Society for its Annual Summer Courses and actively participating in the Projects of the Society, he is a member of the Indian Law Institute. He has served as a Law Member in the 'Expert Group on Welfare Legislations' set up by the Planning Commission of India in the year 1990; Member of the South Asian Task Force on Judiciary, consisting of Members of SAARC Nations to submit reports on the conditions of Judiciary, reforms in Institutional structures and conditions of service etc. with a view to enhancing the rule of law and the availability of efficacious legal remedies. He was a Panelist of the Jury invited for Public Hearings on Child Labour at New Delhi in 1997 and on Crimes on Women at Bangalore in 1999; Member of the Sub-Committee on Directive Principles of State Policy, constituted by the Commission reviewing the working of the Constitution.

He has several publications to his credit including: Books- on 'Land Reforms' (Co-author: 1975), 'Judgements of Justice O. Chinnappa Reddy' published by the International Institute of Human Rights Society (1995), Volume on 'Torts' in the series of Halsbury's Laws of India, published by Butterworths and Restatement of Indian Law (Public Interest Litigation) [sponsored by the Committee on Restatement of Laws - Joint Committee of the Supreme Court of India and the Indian Law Institute].

Keynote Address

The Idea of Constitution and Rights-Public and Private

Mr. R. Venkatramani

Senior Advocate- Supreme Court of India

Synopsis

The idea of a Constitution is not necessarily modern. Contemporary understanding and endeavours to give an expansive meaning to the idea may owe it to, as is often said, the history of the times. Every growth is noticed by the culmination of its features.

History is strewn with examples of edicts of Emperors, which are in some sense or the other a codification process. From Hammurabi's Code in 1754 B.C., the 17 Article Constitution of the crown Prince *Shotoku* of Japan in the year 604 C.E. King *Ashoka's* edicts, the *Ancestral Injunctions and the Great Ming Code* of the founder of China's *Ming* Dynasty are some of the well-known chronicles of codifications. There are other lesser known statements. The question of codification of State and all other powers in a given community, for the orderly pursuit of certain nominated ends and goals might not have been the central idea of these chronicles. The fact however remains that engagement of people in social and moral ordering, has been as powerful an idea, as the persuasions towards exploration and understanding of the material universe through tools of science.

It is documented that in the span of 300 years or so between 1600 and 1900 A.D., there has been a spurt in the activity of Constitution making. Roughly more than 175 and odd Constitution making exercises during this period, in some form or the other, have been noticed. That is like an idea which is catching up. One is tempted to compare the graph of emergence, and the refinements of constitutional ideas, in social and political spaces, with the history of science in the past 300 years or so. It is a matter of interest and curiosity that while science and particularly mathematics and astronomy had developed in a big way in the Asian and Arab civilizations long prior to the west catching up with them, they seem to have happened in isolation from social and political structures or ideas. Comments will be made on the so called stagnation in some of the Asian cultures and civilizations. It will be a challenging task to project some of the seminal philosophical and religious ideas, as matters which are as powerful and perennial as the triumvirate of the French revolution namely, liberty fraternity and equality.

From the birth of the principle that for a society to be free and open and to honour the capacities and freedoms of all people, the power that is assumed or seen to be necessary for community organization, will have to yield to regulation and codification, comes the concomitant idea that all power, power to be exercised in the public sphere and the competence, capacity and freedoms, all relevant for private

human relationships in all their manifestations, should be necessarily regulated and codified. The challenge however, is the great appeal and the indestructible value of an open society where freedoms are splendidly honoured as well as subject to interventions on the basis of socially constructed norms and principles. Some people have argued that private law like love has no goals and we are warned of the dangers of excessively seeing law as a means to an end.

It is possible to suggest that the post-world war II corpus of international and national thoughts on human rights, also owe their moorings to the idea of Constitution-namely an over-arching document, which codifies and regulates governance, which issues sign posts for governance, which grants powers and freedoms in the language of rights, and call upon members of a community to endeavour towards a happy marriage of the universe of private sphere with the universe of the community.

Both the idea of a Constitution in its manifold forms but with overlapping chapters, along with the thought processes on human rights, and pushed by human advancements in science and technology have led to a historical stage in human community organization. International, trans-boundary movements and sharing of ideas and resources and national motions of recording the domestic spheres are both vehicles of this stage. Both the 'scares' namely the 'Brave New World' of Aldous Huxley and those of 'Nineteen Eighty four' of George Orwell are before us in their genetic mutations. This stage, because of the enormity of the issues and the wealth of possible ways of advancing human aspirations, goals and ends, is beset with its challenges. The attempt here would be to peep into all the above aspects and to suggest that the jurisprudence of post-Constitutional stage of human history may have to invent strong adhesives.

Faculty of Law

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**Right to Information and the Protection of Intellectual Property Rights: An Analysis of
the impact of Trade Secrets and the Law relating to Undisclosed Information in
Sri Lanka**

H.A.M. Harankaha

Department of Commercial Law, University of Colombo

The right to information is a human right guaranteed by many national laws worldwide. In a broad context, this right assists upholding the rule of law, good governance and transparency of the State's actions. Hence no doubt, the right to information law granting citizens legal right to access to information increases governmental transparency. However, the right of access to information is subject to several important restrictions imposed by national laws. Among these, the exemption given to information which is commercially confidential or information coming under trade secrets or intellectual property is noteworthy. As the right to access information is a new phenomenon in Sri Lanka, this research attempts to identify to what extent and how exemptions relating to trade secrets, confidential information and some other IP rights, can be secured against the right of the general public to access information.

This is an exploratory research done by the researcher analyzing the impact of the Right to Information Act of Sri Lanka on the confidential information and intellectual property rights of people having an emphasis on the non-disclosure factor of information.

This research, while analyzing the nature of undisclosed information and trade secrets as provided by the intellectual property Act of Sri Lanka, identifies the importance of protecting private rights of persons. At the same time, it emphasizes the importance of striking a balance between some private rights and the public interest to have access to information.

The research concludes by analyzing that any future competent authority will have to face the issue of determining the fact that whether it is an information of 'public nature' which can be disclosed to the public or whether the requested information is something subjected to the category of private confidential information protected under confidential commercial law or intellectual property law. Information can only be denied if it is purely in the domain of private rights and is only confidential like trade secrets or undisclosed information.

Keywords: Right to information, confidential information, trades secrets, intellectual property

Investments and Offshore Companies - Implications for the Port City Project

N. Kamardeen

Department of Commercial Law, University of Colombo

The Government of Sri Lanka plans to adopt a special regulatory regime to encourage the setting up of “Off-shore Companies”. The objective is to attract significant foreign capital into Sri Lanka which hopefully could be utilized by these companies as equity participations in much needed infra-structure projects such as the Port City Project.

“Offshore Companies” refer to companies established with foreign capital in a foreign country, by investors who are not nationals of that country. These investors are known as “Offshore Investors” and the foreign capital “Off-shore Investment”. The objective of Off-shore Investors in establishing such companies is to avoid payment of heavy taxes in their home countries. There is no evidence that such Off-shore Investments have been used for any developmental activities in the host countries. In reality, however, some of the “Off-shore Investments” have been used for payment of trading activities of the Off-shore Investors but such capital has hardly been used for productive purposes in host countries. The objective, rather, from a host country’s stand-point, is that some of the foreign capital will be used for equity participation in development projects, to avoid reliance by such host countries on debt with high interest rates.

The recently released Panama Papers and the revelation of the activities of the Panamanian Law firm of Mossac Fonseca, addresses precisely the problems of setting-up of Off-Shore Companies. More importantly, there is a serious lacunae of international and domestic regulations to control private capital flows and such entities. These companies may have also been used to engage in illegal activities such as money-laundering, and have contributed to serious reputational damage to countries which provided safe havens for Off-shore Companies.

This study seeks to identify the relevant issues relating to investment of foreign capital in Off-shore Companies and the potential advantages and disadvantages, particularly in the context for use of such capital as equity in infrastructure projects such as the Port City Project. The objective is to create a foundation for a policy debate on the subject. Based on the findings, recommendations will be made on the most appropriate and optimal measures for regulating “Off-shore Companies”.

Keywords: Off-Shore Investment/Investors, Offshore Companies, Port City Project

The Need for Corporate Governance Mechanism: A Critical Review

Y. Kumaraguru

Dean's Office, Faculty of Law, University of Colombo

Several corporate scandals and collapses in recent years have brought the concept of corporate governance to the forefront of economic and legal discussion. While the purpose of corporate governance is to facilitate effective, entrepreneurial, prudent management that delivers long term success to the company, the concept also advocates strong adherence to underlying principles of good governance such as accountability, transparency, fairness, probity and sustainability.

While general consensus pertaining to benefits yielded by a strong culture of corporate governance has resulted in extensive formulation of rules and regulations towards increased levels of corporate governance, there exists an opposing view which is largely neglected. This view questions the relationship between innovation and conservation, governance and growth; and voices the concern that although tight governance can protect investors from fraud, error and undue risk, it can also heavily threaten agility and innovation. The implementation of excessively stringent controls and the wielding of unchecked power by corporate governance watchdogs serve as examples for how and when measures in furtherance of corporate governance may prove to have adverse effects on companies and other stakeholders.

While acknowledging the necessity to pursue high standards of corporate governance, the paper explores the concerns that arise in implementing measures that work towards such an end. The author first ascertains, through past examples, what negative impacts could take place incidental to the furtherance of high standards of corporate governance and briefly contrasts the situation in Sri Lanka in this regard. Second, the author determines how concerns regarding such negative impacts could be best reconciled with the importance of maintaining high standards of corporate governance and concludes that this could only be achieved through acknowledging the potential negative consequences of corporate governance and striking the right balance, supported by strict regulation of any institutions acting as watchdogs of corporate governance.

Keywords: Corporate governance, innovation, corporate governance watchdogs

Opportunities, Threats and Legal Issues in Electronic Banking in Sri Lanka and Law Reforms for the Future

W. I. Nanayakkara

Department of Commercial Law, University of Colombo

Phenomenal developments in information and communication technology (ICT) have revolutionized the banking industry, which, like many other spheres of the economy and industry of Sri Lanka, has significantly benefited through a new paradigm shift. The banks now provide an expanded array of functions and services through electronic means thanks to advanced ICT. Electronic-banking has paved the way to significant innovations in banking services and methods in its product and service provision, promoting confidence in banking systems. These include better efficiency, speed, quality of service, time optimization, quick access to information, instant connectivity, ease of banking, etc. Banks attract customers through novel, user friendly modes of e-banking which allow them expeditious transactions even across geographical boundaries. In essence e-banking has helped banks to carry out their work more efficiently and effectively leading to higher productivity and profitability.

Even though e-banking has numerous merits this has also created complex legal issues and uncertainties - over validity of services provided through electronic means triggering enormous risks and threats to both the banks and their customers in terms of its operations and security. This has led to many issues, such as financial losses, frauds, misappropriation of funds, breach of privacy and secrecy, jurisdictional issues, money laundering, etc. Considering the developments in ICT, the Sri Lankan legislature has also enacted certain laws and introduced new regulations towards addressing these issues in the e-banking business.

This research examines the importance of e-banking in Sri Lanka's economy and identifies in particular the major legal issues pertaining to frauds being committed in e-banking. It evaluates how the existing legal framework addresses these issues and makes recommendations by drawing from other jurisdictions. The study finds that the current legal regime does not adequately address all prospective risks and issues. Thus the laws still suffer from certain lacunae; lack of proper administration, monitoring and enforcement mechanisms along with limited funds afflicts the sector. The study recommends that these laws should be strengthened further to tackle issues arising from technological developments in the Banking sector and to ensure secured and confidential banking services to the society. The research is based on a review and critical analysis of the articles published in the internet, law journals, law books and case law local and foreign with regard to e-banking.

Keywords: E-banking, Risk, Fraud, Regulations

‘Growing Without Rain’: A Study of Corporate Responsibility towards Unpaid Unsecured Creditors

S. Segarajasingham

Department of Commercial Law, University of Colombo

Corporate Social Responsibility (CSR) is a well-known corporate activity that has gained much recognition in the recent past. It comprises of a range of benefits for stakeholders, including environment, human rights, employees, creditors, society and the State. Nevertheless, the idea of CSR implies that a company could involve in CSR activities only when it makes profits; therefore companies should be assiduous in bringing positive outcome and then use a portion of the profits for the betterment of those who contributed to the success.

It is observed that a universally acceptable definition for CSR has not been formulated. According to the UN, CSR is an overall contribution to sustainable development. The scope of CSR practices call for responsible business behavior and ‘do no harm’ policy. The concept of CSR implies that the company directors who carry out duties on behalf of companies must bring financial success to companies and the broad framework of CSR is against suppressing the interest of one of the stakeholders, namely the creditors, especially the unsecured.

It is also observed that, in Sri Lanka, unsecured creditors are quite vulnerable, and are affected financially and psychologically. Deposit holders are the known category of unsecured creditors who are large in numbers. Some of them had committed suicide due to unsettlement.

There is no fixed definition, demarcation or boundaries for CSR. It is a developing concept and flexible too. The perception that CSR is a mere charity needs to change. Promoting wider goals for CSR might give an answer to the burning issue of unsecured creditors. It is suggested that CSR should move away from a traditional approach and extend to the protection of the unsecured creditors as well.

It is not practically feasible to have laws to the effect that unsecured creditors should be settled within a specified period of time for the reason being creditors falling last in the list of priority payment order in the winding-up of companies. CSR is only at minimum level; it is only business ethics and not law. It is essential that there is some responsibility cast upon companies and therefore this research suggests that CSR is the best possible way to companies to instill responsibilities in practice.

Keywords: Corporate Social Responsibility, Unpaid Unsecured Creditors, Winding Up

Promoting ‘Corporate Environmental Responsibility’ through Corporate Social Responsibility – Prospects and Limitations with Special reference to Sri Lanka

P. S. P. G. Vithanage

Department of Commercial Law, University of Colombo

Successful business and sustainably developed society are interdependent phenomena. The corporate sector being a vibrant sector that contributes to the nation’s development holds a high level of responsibility in promoting Sustainable Development through CSR. Despite this concept has been in the forefront since the early 1970s there is inadequate linkage between ‘Corporate Social Responsibility’ and Corporate Environmental Responsibility. The concept of ‘Corporate Environmental Responsibility’ remains a major concern within the broad framework of CSR, which encompasses within it other important aspects. In achieving Sustainable Development goals, it is not possible for the governments to ignore concerns relating to environment. In Sri Lanka CSR as a concept is weighed down by misconceptions and a large majority of companies believe it to be a mere philanthropic affair. Though the corporate sector contributes considerably to economic and social sustainability through CSR activities, there is no comprehensive framework with public-private partnerships with regard to corporate environmental responsibility that would have realistic long-term benefits. The objective of this paper is to analyse current practices, approaches to CSR, especially towards a green environment, and to propose steps that would allow companies to contribute immensely in achieving a clean environment for all. The studies in this area indicate that developed countries are more concerned about ‘corporate environmental responsibility’ and increased environmental management practices than developing countries. This is because positive signs are not seen in developing countries with regard to pollution prevention, environment degradation, energy efficiency, industrial ecology etc. Companies usually implement individual selected initiatives, ignoring environmental needs as a whole. The study emphasizes that it is important to introduce environmental audit, green procurement and products, environmental education and ethics among employees and employers. The study also suggests the establishment of open policy towards green and clean environment and discourages using CSR for image building of companies. Better integration of law or regulation is needed rather than voluntary initiatives.

Keywords: Corporate Social Responsibility, Environmental sustainability, Corporate Environmental Responsibility, Sustainable Development

Drones: Legal Complexities from the Perspective of Property Law

M.D.M. Abeyratne

Department of Private & Comparative Law, University of Colombo

Technological advances are for the most part, if not always, looked to as means of empowering humanity. Unmanned aerial vehicles (UAVs), colloquially known as ‘drones’ have aroused considerable interest for the benefits they can deliver. Once the preserve of military forces, drones are now acquired by commercial entities and individuals for uses as diverse as search and rescue operations, aerial surveillance of crops, delivery of medical supplies to remote areas and commercial packages to customers. Increasing sophistication in the construction of drone devices, ranging from those as small as a fly to those as large as an airliner, and ever decreasing prices have led to escalating civilian use. Such civilian use however, exploits a static property resource, the national navigable airspace. This airspace has both a public and a private character. The airspace which overlies privately owned land is the focus of this article.

The article answered the following primary questions: What legal challenges are posed when the navigable airspace of a private land is penetrated by a drone, itself the private movable property of another? Is the law as it currently stands in Sri Lanka fully alert to the required legal responses it must make available to private landowners as well as to drone owners? The research methods used include collected analysis of both legal and technological scholarly sources as well as primary sources in the form of statutes and cases. Countries driving advances in drone technology and its innovative civilian use visibly forge responses to rapidly evolving legal complexities. Several such key jurisdictions were examined, including the United States of America, Great Britain and the European Union. Points of comparison were drawn to the bedrock of Sri Lankan private law, and thus property law, the Roman-Dutch received law, as well as statutory and regulatory measures currently in place.

This research concluded firstly that drones pose legal challenges to several aspects of the Roman-Dutch law concept of ownership, manifested in concerns of security, safety and privacy. Secondly, that though these principles are sufficiently robust to provide a legal response, the modern tendency to provide a statutory and regulatory framework for citizen activity will provide additional safeguards to private landowners. Thirdly, that the current regulatory framework needs amendment to keep pace with legal responses being developed in other jurisdictions to meet technological advances.

Keywords: Property, ownership, airspace, drones, regulations

A Critical Assessment of the Legal Responses to Child Labour in Sri Lanka in the Light of International Instruments

E.M.Y.G. Ekanayaka

Department of Private and Comparative Law, University of Colombo

This study reviews the legal framework governing child labour in Sri Lanka. The main objective of this study is to evaluate the adequacy of existing legal measures to eliminate child labour. Furthermore, law reforms will be proposed for existing legislation to create more effective rules to eradicate child labour and ensure child rights of children in Sri Lanka. Many children fail to enjoy their child rights due to various reasons such as child labour, at times, compelled by circumstances, recruitment into armed forces, financial problems and parents' lack of awareness about the importance of education. Child labour is a burning issue which is mentally, physically, socially and/or morally dangerous and harmful to children. Sri Lanka has signed and ratified the ILO Minimum Age for Employment Convention (No. 138) and ILO Worst Forms of Child Labour Convention (No. 182) to eliminate child labour. Regardless of certain legal measures enforced to safeguard child rights, there are 302,865 children aged 5-14 years old who are engaged in different kinds of economic activities. Such involvement injures each and every right of children. Some of these work, in fact, entail hazardous work that seriously affect their life and health. Although legislative enactments prohibit utilizing children below 14 years in labour, the Labour Department receives over 200 complaints monthly of child labour. Due to engagement in work, children eventually drop out from school and this leads to deprivation of their right to education. They are deprived of their childhood and opportunities to receive a wholesome education and secure better employment. Sri Lanka has ratified the Convention on Rights of the Child (UNCRC), even though still there is no adequate legislation for ensuring the best interests of the child under UNCRC. In Sri Lanka, only the ICCPR Act recognizes the 'best interests of the child. Thus, this paper intends to establish that legislative intervention is necessary for revising the existing legal framework, in order to bring it on par with international standards, and thereby uphold the best interests of the child. These measures are expected to ensure child's economic security and social empowerment in contemporary society. This research is mainly based on domestic legislation, statistics, policies and International Conventions.

Keywords: Child labour, Legal framework, Best interests of the child

The Need for Public Participation in the Legislative Process: A Critical Examination of Law and Process

A.M. Kumarage

Department of Private and Comparative Law, University of Colombo

Immutable principles of democracy entail people's right to participate in the legislative process of their country. Thus facilitation of public involvement in drafting and legislative process is regarded to be crucial to a representative democracy. In the backdrop of post-conflict reconciliation, increasing levels of literacy and the interest shown by the civil society to actively participate in governance, it is imperative that Sri Lanka seriously considers all opportunities that can be accorded to public, to enhance their faith and participation in the democratic process. As a signatory to international human rights instruments, Sri Lanka has pledged to facilitate citizens to take part in the conduct of public affairs, either directly or through chosen representatives. Jurisdictions such as South Africa has constitutionally recognized the legislature's obligation to facilitate public involvement in the legislative and other processes. The opportunities available, locally, for the public to engage in the legislative process are minimal and our representative democracy or the Parliament has not always been adequately reflective of the demands and interests of people, due to impediments rooted in the socio political milieu of the country. In this context, pre-enactment judicial review of bills has proven itself to be an insufficient mechanism to safeguard prejudiced public interests.

In a qualitative analysis, with reference to statutes, case law and secondary sources, this paper explores how public participation in the legislative process can be facilitated to a certain extent, by interpretation of the existing legal framework for legislating, especially with regard to matters which have a direct impact on public welfare and rights of the people. While appreciating recent opportunities accorded to public via legislation such as the Right to Information Act of 2016, this research examines into possibilities of introducing apt legislation and suitable amendments, at relevant stages in law and process, with a view to accord substantial rights for public participation in legislative process and drafting.

Keywords: Legislative process, Democracy, Public participation, Interpretation of rights

Developing Class Actions in Delict: A New Dimension in Private Law in Sri Lanka

D.S.E.U.S. Liyanage

Department of Private and Comparative Law, University of Colombo

The procedural law as adopted in our legal system, with regard to civil suits, facilitates only individual legal actions. However, the tendency in the present scenario is to experience harmful events as larger groups of victims. Several environmental hazards took place in recent times, effects of mass productions, the effects of economic inter-dependence and regular corporate practices are worthy to note in this connection. Bringing private actions in cases of a public menace is also problematic as the proof of special damage is relatively difficult in such events. Moreover, it burdens the litigants because they are subject to show the court that the special damage caused to them is distinguished from the damage caused to the others. On the other hand, economically handicapped victims never opt for litigation. However, in this background, even economically potent litigants would also be discouraged by the process. Though, these claims are small in aggregate, as a whole it forms illegal profits for the persons and entities that create risks in the society. This cannot be socially justiciable. Thus, in view of corrective justice, class actions play a significant role as it is a powerful legal tool used to remedy needy people. Class actions enable one or more persons to file a lawsuit on behalf of a larger group with common rights and grievances. In the United States, class actions have been utilized to enable the release of claims, in which could never be litigated otherwise. Also, class action lawsuits have been adapted by Indian legal system in the cooperate sector. In this scenario, this research would analyze how procedural law could be adjusted to accommodate class actions in private law, in Sri Lanka, to enable vulnerable claimants to access to justice through a civil law action.

Keywords: Class actions, Delict, Private law, Deterrence

Current Applicability of the Austinian Concept of Sovereignty: A Critical Analysis of the Sri Lankan Perspective

G.P.D. Madhushan

Department of Private and Comparative Law, University of Colombo

Sovereignty plays a diametrical character in the philosophy of law. Austin's Supremacy of the political sovereign has placed a firm foundation to build his 'Command Theory of Law.' In Austin's classification of law, positive law is 'laws properly so called' and it should be derived from the source of political sovereign. It acquires the habitual obedience of the bulk of the people with the sentiment that the emperor is the appointed agent of the god to govern people exercising certain powers.

This is a qualitative research based on text books and journal articles. The paper will explain the characteristics of the political sovereign as propounded by Austin and its inadequacies with respect to the present Sri Lankan legal system.

The concept of sovereignty appears to be exercised by the Parliament and the Executive President under 1978 Constitution and habitual obedience of the bulk of the people is received by the institutions or the designation rather than the person holding it. However, the concept is very different from the apparent monarchical attitudes of the people. Furthermore, the 'Social Contract Theory' clashes with the presentation of the 'People' as conceptualized by Austin. In the 13th Amendment to the Constitution, power delegation reflects that the sovereign is not in the habit of obedience to any other human superior. Under Constitutionalism and separation of powers, sovereignty is subject to be divided and legally limited. 'Doctrine of Checks and Balances' also controls and regulates arbitrary use of sovereign powers in the Sri Lankan legal context.

The characteristics of sovereign power described by Austin do not appear to be practically available in the Sri Lankan legal system in its original manner. However, Austin's concept of Sovereignty cannot be dismissed completely because legitimacy of law is based on the concept of sovereignty. As the world focuses on promoting Constitutionalism by eliminating monarchism, Sri Lanka should rethink to redesign its Constitution rather than loyally adhering to certain characteristics of the Austinian concept of political sovereign.

Keywords: Sovereignty, Jurisprudence, Constitutionalism, Separation of powers

A Critical Analysis of Registration of Title in Sri Lanka: Challenges Faced and the Way Forward

E.R.A.H. Menaka

Department of Private and Comparative Law, University of Colombo

Land is a natural resource while land with a secured property rights is an economic resource. The nature of land rights and the way they are enforced have significant consequences for resource allocation and economic efficiency. In Sri Lanka, land ownership has a cultural significance to the average Sri Lankans beyond its economic value. Globally, there has been an increased focus on land rights and land titling. From the beginning of the eighteenth century, attempts have been made to solve certain land ownership problems and produce a systematic land record system in Sri Lanka. A move away from the registration of documents system has commenced with the Registration of Title Act No. 21 of 1998 (RTA). This new system conferred a government guarantee on the title to land and provided a cadastral survey plan with each title registered. The purpose of this Act is to register ownership, to inquire on land ownership and to regulate transactions in relation to land ownership. However, at present, substantial and procedural law of RTA are creating many problems; such as issues related to co-ownership, prescription, dispute resolution mechanisms, cadastral map, condominium property, etc. RTA has not been efficient and effective in addressing the issues pertaining to land in Sri Lanka presently. The main objective of this study is to examine methods to improve RTA in Sri Lanka. This research will be conducted as a literature review based on secondary sources, including International Conventions, Constitutions, statutes, parliamentary material, textbooks, electronic databases, journals with comparative reference to other jurisdiction, etc.

Keywords: Registration of Title, Land reforms

‘A More Perfect Union’: A Proposal for the Division of Matrimonial Property in *de jure* Separation - An Analysis of Sri Lankan Law

M.P.S.K. Pathirana

Department of Private and Comparative Law, University of Colombo

Sri Lankan family law falls into a crisis with so many divorce suits and separation matters filed in courts, due to the change in patterns of lifestyle among Sri Lankan communities. The question is that when spouses divorce or separate, what happens to their property? The law’s interference is very little in proprietary matters pertaining to married couples. By contrast, on divorce or separation, the law is willing to intervene to ensure that the spouses’ financial interests are adequately protected. The law in the process of doing so may cause some ill feelings among the spouses or hardship to one of them. The duty of the court is to pronounce a very reasonable understanding in order to minimize hardships, to at least some extent. Nevertheless, there is no doubt that the difficulties arise in dividing property in divorce and dissolution because of the lack of accurate criteria and guidelines in the court procedure. The statutory provisions introduced in the Civil Procedure Code in this regard may cause some difficulty when reallocating property rights between spouses. Further, there is no doubt, whilst examining the decided cases, that the consensus of judicial opinion appears to favour the view that although there are express statutory provisions, the common law principle of forfeiture of benefits continues to apply. Therefore, Sri Lanka is still facing the problem of lack of proper criteria in order to divide the matrimonial property in a divorce or separation suit. Remedial Constructive Trust (RCT) is a proprietary remedy which is recognized as a remedy in most Commonwealth countries for the parties’ rights of financial and non-financial contributions in matrimonial property matters. The objective of this research is to discuss the developments of RCT as one of the remedies in matters relating to matrimonial property rights in selected countries and evaluate the possibilities in order to introduce RCT to Sri Lanka.

Keywords: Divorce, Division of matrimonial property, Remedial constructive trust, Sri Lankan perspective

Industrial Disputes Act of Sri Lanka: Curiously Worded Labour Legislation for Promotion of Industrial Peace

A. Sarveswaran

Department of Private and Comparative Law, University of Colombo

The Industrial Disputes Act has been enacted to settle industrial disputes and promote industrial peace in the country. The Act has created Labour Courts with special jurisdiction and special powers to make just and equitable decisions. This paper discusses whether the provisions that expressly require Labour Courts to make just and equitable decisions are adequate to make such decisions or whether the provisions that require Labour Courts to make just and equitable decisions depend on other provisions of the Act. The finding of the research is that the Industrial Disputes Act has words and phrases that have been thoughtfully chosen to achieve the objective of the Act, which is to promote industrial peace. The words and phrases in the Act expand the scope of the jurisdiction of Labour Courts, make the procedure in Labour Courts flexible, give wide powers to Labour Courts to make just and equitable decisions and provide discretion to Labour Courts to award equitable remedies. The words and phrases are the thread that has knitted the fabric of 'just and equitable,' which runs from the beginning to the end of the Act. The important finding is that it is not the provisions that expressly empower Labour Courts to make just and equitable decisions but it is the other provisions which become more important in making just and equitable decisions. Therefore, as Lord Viscount Dilhorne stated in the *Devanayagam* Case, it could be said that the Industrial Disputes Act is a curiously worded legislation to promote industrial peace in the country.

