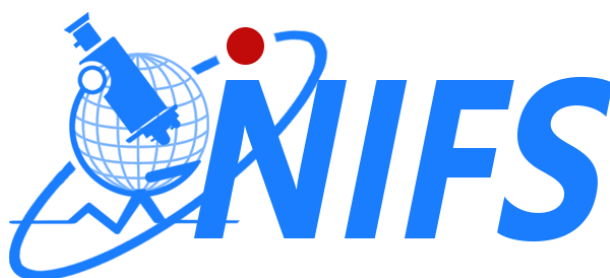




Ministry of Science, Technology & Research



National Institute of Fundamental Studies

Annual Report

2016

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1. Introduction

National Institute of Fundamental Studies

The National Institute of Fundamental Studies (NIFS) was established in 1981 by the Parliament Act No 55. NIFS is the only national institute which by its Act, has the main objective as to initiate, promote and engage in advanced research in fundamental studies with an emphasis on basic research for the advancement of scientific knowledge, human resources, and national development.

Vision

“To be a world renowned center of excellence for research in fundamental studies.”

Mission

“Initiate, promote and Engage in advanced research in fundamental studies for the enhancement of scientific knowledge, human resources, and national development”

Objectives

- Initiate, promote and conduct research and original investigations to fundamental studies in general with particular emphasis on mathematics, physical and chemical sciences, life sciences, social sciences and philosophy, taken in the broadest sense to collaborate with public and private institutions as may be necessary to develop applications relevant to the studies conducted
- Arrange lectures, meetings, seminars, and symposia in pursuance of its research work and for the diffusion of scientific knowledge;
- Invite scientists in Sri Lanka and from abroad, who are actively engaged in creative work to deliver lectures and participate in its research activities;
- Establish and maintain liaison with scientific workers and scientific institutions in other countries and promote international co-operation in matters relating to the aims and objects of the Institute, while taking care to protect and promote the national interest;
- Provide training, guidance, and assistance for research leading to the award of post graduate degrees by institutions recognized by the University Grant commission established by the University Act, No.16 of 1978.
- Do such other acts and things as may be necessary to promote the aims and objectives of the Institute.

2. Board of Governors

- **Prof. Anura Wickramasinghe**

Chairman/ Board of Governors/ NIFS
University of Peradeniya

- **The Advisor to the President on Scientific Affairs**

- **Prof. Mohan De Silva**

Chairman/ University Grants Commission

- **Prof. S.H.P.P. Karunaratne**

Director/ NIFS

- **Prof. M.A.K.L. Dissanayake**

Research Professor/ NIFS

- **Prof. N.G.J. Dias**

Professor in Computer Science/ University of Kelaniya

- **Dr. W.K.B.N. Prame**

Former Director General/ Geological Survey & Mines Bureau

- **Prof. C.P. Deepal W. Mathew**

Senior Professor in Biochemistry/ University of Colombo

- **Prof. M.J.S. Wijeyaratne**

Senior Professor of Zoology & Environmental Management, Univ. of Kelaniya
Chairman/ National Science & Technology Commission

- **Prof. Namal Priyantha**

Director/ Postgraduate Institute of Science, University of Peradeniya

- **Mr. J.M.U.P. Jayamaha**

Additional Director General/ Dept. of Public Enterprises, Ministry of Finance

- **Prof. U.L.B. Jayasinghe**

Senior Research Professor/ NIFS

- **Dr. P.S.B. Wanduragala**

Secretary to the Board of Governors/ NIFS

3. Research Council

Prof. S.H.P.P. Karunaratne
(Chairman)
Director/ NIFS

Prof. D.M.D. Yakandawala
Head/ Dept. of Botany
University of Peradeniya

Prof. H.M.D. Namal Priyantha
Director/ Postgraduate Institute of Science
University of Peradeniya

Prof. G.K.R. Senadeera
Department of Physics
The Open University of Sri Lanka

Prof. A. Nanayakkara
NIFS

Prof. U.L.B. Jayasinghe
NIFS

Prof. M.A.K.L. Dissanayake
NIFS

Prof. G.R.A. Kumara
NIFS

Prof. M.C.M. Iqbal
NIFS

Dr. D.N. Magana-Arachchi
NIFS

Dr. R.R. Ratnayake
NIFS

Dr. R. Liyanage
NIFS

Prof. R.D. Jayasinghe
Dept. of Oral Medicine & Periodontology,
University of Peradeniya.

Prof. R.L. Chandrajith
Head/ Department of Geology
University of Peradeniya

Prof. D.K. Weerakoon
Department of Zoology
University of Colombo

Prof. J. Bandara
NIFS

Prof. G. Seneviratne
NIFS

Prof. D.S.A. Wijesundara
NIFS

Prof. S.P. Benjamin
NIFS

Prof. N.D. Subasinghe
NIFS

Dr. M.S. Vithanage
NIFS

Dr. H.W.M.A.C. Wijaysinghe
NIFS

Dr. P.S.B. Wanduragala
Secretary to the Council, NIFS

4. Message from the Director

It is a great pleasure to make this note on the occasion of the 2016 Annual Report. Institute of Fundamental Studies was established in 1981 and the name was changed to National Institute of Fundamental Studies (NIFS) Sri Lanka in 2014. NIFS is the only national institute which, by its Act, has the main objective as to engage in scientific research to facilitate fundamental and advanced studies with an emphasis on basic research for national development as well as for the advancement of science.

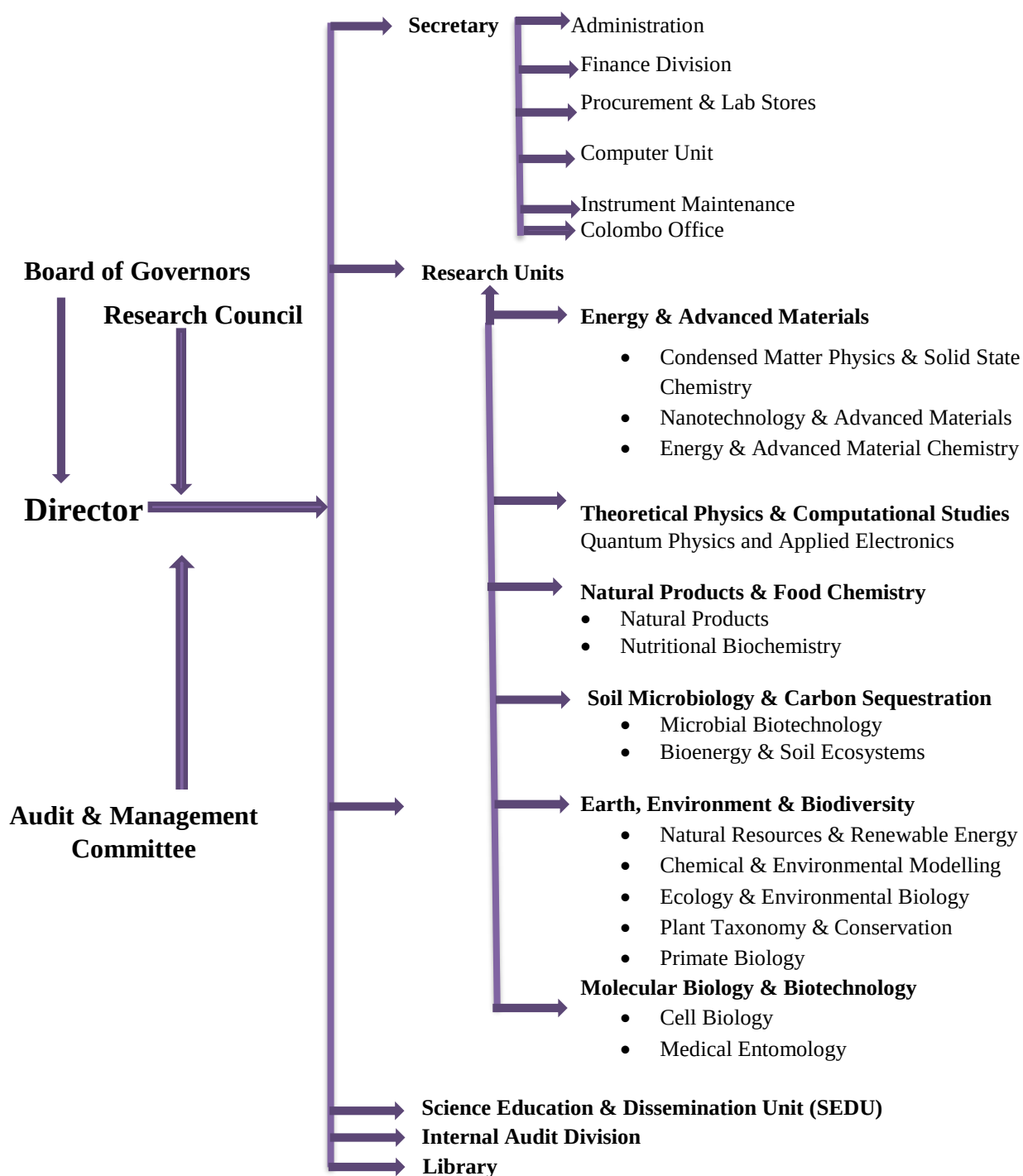


The Institute had 05 Senior Research Professors, 02 Research Professor, 03 Associate Research Professors, 02 Senior Research Fellows and 02 Research Fellows. Eighty-four (84) postgraduate research students conducted their research under these scientists. Scientists at NIFS have published 86 research papers in referred journals including 61 in SCI/ SCI expanded journals, and 108 conference papers/ abstracts in the year 2016 along with two patents (one International and one National). Eleven (11) research assistants obtained their postgraduate degrees (05 Ph.D.s and 06 M.Phil.s). In addition, several M.Sc. students (12) and undergraduates (14) completed their research projects at NIFS in 2016. Several prestigious research awards including the CVCD Research Excellence Award and the NSF/TWAS Young Scientist Award were received by NIFS staff.

We spent more than 70 million LKR from our 2016 budget for the purchase of major equipment such as XRD, GC, HPLC, LC-MS, Thermal Evaporator, ICPOES and multi-mode microplate reader. Science Education and Dissemination Unit (SEDU) concluded another excellent year by organizing inspiring programs for the scientific community, school children and teachers, and the general public. In 2016, the Consultation and Collaborative Division (CCD) has strengthened national and international collaborations of NIFS by extending the services and collaborations to various government and nongovernment organizations. I should also thank the technical, administrative, accounts, maintenance and other staff of NIFS for their invaluable support given to make a successful progress in 2016.

Prof. S.H.P. ParakramaKarunaratne
BSc, MSc (Perad), PhD (Lond), FRES (Lond), FNAS (Sri Lanka)
Director & Senior Research Professor/NIFS
Senior Professor & Chair of Zoology, University of Peradeniya.

5. NIFS ORGANIZATION STRUCTRE



6. SWOT Analysis of NIFS

Strengths

1. The only national research institute in Sri Lanka dedicated to conduct research on fundamental studies.
2. Ideal location in the hill capital of the country to perform collaborative research. NIFS is situated close proximity to other research and higher education institutes such as the University of Peradeniya, Postgraduate Institute of Agriculture, Postgraduate Institute of Science, Department of Agriculture, Tea Research Institute, Veterinary Research Institute, Royal Botanical Gardens etc.
3. Availability of advanced sophisticated equipment to conduct advance scientific research.
4. Ability to maintain international standards of research as one of the most productive research institutes in the country in terms of high-quality research publications judged by Science Citation Index.
5. Serving as a well-equipped center for the human resource development in science, technology & research in the country to complete their postgraduate research work.
6. A carder of well qualified and experienced senior and junior scientists. NIFS is the only research institute with carder positions of “Senior Research Professor” and “Research Professor”

Weakness

1. Difficulty in maintaining equipment and laboratories up to standards.
2. Inability to expand at the present location & the weak and instability status of the old building.
3. As an Institute far away from the capital of the country, it is difficult to participate official events held in Colombo.
4. The inefficiency of the existing management structure for an effective delivery of expected outcomes of the Institute.

Opportunities

1. The success of existing research projects enhances the potential to initiate and engage in new research projects in fundamental studies
2. Potential to conduct collaborative research projects with combining different fields of basic research
3. Opportunity to organize research meetings, workshops, and research colloquia to enhance the exchange of technical and scientific information
4. Opportunity to recruit more young students as volunteers, trainees, and research assistants to different research projects giving them invaluable research training under competent senior scientists to serve the nation in the future as great scientists

Threats

1. Difficulty in convincing the importance of fundamental research for the well being of the country to funding agencies and policy makers.
2. Request to conduct applied reach instead of fundamental research by higher authorities
3. Inadequate funding for capital and recurrent expenditure
4. Competition from other research institutes

7. Performance of Institute

Over the years, NIFS has achieved several goals with the limited number of resources it had. Progress achieved during the year 2016 had been excellent and the research carried out at NIFS had made a significant contribution towards science, in general, and the development of the country.

Scientists at NIFS had published 86 research papers in referred journals including 61 in SCI/ SCI expanded journals, and 108 conference papers/ abstracts in the year 2016 along with two patents (one International and one National).

Publications	Number of publications
SCI Journals	31
SCI extended journals	30
Refereed Journals	24
Abstracts of papers presented at conferences/symposia etc.	108
Book Chapters	11
Newspaper Articles	28

7.1.Awards & Recognitions

For the utmost contribution by Scientists of NIFS for the wellbeing of the nation and for the sustainable development of science, our scientists have been awarded and recognized with national & International Awards in 2016.

a) International Awards & Recognitions

Name of the Award	Name of the Researcher	Designation	Institute
Alexander von Humboldt Research Fellowship to conduct research work	Prof . J. Bandara	Senior Research Professor	Max- Plank institute, Germany
CAS President 's International Fellowship Initiative award to conduct his research in China	Prof . J. Bandara	Senior Research Professor	Chinese Academy of Science
International Competitive Research Fellowship to conduct research in a German University	Prof . M.C.M. Iqbal	Associate Research Professor	Erasmus-Mundus program, Germany

SPIE (international Society for Optics & Photonics) International Award 2016	Mr. A.M.J.S. Weerasinghe	Research Assistant	International Society for Optics & Photonics
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b) National Awards & Recognitions

Name of the Award	Name of the Researcher	Designation	Institute
Kandiah Memorial Award for Basics Sciences at the 45th Annual Sessions	Ms. A.G.A.W. Alakolanga	Research Assistant, Natural Product Project	Institute of Chemistry Ceylon
Presidential Award for his scientific publications in the year 2014	Prof . J. Bandara	Senior Research Professor	National Research Council
Presidential Award for Scientific Publications for 2014	Prof . M.A.K.L. Dissanayake	Research Professor	National Research Council
Presidential Award for Scientific Publications for 2014	Prof . L. Jayasinghe	Senior Research Professor	National Research Council
Presidential Award for Scientific Publications for 2014	Prof . N.S. Kumar	Visiting Research Professor	National Research Council
Presidential Award for Scientific Publications for 2014	Ms. A.G.A.W. Alakolanga	Research Assistant	National Research Council
CVCD excellence award - 2016 for the most outstanding researcher in the field of Biological Sciences including Agriculture & Allied Sciences	Prof . S.H.P.P. Karunaratne	Senior Research Professor & Director of NIFS	Committee of Vice-Chancellors & Directors, UGC, Sri Lanka
<i>Med. Chem. Com.</i> Best Poster Presentation Prize	Ms. C.L. Kehelpannala and Ms. D. Thanabalasingam	Research Assistants, Natural Products research group	The Royal Society of Chemistry
<i>Med. Chem. Com.</i> Poster Prize	Dr. Ruvini Liyanage and her team (Rizliya Visvanathan, Chatuni Jayathilake)	Research Fellow	The Royal Society of Chemistry
Presidential Awards for Scientific Publications for 2014	Dr. Meththika Vithanage	Senior Research Fellow	National Research Council
TWAS-NSF Award for Young Scientist (Chemistry), 2016	Dr. Meththika Vithanage	Senior Research Fellow	National Science Foundation

Science popularization, Print media (Sinhala) 2016	Dr. Meththika Vithanage	Senior Research Fellow	Sri Lanka Association for the Advancement of Science (SLAAS)
Best Poster Award on Microarray analysis in Chronic Kidney Disease of Unknown Aetiology (CKDu) patient s: Personalizing Diagnosis and Treatment at Health Science' theme	Dr. D.N. Magana-Aracchi, S. Sayanthooran, L. Gunarathne, T. Abeysekera	Senior Research Fellow Research Assistants	NSF Research Summit 2016
Presidential Award for Scientific Publications of 2014	Dr. G.K.R. Senadeera	Visiting Associate Research Professor	National Research Council
Kandiah Memorial Award for Applied Sciences	Ms. D. Thanabalasingam	Research Assistant, Natural Product Project	Institute of Chemistry Ceylon
Presidential Award for Scientific Publications of 2014	Mr. C.A. Thotawatthage	Research Assistant	National Research Council
The Best Research Paper Award	Prof G. Seneviratne , Ms. P.C. Wijepala	Senior Research Professor Research Assistant	the Sri Lanka Next : A Blue-Green Era - International Research Symposium, BMICH, Colombo
Presidential Award for scientific publications in the year 2014	Prof N.D. Subasinghe	Associate Research Professor	National Research Council
Presidential Award for scientific publications in the year 2014	Dr. Athula Wijayasinghe	Research Fellow	National Research Council
Award for Science popularization, Electronic media (Sinhala) 2016	Mr. A.M.J.S. Weerasinghe	Research Assistant	Sri Lanka Association for the Advancement of Science (SLAAS)

7.2.Human Recourses

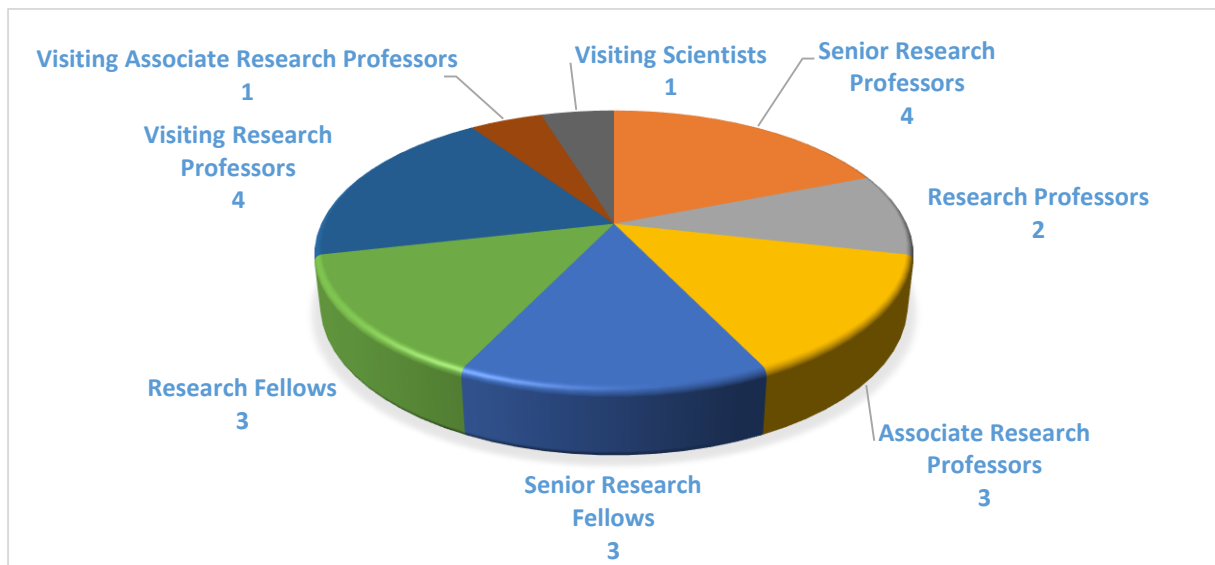
Well qualified human resources are the most valuable assets NIFS has. Administration of NIFS works on providing human resources expertise and services to all staff across the Institute to foster an effective and collaborative work environment that supports Institute's vision and mission.

Summary Information of Staff Strength of NIFS

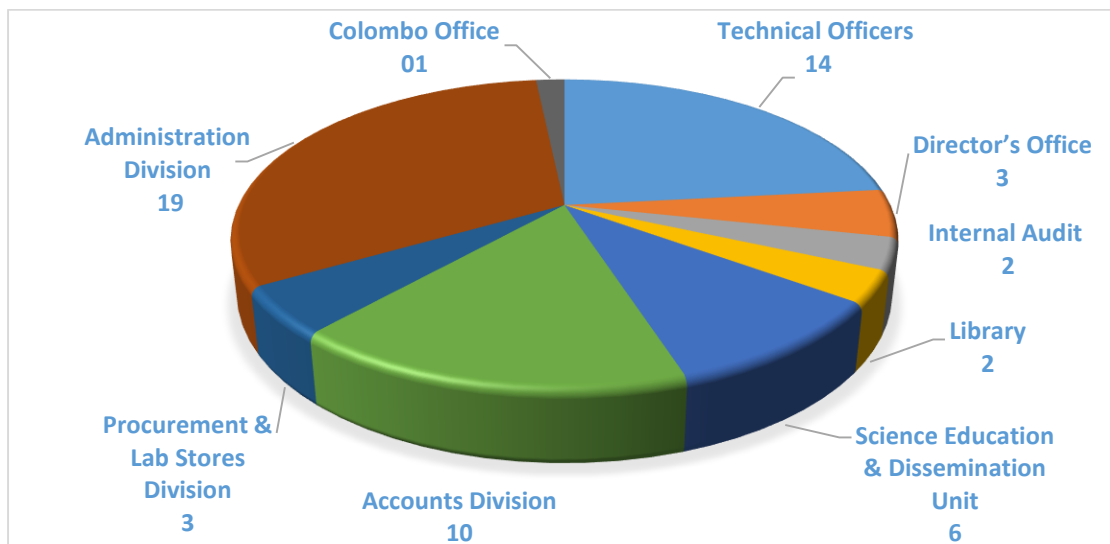
The HR carder of NIFS constitutes 126 employees and this includes

- 21 Scientists
- 45 Research Assistants
- 16 Technical officers and
- 46 Non Research Staff

Scientists of Research Staff have 5 different positions



Non Research Staff was sub divided into 9 divisions at NIFS



7.2.1. New Recruitments and Resigning.

Following New Recruitments had been made at NIFS during the year 2016.

Name	Designation	Date of Appointment
Ms.K.M.U.J Bandara	Research Assistant Gr.II	01.01.2016
Prof.S.Wijesundara	Research Professor	11.01.2016
Mr.D.R.L Dodangodage	Research Assistant Gr.II	01.02.2016
Ms.J.A.D.M.N Jayakody	Research Assistant Gr.II	15.02.2016
Ms.S.K Jayasekara	Research Assistant Gr.II	02.05.2016
Ms.R.W.K Amarasekara	Research Assistant Gr.II	16.05.2016
Ms.E.M.U.A Ekanayake	Research Assistant Gr.II	16.05.2016
Ms.W.M.L.S Weerasundara	Research Assistant Gr.II	09.05.2016
Prof.S.A Kulasooriya	Visiting Research Professor	15.07.2016
Prof.N.S Kumar	Visiting Research Professor	03.08.2016
Mr.P.L.C.U.S.B Lekamge	Research Assistant Gr.II	01.12.2016
Mr.A.M.K.L Abeykoone	Research Assistant Gr.II	08.12.2016
Prof.G.R.A Kumara	Research Professor	02.01.2016
Prof.N.K.B Adikaram	Visiting Research Professor	02.01.2016
Ms.G.T.R Abenayake	Research Assistant Gr.II	16.01.2016
Prof.M.A.K.L Dissanayake	Research Professor	05.09.2016
Prof.G.K.R Senadeera	Visiting Associate Research Professor	01.10.2016

Following staff members had resigned from NIFS in the year 2016.

Name	Designation	Resigned date
EGCK Priyadarshika	Research Assistant Gr.II	29.02.2016
T.P Keerthirathne	Research Assistant Gr.II	26.03.2016
PHMIDK Herath	Research Assistant Gr.II	29.02.2016
NN Jayawardene	Research Assistant Gr.II	15.06.2016
MI Watawara	Research Assistant Gr.II	15.06.2016
DMTU Baudar	Research Assistant Gr.II	14.07.2016
RMGCSK Jatathilaka	Research Assistant Gr.II	24.08.2016
TB Nimalasiri	Research Assistant Gr.I	15.10.2016
SA Samaranayaka	Research Assistant Gr.II	03.11.2016
I Tumpale	Chief Technical Officer	15.10.2016
RMNM Rathnayake	Research Assistant Gr.II	30.12.2016
M.C.Rajapaksha	Coordinator Cum Scientific Officer	30.11.2016

7.2.2. Capacity Building /Skill Development/Training

NIFS is serving as a well-equipped training center for young scientists who study for their post graduate degrees. In 2016, Our scientists have trained 84 students for conducting their postgraduate research. Among them, 11 research assistants obtained their postgraduate degrees in 2016(05 Ph.D.s and 06 MPhil.s). In addition, several M.Sc. students (12) and undergraduates (14) completed their research projects at NIFS in 2016.

Both Research and Non-Research Staff of NIFS have got opportunity to participate for different training/skill development programs which are relevant to their field of work.

Foreign workshops, seminars and conferences for Research Staff

Titles of Training Programs	Institute/ Training provider	Participants	Duration	Funding Agency
Collaborative research	Charmers University of Technology, Sweden	Scientist	08-20,06,2016	
Collaborative research	Charmers University of Technology, Sweden	Scientist	29.04.2016 – 01.07.2016	
Research Training	Toyota Technological Institute of Japan	Research Assistants	30.01.2016 – 01.07.2016	
Conduct research	Max-Planck-Institut für Eisenforschung GmbH, Dusseldorf, Germany	Scientist	01.07.2016 – 30.09.2016	
Conduct research on Solar Cells	Center for Ionics, University of Malaya	Research Assistants	15.07.2016 – 10.09.2016	
Postdoctoral Program on research	Department of Crop Science, University of Goettingen	Scientist	15.09.2016 – 15.12.2016	
Workshop on Unlocking the Industrial Potential of Seaweed Resources of Sri Lanka	Sri Lanka Institute of Nanotechnology (SLINTEC)	Mr. MM Qader, Research Assistant	January 13, 2016	N/A
National Workshop on Separation Techniques used in Natural Product Research	Natural Products Research Group, NIFS	Mr. MM Qader, Research Assistant	September 19-23, 2016	NIFS

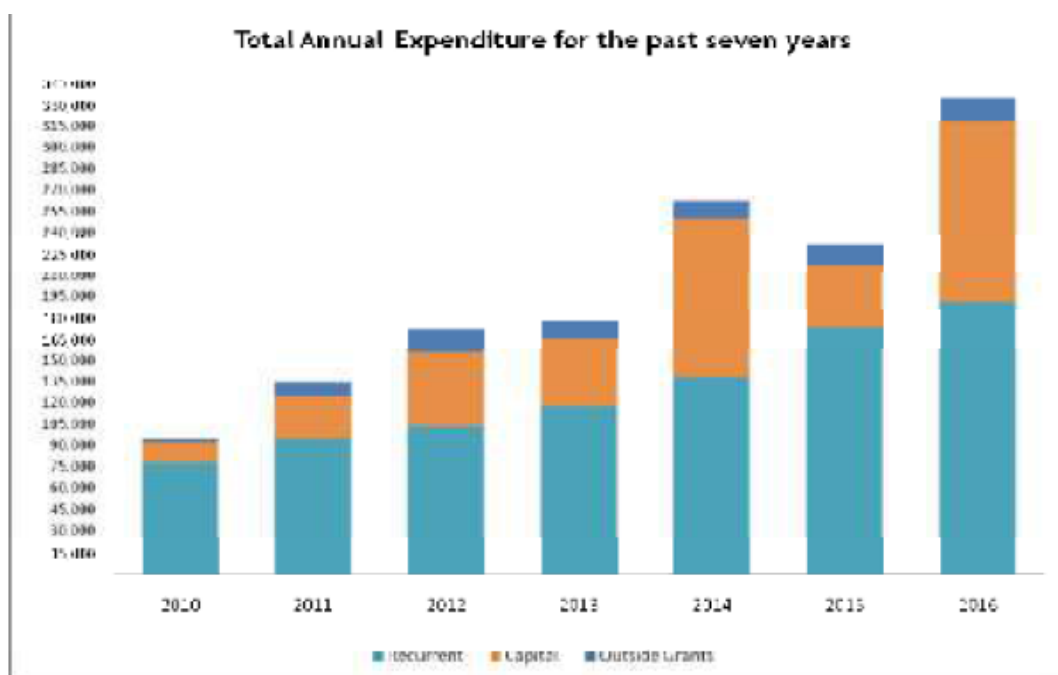
Seminar and Workshop on Bioassay Methods in Natural Product Research	College of Chemical Sciences, Institute of Chemistry Ceylon	Mr. MM Qader, Research Assistant	September 30, 2016	Self-funded
Multivariate data analysis	Board of study of Biostatistics, Postgraduate Institute of Agriculture, University of Peradeniya	Ms. W.M.L.S. Weerasundara, Research Assistant	18 th – 20 th March 2016	Self-funding
Short Course on Basic Statistics for Researchers: Principles and Practices	Young Scientist Forum of the National Science and Technology Commission	Ms. W.M.L.S. Weerasundara, Research Assistant	13 th – 14 th June 2016	Self-funding
6 th National Workshop on Scientific Writing	Postgraduate Institute of Science in collaboration with the National Science Foundation	Ms. W.M.L.S. Weerasundara, Research Assistant	24 th – 25 th November 2016	Self-funding
One-day Seminar on Air Pollution and Human Health in Sri Lanka	Postgraduate Institute of Science in collaboration with the International Research Center	Ms. W.M.L.S. Weerasundara, Research Assistant	2 nd December 2016	Self-funding
A Conclave of Young Scientists in Central & South Asian Region	TWAS Regional Office for Central & South Asia (TWAS-ROCASA)	Ms. R.P.S.K. Rajapaksha	December 5-7, 2016	Travel Grant from Third World Academy of Science (TWAS) - Regional Office for Central & South Asia Subsistence from NIFS, Kandy, Sri Lanka

7.3. Annual Budget

Funds received for research work during the year

Source of Funding	Amount Requested (Rs.)	Amount Received (Rs.)	Amount Spent (Rs.)
Treasury	332,200,000	326,000,000	232,530,292
National Science Foundation	7,635,071	7,635,071	9,326,144
Foreign	-	-	2,492,817
Other	2,140,094	2,140,094	2,687,103

Total Expenditure (Rs.'000)



The Government Treasury funds for recurrent expenditure had been increased by Rs. 114,383,000/= from 2010 to 2017, while treasury funds for capital expenditure had been increased by Rs. 111,350,000/= from 2010 to 2017.

8. Progress of Research Projects

Research Projects;

Energy & Advanced Materials

- Condensed Matter Physics & Solid State Chemistry
- Nanotechnology & Advanced Materials
- Energy & Advanced Material Chemistry

Theoretical Physics & Computational Studies

- Quantum Physics and Applied Electronics

Natural Products & Food Chemistry

- Natural Products
- Nutritional Biochemistry

Soil Microbiology & Carbon Sequestration

- Microbial Biotechnology
- Bioenergy & Soil Ecosystems

Earth, Environment & Biodiversity

- Natural Resources & Renewable Energy
- Chemical & Environmental Modelling
- Ecology & Environmental Biology
- Plant & Environmental Science
- Plant Taxonomy & Conservation
- Primate Biology

Molecular Biology & Biotechnology

- Cell Biology
- Medical Entomology

8.1. Project: Condensed Matter Physics and Solid State Chemistry

Project Leader- Research Professor .M.A.K.L.Dissanayake

Introduction

During 2016, the Condensed Matter Physics and Solid State Chemistry (CMP & SSC) projects at NIFS focused on several technologically important sub-projects; These were, efficiency enhancement in dye sensitized solar cells by (a) non-structural modifications to the TiO_2 photo anodes, (b) development of novel solid and quasi-solid polymer electrolytes by incorporating polymer nanofibers, (c) fabrication of quantum dot-sensitized solar cells, (d) development of novel Mg^{++} ion batteries, and (e) synthesis and characterization of polymer nanofiber water filters for bacteria and Arsenic removal from drinking water.

Among the major research findings from our group during 2016 are: (a) the “*mixed cation effect*” where by using a binary iodide mixture, containing a small size cation (such as Li^+ , K^+) and a large size cation (such as Pr_4NI) in the redox electrolyte, the solar cell efficiency could be enhanced by 20-25% , (b) By having a three-layer composite photo anode made by a TiO_2 nanofiber layer sandwiched in between two normal TiO_2 nan particle layers the solar cell efficiency could be enhanced by more than 30%.

The group has also established the unique properties of TiO_2 as a technologically important, multi-functional material which can be used in dye sensitized solar cells, electrochromic display devices, rechargeable Mg^{++} batteries and polymer nanofiber water filters.

Research activities

A nanostructured, tri-layer TiO_2 photo anode consisting of a rice grain-shaped (RG), electro spun TiO_2 nanofiber layer (NF) sandwiched between two TiO_2 nanoparticle (NP) layers has been successfully used for the efficiency enhancement in quasi-solid-state electrolyte-based dye-sensitized solar cells (DSSCs).

In the polymer nanofiber based project, completed in 2016, the electro spun PAN nanofiber membranes were prepared using the NABOND electrospinning system. The liquid electrolyte with tetrapropyl ammonium iodide (Pr_4NI), propylene carbonate (PC) and iodine was used to swell the PAN nanofiber mat to obtain a gel electrolyte. The *I-V* characteristics of DSSCs fabricated with this nanofiber membrane gel electrolyte having the configuration FTO/ TiO_2 /dye/PAN NF: Pr_4NI : PC: I_2 /Pt/FTO were measured under the illumination of 1000 mW cm^{-2} simulated sunlight.

A novel, polymer-free, quasi-solid state (gel), electrolyte has been prepared using fumed silica as the gelling agent. The electrolyte consists of tetrapropyl ammonium iodide (Pr_4NI) and potassium iodide (KI) as the binary iodide salt mixture and iodine dissolved in ethylene carbonate (EC) and propylene carbonate (PC) co-solvent. Dye sensitized solar cells were fabricated with this gel electrolyte and Ruthenium dye (N719) sensitized TiO_2 photo anode.

Solid polymer electrolytes (SPEs) based on polyethylene oxide (PEO) complexed with magnesium triflate $\text{Mg}(\text{Tf})_2$ or $\text{Mg}(\text{CF}_3\text{SO}_3)_2$ and incorporating the ionic liquid (IL) (1-butyl-1 methylpyrrolidinium bis(trifluoromethanesulfonyl)imide (PYR14TFSI)) were prepared by solution cast technique. A battery of the configuration $\text{Mg}/$ and $[(\text{PEO})_{15}:\text{Mg}(\text{Tf})_2+10\%\text{IL}]/\text{TiO}_2\text{-C}$ was assembled and characterized.

Hg-doped PbS quantum dot-sensitized solar cells (QDSSC) were fabricated with TiO_2 single layer, double layer and trilayer nanostructures. The tri-layer TiO_2 film with a sandwich structure of nanoparticles/ nanofiber/ nanoparticles were used to enhance the light harvesting through effective light

scattering process. Photovoltaic characterization of the QDSSC was done under 100 mW cm^{-2} . Electrochemical impedance analysis of the solar cells was performed in order to determine interfacial resistances.

The electrospinning technique was used to successfully make nanofibers of selected bio-compatible polymers. Nanofiber membranes made from these polymers were used successfully as an effective filter medium to fabricate a low cost, portable, polymer nanofiber water filter which is capable of removing coliform bacteria and E-coli bacteria from river water.

Progress Review (Achievements)

DSSCs fabricated with three-layer composite TiO_2 nanostructured photoanode (TiO_2 NP/RG/NP) showed an enhanced efficiency of 6.90%. Post-treatment of the three-layer photoanode with TiCl_4 further enhanced the efficiency up to an impressive 7.30% which is among the highest for a quasi-solid-state DSSC.

The *I-V* characteristics of DSSCs fabricated with this nanofiber membrane gel electrolyte having the configuration FTO/ TiO_2 /dye/PAN NF: Pr_4NI : PC:I_2 /Pt/FTO measured under the illumination of 1000 mW cm^{-2} simulated sunlight showed an efficiency of 5.5 %.

Dye sensitized solar cells fabricated with a novel gel electrolyte consisting of tetrapropyl ammonium iodide (Pr_4NI) and potassium iodide (KI) as the binary iodide salt mixture and Ruthenium dye (N719) sensitized TiO_2 photoanode exhibited an overall efficiency of 6.03 %.

The magnesium rechargeable battery of configuration $\text{Mg}/[(\text{PEO})_{15}:\text{Mg}(\text{Tf})_2+10\%\text{IL}]/\text{TiO}_2\text{-C}$ showed a discharge capacity of 45 mA h g^{-1} .

Photovoltaic characterization of the PbS:Hg quantum dot sensitized solar cells with tri-layer TiO_2 photoanode done under 100 mW cm^{-2} and dark showed a power conversion efficiency of 4.72 % with a short-circuit current density of 12.98 mA cm^{-2} and open-circuit voltage of 686 mV.

The low cost, portable water filter fabricated using nano fiber membranes made from selected bio-compatible polymers was capable of removing coliform bacteria and E-coli bacteria from river water. The filtered water was found to be entirely free from such disease causing bacteria.

8.2.Project: Nanotechnology and Advanced Materials

Project leader: Dr. H.W.M.A.C.Wijeysinghe, Research Fellow

(1). Introduction

This project highly emphasizes on performing target oriented fundamental and advanced scientific investigations leading to develop Sri Lankan minerals and related materials for nano-technological and advanced industrial applications. Nanotechnology and Advanced Materials fields have already contributed to most of the recent technological advancement and inventions, hence creating novel highly profitable nano-technological and advanced industrial applications. These industrial applications are mostly dependent on material resources, specially acquired through upgrading natural materials such as minerals.

Sri Lanka is well known for possessing a variety of technologically important minerals, which can play a major role in these advanced industrial applications. However, upgrading of our mineral resources suitable for these industrial applications has almost been lacking in the country, due to dearth of advanced scientific research conducting along higher value addition to our mineral resources. Nevertheless, the increasing of the income generating through exports by introducing value addition to our mineral resources is presently getting a national priority of Sri Lanka. Therefore, these factors inherent to our country are carefully considered when planning our research activities through adapting or contributing to the advancement of Nanotechnology and Advanced Materials fields.