Keywords: Labour courts, Just and equitable, Industrial peace

**Judicial Approaches to Compensate Pain and Suffering: A Critical Analysis of the Law
relating to Compensation for Pain and Suffering in Sri Lanka**

K. Thushanthiga

Department of Private and Comparative Law, University of Colombo

Historically, one of the non-economic aspects of damages, known as pain and suffering claims, has posed difficulties in litigation in terms of its interpretation and quantifying the effects in monetary terms. While the English courts address this issue via statutes, the South African courts, where the Roman Dutch Law is considered as the General Law of the country, developed a separate action for pain and suffering, influenced by Germanic customs, instead of compensating under the Aquilian Action.

The question remained open in Sri Lanka after the judgment of *Prof. Priyani Soya v. Reinzie Arsecularatne* (2001 SLR 293) as to whether pain and suffering could be compensated in Sri Lanka was answered in 2005. The Court of Appeal, in the case of *Jayakody v. Jayasuriya* (2005 (1) SLR 216/217) allowed the claim for pain and suffering under the purview of Aquilian Action. The judgment was on the observation that the claims for pain and suffering should be interpreted literally and the award should be on equitable terms at the discretion of the courts. This clearly demonstrates that our courts are in favor of the old Roman Dutch Law approach and that there are no guidelines to determine the amount of compensation that makes the law vague.

In this paper, it is argued that the Sri Lankan approach to pain and suffering should not be under the purview of Aquilian Action. The current notion prevents the available maximum potential way to compensate the victims compared to the South African jurisprudence for pain and suffering. This paper focuses on the possibilities to adapt a separate action for pain and suffering via statutes within the Sri Lankan regime.

Keywords: Damages, Pain and suffering, Aquilian Action

**Achieving Gender Justice through Access to Justice: Recommendations for
Strengthening *Access to Justice* for Women in Civil Litigation and Fundamental Rights
Violations**

G.I.D.I. Udani

Department of Private and Comparative Law, University of Colombo

Providing effective and affordable opportunities for guaranteeing access to justice is an essential condition for ‘*de facto* realization’ of fundamental rights and freedoms. Although, equality before the law is guaranteed by the Article 12 of the Constitution of Sri Lanka, women are often deprived of access to justice, as a result on the existence of various extra-legal obstacles and *gender-based constraints* such as: undue delay in the administration of justice, *high cost of litigation*, ‘shame’ and ‘fear’ about being disgraceful in the society, lack of awareness and the fear of being subject to re-victimization or retaliation. Therefore, the main objective of this research is to recommend effective measures for strengthening women’s access to justice in civil litigation and fundamental rights violations by eliminating extra-legal obstacles that impede women from realizing their rights. This study further advocates that, as a States party to the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW), Sri Lanka is obliged to respect, protect and fulfil the obligations imposed by the Article 2(C) and Article 15 of the Convention. When interpreting the fundamental rights, together with the constitutional obligations enriched in Article 4(d) and 27(2)(a), it must be noted that the government has pledged to guarantee the full realization of the right to access to justice and thus the obstacles against women must be eliminated by providing legal aid for all legal matters, raising public awareness, providing capacity-building opportunities for judges, lawyers and law enforcement officers and by facilitating women to collect legal evidences. At the same time, the judiciary and the civil society can also play significant roles in promoting ‘Public Interest Litigation’ (PIL) for advancing access to justice of marginalized women, against infringements of their *fundamental rights*. The study adopts qualitative research method, and includes comparative legal insights taken from selected jurisdictions.

Keywords: Access to justice, Gender justice, Public interest litigation, Fundamental rights, Gender-based constraints

**Gender and Land in the Post-Armed Conflict Northern Province of Sri Lanka:
Women's Right to Restitution**

N.R. Wijeyesekera

Department of Private and Comparative Law, University of Colombo

The study critically analyses the laws, policies and institutional framework relevant to land rights, including restitution of housing/land/property of women of the Tamil community in the Northern Province, in light of national, regional and international laws, policies and standards of gender equality. Though the Northern Province has a diverse community, women's land rights are different to those of women of other communities though located in a general context that applies to all women. The issue of land rights is therefore studied in relation to this particular community of women since different and complex issues arise, relative to other groups such as Muslim women whose rights are determined by their own laws. It proposes to entrench the principle of equality in its substantive sense in the post-armed conflict restitution process, and to recognize gender equality relative to all the rights recognized in law in respect of land. In recognition of past inequalities, gender stereotyping and change of gender roles subsequent to the armed conflict, it proposes affirmative action to benefit women where necessary; and to give priority to the property issue in recognition of its importance in the process of transitional justice. It attempts to find a way forward for Northern Tamil women, to rebuild their lives after the devastating armed conflict, through rights relating to land based on substantive gender equality. The proposed reforms are based on a two-fold thematic framework:

- A. Land restitution should be recognized as a right on its own accord, as much as a legal remedy and a necessary pre-requisite for transitional justice;
- B. Substantive gender equality should be recognized as an inviolable right, hence a main guiding principle in state policy relating to property restitution, and in reforming laws relating to private and state land.

Keywords: Women, Gender equality, Land rights, Restitution

**Empowerment of Grass-root level People in Sri Lanka: An Appraisal of the
Right to Information Act No 12 of 2016**

T.R. Galappaththige

Department of Public and International Law, University of Colombo

The Right to Information (RTI) is one of the most essential components of modern democracy. It gives a person a right to demand information from a public body (in some cases from a private body) without having to say why the information is being sought. It may deepen democracy by incentivizing citizen participation in decision making at rural, local, provincial and national levels. In Sri Lanka, there was no constitutional recognition of the RTI until the 19th Amendment to the Constitution. Nevertheless, the Supreme Court of Sri Lanka, in several judgments, interpreted this right as being embodied in the Freedom of Speech and Expression. The Right to Information is now a Fundamental Right and the RTI Bill was adopted in the Parliament recently. However, the task of implementing this right is not without challenges. In that regard, the main objective of this research is to examine whether the Right to Information Act of 2016 caters the expectations of the grass-root level people in terms of providing them access to receiving information. Further, this research observes which strategies have been followed in reaching this goal and the pros and cons in the implementation process embodied in the RTI Act. One crucial problem is the lack of awareness among the people at the grass-roots level of their RTI. This research found that the inexistence of the appropriate criteria to measure the capacity of the Public Information Officers under this Act could be an obstacle to the applicants who can receive significant benefits from this process. In that regard, Public Information Officers need better methods of information storage for effective performance. Striking an appropriate balance between the RTI and National security is found as another challenge. This library based research concludes with how the RTI Act should mobilize civil society and create a strong demand for information that should be in the public domain.

Keywords: Right to Information, Grassroots level, Democracy, Implementation, Empowerment

‘Gardens for the Rich and Garbage for the Poor’: An analysis of the Principle of Environmental Justice in the Urban Context

G.I.M. Liyanage

Department of Public and International Law, University of Colombo

Garbage collecting and locating of garbage dumps is mostly done at the local government level in Sri Lanka. Such local governments take this as a mere task and locate or dump the collected garbage in a place convenient to them. This has created a number of problems, including health issues, in many urban areas. These problematic conditions adversely affect living conditions of the people who reside near these locations and it can be argued that their basic rights are being violated as well. The most critical aspect of the issue is that environmental harm caused by the dump is disproportionately distributed among the low income families. The principle of environmental justice has been a fundamental principle under international environmental law in addressing this nature of disproportionate distribution. Against this background, the main problem examined in this paper is why the principle of environmental justice is not yet applied effectively in Sri Lanka, in particular in urban areas, in order to address the hazard of garbage dumping and resulting problems despite the number of initiatives introduced to protect the environment of Sri Lanka, including the National Environmental Act No 47 of 1980 and Central Environmental authority. This is mainly a qualitative research based on the use of primary and secondary data. Further, this study engages in a critical and comparative analysis of the applicability of the principle of environmental justice with domestic environmental scenarios. The key findings of the research show that, this inequality is due to the dumping of garbage without having any effective monitoring mechanism, as well as the failure to apply the principle of environmental justice elements in these situations. Moreover, insufficient management of garbage dumps results in creating negative conditions. The environmental inequality undermines three basic types of equity: procedural, geographic, and social. In these situations such types are critically ignored by the different stakeholders involved with the garbage dumps. The paper identifies some of the reasons for the disregard of the principle of environmental justice in such scenarios.

Keywords: Environmental justice, Right to clean environment, Garbage Dumping

**A Comment on the interface of harmful tax practices, human rights and WTO law,
in light of the Panama Papers Scandal and *Argentina-Financial Services* case**

N. Mendis

Department of Public and International Law, University of Colombo

Good governance, particularly regarding taking steps against corruption and increasing the transparency and accountability of financial transactions and taxation policy, is a major issue of public concern in recent times, both globally and in the Sri Lankan context. The recent ‘Panama Papers’ scandal highlights the large scale international tax avoidance and evasion occurring currently, which can also be linked with global corruption, money laundering, organized crime and terrorist financing. The lack of good governance in relation to inefficient or harmful financial and tax regulatory measures and the resulting impact on revenue can also be linked to serious negative repercussions for progressively achieving human rights obligations, especially obligations under the International Covenant on Economic, Social and Cultural Rights (ICESCR) which require provision of public goods and services, such as education and healthcare and other social welfare. Coinciding with the Panama Papers scandal, in April of this year, the Appellate Body of the World Trade Organization issued its decision in *Argentina-Financial Services*. This dispute originated when Panama, a country well known as a tax haven, alleged that various Argentine domestic legal regulations concerning financial transparency, which were applied against Panama, were inconsistent with Argentina’s WTO obligations. This research intends to analyze the interface between recent developments in the interpretation of human rights obligations of States in the context of harmful tax practices and the WTO obligations of States with regard to the design and implementation of defensive measures against harmful tax practices of other States. The study relies on secondary sources, including reports by human rights experts, and WTO case law. In conclusion, both domestic legal reform and greater Inter-State cooperation is required to address the gaps in the regulation of cross-border transfer of funds and the prevention of harmful tax practices. In terms of enforcement, measures which are non-discriminatory and non-arbitrary, to restrict financial goods and services trade with tax havens still remain possible under current WTO law, and preventing harmful tax practices is a recognized value and objective. The recent developments highlight the importance of the underlying principles of good governance, rule of law, recognition of human rights obligations of States and harmonization of international standards in the design and implementation of the relevant domestic and international regulation.

Keywords: Harmful tax practices, Financial services, Human rights, Panama papers, WTO

Protection of the Rights of Environmental Crime Victims: A Review of the Contribution of International Treaty Law

M.A.D.S.J.S. Niriella

Department of Public and International Law, University of Colombo

Historically, victims of crime have not been adequately recognized in the field of traditional criminology and little attempt has been taken to analyze the issues pertaining to victims of crimes in traditional criminal law. Harm done to the environment was also not considered significant as crimes in the traditional criminal law until the 20th century. However, there is a tendency in modern criminology and criminal law to consider the harm done to the environment as a specific typology of crime known as environmental crimes. Though environmental crimes affect living and non- living things collectively, its effects often cannot be seen at the time of commission of the crime or soon after the crime, as in other traditional crimes. This specific nature usually results in environmental crimes being recognized as victimless crimes. It leads to many problems in protecting the victims of environmental crime and their rights. International treaty law has set out minimum standards to safeguard the basic human rights of the people. It also developed some norms and principles to protect the environment from harmful activities committed by people. However, only a few treaties paid specific attention to environmental crimes and victims of environmental crimes. This study intends to review the adequacy of those international treaty laws in protection of the rights of the victims of environmental crimes. The study mainly discusses the issues in the definition of environmental crimes and victims of environmental crimes and the rights of victims of environmental crimes in the criminal justice system under the aforementioned international conventions.

Keywords: Environmental crimes, Victims of environmental crimes, International treaty law, Rights of the victims of environmental crimes, Criminal justice system

**‘Should the Pandora’s Box be opened?’: The need for a set of Guidelines for regulating
‘Humanitarian Interventions’**

W. Seneviratne

Department of Public and International Law, University of Colombo

The prohibition of use of force by states against other states is a well-established principle of international law. However, this general prohibition is subject to two narrow exceptions; the right of self or collective defense of states or collective security measures authorized by the Security Council. However, no specific legal provision exists on the use of force with regard to the international interventions carried out under ‘humanitarian reasons’. However, such pretextual military interventions have been carried out frequently in the aftermath of the post-Cold War period by groups of states either without the prior authorization of the Security Council or not claiming the right of self or collective defence. Hence, the legality of such interventions remains problematic. Hence, the question of this research is whether humanitarian interventions should be accepted as a new/third exception to the general prohibition stipulated in the UN Charter and if so, what kind of safeguards or criteria are to be developed to avoid any possible abuses. The main objective is to propose safeguards to regulate humanitarian interventions under strictly limited/exceptional circumstances. Key findings reveal that a rational ‘threshold’ in order to allow for humanitarian interventions under extremely limited circumstances should be identified. Strict conditions should be set out and great care should be paid to assess whether the situation has reached an uncontrollable level or an irreparable harm is imminent. The proposed guidelines should be employed by a designated authority on a case by case basis, with great circumspection. Such use of force should be carried out in conformity with the canons of human rights and humanitarian law, by a group of states (not one hegemonic power) under the flagship of an accepted organization, willing to be scrutinized under the set guidelines. Due process as stipulated in the UN Charter must be observed. If the Council fails in authorizing the General Assembly should take over the matter. Finally, the set of guidelines should be endorsed by the General Assembly and notified to the Council. If the guidelines receive wide international support they will become strong customary international law. The set of guidelines should be the last resort when no alternative is available. Extreme care should be paid to avoid the abuse of the safeguards.

Keywords: Use of force, Humanitarian interventions, UN Charter, Safeguards

War Crimes and Non-International Armed Conflicts (NIACs): A Critical Study of ICC Statute

S. Susarithaa

Department of Public and International Law, University of Colombo

For a long time, the absence of universal competence to suppress the serious violations of the principles of International Humanitarian Law during non-international armed conflicts and enforcement of individual criminal responsibility for war crimes were encountered in the world at large. It is neither envisaged in the 1949 Geneva Conventions nor in Protocol II of 1977. But with the adoption of the ICC statute and its Article 8, the International Criminal Court gained its competence in this regard and the ICC is currently in the process of prosecuting war crimes allegedly committed during several Non International Armed Conflict situations (NIACs). This is a qualitative research exercise based on library search. The necessary information is gathered from secondary sources accessible and available such as constitutions; laws; journal articles; textbooks; research and working papers; government publications; newspapers; electronic databases; and e - journals. The Author of this paper intends to talk about two broad issues involving war crimes and NIACs. Firstly, interpretative issues attached to the current provisions of the ICC statute with respect to the definition of war crimes committed during NIACs will be considered about in particular. This issue poses obstacles in properly prosecuting war crimes committed during NIACs. This paper tries to discuss the interpretative issues of the definite provision of Article 8 of the ICC statute, in particular Articles 8 (2) (d), 8 (2) (f) and Article 8 (2) (e), and examines the appropriate position between the competing views in this regard to meet the recent challenges or otherwise in International Humanitarian Law. Secondly, this paper will analyse the practical issues of lack of proper military regulations and proper implementation mechanisms through legislative, administrative and judicial bodies within the domestic sphere of countries. This presents a major obstacle to the ICC in prosecuting war crimes in an appropriate manner. It is intended in this paper to analyse the above-noted issues by comparatively analysing decisions and processes of the war crime tribunals established in order to prosecute such war criminals. Through this theoretical study the author intends to ascertain some important lacunae in the interpretation of the ICC statute and practical issues in prosecuting war crimes committed during NIACs.

Keywords: War crime, Non-international armed conflict, ICC statute

Risk Allocation Relating to Frustrated Contracts: the English Law approach for a New Sri Lankan Act

K.A.A.N. Thilakarathna

Department of Public and International Law, University of Colombo

Risk allocation in frustrated contracts has come a long way from one of strict liability to a liberal one. The UK took the main initiative in introducing The Law Reform (Frustrated Contracts) Act in 1943 to get the rigidity of the common law out of the way. Though the Sri Lankan Law relating to frustration is governed by the Roman-Dutch Law the judicial practice has shown that it easily draws from the English decisions. Against this backdrop it is proposed that we should have an Act of our own based on a modified English version for the optimum risk allocation with regard to frustrated contracts. There have been many theories put forward regarding the doctrine of frustration. The one that was based on implied condition has given way to more scientific ones advanced by scholars adhering to a more economic analysis with the economic analysis focusing on the superior risk bearer being the most discussed. With these findings it is submitted that the proposed Sri Lankan Act should employ an economically viable theory and optimum risk allocating method. It has been observed that under the current practice in Sri Lanka many of the contracts embody a *force majeure* clause for risk allocation regarding frustrating events. To a lesser extent market insurance also plays a part in allocating the risk between the parties. However since *force majeure* clauses are subject to judicial scrutiny, they may at times be invalidated and market insurance may always not be cost efficient for all the parties concerned. Taking into account the above mentioned reasons it is still argued that a specific Act relating to the issue should be introduced in Sri Lanka to meet the challenges it may face with the economy moving forward at a rapid speed.

Keywords: Contracts, Frustration, Risk Allocation, Statutory Reform

Faculty of Management and Finance University of Colombo



'Empowering Humanity: Challenges for Managers'

**Message from the Dean
Faculty of Management and Finance**

Dr. R. Senathiraja



I am pleased to send this message on the occasion of the Annual Research Symposium 2016 of University of Colombo. The theme of the University Symposium this year is 'Empowering Humanity'. Under this overall theme, the Faculty of Management and Finance has organized its presentations under the sub-theme of 'Empowering Humanity: Challenges for Managers'.

It is imperative that we continue to foster and strengthen our research culture and support/create new multidisciplinary and interdisciplinary collaborations in order to capitalize on the emerging challenges and opportunities, to further deepen our intellectual landscape, and to generate new knowledge with the aim of improving the overall quality of human life.

I believe, in this ever changing world, it is important that researchers engage in scholarly work that cuts across disciplines to respond to contemporary challenges that managers face today in sustaining their business. This symposium provides an opportunity to academics to conduct research not only on matters pertinent to the country but also to the wider global community, and promotes the creation of a vibrant research culture in the Faculty. Research papers were called from the academic staff of the Faculty, and following the review process, six research articles were selected to be presented at this conference. These research papers are in areas of work-life balance, performance evaluation, investor overconfidence and capital structure dynamics.

I take this opportunity to encourage staff and students to play an active role in making this event a success. I would also like to thank the organizing committee and all staff who supported to make this symposium a success.

I wish the Annual Research Symposium of FMF 2016 the very best and hope that this event will create a new platform for renowned and novice researchers from the academia.

**Faculty of Management and Finance
University of Colombo**

Annual Research Symposium 2016

Empowering Humanity: Challenges for Managers

18 October 2016, 9.00 a.m.to 1.00 p.m.

**New Conference Hall
Faculty of Management and Finance**

PROGRAMME

- 8.30 am Registration**
- 9.00 am National Anthem and Lighting of the Oil Lamp**
- 9.20 am Welcome Address by Dr. Thilakshi Kodagoda**
Chairperson, Faculty of Management and Finance Research Symposium
Organising Committee
- 9.25 am Address by Dr. R. Senathiraja**
Dean, Faculty of Management and Finance, University of Colombo
- 9.30 am Address by the Chief Guest**
Professor Lakshman Dissanayake
Vice-Chancellor, University of Colombo
- 9.40 am Keynote Address**
Professor W. Amarakirthi Liyanage
Department of Sinhala, University of Peradeniya
- 10.05 am Vote of Thanks by Dr. S. Buvanendra**
Faculty of Management and Finance Research Symposium Organizing
Committee
- 10.10 am Tea**
- 10.30 am Paper Presentations (Two Parallel Sessions)**
- 12. 00 pm Plenary Session**
- 12. 30 pm Lunch**

Introduction to the Keynote Speaker

Professor Liyanage Amarakeerthi

Department of Sinhala, University of Peradeniya



Liyanage Amarakeerthi is a scholar in Sinhala literature and a professor at the Department of Sinhala University of Peradeniya. He received his BA from the University of Colombo in 1994, MA in 2000 and PhD in 2004 from the University of Wisconsin, USA. While working at the University of Colombo as an assistant lecturer for three years from 1995 to 1998, Amaraakeerthi won a Fulbright scholarship which enabled him to obtain his postgraduate education. At the University of Wisconsin, Amaraakeerthi studied a host of subjects such as literary theory, comparative literature and postcolonial literature. After receiving his PhD, he taught at Cornell University before accepting a senior lecturer position at the University of Peradeniya. Professor Amaraakeerthi has been a visiting scholar at numerous national and international universities including Harvard University (2010) and University of Santiago de Compostela, Spain (2013). In addition to being a scholar, Amaraakeerthi is a fiction writer and has won several awards for his fiction.

Keynote Address

Critical Cosmopolitan Consciousness and Empowering Humanity

Professor Liyanage Amarakeerthi

Department of Sinhala, University of Peradeniya

Empowering humanity takes many forms. Economic and material empowering, which often take the primary form of human development, are indeed important. Yet, to think that economic-material abundance would automatically lead to human empowering is also misleading. In this keynote address, I will make a claim for some other aspects of human empowering from the vantage point of a scholar in the Humanities. One of the factors that prevent human beings from achieving the 'fullness' of their personhood is the lack of critical awareness of the cultural milieu in which they live. More often than not people take culturally produced boundaries to be natural and unchanging, and that fact cripples their imagination. Therefore, critical awareness of one's surrounding is essential in achieving the fullness of personhood. People often find themselves trapped in culturally constructed identities, taking them as rigid as unchanging objects. Notions such as race, religion, and ethnicity for example are taken to be concepts of inherent value, and their value is also considered unchanging. Recent critical theory, however, has begun to approach those concepts differently and has suggested new ways of understanding identity and difference. Amartya Sen, a Nobel laureate in Economics, for example, has put forward a 'theory of multiple identities' with which one is able to understand that human beings should not and cannot be trapped in a set of rigid identities and that human beings keep adopting new and diverse identities. Drawing heavily on Sen, I argue in this paper that training citizens to understand that everyone has more than one identity is an integral part of true education, i.e. empowering. In addition, to empower humanity, human beings have to be able to critically evaluate their received notions of identity while adopting new identities with the hope of participating in the flourishing of the communities they live in. These arguments will be made taking examples from contemporary literary culture in Sri Lanka.

Faculty of Management and Finance

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**Invisible underemployment experienced by young employees graduated from
Sri Lankan state universities: exploring three different perspectives**

G L D Fernando and K. D. T. K. Wijayawardena

Department of Human Resource Management, University of Colombo

Invisible underemployment among youth has been recognized as a gloomy area in the Sri Lankan labour market. Even though many studies have attempted to address the causes and consequences of underemployment, least priority has been given to discuss invisible underemployment experienced by Sri Lankan youth and has not been recognized as a challenge to empowering the youth. Moreover, there are very few researches available in the Sri Lankan context, which address the issues in the graduate labor market. The purpose of this study is to explore the nature of invisible underemployment experienced by graduates in Sri Lanka. A qualitative approach was adopted in this study where twelve graduate employees from state universities were the key respondents. Further the study utilized the views of private sector human resource professionals and academics (university lecturers) in order to expound the research problem. The research findings highlighted the experience of invisible underemployment undergone by graduate employees, cost of invisible underemployment, and different perspectives of the causes of invisible underemployment. Almost all graduate employee participants reported the difficulty in utilizing the skills and education qualifications obtained under the university curriculum. Furthermore invisible underemployment creates costs for individuals since it leads to lower job satisfaction, career dissatisfaction, frustration, less psychological well-being, and low earnings. In addition to that, HR professionals and academics identify the causes of invisible underemployment as low job creation in an economy, lack of employability skills within graduates, education-job mismatch, and issues in university education system leads to an invisible underemployment. This study has implications for a range of stakeholders including policy makers, potential graduates, undergraduates, private sector employers, and curriculum developers.

Keywords: Invisible underemployment, graduate employees, graduate labor market

What makes investors overconfident? Evidence from the Colombo Stock Exchange

T. T. P. Ranathunga and D. L. P. M. Rathnasingha

Department of Finance, University of Colombo

Many researches in the field of behavioral finance have identified the importance of psychological aspects in investor decision making process, and overconfidence is one such aspect that makes humans depart from rationality. This study examines the possible causes for investors to be overconfident with a sample of individual investors of the Colombo Stock Exchange, Sri Lanka. Opinions are mainly solicited using a five-point Likert scale survey questionnaire. Correlation analysis, chi-square test, and regression analysis are employed as statistical tools for achieving objectives of the study. The analysis of 148 investors' responses reveals that the most significant factor for investors to be overconfident is their experience in the stock market. Additionally, knowledge on financial markets, qualifications of the managers who govern companies, the degree of investor's control over their decisions, and risk tolerance of investors are found to be other factors which influence investor overconfidence. This paper also provides insights into how factors influencing investor overconfidence change according to demographics of investors namely; gender, age, marital status, and educational qualifications. Accordingly experience in the stock market is found to be the most significant cause for male investors, investors in older age ranges, single and married investors, and investors who exhibit educational qualifications at both higher and lower extremes were found to be overconfident while it is knowledge on financial markets for female investors, degree of investor's control over their decisions for younger investors and hindsight for undergraduate investors to express overconfidence.

Keywords: Behavioral finance, investor overconfidence, Colombo Stock Exchange

Women in IT in Sri Lanka: Balancing work and family

A. Adikaram and P. Kailasapathy

Department of Human Resources Management, University of Colombo

Despite having made substantial advances in the labour market over the last few decades, women are still underrepresented in science, technology, engineering, and mathematics disciplines universally. Within this context, women's participation in Information Technology (IT) industry is specifically gaining increased interest, mainly due to the labour shortage and the augmented demand for IT professionals around the globe. Previous studies on women in IT has explored various issues women face in their careers such as discrimination and differential treatment, difficulties women face in advancing their careers and hence their underrepresentation in higher managerial positions, stress they face in IT profession, emotional cost and the resultant work-family conflicts. In this backdrop, we explore the role of work-family balance in attracting and retaining professional IT women in the IT industry in Sri Lanka. The study employs a qualitative research approach to understand in-depth the experiences of women IT professionals. Three focus groups, with a total of 14 women IT professionals from three IT companies, were carried out.

The study revealed the priority women give to work-life balance when, selecting an area of specialization/jobs within the field of IT, the company to work for, retaining in the workforce, and their contentment. They specifically highlighted the support they receive from family members such as husbands, parents, and in-laws. Many respondents stated how difficult it would be for them to balance work-family if they did not get this support. They stated how their husbands are very understanding and supportive, citing their support when they have to travel overseas on work. Respondents also emphasised how the support of their customers, colleagues and managers help them to manage work. In sum, these were the factors in work-life balance that play a role in their employment related decisions.

Keywords: Women, IT industry, work-life balance, qualitative research

Performance management practices: Towards future research in public sector organizations in Sri Lanka

M. M. Aliyar¹ and K. A. S. P. Kaluarachchi²

¹ *Faculty of Management and Finance, University of Colombo*

² *Department of Management and Organization Studies, University of Colombo*

During the last few decades, many public sector organizations around the world have attempted to implement various kinds of Performance Management (PM) practices. Though such attempts aimed a results-based management in the public sector organizations, the expected improvements in performance of the organizations have never been materialized to a significant level. The situation is crucial to the public sector organizations operating in Sri Lanka, which is mainly because of such efforts often face enormous problems and challenges due to the cultural and behavioural mismatches of the organizations. Therefore, based on the review of literature on organizational culture and PM practices in public sector organizations and some past studies on culture and new public management in Sri Lanka, this paper provides some concluding remarks on how future studies need to be carried out to more understand about the PM practices of public sector organizations in Sri Lanka. A better understanding of culture and PM practices of the public sector organizations in Sri Lanka would be helpful to managers of the public sector organizations to implement such practices in line with the local context and achieve the success of organizations to a significant level. Based on the issue of culture and PM practices of public sector organizations, which was pointed out as the main purpose of the present paper, future studies on the topic would be further studied empirically as a single or multiple cases or survey research in particular in the public sector organizations in Sri Lanka.

Keywords: Performance management practices, organizational culture, new public management, public sector organizations in Sri Lanka

**Volatility transmission between stock returns and exchange rates:
A BEKK-GARCH Approach**

Y. D. Withanage and H. A. P. K. Perera

Department of Finance, University of Colombo

With the rapid advancement in modern market economies it has created copious global interlinks among financial markets. Hence, the movements in the foreign exchange rates have become very critical in determining the stock returns. Thus, the purpose of this study is to examine the impact of exchange rate volatility on stock return volatility from an emerging market's perspective. This study employs a trivariate Baba. Engle, Kraft and Kroner - Generalized Autoregressive Conditional Heteroscedasticity (BEKK-GARCH) model to analyse the daily time series data of All Share Price Index (ASPI) of Colombo Stock Exchange (CSE) and exchange rates over a six-year period from January 2010 to December 2015. The empirical results of the study demonstrate that the volatility of US Dollars has a significant impact on volatility of stock returns of the listed firms in CSE indicating that the foreign investors tend to choose Sri Lanka as a potential destination for investments which ultimately created a severe exposure to foreign currency risk. However, the volatility impact of Euros is found to be insignificant while the magnitude of Euro rate volatility is also found to be lower compared to US Dollars. The empirical findings of the study construct a marked departure from the existing literature in the emerging market context where it emphasizes the inevitability of conducting further research on this discipline.