This project also involves with the development of performance enhanced advanced semiconducting materials with special attention on energy related applications. It is carried out, while introducing/developing modern nano technological techniques/processes for the preparation and property enhancement of these advanced materials. Our project recently initiated another new sub-project in order to develop potential local minerals for water purification. It is carried out with the ultimate aim of designing low-cost house hold water filters for an affordable price for the common mass.

(2). Research activities:

This project commenced its work in January 2013, and presently conducting its research activities under the following four sub-projects.

(a). Development of Sri Lankan natural graphite for rechargeable battery applications.

Sri Lanka is the only commercial producer of the rarest and most valuable natural vein graphite. However, the purity and the performance of our natural graphite should be thoroughly enhanced for using them in advanced technological applications. To address this, our project has developed a number of successful low-cost purification techniques to purify our graphite into ultra-high purity of 99.99%. This ultra-pure graphite has then been further developed through surface modification to be suitable for the rechargeable lithium ion battery application. Accordingly, our best developed graphite anode electrode showed a very promising results with Columbic efficiency of over 99.9% and high stable reversible capacity of 378 mAhg^{-1} . Further investigations are now carried out on structural modification of our graphite for the intercalation of bigger ions, aiming to develop for upcoming Na-ion, Mg-ion and the related hybrid rechargeable batteries.

(b). Synthesis of graphene and graphite based composites using Sri Lankan graphite.

Because of its exceptional properties and suitability for a wide range of applications, graphene has emerged as a most promising nano-material. The quality and the price of the graphene product will be

mainly depending on the purity and cost of graphite source. Because of that, very expensive synthetic graphite presently is used to prepare graphene. Therefore, our aim was to convert the cheaper Sri Lankan vein graphite into this highly valuable graphene. Our studies have revealed important findings on the effect of the structural variety of graphite on the properties and the yield graphene product. Accordingly, our best developed graphene showed very promising performance by resulting individual sheets of a layer thickness of around 1.2 nm corresponding to a single layer.

(c). Development of materials for efficient water purification using local minerals.

Sri Lanka possess a variety of cheaper minerals already identified for water purification, through the vast number of research activities conducted by local scientist over the decades. However, no proper efforts have yet been made to use them in efficient water filtering. In addressing this, our project involves with developing the identified local minerals through property enhancement and forming into effective structures. The property enhancement is carried out through purification of materials followed by morphological and structural modifications. Presently, a number of local minerals such as clays and sands together with bio materials are under investigation. The ultimate aim of this project is the designing of low-cost water filters with developed materials to improve the quality of drinking water.

(d). Novel transition metal oxide semiconductors for energy conversion applications.

This sub project involves on developing advanced semiconducting materials through novel nano-material synthesis techniques. For that, the low-cost wet chemical methods were developed to precisely control the size of the resulting powder particles into nano-scale. Currently, investigations are going on Na and Mg ion based transition material oxide systems to be used in the upcoming rechargeable batteries. So far, most of the advanced characterization, specially the cell testing of our developed materials had to be performed in overseas laboratories under a number of difficulties. However, with the acquiring of a dedicated constant environment chamber, a battery tester and other homemade accessories during 2016, already a small scale but fully functional cell testing facility has been established now at NIFS.

(4). Progress review:

- (a). Research articles published in SCI journals: 01
- (b). Research articles published in SCI expanded journals: 02
- (c). Research articles in other recognized journals: 04
- (d). Conference proceedings (International/local): 14
- (e). Innovations/Patents: Applied for 03 local patents.
- (f). Post graduate degrees: 01 Ph. D, 01 M. Sc.
- (g). Undergraduate projects: 05
- (h). Research grants continued in 2016: 03

8.3.Project: Energy & Advanced Material Chemistry

Project leader: Senior Research Professor.J.M.S. Bandara

Introduction

The main objective of the Energy & Advanced Material Chemistry project is to carry out research on renewable energy. Research is mainly focused on chemistry and physics of new materials for the conversion of solar energy into chemical and electrical energies. Several research projects such as; Extending and adapting current photovoltaic technology mainly dye-sensitized, Q-dot and polymer solar cells to generate electricity directly from solar radiation; Constructing artificial chemical devices mimicking photosynthesis to collect, direct, and apply solar radiation, for example to split water, convert atmospheric carbon dioxide and thus produce various forms of environmentally clean fuels; Chemical, Electrochemical and Photochemical methods for the purification of air and water are the main research topics of the project. Additionally, the project also involves investigation of low cost water and air purification methods for abatement of industrial pollutants by using sunlight. In the research topics of conversion of solar energy into either electrical or chemical energy mentioned, the fundamental requirements are; sunlight must have absorbed efficiently by light harvesting materials; photo excited electron and holes must be separated in space to prevent recombination; photo excited charge must be energetically and kinetically able to perform a chemical transformation and hence we investigate all these factors in our research.

Research activities

Conversion of solar energy into electrical energy: Dye-sensitized solar cells (DSC) has been introduced as a low-cost alternative to currently available expensive Si solar cell in the market. DSCs are fabricated with large band gap oxide semiconductors such as TiO_2 , ZnO , and SnO_2 decorated with light absorber dye molecules. The foremost problem in DSC is the rapid charge recombination problem and research is being carried out by Energy & Material Chemistry group to minimize the charge recombination by introducing 1-D materials in the fabrication of photoanode of DSC. During recent pass, the group synthesized different 1-D nanostructures such as 1-D- TiO_2 , SnO_2 , ZnO , SrTiO_3 , BaTiO_3 and successfully demonstrated that these 1-D materials in fabrication of DSSC.

In addition, Q-dot sensitized solar cells have been investigated to optimize and utilization of wide-spectrum solar energy. Three different complementary Q-dots were deposited on TiO_2 nanoparticles in order to absorb UV, Visible as well as IR and near IR light.

Conversion of solar energy into chemical energy: Hydrogen is considered as the future energy source and production of hydrogen using solar energy is one of the main goals of the Group. Efficient water splitting with solar light is one of the most promising technologies for solar hydrogen production. However, this is one of the problems considered as unresolved problems in Physical Chemistry field and the Group actively carries out research to tackle this problem.

In photocatalysis, TiO_2 is the most widely used material. Though TiO_2 is a highly stable photocatalyst with appropriate energy positions for water splitting reaction, practical use of TiO_2 is limited as it absorbs mainly high energy photons in the UV region of the solar spectrum. However, successful methods have not been reported to use the IR region of the solar spectrum for photolysis of water. Advantage of such a system is that IR waves are available from the sunset to sunrise and the solar

spectrum consists of 47% IR radiation. We have recently developed Ag₂O/TiO₂ photo catalyst that utilizes IR region and produces hydrogen from water and water/methanol mixture. This is the first report on purely IR based photo catalyst and a possible photocatalytic mechanism is proposed.

Photochemical methods for the purification of air and water: Under this project, IR radiation active photocatalytic was developed for the degradation of airborne pollutants. In this investigation, Ag₂O/Ag/TiO₂ catalyst was synthesized and successfully applied for the degradation of gaseous phenol under IR irradiation. As the photo degradation described in this report involves low energy IR photons under ambient indoor conditions, the catalytic system can be applied for the degradation of common airborne pollutants found in indoors.

Progress Review

The following research articles were published in 2016.

- UB Gunatilake, J Bandara, Fabrication of highly hydrophilic filter using natural and hydrothermally treated mica nanoparticles for efficient waste oil-water separation, J. Env. Management,
- UB Gunatilake, J Bandara, Efficient removal of oil from oil contaminated water by superhydrophilic and underwater superoleophobic nano/micro structured TiO₂ nanofibers coated mesh, Chemosphere,
- K Kulathunga, A Gannoruwa, J Bandara, Infrared light active photocatalyst for the purification of airborne indoor pollutants, Catalysis Communications 86, 9-13, 2016
- A Manjeevan, J Bandara, Robust surface passivation of trap sites in PbS q-dots by controlling the thickness of CdS layers in PbS/CdS quantum dot solar cells, Solar Energy Materials and Solar Cells 147, 157-163, 2016
- H.M.S. Wasana, G. D.R.K. Perera, P. De S. Gunawardena, P. S. Fernando, J. Bandara, WHO water quality standards Vs Synergic effect(s) of fluoride, heavy metals and hardness in drinking water on kidney tissues, Scientific Reports, 2016 (accepted)
- E Yılmaz, EB Olutaş, G Barım, J Bandara, Ö Dag , Lithium salt–nonionic surfactant lyotropic liquid crystalline gel-electrolytes with redox couple for dye sensitized solar cells, RSC Advances 6 (99), 97430-97437, 2016
- A Gannoruwa, B Ariyasinghe, J Bandara, The mechanism and material aspects of a novel Ag₂O/TiO₂ photocatalyst active in infrared radiation for water splitting, Catalysis Science & Technology 6 (2), 479-487

Intellectual Properties

Patent in pending (Local): Fabrication of superhydrophilic filter using natural and hydrothermally treated mica nanoparticles for waste oil-water separation in service station waste water, UB Gunatilake, J Bandara

One PhD was completed: H.M.S. Wasana, Ph.D., 2016, Assessment of drinking water quality towards the identification of causative factors for chronic kidney disease of unknown etiology (CKDu), J. Bandara, R. Weerasoorya

8.4.Project: Quantum Physics

Project leader: Senior Research Professor. A. Nanayakkara

Introduction

Quantum mechanics, quantum field theory and relativity together form the theoretical foundations of modern physics. Despite decades of rigorous, almost obsessive scrutiny, no experiment has ever shown quantum theory to be false. Even 100 years after its inception fundamental aspect of quantum mechanics is one of the most dynamic areas of current physics research. In particular, fundamental research on Quantum Non-locality, Quantum Correlations and Quantum to Classical Transition is not only very important in understanding the true nature of the quantum reality but also their existence has practical consequences, enabling much stronger forms of information processing, communication and extremely fast quantum computing.

Nonlocality is the most distinguishing feature of quantum mechanics, but recent research seems to propose the possible existence of nonlocal correlations stronger than those predicted by quantum theory, especially the nonlocal effects beyond Bell non-locality. This raises the question of whether nature is in fact more nonlocal than expected from quantum theory or, alternatively, whether there could be an as yet undiscovered principle limiting the strength of nonlocal correlations. Another important and unsolved problem is the following: When do we call a physical system a quantum system and when do we call it a classical measuring apparatus? In other words, where is the quantum-classical divide? How much mass or how many degrees of freedom should an object have, before it qualifies as a classical object? Currently nobody knows at what mass scale this transition from the microscopic to the macroscopic (and the breakdown of superposition) takes place.

Research activities

At present we are working on three sub projects related to Non-locality, Quantum to Classical Transition and Classical-quantum hybrid systems. Quantum Random walk is used as the testing platform to investigate the above aspects. We have already completed the foundations of Quantum Random walk.

Non-locality: We are investigating the origin and measures of nonlocal correlation effects encountered in quantum systems especially that are not entangled. As the first step we studied how to induce non-classical correlations to quantum states using quantum random walks. However, still there is no method available to identify and quantify the quantum correlations which are not due to quantum entanglement. One of our aims is to find a reliable measure to quantify quantum correlations other than quantum entanglement. The testing of the method will be carried out via quantum random walks and single photon experiments.

Quantum to Classical Transition: Under this topic we are investigating in detail what classical and quantum interactions make the wave functions collapse. This will help us to determine whether there is a smooth transition from quantum systems to classical systems and how the breakdown of superposition takes place during this process.

We will also be engaged in investigating the influence of gravity on wave functions. This includes de coherence due to gravitational time dilation and influence of gravitation redshift (wave property) as well as curvature of space-time (particle property) on photon states in strong gravitational fields.

Classical-quantum hybrid systems: Here we are constructing quantum-classical hybrid random walks (No one has done this so far) which enable us to understand not only the subtle issues which prevent from having a consistent theory for quantum-classical hybrid systems but also to understand how the classical quantum interactions cause wave function collapse

.

Experimental Work: It will be very useful to test theories and models we develop experimentally. We will be carrying out single and multi-photon experiments to test various concepts and models (random walks) in our laboratory.

Progress Review

We discovered a non-local two particle coin which produces entangled particle states from non-entangle initial coin states. The entanglement was produced without any particle interactions or introducing higher dimensions as it has been achieved in the past by others. This new coin can also remove entanglement from maximally entangled initial coin states. The newly found quantum coin has unique features which have not been observed in any other two particle coins. As an example, when de coherence is introduced to one particle, the new coin made the wave function of the other particle undergo de coherence even though quantum walks based on 2-D Hadamard coins do not show similar behavior.

Up to now the project has achieved a very good progress. We have successfully introduced non-classical correlations into quantum states using this non-local two particle coin. Attempts have been initiated now to employ this coin to study on de coherence and make the wave function collapse.

8.5.Project: Artificial Intelligence

Project Leader: Senior Research Professor. Asiri Nanayakkara

Introduction

Patients who are completely paralyzed cannot move their muscles according to their intentions. However, the majority of partially paralyzed individuals can move some of their muscles and eyes voluntarily.

Due to the advancement of modern medical sciences, people with severe paralysis can now live a long life. Although their minds function perfectly, some may not even be able move a single muscle in the body to communicate with outside world. Brain Computer Interface (BCI) system is a direct link

between human brain and external world. This enables the controlling of external devices without physically interacting with them. Therefore a Brain Computer Interface system would enable severely physical disable people to communicate with outside world via computer voice in his or her native language (in Sinhala, Tamil or English) and / or control equipment such as wheel chairs and televisions. These types of communicating abilities could greatly improve the quality of their lives. One of the key components of BCI system is to measure brain activities. Out of several methods, because of its simplicity, most of the BCI systems use Electroencephalography (EEG) to measure the brain activities. The patients who are completely paralyzed cannot move their muscles according to their intentions.

Therefore, EEG based BCI system is the best solution for them to communicate with the outside world.

On the other hand, the majority of people with motor disabilities can move their various muscles and eyes voluntary. The monitoring of electrical activity produced by muscle movements are known as Electromyography (EMG) and the same due to eye blinks and eye movements are known as an electrooculography (EOG). Furthermore, the signals coming from EMG and EOG activities are stronger than same produced by Electroencephalography (EEG). Therefore, it is useful to have a Brain computer interface system (BCI) which operates on EMG and EOG activities in addition to EEG.

Research activities

The main aim of the BCI group in 2016 was to design and construct low cost hardware and software for portable BCI system to be used in Sri Lanka. During 2016, we have mainly concentrated on designing and constructing a portable Brain Computer Interface system which utilizes EEG (Electroencephalogram) as well as EMG (Electromyogram) and EOG (Electrooculogram) signals generated by humans. The BCI system described above can be divided in to two main parts; i) Bio potential amplifier with electrode cap ii) Data monitoring software in a separate computer. We have used a Bluetooth interface to establish the communication between the amplifier unit and the controlling computer. The circuits for amplification and some pre-processing are attached to the electrode cap which is place on the head. Amplification and the analog to digital conversion are carried out by ADS1299 chip, manufactured by Texas Instruments. Our BCI system uses wireless communication links for sending brain signals and other electrophysiological signals from the person to the computer. Software GINIE which reads and analyses data from the electrode cap was developed in our laboratory.

Progress Review

We have successfully completed the construction of the portable BCI system in 2016 and a live demonstration was given in front of a large audience in the 2016 research annual review.

8.6. Project: Natural Products

Project Leader: Senior Research Professor. U.B.L. Jayasinghe

Introduction

Natural Products are compounds produced by plants, fungi marine organism etc. These compounds can be used to improve the quality of human life. The use of natural products in the management and treatment of diseases in humans and plants is more acceptable and offers less risk than use of synthetic compounds.

The overall objective of the Natural Products Project of the NIFS is the identification of bioactive extracts and compounds from natural sources, as potential resources for control of human and plant diseases. Research activities have been focused on the chemistry and bioactivity of secondary metabolites from plants, fungi (including endophytic fungi) and edible fruits of Sri Lanka. Another area of research has been the identification of polyphenols found in tea, medicinal plants, edible fruits and spices using Liquid Chromatography – Mass Spectrometry (LC-MS). In our studies, the bioactivities of extracts and compounds are assessed using bioassays; [DPPH (2,2'-diphenyl-1-picrylhydrazyl) radical scavenging assay to detect the presence of natural antioxidants; the brine shrimp (*Artemia salina*) lethality assay to detect cytotoxicity; the lettuce (*Lactuca sativa*) seed germination assay to detect the presence of phytotoxic and allelopathic compounds, the TLC bioautography method to detect the presence of antifungal compounds; α -amylase, α -glucosidase and lipase enzyme inhibitory activity assays to detect drug targets for the treatment of diabetes, obesity and hyperlipidemia. Bioactive extracts are subjected to activity guided fractionation using chromatographic techniques to isolate bioactive compounds. Structures of isolates are determined by detailed analysis NMR, MS spectral data. Partial syntheses of isolates are carried out to enhance the bioactivity of isolates.

Research Activities

Research activities of the Natural Products Project of the NIFS are mainly on the following three areas.

- (1) Investigation of extracts from plant sources and, epiphytic and endophytic fungi, for use in agriculture and human health
- (2) Chemistry and bioactivity of edible fruits
- (3) Plant secondary metabolites and LC-MS profiling of bioactive extracts

Chemistry and bioactivity of fungi associated with medicinal plants and edible fruits

Fungi can be mainly categorized as endophytic and epiphytic fungi. Endophytes are found in the inner tissues or even in the cells of their host while epiphytic fungi grow on the surface of the host. Endophytes are considered to be a rich source of secondary metabolites with novel structures and interesting bioactivities. These metabolites have found extensive applications as agrochemicals, antibiotics, immunosuppressants, antiparasitic and anticancer agents. Some endophytic fungal strains produce natural products that are either identical or closely related to those produced by the host plant. A well-known example is the production of Taxol, an anti-cancer drug obtained from the Pacific Yew tree *Taxus brevifolia*, which was also produced by the endophytic fungus *Taxomyces andreanae* isolated from the bark of *T. brevifolia*.

Metabolites produced by the fungus *Monacrosporium ambrosium*.

The shot-hole borer beetle (SHB) *Xyleborus fornicatus* causes serious damage in the tea (*Camellia sinensis* var. *assamica*) plantations of Sri Lanka and South India. SHB is found in symbiotic association with the ambrosia fungus *M. ambrosium* (syn. *Fusarium ambrosium*) in galleries located within the pencil thick stems of tea bushes. *M. ambrosium* is known to be the sole food source of SHB beetles.

Profiling of some medicinal plants and edible fruits

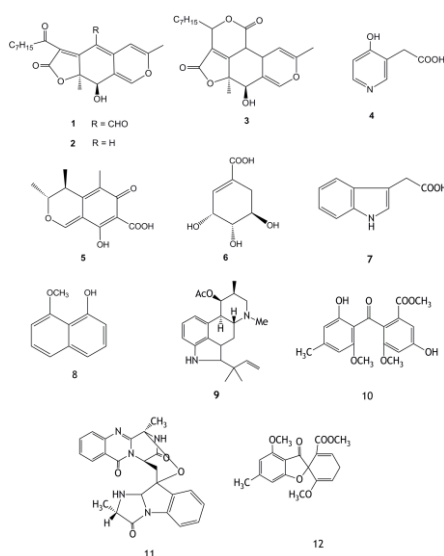
The major bioactive groups of compounds in dietary plants are polyphenols. Most of the dietary plants have physiologically active components with a health enhancing role. Polyphenols are receiving more attention from scientists due to their beneficial effects as antioxidants, anticancer, cardio protective, antimicrobial, antiaging, anti-inflammatory agents etc. Several epidemiological studies suggested that regular consumption of food and beverages rich in polyphenols is associated with a reduction in the risk of a range of pathological conditions ranging from hypertension to coronary heart disease, stroke and dementia. Chlorogenic acids (CGAs) are the most important single class of dietary polyphenols. Since a majority of the Asian population consumed a large number of dietary medicinal plants it is important to profile the chemical constituents in these plants. LC-MS is a powerful technique to analyze chemical constituents present in a mixture. Structures of the chemical constituents are generally identified on the basis of their retention times and mass fragmentation pattern by LC-MS studies.