Keywords: Stock returns, exchange rates, GARCH model, Sri Lanka

Capital structure dynamics: Near versus off target firms in Sri Lanka

S. Buvanendra

Department of Finance, University of Colombo

This research paper aims at examining the determinants of the Speed of Adjustment (SOA) towards the optimum capital structure of near or off target firms in Sri Lanka. Particularly, it analyses the impact of firm-specific factors and corporate governance factors on optimum capital structure. The methodology utilizes the benefits of the partial (stock) adjustment model, viz, two step Generalised Method of Moments (GMM) to determine the SOA to optimum capital structure. The results indicate that there is discernible concrete evidence of dynamic behaviour of capital structure in Sri Lanka, that is, the existence of optimum leverage ratio and the consequent move to attain the target in each period, in each model of the three capital structure measures. This confirms the applicability of dynamic trade-off theory. The near or off target firms' capital structure adjustment exhibited the significant difference in SOA between the two types, implying that off target firms adapt swiftly vis-à-vis those at the doorstep of target firms, in each of the three models; that is, off-target firms adapt with verve in juxtaposition with near target firms. There is a clear indication of firm related factors and corporate governance factors swaying capital structure adaptation in at least one of the measures of leverage in both situations, very near to and far off from optimum level of debt.

Keywords: Capital structure dynamics, near versus off target firms, Generalised Method of Moments (GMM), Speed of Adjustment (SOA)

Faculty of Medicine University of Colombo



*'Empowering Healthcare Professionals and Public:
The Way Forward'*

Message from the Dean Faculty of Medicine

Professor Jennifer Perera



I am pleased to provide this message for the Annual Research Symposium of the Faculty of Medicine, Colombo. This is an important calendared event of the whole university and Faculties participate in this activity with enthusiasm and commitment.

The Faculty theme for this year, 'Empowering healthcare professionals and public: The way forward', describes the need for empowering healthcare professionals by providing them with required facilities and training to move forward in the country's research agenda. The general public or the community is the main stakeholder to whom products and results of research will be of benefit to improve their life in both health and disease. The amount of research grants awarded by the state has increased exponentially during the last three years and we hope that this trend will continue. The public contribute to these grants enormously through tax payer generated funds. We owe it to the public that the research is conducted on national priority areas which have been identified based on needs of the community and the country.

Multi-stakeholder collaboration has to be strongly encouraged in health research as health is an integral component of all types off research work, be it engineering, basic sciences, humanities, economics, environment, law or agriculture. I cannot think of any field of study that is delinked from health. This factor needs to be considered in planning research projects. It is also important for researchers to understand that mere publication of a research papers does not achieve the majority of the initially intended outcomes unless the research findings are used for changing practice or policy. This must be considered as a social responsibility of each researcher as most medically related research are conducted using public funds and humans. Ethics play a seminal role in ensuring that research is appropriately conducted as per prescribed guidelines and the benefits to reach the wider population.

We at the medical faculty will be conducting our respective programme with the patronage of our chief guest - Prof. A H Sheriffdeen, a distinguished alumnus of our Faculty, who is an Emeritus Professor of Surgery. Much of his research was translated into practice to provide a good quality life to those disabled by war or following accidents. He disseminated his research findings to other stakeholders and worked collaboratively for the common good of those in need.

I am very grateful to our Faculty's research symposium organizing committee, very efficiently led by Prof. Priyadarshani Galappaththy and her team, for organizing this event with commitment and dedication. On behalf of the academics, administrators and the support staff of the Faculty of Medicine, University of Colombo, I send the organizing committee and all the participants of this Annual Research Symposium 2016, my sincere good wishes for a very productive and enjoyable event that would yield very fruitful outcomes.

Faculty of Medicine University of Colombo

Annual Research Symposium 2016

Empowering Health Care Professionals and Public: The Way Forward

14th October 2016, 8.30 am–4.00 pm at the Faculty of Medicine, University of Colombo

PROGRAMME

8.30-8.50 am	Registration
8.50-9.00 am	Academic Procession of the Inauguration Ceremony of the Annual Research Symposium
9.00-9.10 am	National Anthem and Lighting of the Oil Lamp
9.10-9.15 am	Welcome Address by Prof. Priyadarshini Galappaththy, Chairperson, Faculty of Medicine Research Symposium Organizing Committee
9.15-9.20 am	Address by the Dean, Faculty of Medicine Prof. Jennifer Perera
9.20-9.25 am	Address by the Vice-Chancellor Prof. Lakshman Dissanayake
9.25-9.30 am	Address by the Chief Guest Prof. A.H Sheriffdeen
9.30-9.50 am	Address by the Guest of Honour Prof. Barbara Gastel Professor of Integrative Biosciences and Medical Humanities, Texas A&M University
9.50-10.30 am	Faculty Oration: ' <i>A ten year journey of diabetes research in Sri Lanka</i> ' Dr. Prasad Katulanda, Senior Lecturer, Department of Clinical Medicine.
10.30-10.35 am	Vote of Thanks by Dr. Shreenika Weliange Secretary, Organizing Committee
10.35-11.00 am	Tea Poster Presentations
11.00-11.30 am	Keynote Address: ' <i>Empowering the public: Challenges and responses</i> ' Dr. Vinya Ariyaratne, Director, Sarvodaya
11.30-12.30 am	Free Paper Session 1 (Oral presentations OP1-OP5)
12.30-1.00 pm	Plenary Lecture: ' <i>Research in medical humanities: A resource for health care professionals and the public</i> ', Prof. Barbara Gastel
1.00-2.00 pm	Lunch Poster Presentations
2.00-3.00 pm	Free Paper Session 2 (Oral presentations OP6-OP10)
3.00-4.00 pm	Symposium on ' <i>Empowering the Mindset</i> '
3.00-3.20 pm	' <i>Healthcare Professionals</i> ' - Prof. Diyanath Samarasinghe
3.20-3.40 pm	' <i>Empowering the Mind</i> ' - Dr. Tara de Mel
3.40-4.00 pm	' <i>Health Sector Perspective</i> ' - Dr. Susie Perera
4.00-4.15 pm	Discussion
4.15 -4.25 pm	Awards Ceremony
4.25-4.30 pm	Combined Faculty Song
4.30 pm	Reception

Introduction to the Keynote Speaker

Dr. Vinya Shanthidas Ariyaratne

General Secretary, Sarvodaya Movement, Sri Lanka



Dr. Vinya Ariyaratne is the General Secretary of the Sarvodaya Shramadana Movement which is Sri Lanka's largest non-governmental grassroots development organization. He is a Board Certified Specialist in Community Medicine and a past President of the College of Community Physicians of Sri Lanka (CCPSL).

Dr. Ariyaratne obtained his Doctor of Medicine (M.D.) degree from the De La Salle University in the Philippines in 1989 and his Master of Public Health (M.P.H.) degree from Johns Hopkins University, U.S.A, in 1990. He also holds the Degrees of Master of Science (M. Sc. in 1996) and Doctor of Medicine (M. D. in Community Medicine, in 2003) from the Post-Graduate Institute of Medicine of the University of Colombo, Sri Lanka. He was a Visiting Fellow at the Liverpool School of Tropical Medicine, U. K. (1992) and a Chevening Fellow at the Nuffield Institute of the Faculty of Medicine and Health of the University of Leeds, UK, where he obtained with distinction, the Postgraduate Certificate in Health Management, Planning and Policy (2006).

Dr. Ariyaratne started his career as an Intern Medical Officer at the Government Hospital in Polonnaruwa in Sri Lanka in 1990. After a brief spell serving in the Government Department of Health and overseas fellowships and training in public health, in 1995 he joined the Faculty of Medical Sciences of the University of Sri Jayawardenepura as a Lecturer in Community Medicine. After serving in the academia for five years, he decided to join the voluntary non-government development sector with which he has had a lifelong association. In July 2000, Dr. Ariyaratne resigned from the University of Sri Jayewardenapura and became the Executive Director of Sarvodaya, the position he held up to December 2010. As the Executive Director of Sarvodaya, Dr. Ariyaratne was responsible for the implementation of the island-wide integrated community health and development programmes of Sarvodaya through a network of over 50 district centres and training institutions with a full-time staff of over 800. In 2012, Dr. Ariyaratne became the General Secretary of the Sarvodaya Movement.

Through Sarvodaya, Dr. Ariyaratne developed numerous innovative community health programmes working closely with the government sector, universities, professional colleges as well as other civil society organizations. He has been extensively involved in health and development programmes related to the war affected communities in Sri Lanka.

Keynote Address

Empowering the public: Challenges and responses

Dr. Vinya Shanthidas Ariyaratne

General Secretary, Sarvodaya Shramadana Movement, Sri Lanka

Empowerment is a broad concept. In community development, empowerment entails processes that result in individuals and groups, often considered disadvantaged and marginalized (the “disempowered”), being able to gain greater control of their lives and resources, and be able to represent their interests in decision making. Poverty and powerlessness go hand in hand. We also recognize that poverty and ill-health are directly linked. Therefore addressing poverty and ill-health essentially requires the empowerment of individuals and communities in a scientific and systematic way. Empowerment processes can be social, economic, political and even psychological or spiritual. If we recognize good health as an outcome of multiple underlying determinants – biological, social, economic, cultural etc., empowerment requires a holistic and integrated approach that addresses all these factors simultaneously. Experience from a local grassroots development movement demonstrates greater success when an integrated model towards empowerment is adopted at a community level. Well planned social and economic empowerment processes that are built on a firm spiritual foundation, empower communities and contribute to promoting their health in a sustainable and equitable manner. The very same empowered communities can then, with proper guidance, take their own initiatives to address specific health issues such as communicable and non-communicable diseases, and other local health challenges that affect them. However, recent developments in the field of community empowerment promote more advanced but practical methods such as Community Score Cards to measure the quality and adequacy of public services such as health and education. The “empowerment model” has also been used in prevention and control of substance abuse, tobacco and alcohol. In the health sector, empowering the public in general and patients in particular is an important step if we truly recognize health as a fundamental right.

Faculty of Medicine

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**Socio-economic and cultural factors associated with career advancement of women
scientists in Sri Lanka**

W. L. B. P. Abhayawickrama, H. Silva and N. D. Karunaweera

Department of Parasitology, University of Colombo

Balancing work and family is difficult in a society which considers women are more responsible for taking care of the family. This study was conducted to discover the impediments faced by women engaged in scientific professions in Sri Lanka. Electronic questionnaire was sent to 1400 women scientists and data was collected and analysed to identify socio-economic and cultural limitations associated with their career advancement and the suggestions given were recorded. Out of the women scientists (351) who responded to the questionnaire 77% were married, 20% were unmarried and 2% were previously married. 35% of the married and previously married women scientists had no children and 27%, 31% and 5% had one, two and three children respectively. Majority of scientists have received more than one type of support in child care and domestic chores. Categorically, 50% have received child care support from another family member and 48% through hired help. Minority have obtained support from husband (16%) or day care facilities (20%). Support for household chores in 36% has been through hired help, 35% by the husband, 33% by another family member, while 18% has not received any support. 34% of the women scientists believe that their family life has interfered with their career and promotional prospects with responsibilities of children being the main cause given by the majority (52%). Conversely, 39% believe that their career has interfered with the family life due to reasons such as lack of quality time to spend with the family with long distances to travel between work place and home. Suggestions by women scientists included provision of better opportunities in “dual career” of science and family, flexible working hours, policies on maternity leave, high quality child care facilities at working places and mentorship by successful, experienced women scientists.

Keywords: Women scientists, career advancement

Correlation between neurocognitive parameters and renal function in patients with type 2 diabetes with renal impairment

T. T. Chathuranga, M. S. T. T. Dayaratne, I. D. Wijewardana, H. M. P. S. Herath, H. Jayawardena, M. A. H. P. Kumarasiri, U. A. H. Udagedara, M. Gunatilake and W. D. N. Dissanayake

Department of Physiology, University of Colombo

Studies suggest that neuropathy is associated with abnormal renal function in patients with late stage nephropathy due to type 2 diabetes mellitus (T2DM). However the association between neuropathy and early stage diabetic nephropathy is not clearly defined. This study aimed to assess the correlation between renal function and neurocognitive parameters in patients with early stage diabetic nephropathy. A preliminary study was conducted among 20 patients with type 2 diabetes mellitus and estimated glomerular filtration rate (eGFR) 30-90 ml/min/1.73m² (age ≤60 years) who are attending to medical clinics at National Hospital, Colombo. Neurocognitive assessment was done using a validated diabetic neuropathy symptom (DNS) score, diabetic neuropathy examination (DNE) score, mini mental state score (MMSE) and nerve conduction studies of right sural and tibial nerves (amplitude, velocity and latency) using NCV-EMG system-Nicolet Biomedical. Renal function was assessed by calculated eGFR with serum creatinine level (photometric-colorimetric test) and urinary microalbumin levels (UMA; turbidimetric test). Data was analyzed to assess correlation. The mean age of the patients was 56.68±4.62 years (mean±SD; n=20; females=14). The duration of T2DM was 11.24±6.16 years. No significant correlation was noted between eGFR (49.68±12.31 ml/min/1.73m²) and DNS score (1.68±1.34; p=0.554; r= -0.15), DNE score (2.79±1.58; p=0.599; r= -0.13), MMSE (29±1.25; p=0.825; r= -0.05) and right sural and tibial nerve conduction studies (p>0.05). Also there was no correlation between UMA (357±205.30 mg/l) and DNS score (p=0.132; r=0.36), DNE score (p=0.988; r=0.004), MMSE (p=0.727; r=0.086) and tibial and sural nerve conduction studies (P>0.05). The preliminary findings suggest that there is no significant correlation between renal function tests and neurocognitive parameters in early stage diabetic nephropathy. However, possible correlations between parameters will be tested in the future by recruiting more patients.

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A Case report of Cutaneous Leishmaniasis affecting the nasal process

M. A. B. Deepachandi¹, K. K. G. D. U. L. Kariyawasam¹, S. Weerasinghe¹, C. Gunasekara²,
S. S. S. B. D. P. Soysa³, N. D. Karunaweera¹ and H. V. Y. D. Siriwardana¹

¹ *Department of Parasitology, University of Colombo*

² *National Hospital of Sri Lanka, Colombo*

³ *Department of Biochemistry and Molecular Biology, University of Colombo*

Cutaneous leishmaniasis (CL) is the main clinical manifestation of leishmaniasis in Sri Lanka. It is caused by a genetic variant of *Leishmania donovani*, a usually visceralizing parasite. Therefore, it is important to understand the extent of skin localization and other sequelae of local CL. A case with CL is presented here to highlight the dermatropic nature of the local parasite: A 35-year-old male from Monaragala District presented with a facial ulcer of 2 months duration. He had never travelled out of the country. The lesion started as a painless, acne-form papule and enlarged and ulcerated within a week after native treatment. Dermatological examinations revealed the presence of an oval-shaped, hypo-pigmented ulcer about 4 cm (diameter) on the left lateral nasal process. Nose was swollen and congested. Surrounding skin was erythematous and non-scaling. Lesion extended to the muco-cutaneous junction but it was confined to the skin without involvement of nasal mucosa. Infection was not associated with fever, weight loss, poor general conditions, nasal discharge, lymphadenopathy or visceromegalies. There were no oral lesions. Total protein, WBC and Hb were within normal ranges. rK39 assay, the WHO recommended serological test for visceral leishmaniasis (VL) was negative. Enzyme-linked immunosorbent assay based on local crude antigen was positive. After confirmation for leishmaniasis by microscopy and culture, he received weight adjusted 18 doses of daily intra-muscular sodium stibogluconate injections within a month. Within 6 months of post-treatment new epithelialization was complete. There were no new skin or mucosal lesions or systemic manifestations compatible with VL. The site of infection was highly susceptible to convert to muco-cutaneous leishmaniasis by direct spread to nasal mucosa. However, this case highlights the ability to contain the spread of a lesion even from a highly vulnerable site, probably due to a fully functional immune system.

Keywords: Leishmaniasis, Leishmania donovani, Muco-cutaneous, Dermotropic

Acknowledgements: We acknowledge University of Colombo research grants (AP/3/2/2014/RG/13) and National Institute of Health research grants (IRO1AI099602) for funding.

Use of clinical markers in assessing the healing lesions of Cutaneous Leishmaniasis

M. A. B. Deepachandi, K. K. G. D. U. L. Kariyawasam, S. Weerasinghe, H. V. Y. D.

Siriwardana and N. D. Karunaweera

Department of Parasitology, University of Colombo

Early case detection and management is very important in the control of leishmaniasis. With already employed laboratory methods, diagnostic clinical markers were also identified for cutaneous leishmaniasis (CL) detection recently. Understanding of clinical markers associated with lesion healing is equally important to assess the disease progression and treatment efficacy. The present study aimed to describe clinical features associated with healing lesions and treatment profiles. Thirty laboratory confirmed cases of CL were studied after informed written consent. Quarterly post-treatment follow-ups were carried out for 12 months. Flattening/size reduction of lesions, new epithelialization and reduction of inflammatory signs were considered as signs of healing. Complete epithelialization of ulcer and complete flattening of a nodule were considered as clinical cure. All the cases were examined by a single investigator. Patients received 3-46 doses of intra-lesional/intra-muscular sodium stibogluconate (SSG) (≤ 10 doses in 55.2% cases, 11 in 30-38% and >30 in 6.9%). Most (63.3%) lesions healed within 3 months while 97% (n=29/30) were cured within 12 months. Average treatment completion period was 15 weeks. All patients investigated at post-treatment 3-12 months, (n=12/12; 100%) turned parasite negative by direct smear within 12 months. On completion of treatment, n=21/22 (95.5%) of nodules showed flattening and n=8/8 (100%) ulcers completely epithelialized (On average 4 months were taken). Reduction of erythema was observed in n=16/19 (84.2%) of initially erythematous lesions within post-treatment 12 months. In average, nodule flattening, reduction of erythema and epithelialization were first noticeable at 3, 4 and 3 months respectively. After 12 months post-treatment, 53.8% of cases ended up with a scar and 42.3% had no scar. Patients have been followed-up for >24 months with no relapses or visceral disease so far. Parasite clearance appears to take several weeks following initiation of treatment. Careful understanding of clinical features of a healing lesion can be useful as predictors of treatment efficacy.

Keywords: Clinical markers, Follow-up, Cutaneous leishmaniasis

Acknowledgements: We acknowledge University of Colombo research grants (AP/3/2/2014/RG/13) and National Institute of Health research grants (IRO1AI099602) for funding.

**An outbreak of malaria among Sri Lankan security forces personnel deployed in
Central African Republic: a case study and lessons learnt**

S. D. Fernando¹, C. H. Mallawarachchi², R. Booso³, P. Dharmawardana⁴, A. Harintheran¹, C. Rodrigo⁵, M. Dewapriya⁴ and A. R. Wickremasinghe⁶

¹*Department of Parasitology, University of Colombo;* ²*Post Graduate Institute of Medicine, University of Colombo;* ³*Directorate Of Health Services, Sri Lanka Air Force;* ⁴*Anti Malaria Campaign, Narahenpita, Colombo;* ⁵*Department of Clinical Medicine, University of Colombo;* ⁶*Department of Public Health, University of Kelaniya*

Sri Lanka has been free of indigenous malaria since November 2012. With an increase in global travel the country remains at risk of re-introduction of malaria. Security forces personnel returning home from international peace keeping missions are considered a high risk group for imported malaria. The present study investigated an outbreak of malaria among a contingent of Air Force personnel during a 14 month deployment in Central Africa and investigated strategies to prevent outbreaks. Following their return to Sri Lanka, an interviewer administered questionnaire was used to collect data. Quantitative/qualitative approaches were used to understand the origins and potential contributory factors for the outbreak. Out of a contingent of 122 Air Force personnel, 120 persons were interviewed. One individual was not present and the other had died due to malaria while overseas. Among the individuals interviewed, 61.7% reported regular use of chemoprophylaxis. Thirty seven persons suffered from malaria while overseas. Of them, 31 reported one attack and six persons had more than one attack resulting in a total of 44 attacks. The number of attacks due to *Plasmodium falciparum*, *P.vivax* and *P.malariae* were ten, six and one attack/s respectively. The diagnosis of the others was not known. All who got malaria did not comply with the chemoprophylaxis drugs. Two thirds of these cases occurred within the first four months. Two additional cases of malaria were diagnosed upon arrival in Sri Lanka. It is recommended that improved co-ordination with foreign destination health care services, central co-ordination of anti-malaria activities prior to and after departure within Sri Lanka for all security forces and directly observed administration of chemoprophylaxis may help to avoid similar outbreaks. As asymptomatic and sub patent infections cannot be excluded, re-screening is done two-weeks after return. Such mechanisms ensure the prevention of re-introduction of malaria to Sri Lanka.

Keywords: Imported malaria, Security forces, Sri Lanka, Central African Republic, Chemoprophylaxis

Acknowledgements: Financial assistance from the National Science Foundation (Grant No: RG/2014/HS/03) is gratefully acknowledged.

Double aneuploidy in three Sri Lankan patients

D. Hettiarachchi and V. H. W. Dissanayake

Human Genetics Unit, University of Colombo

Double aneuploidy is a relatively rare condition in which there is a coexistence of two different chromosomal abnormalities in the same individual. These patients are known to be incompatible with life as most reported conceptions have resulted in spontaneous abortions or succumbed to death soon after birth. The objective of the present study was to analyse contributing chromosomal abnormalities. This study was conducted at the Human Genetics Unit, Faculty of Medicine, University of Colombo. Cytogenetic analysis of the probands were performed on 25 -40 spreads of metaphase chromosomes from peripheral blood lymphocytes using standard G-banding techniques for each case. We have observed three live born double aneuploidy cases between the years 2012 and 2015. They were a 49 days old boy born to a 40 year old gravida 2 para 2 lady referred due to intrauterine growth retardation (IUGR), dysmorphic features and a large ventricular septal defect (VSD), a double outlet right ventricle and a moderate size patent ductus arteriosus (PDA) leading to moderate pulmonary hypertension. A 17 days old boy born as the first child to an elderly primi (38 years) with microcephaly, low set eyes, microphthalmia, cleft lip, cryptorchidism, polydactyly, “rocker-bottom” feet. A 1-year-old male child of an elderly primi (37 years) with dysmorphic features similar to Down's syndrome including a flat nasal bridge, preauricular pits, epicanthic folds, clinodactyly and short stature. Karyotype results of the probands were as follows 48XXY; +18, 48 XXY; +13, 47, XY, +21 [30]/ 47, XY, +22 [10]. These results confirmed the co-existence of Edward and Klinefelter syndrome in the 1st case, Patau and Klinefelter syndrome in the 2nd case and a mosaic pattern for both trisomy 21 and 22 in the 3rd case. Advancing maternal age was common for all three.

Keywords: Double aneuploidy, Edwards syndrome (trisomy 18), Klinefelter syndrome (XXY), Patau syndrome (trisomy 13), Down's syndrome (trisomy 21).

**Isolation of *Mycobacterium sinense* from a pulmonary specimen acquired from the
Central Chest Clinic in Colombo**

D. G. D. Jayasuriya¹, N. V. Chandrasekharan² and A. J. Perera¹

¹ *Department of Microbiology, University of Colombo*

² *Department of Chemistry, University of Colombo*

M. sinense is a recently identified species of mycobacteria causing pulmonary disease. This species which was first isolated in 2013 in Shanghai, China is closely related to the *M. terrae* complex and has a genome size of around 4.6 x10⁶bp. It has been reported to be resistant to multiple drugs such as streptomycin, ciprofloxacin, levofloxacin, rifampin and amikacin. The pathogenicity of *M. sinense* is related to its mycolic acids. The organism shows evidence of genomic degeneration and its high percentage of nucleotide usage shows it is evolving to a cytoparasitic life. The present study reports biochemical and genetic characterisation of *M. sinense* strain, a relatively new species reported globally. *M. sinense* (n=1) was isolated among 68 Non tuberculous Mycobacteria (NTM) while screening sputum samples from 451 patients with pulmonary disease. The isolate was characterised using culture and biochemical testing. Genetic characterisation was carried by PCR amplification of the 16s rRNA and DNA gyrase B genes and DNA sequencing. *M. sinense* is a slow growing mycobacterium with buff colour rough colonies with no pigmentation. Biochemical properties for tellurite reduction, both semi-quantitative and heat stable catalase and iron uptake showed positive results but nitrate reduction assay, urease and 14 day arylsulfatase production, growth on MacConkey agar and tween-80 hydrolysis were negative. BLAST analysis of 16s rRNA and DNA gyrase B genes, showed a sequence identity of 99% and 92% respectively to the corresponding genes of *M. sinense*. The isolation of *M. sinense* shows the emergence of new species of NTM causing pulmonary disease in Sri Lanka. Their role is largely underestimated as they often remain unrecognised. As this species is inherently multi-drug resistant a definitive identification of the species is required for the accurate selection of antibiotics.

Keywords: Nontuberculous mycobacteria, M.sinense, pulmonary disease, biochemical, genetic characterisation

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Effects of ‘plate model’ on modification of selected cardio-metabolic risk factors in Post Myocardial Infarction patients: study protocol for a randomized, single blinded, interventional study

U. P. M. Fernando¹, N. Lokunarangoda^{1,4}, J. B. Jayawardane¹, A. K. Pathirana¹ and R. Jayawardena^{2,3}

¹*Institute of Cardiology, National Hospital of Sri Lanka, Colombo*

²*Department of Physiology, University of Colombo*

³*Institute of Health and Biomedical Innovation, Queensland University of Technology, Australia*

⁴*Department of Medicine, University of Rajarata*

Cardiovascular diseases (CVDs) remain the leading cause of morbidity and mortality worldwide and global burden of CVDs is rising. Nutritional intervention is a cost effective approach in risk reduction in post myocardial infarction (MI) patients. The “plate model” is one of the practical methods which will provide guidance to Sri Lankans to follow a healthier eating pattern. The study aims to evaluate the effects of ‘plate model’ on modification of selected cardio-metabolic risk factors in patients with a history of MI. The study will be conducted as a randomized, single-blind, controlled clinical trial for a period of 3 months. A total of 120 overweight (BMI>23kgm⁻²) adults (age 20–70 years) with a history of troponin positive Acute Coronary Syndrome within past 1 month will be recruited. Simple randomization will be used in participant allocation. The intervention group will receive the model plate which is designed to control portion size of meals with visual reinforcement with different colours for each food group. The control group will be provided with routine dietary advice. Other domains such as advice on exercise, lifestyle modification will be equalized among both groups. The evaluations are done at recruitment (visit 0), 4 weeks (follow-up 1), and 12 weeks (follow-up 2) after the intervention. The primary outcome will be, mean body weight reduction by 10% in test group when compared to the control group and secondary outcomes include, mean reduction of systolic and diastolic blood pressure, anthropometric parameters, improvement of lipid profile and liver enzymes in test group when compared to the control group at 12 weeks following the ‘plate model’ diet. This will be the pioneering study to investigate the practicality of ‘model plate’ in local settings and as well in the South Asian region.

Keywords: Cardiovascular disease, cardiac rehabilitation diet, nutrition, plate model, Sri Lanka

Modified virulence of *L.donovani*; causative agent of Leishmaniasis in Sri Lanka

K. K. G. D. U. L. Kariyawasam¹, H. V. Y. D. Siriwardana¹, A. Dube², H. Nakhasi³ and N. D.

Karunaweera¹

¹Department of Parasitology, University of Colombo

²Central Drug Research Institute, Lucknow, India

³Division of Emerging and Transfusion Transmitted Diseases, Food and Drug Administration, Bethesda, USA

Cutaneous leishmaniasis (CL) in Sri Lanka is caused by a genetic variant of *L.donovani*, a usually visceralizing parasite elsewhere. The infection of *Leishmania* parasites can be attenuated by the building of protective immunity. IL-10 and IFN- γ production is closely associated with the level of protective immunity against *Leishmania*. The role of cytokines in disease outcome of local *L.donovani* infections (*L.donovani-SL*) is not yet fully understood. The present research aimed to study the level of virulence of *L.donovani-SL*, using a mouse model. BALB /c mice were inoculated intravenously (IV)(n=6) and intradermally (ID) (n=6) with 10^7 promastigotes of *L.donovani-SL*. Another batch of BALB/c were injected intradermally with wild type strain *L.donovani* 1S (*L.donovani-WT*)(n=6). Six BALB /c mice were similarly treated with normal saline as controls. Mice were euthanized at 10 weeks following inoculation. The effects of infection on the animals were measured along with levels of IFN- γ & IL-10 produced by splenocytes and cells derived from lymph nodes (LNs) in in-vitro cultures (72hrs). Weight loss and splenic enlargement were seen in BALB/c mice injected with *L.donovani-WT* and *L.donovani-SL* (IV). ID injected animals showed only cutaneous lesions at the site of injection. High IL-10 and low IFN- γ levels were observed in supernatants of splenocyte (280×10^9 pg/ml and 46.8×10^9 pg/ml) and LN cell cultures (77.4×10^9 pg/ml and 28.2×10^9 pg/ml) derived from IV-infected mice. Moderate levels of IFN- γ and minute levels of IL-10 were observed in LN cell cultures of ID-infected mice (83.6×10^9 pg/ml and 22.3×10^9 pg/ml). High level of IL-10 (383.4×10^9 pg/ml in spleen and 119.2×10^9 pg/ml in LN) and no IFN- γ was observed in mice injected with *L.donovani-WT*. Comparisons were made with the control group, which were normal. *L.donovani* in Sri Lanka appears to have modified levels of virulence affecting host IL-10 and IFN- γ levels, which is likely to explain the clinical picture seen in local patients.

Keywords: L.donovani, cytokine balance, Sri Lanka, BALB/c mice

Gene variations in *oxyR-ahpC* region of *Mycobacterium tuberculosis* (Mtb) isolates from Sri Lanka contribute insignificantly to isoniazid (INH) resistance

G. H. R. E. Karunaratne¹, W. S. S. Wijesundera², D. Vidanagama³, C. P Adikaram.⁴ and A. J. Perera¹

¹*Department of Microbiology, University of Colombo*

²*Department of Molecular Biology and Biochemistry, University of Colombo*

³*National Tuberculosis Reference Laboratory, Welisara*

⁴*Central Public Health Laboratories, Ministry of Health, Oman*

INH is one of the important first line drugs in anti-tuberculosis therapy. INH resistance is mainly due to mutations in *katG*, *inhA* and *ahpC* genes of Mtb genome. *ahpC* mutations can be occurred in the *oxyR-ahpC* region which consist of *ahpC* gene, *oxyR* gene (a pseudo gene situated 5'to the *ahpC* gene) and 105bp *oxyR-ahpC* intergenic region. The importance of the mutations in *oxyR-ahpC* region for the detection of INH resistance is not yet determined in Sri Lanka. The objective of this study was to identify mutations in *oxyR-ahpC* region of INH resistant Mtb isolates in Sri Lanka. The total sample included forty (40) INH resistant Mtb isolates. Mutations associated with *katG* and *inhA* genes of the 40 isolates have been previously identified. Two primer sets were designed to amplify regions flanking the entire *ahpC* gene, *oxyR-ahpC* intergenic region and the *oxyR* gene by Polymerase Chain Reaction. DNA sequences of amplified products were analyzed using BioEdit7.2.5, Chromas LITE2.1.1 software, and NCBI sequence alignment tools. DNA sequence analysis revealed the presence of a point mutation (C to T) at -10 (2.5%, n=1) in the *oxyR-ahpC* intergenic region. A single polymorphism (C to T) with a moderate frequency (35%, n=14) was observed at position 37 in the *oxyR* pseudo gene. No mutations were found in the *ahpC* gene. All isolates showing a sequence variation in *oxyR-ahpC* region also harboured another point mutation either in *katG* (at codon 315) or *inhA* gene (at -15). According to the results observed, screening of mutation in the *ahpC-oxyR* region has minimal value in detecting INH resistance of Mtb isolates in Sri Lanka, as the sequence variations always occurred along with a mutation either in *katG* or *inhA* genes.

Keywords: Tuberculosis, INH Resistance, ahpC, oxyR, Mutations

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Palatability assessment of a formulated health snack

U. Kulasooriya¹, S. Jayasena¹, P. Katulanda² and M. de Lanerolle-Dias¹

¹*Department of Biochemistry and Molecular Biology, University of Colombo*

²*Department of Clinical Medicine, University of Colombo*

A snack was formulated for the health-conscious population, using natural ingredients and no added sugar. The present study aimed to carry out a palatability evaluation of the formulated snack in both diabetics and non-diabetics (aged 25–65) and to assess consumer acceptability. The health snack was formulated using olu rice (*nymphaeapubescens*), foxtail millet (*Setaria italic*), barley (*Hordeumvulgare L.*) and chickpea (*Cicerarietinum*), wheat flour, cinnamon, butter, raisins, egg white, baking powder and vanilla essence. Palatability was carried out on 60 diabetics and 60 non-diabetics, using questionnaires on nine point and five point hedonic scales. The blood glucose levels were monitored on diabetic volunteers prior to and 1, 2, 3 hours after consumption of the snack, to ensure no adverse effect on their blood glucose levels. Acceptability (yes /no) of the snack was statistically assessed using Chi- square. Apart for the visual appeal of the snack for the diabetics, all other aspects were acceptable (significantly higher ratings for being acceptable over not acceptable) by both groups, with significantly ($p < 0.001$) high ratings for overall acceptability. There were no signs of abdominal discomfort associated after consumption. The blood glucose levels of diabetics at 0, 1, 2 and 3 hours were 142.41 ± 27.62 mg/dl (101-188mg/dl) , 126.91 ± 24.05 mg/dl (98-169 mg/dl), 113.05 ± 15.06 md/dl (90-145 mg/dl) and 101.55 ± 14.01 mg/dl (82-135 mg/dl) respectively. Statistical analysis showed that there was a significant ($p < 0.001$) decrease in blood glucose levels following consumption of the snack, ensuring there was no adverse effect on the blood sugar of diabetics after consumption. The formulated health snack was accepted by both the diabetic and the non-diabetic populations, apart for visual acceptability by the diabetic population. In relation to blood glucose estimation the snack is safe for consumption by diabetics, and beneficial for all health conscious individuals.

Keywords: Snack, diabetic, palatability, blood glucose

Role of pro-inflammatory cytokines in the pathogenesis of *L. donovani*-induced Cutaneous Leishmaniasis

N. H. Manamperi¹, S. Oghumu², K. P. N. Pathirana³, U. A. D. D. Munidasa⁴, K. K. V. N. Somaratne⁵, M. V. C. de Silva⁶, C. S. Fernando⁶, A. Pathmeswaran⁷, W. Abeyewickreme¹, A. R. Satoskar⁸ and N. D. Karunaweera⁹

¹Department of Parasitology, University of Kelaniya; ²College of Public Health, Ohio State University, USA; ³Sri Lanka Army Medical Services, Colombo; ⁴District General Hospital, Polonnaruwa; ⁵District General Hospital, Hambantota; ⁶Department of Pathology, University of Colombo; ⁷Department of Public Health, University of Kelaniya; ⁸Department of Pathology, Wexner Medical Center, Ohio State University, USA⁹; Department of Parasitology, University of Colombo

Cutaneous leishmaniasis (CL) in Sri Lanka is caused by the usually visceralizing *Leishmania donovani*. Pro-inflammatory cytokines Interferon-gamma (IFN- γ) and Tumour necrosis factor (TNF- α) are essential for a parasite clearing host immune response. The present study aimed to assess variations in tissue cytokine expression with lesion duration in CL due to *Leishmania donovani*. Skin biopsies from 58 patients with parasitologically or histopathologically confirmed CL and 25 healthy controls were analysed for tissue expression of Interleukin (IL)-12A, IL-4, IL-10, IFN- γ and TNF- α . Cytokine mRNAs were quantified by real-time RT-PCR using SYBR green. Relative copy numbers were calculated for each gene by $2^{-\Delta\Delta Ct}$ method using β -actin as the reference gene and healthy controls as the calibrator. Lesions were categorized as recent (< 6 months) and late (≥ 6 months). Direct correlation between cytokines and lesion durations were determined using Spearman correlation test and the difference in cytokine expression between recent and late lesions were determined by Mann-Whitney U test. Study group consisted of 37 males (63.8%) and 21 females (36.2%) with a mean age of 35 years (SD=12.05, range 18-66), and a mean lesion duration of 6.8 months (SD=9.10, range 1-48). There were 38 (65.5%) recent and 20 (34.5%) late lesions. Spearman correlation coefficient for relative copy numbers and lesion duration was 0.216, 0.072, 0.070, 0.232 and 0.294 for IL-12A, IL-4, IL-10, IFN- γ and TNF- α respectively. Expression of TNF- α showed significant positive correlation with lesion duration (p=0.024). Late lesions had significantly increased expression of IFN- γ (p=0.018) and TNF (p<0.001) compared to recent lesions. Development of a strong pro-inflammatory response in the lesion as it progresses is beneficial for parasite clearance but may adversely affect the healing process by increasing host tissue damage.

Keywords: Cutaneous leishmaniasis, Sri Lanka, Cytokines

Validation of a flame photometric method for serum lithium estimation

U. Mannapperuma, M. C. M. Peiris, D. Thambavita, P. Galappatthy and R. L. Jayakody

Department of Pharmacology and Pharmacy, University of Colombo

Lithium is a first line drug used to treat bipolar affective disorder. Frequent monitoring of serum lithium is recommended as it is a narrow therapeutic index drug. Flame photometry is a cost-effective, reliable and quick method of serum lithium estimation. The objective of the study was to validate a flame photometry method for serum lithium estimation according to the United States Food and Drug Administration (USFDA) guidance on bioanalytical method validation. Sherwood 410 flame photometer was used for the analysis. Serum samples were diluted 1:2 using a lithium blank solution containing 140mmol/L of sodium and 5mmol/L potassium. Aqueous lithium standards were prepared using the same blank. The method was validated for the range 0.2-1.5 mmol/L of lithium. Linearity, recovery, accuracy, precision, and long term stability was determined by standard lithium serum samples. The lower limit of quantification (LLOQ) was 0.2 mmol/L, median level of quantification was (MLOQ) 0.8 mmol/L and the upper limit of quantification (ULOQ) 1.5 mmol/L. Five replicates of serum and aqueous lithium samples were used to determine linearity in the range between LLOQ and ULOQ using the correlation coefficient (r^2). Five standard serum replicates were used for recovery, accuracy and precision studies. Precision was determined by the coefficient of variation (CV%) on three different days. The r^2 for the aqueous samples were 0.9981 and 0.9955 for the serum samples demonstrating linearity. The recovery was 92.5%, 99.4% and 105% for the LLOQ, MLOQ and ULOQ respectively. The accuracy for LLOQ, MLOQ of and ULOQ were 98.1%, 101.5% and 105.8% and 96.9%, 99.9% and 106.5% after one month. The CV% of the LLOQ, MLOQ and the ULOQ was 7%-10.9%, 0%- 2.8% and 2.2%-2.9%. All accuracy and precision values were below $\pm 15\%$ according to the USFDA recommendation. The flame photometric method is suitable for determining serum lithium concentrations in therapeutic drug monitoring.

Keywords: Lithium carbonate, flame photometry, therapeutic drug monitoring, validation

**Bioequivalence study of two sodium valproate tablet formulations in healthy
Sri Lankan subjects**

U. Mannapperuma¹, D. Thambavita¹, T. N. Wickramaratna¹, S. Mythily¹, K. Sathirakul², P.
Galappathy¹ and R. L. Jayakody¹

¹ *Department of Pharmacology and Pharmacy, University of Colombo*

² *Department of Pharmacy, Mahidol University, Thailand*

Sodium valproate is a narrow therapeutic index drug used to treat epilepsy and bipolar disorder. Bioequivalence data is required for antiepileptic drugs by the National Medicines Regulatory Authority for registration. Sri Lanka had no facilities to conduct bioequivalence studies. The present study aimed to conduct a bioequivalence study of gastro-resistant sodium valproate tablets (200mg) available in the government hospitals with the innovator gastro-resistant product of sodium valproate (200mg). Fourteen adult healthy volunteers were recruited for an open label randomized, two period, two treatment and two sequence and crossover design study. A single tablet of sodium valproate (200mg) either the test or reference product, was administered with a wash out of 1 week. Serial blood samples were collected over a period of 24 hours. Serum concentrations of valproic acid were measured by a validated LC-MS-MS method. Pharmacokinetic (PK) variables C_{max} , AUC_{0-24h} and $AUC_{0-\infty}$ were determined to assess bioequivalence after log-transformation of data. Differences between means of PK parameters of test and reference product using ANOVA and percentage ratio between log-transformed data of PK parameters were analysed by WinNonlin6.4[®] software. Products were considered bioequivalent if the log-transformed ratios of the variables were within the USFDA specified 90% confidence interval (CI) 80.00%-125.00%. The mean age of participants was 26 (21-41) years and 9 were males. Mean C_{max} , AUC_{0-24h} and $AUC_{0-\infty}$, T_{max} of reference and test product and percentage coefficient of variation (CV) were 27.48mcg/ml (CV:21.5) vs 27.35 mcg/ml (CV:23.77), 22131.37min.mcg.ml⁻¹ (CV:26.46) vs 21975.77 min.mcg.ml⁻¹ (CV:21.70), 3843.22min.mcg.ml⁻¹ (CV:32.91) vs 40033.46min.mcg.ml⁻¹ (CV:30.83) and 211min. (CV:14.27) vs 219min. (CV:24.65) respectively. The percentage ratio between the test and the reference product was 99.81 for C_{max} , 90%CI 90.22-110.41% and for AUC_{0-24h} the ratio was 100.66, 90%CI 89.99-112.58%. For $AUC_{0-\infty}$ the ratio was 104.71, 90%CI 85.65-128.00%. In these healthy Sri Lankan volunteers, the test and reference formulations of sodium valproate 200mg tablets were bioequivalent with respect to C_{max} and AUC_{0-24h} .

Keywords: Bioequivalence, Sodium valproate, Pharmacokinetics, C_{max} , AUC

Polymorphisms of candidate genes related to aggrecan degradation are associated with lumbar disc degeneration

G. L. R. S. Perera¹, L. S. Wijayaratne², U. Senarath¹, P. H. Dissanayake³, A. L. Karunanayake⁴ and V. H. W. Dissanayake¹

¹ Faculty of Medicine, University of Colombo; ² National Hospital of Sri Lanka; ³ Faculty of Medical Sciences, University of Sri Jayewardenepura; ⁴ Faculty of Medicine, University of Kelaniya

Lumbar disc degeneration (LDD) is one of the main associated factors in chronic mechanical low back pain (CMLBP). Aggrecan is the major proteoglycan (PG) in the intervertebral disc and progressive reduction of PG is a major feature of LDD. The study aimed to assess the associations between the severity of LDD and 63 single nucleotide polymorphisms (SNPs) of candidate genes related to aggrecan and its degradation pathway. A descriptive cross sectional study was carried out on 106 patients with CMLBP. Each lumbar disc was graded for LDD (grade 1-5) on T2 weighted sagittal lumbar MRI scan using modified Pfirrmann grading system by a consultant radiologist blinded to clinical details. Cumulative score of five lumbar levels was used as the severity of LDD. Sixty three SNPs in eleven candidate genes (ACAN, HAPLN1, IL1A, IL1B, IL6, MMP3, ADAMTS4, ADAMTS5, TIMP1, TIMP2 and TIMP3) were genotyped on Sequenom MassARRAY iPLEX platform. Severity of LDD and genotypes were treated as quantitative variables and multiple linear regression analysis was carried out adjusting for age, gender and body mass index. Mean age was 52.42 years. 74 (69.8%) were females. 27 (25.5%) were obese. Mean severity of LDD was 12.56±2.88. Each additional “G” allele of rs2856836, “C” allele of rs1304037, “A” allele of rs17561 and “A” allele of rs1800587 of IL1A gene were associated with progressive reduction in severity of LDD (p = 0.01). These four SNPs were in strong linkage disequilibrium. Furthermore, each additional “C” allele of rs41270041 of ADAMTS4 was associated with progressive reduction in severity of LDD. “AG” genotype of rs226794 of ADAMTS5 gene was associated with increased severity of LDD in contrast to “GG” genotype. SNPs of IL1A, ADAMTS4 and ADAMTS5 genes are associated with the severity of LDD in patients with CMLBP.

Keywords: Lumbar disc degeneration, ACAN, IL1A, ADAMTS4, ADAMTS5

Comparative study of *Nauclea orientalis L.*, *Clerodendrum infortunatum L.* and *Paramignya monophylla* on their anti-oxidative potential and apoptosis induction

R. A. U. I. Ranatunge and P. Soysa

Department of Biochemistry and Molecular Biology, University of Colombo

Nauclea orientalis L., *Clerodendrum infortunatum L.* and *Paramignya monophylla* are used for cancer treatment in Sri Lanka. However, the detailed mechanisms underlying their anti-cancer properties have so far not been elucidated. The present study was carried out to evaluate the anti-oxidative potential and induction of apoptosis by *N orientalis L.* (bark), *C infortunatum L.* (roots) and *P monophylla* (roots) in-vitro using Rhabdomyosarcoma (RD) cancer cells. Lyophilized samples of aqueous extracts were used. Anti-oxidant activities were determined using hydroxyl-radical scavenging capacity and measurement of reducing power. Antiproliferative activity was evaluated by MTT assay after 24 hour treatment of plant extracts. Morphological changes characteristic to apoptosis was observed after Ethidium Bromide/Acridine Orange staining. The highest OH radical scavenging capacity was observed with *C infortunatum L.* with an EC₅₀ value of 19.7(± 2.3) µg/ml, (p<0.001). The reducing power increased in a dose dependent manner; *N orientalis L.* > *C infortunatum L.* > *P monophylla*. Antiproliferative activity was significantly high with *N orientalis L.*, (p<0.01), followed by *C infortunatum L.* and *P monophylla* with EC₅₀ values of 181.5(± 7.2) µg/ml, 579.9(± 8.2) µg/ml and 513.5(± 2.5)µg/ml respectively. Ethidium Bromide/Acridine Orange staining showed that apoptosis was triggered at a lower concentration (10µg/ml) of *N orientalis L.* compared to *C infortunatum L.* and *P monophylla*. The results show that *Nauclea orientalis L.* has higher antiproliferative activity and cell death is caused via apoptosis. It can be suggested that *Nauclea orientalis L.* has an ethno-botanical significance for anticancer activity and studies are necessary to assess further to develop a treatment for cancer.

Keywords: Anti-oxidative Potential, Apoptosis, Clerodendrum infortunatum L., Nauclea orientalis L., Paramignya monophylla

Study on delay in seeking treatment for Cutaneous Leishmaniasis among patients in selected dermatology clinics

S. A. S. C. Senanayake¹, K. K. V. N. Somaratne², D. Munidasa³ and N. D. Karunaweera¹

¹*Department of Parasitology, University of Colombo*

²*District General Hospital Hambantota, Sri Lanka*

³*District General Hospital Polonnaruwa, Sri Lanka*

Cutaneous leishmaniasis (CL) is endemic in Sri Lanka and the disease contributes to mild symptoms which do not affect individual's routine activities. Therefore patients are reluctant to seek medical advice and delay the seeking of medical advice even though active lesions cause spread of the disease. This study was carried out to determine the time lapse between occurrence of clinical symptoms and seeking treatment among CL patients attending General hospitals in Hambantota and Polonnaruwa. A total of 105 patients were interviewed using a self-administered questionnaire. The time lapses between (a) the appearance of skin lesion and the visit to primary care medical professional for advice and (b) the receipt of first medical advice to attendance at the dermatology clinic were determined under four categories (<1month, 1-2 months, 2-3 months, >3months). Majority of the patients (59/105 – 56.1%) visited a medical professional for advice after a time lapse of >3 months. Only 14/105 (13.3%) patients had visited a medical professional during 1st month of the appearance of the skin lesion. Less than half of the study group 46/105(43.8%) had attended to dermatology clinic within the 1st month after seen by the primary care medical professional. There was more than a 3 month time lapse after 1st medical advice to seek treatment from dermatology clinic among 38/105(36.1%). Patients' noncompliance with medical advice and delay in referral seems the causes for the delay. There was no significant difference between patients from two different clinics in seeking treatment for CL. There is a considerable time lapse between occurrence of clinical symptoms and receiving specific treatment. Therefore effective programs to improve the awareness of general public and the medical professionals on CL will have a positive impact in reducing this lag period with associated health benefits.

Keywords: Cutaneous leishmaniasis, symptoms, time lapse, treatment

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**Assessment of cardiovascular disease risk among medical students of
Faculty of Medicine, Colombo**

J. T. N. Senevirathne¹, A. G. M. Ojithmali¹, W. A. P. S. Wickramarachchi¹, W. A. A. M.
Weerasinghe¹, M. M. Muthuthamby¹, D. B. D. L. Samaranayaka² and V. P. Wickramasinghe¹

¹*Department of Paediatrics, University of Colombo*

²*Department of Community Medicine, University of Colombo*

Non-communicable diseases are becoming an emerging health problem irrespective of the age all over the world. Cardiovascular diseases have been identified as the leading cause of morbidity and mortality among adults globally. The objective of the present study was to determine the prevalence of cardiovascular disease risk among medical students of Faculty of Medicine, University of Colombo. A cross sectional study was carried out among medical students (volunteered from 5 batches) of Faculty of Medicine, Colombo using a questionnaire (to assess diet, physical activity, consumption of alcohol and smoking), anthropometric measurements (height, weight, waist circumference, hip circumference, BMI, percentage fat mass, blood pressure) and laboratory investigations (Fasting Blood Glucose, Oral Glucose Tolerance Test, Lipid profile). Chi square test and logistic regression were used to assess factors associated with risk factors. 188 students were studied (males=66). Mean (SD) age was 23.1yrs \pm 1.71 and mean BMI 22.01 kg/m² \pm 3.4. Prevalence of overweight (95%CI) was 35.1% (28.3-41.9), obesity 5.9% (2.5-9.3) and central obesity 16.9% (11.5-22.3). 25.8% of males & 46.7% of females had abnormal percentage body fat. Impaired fasting glucose (IFG) and impaired glucose tolerance (IGT) were seen in 13.8% and 1.1% respectively. 25.4%, 12.2%, 31.6%, 5.3% had hypercholesterolemia, High LDL, low HDL and hypertriglyceridemia respectively. Consumption of alcohol was seen in 9%, low physical activity in 39.5%, sedentary life in 58%, low consumption of vegetables in 83.4% & low consumption of fruits in 86% (81-91). When compared to females, males had higher rate of overweight/obesity (p=0.02), central obesity (W/Ht ratio)(p=0.04), hypertriglyceridemia(p=0.06) while females having higher rate of abnormal fat mass(p=0.005) and high W/Hip ratio(p=0.000). Low consumption of vegetables was significantly associated with low HDL levels (p=0.016). Medical students (young adults) have high prevalence of cardiovascular disease risk with metabolic risk, highlighting the importance of routine screening, proper health education & practice as they are the future doctors who should be a role model to the society.

Keywords: Medical students, cardiovascular risk, obesity

Gender difference in insulin resistance and metabolic complications in a group of overweight/obese Sri Lankan children

J. T. N. Senevirathne¹, S. N. Seneviratne¹, D. B. D. L. Samaranayaka² and V. P. Wickramasinghe¹

¹*Department of Paediatrics, University of Colombo*

²*Department of Community Medicine, University of Colombo*

Gender based differences in obesity related metabolic complications has been recognized in some ethnicities worldwide. There is a rising epidemic of childhood obesity in Sri Lanka, but differences of metabolic complications between males and females have not been established. The health of the female child is gaining increased importance according to the life cycle approach to prevention of non-communicable diseases. The objective of the present study was to determine any gender based differences with insulin resistance and metabolic complications among overweight/obese Sri Lankan children. Overweight and obese children aged 5-15 years, followed up at the Obesity clinic, Lady Ridgeway Hospital, Colombo were screened for metabolic complications defined as follows; impaired glucose tolerance (IGT) as 2-h OGTT 140–199 mg/dl, dyslipidemia; HDL <40mg/dl, triglycerides \geq 150mg/dl and insulin resistance as fasting insulin >17mIU/ml, 2h insulin >150mIU/ml and HOMA-IR. Rate of insulin resistance, dyslipidemia and IGT was compared between girls & boys using chi square test. Logistic regression was used to adjust for the effect of age, birth weight and BMI Z score (BMIZ). 197 children were studied (boys=132, girls=65) with no statistically significant difference in mean age, birth weight, BMIZ between girls and boys. Compared to boys, girls had higher rates of insulin resistance (elevated fasting insulin 43.5% vs 18.2%, $p=0.001$), elevated 2h insulin (37% vs 14.9%, $p=0.003$), high HOMA-IR (69.6% vs 37.6%, $p<0.001$), IGT (17.3% vs 5.5%, $p=0.032$) and dyslipidemia (low HDL 63.3% vs 43.9%, $p=0.025$, hypertriglyceridemia 28.6% vs 13%, $p=0.018$). These differences remained even after adjusting for BMIZ, age and birthweight. Among overweight/ obese Sri Lankan children, girls have a higher prevalence insulin resistance, dyslipidemia and impaired glucose tolerance. The underlying reasons need to be explored. This finding is of considerable importance, given that the obesity related metabolic complications in young females will also affect the next generation.

Keywords: Childhood obesity, insulin resistance, gender

**Can we grant biowaiver for immediate release solid oral dosage forms of amoxicillin?:
results of a literature review**

D. Thambavita¹, P. Galappatthy¹, U. Mannapperuma¹, R. L. Jayakody¹, R Cristofolletti² and J. Dressman³

¹*Department of Pharmacology and Pharmacy, University of Colombo*

²*Brazilian Health Surveillance Agency (Anvisa), Division of Bioequivalence, Brazil*

³*Institute of Pharmaceutical Technology, Johann Wolfgang Goethe University, Germany*

Waiving *in vivo* bioequivalence (BE) requirement for generic drugs is applied by Drug Regulatory Authorities based on Biopharmaceutics Classification System (BCS). We reviewed literature relevant to a biowaiver (BW) for amoxicillin trihydrate. The objective of the study was to review possibility of granting BW for immediate release (IR) solid oral dosage forms of amoxicillin trihydrate. Literature published in PubMed, Google Scholar and international pharmacopoeias until May 2016 were reviewed. Solubility and permeability characteristics according to BCS, therapeutic uses, therapeutic index, pharmacokinetics, excipient interactions, reported bioequivalence/bioavailability (BE/BA) problems, dissolution, bioequivalence and BW studies were considered. In literature, amoxicillin is categorized into BCS classes I, III and IV based on reported different solubility and permeability values at different doses. IR oral dosage forms containing 125mg to 3g are available. Amoxicillin shows pH dependent aqueous solubility. Doses of 1000mg or less showed high dose: solubility ratio (0.73) at physiological pH conditions while doses >1000mg had low dose: solubility (>1). Bioavailability is >85% for doses <1000mg but is 45-70% at doses >1000mg. These indicate that doses up to 1000mg belong to BCS class I with high solubility and permeability while doses >1000mg belong to BCS class IV with low solubility and permeability. Different dissolution and BW studies using different methods and comparators are reported giving varying results. Only 4 out of 36 products tested in four BCS-based dissolution studies met dissolution criteria for BW studies. There was no effect of excipient on the absorption of amoxicillin in the quantities used in formulations. Biowaiver can be considered for amoxicillin trihydrate products containing up to 1000mg, provided (a) only recommended excipient are used (b) BW study is performed according to the WHO/FDA/EMA methods using innovator as the comparator and (c) results comply with 'very rapidly' or 'similarly rapidly' dissolution criteria. Products containing >1000mg or other excipient should be subjected to an *in vivo* BE study.

Keywords: Amoxicillin trihydrate, biowaiver, Biopharmaceutics Classification System (BCS), permeability, solubility

Transfection of HepG2 cells with pmirGLO reporter: optimization of dual luciferase reporter assay

S. Vaihunthan¹, S. S. B. P. Soysa¹, V. H. W. Dissanayake² and S. M. T. Jayasena¹

¹*Department of Biochemistry & Molecular Biology, University of Colombo*

²*Human Genetics Unit, University of Colombo*

Dual-luciferase reporter assays provide a platform for testing microRNA (miRNA) targets as well as antisense oligonucleotides against pathologically elevated miRNAs. The pmirGLO reporter vector contains two bioluminescence-active genes. miRNA targets can be cloned to the 3' end of firefly luciferase gene. The *Renilla* luciferase gene provides baseline value for normalizing assays. This study was carried out to transfect HepG2 cells with pmirGLO and optimize bio-luminescence assays as a primary step for testing of antisense molecules against miR-107, elevated in hepatic steatosis. The pmirGLO reporter was transformed into *E.coli* JM109 in which it was maintained. Plasmid DNA was purified from this culture as required. HepG2 cells were cultured at 37°C to 80% confluency and transferred to 24-well plates (2×10⁵ cells/well) for 24hr. Transfection of pmirGLO was carried out using Viafect (Promega) at 37°C for 24hr followed by cell lysis and dual-luciferase assays. Initially, the amount of DNA transfected was optimized by varying from zero (control) to 500ng. The ratio of transfection reagent to amount of DNA was varied 2:1 to 4:1. Then the concentration of the DNA sample used in transfection was varied from 25ng/μl to 200ng/μl when transfecting 500ng. Cell viability was assessed by MTT assay. Transfection of 500ng DNA yielded the maximum luminescence values. The bioluminescence values increased with the increasing ratio of transfection reagent: DNA, despite decreasing cell viability. 4:1 ratio 400-fold higher luciferase units signal intensity than controls, while 3:1 and 2:1 ratios gave 300-fold and 38-fold increases respectively. This indicates that 4:1 ratio achieved the highest efficiency of transfection. Additionally, increasing the concentration of the DNA sample used for transfection improved luminescence readings. Transfection of reporter plasmid into HepG2 cells and dual luciferase reporter assays have been established and optimized. The effect of plasmid DNA concentration on transfection was an unexpected result.