Edible fruits as a source of Bioactive Compounds

Fruits have been consumed for centuries by animals and humans and are reliable source of non-toxic and environmentally friendly bioactive compounds. Most of the studies on edible fruits are limited only to their nutritive value. Consumption of fruits has been associated with a reduced risk of chronic diseases and the reduction of functional declination associated with aging. Bioactivity studies of compounds specific to tropical fruit plants have led to the discovery of new chemical entities with interesting bioactivities and reduced toxicity. The presence of inhibitors of carbohydrate hydrolyzing enzymes; eg. α -amylase, α -glucosidase in plant derived foods is of immense importance in the control of blood glucose level in patients with type-II diabetes.

Progress Review

Currently we are studying the chemistry and bioactivity of secondary metabolites produced by the endophytic fungi isolated from some medicinal plants. Several secondary metabolites with interesting structural features and some useful bioactivities have been isolated. Some examples are Pithaloid B & D (**1** & **2**) and a new pithaloid with a lactone ring (**3**), demethoxycinnapine (**4**) {*Phialemonium curvatum* from *Manilkara zapota*}; speciferone A (**5**) {from *Artocarpus altilis*} shikimic acid (**6**) {from *Flacourtia inermis*}; indole-3-acetic acid (**7**) {*Colletotrichum siamense* from *Piper nigrum*}; 1-methoxy-8-naphthol (**8**) {*Daldinia eschscholtzii* from *Phyllanthus acidus*}; fumigaclavin C (**9**) monomethylsulochrin (**10**), fumaquinazoline C (**11**), and trypacidin (**12**) {*Aspergillus fumigatus* from *Solanum insanum*}.



Six pigmented naphthoquinones produced during spore germination in a laboratory culture broth of *M. ambrosium* were isolated and identified as dihydroanhydrojavanicin, anhydrojavanicin, javanicin, 5,8-dihydroxy-6-methyl-7-(2-oxopropyl) naphthalene-1,4-dione, anhydrofusarubin and solaniol. Extraction with chloroform of tea stems having red colored galleries occupied by SHB beetles led to the detection of UV active compounds similar to the above naphthoquinones. Laboratory assays demonstrated that the combined ethyl acetate extracts (Extract A) of the fungal culture broth and mycelium inhibited the growth of endophytic fungi *Pestalotiopsis camelliae* and *Phoma multirostrata*, which were isolated from tea stems. By contrast, *M. ambrosium* did not inhibit the growth of *Bipolaris sorokiniana*, *Daldinia eschscholizii* and *Glomerlla magna*, also endophytic fungi, isolated from Sri Lankan medicinal plants. These results suggest that the naphthoquinones secreted by *M. ambrosium* during germination of spores possess fungal inhibitory activity to prevent other fungi residing in tea stems from invading SHB galleries. Thus, it is proposed that the fungal ectosymbiote of SHB provides not only the food and sterol necessary for the development of the beetle during its larval stages, but also serves as a producer of fungal inhibitors.

Further we are in the process of profiling polyphenols in popular green herbs in Sri Lanka. These research activities resulted 2 M.Phil Degrees in addition to 3 peer reviewed publications and 20 abstracts.

Visiting Scientists: Prof. N.S. Kumar, Prof. Y.Fujimoto, Prof. Nikolai Kuhnert

Research Assistants: Ms. Cheka Kehelpannala (M.Phil.-2016), Ms. Dharushana Thanabalasingam (M.Phil.-2016), Mr. Nalin Rathnayake (Reg. for M.Phil.), Mr. Mallique Qader (Reg. for Ph.D.), Ms. Dilhara Dissanayake (Reg. for M.Phil.), Ms. Vindya Munasinghe (Reg. for M.Phil.), Ms. Chamini Gunawardhana (Reg. for M.Phil.)

Chief Technical Officer: Mr. D.S. Jayaweera

8.7.Project. Nutritional Biochemistry

Project Leader – Dr.R.Liyanage, Research Fellow

Nutritional Biochemistry project focuses on various aspects of functional and nutritional properties of foods and cover a wide area like functional and nutritional properties of food, food safety, and functional food product development to improve health and well-being of people.

Functional and nutritional properties of food:

Under this research theme, studies are done to assess the antioxidant, enzyme inhibition (amylase, glucosidase, lipase), radical induced DNA damage prevention and identification of active compounds. In addition, *in vivo* studies are also done for further confirmation of functional properties. At present there are several ongoing studies such as assessing functional properties of some starches available and some selected macro algae in Sri Lanka.

Novel assay development (GOD method):

A novel assay was developed to determine α -amylase activity (GOD method). α -Amylase is an enzyme responsible for hydrolyzing α bonds in such as starch and glycogen, yielding glucose and maltose. Although there are several methods to determine α -amylase activity, the novel method is more convenient, less costly, and less laborious. The results demonstrate that the developed method is accurate, quantitative, precise and highly reproducible. The new method can be considered as a high-throughput technique as it allows the analysis of several samples at once and also it is most suitable for kinetic studies.

Food Safety: Heavy metals are trace elements that cause negative impacts on human health, even at very low concentrations. In this study Heavy metal residues and trace elements in milk powder available in market were analyzed.

8.8.Project: Microbial Biotechnology (Biofilm Biofertilizers)

Project Leader: Senior Research Professor. P.R.G.Seneviratne

Introduction

This concept of microbial biofilm application as biofertilizers in agriculture was first reported in 2003 by us. Since then, we have been doing a large number of studies on the biofilm formation, their characterization for nitrogen fixation, phosphorus solubilization and plant growth hormone production, and also their effects on crop plant growth and soil fertility. These Biofilm biofertilizers (BFBFs) can cut down imported chemical fertilizers use up to 50% in agriculture and plantation sectors (mainly non-legume crops) with average yield increases up to 30%. Normal biofertilizers can cut down the chemical fertilizers use only up to 25% or less. In 2014, this biofertilizer was first commercialized for tea cultivation in the country by a 100% Sri Lankan company in an agreement with the NIFS. Then, in 2016, this was commercialized for rice cultivation. At present, these biofertilizers are used in thousands of acres of the crops. Also, we have already started exporting this biofertilizer to India for tea cultivation.

Research activities

Research studies conducted in 2016 were centered on agriculture, health and environmental benefits of the use of BFBFs, and also industrial applications of fungal-bacterial biofilms (FBBs).

Microorganisms are of great importance in the production of industrial enzymes. Thus, a study was conducted with to identify the effect of the physical nature of culture media on the microbial amylase production, an enzyme used in a range of industries. Intervention of microbial biofilms in this was investigated. One bacterial sp., one fungal sp. and one FBB were inoculated with two different culture media (solid and liquid). Control was maintained without adding any microbes. Bacteria and FBB showed good biofilm formation. Bacterial biofilms significantly improved the amylase enzyme production in liquid medium, whereas in solid medium FBB showed the highest enzyme production. According to this study, microbial amylase enzyme production was observed to vary with the physical nature of the culture media. Thus, amylase enzyme production depends on the selection of culture medium according to industrial requirement. Further studies are required to understand the effects and potentials of the physical nature of culture media.

Chronic kidney disease of unknown etiology (CKDu) is now a very serious health problem in some parts of Sri Lanka. This disease has now been identified to be multi factorial origin. Causes of chronic kidney disease are suspected to be occupational and environmental. Paddy cultivation is one of the key economic sectors in the areas where the chronic kidney disease has been spread. Cadmium (Cd) contamination and high fluoride (F) level are suspected to be two key parameters responsible for the CKDu. Chemical fertilizers are one of the major sources of the causative agents. Thus, a study was conducted in a greenhouse in the National Institute of Fundamental Studies to evaluate the above CKDu parameters with the application of a BFBF to rice. Results showed that the biofertilizer can reduce F and Cd levels in soil water and also Cd uptake by the plant. Further studies are necessary to evaluate these effects for a longer period.

Use of various chemicals to increase plant growth results in environmental issues and reduced sustainability of conventional agroecosystems. Recent studies have introduced microbial biofilms as BFBFs, to reinstate sustainability of degraded agroecosystems. A study was conducted to evaluate temporal changes of soil microbes and endophytes under lowland conditions using rice in a pot experiment, with treatments; 50% chemical fertilizers NPK (CF), 100% CF, Biofilm alone, 50% CF + Biofilm and the control with no amendments. Compared to the other treatments, 50% CF + Biofilm and

Biofilm alone showed significantly increased soil microbial and endophytic counts, and endophytic biofilm induction that contributes to healthy plant growth. Further, 50% CF + Biofilm showed the significantly highest fungal-bacterial ratio in the soil, reflecting restoration. This field of research is still in early stages, thus further studies are needed to identify its effects and potentials.

Progress Review

From the study on microbial enzyme production, it was identified that FBBs can be employed for the production of enzymes and other biomolecules of interest for various biotechnological applications. Thus, plans are underway to initiate research studies on the use of microbial biofilms in biomolecule production for various applications. Once we understood the potential of BFBBs in reducing CKDu parameters from the results of the study mentioned above, we are now evaluating the same effects with the BFBB application to rice cultivation under real farmers' field conditions. We are also continuing studies on endophytes with the application of BFBBs to rice cultivation in order to investigate the potential of endophytes in increasing yield and quality of the harvest.

8.9.Project: Bioenergy & Soil Ecosystems

Project leader: Dr. Renuka Rathnayake, Senior Research Fellow

Introduction

Bio energy and soil ecosystems are the main research areas investigated in this project with sub projects in each category. The bio energy project aims to explore the microbial flora of Sri Lanka to isolate efficient degraders of cellulose, hemicellulose and lignin, study the effect of biofilms and/or co-cultures on degradation of cellulosic biomass. The application of microbial cellulases in other value added products and processes are also under investigation. The present project also aims to study possible enhancement of enzyme production by application of different inducers. Research on biodiesel production from freshwater cyanobacteria and micro algae was also carried out. Isolation of Denitrifying Bacteria and their Potential use in Nitrate Removal from Well Water of Jaffna District is another research under investigation. The project on soil C sequestration targets to study soil C sequestration potential, its dynamics and the method of improvement in different major vegetation types of Sri Lanka including natural and plantation forests, agricultural plantations, farm lands, home gardens and small holder cultivations etc.

Research activities

Soil Ecosystem

A project has recently been completed on “Assessment and Mapping of Soil C Stocks in Knuckles Forest Region of Sri Lanka”. M. Phil thesis is under preparation on these findings. Digital maps are under preparation. Attempts have been initiated now to study C sequestration capacity of lowland paddy soils and to prepare a digital map showing the available C stocks in paddy soils of Sri Lanka.

Bioenergy

The enzyme assay for cellulolytic activities of bacteria and fungi are conducted in order to determine efficient cellulolytic strains. Moreover, in order to improve the efficiency of cellulose degradation co-culturing of efficient strains could be assessed. Furthermore, the characterization of ethanologenic yeast strains and assessment for ethanol production by Ethanol assay is also carried out. The possibility of applying crude cellulase enzyme produced by cellulolytic strains in other processes such as biostone washing of denim was tested on preliminary scale. Fresh water samples were collected from 38 freshwater bodies of Sri Lanka representing three climatic zones and a total of 74 uni-algal cultures were obtained. For the period of 2016 a total number of 31 efficient isolates were selected based on highest biomass, total pigments and lipid content and identified up to molecular level. Cyanobacterial strains were characterized. Identified isolates sequences were stored in Gene Bank database. Suitable analytical methods were tested and modified for the purpose of studying denitrification capacity of well water of Jaffna based on the previous studies. Selections of sampling sites were completed. Environmental samples for isolating microorganisms were collected from different places of Jaffna district. Isolation of aerobic and Cyanobacteria and primary and secondary screening of bacteria was carried out in laboratory. Starch hydrolysis and carbohydrate fermentation test was done with the standard method to evaluate the efficiency of utilization of carbon sources by selected strains. Tentative identification of selected strains was done by microscopic observation and gram staining.

Progress Review

Bio energy

So far 43 cellulolytic fungal strains have been isolated and found to be cellulolytic while 15 are more efficient. 60 bacterial strains have been isolated and assessed for the production of cellulolytic enzymes production. 35 yeast strains have been isolated and they have characterized for the ethanol production ability. The fatty acid content in cyanobacteria in laboratory culture was recorded up to $31.9 \pm 2.01\%$ of dry biomass. The study showed that there is a great potential in using these strains in producing biodiesel. One novel species of cyanobacteria named *Cephalothrix komarekiana* was identified for the first time in Sri Lanka. The availability of *Alkalinema pantanalense*, *Geitlerinema sp.*, *Westiellopsis prolifica* which was rarely been reported in 1986 or thereafter from Sri Lanka. Cyanobacterial strains were characterized and Identified isolates sequences were stored in Gene Bank database.

Soil ecosystems

The studies conducted so far by our group are among the few studies reported so far on soil C sequestration in Sri Lanka. Up to now the project has achieved a very good progress. Attempts have been initiated now to study C sequestration capacity of lowland paddy soils and to prepare a digital map showing the available C stocks in paddy soils of Sri Lanka. Maps

8.10. Project: Natural Resources and Renewable Energy

Project leader: Associate Research Professor N.D. Subasinghe

Introduction

Several projects focused on the fundamental aspects of science, with some possible applications towards the national development are being conducted. A project on geothermal resources of Sri Lanka aims to evaluate the geothermal resources with a view to utilize them for national development. A combination of geophysical techniques was used in evaluation of geothermal resources.

Mapping the radiation levels throughout the country and establishing the baseline of the background radiation levels are useful to identify hazardous areas, find mineral resources, as well as to identify any radiation leak due to human activities. First-ever radon mapping is being conducted jointly with the Atomic Energy Board, Sri Lanka.

A joint project on Sri Lankan petrology is conducted with the University of Peradeniya. Mineralogy and petrology are some of the most fundamental aspects of geology. Deep understanding of them leads not only to discover new natural resources and to develop new economic aspects, but also to understand the origins of lithological complexes in Sri Lanka and thus improve the advanced knowledge of the subject.

The pioneering research project on thermoelectricity was initiated with the objective to introduce this new area of research to Sri Lanka. Thermoelectric generators use “*Seebeck Effect*” to produce electricity directly from heat energy. Thermoelectricity also has the unique ability to increase the overall efficiency of an existing system by ‘scavenging’ and converting waste heat to electricity. Other advantages include the ability to operate with any heat source and any temperature range, durability, low-maintenance and scalability.

Activities: Following sub-projects were carried out during 2016

Geothermal Resource Mapping Project:

Although not located on a highly active geothermal region, Sri Lanka still has geothermal resources which may have a potential of generating electricity and contributing to the energy needs of the country.

NIFS in collaboration with few other institutes, conducted the first ever comprehensive geophysical survey. In this survey, passive and active geophysical techniques were employed to investigate the near-surface as well as deep structures of the earth. One of the non-invasive, passive geophysical techniques used in the survey was Magneto-Telluric (MT) technique. Time-Domain Electromagnetic (TDEM) is an active technique used in the survey. Without the need for drilling, above two techniques can provide information on geological structures, heat sources and water resources hidden under several meters to several kilometers of the earth. Processed data is used to produce resistivity profiles that represent the sub-surface structures, which are essential to determine the flow path, heat source and possible locations for power plants.

Radon Mapping Project:

Radon is a naturally occurring gas, which is radioactive. It is generated by radioactive decay of uranium and thorium, naturally found in rocks and minerals. It is responsible for delivering the largest dose of

natural radiation we are exposed to on earth. While the mineral deposits with uranium and thorium produce more radon, level of radon in the atmosphere changes due to many factors. In health perspectives, it is important to monitor the indoor radon levels. Further, it is imperative to establish our country's radiation baseline in order to monitor any radiation leak or nuclear accident, here or in a neighboring country.

In collaboration with the Atomic Energy Board of Sri Lanka, NIFS is conducting a radon monitoring program with a view to produce a radon distribution map of the country. Passive and active methods are used in this exercise. Mapping the natural radiation levels of the country is almost complete now.

Mineralogy & Petrology Project:

Mineralogy and petrology are some of the most fundamental aspects of geology. Fundamental understanding of them leads not only to discover and to develop new economic aspects, but also to improve the advanced knowledge of the subject. A collaborative research activity between the NIFS and the University of Peradeniya, has led to many high-quality publications and findings that will lead to national development through discovering new mineral resources and new knowledge.

Thermoelectricity Research:

Research work on thermoelectricity (TE) at the NIFS is a pioneering work, since this area of research was new to Sri Lanka, despite the fact that it is a fast growing area globally. While TE can be considered as a source of renewable energy, the main advantage is its ability to improve the overall energy efficiency of existing systems by energy scavenging and co-generation. In thermoelectricity, heat is directly converted to electricity using thermoelectric effect, known as the *Seebeck* effect. Unlike other methods, TE can utilise heat energy from any source; for example, solar energy, geothermal energy, waste energy from cooking, baking, factories, or from automobile engines. Some other advantages of thermoelectric generators (TEGs) are the scalability (from a large plant to nano-scale module), reliability and durability due to no moving parts. New designs for TEGs are tested while new material are developed to increase the "figure of merit", which has direct connection to the overall output.

Progress Review

During 2016, following scientific papers and communications were published:

In refereed international journals: 03 Full research articles

In conference proceedings: 04 Conference papers including one international conference

One Book Chapter on policy making: Subasinghe, N.D.* (2016) Prerequisites for Science Technology and Innovation Policy Making in Sri Lanka in Tacheba, B., Shaeri, M. and Yousef, A.J.J. (Eds) The Science Technology and Innovation Policy Making. Daya Publishing House, New Delhi. p. 79-94.

Postgraduate and undergraduate students trained:

PhD Students:	02
MPhil Students:	03
MSc Students	02
Undergraduates	04

Grants Received: 01 Equipment Grant from NSF: RG/2016/EQ/11

Grants Continued: 01 Competitive Research Grant from NRC: NRC/15-119

Other Honours and Contributions to National Development:

- President's Award for Scientific Publications – 22 November 2016
- Key Note Address at the inauguration of the International Conference on Energy, Environment and Natural Resources 2016 (ICEENR 2016), Hangzhou, China. May 2016.
- Member of the Energy Expert Group
- Vice-President – Geological Society of Sri Lanka
- Reviewer & Editorial Board member – Jour. Geol. Soc.

8.11. Project: Environmental Chemodynamics
Project leader: Dr. Meththika Vithanage, Senior Research Fellow

Introduction

The Environmental Chemo dynamics research group is engaged in monitoring, understanding, and modeling the flow, transport, and chemical processes in water, wastewater, atmosphere and soil systems as well as the pollution remediation aspects in order to find feasible solutions for human benefit. To accomplish this, the Environmental chemo dynamics group is carrying out monitoring environment for key pollutants which is essential to understand the fundamental mechanisms behind the release or removal in order to formulate a better remediation technique and/or a mitigation strategy, laboratory and field experiments on toxic metal release from soil and water, their removal using low cost as well as efficient materials such as bio char and nano-materials, and modeling pollutant plume dynamics. Moreover, for the purpose of enhancing the capability of these low cost materials to removal of particular pollutants, the research group is engaged in development of different composites by using different geo materials with bio char and nano substances. The outcomes of the research finding in this group lay good foundation to identification of current threats to the environment in the means of solid waste, water pollution and atmospheric pollution and suggest the remedial measures and transform the gained knowledge to the scientific society as well as to the general public.