Keywords: HepG2, bioluminescence, dual-luciferase, microRNA, antisense

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Cloning of DNA polymerase gene from thermophilic *Bacillus licheniformis* into an *E.coli* expression system

W. M. J. M. B. Wanigasekara, N. Palpola, S. M. T. Jayasena, A. W. C. P. Witharana, C. P. D.

W. Mathew and W. S. S. Wijesundera

Department of Biochemistry & Molecular Biology, University of Colombo

DNA polymerase (DNAP), catalyze template directed synthesis of DNA from nucleotide triphosphate. Thermostable DNA polymerase-1(DNAP-1) has been a common reagent in molecular biology because of its use in DNA amplification and DNA sequencing by PCR. DNAP-1 produced in moderate thermophiles such as *Bacillus* species may not be suitable for PCR, However, moderately thermophilic DNAP from *Bacillus* has been used in molecular biology techniques such as loop mediated isothermal amplification. It is a low cost alternative to detect certain infectious diseases such as tuberculosis, malaria, sleeping sickness and can be applied in low and middle income countries. The objective of the study was isolation and cloning of DNAP-1 gene from native thermophilic bacterium, *Bacillus licheniformis* and over-expression by using expression host *E. coli* BL21 (DE3) pLysS. A gram +ve endospore forming thermophilic bacterium was isolated from soil near the hot water springs at nelumwewa, Polonnaruwa. The identification of *Bacillus licheniformis* was carried out using morphological tests and 16s r.RNA gene sequence analysis. Initially the gene was cloned into pGEMT-easy vector and transformed into *E. coli* JM109 followed by sequence confirmation and protein blast analysis by NCBI. Thereafter the DNAP-1 gene re-cloned into PET28a+ vector and transformed into *E. coli* BL21 (DE3) pLysS expression host. Recombinant *E. coli* clones were confirmed by colony PCR. Sequence analysis confirmed the presence of the complete gene (2640bp) including start and stop codons. The complete protein sequence consists of 879 amino acids. Protein blast (NCBI) of the amino acid sequence obtained from forward sequence, detected the presence of 5'-3' exonuclease domain (PIN-53EXO). An expression system for recombinant thermostable DNAP-1 has been constructed in *E.coli* and assays for enzyme expression, his-tag purification, and kinetic assays are underway.

Keywords: DNA polymerase-1, Bacillus licheniformis, recombinant expression

The role of macrophages in host protection in infections with *Leishmania donovani*

M. W. A. H. D. Wijesooriya¹, T. N. Samaranayake¹, K. K. V. N. Somaratne² and
N. D. Karunaweera¹

¹*Department of Parasitology, University of Colombo*

²*District General Hospital, Hambantota*

Sri Lanka is endemic for localised cutaneous leishmaniasis (LCL) caused by *Leishmania donovani*; a usually a visceralizing species. The clinical outcome of infection is determined primarily by the infecting species and the immune response of the host. We hypothesized that distinct alterations in the innate immune response contributed to the outcome of infection observed in Sri Lanka. Macrophages are one of the most important cell types of the innate immune system, which play a decisive role in the interaction between the parasites and the host's immune system. The aim of this study was to characterize the production of selected cytokines and Nitric Oxide (NO) by macrophages; the cells which allow the parasite to multiply but can also, kill the parasite. Peripheral blood mono nuclear cell (PBMC) derived macrophages from newly diagnosed LCL patients (n=20) and healthy endemic (n=10) & non-endemic controls (n=10) were stimulated with *L. donovani* antigen (50µg/ml) *in vitro*. At the 24, 48 and 72 time points, the production of IL-10, TNF α , TGF β and Nitric Oxide (NO) in the cell culture supernatant were measured by ELISA and Griess reaction. The three groups were compared using the Kruskal-Wallis test with the Dunn's multiple comparison test. IL10 level of patients was significantly higher than the endemic control group at 48h and at 72h than both the control groups. TNF α production of the CL group was significantly higher than both the control groups at 48 h and 72h. TGF β and NO levels were significantly higher than the non-endemic controls at all the time points. These data suggest that IL-10, TNF α , TGF β and NO may play a role in determining disease outcome in LCL due to *Leishmania donovani*.

Keywords: Leishmania, macrophages

RNA degradation exosome in *Archeon: Sulfolobus solfataricus*

C. Witharana

Department of Biochemistry and Molecular Biology, Universtiy of Colombo

RNA processing and degradation are essential processes in the cell. The exosome of *S. solfataricus* is able to degrade and polyadenylate RNA and is localized at the periphery of the cell. The in vitro reconstituted *S. solfolobus* exosome is built of a hexameric ring, containing Rrp41 (the catalytically active subunit) and Rrp42 to which a trimeric cap of RNA binding proteins Rrp4 or Csl4 is bound. The objective of the present study was to characterize the archeal exosome and thereby find out the evolutionary links. Sucrose density gradients and co-immuno precipitations were done to isolate exosomes from the cell extracts. Characterization of the exosomes were done by radioactive RNA assays. The exosomes were formulated in vitro by cloning the genes and synthesizing the proteins and visualized by Single Particle Electron Microscopy. It was found that the soluble and insoluble exosomes have different compositions. The soluble exosome contains less DnaG/Csl4 than the insoluble exosome which co-sediments with ribosomal subunits in sucrose density gradients. The soluble, insoluble and the reconstituted exosomes were active. Csl4 was co-immunoprecipitated with the exosome using anti-Rrp4 antibodies and vice versa. The deletion of the KH domain decreased the degradation activity, but the poly(A) specificity was retained. For the first time, the native DnaG which was directly isolated from *S. solfataricus* was observed as a dimer with 2 lobes and a central pore. The presence of the heteromeric RNA binding cap probably ensures its interaction with different transcripts and probably different interaction partners. Additionally, the KH domain of the RNA binding Rrp4 protein is not responsible for the poly(A) specificity. However different compositions of the exosome in the cell and thereby the localization could apparently be a common system in prokaryotes to separate biochemical processes in cells without compartmentalization. Moreover, structure of the protein may help to solve many functions delusions.

**Faculty of Science
University of Colombo**



'Empowering Humanity through Sciences'

Message from the Dean
Faculty of Science

Professor K.R. Ranjith Mahanama



It is with great pleasure that I forward this message to the Book of Abstracts issued on the occasion of the Annual Research Symposium 2016 of the University of Colombo. This year's theme for the Faculty of Science is 'Empowering Humanity through Sciences' and it complements our degree programmes designed to strengthen competent human resources in the disciplines of sciences and mathematics.

The Faculty of Science provides a foundation for intellectual and creative experiences through research, scholarship, and creative activity. As the premier science faculty in the island, we play a prominent role in the larger global community as scholars and educators, and in preparing students to become leaders in the world in which they live. We create lifelong relationships with our students and foster collaboration, promote quality, recognize excellence, and ensure the thoughtful stewardship of resources.

At this Annual Research Symposium, 47 abstracts will be presented on 14th October 2016 at the Faculty of Science research sessions, reflecting innovative research carried out by our postgraduate students under the able guidance of the proficient academic staff.

The endeavour in the preparation of abstracts and presentations is sincerely acknowledged. My gratitude is extended to the reviewers and the research committees of the Faculty and the other committees of the University for the successful completion of their assignments. On behalf of all the academic and non-academic staff of the Faculty of Science, I express my profound gratitude to the organising committee and all the participants at this Annual Research Symposium 2016, and send my very best wishes for a very rewarding and productive event.

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Growth inhibition and cytotoxicity of leaf extracts of Ceylon cinnamon (*Cinnamomum zeylanicum*) on human breast carcinoma (MCF 7) and hepatocarcinoma (HepG₂) cell lines

W. P. K. M Abeysekera,¹ G. A. S Premakumara,¹ and W. D Ratnasooriya^{2,3}

¹*Industrial Technology Institute (ITI), Baudhaloka Mawatha, Colombo 7*

²*Faculty of Allied Health Sciences, General Sir John Kotelawala Defence University*

³*Department of Zoology and Environment Sciences, University of Colombo*

Cancer is the second leading cause of mortality among various diseases worldwide. Despite advances in cancer therapies the cancer mortality rate is increasing alarmingly globally. Thus, there is an imperative need to search for novel lead molecules from natural products, preferably from plants. Ceylon cinnamon (*Cinnamomum zeylanicum* Blume), known as ‘true cinnamon,’ was used as a spice in many countries including Sri Lanka for centuries. Although bark of Ceylon cinnamon (CC) reportedly possesses diverse pharmacological activities, the leaf is scarcely investigated for biological activity with no previous reports on anti-cancer activity of leaf of CC. Therefore, we investigated the growth inhibition (GI) and cytotoxicity (CT) of leaf extracts of CC on human breast carcinoma (MCF 7) and hepatocarcinoma (HepG₂) cell lines using freeze dried 95% ethanolic and 1:1 dichloromethane:methanol (DCM:M) leaf extracts. GI and CT were evaluated using different concentrations of ethanolic and DCM:M leaf extracts on MCF 7 and HepG₂ carcinoma cell lines (25, 50, 100, 200 and 400 µg/ml; n = 4 each) using sulforhodamine-B cytotoxicity (SRB) assay. Paclitaxel served as the reference drug (0.625, 1.25, 2.5, 5 and 10 µg/ml; n = 4 each). Both ethanolic and DCM:M leaf extracts showed significantly high (p<0.05) GI and CT for HepG₂ cell line compared to MCF 7 cell line. Further, the ethanolic extract had significantly high (p < 0.05) GI (HepG₂ and MCF 7: GI₅₀ 144.8 ± 1.6 and 152.9 ± 1.0 µg/ml respectively) and CT (HepG₂ and MCF 7: LC₅₀ 355.4 ± 9.4 and 651.0 ± 3.4 µg/ml respectively) compared to DCM:M extract (HepG₂ and MCF 7: GI₅₀ 197.2 ± 8.9 and 291.2 ± 4.4 µg/ml respectively; LC₅₀ 516.9 ± 26.7 and 801.2 ± 14.5 µg/ml respectively). Moreover, both extracts showed moderate GI and CT for both MCF 7 and HepG₂ carcinoma cell lines compared to the reference drug paclitaxel. In conclusion leaf of CC possesses GI and CT against human breast carcinoma (MCF 7) and hepatocarcinoma (HepG₂) cell lines.

Keywords: Ceylon cinnamon (Cinnamomum zeylanicum Blume), leaf extracts, MCF 7 and HepG₂ carcinoma cell lines, growth inhibition, cytotoxicity

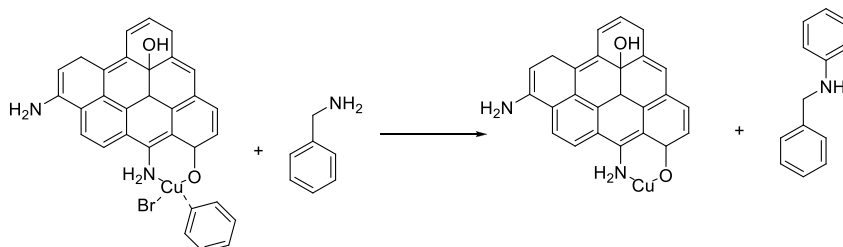
Developing a graphene-based solid phase catalyst for the Ullmann coupling of bromobenzene and benzylamine

A. M. T. S. Adhikary, D.P. Dissanayake and D. T. U. Abeytunga

Department of Chemistry, University of Colombo

The Ullmann coupling is an important and well known nucleophile aromatic substitution (S_NAr) reaction. This reaction is widely used in pharmaceutical and agrochemical industries, where homogeneous ligated Cu(I) compounds are employed as catalysts.

In the present study, a solid graphene based catalyst was developed to synthesize N-phenylbenzylamine starting from bromobenzene and benzylamine using nucleophilic aromatic substitution under modified Ullmann coupling conditions. The solid catalyst was developed by converting graphite to graphene oxide, then converting graphene oxide into aminated graphene oxide (AGO) and chelating the same with Cu(I). Graphite, graphene oxide and aminated graphene were characterized using FT-IR and XRD techniques. After the Ullmann reaction the so formed product of the reaction was separated by the column chromatography and characterized by proton NMR and IR spectroscopy.



It was observed that the order of addition of reagents has a profound effect on the product yield. For example, the addition of bromobenzene prior to benzylamine, resulted a higher percentage yield of N-phenylbenzylamine (13.0% as opposed to 3.3%). The addition of benzylamine prior to bromobenzene brings about an inhibition of the reaction as the amine groups of benzylamine can chelate Cu(I) and reduce the availability of active sites for the polarization of C-Br bond in bromobenzene.

As the active Cu(I) can be oxidized to Cu(II), the reaction was attempted under nitrogen atmosphere and an improvement (5.3% as opposed to 4.6%) in the percentage yield was observed.

Activity of aminated graphene chelated Cu(I) was also tested by packing the catalyst in to a column and by passing reactants while heating the column to obtain only 0.9% yield. However, when the catalyst was packed inside a heated U tube at 80°C and the reaction was carried out while electrolyzing using Cu electrodes, the yield improved to 5.1%. We conclude that AGO-Cu⁺ can be used as a solid phase catalyst for the above coupling reaction.

Development of a bio-feedback device based on skin response

K. Anpalagan, D. U. J. Sonnadara and H. H. E. Jayaweera

Department of Physics, University of Colombo

A bio-feedback device which can be used to identify psychological stress levels based on skin response was developed. This device inherits the signal from human skin and reveals the variation of mental stress. Since the electro-dermal activity of the skin is directly linked with the human nervous system, the conductivity of skin is measured to analyze mental stress. It is designed to help the user relax and manage stress through bio-feedback. Data used in this research were collected from twenty individuals, including male and female, who are young and healthy. Five different types of experiments were used to change their psychological stress state and the voltage on their finger tips were measured. A clear variation of skin conduction was observed between relaxed state and nervous state. At relaxed state, 15 out of 20 people showed a voltage difference around 3.4 V across the skin. The skin resistance was almost above 0.2 M Ω when they were relaxed. During the experiments, the voltage difference between the electrodes was decreased. The skin resistance has approached 85 k Ω when they were nervous. According to the data gathered, Atmel ATmega32A microcontroller was programmed and a device was developed. This device is capable of indicating emotional stress of a person in four levels and providing bio feedback. This portable and affordable device is an amalgamation of electronic technology and psychophysiology.

Factors affecting T1 accuracy and quantification of fibrosis

R.M.U.K.G.M.S. Bandara¹ and J.P. Wansapura²

¹*Department of Nuclear Science, University of Colombo*

²*Department of Physics, University of Colombo*

The study was based on simulated magnetic resonance images (MRI) created by MATLAB software. The aim of the study was to estimate the effects of signal to noise ratio (SNR) and flip-angle variations, in the determination of longitudinal relaxation time T1. Simulated MRI experiments were used to determine the optimal image pixel sampling method to be used in the calculation of T1. Five sampling methods were used to determine mean values of MR image: (1) Dividing the image into four equal blocks, (2) Dividing the image in the direction of flip angle variation, (3) Dividing the image in the direction perpendicular to the flip angle variation, (4) Taking mean pixel value of whole image, and (5) considering the values pixels by pixel. Calculation of T1 using the whole image was identified as the most effective approach, with a minimum deviation of 2.3 ms from the reference value 1000 ms. Minimum and maximum error percentages for flip-angle range 160° to 180° and SNR = 20 were 0.283% (whole image) and 3.288% (in the direction of flip angle variation) respectively. As expected, results show that the minimum deviations occur in narrowed flip angle regions towards 180 degrees and with high SNR values. T1 based extracellular volume (ECV) fraction error was found to be 21.78% for the whole image averaging method and 36.39% for four equal slice method at the lowest SNR (2.5) value.

Keywords: MRI, T1 calculation, fibrosis

Simulation of two-wheeled self-balancing autonomous robot

R. A. D. D. Dharmasiri^{1,2} and M. K. Jayananda²

¹ *Department of Physics, University of Sri Jayewardenepura*

² *Department of Physics, University of Colombo*

A two-wheeled self-balancing robot, which is based on an inverted pendulum system, is dynamically stable and statically unstable. In the recent years two-wheeled self-balancing robots have become popular mainly due to the success of the two-wheeled, self-balancing, battery-powered electric vehicle called Segway. In this work, using dynamical systems theory, a mathematical model was developed for a two-wheel self-balancing system and its stability was studied by using a mathematical simulation environment. In this simulation, the robot was controlled by a PID controller designed via root-locus design. The PID controller was designed by adding two zeros and a pole at the origin to the loop gain and by determining the parameter K via root-locus analysis. It was found that closed-loop poles enter the open left-half-plane for K values greater than 15. At a damping ratio equal to 1, we obtain the gain $K = 20$. Then using the K value K_p , K_i and K_d parameters were calculated. By applying an impulse response to the system it was found that, the system can reach to a dynamical balance within a period less than 1.2 seconds. Then a PID controller was designed using the above K_p , K_i and K_d values, to generate a counterbalancing torque to maintain the two-wheel robot upright. In PID controller design, it was found that the system was able to reach dynamic balance within about 3 seconds even when it is given a $\theta = \pi/2$ rad disturbance angle. But at this disturbance angle it was found that motor voltage (V_a) at time 0 is about 311 V which is not possible to be applied to a 12 V DC motor. The maximum disturbance angle that could be applied to two-wheeled robot was found to be $\theta = 3^\circ$, while the motor voltage at time 0 remained below 12 V. The simulations also showed that the vehicle was able to return to stability with the same set of PID parameters even when the mass was changed over a significantly large range.

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**Dissolution resistant hydroxyapatite nano-particle coatings on gold surfaces:
A study through nanogravimetric method**

N.L. Fernando,¹ N. Kottegoda,² J. K. D. S. Jayanetti,¹ V. Karunaratne,³ D. R. Jayasundara¹

¹*Department of Physics, University of Colombo*

²*Department of Chemistry, University of Sri Jayewardenepura*

³*Department of Chemistry, University of Peradeniya*

Functional coatings have increasingly become popular in recent times in the design and development of smart surfaces and have also become an economical and a practical method for overcoming compatible issues at interface. Hydroxyapatite (HA) and its nano-derivatives have been widely used in medical applications, such as coatings on metal implants, dental and drug delivery. It is the main mineral component of bone and show excellent biocompatibility, slow biodegradability, osteoconductivity and mechanical properties.

Among different methods employed for the fabrication of HA, electrophoretic deposition (EPD) and spin coating are effective techniques that are currently being used for coating. In most cases these depositions are made on gold substrates. In order to detect the thickness of coatings the quartz crystal microbalance (QCM) is used as it is one of the best *in situ* and real time monitoring methods with the ability of detecting mass changes with nanogram resolution. In this research the fabrication of HA using EPD and spin coating technique is reported and the stability of the quartz crystal coated with HA was monitored. Change in the frequency which corresponds to the change in mass, is obtained by the QCM. Therefore by monitoring the change in frequency, the thickness of the coating was determined. The EPD technique gave thicker coatings when more current is drawn out, whereas the spin coating technique gave thinner coatings, which varied based on the concentration of the initial solution. It was observed that the increase in the thickness of the coating, leads to lesser stable coatings. This indicates that the dissolution resistant properties of HA nano-particle coatings on gold surfaces increase with the decrease of the coating thickness. Even within the two techniques, it was observed that it is possible to obtain a thin stable coating by using the spin coating technique, and a thick stable coating, by using the EPD technique.

Keywords: Hydroxyapatite, quartz crystal microbalance, electrophoretic deposition, spin coating

Financial assistance given by the National Research Council (NRC Grant: 15 004) is acknowledged.

Hexavalent chromium induced superoxide production in the earthworm (*Eudrilus eugeniae*) and Asian common toad (*Duttaphrynus melanostictus*) in vitro

V. A. K. Fernando,¹ S. Handunnetti,² I. C. Perera,¹ C. D. Dangalle,¹ S. Premawansa,¹ and
M. R. Wijesinghe¹

¹ *Department of Zoology and Environment Sciences, University of Colombo.*

² *Institute of Biochemistry, Molecular Biology and Biotechnology, University of Colombo*

In an aquatic medium, the heavy metal contaminant chromium generally occurs as either a trivalent (Cr(III)) or a hexavalent (Cr(VI)) form, the latter being a more potent toxicant, due to its ability to readily cross the cell membrane. The entry of Cr(VI) into the cell and its subsequent reduction to form Cr(III) causes the production of Reactive Oxygen Species (ROS). Apoptosis of cells due to Cr(VI) is mainly caused by the superoxide anion. The present study investigated superoxide production in cells of an invertebrate, the earthworm (*Eudriluseugeniae*), and a vertebrate, the Asian common toad (*Duttaphrynusmelanostictus*) exposed to different concentrations of Cr(VI) (0.0015, 0.003, 0.015, 0.03, 0.15 mg/ L), using the NBT Assay. Earthworm coelomocytes and toad erythrocytes were suspended in RPMI and incubated for 1hr with 5% CO₂ in microcentrifuge tubes. The suspension was centrifuged and the NBT solution and relevant Cr(VI) concentrations were added to the pellet, and incubated for ½ hr as above. The cells were washed with PBS, fixed with 70% methanol and air dried, 2M KOH and DMSO were added to each tube to dissolve the formazan produced. The supernatants were added into a well plate to measure OD₆₂₀.

The study shows that levels of ROS produced were greater in Cr(VI) treated earthworm coelomocytes and toad erythrocytes ($P < 0.001$), than that in the respective unexposed cells. Concentrations of superoxide produced in both coelomocytes and erythrocytes enhanced progressively with increasing Cr(VI) concentrations, exhibiting positive dose dependent trends, although only significant for the erythrocytes ($r = 0.92$, $P < 0.05$). These observations suggest that excessive ROS production could be responsible for the elicited toxic effects in Cr(VI) exposed organisms. Although shown previously for other taxa, this study is the first to demonstrate Cr induced oxidative stress in earthworm coelomocytes and amphibian erythrocytes.

Keywords: Chromium, coelomocytes, erythrocytes, reactive oxygen species, superoxide

Financial assistance from World Bank (HETC/CMB/QIGW3/SCI) and University of Colombo (AP/3/2/2013/RG/Sc/06) is acknowledged.

Development of non-destructive testing methods for adhesively bonded textile structures

W.D.R. Fernando,^{1,3} D.A. Tantrigoda,² S.R.D Rosa³ and D.R Jayasundara³

¹ *Bodyline (PVT) Ltd, Ratnapura Road, Horana*

² *50, Wijerama Lane, Gangodawila, Nugegoda.*

³ *Department of Physics, University of Colombo*

Today the apparel industry is increasingly adopting bonding technology into their manufacturing processes where layers of fabric materials are bonded together with adhesives instead of sewing. At present in the industry, the bonding strength of the seams are tested adopting destructive methodologies such as peel strength, seam strength and wash test, which will also contribute towards additional processing of garments. Therefore this research will look into suitable non-destructive methodologies that would provide information to develop a criterion that would eliminate the need for destructive measurements for bond quality testing. After reviewing methods that are used for similar purposes in other industries, it was identified that passive infra red thermography is most suitable for this purpose, especially in view of its capability of detecting subsurface features such as defects, and surface anomalies, through observed temperature differences.

In this work passive thermography is used, where a thermal image of the bonded area is obtained using a high spatial and temperature resolution IR camera. The images were processed to obtain spatial temperature variations and a parameter identified as “in-homogeneity factor” was calculated for the imaged area. Analysis of the preliminary results of the experiments carried out on similarly bonded constructions indicated a possible correlation of the in-homogeneity factor to the bond strengths obtained through destructive methods.

A method based on Fourier transforms is also attempted to analyze the imaged area to identify possible spectral features that can be correlated with the bond strength measured via destructive methods. Additionally, changes in the in-homogeneity factor with bonding process parameters is looked at to identify optimal parameter value combination that would satisfy industry set standards for bonding strength.

Keywords: Textile, bonding, infrared, thermography, non-destructive

**Comparison of two beam parameter of Elekta and Varian linear accelerators at
National Cancer Institute, Maharagama**

A. Gabchia,¹ K.V.A.W. Kumara² and P. Mahawatte¹

¹ *Department of Nuclear Science, University of Colombo*

² *National Cancer Institute, Maharagama*

In radiotherapy practice, for various practical reasons, it is important to know whether two or more linear accelerators (linacs) are dosimetrically matched and whether the patient's treatment can be shifted from onelinac to another without reducing the treatment quality. This research presents the data from the dosimetric comparison of the two linacs, Varian (Clinacs 2300C/D) and Elekta(Synergy) at the National Cancer Institute (NCI), Department of Radiotherapy, Maharagama, Sri Lanka.

Two important beam parameters, beam flatness and beam symmetry for 6 MV and 15 MV energy x ray beams generated from the two accelerators were measured using the IBA Blue phantom 2, OmniPro-Accept software and two cylindrical ionization chambers.

The results from the comparison of the beam profile curves show that the flatness percentage differences were smaller than 2.5% and within the acceptable range of ICRU recommendation for both accelerators for all field sizes. For Elekta accelerator the symmetry is also within the range recommended by the ICRU for both energies except for the field size 10x10 cm² at 6 MV. However the symmetry is out of the acceptable range recommended by ICRU for all field sizes for both energies for Varian accelerator.

This suggests that since the symmetry is out of the recommended range for the Varian accelerator the patient cannot be transferred from the Elekta machine to Varian machine without recalculating the treatment plan.

GeV gamma-ray flux variability of the BL Lacertae object

K.L.I. Gunawardhana¹, K.P.S.C. Jayaratne¹, A.U. Abeysekara² and M. Herath¹

¹*Department of Physics, University of Colombo.*

²*Department of Physics and Astronomy, University of Utah, USA*

Blazars are a subclass of Active Galactic Nuclei that has relativistic jets pointing along the Earth. Blazars are bright point sources of Gamma-Rays. They have been observed in a wide wavelength band, extending from Radio to TeV energies. Blazar flux at all wavelengths is known to have highly variable flux. The variability timescale of the flux is a key measurement to identify the location and the size of emission zones. The BL Lacertae object (also known as 1ES 2200+420, TeV J2202+422 or 3FGL J2202.7+4217) is an example of one such blazar. It is hosted in an elliptical galaxy located at a redshift of $z = 0.069$.

The long term GeV Gamma-ray flux variability of the BL Lacertae object from January 2013 to January 2016 has been studied using Fermi-Large Area Telescope (Fermi-LAT), which is the paramount scientific instrument on the Fermi Gamma ray Space Telescope Spacecraft. The measured average flux in the energy range 1-200 GeV is $1.88 \pm 0.30 \times 10^{-8} \text{cts cm}^{-2} \text{s}^{-1}$. The measured highest flux is $5.36 \pm 0.58 \times 10^{-8} \text{cts cm}^{-2} \text{s}^{-1}$ on January 2016 and lowest flux is $2.42 \pm 1.48 \times 10^{-9} \text{cts cm}^{-2} \text{s}^{-1}$ on August 2014. The monthly binned light curve has been fitted to a constant flux. The best fit to a constant flux has 16.7 chi-square per degree of freedom, and 89.18% data points are inconsistent with the constant flux. The Mean Fractional Variation (MVF) of the light curve is 0.65. The reduced chi-square greater than one (16.7) for a constant flux, inconsistency of majority of data points with the constant flux, and larger MVF are strong evidences to conclude that the BL Lacertae object has a GeV flux that is variable in the monthly scale.

Keywords: Blazars, flux, gamma-rays, light curve, variation

Quantification of diastolic dysfunction and dyssynchrony in sickle cell disease by MRI tagging

H.M.S.K.Herath¹ and J.P. Wansapura²

¹*Department of Nuclear Science, University of Colombo*

²*Department of Physics, University of Colombo*

We hypothesized that sickle cell disease is associated with left ventricular diastolic dysfunction. The cardiac function of Wild Type (WT, n= 18) and Sickle Cell Disease (SCD, n=21) mice were studied using Magnetic Resonance Imaging (MRI) at Cincinnati Children's Hospital, Cincinnati, Ohio, USA. The image processing and data analyzing was performed at Department of Physics, University of Colombo. We used the tagged MRI data to track the Left Ventricular (LV) motion using harmonic phase (HARP) algorithm. LV segment wise strain versus time curves were generated for each mouse. Diastolic dysfunction was quantified by diastolic relaxation rate (DRR). The cardiac dyssynchrony was quantified by cross correlation delay (XCD) of the left ventricular strain curves. Dependency of sickle cell disease on gender and age was also assessed.

We found that the DRR was higher in SCD (0.23 ± 0.02 strain % / ms) than that of wild type (0.19 ± 0.01 strain % / ms). The sole reason for DRR to be higher was found to be more energetic contraction of the heart which was proved by higher peak mid-wall circumferential strain (Ecc) values (16.90 ± 0.52 strain %) for SCD models compared to wild type models (15.07 ± 0.82 strain %). There was no significant correlation between SCD and gender of mice. Diastolic Dysfunction is prominent in older age than in younger age. XCD for SCD models (6.43 ± 1.96 ms) was found to be higher than that of wild type (2.22 ± 0.61 ms). Our results show that sickle cell hearts are dyssynchronous.

While disease in mouse models do not correlate exactly to humans, it is plausible that human sickle cell disease is presented with dyssynchronous hearts. XCD, derived from strain curves of tagged MRI is an efficient tool to quantify dyssynchrony and can be easily used in patients with sickle cell disease.

Keywords: Sickle cell disease, tagging magnetic resonance imaging, mouse models, diastolic dysfunction, cardiac dyssynchrony

The highly variable activity of the Blazar 1ES 1959+650, and its implications towards understanding the physics of AGN's

M.V.Y. Herath,¹ U. Abeysekara² and K.P.S.C.Jayaratne¹

¹*Department of Physics, University of Colombo*

²*Department of Physics and Astronomy, University of Utah, USA*

Blazars are a class of Active Galactic Nuclei (AGN) that exhibit variable flux states across the electromagnetic spectrum, from radio to TeV. Current measurements show that the MeV to GeV flux of a blazar could have a variability time scale as small as few hours or as long as several months. This project summarizes the results of an investigation into the variability of the blazar 1ES 1959+650, which is at a redshift of $z=0.047$. Since mid-2014, this blazar has been of particular interest due to the sudden high activity displayed at high energy wavebands (100 MeV – 300 GeV). The data was obtained from the Fermi-LAT archival database, and the analysis was carried out using the Pass 8 Fermi Science tools package. The processed data were then used to make lightcurves of the target blazar from January 2012 to March 2016. The lightcurves, which were binned at time intervals of 3 days and 5 days, showed strong variation between bins. The greatest variation was seen at the bins corresponding to data collected after January 2014, by which point the flux was radiating at an average luminosity much higher than that of the timeframe prior to 2014. The lightcurve peaks did not reach significance higher than 3.7 sigma with respect to the lightcurve average. This short term variability is an indicator of a powerful astrophysical process driving the increase in luminosity over the past 2 years.

Keywords: Active galactic nuclei, variability, blazars, gamma rays

Quadcopter navigation with a fuzzy logic controller

G.D. Illeperuma¹ and D.U.J. Sonnadara²

¹ *Department of Physics, Open University of Sri Lanka*

² *Department of Physics, University of Colombo*

Honey bees use optical flow to avoid obstacles. This is more efficient than current computer vision based obstacle avoidance systems. In this research, computer simulation was used to replicate the same to navigate a Quadcopter. The simulation platform was implemented using VRML and Simulink. Video scenes captured from the virtual world were used to calculate the optical flow by the Horn-Schunck algorithm. Average values of optical flow vectors for the left, right and middle regions of the video scenes were used as inputs in the control program.

The control program was developed using fuzzy logic. Fuzzy rules instruct to move away from the direction of high optical flow and to slow down if the optical flow in all regions is high. In the simulation, the Quadcopter successfully navigated through the obstacle-filled environment. It managed to slow down when facing narrow openings and did not overshoot at tight turns.

The optical flow of the ground scene was kept at zero for hovering. When the initial velocity was below 25 ms^{-1} , the Quadcopter was able to stabilize and hover its position under 1 second. In cruising, the altitude and optical flow were kept constant. When cruising above 10 m with a speed above 5 ms^{-1} , the error in the deviation from the set value was less than 0.1 ms^{-1} . Therefore, it was concluded that optical flow coupled with a fuzzy logic controller can be used by a Quadcopter to avoid obstacles, hover and cruise.

Keywords: Obstacle avoidance, optical flow, fuzzy logic

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Application of record linkage in a repeated measurement study

I.T. Jayamanne and K.P.A. Ramanayake

Department of Statistics, University of Colombo

Record linkage is the process of matching records from different data sources from same set of entities. Data matching is important mainly in repeated measure studies where same entity is measured more than once in several time periods to acquire more information. This study is based on a census carried out in all state universities by the Higher Education for Twenty first Century (HETC) Project in 2012 to measure their employment status few days prior to convocation and a pilot survey carried out in 2015 for few randomly selected graduates from the same batch to identify the changes in employment. The main objective of this study is to match each record in the pilot survey with census data to identify the best match among all possible matches. Threshold-Based Classification method was used to classify each pair of records as a match, a non-match or a possible match. Initially both datasets were cleaned and standardized. Both datasets do not have any unique identifiers. But the variables, university, degree, class, gender, ethnicity, parents' highest education, type of area lived, type of school attended, district and AGA division are common to both datasets. University was selected as the blocking key to reduce the number of comparisons to be performed. In the record pair comparison stage, phonetic and string similarity techniques were used to normalize the data. Different weights were given according to the importance of each variable and then an index was created for each comparison. According to the objective the best match was identified among match pairs by considering the highest index. Among all records of the pilot study 20% were exactly matched with the census data. Among the rest most variables matched perfectly, except the AGA division and the type of school attended.

Keywords: Data linkage, data matching, blocking, index techniques, university graduands

**Platelet increasing activity of mature leaf concentrate of Sri Lankan wild type
Carica papaya: potential mechanisms**

C. D. Jayasinghe, W. D. Ratnasooriya and P.V. Udagama

Department of Zoology and Environment Sciences, University of Colombo

Platelet increasing activity of *Caricapapaya* leaf preparations has been extensively studied, yet the underlying molecular mechanism/s remain obscure. Thus, in the present study platelet increasing activity of the mature leaf concentrate of Sri Lankan wild type *Carica papaya* (MLCC) was investigated in terms of enhancement of thrombopoiesis and stabilization of the platelet membrane.

Hydroxyurea induced thrombocytopenic rats (N = 6/group) were orally gavaged with three doses of the MLCC [low dose (LD)-0.18, human equivalent dose (HED) - 0.36 and high dose (HD) - 0.72 ml/100 g BW] once daily for three consecutive days. On day 4 blood was collected and the plasma levels of potent thrombopoietic cytokines, thrombopoietin (TPO), and interleukin 6 (IL-6) as well as of platelet activating factor (PAF) were quantified using rat sandwich ELISA kits. IL-6 levels in bone marrow cultures treated with the MLCC were also evaluated *in vitro*. Moreover, the MLCC mediated protection against Triton x-100 induced platelet membrane damage was analyzed by evaluating the lactate dehydrogenase (LDH) leakage *in vitro*. Plasma level of TPO and PAF levels were significantly increased in rats treated with hydroxyurea compared with the normal rats ($p < 0.05$). However, both TPO and PAF levels in thrombocytopenic rats reduced when treated with LD, HED and HD of the MLCC ($p < 0.05$). IL-6 levels were comparable between the MLCC treated and non-treated thrombocytopenic rats ($p > 0.05$). Mature LCC at 31.25, 62.5 and 125 $\mu\text{g mL}^{-1}$ concentrations significantly enhanced the secretion of IL-6 from rat bone marrow cell cultures ($p < 0.05$).

Moreover, pre incubation of platelets with the MLCC at 1000, 500, 250 and 125 $\mu\text{g mL}^{-1}$ significantly inhibited LDH leakage from platelets and provided protection against chemically induced membrane damage ($p < 0.05$). *In toto*, the present study established that the MLCC may increase the platelet counts by stimulating thrombopoiesis in the bone marrow via modulating cytokines and by inhibiting the peripheral platelet destruction via stabilizing the platelet membrane.

Keywords: Mature leaf concentrate, Carica papaya, platelets, thrombopoietic, Interleukin 6, platelet activating factor

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Nano-cubic cuprous oxide thin films for LP gas sensing applications

J.L.K. Jayasingha,¹ K.M.D.C. Jayathilaka,² M.S. Gunewardene,¹ D.P. Dissanayake³ and

J.K.D.S. Jayanetti¹

¹ *Department of Physics, University of Colombo*

² *Department of Physics, University of Kelaniya,*

³ *Department of Chemistry, University of Colombo*

Metal oxide semiconducting materials have been extensively utilized for gas sensing due to material stability, enhanced sensitivity and simplicity of fabrication. In this work we report the enhanced Liquefied Petroleum (LP) gas sensing properties of template assisted electrodeposited *n*-type nano-cubic Cu₂O thin films deposited on Ti substrates. The films were fabricated by electrodeposition in an acetate bath containing cupric acetate and sodium acetate under potentiostatic conditions. The pH of the electrolytic bath was adjusted using NaOH. SEM measurements revealed nano-cubic surface morphology of the films having grain sizes in the range of ~150-300 nm. Spectral response measurements of these films also showed improved photo-current response and confirmed the conductivity types of the films. XRD measurements were consistent with single phase polycrystalline Cu₂O structures. Nano-cubic Cu₂O films exhibited two-fold increase in the maximum sensor response observed at 180°C compared to microcrystalline *n*-type Cu₂O thin films when the films were exposed to LP gas of 2 vol. % concentration in dry air. This improvement is attributed mainly to the increased film surface area associated with nano-cubic Cu₂O films. The sensor showed good response and recovery characteristics during many repeated LP gas ON/OFF cycles in the tested range of temperatures from 100°C to 250°C.

Keywords: Cuprous oxide, electrodeposition, photo-current, sensor response, liquefied petroleum gas

**Neuro-endocrine and reproductive toxic effects of heavy metal exposure in the
Indian green frog, *Euphlyctis hexadactylus***

U.A. Jayawardena, D.D. Wickramasinghe, W.D. Ratnasooriya and P.V. Udagama

Department of Zoology and Environment Sciences, University of Colombo

Exposure to xenobiotic neuro-endocrine disruptors is identified as a potential cause of amphibian decline. The present study evaluated the effects of previously reported heavy metal contaminants (Cd, Cr, Cu, Pb, Zn; ~5ppm) in a polluted urban wetland, the Bellanwila Attidiya Sanctuary (BAS), on the neuro-endocrinal and reproductive toxicological performances of adult *Euphlyctis hexadactylus*. The same metal mixture in the same concentration was used for laboratory exposure of the adult frogs. Comparisons were drawn with counterparts in a pristine reference site, the Labugama reservoir catchment area. Biomarkers for neurotoxicity (acetylcholinesterase (AChE), Na⁺, Ca²⁺, alkaline and acid phosphatases in the frog brain), endocrine toxicity (thyroxine and cortisol) and reproductive toxicity (fecundity and estradiol production) were evaluated by following standard protocols of commercial kits.

The average AChE production of *E. hexadactylus* showed no significant variations ($p > 0.05$, ANOVA) among test groups ($n = 15/\text{group}$) though it decreased with metal exposure. Sodium ion concentration significantly increased in metal exposed frogs suggesting excitotoxic effects of metal ions in nerve tissue ($p < 0.05$). The dual phosphatase, as indicators of general cytotoxic effects, showed significant alterations ($p < 0.05$), suggesting possible cellular damage caused by metal toxicity. Significantly elevated thyroxine and cortisol levels with metal exposure may express the endocrine disruptive effect of heavy metals. Enhanced thyroxine concentration may possibly affect *E. hexadactylus* in both adrenal and gonadal homeostasis. Both relative fecundity and estradiol production showed no significant alterations with metal exposure ($p > 0.05$). Nevertheless, skewed primary sex ratio towards females observed in the current *E. hexadactylus* population in the BAS warrants detailed population surveys.

Thus this sentinel species, *E. hexadactylus*, demonstrated neuroendocrine and plausible reproductive consequences of heavy metal contamination of the wetland ecosystem. Among the tested biomarkers, phosphatases, thyroxine and cortisol may be used as indicators for heavy metal toxicity of amphibians.

Keywords: Neuro-endocrine and reproductive toxicity, environmental sentinel, heavy metal pollution, wetland ecosystem

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Multilevel log normal survival model for dengue epidemiology In Sri Lanka

G.H.S. Karunaratna and M. R. Sooriyarachchi

Department of Statistics, University of Colombo

Dengue is a common mosquito-borne tropical disease caused by the dengue virus and has rapidly spread in many countries in recent years. According to the Epidemiological Unit of Sri Lanka, dengue was first documented in 1962 in Sri Lanka and dengue still remains as a major problem. Thus, this article focuses to explore the factors associated with the length of hospital stay of dengue patients within the period of 2006-2008 in 10 high risk districts in Sri Lanka. The clustering effects of districts will also be considered. The shared feature, given the presence of clusters or sub groups within data, is that observations within groups are related or similar to each other. Since the dominant statistical assumption of independence for such data are violated due to clustering, conventional statistical methods cannot be carried out. Multilevel modeling is the most popular choice to handle correlated data among the various methods available for analyzing such data. The data set for this study was obtained from the Epidemiology Unit, Medical Statistics Bureau, Colombo, Sri Lanka.

Clinical features of dengue fever has been divided into three phases, 0-4 days, 4-6 days and 6-10 days and named as febrile phase, critical phase and recovery phase respectively. This data set also studied each individual within 10 days of the admission, by considering the response variable, length of hospital stay as a continuous variable for the 10 selected districts. From the analysis, log normal distribution was mapped with the dengue patient's length of stay when having censoring observations. Therefore to add up the correlated structure, initially, multilevel lognormal survival model was built up for length of stay by incorporating age, ethnicity, platelet count, classification (DF, DHF2 and DHF3), WBC (White Blood Cell) and PCV (Packed Cell Count) as patient characteristics. The best model was selected using the forward selection method and the deviance statistic. The model adequacy was tested, using normal probability plots. The best model implies that age, ethnicity, classification and platelet count are associated factors for length of hospital stay for dengue patients. The age of the patient has a positive relationship, and platelet count has a negative relationship with the length of hospital stay or time to discharge.

Keywords: Multilevel, lognormal, survival, length of stay

Experimental investigation of the temperature dependency of the thermal conductivity of glass wool used in a steam generator

P. D. C. Kumara,^{1,2} M. P. S. Viraj,² H. H. E. Jayaweera,² A.M. Muzathik³ and
T. R. Ariyaratne²

¹*Institute of Technology, University of Moratuwa*

²*Centre for Instrument Development, Department of Physics, University of Colombo*

³*Faculty of Engineering, South Eastern University of Sri Lanka*

The temperature-dependent behaviour of the thermal conductivity of 25 mm thick glass wool insulation used in a steam generator has been studied experimentally by using the Newton's law of cooling and experimentally calculated convective/radiative heat transfer coefficients at fluid to solid boundaries. The experimental set up used was a cylindrical steam generator of diameter of 0.306 m and height of 1.1 m totally filled with water. The experimental setup was kept under a controlled environment which was free of wind and the ambient temperature fixed at 30 °C. Water was heated to 100 °C and allowed to be cooled for about 8 ½ hours while taking temperature measurements at the inner side of the metal surface, outer side of the metal surface (inside the glass wool layer) and outer side of the glass wool layer.

It was observed that the maximum cooling rate through the insulation is 200 W and the thermal conductivity of the insulation over the temperature range from 86°C to 100°C can be given as $\lambda(T) = a * \exp(b * T)$, where λ is thermal conductivity in $W m^{-1} K^{-1}$, T is temperature in K, $a = 2.2 \times 10^{-4}$ and $b = 0.061$. This relationship verifies the theoretically calculated behaviour.

Keywords: Thermal conductivity, glass wool, insulation, heat transfer coefficient, cooling curve

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**Numerical simulation of heat flow of a circular tube with a hemispherical cup
at the bottom of an evacuated solar collector**

K. D. N. Kumari and J. K. Wijerathna

Department of Mathematics, University of Colombo

The present study is focused on a numerical investigation of the unsteady performance of solar energy gain in a circular tube in an evacuated-tube solar collector. The heat and fluid flow is assumed to be unsteady, two-dimensional, laminar and incompressible. The velocity profile and temperature profile of the fluid particles within the tube are investigated by giving uniform heat flux 950Wm^{-2} at the upper lateral surface of the tube for a period of 15minutes. The Finite Volume Method (FVM) is used for discretization of the governing equations, since it offers high flexibility as a discretization method and due to the fact that discretization with FVM is carried out directly in the physical space without use of any transformation between the physical and computational domains. As numerical tools, the Open Foam software and the merged PISO- SIMPLE (PIMPLE) algorithm are used. The results show a low velocity profile, where the fluid particles which are near the upper lateral surface have an upward direction flow, while the fluid particles which are near the lower lateral face have a downward direction flow. Thus, there is a circular fluid flow within the tube. The temperature profile of the fluid particles within the tube shows that fluid particles at the top of the tube have a high temperature compared to those at the lower part of the tube. The highest temperature of the system is around $70\text{ }^{\circ}\text{C}$ (343K).

Keywords: Heat transfer, evacuated tube, buoyancy, driven flow, numerical study

Mass propagation of *Aspergillus* and *Penicillium*, two native potential phosphate biofertilizers

P. D. S. U. Kumari and C. M. Nanayakkara

Department of Plant Sciences, University of Colombo

Efficient phosphate solubilizing fungal (PSF) species are widely used as biofertilizers in the world. Among the PSF, *Aspergillus* and *Penicillium* species are highly recognized as potential candidates. Obtaining a maximum growth and harvesting their spores are critical factors involved in the development of a successful inoculum. The current study was aimed at finding a suitable and easily available substrate for effective mass propagation of *Aspergillus* and *Penicillium*. A total of thirteen different organic substrates consisting rice straw alone, rice straw + 1 g of broken maize, rice straw + 2 g of broken maize, rice straw + 3 g of broken maize, rice husk alone, rice husk + 1 g of broken maize, rice husk + 2 g of broken maize, rice husk + 3 g of broken maize, saw dust alone, saw dust + 1 g of broken maize, saw dust + 2 g of broken maize, saw dust + 3 g of broken maize and refuse tea alone were evaluated in this study. Three different parameters: time taken for mycelial growth, time taken for initiation of sporulation and mean spore concentration at 21 days, were measured. Five grams of each substrate placed within a glass bottle were moistened with 10 ml of distilled water and sterilized. Each bottle was inoculated with 1 ml of spore suspension of two fungi containing 1×10^7 spores/ml separately and incubated for 21 days. Three replicates were maintained for each substrate. The results were analyzed using Minitab 16.1 statistical software. For both types of fungi, mean spore concentrations at 21 days were significantly different among the substrate types ($p = 0.000$ and $p = 0.000$) and the highest significant mean spore concentrations of $3.29 \times 10^9 \pm 1.17 \times 10^8$ and $2.85 \times 10^9 \pm 4.39 \times 10^8$ spores/5 g of substrate were recorded by *Aspergillus* sp and *Penicillium* sp., respectively on refuse tea. Time taken for mycelial growth (1 day for *Aspergillus* and 2 days for *Penicillium*) and time taken for initiation of sporulation (2 days for *Aspergillus* and 3 days for *Penicillium*) of both fungi were found to be significantly low in refuse tea than other substrates (respective p values are 0.000, 0.001, 0.000 and 0.000). Hence, the study identified the ability of using refuse tea as a potential substrate in effective mass propagation of the PSF *Aspergillus* and *Penicillium*.

Keywords: Biofertilizers, *Aspergillus* sp., *Penicillium* sp., phosphate solubilizing fungi.

The National Research Council is highly acknowledged for providing financial assistance for the project.

Phylogenetic analysis of rod shaped heavy metal tolerant bacterial strains isolated from a textile industrial effluent in Sri Lanka

W.M.N.H. Kumari, C.D. Wijayarathna and N.V. Chandrasekharan

Department of Chemistry, University of Colombo

Bioremediation of heavy metals using bacteria is a very promising application today. In this study, a few bacterial strains having heavy metal tolerance ability were isolated from a textile industrial effluent in Sri Lanka and characterized to help elucidate the mechanisms involved in bioremediation.

Isolated rod shaped bacterial strains (10) were characterized up to the species level using 16S rRNA sequence analysis as the molecular identification method. For this, partial 16S rRNA gene sequences of the isolates were PCR amplified and resulting fragments (~1500 bp) were sequenced. The sequences were analyzed using BioEdit software v7.1.11 and compared with homologous sequences available in the NCBI databases using BLAST. Multiple alignment of the 16S rRNA sequences of this study and sequences from NCBI database (*Bacillus* sequences and most distant species of *Bacillus*) was carried out using Clustal W and a phylogenetic tree was constructed using MEGA 7.0.14. The evolutionary history was inferred by using the Maximum Likelihood (ML) method based on the Jukes-Cantor model.

According to the phylogenetic analysis the isolated bacterial strains were grouped into two distinct genera *Bacillus* and *Fictibacillus*. The strain TWSL-23 was exceptionally clustered with *Fictibacillus* species, which was previously classified as *Bacillus*. All the strains other than TWSL-23 were characterized as *Bacillus* and TWSL-23 as *Fictibacillus rigui*. Other strains belong to five different species and were identified as *B. megaterium* (TWSL – 4), *B. cereus* (TWSL – 5), *B. marisflavi* (TWSL-7, TWSL – 8, TWSL – 11), *B. aquamaris* (TWSL – 10), and *B. flexus* (TWSL – 12, TWSL – 13, TWSL – 14). The strains TWSL-4 and TWSL-12, 13, 14 are closely related at the species level (Group-A). *B. aquamaris* and *B. marisflavi* are closely related species and show more relatedness to *B. subtilis* than to group A. The strain TWSL-5 is also grouped with *B. subtilis* in one cluster.

Keywords: 16S rRNA, bioremediation, Bacillus, Fictibacillus, phylogenetic analysis

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Anti-glycation activity of a homeopathic medicine prescribed for diabetes

H.V.N. Lakmali,¹ S.C.D. Fernando ² and S.A.Deraniyagala³

¹*Quality Assurance Laboratory, National Medicines Regulatory Authority, Sri Lanka*

²*College of Chemical Sciences, Institute of Chemistry, Ceylon*

³*Department of Chemistry, University of Colombo*

Glycation is the non-enzymatic reaction between a protein and sugars. After a series of complex reactions following glycation, advanced glycation end products (AGEs) are formed. AGEs are responsible for the pathogenesis of diabetic complications such as atherosclerosis, nephropathy, neuropathy, retinopathy and cataract. There are alternative treatment methods in Sri Lanka which possess anti-diabetic activity; but whose antiglycation activity has not been investigated. The objective of this study was to analyze inhibitory potential of a popular Homeopathic medicine (**HM**) of *Syzygium jambolanum* preventing the formation of AGEs. The mother tincture was used for this purpose.

The inhibitory effect of **HM** on fructose mediated non enzymatic glycation was investigated according to a published method with slight modifications. The reaction mixtures made in phosphate buffered saline (0.2M, pH 7.4) contained Fructose (36 mg/ml), Bovine Serum Albumin (BSA) (5mg/ml) and Sodium Azide (0.02% to minimize microbial activity) and different concentrations were prepared from the mother tincture of HM. Formation of fluorescent AGEs was measured using a spectrofluorometer, at excitation and emission wavelengths of 355 and 440 nm respectively. Each mixture was measured after 1 week of mixing. The inhibitory action on glycation by **HM** was determined as follows:

$$\text{Inhibition of fluorescent AGEs (\%)} = \{(F_C - F_{CB}) - (F_S - F_{SB}) / (F_C - F_{CB})\} * 100$$

Where “F” denotes the fluorescence emission, and subscripts C, CB, S and SB denote control (BSA and fructose), control blank (BSA only), sample (BSA, Fructose and **HM**) and sample blank (**HM** only) respectively. Aminoguanidine (**AG**) was the positive control. The inhibitions observed after one week of incubation of **HM** (4.2, 5.0, 8.4, 16.8, 25.2 mg/ cm³) solution mixtures were 77%, 85%, 83%, 88%, 95% respectively. **AG** (0.5 1.0, 5.0 mg/cm³) gave inhibition of 65%, 68% and 98% respectively.

Therefore, **HM** efficiently inhibited fluorescent AGE formation during fructose mediated protein glycation. Further studies would help in ascertaining its potential to be developed as a drug to prevent diabetic complications.

Keywords: Advanced glycation end products, Syzygium jambolanum, Homeopathic medicine

Safety concerns of PbCrO₄ in enamel paints

M. C. Lakmini and K. R. R. Mahanama

Department of Chemistry, University of Colombo

Heavy metals are considered to be one of the priority pollutants. Lead and chromium are two of the heavy metals in enamel paints, and can enter to the environment from painted surfaces where children and painters are more vulnerable to exposure, contributing severe health problems. Pb is ranked second and Cr ranked seventeenth by the “Agency for toxic substance and disease registry.” PbCrO₄ is a yellow inorganic pigment giving Pb and Cr in to enamel paints but its use has been restricted by the U.S. Environmental Protection Agency due to toxicity concerns. Hence, assessing the consistent compliance of Pb and Cr levels in enamel paints with regulatory standards is of global concern.

Samples of liquid paints were dry ashed and acid digested to analyze for Pb and Cr by atomic absorption spectroscopy according to ASTM D 3335-85a and ASTM D 3718-85a. All these paints have been manufactured between January 2014 and January 2015. A total of 36 samples were analyzed from six brands. One yellow and one green paint from two manufacturers showed the highest Pb and Cr levels. From these two paints, analyses were conducted for five samples and Pb levels were 11536 ± 9 mg/kg and 4090 ± 11 mg/kg in the yellow and green paints respectively and these values are greater than the Sri Lankan regulatory limit of 600 mg/kg. Cr levels were 2618 ± 11 mg/kg in yellow and 856 ± 9 mg/kg in green paints, which exceeded the regulation for Cr, 250 mg/kg. Though the above Pb levels exceeded the recommended level, this yellow paint was labeled as “SLS 539” and the green paint as “lead safe.” Pb and Cr in the other 34 samples were below the regulatory limits.

Five samples of aforementioned yellow and green paints from same batch were purchased from different locations and their Pb and Cr levels were consistent. Five samples of different batches from different locations showed lower levels than the recommended levels. These results demonstrate the feasibility of manufacturing paints while adhering to safe standards. In the samples with high Pb and Cr levels, the mole ratio of Pb and Cr is 1:1. This suggests the possibility of the presence of PbCrO₄ in certain paints. This study suggests the need of establishing a proper mechanism for regular monitoring of Pb and Cr levels in enamel paints before delivering to the market.

Keywords: Lead, chromium, Yellow and green enamel paints

Validation of a high performance liquid chromatographic method for the determination of free amino acids in rice using L-theanine as the internal standard

G.V.V. Liyanaarachchi,¹ K.R.R. Mahanama,² H.P.P.S. Somasiri¹ and P.A.N. Punyasiri³

¹ *Industrial Technology Institute, Baudhaloka Mawatha, Colombo*

² *Department of Chemistry, University of Colombo*

³ *Institute of Biochemistry, Molecular Biology and Biotechnology, University of Colombo*

The apparent relationship of free amino acids (FAAs) with the organoleptic properties of food has created increased demand for analytical methods sensitive enough to detect FAAs, which are present in nanomolar levels in the food. Rice being the staple food in Sri Lanka, this study presents the validation results of the method carried out for analysis of FAAs in rice using L-theanine, a unique amino acid as the internal standard (IS).

The validation parameters revealed that the method is suitable for performing a satisfactory chromatographic separation of 19 amino acids including both L-Theanine and L-Norvaline as internal standards within 45 min on an Agilent Zorbax Eclipse AAA column (4.6 x 150 mm, 5micron) with pre-column derivatization with OPA reagent using high performance liquid chromatography (HPLC)-fluorescence detection. The detection limits and quantification limits of the method were in the range 2-16 nmol/kg and 3-19 nmol/kg respectively. The linear range of the method was 25-600 nmol/kg with a regression coefficient of 0.999. The precision of the method measured in terms of repeatability and reproducibility, expressed as percentage relative standard deviation (% RSD) was below 8 % for the primary amino acids analyzed, except for Threonine and Aspartate, which were 10%. The recoveries obtained for samples fortified at three concentration levels (125, 225 and 450 nmol/kg) covering the working range of method were in the range 76-105%. Measurement uncertainty of the method was below 15% for all the amino acids analyzed.

The findings revealed that there is no significant difference at 0.05 probability level in results obtained for all validation data produced using L-Theanine as the IS, compared to results obtained using L-Norvaline as the IS. Hence L-Theanine is suitable as an IS and the validated method can be used for FAA determination in rice.