Research activities

During 2016 the Environmental Chemo dynamics research group has engaged with different research activities that basically related to environmental pollutant monitoring, modeling, removal and remedial measures and those are,

Perchlorate induced heavy metal release and destruction of organic carbon

The main objective of this research was to modeling of perchlorate on metals and organics using model regolith such as serpentine soils and basaltic soils. Overall, this study illustrated that perchlorate, even at low concentrations, can both accelerate metal release and increase the bioavailable metal fraction in soils, and biochar could be utilized as an effective amendment to immobilize heavy metals and perchlorate contaminated soils.

Biochar research

- Biochar for pesticide and heavy metal remediation and phytotoxicity reduction
- Biochar for the removal of carcinogenic volatile organic compounds from municipal solid waste dumpsite in the landfill leachate

Our recent attempts with biochar were focused on pesticide removal and improving soil quality by immobilizing pollutants using biochars generated as a byproduct from the dendro power industry. At the same time, we produced biochar from the organic portion of municipal solid waste and seek the potential for the removal of carcinogenic volatile organic compounds from municipal solid waste dumpsite in the landfill leachate. Further pot, incubation, batch, column experiments, modeling and spectroscopic techniques were conducted. This project was granted by National Research Council.

Environmental monitoring

- Monitor atmospheric deposition for heavy metals and hydrocarbons
- Monitor and assess environmental pollution by Gohagoda Municipal Solid Waste (MSW) Dumpsite and test remediation methods for leachate

- *Monitor and assess pollution by Hospital Wastewater and test remediation methods*

The heavy metals and polycyclic aromatic hydrocarbons attached to particulate matter were monitored in Kandy and the human and ecosystem health risk associated with those were assessed. This project was granted by National Science Foundation. The leachate samples collected from Gohagoda municipal solid waste dumpsite were analyzed for heavy metals, volatile organic compounds and several other parameters. The wastewater collected from three selected hospitals; Kandy, Diyathalawa, Badulla were analyzed for heavy metals, volatile organic compounds, pathogenic microorganisms and several other water quality parameters in order to assess the quality of water release from hospitals into the surface water streams.

Heavy metal stress on plants and soil microbes

The effect of heavy metal stress on the growth of *Bradyrhizobium japonicum* and IAA production were assessed. The results showed that the bacterial growth was reduced with the increase of heavy metal concentrations. Also it showed that the microorganisms are sensitive to heavy metals stress with a retardation of growth and IAA production, though it is able to enhance the growth of seedlings.

Remedial measures for environmental pollutants

Constructed wetlands were used to investigate as potential remedial measures for reverse osmosis rejected water. The constructed wetlands were established in chronic kidney disease of unknown etiology endemic area with low cost materials. This study was supported by the collaborator and students from the Open University of Sri Lanka.

Progress review

The projects related to Perchlorate and pesticide removal with biochar were ended in 2016 and other projects were conducted throughout the year. During the research activities, the research findings were published in various local and international journals and other media. 13 of research papers in SCI journals, 04 of research papers in SCI expand journals, 03 of research papers in other recognized peer reviewed journals, 01 of full paper in international conference proceedings, 13 of abstracts in national and international conference proceedings and 04 of book chapters were published during year of 2016. Nine Newspaper articles were published in leading National Newspapers. Five M.Phil students were worked and two of them completed their M.Phil programs. Three MSc. projects, one undergraduate project also conducted during the year of 2016. Two Presidential Awards for Scientific Publication for 2014, TWAS-NSF Award for Young Scientist (Chemistry), Science Popularization, Print media (Sinhala) 2016 by SLAAS were obtained. Different lectures were conducted for dissemination of the outcomes of the project; Keynote speech at the 6th International Congress on Arsenic in the Environment (As2016) conference, Sweden, and invited lecture on e-waste management organized by SLAYS at Department of Chemistry, University of Colombo.

8.12. Project: Ecology and Environmental Biology
Project Leader: Associate Research Professor. Suresh P. Benjamin

Introduction

Basic research in biodiversity covers every aspect of ecosystem function. Research in my laboratory focuses on understanding how ecosystems are modified by the loss of biodiversity. Ecosystems sustain human lives and diversity of species is fundamental to healthy ecosystems. We believe that biodiversity loss is the single most significant challenge facing not only Sri Lanka but also the entire planet. Biodiversity loss is also a hindrance to achieving sustainable development.

Research activities

Studies in my lab are currently on plants and animals in terrestrial and freshwater ecosystems worldwide, with a special focus on the Western Ghats-Sri Lanka biodiversity hotspot. The primary focus however is the largely uncharted fields of invertebrate and small plant biodiversity. The invertebrate fauna of our country remains largely unexplored, with most studies originating during the colonial period. Arthropod diversity estimates can be useful as indirect assays of ecosystem function or productivity or as direct estimators of ecosystem responses to human induced change. The groups of our focus are pseudoscorpions, spiders, bees and orchid, groups of high conservation necessity. These findings are then shared through papers published in peer reviewed journals.

Progress Review

Dwarf hunting spiders or goblin spiders (Oonopidae) are an extremely diverse spider family with over 1655 described species in 113 genera worldwide. 430 oonopid spiders of seven reported genera (*Aprusia*, *Brignolia*, *Camptoscaphiella*, *Ischnothyreus*, *Orchestina*, *Opopaea* and *Xestaspis*) and five new genera for the country were studied. Three new species of the genus *Xestaspis* and four new *Brignolia* species was described during 2016. In addition, Sri Lankan Oonopids are included for the first time in a worldwide molecular analysis.

608 crab spiders belonging to 28 genera were collected and most of them identified up to species level in 2016. To date we have new records for Sri Lanka in the genera; *Platythomisus*, *Mastira*, *Massuria*, *Ozyptila*, *Strigoplus*, *Angaeus*, *Cebreninnus*, *Alcimochthes*. Several species of the genera *Peritraeus*, *Tmarus*, *Indoxysticus*, *Cebreninnus* and *Alcimochthes* are new to science and would be formally described in 2017.

8.13. Research Project - Plant and Environmental Sciences

Project Leader – Associate Research Professor.M.C.M.Iqbal

Introduction

The Plant and Environmental Sciences group is conducting research related to the plant sciences and the environment. Our Major Focus is on Forest Ecology and Environmental Remediation using plants. The Forest Ecology project is concerned with the degradation of dry forests in Sri Lanka and their restoration. The NIFS also owns a Forest Arboretum in Dambulla, which is a model for forest restoration. We have also studied the ecology of a relict pristine wet zone forest, a rare undisturbed forest patch. Another focus of our research is the ecology of serpentine sites in Sri Lanka to understand the accumulation of heavy metals in plant species in this unique habitat. The Environmental Remediation project is investigating how certain species of plants can be utilized to remove pollutants such as heavy metals and textile dyes from the aquatic environment. Besides live plants this project is also looking at adsorbents made from plant material to adsorb pollutants and how they can be further modified by combining them with minerals to increase their performance. The pollution from fertilizer escaping from agriculture into water bodies such as irrigation tanks and canals is causing the multiplication of aquatic plants. Removing phosphates and nitrates is the focus of another research project by using live plants and composite material made from biological and mineral materials.

Research Activities

Forest Ecology

Our research is focused on a relict wet zone forest in Moraella in the Central Province and Dry Forests in the dry zone. The Moraella forest was discovered in 2007 by Anuradha Medawatte, research assistant in this project. This is part of a network of forests in the Kandy plateau, which escaped conversion to cash crop plantations during the colonial period. The forest is 100 ha large with more than 200 flowering plants and species with massive dipterocarp trees exceeding 45 m in height.

We are conducting studies on the causes of forest degradation of dry forests in the Hurulu Forest Reserve in the Anuradhapura and Polonnaruwa districts and the Nuwaragala Forest Reserve in the Ampara district. This includes phyto-sociological and socio-ecological studies, to identify the human contribution to forest degradation and measures to be taken for forest restoration.

The NIFS owns a 30 ha Arboretum in Dambulla, which was an abandoned *chena* land. It is now restored to a model dry forest after 50 years by Mr. Sam Popham using his philosophy of assisted regeneration of forest species. He gifted the 3 ha Arboretum to the NIFS in 1989 to which the NIFS added the neighboring 27 ha. The Arboretum serves as a teaching tool for students and for research. Our investigations also extend into alien invasive species in the dry forests to determine their identity and impact on the forest ecosystem.

Serpentine Ecology

Serpentine sites originated millions of years ago when molten magma from the Earth's upper mantle escaped to the surface through weak tectonic boundaries. The weathering of solidified magma rocks, rich in ferro-magnesium minerals, gave serpentine soils which are high in Mg and other toxic heavy metals such as Ni, Cd and Fe. Plants, however, have colonized these soils and adapted to survive under the harsh unfriendly soil environment. In Sri Lanka, five serpentine sites were discovered along the

geological boundaries of Highland and Vijayan. We are studying the ecology and adaptation of plants on the picturesque serpentinite site on the southern coast in Ussangoda. This site has a characteristic reddish soil, with stunted vegetation to give the appearance of a large flat plain. The Man and Biosphere committee of the National Science of Sri Lanka has initiated setting up a Geo-Park in Ussangoda, in collaboration with the Departments of Wildlife Conservation, Archaeology and Forestry. We have contributed, among others, to the compiling of a dossier, for submission to the UNESCO for declaration of Ussangoda as an Internationally recognized Geo Park.

Environmental Remediation

We use and discard a variety of toxic materials into the environment. Intensive food production is polluting our water bodies through the use of fertilizers, particularly, phosphates and nitrates. These provide nutrients for algal blooms and invasive aquatic plants, which interfere with the aquatic ecosystem. Small and Medium scale textile industries discharge their waste material with dyes into waterways, which conveniently remove them away to other locations. We are investigating the use of plants to remove such toxic waste (phyto-remediation) and the use of plant and mineral derived material as adsorbents to remove them through physical and chemical processes (bio sorption). Potential aquatic plant species are being investigated to absorb textile dyes, which are difficult to biodegrade.

Bio sorbents, prepared from dried biomass, are prepared from ferns and invasive plant species to adsorb dyes and heavy metals. Biochar, derived from pyrolysis of agriculture and forestry by-products, are investigated for their sorption behaviors and adsorption mechanisms. Our research also includes material synthesis using biological and mineral materials and their characterization to enhance uptake of hazardous pollutants.

Progress Review

The progress in the project was shown in four publications in peer reviewed journals. We also presented our results in two national and four international conferences. One student completed an M.Sc degree, two have registered for their Ph.D and one for the M.Phil degree.

8.14. Project: Plant Taxonomy and Conservation

Project leader: Research Professor D.S.A.Wijesundara

Introduction

Sri Lanka has a remarkably rich biodiversity. According to the last enumeration, there are 3,154 species of flowering plants in Sri Lanka, with 348 species of ferns, 788 species of mosses and liverworts, and over 1,000 species of lichens. Nearly one in four flowering plant species is endemic to Sri Lanka. Apart from 894 species of endemic flowering plants, 49 species of ferns are also endemic to Sri Lanka. However, recent surveys have shown that about 44% of flowering plants are threatened. Major areas covered in this project include a) taxonomic and biogeographical studies of flora of Sri Lanka, b) preparation of the National red list for flora, c) sustainable use of plants, d) factors affecting the conservation of flora of Sri Lanka including Invasive Alien Species, and e) restoration ecology.

Assisted natural regeneration (ANR) is one of the important methods used in restoration ecology. NIFS-Sam Popham Arboretum is the best site in Sri Lanka for ANR. This arboretum was gifted to NIFS (then IFS) by an Englishman, Mr. F.H. Popham in 1989. After taking over, IFS added 27 more acres of adjoining scrub land to expand the arboretum. ANR was practiced to convert that land also into a dense woodland. On account of its significance as a benchmark site for Assisted Natural Regeneration, many forest ecologists and botanists use NIFS-SPA as a research site. It is also a popular tourist destination owing to the presence of unique fauna with a rich bird life and some unique animals such as Slender Loris and Pangolin. NIFS-SPA also has a dry evergreen rich vegetation consisting of over 200 species of trees. One of the main tasks of this project is to develop this important arboretum. During 2016 work began to develop a GIS map of the vegetation and develop nature trails and interpretative signage within the arboretum.

Research activities

1. Development of NIFS-Sam Popham Arboretum, Dambulla

One of the main tasks of this project is to develop NIFS-Sam Popham Arboretum in Dambulla developed using Assisted Natural Regeneration (ANR) which is an important method used in forest restoration. In addition to conducting several education programs, work began in 2016 to develop a GIS map of the vegetation, improving the outlook, develop nature trails and interpretative signage within the arboretum.

2. Taxonomic and Biogeographical studies

Endemism in Sri Lanka shows a specific geographical pattern. The locations of the endemic flowering plants in Sri Lanka were obtained using records from the National Herbarium and reliable published ecological studies. Over 84,000 location records were plotted in a 5 km x 5 km grid consisted of 2847 cells overlaid on a map of Sri Lanka using the GIS software Arc GIS 10. The areas of endemism were identified by using the weighted endemism scores of grid cells and were classified by natural break method and geographic features. Highest endemism was recorded in the wet zone of Sri Lanka. However, there were areas with high endemism in some dry zone areas as well.

3. Factors affecting the conservation of flora

Invasive plants are considered as the second most important factor causing the loss of biodiversity. *Panicum trichocladum* K. Schum., a grass native to Tropical East Africa was first reported in Sri Lanka from Hanguranketha area around 2002. A study was carried out to find the distribution of *P.*

trichocladium by conducting an island wide field survey. Experiments were also conducted to explore uses of invasive plants.

4. Using an invasive tree for grafting economically important plants

Clusia rosea (gal goraka) is a plant species having a highly efficient C4 photosynthetic pathway. This plant, native to Central America, has become a nationally significant invasive plant in wet sub-montane Sri Lanka. An experiment was conducted at Hapugastenne estate, Maskeliya, to ascertain the possibility of using *C. rosea* as a rootstock in grafting of crop plants such as *Garcinia quaesita* (goraka) and *G. mangostana* (Mangosteen) in the Clusiaceae family to which *Clusia* also belongs.

5. Preparation of the National Red List for flora

Preparatory work for the National Red List 2017 was initiated by forming expert teams and planning meetings and appointing research assistants to do data entry work at the National Herbarium, Peradeniya.

6. Sustainable use of plants

Research activities on natural products from medicinal and invasive plants were carried out in collaboration with Universities of Peradeniya and Jayawardenapura.

Progress Review

Nine areas of endemism were identified in Sri Lanka. They are: Central Highlands, South Western Wet Zone, Northern Highlands, Eastern Highlands, Ritigala, Dolu kanda, Yala, Wilpattu and Jaffna. Five core endemic areas (Sinharaja, Adams Peak, Knuckles, Horton Plains and Kandy) were recognized within those endemic areas.

It was observed that *P. trichocladium* was present in all agro-ecological regions visited except DL1, DL3, DL5, and WU3. Among those agro-ecological regions where this grass is present, IM1, IM3, WM3 and WL1 showed the highest density compared to the other regions. It appears that this grass prefers wet areas in the low and mid country and the dry and cold areas are not invaded.

Grafting of *G. quaesita* and *G. mangotana* on *C. rosea* rootstock were successful. This will help propagation of those important economic plants.

One book chapter, 01 paper in a SCI (expanded journal), 3 papers in other peer reviewed journals, and 4 abstracts were published in 2016.

8.15. Research Project - Primate Biology

Project Leader – Dr.W.P. Dittus, Visiting Senior Scientist

Introduction

The research program involves observational studies of monkeys (primates) in their natural forest habitats. Our “laboratory” is the Polonnaruwa Nature Sanctuary (cum Archaeological Reserve) where we have established the empirical foundations for our research over several decades. The research subjects involve mostly the endemic toque macaques (*Macaca sinica*) but also the Purple-faced langur (*Semnopithecus vetulus*), Hamuman langur (*S. priam*) and slender loris (*Loris lydekkerianus*). Our aims are: (1) to contribute new knowledge to the understanding of the evolution of social behavior in primates (and by extension in humans); (2) to provide a scientific basis for the effective management and conservation of primates and other organisms; and (3) to disseminate new knowledge through scientific publications as well through professionally produced documentary films with an eye towards - not only educating and entertaining, but also gaining public support for conservation efforts in the local and international communities. Our films contribute positively to the image of Sri Lanka as a tourist destination. Our research results are published mostly in quality SCI journals.

Research Activities

1. Demography and range use of toque macaque *Macaca sinica sinica*. Routine monthly census of 20 groups of toque macaques to monitor rates of birth, death, immigration and emigration. Census of “lost groups” of toque macaques that have left limits the 3 km² designated study area and transferred into surrounding human inhabited areas. Initiate drafting new maps to incorporate expanded areas of occupancy by 34 study groups. Monitor group fission.

Researchers: Mr. Sunil Gunathilake and Chameera Pathirathna, professionally certified naturalist staff of the Association for the Conservation of Primate Diversity (ACPD), Polonnaruwa.

2. Demography and range use of hanuman langur *Semnopithecus priam thersites*. Routine monthly census of 11 groups hanuman langurs to monitor rates of birth, reproductive seasonality, sex ratios at birth, change in age-sex composition of groups with time, mortality and transfer between social groups. Range use changes according to month and year.

Researchers: Mr. Sunil Gunathilake, senior naturalist of the ACPD, Polonnaruwa.

3. Demography and range use of purple-faced langur (PPF) *Semnopithecus vetulus philbrickii*. Routine monthly census of 14 groups PPF langurs to monitor rates of birth, reproductive seasonality, sex ratios at birth, change in age-sex composition of groups with time, mortality and transfer between social groups. Range use changes according to month and year.

Researcher: Mr. Sunil Rathnayake, naturalist staff of the ACPD, Polonnaruwa.

4. Nocturnal observation of slender loris *Loris lydekkerianus nordicus* in and around the field research station (n=12) at Polonnaruwa. Aim to identify social organization, range use, diet and vital statistics such as birth and death.

Main Researchers: Chameera Pathirathna and Sunil Rathnayake, naturalist staff of the ACPD.

5. Public education program: American International School of Cairo, Egypt. 37 participants.

6. Scientific consultancy and logistic support for professional film crews in 2016: NHK – Japan National Television (Male toque macaques)

Researchers: all Primate Project staff

7. Data analyses, trip to USA (Smithsonian Institution) for collaboration in analyses and publication preparation of toque macaque data regarding (1) general milk composition (2) Vitamin D in macaque milk and (3) weaning and amenorrhea. Also accept invitation to write review of Biogeography of Mammals for special edition of Ceylon Journal of Science.

Researcher: W. Dittus and colleagues (Ofstedal, Jayawickrema, Power and Baker).

Progress Review

1. The planned behavioral, ecological and demographic field research has been accomplished involving three species of primates at Polonnaruwa. Nocturnal observation of loris locations and activity were monitored.

2. Research and collaborations with colleagues in the USA resulted in three reports that are at different stages of maturity towards publication.