Keywords: Free amino acids, L-theanine, internal standard, method validation, rice

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***Aedes aegypti* population dynamics help evaluation of current vector control measures in Sri Lanka**

M. D. Nirmani,¹ P. D. Gangani,¹ K. L. N. Perera² and G. H. Galhena¹

¹*Department of Zoology and Environment Sciences, University of Colombo*

²*Genetech, Kithulwatte Road, Colombo*

Dengue is currently the most important flaviviral infection worldwide. Although a new dengue vaccine is under development, vector control would remain a major tool in the management of this disease. In Sri Lanka, the primary vector is the mosquito *Ae. aegypti*. Since 2005, many nationally coordinated vector control efforts have been conducted island wide. Population genetics can be used to assess the impact of these control measures by evaluation of the dynamics of the targeted vector populations. Accordingly, this study attempted to evaluate the effectiveness of the current vector control measures in the prevention of dengue in Sri Lanka, using a microsatellite marker based population study for *Ae. aegypti*. DNA was extracted from *Ae. aegypti* larvae collected during 2014-2015 from nine populations (Dematagoda (N = 24), Kirulapone (N = 42), Grandpass (N = 24), Thummulla (N = 28), Horana (N = 26), Keselwaththa (N = 21), Galle (N = 30), Negombo (N = 36) and Dalugama (N = 17)) covering an area with a diameter of 500 m each. Genotyping was conducted with six microsatellite markers; CT2, AC7, GyP08, BbB07, BbH08 and BbA10. Possible population bottlenecks were assessed using Bottleneck 1.2.02 and gene flow (Nm) and effective population sizes (N_e) were estimated using standard formula. All markers conformed to HWE ($P > 0.05$) and did not reveal significant linkage disequilibrium ($P > 0.05$). Population bottleneck analysis, which assumes closed populations without migrations, demonstrated significant bottleneck signatures in Dematagoda, Dalugama, and Thummulla areas ($P < 0.05$). However, observed high N_e estimates (88,472 - 137,598) contradicted this result. Further, independent estimates of Nm for the three populations ranged from 5.4 to 37.1, indicating high levels of migrations. This disagrees with the assumption of closed population upon which the bottlenecks were detected. These results render population bottlenecks to be unlikely in these three areas within the recent past. The lack of evidence for real bottleneck signatures in these areas indicates the ineffectiveness of current vector control measures. A likely cause for this failure might be the forced movement of vectors to other areas from the control sites as opposed to the expected vector elimination.

Keywords: Population bottlenecks, effective population size, geneflow, vector control, microsatellite markers

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Movement patterns of ashy-headed laughing thrush (*Garrulaxcinereifrons*) in mixed-species foraging flocks in Sinharaja World Heritage Reserve

J.N. Perera,¹ S.W. Kotagama,¹ E. Goodale² and S.S. Seneviratne¹

¹*Department of Zoology and Environment Sciences, University of Colombo*

²*College of Forestry, Guangxi University, China*

The ashy-headed laughingthrush is an endemic, relict species, forage as gregarious, understory forest bird in mixed-species foraging flocks (MSFF) in the lowland rainforests of Sri Lanka. This laughingthrush has a large contribution to the biomass of the MSFF, and it is considered as a nuclear species. As a result the understanding of its patterns of movement may be important to determine the spatial requirements of the MSFF, a potential management tool for protecting the health of the last remaining lowland rainforests of Sri Lanka. We colour banded 20 individuals of ashy-headed laughingthrush at the Sinharaja World Heritage Reserve and followed them in the MSFF through the forest for 20 days on a 500 m x 500 m forest plot. The 0.25 km² forest plot was further subdivided into 25 m x 25 m grids. We recorded the composition of the flock, its position in the plot and the speed at which it moved during consecutive 30 minute periods. Our observations showed that the ashy-headed laughingthrush is a frequent and highly persistent species in MSFF, and that they determined the home range of the MSFF. Furthermore these laughingthrushes determine the speed of the flock. The speed of the MSFF is highest in the morning hours and gradually reduces through the day. When foraging in MSFF, laughingthrushes used some of the grids more than others, but there was no correlation observed between well-used grids and their measured biological and physical variables (e.g. canopy height and vegetation cover).

Keywords: Garrulax, laughing thrush, lowland rainforest, mixed-species feeding flocks, Sri Lanka.

Evaluation of hexadecane biodegradation by a natural microbial biofilm over single cultures of its counterparts

S.M.D.Perera,¹ S.D.M. Chinthaka,² G. Seneviratne,³ W.S.S. Wijesundera,¹ C.D. Wijayaratne⁴
and S.M.T. Jayasena¹

¹*Department of Biochemistry & Molecular Biology, Faculty of Medicine, University of Colombo*

²*Department of Chemistry, Faculty of Applied Sciences, University of Sri Jayawardenepura*

³*National Institute of Fundamental Studies, Kandy*

⁴*Department of Chemistry, Faculty of Science, University of Colombo*

Microbes can be used in bioremediation either in the form of planktonic cells or as biofilms. Biofilms can be of single organism or mixed communities, which are attached to biotic or abiotic surfaces. In the nature, they interact with all the biotic and abiotic factors and maintain the persistence through balancing the synergistic and antagonistic effects. When bacteria are attached to fungal filaments, they are called fungal-bacterial biofilms (FBBs). One of three natural FBBs isolated from a previous study, which showed degradation of hexadecane up to 99% in liquid cultures in 14 days, was selected to study hexadecane biodegradation. The FBB community comprised of a single bacterium (*Bacillus*) and a fungus (*Aspergillus*), as identified from molecular and biochemical characterization. Hence, the FBB was named as *Aspergillus-Bacillus* biofilm. The present study investigates the synergistic effect of a FBB in comparison with its single cultures for hexadecane biodegradation. Monocultures of *Aspergillus* and *Bacillus* were then prepared and grown on Bushnell and Haas medium supplemented with 1% (v/v) hexadecane as the sole source of carbon, at 40°C for a period of 14 days. At the end of 14 days of continuous incubation, residual hexadecane was analyzed by gas chromatography/mass spectrometry. All assays were conducted in triplicate. Hexadecane biodegradation by the fungal and bacterial monocultures in liquid culture were 53% and 9%, respectively and biodegradation of FBB was 97%. Results showed that the FBB was more efficient in degradation of hexadecane compared to the monocultures, confirming the synergism between the two organisms for biodegradation.

Keywords: Fungal-bacterial biofilms, hexadecane biodegradation, synergism

Yield performance of *Pleurotus ostreatus* mushrooms cultivated on five different growth substrates

J.C.Rajakpaxe,¹ C.M.Nanayakkara,² H.K.A.Karunatilaka¹ and G.L. Siriwardena¹

¹*Agriculture Research Station, Department of Agriculture, Telijjawila*

²*Department of Plant Sciences, University of Colombo*

Edible mushroom cultivation can be viewed as a strategy for sustainable use of agricultural wastes for food production. Oyster mushrooms (*Pleurotus* spp.) are the widely cultivated mushrooms in Sri Lanka utilizing soft wood saw dust (SD) as the sole basal substrate for cultivation disregarding the advantages of using mixed substrates as practiced in other countries. Nevertheless, urgent need prevails to search for alternative basal substrates due to recent scarcity of SD and also study the suitability of mixed basal substrates. Therefore, investigations were undertaken to evaluate the oyster mushroom yields obtained from mixed substrates formulated with different agricultural wastes. Four different agricultural wastes, namely paddy straw (PS), paddy husk (PH), spent mushroom substrate (SMS), and banana pseudo stem (BS) were mixed with SD in equal proportions (w/w) to prepare the basal growth substrate, with added Department of Agriculture recommended supplements and compared with the control having sole SD based substrate. Spawn run rate (cm/day) and mushroom fresh yield (grams/flush) were taken as measurements. The experiment consisted of five treatments and 10 replicates and was laid in Complete Randomized Design (CRD). Subsequent to a preliminary study, another set of compounded substrates were also formulated using carbonated paddy husk; biochar (BC) at 10%, 15%, 20%, 25%, 30% and 35% (w/w) with SD and compared with the control with 100% SD. The experiment was arranged in CRD and had ten replicates. The highest mushroom yields (at $p \leq 0.05$) were reported from substrates amended with 50% paddy straw followed by 35% BC but the difference between the two treatments were non-significant. The control reported the lowest yield. Higher levels of essential amino acids in the yields obtained from 35% BC incorporated substrates further substantiate the superiority of mixed growth substrate for oyster mushroom cultivation while providing a partial solution to the scarcity of sawdust in the country.

Keywords: Oyster mushrooms, growth substrate, scarcity

Molecular identification of root knot nematode *Meloidogyne enterolobii* from infected tomato (*Lycopersicon esculentum*) plants

R.V.D.U.P. Rajapakse, G.H.C.M. Hettiarachchi and R.S. Dassanayake

Department of Chemistry, University of Colombo

Tomato (*Lycopersicon esculentum*) is one of the most economically important agricultural crops worldwide. Phytoparasitic root knot nematodes (RKNs) of the genus *Meloidogyne* have proven to be one of the important biotic constraints in tomato production. Predominant RKN species such as *Meloidogyne incognita*, *M. arenaria*, *M. javanica* and *M. hapla* have been recorded to infect tomato in many countries. However, there is no information available in literature about RKN identification on tomato in Sri Lanka. Accurate identification of RKNs in a field of crops is important, for the implementation of effective RKN management programs such as crop rotations with resistant cultivars. In order to identify *Meloidogyne* infection in tomato plants, yellowed and stunted plants were collected from different tomato growing regions in Sri Lanka, during the year 2014/2015. Root systems of plants exhibited severe root galling, which is the typical symptom of RKN infection leading to yield loss. Genomic DNA was isolated from juveniles of RKNs. Then 28S rRNA D2D3 expansion domain was amplified by PCR technique using universal primers MF/MR and yielded a fragment of 500 bp specific for *Meloidogyne* genus for all samples. Universal primers C₂F₃/1108 were used to discriminate important *Meloidogyne* species by amplifying different size fragments of mitochondrial DNA between the COII /rRNA region. Samples collected from Kalpitiya and Kaduwela regions yielded a fragment of 705 bp, specific for *M. enterolobii*. Therefore, these samples were further analyzed with *M. enterolobii* specific primers Me-F/Me-R, which amplifies a portion of the rDNA-IGS2 region. Sequences of 200 bp fragments obtained for both samples, proved 100% homology to sequences of *M. enterolobii* isolates from Taiwan, Oman, China and Switzerland in Genbank database (GenBank Accession Nos. KP411228.1, KM008548.1, JN005846.1, GQ395524.1). Hence, RKNs isolated from tomato plants collected in Kalpitiya and Kaduwela regions were confirmed as *M. enterolobii*. To the best of our knowledge this is the first record of *M. enterolobii* in Sri Lanka and it expands the formerly known worldwide distribution. This finding indicates a serious threat to Sri Lankan agriculture due to wide host range, high reproduction rate and the ability of *M. enterolobii* to overcome resistance genes in several crops such as tobacco, pepper, watermelon, and tomato.

Keywords: Agriculture, Meloidogyne species, mitochondrial DNA, PCR technique, rDNA

Haematotoxicity of arsenic and cadmium in the common carp (*Cyprinus carpio*)

R. A. A. R. Ranatunge,¹ M. R. Wijesinghe,¹ D. N. De Silva,¹ I. C. Perera,¹ and R.D. Wijesekera²

¹*Department of Zoology and Environment Sciences, University of Colombo*

²*Department of Chemistry, University of Colombo*

The pollution of aquatic ecosystems due to the accumulation of heavy metals has become a matter of concern throughout the globe. Aquatic organisms are therefore frequently exposed to these heavy metals which induce toxic effects. Assessing haematological profiles has been used as a method of determining the health status of fish exposed to toxicants, particularly to heavy metals. The present study examined the effects of arsenic and cadmium on the haematological profile of the common carp (*Cyprinus carpio*) via exposure to environmentally relevant concentrations of the two metals. Healthy adult male carps (153 ± 6.7 g and aged 4 – 6 months) obtained from the National Aquaculture Development Authority, Dambulla, were held individually in glass tanks containing 30 L of water. The fish were repeatedly exposed (n = 6 per treatment and control) to three field concentrations of arsenic (0.001, 0.005, 0.01 mg dm⁻³) and cadmium (0.005, 0.01, 0.2 mg dm⁻³) for 30 days under monitored empirical conditions. At the end of the trials fish were sacrificed to determine selected haematological parameters.

The study revealed that, both As and Cd has the potential to alter several parameters: the erythrocyte counts (RBC), white blood cell counts (WBC), haemoglobin concentration (Hb) and Pack Cell Volume (PCV) were enhanced while the secondary indices mean cell haemoglobin (MCH), mean cell haemoglobin concentration (MCHC) and mean cell volume (MCV) were reduced. For both metals RBC, Hb and PCV values were significantly higher in the highest exposed concentrations (p < 0.05). Unexpectedly for Cd, WBC counts were significantly elevated in the lowest exposed concentration (0.005 mg dm⁻³). The changes in levels of many of the monitored haematological parameters in comparison to those of the unexposed fish, indicate physiological stress. The results of the study are of particular concern since the alterations of the haematological parameters were observed at levels of As and Cd recorded in both rural as well as urban waterbodies of Sri Lanka.

Keywords: Arsenic, cadmium, haematology, common carp, toxicity

National Research Council of Sri Lanka (Grant 12-53) is acknowledged for financial assistance.

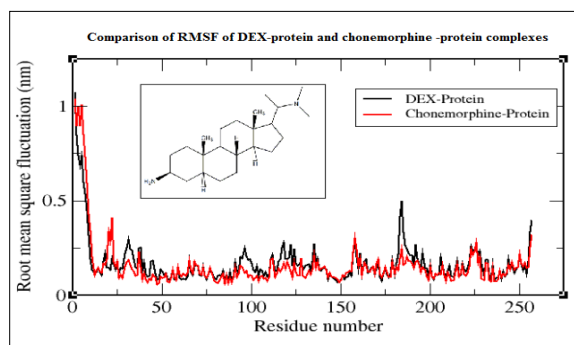
Molecular dynamics simulation and binding studies of chonemorphine with glucocorticoid receptor

S. Rathnayake and S. Weerasinghe

Department of Chemistry, University of Colombo

Chonemorphine is a steroidal alkaloid isolated from *Chonemorpha fragrans*. It is already identified as an antiameobic agent. Current study comprised of interaction of chonemorphine with glucocorticoid receptor protein in terms of molecular docking, and molecular dynamics simulation methods. The force field parameters of chonemorphine were developed and stored on online database “Sri Lankan Flora” (www.science.cmb.ac.lk/tools/slflora) which contains isolated compounds of flora of Sri Lanka.

The molecular docking procedure was employed to predict binding affinity and pose of synthetic steroid; dexamethasone and chonemorphine to glucocorticoid receptor, and calculated the grid scores. It revealed that the chonemorphine has been successfully docked into the same binding site with a compatible binding affinity of dexamethasone. Thus these two ligand-protein complexes were pursued for molecular dynamics (MD) simulation study for 30 ns each to investigate the stability of the complexes in aqueous medium. The conformational fluctuations of the protein and ligands, ligand-protein interactions and stability of complexes were studied in details in terms of root mean square deviations (RMSD), radius of gyration



(Rg), root mean square fluctuations (RMSF) and total solvent accessible surface area (SASA). The MD analysis, especially, the RMSF analysis indicates that steroids; dexamethasone and chonemorphine complexes behave similar manner in aqueous medium. Therefore, it could be concluded that the binding affinity of

chonemorphine to glucocorticoid receptor as an agonist may produce biological effects as produced by glucocorticoids. Therefore it can be suggested to conduct further studies under wet-laboratory studies to conform those agonistic activities concluded using computational studies.

Keywords: Sri Lankan Flora, molecular dynamics, molecular docking

Acknowledgement: Financial assistance by University of Colombo Research grant (AP/3/2/2014/RG/01).

Investigation of the food habits of Corrugated Water Frog, *Lankanectes corrugatus*

R. K. Rodrigo,¹ M. R. Wijesinghe,¹ U. K. G. K. Padmalal,² M. R. A. K. Peiris,² K. M. A. Bandara² and S. O. M.P. S. Samarasekara²

¹ *Department of Zoology and Environment Sciences, University of Colombo*

² *Department of Zoology, The Open University of Sri Lanka*

The Sri Lanka corrugated water frog, *Lankanectes corrugatus*, belongs to an endemic and relict monotypic genus, this taxonomic distinction warranting its inclusion as a vulnerable species in the National Red List 2012 of Sri Lanka. Despite its conservation value, the ecology and biology of this frog remains sparsely investigated. Here we investigate the diet composition of *L. corrugatus* captured from the Dombagaskanda forest, Kalutara, and the Endana tea estate, Ratnapura. Sampling was conducted from January to June 2016 during the wet season. A total of 24 individuals including three juveniles, 13 males and eight females with snout-vent lengths (SVL) between 27.5 - 33.2, 34.7 - 44.0 and 43.3 - 48.0 mm, respectively, were captured. Diet composition was assessed by stomach flushing. Of the stomachs flushed 91.7 % had contents. The Lechner's formula generating a value of 0.93 and the rarefaction curve which reached an asymptote at 15 individuals, confirmed sampling adequacy.

Overall the diet contained items from 11 faunal prey orders which included nine arthropods (Arachnida, Coleoptera, Diptera, Hemiptera, Hymenoptera, Lepidoptera, Odonata, Orthoptera and Trichoptera), one Gastropod (with shell) and one unidentified taxa. A total of 69 prey types were identified with 18.8 % being of larval stages. Also, 72.5 % comprised terrestrial prey. Frogs preferred smaller prey (1 – 5 mm) and accordingly no association between prey item size and SVL was evident. The Levins measure of the Standardized Niche Breadth of 0.10 for *L. corrugatus* indicates that the species is a strict dietary specialist. Males appear to be less selective in their diet than females. Floral elements (higher plants and algae), and sand, mud and pebbles in the diet were most likely ingested during prey consumption. This study is, to the best of our knowledge, the first to disclose the food habits and to characterize the dietary niche of *L. corrugatus* in its natural environment.

Keywords: Dietary niche, food habits, L. corrugatus, stomach flushing

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A brute-force algorithm for *aturu-mituru*

M.F.M. Sabri, A. Mahasinghe and S. Nallawangsa
Department of Mathematics, University of Colombo

Aturu-mituru is a widely-known folk game played by Sri Lankan children. According to one version of this game, the players sit in a circle putting their hands on the floor, with fingers spread apart, while one player recites the popular verse *aturu-mituru dambadivaturu rājakapuru settiyō*, touching the fingers to the rhythm of the verse. The player on whose finger the verse ends folds that finger, and the game restarts from the finger immediately next to the one folded. The first to close all ten fingers is declared the winner.

It is natural to ask, who the winner would be, when n Children take part in this game. We developed a computer program to determine the winner, by restating the problem as follows: *If beads of n colours arranged in a circle so that 10 consecutive beads of each colour are placed together; if each 8th, 8th, 8th and 3rd bead is removed repeatedly, which colour would be the first to disappear from this circle?* Based on this problem statement, we developed a brute-force algorithm to determine the disappearing colour. It was implemented using Java, and tested with empirical results.

In a second version of *aturu-mituru*, instead of fingers, the hands are counted with the same elimination order. We show that the second version has a close resemblance to the Josephus problem, and propose to program it using the Josephus function $J(n, k)$, which is computable using $O(n \log k)$ operations, as it gives the last survivors' position in a circle consisting of n people, when every k^{th} person is eliminated.

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Nickel hyper accumulating plants in the Indikolapelessa serpentinite, Sri Lanka

R.M. Samarakkody,¹ P.S. Saputhanthri,¹ M.C.M. Iqbal² and S.W. Ranwala¹

¹*Department of Plant Sciences, University of Colombo*

²*National Institute of Fundamental Studies, Kandy*

Serpentinite, the bedrock and soils derived from metamorphic transformation of ultramafic rocks, occur throughout the globe in localized patches. In Sri Lanka, five serpentinite outcrops, namely, Ussangoda, Ginigalpelessa, Indikolapelessa, Yodhaganawa, and Rupaha, have been identified. Generally, soil cover over a serpentinite bedrock is shallow and rocky, and characteristically is poor in Ca and other major plant nutrients, but rich in elements toxic to plants such as Ni, Cr, and Cd. They also contain high concentrations of Fe and Mg. Some serpentine plants bear the unique physiological mechanism of hyper-accumulation, in which plants can actively uptake and accumulate heavy metals in their tissues, for survival under harsh edaphic conditions. Such hyper-accumulators represent an unusual and valuable biological resource with great potential for use in a variety of strategies, particularly for soil remediation. Nickel hyper accumulators are defined as species containing > 1000 µg Ni/g dry mass in the aboveground parts of at least one specimen collected from the wild. The objective of the present study was to identify Nickel hyper-accumulator plant species growing in the Indikolapelessa serpentinite, in the Udawalawe area. Elemental analyses of the soil and plant samples were conducted using Flame AAS, after acid digestion of the dried samples in a closed vessel microwave digester. Of the soil samples collected from 9 locations to represent the entire serpentinite, the mean concentrations (\pm SD) of Ni (II) ranged from 1734 ± 562 to 4791 ± 738 µg/g. Thirty eight plant species belonging to 23 families were identified from the site. Of those, *Frimbistylis ovata* (Burm.f.) J. Kern, *Lantana camara* L., *Morinda tinctoria* Roxb., *Azadirachta indica* A. Juss., *Calotropis gigantea* (L. https://en.wikipedia.org/wiki/Carl_Linnaeus) W. T. Aiton, *Evolvulus alsinoides* (Linn.) Linn., *Eupatorium odoratum* L. and *Sida acuta* (Burm.f.) were identified as Ni hyper-accumulators as Ni (II) amounts in vegetative tissue ranged between 1500 to 6500 µg/g dry weight. These species may have potential in phytoremediation of Ni contaminated soil and further studies are needed to verify the efficiency of this hyper accumulation.

Keywords: Indikolapelessa Serpentinite, nickel, hyper-accumulator plants

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Investigation of the influence of electron contamination in depth dose in the Cobalt-60 radiotherapy treatment

S.B.B.S. Sesath Bandara,¹ M. Kajani,¹ J. Jeyasugiththan,^{2,3} T. Pathmathas¹ and A. Ramalingam³

¹*Department of Physics, University of Jaffna*

²*Department of Nuclear Science, University of Colombo*

³*Department of Clinical Oncology, Jaffna Teaching Hospital*

The direct photon collision with beam collimator jaw, air and any other scattering materials in the beam produce secondary electrons that contaminate the 1.25 MeV gamma beam used in Cobalt-60 radiotherapy. These electrons can damage skin surface during radiotherapy treatment. This skin damage can be minimized by introducing a suitable material to filter the secondary electrons. The main objectives of this work are to investigate the influence of the electrons in depth dose measured experimentally and to identify a suitable thickness of a material to absorb those electrons using Monte Carlo simulations.

A 1.25 MeV photon beam was investigated with different source to surface distances (SSD), field sizes and wedges. The electron contamination was found to be dependent on treatment field size and SSD, and demonstrated that the dose near the skin was increased by the contaminated electrons. The experimental outcome revealed a shift in depth dose maximum (d_{max}) by 3 mm towards the skin surface.

A Monte Carlo model was successfully developed for both electrons and gamma-rays. It was found that materials of higher atomic number such as lead and copper possessed lower capability in absorbing the contaminated electrons. But thickness of about 7.3 mm of white photo-copy paper showed 100% capability in absorbing the contaminated electrons without diminishing the intensity of the primary beam. PC board of 2.8 mm thickness was to be another material fit for absorbing the contaminated electrons without significantly diminishing the intensity of the primary beam. Also it was found that, among metals that were used in this research, aluminium transmitted the gamma rays 100% with significant attenuation of the contaminated electrons.

Onset and retreat of rainy seasons in the wet zone

D.U.J. Sonnadara

Department of Physics, University of Colombo

A method of determining the onset and retreat dates of the rainy seasons in the wet zone of Sri Lanka based on cumulative rainfall during the period 1961-2010 is discussed. Two weather stations (Colombo and Galle) that receive rainfall predominantly from the southwest monsoon season and having two distinct growing seasons, Yala and Maha, were selected for this study. There is high inter-annual variability in the onset and retreat dates. For the Yala season, the mean onset and retreat dates fall during the standard weeks 12.0 and 22.3, which correspond to late March and early June respectively. For the Maha season, the mean onset and retreat dates fall during the standard weeks 36.1 and 47.7 which correspond to early September and late November respectively. The mean duration of the growing season for Yala and Maha is approximately the same (11 weeks). The results indicate that there has been no significant positive or negative trend in the onset and retreat dates of the Yala and Maha rainy seasons during the last 50 years in the wet zone of Sri Lanka. The onset date and the length of the growing season for both Yala and Maha are weakly correlated with early onset dates leading to longer growing seasons. This finding can be exploited to improve agricultural food productivity.

Keywords: Wet zone, dry zone, rainfall onset and retreat, growing season

Financial assistance given by the National Research Council, Sri Lanka for the research grant number NRC 06-18 is greatly acknowledged.

Identification of lead compounds from Sri Lankan flora to treat prion and Huntington's diseases: A molecular mechanics approach

S. Thiruchittampalam and S. Weerasinghe

Department of Chemistry, University of Colombo

Different age-related neurodegenerative diseases prion disease and Huntington's disease share the common predominant etiology of altered metal homeostasis even though insult in the different regions of the brain and knotted with different factors. Since the transition metals Cu and Fe are central to the pathogenesis of neurodegeneration, such as aggregation and accumulation of misfolded proteins and oxidative stress, metal chelation therapy is a rewarding approach to minimise neurotoxicity by restoring metal balance. Therefore, potential metal binding ligands, particularly for Cu^{2+} and Fe^{3+} ions, are classified from an existing database of chemical compounds identified from Sri Lankan flora via a computational approach to be employed as lead compounds for the aforementioned diseases.

Evaluation of copper, iron (Cu^{2+} , Fe^{3+}) complexes were done by means of umbrella sampling molecular dynamics (MD), which determine the free energy changes of a molecular system along a reaction coordinate, while ensuring sufficient sampling at the potential barriers and efficiency. The complete free energy profile was obtained from the weighted histogram analysis method (WHAM), which is implemented natively in the GROMACS software.

The binding free energy (ΔG) values of the compound isoshinanolone towards Cu^{2+} and Fe^{3+} show the binding capacity into a single compound enhancing the likelihood of designing a drug for prion disease. The copper binding compounds cyathocaline and 3-hydroxy-1-methoxyxanthone could be combined with isoshinanolone or some other iron chelator to work alongside each other, in the case of prion disease. Further, isoshinanolone might possess the potential to ameliorate the symptoms of Huntington's disease. Moreover, screening the potential compounds through reliable MD based computational free energy calculations narrow down the proportion of synthetic work.

Keywords: Neurodegeneration, metal chelation, umbrella sampling

Selection of tiger beetle species as potential bioindicator organisms for coastal ecosystems of Sri Lanka

A. Thotagamuwa, C. D. Dangalle, N. Pallewatta and E. Lokupitiya

Department of Zoology, University of Colombo

Biological indicators reflect the environmental conditions of a given habitat which may not be reflected fully by incident habitat monitoring techniques. Bioindicators of habitat quality and environmental change, to be useful, must be identified qualitatively and quantitatively. Indicator criteria proposed by McGeoch and Pearson were used where each criterion was valued using a 1-4 scale based on field experience and available literature. In order to assign a quantitative value for selected species, indicator value (*IndVal*) method proposed by Dufrene and Legendre was used which uses measures of specificity and habitat fidelity to assess the suitability of coastal tiger beetles as indicators. Species with high specificity and high fidelity will have high indicator values. Field surveys were conducted in eighty locations from July 2014 to July 2016 spanning the area anti-clockwise from Trincomalee to Hambantota. Each location was visited twice on days with no overcast and sampled using standard line-transect and time constant sampling techniques. Five coastal tiger beetle species were identified, namely *Hypaethabiramosa*, *Callytronlimosa*, *Calomeraangulata*, *Myriochiledistinguenda* and *Hypaethaquadrilineata*. When proposed qualitative indicator criteria were applied on these species, *Hypaethabiramosa* was found to be the most suitable indicator species. Further, *IndVal* method was applied to *H. biramosa*. The indicator responses were verified by sampling in twenty coastal sites distributed in the dry and wet zones of the island located in districts of Jaffna, Mannar, Galle, Matara, Trincomalee, Kalutara, Hambantota and Colombo. Application of *IndVal* method resulted in *Hypaethabiramosa* scoring over 70% with a 100% habitat specificity and fidelity of 75% to coastal habitats which demonstrates *H. biramosa* as the characteristic indicator species to coastal habitats. Indicator values computed for other species were below 70%; *Callytronlimosa* (10%), *Calomeraangulata* (12%), *Myriochiledistinguenda* (13%), *Hypaethaquadrilineata* (10%). Therefore, we suggest the tiger beetle species *Hypaethabiramosa* as a potential candidate indicator for coastal habitats of Sri Lanka.

Keywords: Bioindicators, coastal tiger beetles, Hypaethabiramosa, indicator value method

Reconstruction of fluorescence and absorption spectra of water samples collected from different locations of Beira Lake considering spectral signatures of possible constituents

K.M.W.Udeshi,¹ H.H.E.Jayaweera,¹ D.D.Wickramasinghe² and T.R.Ariyaratne¹

¹*Centre for Instrument Development, Department of Physics, University of Colombo*

²*Department of Zoology and Environment Sciences, University of Colombo*

This study was focused on identifying the fluorescence signatures (405nm excitation) and absorption signatures (430 - 700 nm) of different constituents dissolved in water for the further development of a broadband detection system of chlorophyll concentrations in water bodies. A tungsten halogen lamp (OSRAM, 25 W, 240 V) has used for lightening to capture absorption spectrum, a blue laser diode (405 nm) has used for fluorescence excitation and a spectrometer (Oceanoptics, USB650) has used for detection with an optical transmission filter. Beira lake samples have resulted in spectra with unnecessary rises against chlorophyll (absorbing at 430 nm and 662 nm, and fluorescing 680 nm and 735 nm). Fluorescence signatures (405 nm excitation) like cyanobacteria (680 - 850 nm), bacteriophage (400 nm and 480 nm), some vegetative bacterias (400 nm and 500 nm) and diesel (350 nm and 430 nm) and absorption signatures like Peridinin (483 nm), vegetable extractions and detergents could interfere with the chlorophyll optical measurements. These fluorescence and absorption signatures of different constituents dissolved in water can be studied separately to achieve a good indication for the broadband detection system and can be calibrated *in vivo*.

Keywords: Fluorescence, absorption, pollution, Beira Lake

Energy usage and greenhouse gas emissions associated with tea manufacturing process in Sri Lanka

J. Vidanagama and E.Y.K. Lokupitiya

Department of Zoology and Environment Sciences, University of Colombo

Tea is a main export product of Sri Lanka. Greenhouse gas (GHG) emission within the life cycle of a product is an important indicator of its impact on climate change and global warming. We aimed to identify the main GHG emitting sources and quantify and compare the emissions from the tea manufacturing process within different tea regions of Sri Lanka as part of an ongoing project on life cycle carbon footprint assessment of major export agricultural products of Sri Lanka. The current study analyzed a comprehensive GHG inventory of three GHGs (*i.e.* carbon dioxide [CO₂], methane [CH₄] and nitrous oxide [N₂O]), from harvesting to tea processing at the factory. We followed the GHG emission calculation protocols and IPCC guidelines using tier-1 and country specific emission factors. The functional unit considered was '1 kg of made tea.' Annual activity data of three consecutive years (2011 - 2013) were gathered from 63 tea factories representing all tea growing regions and different green leaf supply chains. The total GHG emission per unit processed tea was not significantly different among the tea regions ($p > 0.05$) and the mean emission per unit product ranged from 0.553 ± 0.168 (Uva) to 0.479 ± 0.089 (high-grown) kg CO₂ kg⁻¹ made tea. Electricity consumption and green-leaf transport contributed to 55 - 67% and 7% - 15%, respectively, of the total GHG emissions. Biomass burning contribution to CH₄ and N₂O emissions was ~17% in all regions. The annual GHG emission contribution from electricity varied based on fluctuations in thermal energy fraction of the grid electricity. Biomass transport contributed to only 3% - 7% of the total emissions in tea processing, and biomass transport in the high-grown region had significantly higher emissions compared to other regions ($p < 0.05$). The emissions of CO₂, CH₄ and N₂O comprised 98.28%, 0.11% and 1.6%, respectively, of the total emissions from diesel usage in green leaf and biomass transportation.

Keywords: Tea, greenhouse gas emissions, Sri Lanka

We acknowledge the University of Colombo and National Research Council of Sri Lanka for funding this research.

Feasibility study on constructing a heat battery for parabolic trough solar thermal energy plant

M. P. S. Viraj,¹ P. D. C. Kumara,^{1,2} H. H. E. Jayaweera,¹ and T. R. Ariyaratne¹

¹*Centre for Instrument Development, Department of Physics, University of Colombo*

²*Institute of Technology, University of Moratuwa*

A feasibility study for constructing an efficient, stable and low cost heat storage battery for a medium scaled parabolic trough concentrator (PTC) type solar thermal plant is reported. The purpose of having a heat battery on this system is to regulate fluctuations of temperature and backup energy whenever required. The dimensions of the PCT is 4.5 m × 4.8 m which gives rise to an aperture area of 22.3 m². The power that can be harnessed by the PTC is 9.12 kW at 150°C. Assuming the solar radiation is available only for four hours a day, the required capacity of the heat battery is 65.7 MJ in order to store half of the harnessed energy in a day and the required energy output from the heat battery is 4.56 kW. When designing the heat battery, capacity, output power, size, cost, and materials were considered as the main factors, and also the method of construction and ease of maintenance were considered. Out of main heat storage mechanisms – latent heat, sensible heat and reversible chemical reactions – reversible chemical reactions are not feasible due to the requirement of higher order technical skills to maintain such a system. Sn is the only material that can be used as a latent heat based storage system. However, in order to achieve the desired capacity about 867 kg of Sn is required. Molten salts and thermic oils are the available sensible heat storage materials for this temperature range. When heat capacities are considered thermic oils outsmart molten salts. Mobiltherm-605 was selected as the heat storage material due to commercially availability and two tank method is recommended for the design where hot tank operates at 250°C and cold tank operates at 150°C.

Keywords: Heat battery, thermal energy, solar power, energy storage

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Development of a combinatorial optical property measuring system for liquids

D. D. C. Wickramarathna¹, M. N. Kaumal² and H. H. E. Jayaweera¹

¹*Centre for Instrument Development, Department of Physics, University of Colombo*

²*Department of Chemistry, University of Colombo*

A system capable of measuring simultaneously the optical properties such as scattering, absorption, and fluorescence has been developed. A quartz tube was used as the sample holder. A photodiode and two tri-colour (red, green and blue) Light Emitting Diodes (LEDs) are mounted in the plane perpendicular to the axis of the sample holder tube in such a way that one LED makes an angle of 180° with the photodiode while the other makes an angle of 90° with the photodiode. Switching of the lighting of LEDs and reading of the photodiode (output through the transimpedance amplifier and analogue to digital converter (ADC)) are controlled by a microcontroller connected to a personal computer. Each measurement was taken by switching LEDs sequentially while reading the output from the photodiode. Diluted series (0.1×10^{-4} to 4×10^{-3} M) of four non-scattering solutions, Fe(SCN)₃ (dark brown), KMnO₄ (purple), K₂Cr₂O₇ (orange), CuSO₄ (blue) and milk (scattering) were used to test the operation of the proposed system. It was observed that the results produced by the scattering sample (milk) closely matched with the Rayleighscattering principle and the other non-scattering samples obeyed the Beer-Lambert law. KMnO₄ with the green LED, Fe(SCN)₃ and K₂Cr₂O₇ with the blue LED show fluorescence and for those LEDs, the system demonstrated deviations from the Beer-Lambert Law. It can be concluded that the system is capable of measuring optical properties such as wavelength selective scattering, concentration of non-scattering media, colour and certain fluorescing phenomenon. By coupling machine learning capabilities to the proposed system, it can be used as an alternative instrument to spectrophotometers in certain applications.

Keywords: Colorimetry, absorption, turbidity, scattering, non-destructive tests

**Impact of agricultural land use on stream water quality: a case study from
Kaluganga river basin, Sri Lanka**

D. Wickramasinghe¹ and K. Kulasekara²

¹*Department of Zoology and Environment Sciences, University of Colombo*

²*Sekara, Diggoda, Baduraliya*

This study focuses on the impacts of different agricultural land uses on stream water quality in the river basin of Kaluganga which is one of the most important rivers in Sri Lanka. Water quality parameters of streams were investigated in Kathalugala sanctuary (natural forest) as a reference site with no human impact and were compared with those of paddy fields, rubber and tea plantations in Palindanuwara, Mathugama. Sampling sites were visited at least twice a month for 5 months starting August 2013 and triplicate samples were collected from each site on each visit. Parameters recorded in the site were temperature, pH, conductivity, salinity, dissolved oxygen (DO), flow rate and bottom substrate type. Total phosphate and nitrate concentrations were determined in the laboratory. The results revealed that the natural forest consists of finest water quality parameters (means \pm SD; pH 6.9 ± 0.5 , EC 39.0 ± 5.6 μ S/cm, DO 9.7 ± 2.2 mg/l, flow rate 0.25 ± 0.18 km/hr, rock % 59.0 ± 3.6 , sand % 4.9 ± 4.2 , mud % 2 ± 2 , litter % 14.0 ± 7.2 , temperature 25.9 ± 0.8 °C, total phosphate concentration 0.32 ± 0.12 mg/l; no salinity and negligible amounts of nitrates)

In contrast, all water quality parameters in different agricultural practices were significantly different from those of the forest and from each other (ANOVA, $p = 1.000$). Streams in paddy cultivation areas exhibited high electrical conductivity, salinity, low DO and muddy bottoms were evident. Similarly, except for the forest, all other areas had water with undesirably low pH. This clearly reflects the possible influence of the land use on water sources. Yet, all parameters were within the permissible levels of Sri Lankan Water Quality Standards (SLS, 1983) except for pH. The results emphasize the necessity of continuous monitoring and setting priorities for water conservation and responsible use.

Keywords: Water quality, impacts, land use, Kaluganga basin

**Cloning, characterization, and expression analysis of genomic and c DNA clones of
BGLI gene from *Trichoderma virens* in *Saccharomyces cerevisiae*.**

G.H.I.M. Wickramasinghe,¹ N.V. Chandrasekharan,¹ R.L.C. Wijesundera,²

M.D.N.T.Perera¹ and W.S.S. Wijesundera³

¹ *Department of Chemistry, Faculty of Science, University of Colombo*

² *Department of Plant Sciences, Faculty of Science, University of Colombo*

³ *Department of Biochemistry & Molecular Biology, Faculty of Medicine, University of
Colombo*

Plant biomass (lignocellulose) comprises on average dry weight of 23% lignin, 40% cellulose, and 33% hemicellulose, and is the most abundant renewable polysaccharide on earth. Cellulose consists of long polymers of β (1-4) linked glucose units. Cellulase is a complex of three enzymes that act synergistically to convert cellulose to glucose. These enzymes are endoglucanase (EG) cellobiohydrolase (CBH) and β -glucosidase (BGL). *Trichoderma* species are known to be good cellulase producers and has been widely studied. BGL plays a major role in the conversion of randomly cleaved cellooligosaccharides into glucose. Yeast (*Saccharomyces cerevisiae*), can efficiently convert glucose into ethanol under anaerobic conditions. The present study describes the characterization, cloning and comparative expression analysis of both genomic and cDNA clones of β -glucosidase I (BGLI) in *S. cerevisiae* from a locally isolated strain of *Trichoderma virens*.

The BGLI gene was successfully PCR amplified using both genomic DNA and cDNA of *Trichoderma virens*. Amplified fragments were cloned into pGAPZ α expression vector and then separately transformed into *S.cerevisiae*. Recombinants were confirmed by sequence analysis. The size of the gene was 1439 bp with one intron (76 bp). The cDNA clone was 1363 bp in length. BGLI was 90% similar to the DNA sequence and 99% similar to the deduced amino acid sequence of 1,4- β -D-glucosidase of *T. atroviride* (AC237343.1) and belongs to the glycosyl hydrolases family 1. The expression of both genomic and cDNA clones of *BGLI* by recombinant *S.cerevisiae* was confirmed using a standard cellulase activity assay and SDS-PAGE analysis. The determined BGLI enzyme activities expressed by recombinant *S.cerevisiae* for the genomic DNA clone was 1.7×10^{-3} IU ml⁻¹ and the cDNA clones was 5×10^{-4} IU ml⁻¹ respectively.

Keywords: Lignocellulose, hemicellulose, cellulase, cellooligosaccharides, glycosyl hydrolases

**Cloning, expression and molecular dynamics simulations of *EXNI* gene from
Trichodermavirens and its expression studies in *Pichiastipitis***

G. H. I. M. Wickramasinghe,¹ S. Rathnayake,¹ S. Weerasinghe,¹

N.V. Chandrasekharan,¹ R.L.C. Wijesundera,² M.D.N.T.Perera¹ and W.S.S. Wijesundera³

¹ Department of Chemistry, Faculty of Science, University of Colombo

² Department of Plant Sciences, Faculty of Science, University of Colombo

³ Department of Biochemistry & Molecular Biology, Faculty of Medicine, University of
Colombo

Xylan is a major component of hemicellulose in plant biomass and is a polymer of 1,4-linked β -D-xylose units. Xylanases, including *endo*-1,4-D-xylanase (EXN), are fundamental enzymes that convert hemicellulose biomass to fermentable xylose. The enzyme is produced in considerable amounts by the *filamentous fungal species Trichoderma*.

The present study is based on the development of a recombinant *Pichiastipitis* expressing EXN gene of locally isolated *Trichodermavirens* species. *EXNI* gene was successfully PCR amplified from genomic DNA of *T. virens*. The amplified gene was cloned into pGAPZ α expression vector followed by transformation into *P. stipitis*. Hemicellulase activity of *EXNI* containing recombinant *P. stipitis* was estimated to be 529.3 nkat ml⁻¹ and SDS-PAGE analysis revealed a 24kD protein corresponding to EXNI.

The size of the gene was 690 bp with a single intron (115 bp). The coding region contained a 573 bp open reading frame encoding 191 amino acids. The deduced amino acid sequence was found to belong to the glycosyl hydrolases family 11 and the mature protein was identical to the EXN of *Trichodermaviride* (AAP83925.1).

Multiple sequence alignment homology method was used to model the protein. Molecular docking with DOCK6 software was used to predict binding affinity with xylose. The ligand binding site of EXNI protein and the grid score indicating the binding affinity were recorded. The modeled protein and the docked complex of xylose were subjected to each 15 nano-second long molecular dynamics (MD) simulations to investigate the stability of the protein and the complex in aqueous medium. The stability of the above systems was studied in terms of root mean square deviations, radius of gyration and root mean square fluctuations.

MD results indicate that the protein and xylose-protein complex behave in a similar manner with considerable stability in the aqueous medium. Constructed homology model of the protein, deduced binding site and the binding affinity appear to be reasonable.

Key words: Xylan, filamentous fungus, glycosyl hydrolases, hemicellulase, homology model

Deterministic time series models for short-term forecasting of gold price in Sri Lanka

B.N. Wijewickrama¹ and R.A.B. Abeygunawardana²

¹*IESL College of Engineering, Hector Kobbekaduwa Mawatha, Colombo*

²*Department of Statistics, University of Colombo*

The importance of gold as a precious metal is increasing daily. Therefore it is worthwhile to study the fluctuations of gold prices. This study was conducted to forecast the market price of gold in Sri Lanka based on the monthly data during 2007-2014. Descriptive analysis shows that the gold price has increased until 2012 and thereafter it has decreased. Detailed analysis shows that the current gold price mainly depends on a few past observations. So more advanced time series models (ARIMA, VAR or GRACH models) may not be applicable, due to lack of past data. In this study, some deterministic procedures such as exponential smoothing were used for short-term forecasting. Exponential smoothing takes moving averages to estimate the current value of the mean and then use that as the forecast for the near future. In this study forecasting was done using exponential smoothing techniques and considering the optimal smoothing constant. Single exponential smoothing has one-parameter and it shows the observed values in a straight line of forecasted values. Since a line is not suitable to predict the fluctuations accurately, a double exponential smoothing was carried out. Double exponential smoothing plot shows the observed values overlaid with smoothed curve. Based on the sample data, the most suitable smoothing constant for level and trend were identified as 1.125 and 0.035 respectively. It was found that the forecast values are very close to the observed values. Furthermore Holt Winter's method shows that the observed values overlaid with the original values up to a peak point and then a small deviation. An error analysis was used to compare these methods. Mean absolute deviation and mean squared deviation for each of the simple forecasting and smoothing methods has been calculated. The smaller the error value, the better the method. The double exponential smoothing error values are much lower than the values from other smoothing methods.

Keywords: Gold price, forecasting, exponential smoothing

Sri Palee campus

University of Colombo



Message from the Rector Sri Palee Campus

Dr. Ranjan Hettiarachchi



It is with great pleasure that I issue this message on the occasion of the Annual Research Symposium of the University of Colombo, 2016.

A university is the centre of knowledge creation, the centre of wisdom and thoughts. The University of Colombo is a symbol of this concept. The vision of the University of Colombo is to be the centre of excellence in every aspect of societal needs. Research is one of the utmost societal needs to uplift the status of the “Sri Lankan citizen in the globe”. Therefore, It is highly commendable to have the reserach symposium as a prime objective on the University agenda every year.

We, the total population of the University of Colombo can be proud for being part of this center of the excellence. The symposium 2016 will make available the opportunities to all academia in the university from all seven faculties, the campus and the institutes to have discussions on issues pertaining to all streams of knowledge. This symposium will be a spectrum of knowledge and will contribute immensely to building a distinct image of the University.

I would like to extend my gratitude to the Vice-Chancellor, as well as the members of the Research Committee for their tremendous dedication to making this glamorous event happen, with the support and participation of the entire university community. It is the strength of the University of Colombo.

I wish the Annual Research Symposium 2016 all success.

Sri Palee Campus

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Latest tendencies of Sri Lankan dance in advertising

R. I. Batuwangala

Faculty of Performing Arts, Sri Palee Campus, University of Colombo

Advertising uses the formats of marketing communication for the purpose of marketing or promoting a product or a service. Today, advertising is capable of satisfying the busiest lifestyle of people with the assistance of globally developed modern technology. Sri Lankan dancing is an art form which developed under the patronage of the elite. Although it does not have a marketing value from the strict sense of commodity value, it has the ability of sending messages to the masses. Due to this, dancing has become a *sine qua non* and the artists have become timely valuable sources in society. Villagers passed the message of dancing festivals vocally, as the temple or the paddy field or the village chief's place had become a central place of sending messages. They did not use the drum beater to send the message. However, today the magazine, TV and radio play an outstanding service in sending advertisements using modern technology as it has become an inevitable part of modern life. The new trend of dancing has reached the discussion table as a result of spreading advertisements via above modes. When compared with the past, advertising today has become a way of enhancing the popularity of a dancer. This research focuses on the importance and values of advertising for a dancer. The modern tendencies are also discussed through it. Information and data are collected by referring to classical literature related to the subject and interviews and participatory observations are also used. More significantly, it deals with a few advertisements which are made following modern Sri Lankan dancing. As a result of that, the importance of the dancer has also emerged in society. Furthermore, advertising focuses on the construction of new dancing forms while attracting the enthusiasm of the audience to the dance. In this study, the importance of advertising is highly recognized. Up-country, low -country and Sabaragamu traditional dancing forms and utilities of the modern dancing to advertising are the limitations of this study.

Keywords: Advertising, Dancing, Trends, Marketing, Communication

Disaster news reporting over social media in Sri Lanka

S.D.P.S Dissanayake

Department of Mass Media, Sri Palee Campus, University of Colombo

With the development of new technologies in the world since the mid-1990s, the masses of Sri Lanka have been led to internet based applications known as “social media,” that enable people to interact and share information through media that were non-existent or unavailable 15 years ago. Examples of social media include blogs, chat rooms, discussion forums, wikis, YouTube channels, LinkedIn, Face book, and Twitter. Social media can be accessed by the computer, tablets, smart and cellular phones, and mobile phone text messaging (SMS).

Social media has become prominent in the social life of the masses of Sri Lanka today. Most people are engaged in social media networks as part of their daily routine. Recent events have indicated that the sharing of news in social media has become a new phenomenon. Individuals of Sri Lanka have been able to participate in news reporting and news productions over the social media.

This study discusses disaster reporting over social media, news sharing and new experiences brought about by them. In the last five years, social media has played a vital role in reporting emergencies and disaster situations. Social media can be ranked as the fourth most popular source to access emergency information. In recent years, the world has experienced a series of unexpected natural disasters. For examples, Katrina in USA, Earthquakes in Haiti, tsunami in Indonesia, earthquake and tsunami in Japan, cold winter in Europe, Aranayaka landslide, Koslanda landslide, Salawa explosion and so forth.

There are three stages of disaster reporting. Those are prior to a disaster occurring, the occurrence of a disaster and the time after the disaster. Social Media paves the way for people to manage themselves with the immediate communication of the incidents. Social Media gives vital information out to the public and disaster management organizations in a quick and efficient manner. Through such information and the efforts provided by social media people can better be informed of the world.

Keywords: Social Media, Disaster, Communication, Management.

A study on the utility of the media magazine for communicating sustainable regional development in Sri Lanka (with special reference to *Peramaga* magazine)

K. P. Gamage

Department of Mass Media, Sri Palee Campus, University of Colombo

Magazines describe branded and edited contents often supported by advertising or sponsorship and delivered in print or other forms. It is noted that magazines are printed periodically and commonly published weekly, monthly or quarterly. Western communication history defines publications appearing at regular intervals (weekly, monthly, and quarterly) other than newspapers, generally of smaller size with cover and binding periodicals and journals to general circulation as magazines. The Brundtland Commission report defines sustainable development as “development which meets the needs of current generations without compromising the ability of future generations to meet their own needs”. This concept strongly supports economic and social development in particular, of regional people. At the same time, it underlines the importance of protecting the natural resource base and the environment. The magazine of ‘*Peramaga*’ was first published in March, 1979 by the Ministry of Provincial Council and Local Government Bodies. The aim of this magazine is to communicate projects that were launched by the Ministry and to ensure accuracy, knowledge and better vision for government officers and the community. This study focuses on the utility of magazine media for communicating sustainable regional development and applies a mixed methodology with qualitative and quantitative data. Interviews, content analysis and observation of selected magazines are employed as tools for collecting data. ‘*Peramaga*’ magazine basically bears the ideology of the Ministry and communicates projects of “Uda gam”, “Pooja bhoomi sanvardhane”, “Gamudha” carried out by the Ministry in order to develop sustainable regional development.

Keywords: Magazine, Sustainable Development, Social Development, communication, Regional people

**Media behaviour and depression among female audiences in contemporary
Sri Lankan society**

R.C.K. Hettiarachchi

Sri Palee Campus, University of Colombo

Television, radio, advertising, movies, the internet, newspapers, magazines, and so forth are considered as mass media. Mass Media is communication and it dominates modern culture. What role does mass media play? Many researchers have debated this controversial question. While opinions vary as to the extent and type of influence mass media wields, all sides agree that mass media is a permanent part of modern culture. The common masses are bombarded constantly with messages that include stereotypical ideologies that promote moods, attitudes, and a sense of what is and is not important. Traditional thinking patterns, norms and values seemed to be replaced by new cultural contents enormously. Media's influence seems more significant on framing human consciousness and limiting the boundaries of thinking in ways how media portrait the reality. Life of people who did not admire much of the material culture seemed to encounter threats and challenges created by modern mass mediated culture. This worrying trend seems to occur despite the preponderance of scientific studies and show the harmful effect of mediated messages on behaviour and attitude. This leads to frustration and frustration, to depression. Women tend to be more vulnerable to this situation. Hence this study is an attempt to investigate media behaviour and its impact on depression of female audiences. The aim of this research was to investigate the influential social power of media on female audiences, media contents and their negative effects on audience, and the relationship between media content and depression. Data was gathered from a sample which consists of ten women who were randomly selected from nationally represented housewives and to investigate the relationship between media effects and frustration which causes depression among female audiences. A quantitative research approach was employed with the use of a questionnaire. Data was analyzed both quantitatively and qualitatively. It was found that when people encounter a new culture they experience a cultural shock. This psychological confusion and emotional discomfort usually causes a tremendous amount of psychological stress. The data seemed to reveal that media content may lead to depression more directly. Further research is worth doing with a bigger sample to generalize the findings.

Keywords: Communication, media behaviour, media power, TV content, depression

A critical analysis of the use of selfies for brand-building campaigns through social media

S.L. Hewapathirana

Faculty of Mass Media, Sri Palee Campus, University of Colombo

The first self-portrait photograph was taken in 1839 using the daguerreotype process, but it is debatable whether it is a true selfie in the modern sense of the word. The “looking-glass self” is a psychological concept explaining the way we see ourselves and it is not determined by who we really are, but rather from the way we think others see us. This is a concept that has been compared to how advertising campaigns need to be aware of the ways the consumers think and how they would see the particular product promoted in the campaign. Research indicates that people in the target mindset (high or stable self-esteem) are generally associating purchases with image benefits. In case a product can be associated with terms like ‘sparkle’, ‘slimming’, ‘exciting’ and ‘fun’ and then it is believed that the marketer should consider trying out a selfie campaign. Businesses will seek to access a ready-made audience, but it also takes a level of comprehension on how best to do so – as with all aspects of social media, understanding their audience is critical to success. There definitely are opportunities within the selfie trend, but brands have to establish the best way to realize it, with what will resonate with their target consumers. This requires listening, and monitoring trends to know what your audience will and will not engage in. But it also necessitates an understanding of the psychology of selfies, of why people engage in this activity in the first place. This research tries to explore the phenomenon of selfies from various points of views. It will pay close attention to how individual selfies are usually given names of the place and the situation or the incident behind the selfie. This research is primarily based on an observation method and online research. Quantitative data has been collected in the form of a questionnaire that was given to a specially recognized focus group discussion on Facebook pages that are specifically created for sharing selfies. The data analysis uses the SPSS software. This research can be useful to find new ways for cost effective brand promotion and would thus be of use to any business that needs promotion of its products, services or ideas.

Keywords: Self-Image, Social Media, Brand, Campaign, Promotion

Using data mining techniques to analyze crime patterns in Sri Lanka

K. P. S. D. Kumarapathirana¹ and S. C. Premaratne²

¹*Department of Computer Studies, Sri Palee Campus, University of Colombo*

²*Department of Information Technology, University of Moratuwa*

Crime is a dangerous factor for any country. Although crimes could occur everywhere, it is common that criminals work on crime opportunities they face in areas most familiar to them. The ultimate goal of crime analysis is to identify likely targets for police intervention and prevent crime or solve past crimes by making statistical predictions. Criminals and victims follow common life patterns and most of the time overlaps in those patterns indicate an increased likelihood of crime. Geographic and temporal features influence the where and the when of those patterns.

Our proposed solution consists of four major modules namely; 'Hotspot Analysis Module', 'Offender Profiling Module', 'Victim Profiling Module' and 'Suspect Predicting Module'. Data related to fast crimes which is used for the analysis is collected from Department of Police, Sri Lanka. Hotspot analysis module identifies crime hotspots considering geographical data of past crime where victim profiling and suspect profiling modules identify the patterns or groups of victims who are most vulnerable and suspects who share same characteristics. The first three modules are developed based on simple k-means clustering algorithm where the fourth module is based on simple k-means clustering and j48 algorithm to generate the classifier model which can be used to predict the cluster of suspects of a crime.

The results of this analysis can be used by law enforcers to find general and specific crime trends, patterns, and series in an ongoing, timely manner in order to maximize the use of limited law enforcement resources, to have an objective means to access crime problems locally, regionally, nationally within and between law enforcement agencies, to be proactive in detecting and preventing crime, to meet the law enforcement needs of a changing society and to understand criminal behaviour.

Keywords: Data Mining, Crime Analysis, Crime Patterns

Emerging feminist consciousness in Wijenaike's *Giraya*

J. Wannisinghe

Sri Palee Campus, University of Colombo

This paper argues that the women protagonists in *Giraya* challenge the patriarchal ideology of the colonised Sri Lankan household, which has sought to confine women to the domestic sphere, by co-opting indigenous norms of Sri Lankan femininity. These women challenge the re-inscription of patriarchal authority in modern and colonial times by seeking to modify the traditional structures of the household and juxtaposing apparent madness with reason in the direction of emerging subjectivities for women that patriarchy cannot yet recognize. In addition, Wijenaike's heroine uses her own son's patriarchal authority to establish a present and future agency for women capable of new 'traffic' in and beyond a patriarchal discourse. Such agency enables women writers like Wijenaike and her fictional protagonists to transform traditional Sri Lankan kinship patterns, rewriting what Gayle Rubin calls the "fiction of origins" in a uniquely Sri Lankan context.

Women protagonists' disruption of patriarchal power at home constitutes a necessary entry for women into the domain of economic activities that were once almost exclusively limited to men. Patriarchal ideologies are deeply embedded in almost all social institutions. However, women are equally capable of playing certain roles that men think only they can play. Households and women play a significant role in any society because gender identity is created in the family household. Therefore, gender relations have to be analyzed from the household in order to understand how women are positioned in the relations of production. As we witness, no woman is ever only a woman playing the role of submissive wife but she performs multiple subject positions in any society. This study attunes to a Marxist Feminist approach wherein gender differences are assumed to be generated through the process of production. The prospective study, therefore, yields new insights into women's emancipation from patriarchal constraints.

Keywords: Patriarchal Ideology, Domestic Sphere, Traffic in Women, Kinship Patterns