Power ML, Dittus WPJ. (2017). Vitamin D status in wild toque macaques (*Macaca sinica*) in Sri Lanka. American Journal of Primatology, 79 (6): e22655 DOI 10.1002/ajp.22655.

Dittus, WPJ (in press). The biogeography and ecology of Sri Lankan mammals point to conservation priorities. In: Biogeography of Sri Lanka (Gunatilleke IAUN, ed) Ceylon Journal of Science (Special edition).

Dittus WPJ (in press). IUCN Red List assessment of Sri Lankan primate taxa (IUCN Red List of Threatened Species, Singapore 2015).

Ofstedal O, Jayawickrama L, Dittus WPJ. (manuscript). Is extended lactation nutritionally important for the weaning of toque macaques, *Macaca sinica*? Evidence from milk composition. Prepared for American Journal of Physical Anthropology (under revision)

Dittus WPJ, Baker, AM (manuscript). Prolonged lactation involves two phases and bimodal weaning peaks, exceeds amenorrhea, and adjusts the reproductive cycle to female body condition and ecology in wild toque macaques (*Macaca sinica*). (Submitted to Behavioral Ecology and Sociobiology, under revision).

8.16. Project - Cell Biology

Project Leader – Dr.D.N.Magana-Arachchi – Senior Research Fellow

Introduction

The research interests of the project revolve around microbial ecology and Human diseases. Mostly, understanding the distribution of microbial communities in environment; mainly in air and in the human lung. The study of human diseases includes both communicable and non-communicable diseases namely pulmonary diseases and chronic kidney disease of unknown aetiology (CKDu) which is the most prevailing health issue in Sri Lanka.

The current research on CKDu focuses on identifying the blood transcriptome patterns of CKDu patients. Disease patients are studied in comparison to healthy individuals, and significantly differentially expressed genes and their related pathways are identified in relation to the disease. Analyzing molecular mechanisms will provide better understanding of the disease, earlier diagnosis and personalized treatment protocols.

Exposure to microorganisms associated with particulate matter has an effect on the general public health. Therefore, it is important to gather knowledge on airborne microorganisms. The study aimed to quantify and identify airborne microorganisms both indoor and outdoor.

The human lung, though considered sterile earlier has found to be a habitat of various microorganisms. Our research group is currently conducting research on lung microbiome of patients with respiratory diseases. Traditional culture methods alongside advanced molecular techniques are used to identify and quantify bacteria and fungi.

Research Activities

In the research on CKDu, a pilot study was initially carried out with a selected panel of genes to analyze changes in expression in between CKDu patients (Stage 2 to Stage 5) from Girandurukotte, a CKDu endemic area, healthy individuals from the same area, and healthy individuals from Kandy, a non-endemic area. Following promising results, microarrays were carried out for the same populations. Fold change of gene expression in patients and Girandurukotte healthy were calculated relative to Kandy healthy. Differentially expressed genes and pathways were analyzed using Ingenuity Pathway Analysis (IPA) software (Qiagen). Genes from enriched pathways in microarrays were then selected for real-time PCR validation.

For the research on airborne microbes in outdoor environments, samples were collected from nine sites within Kandy city which were selected based on the traffic congestion. Quantification of organisms & species identification was carried out using the standard cultures, epi-fluorescence microscopy and the molecular techniques of real-time PCR and DNA sequencing.

For indoor airborne microorganism study, sample collection was done in seven selected areas of Kandy Hospital; Out Patients Department (OPD), Surgical Intensive Care Unit (ICU), Theatre in Gynaecology and Obstetrics Department, and four sites in the respiratory diseases unit: female and male wards, bronchoscopy unit and medical officers' staff room. Quantification of organisms & species identification was carried out using the standard cultures, epi-fluorescence microscopy.

In lung microbiome research project, oropharyngeal swabs and Broncho alveolar larvae samples of lung cancer and bronchiectasis patients visiting Teaching Hospital, Kandy were collected, processed and observed for microbial growth. Cultures obtained were analyzed using Gram's staining for preliminary identification. Following DNA extractions, microbial identifications will be carried out with 16S rDNA sequencing.

Progress Review

The pilot study identified environmental oxidative stress as a major contributing factor to CKDu, and also Key functional clusters of genes with differential regulation in early stage CKDu have been identified with the aid of microarray analysis.

In airborne microbe analysis studies 29 bacterial species and five fungal species were identified in outdoor environment. Though no significant difference was observed for the total bacterial count between the sites higher number of bacterial count was observed from all sites in the city of Kandy. Therefore, the traffic congestion and other anthropogenic factors could be the cause for higher number of bacterial counts observed at the sites of Trinity College, Police Station, Fire Brigade, Children's Park and Railway Station while vegetation was the contributing factor for the higher bacterial counts at sites of Lewalla, Tea Research Institute (TRI), NIFS and Dodanwala.

Fourteen bacterial species and three fungal species were identified from different sites of the hospital. The highest microbial count was detected in the OPD in the hospital followed by sites in the respiratory diseases unit.

A major part of the sample collection for the lung microbiome project was completed. Sample processing, microbial identification through culturing and DNA sequencing is being continued. Results obtained are being analyzed to identify the bacteria that were present in patients' samples.

These findings resulted in seven articles in international /National peer-reviewed journals and nine abstracts in international and local conferences.

8.17. Project – Medical Entomology
Project Leader – Senior Research Professor S.H.P.P.Karunaratne

Research Activities

Five research projects in collaboration with Department of Zoology, University of Peradeniya, Sri Lanka have been carried out during 2016.

1. DNA barcoding of Sri Lankan mosquito species:
Molecular taxonomy/ “DNA barcoding” has become the most powerful method of species identification and evolutionary relationship determination today. Morphological characterization of faces difficulties in identifying sibling species and field collected damaged samples. Our work aims to characterize Sri Lankan mosquitoes, using the genetic markers *Cytochrome c Oxidase subunit I (COI)* and the Internal Transcribed Spacer 2 (ITS2) region.
2. Target site insensitivity of dengue mosquitoes *Aedes aegypti* and *Aedes albopictus* to pyrethroid insecticides:
Aedes aegypti and *Ae. albopictus* are the vectors of dengue, chikungunya and yellow fever in Sri Lanka. They are mainly controlled by pyrethroid insecticides and the development of resistance to pyrethroids has become a threat to control programmes.
3. Distribution and phylogeny of *Wolbachia* strains in wild mosquito populations in Sri Lanka:
Application of symbiotic *Wolbachia* bacteria to control of mosquito-borne diseases has attracted immense attention during the past few decades. Our research investigates the prevalence and host preference of *Wolbachia* strains present in natural populations of mosquitoes by PCR using strain specific *wsp* and *groE* primers.
4. Frog- and bird- biting mosquitoes in Sri Lanka: Blood feeding pattern and host choice of mosquitoes are major biological events that facilitate the transmission cycles of vector-borne pathogens. Frogs and birds serve as amplifying hosts for many pathogens including viruses that are transmissible to humans and other wildlife. In Sri Lanka, any description on these mosquitoes and their role in transmitting diseases to wild birds and other organisms have never been reported. The aim of this study is to determine the diversity, distribution, abundance and biting behavior of frog- bird- biting mosquitoes, and to identify the potential zoonosis diseases that can be transmitted from birds to humans and wildlife of Sri Lanka.
5. Mechanisms of acaricide resistance in the cattle tick *Rhipicephalus (Boophilus) microplus* and the brown dog tick *Rhipicephalus sanguineus* in Sri Lanka: High tolerance of ticks to acaricides is increasingly becoming a problem. Characterization of acaricide resistance in the cattle tick, *Rhipicephalus (Boophilus) microplus* and the brown dog tick, *Rhipicephalus sanguineus* (Acari: Ixodidae), collected from cattle farms and Sri Lankan Police Kennels respectively, are being carried out.

Progress 2016

1. DNA barcoding of Sri Lankan mosquito species:

Fifteen species of Anopheline mosquitoes and 14 species of Culicine mosquitoes have been characterized so far and the phylogenetic trees have been constructed. Several of these sequences have been submitted to the GenBank. Vector species of important mosquito borne diseases and several sibling species have been characterized. Further investigations, especially on the haplotype diversity in different populations and population structure of these species, are also being carried out.

2. Target site insensitivity of dengue mosquitoes *Aedes aegypti* and *Aedes albopictus* to pyrethroid insecticides:

We have shown that they have developed resistance against the pyrethroid insecticides cyfluthrin, deltamethrin, etofenprox, permethrin and λ -cyhalothrin. A mutation (V1016I) in the pyrethroid target site, 'voltage gated sodium channel (VGSC)' of the mosquito nervous system, which has been previously recorded from pyrethroid resistant *Ae. aegypti* from Latin America, was found in Sri Lankan *Ae. aegypti* also. This is the first report to show the presence of this mutation in a Sri Lankan mosquito species. The mutation is known to cause target site insensitivity to pyrethroids and its dispersal can cause a major threat to future dengue mosquito control programmes in Sri Lanka.

3. Distribution and phylogeny of *Wolbachia* strains in wild mosquito populations in Sri Lanka:

Investigations will provide the basic information necessary to use *Wolbachia* as a biological control tool in future mosquito control programmes. So far the results show that the dengue vectors *Ae. aegypti* is negative for *Wolbachia* infections while *Ae. albopictus* shows a 100% infection rate. Japanese encephalitis vectors, *Culex gelidus* and *C. tritaeniorhynchus* and *Anopheles* vectors of malaria are also negative for *Wolbachia* infections. The infection rate is relatively high in the filarial vector *C. quinquefasciatus*. *Ae. albopictus* is super infected with *Wolbachia* strain A (AlbA) and B (Pip) super groups. Phylogenetic analysis of the *wsp* sequences showed two major branches confirming identities obtained from the PCR screening with strain specific primers.

4. Mechanisms of acaricide resistance in the cattle tick and the brown dog tick Sri Lanka

Ticks become resistant to acaricides through increased metabolism of acaricides by tick metabolic enzymes and through insensitive target sites. So far the results have shown that the cattle tick populations have a wide cross-resistant spectrum. They have enhanced activity of esterases for increased metabolism and the insensitive organophosphate and carbamate target site AChEs. *kdr* type mutations G72V was found in the sodium channel regulatory protein (target site of the pyrethroids and DDT) of *R. (B.) microplus*. Systematic and sophisticated insecticide resistance monitoring programmes and a better understanding on the mechanisms which govern resistance development are vital for future tick control programmes.

Rhizobium Project

Visiting Research Professor. S.A.Kulasooriya

Rhizobia are soil bacteria that form root nodules in certain leguminous plants. This symbiosis enables such plants to fix atmospheric nitrogen (N_2). Therefore, many leguminous plants including several important food and forage crops are capable of using fixed atmospheric nitrogen instead of soil nitrogen including those supplied as fertilizer nitrogen. Improvement of symbiotic nitrogen fixation could hence minimize the use of N-fertilizer in the cultivation of these crops. It had been recognized that continuous use of chemical fertilizer (particularly N-fertilizers) contributes to environmental pollution that is responsible for environmental health problems such as chronic kidney diseases of uncertain etiology and certain types of cancer, and global climate change. Therefore, there is international consensus to minimize the use of such fertilizers in crop production. The Government of Sri Lanka had also taken a policy decision to reduce the use of chemical fertilizer and other agro-chemicals in agriculture in order to provide toxin free food for its population. The objective of the Rhizobium project at the NIFS is to conduct fundamental and developmental studies on the rhizobiology of crop and forage legumes widely cultivated in Sri Lanka with the aim of developing relevant rhizobial inoculants to be applied for the improvement of symbiotic nitrogen fixation in these plants.

Research activities

Fundamental studies include the isolation, characterization and identification of rhizobia from root nodules of different plants growing in Sri Lanka. Initial isolations of rhizobia are carried out on Congo Red Yeast Mannitol Agar (CRYMA) which enables one to distinguish contaminant bacteria (pink colonies) from the whitish gummy colonies of rhizobia. After several sub-culturing on CRYMA the isolated rhizobia are routinely cultivated in Yeast Mannitol Agar (YMA solid medium) or YMB broth cultures. The isolates are then characterized morphologically recording the colony characters followed by microscopic examination after Gram staining and spore staining. Typically, rhizobia should be Gram negative, non-spore forming rod shaped bacteria. Biochemical characterizations examine the isolates for slow growth without acid production or fast growth with acid production using Bromo thymol blue YMA (BRYMA) medium. They are further characterized by testing for the utilization of carbohydrates other than mannitol. The characterized isolates are stored in Eppendorf tubes covered with a layer of glycerine under low temperature. These isolates are then screened in green house pot experiments for nodulation and nitrogen fixation with targeted crop plants in order to select the better strains for field trials. In a typical field trial, the test treatment inoculated with the isolate will be compared with an uninoculated control treatment and a standard treatment to which the recommended dose of fertilizer nitrogen is applied. The best strains are then developed as carrier based and other forms of inoculants to be applied for large scale cultivations of these crops. These inoculants are extensively field tested in farms and farmers' fields in different locations, at least for two cultivation seasons (often in comparison to the application of urea fertilizer), prior to their being recommended for general use.

Research progress during 2016

As our coir based inoculants for soybean have been successful to replace urea applications completely since 2008, they were supplied to farmer use in 4300 acres. In addition, we also supplied (on request) to the Government Department of Agriculture small (1/4 acre) inoculant packets to be used in Maha 2016/17, for seed production for the Department's extended soya cultivation program planned for Yala 2017.

Field testing of inoculants formulated for vegetable beans (*Phaseolus vulgaris*) in Doragala, Hanguranketha, Rikillagaskade, Welimada, Badulla and Bandarawela was successful and 3000 packets were released to Oasis Marketing Company (Pvt) Limited for distribution.

Similarly, field testing of inoculants for mung bean (*Vigna radiata*) at Beralihela, Handungamuwa and Tissamaharama areas were successful. Plenty Foods PLC purchased inoculant packets for initial distribution to 140 acres.

Field testing of inoculants for the forage crop white clover (*Trifolium repens*) in experimental plots at Ambewela Farm, Ambewela had been quite successful. Machine seeding of our inoculant coated seeds followed by machine spraying of liquid inoculants after crop cuts, have produced profuse root nodulation and significant increase in biomass production for a period of 15 months. The farm management has decided to adopt large scale application of our inoculants from January 2017 to replace their regular addition of urea to these pasture lands.

We are happy that our efforts could contribute to the reduction of urea additions to these pristine highlands which are the water catchment areas for major rivers in Sri Lanka.

Publications and communications in 2016

1. **Kulasooriya, S. A.** and D. N. Magana-Arachchi (2016) Nitrogen fixing cyanobacteria: their diversity, ecology and utilization with special reference to rice cultivation. Jour Natnal Sci Foundation Sri Lanka, 44(2): 3- 21.
2. **S. A. Kulasooriya**, E. M. H. G. S. Ekanayake, R. K. G. K. Kumara, H. M. A. C. Gunarathna, G. Seneviratne and A. M. Sarath Bandara (2016) Rhizobial inoculants for low cost, environmentally benign food production. Proc of the NSF Research Summit 2016, “Empowered by Research & Innovation” 7th & 8th July 2016, BMICH, Colombo, National Science Foundation, Ministry of Technology & Research: Abstract: p.116.
3. Thilini A. Perera, T. L. Shamala Thirimanne, G. Seneviratne and **S. A. Kulasooriya** (2016) Fifty percent replacement of nitrogen fertilizer recommendation for rice by a biofilm of a diazotroph and a rhizosphere fungus. 1st International conference on Bioscience and Biotechnology-2016, Molecular Life Sciences for Development in the 21st Century. 12 – 13, January< Colombo, Sri Lanka, Faculty of Applied Sciences, University of Sri Jayewardenepura, Sri Lanka: p16.

Collaboration & Consultation Division

The Collaborative & Consultation Division (CCD) facilitate interaction of NIFS scientists and their research projects with outside organizations. The principle objective is to take the findings of research projects beyond the institute so that their impacts are well showing and utilized by the general public.

1. Rhizobium Project

Inoculants for food and forage legumes NIFS Participants: Mr. E. M. H. G. S. Ekanayake, Mr. R. K. G. K. Kumara, Ms. A. M. H. D. C. Abeyratne, Mr. A. H. M. A. Tennekoon and Ms. E. M. N. Ekanayake

- Goals & Objectives

Research, development and application of isolated, screened and field tested rhizobial inoculants to food and forage legume crops in order to improve their nitrogen fixation capabilities and replace/ reduce the application of chemical N-fertilizer (urea). Final objective is to reduce cost of production of legumes, sustain soil fertility and minimize environmental pollution.

- Activities/ Sub activities listed in the Action Plan 2016 under the Project

As the inoculation of our inoculants to soybean (*Glycine max* L.) has been successful to replace urea fertilizer completely, the main efforts this year were to extend the areas of its application. For vegetable bean (*Phaseolus vulgaris* L.) and mung bean (*Vigna radiata* (L.) R. Wilczek) continuation of field testing of inoculants was necessary prior to their release for use by farmers.

- Significant scientific research findings and inventions

Inoculants for soybean supplied to 4300 acres. The department of Agriculture was provided with 3000 small packets of inoculants to be distributed among its farmers as the department has targeted to extend their soybean cultivations to at least to 10,000 ha in 2017. Field testing of inoculants for vegetable bean in Doragala, Hanguuranketha, Rikillagaskade, Welimada, Balangoda and Bandarawela was successful and 3000 inoculant packets were released to Oasis Marketing for distribution. Field testing of inoculants for mung bean at Beralihela, Handungamuwa and Tissamaharama areas has been successful. Plenty Foods PLC has purchased inoculant packets for initial distribution to 140 acres of mung bean.

Field testing of inoculants for the forage crop Clover (*Trifolium repens* L.) in experimental plots at Ambewela Farm has been quite successful. Large scale mechanized seeding using coir dust based inoculant coated seeds and machine spraying of liquid inoculants after crop cuts, have given positive results. The farm management has decided to adopt large scale application of our inoculants to clover from January 2017.

2. Biofilm-Biofertilizers (BFBFs)

NIFS Participants: Prof. G. Seneviratne, Prof. S. A. Kulasooriya, Mr. E. M. H. G. S. Ekanayake, Ms. P. Wijepala, and Ms. S. Gunaratne

Collaborators: Mr. Samantha Kumarasinghe, Mr. Samuditha Kumarasinghe and Mr. Ananda Jayasekera

Field testing of BFBF fertilizer with tea, rice, maize and a number of vegetable crops in several locations in Sri Lanka is progressing well.

Collaborator: Kurunegala Plantations Limited. Field testing of BFBFs with young coconut trees is in progress.

3. Collaboration with the South Eastern University of Sri Lanka on the purification of Sri Lankan natural vein graphite for novel technological applications.

NIFS scientist: Dr. Athula Wijayasinghe assisted by Mr. P. T. S. Hewatilake

This Project has been completed

4. Collaboration with the Sri Lanka Institute of Nanotechnology (SLINTEC) on the development of Sri Lankan natural vein graphite for nano-technological applications.

NIFS scientist : Dr. Athula Wijayasinghe

5. Collaboration with the Uwa Wellessa University of Sri Lanka on the development of next generation advanced materials for future applications including nano-technology.

NIFS scientist: Dr. Athula Wijayasinghe.

Science Education & Dissemination Unit

Objectives;

Foster the exchange of technical and scientific information for the scientific community & promote the public understanding of science.

Forums for the scientific Community

- Special lectures were organized and they were intended to provide a quick forum for the IFS scientists and Research Assistants with the eminent scientists visiting the institute and the country. Twelve special lectures were organized.
- Eleven Journal club meetings were conducted. This activity was mainly organized for the IFS Research Assistants, for them to get an opportunity to discuss their research problems with the scientists and their peers].
- One national Workshops, one symposia and one conference were organized.

Promotion of Public Understanding of science

- **National Competition on “Science Copies Natures Secrets”**

Objective of this competition was to inspire school children to look at nature from a new angle by giving understanding of the ways in which nature helps our existence and the ways in which nature is imitated (bio mimicry) to make human life better. This was organized for Sinhala, Tamil and English medium students of grade. 1,801 articles were received and 1st, 2nd 3rd places and special merit awards were given to student in all three mediums.

Winners’ celebration was held on 20th October 2016, at the National Institute of Fundamental Studies Sri Lanka with the presence of Hon. Secretary Mrs. R. Wijialudchumi, Secretary Minister of Science, Technology & Research.

- **Provincial competition on “Understanding World through Science”**

Objective of the competition was to develop the curiosity and willingness on identification of scientific concepts & their applications among students. They had to find one scientific concept associated with an environmental phenomenon each day, during a period of 20 days. Competition on Understanding world through science was organized in Sinhala English and Tamil medium under two categories (Year 7 & 8).

The Winners Celebration of Central Province Competition on “Understanding the World through Science” -2016 was held on 25th of October 2016, at the NIFS premises with the presence of Prof. Namal Priyantha, The Director of Postgraduate Institute of Science (PGIS), University of Peradeniya.

- **School Science Programme (SSP)**

43rd SSP was held from 20th to 23rd December 2016. School Science Programme (SSP) is one of the most important annually conducted programme for the dissemination of science among the younger generation. The primary goal of the SSP is to expose young students to a few selected frontier areas of science and to provide an opportunity for them to interact directly with scientists actively engaged in

research. One hundred and thirty-eight students from all over the country participated for the programme. In addition, lab visits were organized for school community on request (four visits)

- **Popularization of science through electronic media**

- a) **Open Science Circle in Electronic Media (OSCEM)/ Vidu Nena Hawula project**

Vidu Nena Hawula Science Message Service, also known as OSCEM (Open Science Circle in Electronic Media) was launched on 2nd January 2012 (according to my concept) with the aim of improving the science literacy and scientific temperament of Sri Lankans. OSCEM offers a combination of services to its members to improve scientific knowledge as well as to develop the inquiring minds, and the enthusiasm about science among the school community and the general public. A daily science message service and an open science quiz based on weekly questions via text messages (SMS), e-mail and social media networks is providing. This free service is provided on all weekdays in both Sinhala and English media.

In addition, it provides a Science Blog and an open forum for the subscribers to discuss their problems related to science behind day-to-day activities with the scientific community. This free service is provided on all weekdays except on government holidays.

<http://vidunenahawula.sciencerays.com>

Making a grand milestone of OSCEM, the 1000th Science Message was sent by the Honorable Minister Susil Premajayantha, Minister of Science, Technology and Research of Sri Lanka on 31st August 2016.

The Winner of 2015/2016, Mr. Sanju Darshana who ranked top with the highest total score in the Vidu Nena Hawula weekly science quiz was awarded with the Gold Medal from Hon. Mrs. R. Wijialudchumi, The Secretary, Ministry of Science, Technology and Research on 20th October, 2016.

- b) **MASS project (Mobile Apps for Science Students)**

Mobile Apps for Science Students (MASS) is the first ever known Mobile Application project that creates mobile apps in Sinhala to make Sri Lankan students learn science in a novel and more exciting manner. The second mobile app of this projects has been named as “Sinhala English Science Glossary” and published on Google Play Store on May, 2016. With this app, the users can search words in both Sinhala and English languages. While typing words, it also shows search suggestions and search results are categorized by the subject for selected word. There are more than 90,000 words which covers science disciplines such as Agriculture, Botany, Education, IT, Mathematics, Physics, Statistics, Chemistry, Geography, Library Science, Geo Science, Computer Science, Molecular biology, Nursing and Zoology. After download, all glossaries can access without an internet connection (offline access). Download the app from the following link: http://nifs.ac.lk/?page_id=3267

- **Popularization of science through print media**

SEDU is engaged in popularization of science and disseminating research findings of NIFS in different ways of communication. It holds and daily update social media networks of NIFS and SEDU such as Facebook, Twitter and LinkedIn which easily enable science communication and dialogue and official websites. Moreover, we write news and feature articles to printed and electronic newspapers. In 2016, around 30 newspaper articles were published to disseminate science to general public. Besides that, one TV, two television news and two radio news programs were conducted.

NATIONAL INSTITUTE OF FUNDAMENTAL STUDIES - SRI LANKA

SIGNIFICANT ACCOUNTING POLICIES - YEAR ENDED 31ST DECEMBER 2016

(1) GENERAL ACCOUNTING POLICIES

- 1.1 The financial statements have been prepared on the basis of historical costs in accordance with the Srilanka Public Sector Accounting Standards for the accrual basis accounting and no adjustments have been made for inflatory factors affecting these accounts, instead of Motor Vehicle re-valuation according to the special Re-valuation committee.
- 1.2 Similarly Laboratory Equipment, Machinery Tools & Implements, Refrigerators, Air Conditioners, Communication Equipment, Office & Miscellaneous Equipment, Sports Items are re-valued by the Special Re-valuation Committee and there is no inflator factors affecting to the accounts.
- 1.3 The value of Revaluation of Fixed Asset in 2011 and the value of Motor Vehicle in 2015 have been shown as Revaluation Reserve being adjusted by Institute Fund Account. The Revaluation of Motor Vehicles have been done by Examiner of Motor Vehicles of Department of Motor Traffic, Kandy with effective dates of 16.02.2015 and 20.02.2015 at current market value.
- 1.4 Previous year figures and phrases have been re-arranged wherever necessary to conform to the current presentation.

1.5 CONVERSION OF FOREIGN CURRENCIES

All foreign exchange transactions are converted of the rate of exchange prevailing at the time the transactions were effected. Non-resident foreign currency account balance has been translated at the rate of exchange prevailing at the date of Statement of Financial Position.

1.6 TAXATION

Under the provision of sections 8(a) (xxxix) and 42 (ff) of the Inland Revenue Act No. 28 of 1979 (as amended) the Institute is exempted from income tax in Sri Lanka.

(2) ASSETS AND BASES OF THEIR VALUATION

2.1 STOCKS:

Stocks have been valued at historical cost basis and all issues are valued at FIFO Basis.

2.2 FIXED ASSETS:

- 2.2.1 The cost of fixed assets is the cost of purchase or construction together with any incidental expenses thereon. The fixed assets are recorded at cost and accumulated depreciation which is provided in the depreciation on the basis specified in 2.2.2
- 2.2.2 The cost of Library Books includes a Heritage Asset (Mapping Report) amounting to Rs. 1,097, 477.65 which is not depreciable.

2.2.3 DEPRECIATION OF FIXED ASSETS

The provision for depreciation has been calculated on the cost of fixed assets in order to write-off such costs over the estimated useful lives as follows:

Motor vehicles	20%
Library books	33.33%
Building	10%
Lab Equipment	10%
Sports goods	33.33%
Computers	25%
Computer Software	25%
Furniture & fittings	10%
Communication	10%
Air - Conditioners	10%
Refrigerators	10%
Machinery Tools & Implements	10%
Office & Miscellaneous	
Room Linen	33.33%
Crockery Cutlery & Canteen Equipment	33.33%
* Safety Equipment	10%
Office Equipment	20%
Sundry Assets	10%
Expandable Assets	10%

* Safety Equipment - Rate of depreciation had been changed from 33.33% to 10% with effect from 1999.

The depreciation of Fixed Assets are provided from the date of purchased to the date of disposal.

2.2.3 The Accumulated depreciation has been corrected due on 31st December 2016 to meet the Fixed Assets of the Institution by that date.

2.3 INVESTMENT

Employer's and employees' contributions made towards the NIFS provident fund has been invested in fixed deposits at the National Savings Bank.

2.4 Contribution made towards Consumption Loan Fund has been deposited in Savings Account at the National Savings Bank.

(3) LIABILITIES AND PROVISIONS

3.1 All known liabilities and provisions as the date of the Statement of Financial Position have been provided for in the accounts.

3.2 RETIREMENT GRATUITY

Provision is made in these Accounts for retirement gratuity payable under the payment of Gratuity Act No.12 of 1983 in respect of employees with 5 or more years of continued service in the Institute. This item is grouped under deferred liabilities in the Statement of Financial Position.

3.3 N. I. F. S. PROVIDENT FUND

Members' fund as at 31st December 2016 are shown under specified funds in the Statement of Financial Position.

(4) REVENUE RECEIPTS

4.1 GOVERNMENT GRANT

Government grant received during the year under review towards the recurrent expenditure has been charged to the Statement of Financial Performance for the year. Total revenue and capital funds of the Institute accumulated from the previous years have been shown as Institute funds in the Statement of Financial Position.

4.2 FOREIGN AND OTHER GRANTS

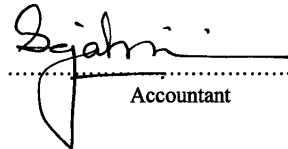
All foreign and other monetary grants received during the year, are dealt with by charging to the Statement of Financial Performance to the extent of such grants recognized in the Financial Statements do match with the associated cost incurred during the year. Unspent grants during the year are shown under specified funds and grants in the Statement of Financial Position.

4.3 RESEARCH GRANT FUND

The un-utilized specified grant balances have been shown as in the Research Grant Fund under specified fund in the Statement of Financial Position.

(5) UTILIZATION OF BUDGET ALLOCATION

The Revised Budget Estimate has been shown in the estimation and the previous year Capital Funds have been utilized in the reporting year.



 Accountant

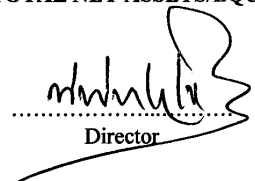
NATIONAL INSTITUTE OF FUNDAMENTAL STUDIES

SRI LANKA

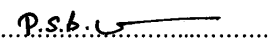
STATEMENT OF FINANCIAL POSITION AS AT 31.12.2016

(RESTATED)

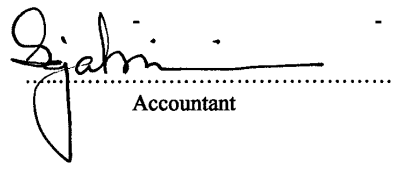
	NOTE	SLRs 2016	SLRs 2015
ASSETS			
CURRENT ASSETS			
CASH AND BANK BALANCES	1	164,994,206.54	145,116,051
DEPOSITS PREPAYMENTS & ADVANCES	2	53,210,960.32	20,235,952
DISPOSABLE OF FIXED ASSETS		24,915,351.37	24,915,352
FESTIVAL ADVANCE FUND INVESTMENT		300,000.00	300,000
CONSUMPTION LOAN FUND INVESTMENT		381,234.88	225,398
INTEREST RECEIVABLE FOR FIXED DEPOSITS		4,521,732.52	3,195,206
STAFF CONSUMPTION LOAN	3	4,317,002.00	4,277,244
ADVANCE AND OTHER RECEIVABLE	4	778,191.22	151,910
STOCKS	5	2,246,151.97	2,169,014
		255,664,830.82	200,586,127
NON-CURRENT ASSETS			
WORK IN PROGRESS (NEW BUILDING)	6	172,171,884.60	142,920,000
PRELIMINARY EXPENSES FOR CONSTRUCTION		-	20,000
PROVIDENT FUND INVESTMENT	7	76,925,668.67	65,342,775
TRAINING CAPACITY		949,197.40	882,197
PROPERTY, PLANT AND EQUIPMENT	8	303,903,902.00	261,035,316
MAPPING REPORT		-	1,097,478
MODEL OF LAND		37,500.00	37,500
		553,988,152.67	471,335,266
TOTAL ASSETS		809,652,983.49	671,921,393
LIABILITIES			
CURRENT LIABILITIES			
ACCOUNTS PAYABLE	9	1,022,628.33	4,659,876
ACCRUED EXPENSES	10	1,930,476.63	2,162,510
		2,953,104.96	6,822,386
NON CURRENT LIABILITIES			
SPECIFIED FUNDS & GRANTS	11	100,983,184.09	88,848,479
DIFFERED LIABILITIES	12	20,844,045.00	19,910,287
		121,827,229.09	108,758,766
TOTAL LIABILITIES		124,780,334.05	115,581,152
NET ASSETS		684,872,649.44	556,340,241
NET ASSETS/EQUITY			
CAPITAL FUND - SPENT	13 }	542,858,695.79	417,752,142
- UNSPENT		132,596,465.21	114,070,275
PRESIDENT'S FUND - SPENT		7,078,501.15	7,078,501
ASSET REVALUATION RESERVE		131,630,743.37	131,630,744
INSTITUTE FUND		(129,291,756.08)	(114,191,421)
TOTAL NET ASSETS/EQUITY		684,872,649.44	556,340,241



Director



Secretary



Accountant

NATIONAL INSTITUTE OF FUNDAMENTAL STUDIES

SRI LANKA

STATEMENT OF FINANCIAL PERFORMANCE FOR THE YEAR ENDED 31.12.2016

			(RESTATED)
	NOTE	SLRs 2016	SLRs 2015
OPERATING REVENUE			
RECURRENT GRANT		181,000,000.00	154,000,000
OTHER INCOME	14	13,884,468.93	11,310,817
		194,884,468.93	165,310,817
EXPENDITURE			
PERSONAL EMOLUMENTS	15	122,711,898.34	113,491,369
TRAVELLING	16	1,255,675.00	1,159,523
SUPPLIERS & CONSUMABLE	17	15,533,937.84	16,616,909
MAINTENANCE	18	8,614,866.32	7,376,205
CONTRACTUAL SERVICES	19	19,348,870.75	17,268,127
DEPRECIATION		47,559,559.48	40,615,891
OTHER EXPENSES	20	23,748,351.60	19,052,300
TOTAL OPERATING EXPENSES		238,773,159.33	215,580,324
DEFICIT FROM OPERATING ACTIVITIES		(43,888,690.40)	(50,269,507)
FINANCE COST			
LOSS OF TRANSFER OF FIXED ASSETS		(928,438.36)	-
NET DEFICIT FOR THE YEAR		(44,817,128.76)	(50,269,507)

**NATIONAL INSTITUTE OF FUNDAMENTAL STUDIES
SRI LANKA**

STATEMENT OF CHANGES IN NET ASSETS/EQUITY FOR THE YEAR ENDED 31.12.2016

ATTRIBUTABLE TO OWNERS OF THE CONTROLLING ENTITY					
	CONTRIBUTED CAPITAL	PRESIDENT FUND	REVALUATION SURPLUS	INSTITUTE FUND	TOTAL NET ASSET/EQUITY
BALANCE AS AT 31 DECEMBER 2015	531,822,417.37	7,078,501.15	131,630,743.37	(113,602,662.78)	556,928,999.11
ADD: FUND ADJUSTMENT IN LAST YEAR				-	
ADJUSTMENTS : PRIOR YEAR ADJUSTMENTS				(113,602,662.78) (588,758.34)	
BALANCE AS AT 31 DECEMBER 2015 (RESTATE)	531,822,417.37	7,078,501.15	131,630,743.37	(114,191,421.12)	556,340,240.77
REVALUATION DEFICIT/SURPLUS	-	-	-	-	-
FIXED ASSET PURCHASE FROM GRANT	-	-	-	6,242,702.66	6,242,702.66
ADDITION DURING THE YEAR TO INSTITUTE FUND	-	-	-	23,474,091.14	23,474,091.14
DEFICIT FROM OPERATING ACTIVITIES	-	-	-	(44,817,128.76)	(44,817,128.76)
DESPOSAL OF FIXED ASSETS	-	-	-	-	-
FUND ADJUSTMENTS	(1,366,835.37)	-	-	-	(1,366,835.37)
CAPITAL FUNDS RECEIVED FROM GOVERNMENT & OTHER SOURCES	144,999,579.00	-	-	-	144,999,579.00
BALANCE AS AT 31 DECEMBER 2016	675,455,161.00	7,078,501.15	131,630,743.37	(129,291,756.08)	684,872,649.44

NATIONAL INSTITUTE OF FUNDAMENTAL STUDIES
SRI LANKA
STATEMENT OF CASH FLOW FOR THE YEAR ENDED 31.12.2016

	REFERENCE	SLRs. 2016		(RESTATED) SLRs. 2015
Cash-Flow from Operating Activities				
Deficit for ordinary activities	Page 5	(44,817,129)		(50,269,507)
Add/Less : Net adjustment to the fund	Page 6	23,474,091		4,289,649
			(21,343,038)	(45,979,859)
<u>Not involving movement of cash</u>				
Depreciation	Page 19 - Note 8	47,559,559		40,615,891
Provision for Gratuity	Page 27 - Note 20	1,897,958		1,839,790
Loss On Disposal of Capital Assets	Page 5	928,438		-
incurred by Projects		-		2,851,810
Adjustments to Provision for Depreciation	Page 6	1,489,147		222,342
(Increase)/Decrease Staff Consumption Loan	Page 4 - Note 3	(39,758)		(248,239)
(Increase)/Decrease Stocks	Page 4 - Note 5	(77,138)		114,890
(Increase)/Decrease Advance and other Receivable	Page 4 - Note 4	(626,281)		109,729
(Increase)/Decrease Festival Advance Inv.Fund	Page 4	-		(44,000)
(Increase)/Decrease Consumption Loan Inv.Fund		-		64,270
(Increase)/Decrease Int.rec.for Fixed Deposits	Page 4	(1,326,527)		(354,754)
(Increase)/Decrease Deposits, prepayment and Advances	Page 4 - Note 2	(32,975,008)		(13,781,019)
(Increase)/Decrease Preliminary Expenses for Construction	Page 4	20,000		(20,000)
Increase/(Decrease) Accounts Payable	Page 4 - Note 9	(3,637,248)		3,527,934
Increase/(Decrease) Accrued Expenses	Page 4 - Note 10	(232,033)		210,262
Gratuity Paid		(964,200)		(900,061)
Adjustment to Accounts Payable		(127,633)		-
Adjustment of Fixed Assets		(9,941,612)		-
Fund Adjustments		(1,366,835)		-
			580,828	
Net Cash flow from Operating Activities			(20,762,209)	(11,771,014)
<u>Cash Flow from Investing Activities</u>				
(Increase)/Decrease Working in progress	Page 4 - Note 6	(29,251,885)		-
Purchase of Fixed Assets		(75,436,305)		(55,363,405)
Training & Capacity	Page 4	(67,000)		(44,500)
Adjustments to Fixed Assets		-		15,955,000
Investments made- Provident Fund	Page 4 - Note 7	(11,582,894)		(14,648,498)
- Consumption Loan Fund	Page 4	(155,837)		-
			(116,493,920)	
<u>Net Cash Flow from Investing Activities</u>			(137,256,129)	(65,872,418)

<u>Cash Flows from Financing Activities</u>				
Government Capital Contribution	Page 6	144,999,579		136,001,000
Specific Funds and Grants	Page 4 - Note 11	12,134,705		11,898,728
			157,134,284	-
Net increase/ (Decrease) in cash and cash equivalent			19,878,155	82,027,310
Cash and cash equivalent at beginning of period			145,116,051	63,088,741
Cash and cash equivalent at the end of the period			164,994,206	145,116,051

**NATIONAL INSTITUTE OF FUNDAMENTAL STUDIES
SRI LANKA**

STATEMENT OF COMPARISON OF BUDGET AND ACTUAL EXPENDITURE FOR 2016

EXPENDITURE CATEGORY	BUDGET ESTIMATES	ACTUAL EXPENDITURE
RECURRENT EXPENDITURE	187,000,000.00	191,213,599.85
Personal Emoluments	126,070,000.00	124,609,855.84
Salaries & Wages	104,070,000	102,280,765.34
Overtime & Holiday payments	1,150,000	1,171,171.79
EPF Contribution	14,000,000	13,696,674.88
ETF Contribution	2,950,000	2,739,334.98
Gratuity Payments	1,000,000	1,897,957.50
Casual Staff Allowances	2,900,000	2,823,951.35
Traveling Expenses	1,300,000	1,255,675
Domestic	300,000	289,054.25
Foreign	1,000,000	966,620.75
Suppliers	20,200,000	15,533,938
Stationery & Office Requisites	650,000	445,436.27
Fuel	2,550,000	2,461,155.85
Chemical, Glassware & Consumable	17,000,000	12,627,345.72
Maintenance Expenditure	9,450,000	8,614,866
Vehicle	2,750,000	2,481,583.58
Plant, Machinery & Equipment	5,700,000	5,306,723.71
Buildings & Structures	1,000,000	826,559.03
Services	29,980,000	41,199,265
Transport	1,250,000	1,239,759.92
Postal & Communication	1,500,000	1,465,231.57
Electricity & Water	9,300,000	9,302,413.75
Other	-	-
Security	2,350,000	2,212,985.86
Garden Maintenance & Janitorial Services	1,800,000	1,773,720.00
Catering Services	300,000	300,000.00
Internet Services	3,100,000	3,054,759.65
Printing & Advertising	2,100,000	2,008,082.00
Insurance - Building, Vehicle & Staff	1,500,000	1,646,298.81
Welfare	2,130,000	2,118,390.46
Arboretum & Woodland	200,000	180,000.00
Audit Fees	450,000	200,000.00
Legal Fees	200,000	168,000.00
Publications	-	-
Periodical & Journals	100,000	357,643.21
Miscellaneous	1,900,000	1,124,724.61
Teacher Programme	-	-
Dayata Kirula	-	-
Annual Review	400,000	385,821.00
Room and Auditorium	100,000	84,160.37
Subscription, Contribution, Membership	1,100,000	814,805.47
Local Registration fees	200,000	116,000.00

Bank Charges	-	52,638.07
Grnt Expenses	-	12,090,329.10
Publication - Donation	-	116,955.00
Room Expenditure (On Earnings)	-	370,940.00
Workshop - Role of Microbial Biofertilizer	-	15,606.00
CAPITAL EXPENDITURE	145,300,000.00	104,882,822.20
Rehabilitation and Improvement of Capital Assets	17,750,000.00	18,615,817.53
Building & Structures	17,300,000.00	18,530,817.53
Vehicles	450,000.00	85,000.00
Acquisition of Capital Asset	127,550,000.00	86,267,004.67
Furniture & Office Equipment		
(i) Fur. Off.-Development of ICT	5,000,000.00	3,124,962.00
(ii) Fur. Off.- Lab Furnisings (New & Old Building)	5,304,000.00	13,890,288.94
(iii) Fur. Off.- Equipment & Others	3,900,000.00	1,818,166.26
(vi) Fur. Off.- Lab	-	-
Plant, Machinery & Equipment		
(i) Pl. Ma.& Equip.-Lab Equipment	101,300,000.00	62,107,108.13
(ii) Pl.Ma.& Equip.-Accessories	-	-
(iii) Pl.Ma.& Equip.-Library Books	1,000,000.00	795,921.69
(vi) Plat,Machinery & Tools	-	42,930.00
Building & Structures	-	-
Lands & Land Improvements	11,000,000.00	4,420,627.65
Training and Capacity	46,000.00	67,000.00
TOTAL EXPENDITURE	332,300,000.00	296,096,422.05

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31.12.2016

(RESTATED)

SLRs	SLRs
2016	2015

NOTE 1

CASH AND BANK BALANCES

National Savings Bank, Kandy - EPF Account A/C No 1-0015-01-02989	4,449,216.44	2,027,628
National Savings Bank, Kandy - Research Fund A/C No 1-0015-01-03152	70,106.00	67,096
National Savings Bank, Kandy -Consumption Loan Fund A/C No 1-0015-109-1808	381,234.88	225,398
Bank of Ceylon, Kandy, -A/C NO RFC/162747	8,394,550.90	7,698,962
Bank of Ceylon, Kandy, A/C No 32794	3,850,669.91	1,966,197
Bank of Ceylon, Kandy, A/C No 32795	13,356,179.97	19,025,057
Bank of Ceylon, Kandy, A/C No 32779	134,492,248.44	114,105,713
	164,994,206.54	145,116,051

NOTE 2

DEPOSITS PREPAYMENTS & ADVANCES

Refundable Deposit (Note 2A)	518,600.00	441,100
Prepayment (Note 2B)	3,289,008.91	1,830,002
Prepayments & Advance Foreign (Note 2C)	4,354,596.98	10,605,629
Prepayments & Advance Letter of Credit (Note 2D)	44,772,771.60	6,623,888
Advance to Suppliers & Others (Note 2E)	94,837.49	105,440
Advance of Stand - Structural Geology	-	4,960
Advance of Director, Building Dep.	123,914.09	614,980
Advance of Hydraulic Jack	-	4,000
Advance for Rack EEB	57,231.25	-
New Rack Stores	-	5,953
	53,210,960.32	20,235,952

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31.12.2016

	SLRs 2016	(RESTATED) SLRs 2015
NOTE 2A		
REFUNDABLE DEPOSIT		
Ceylon Electricity Board	275,000.00	275,000
Sri Lanka Telecom	5,000.00	5,000
Kandy Municipal Council	20,000.00	20,000
Ceylon Oxygen Ltd.	56,100.00	56,100
Colombo Gas Company	2,000.00	2,000
Lanka Internet Service	1,000.00	1,000
Kandy Tyre Rebuilding Co.	50,000.00	50,000
D.A. Epa & Sons (Pvt) Ltd	3,750.00	3,750
C.I.S.I.L.	15,000.00	15,000
Shell Gas Lanka Limited	3,750.00	3,750
MTN Network Pvt. Ltd.	2,500.00	2,500
Dialog Telecom Package	4,000.00	4,000
America Preime Water Systems	3,000.00	3,000
Priya Agencies	77,500.00	-
	518,600.00	441,100

NOTE 2B**PREPAYMENT**

American Chemical Society	117,467.00	171,016
American Physical Society	30,330.00	-
American Society For Microbiology	79,820.30	75,024
Current Science Association Bengal	-	43,400
The American Archeological Society	8,996.25	15,792
Chief Post Master Kandy	5,000.00	5,000
Dr. C.T.K. Thilakarathne	-	22,913
Institute of Food Technologies	-	6,551
Director General of Custome	-	274,002
Metropolitan Office Pvt Ltd	712.25	-
Macmillan Subscriptions Ltd	10,131.51	9,877
National Geographic Society	9,343.65	8,652
New Scientist	46,630.25	16,993
Portland Customer Service	-	8,782
S.B. Freight Services	-	50,221
Scientific America	9,603.25	6,926
JohnKeells Office Automation (Pvt.) Ltd.	26,749.94	22,826
Oxford Journal	8,729.59	10,039
Sri lanka insurance	542,700.00	671,315
Hostmonster	2,471.72	-
Society for the Study of Evaluation	-	14,449
Soil Science Society of America	34,681.25	31,879
American Association for Advance of Science	18,842.02	14,834
Material Research Society	-	12,005
World Health Organization	233,921.89	223,947
Elsevier Ltd Journal	77,283.75	71,242
John Willey & Sons Ltd	8,481.81	-
New York Acedemy of Science	24,093.75	23,164

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31.12.2016

	SLRs 2016	(RESTATED) SLRs 2015
The Union	19,594.41	19,153
S.B. Freigh Services - Clearance	85,196.32	-
Director General Custom - Defence Levy	1,888,228.00	-
	3,289,008.91	1,830,002

NOTE 2C

ADVANCES (FOREIGN PURCHASE)

Springer Customer Service Center	130,190.00	44,643
Amersham Life Science Ltd	-	1,546
Bacheman California	-	11,874
Bacton Dickinson Holdings	-	682,249
CEM Innovators in Microwave Technology	900,375.82	-
Chicago Distribution	-	6,421
New Port Corporation	-	3,246,782
Elsevier Science	-	61,008
Fisher Scientific UK	-	488,399
LC Technology Solution Inc	-	5,059,637
Fluka Chemical	-	34,771
Phatpocket Ltd	16,409.11	6,745
Hopkins Fulfillment Serving	-	20,795
Kluwer Academic	-	47,733
John Willey & Sons Singapore Pvt Ltd	-	22,318
M.J. Patterson (Scientific) Ltd	-	20,448
Sigma Aldrich	-	32,617
Shiramadzo (Asia Racific) Pte Ltd	716,411.50	-
Inter World Highway LLC	-	100,004
Ven India Imports & Export	1,167.50	75,423
VWR International Ltd	316,302.53	219,947
Wageningen Agricultural University Netherlands	-	9,727
Macrogen Inc	195,658.37	-
Thorlabs Inc	1,297,725.33	257,892
Thomes Scientific	-	154,650
Defence levy & Clearance - FP/15/26	401,887.96	-
Defence levy & Clearance - FP/10/74	378,468.86	-
	4,354,596.98	10,605,629

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31.12.2016

(RESTATED)

	SLRs 2016	SLRs 2015
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NOTE 2D

PREPAYMENTS & ADVANCES (LETTER OF CREDIT)

Advanced Geo Sciences Inc KN/SIL/2015/27	-	5,238,053
Agilent Technology Singapore (Sales) KN/SIL/2015/43	-	1,385,835
Rigaku Corporation - KN/SIL/2016/40	17,369,001.17	-
Korvus Technology Ltd - KN/SIL/2016/46	9,526,047.10	-
Thermo Fisher Scientific OY - KN/SIL/2016/59	7,884,271.83	-
Thermo Fisher Scientific Wissenschaftliche Cerate GMBH-KN/SIL/2016/58	9,993,451.50	-
	44,772,771.60	6,623,888

NOTE 2E

ADVANCES TO SUPPLIERS & OTHERS

Lanka Sugar Company Pvt Ltd	86,100.00	-
Burser University of Peradeniya	1,500.00	9,500
Kandy Municiple Coucil	5,755.00	-
Boc Kandy	1,482.49	-
Ceylon Printers PLC	-	9,500
Precusor Control Authority	-	11,500
Sri Lanka Insurance Corporation	-	2,500
Gilbert Brothers	-	22,440
Mrs. Jeewa Kasthuri	-	50,000
	94,837.49	105,440

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31.12.2016

(RESTATED)

	SLRs. 2016	SLRs 2015
NOTE 3		
STAFF CONSUMPTION LOAN		
D. G. Gunathilake	200,000.00	82,745
G. Ariyaratne	166,650.00	13,240
A. V. A. P. Kumara	99,950.00	139,970
R. B. Hapukotuwa	183,325.00	143,305
G. W. R. P. Chandrakanthi	129,965.00	169,985
R. M. V. P. Rathnayake	111,120.00	177,780
C. T. K. Thilakarathne	11,130.00	77,790
M. A. P. Perera	88,080.00	124,560
M. P. P. Guruge	-	23,245
M. A. Lal	143,305.00	183,325
T. C. P. K. Thilakarathne	93,280.00	133,300
G. D. Dharmasena	58,622.00	97,718
D. Aluthpatabendi	126,630.00	166,650
N. P. Athukorale	179,990.00	40,574
A. K. Pathirana	139,970.00	179,990
D. J. M. W. P. Jayasekara	109,955.00	149,975
O. W. K. Senavirathne	82,550.00	116,750
R. B. Weerakoon	193,330.00	-
R. K. C. Karunaratne	129,965.00	169,985
D. M. K. Lukshmi Kumari	113,290.00	153,310
O.K. S. Opatha	79,940.00	119,960
W.G. Jayasekara Banda	133,300.00	173,320
K. M. Ariyawansa	64,125.00	-
M. A. G. Somananda	110,440.00	148,360
H. W. M. R. P. M. Weerasooriya	144,450.00	76,605
M. N. B. Kulatunge	-	29,915
K. G. T. B. Gunasekara	193,330.00	116,625
R. S. K. Gunawardene	133,340.00	200,000
P.S.S. Samarakkody	133,300.00	173,320
C. Illangakoon	161,115.00	79,940
D.S.Jayaweera	19,910.00	59,930
S.S.K. Sakalasooriya	56,595.00	96,615
A.D. Gunawardana	69,935.00	109,955
M.K.D. Keshan	106,454.00	134,222
R.S.M. Perera	72,235.00	138,895
I. Tumpale	-	109,800
K.G.T.Pamukshi	170,046.00	-
L.N.M.D.S.K.Nishshanka	176,655.00	-
K.I.K. Samarakoon	130,725.00	165,585
	4,317,002.00	4,277,244

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31.12.2016

(RESTATED)

SLRs	SLRs
2016	2015

NOTE 4

ADVANCES & OTHER RECEIVABLES

Telephone Charges - Aroma Security Service	1,887.00	4,071
Mrs. Priyadarshika Ruwanpitiya - Rizobium (Invoice No. 31/2015)	-	7,500
Mr. A.M.B.N. Abeysinghe - Rizobium (Invoice No. 29/2015)	-	15,000
Eastern University of Sri Lanka (Invoice No. 28/2015)	-	16,197
Transport - National Science Foundation	12,782.36	32,148
Travelling - National Science Foundation	750.00	2,900
Over Time - National Science Foundation	1,002.08	3,511
Stamp Imprest	8,500.00	7,500
N.I.F.S. E.P.F.1%	54,562.14	45,455
Transport - Mrs. I. S. Illeperumarachchi	6,600.00	-
Transport - Mr.E.M.G.S. Ekanayake	3,780.00	-
Accomadation -F. Hussain	-	5,000
Accomadation - G. Ariyaratne	-	600
Accomadation - Mr. G. Naveendra	2,500.00	-
Accomadation - Prof. R. Weerasooriya	2,700.00	-
Accomadation - Mr. Sunil Panimulla	1,200.00	-
Accomadation - Prof. R.M.G. Rajapaksha	1,200.00	-
Accomadation - Miss. Y.H.H.W. Kumari	2,500.00	-
Accomadation - Miss. W.M.E.H.Wijesinghe	2,500.00	-
Accomadation - Mr.K.Mohanan	-	2,500
Accomadation - Ms.S.Mayakaduwa	-	2,500
Uwa Wellassa University	9,955.68	-
Ministry of science & Technology	7,027.96	7,028
D.S. Construction and Earth Movers	658,744.00	-
	778,191.22	151,910

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31.12.2016

	SLRs	(RESTATED) SLRs
	2016	2015
NOTE 5		
STOCKS		
Chemical Glassware & Labware	1,129,628.93	1,172,985
Stationery Stores	330,993.82	286,482
Sundry Stores	408,941.07	228,780
Publications	32,176.64	151,170
Consignee Stock - Publications	17,405.84	17,406
Building Maintenance	327,005.67	312,191
	2,246,151.97	2,169,014

NOTE 6**WORK IN PROGRESS**

New Building	156,054,032.38	142,920,000.00
Land & Land Improvement	4,420,627.65	-
Integrated Software	660,000.00	-
Installation of Lab Furniture	9,300,912.00	-
Steel Book Shelves	154,200.00	-
Building Improvements	1,582,112.57	-
	172,171,884.60	142,920,000

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31.12.2016

		(RESTATED)	
		SLRs	SLRs
		2016	2015
NOTE 7			
PROVIDENT FUND INVESTMENT			
CERTIFICATE NO.			
1	2-0015-03-19546	5,064,346.80	4,778,587
2	2-0015-03-19538	5,050,996.14	4,765,990
3	2-0015-03-19511	5,050,996.14	4,765,990
4	2-0015-03-19520	5,050,996.14	4,765,990
5	200-15-03-20153	3,018,829.48	2,848,490
6	2-0015-03-18809	4,924,716.06	4,646,835
7	2-0015-03-19988	3,161,376.13	2,982,993
8	2-0015-17-56516	2,367,694.49	2,234,096
9	2-0015-03-20005	2,367,694.49	2,234,096
10	2-0015-17-56486	2,367,694.49	2,234,096
11	2-0015-17-56508	4,529,859.20	4,274,258
12	2-0015-03-21192	4,260,095.46	4,019,716
13	2-0015-03-18752	4,257,553.35	4,017,318
14	2-0015-03-21737	2,309,728.12	2,309,728
15	2-0015-03-21745	3,464,592.18	3,464,592
16	2-0015-18-64203	3,200,100.00	3,000,000
17	2-0015-18-52078	3,179,400.00	3,000,000
18	2-0015-18-28827	2,119,600.00	2,000,000
19	2-0015-18-28843	3,179,400.00	3,000,000
20	2-0015-03-23454	5,000,000.00	-
21	2-0015-03-23446	3,000,000.00	-
		76,925,668.67	65,342,775

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31.12.2016

NOTE 8

FIXED ASSETS

COST

(SL Rs)

(RESTATE)				
DEACRIPTION	TOTAL AS AT 01.01.2016	ADDITIONS	ADJUSTMENT/ DISPOSABLE	TOTAL AS AT 31.12.2016
Land	28,622,151.00	-	-	28,622,151.00
Buildings	31,572,596.91	3,814,672.58	(605,179.59)	34,782,089.90
Laboratory Equipment	279,823,280.75	67,916,813.06	(2,139,982.85)	345,600,110.96
Machinery Tools & Implements }	1,077,881.64	42,930.00	(2,750.00)	1,118,061.64
Motor Vehicles	17,962,000.00	85,000.00	11,576,000.00	29,623,000.00
Library Books	14,766,435.50	795,921.69	1,094,717.02	16,657,074.21
Refrigerators	2,352,090.38	369,535.65	-	2,721,626.03
Air Conditioners	5,537,647.30	561,272.15	-	6,098,919.45
Communication Equipment	903,605.42	9,675.00	-	913,280.42
Computers & Printers	24,614,137.15	3,124,962.00	-	27,739,099.15
Computer Software	408,160.00	-	-	408,160.00
Furniture & fittings	4,498,942.24	3,290,346.87	(83,125.31)	7,706,163.80
Sport Items	13,480.00	-	-	13,480.00
Office & Miscellaneous Equipment }	20,572,615.35	1,808,491.26	(20,329.56)	22,360,777.05
	432,725,023.64	81,819,620.26	9,819,349.71	524,363,993.61

DEPRECIATION

DESCRIPTION	TOTAL AS AT 01.01.2016	CHARGE FOR TH YEAR	ADJUSTMENT/ DISPOSABLE	TOTAL AS AT 31.12.2016
Buildings	23,197,105.21	1,652,426.98	2,950.84	24,852,483.03
Laboratory Equipment	95,837,413.71	30,487,350.25	(761,344.26)	125,563,419.70
Machinery Tools & Implements }	445,029.93	100,957.29	(1,925.00)	544,062.22
Motor Vehicles	3,252,396.18	5,980,917.81	2,077,358.90	11,310,672.89
Library Books	13,073,095.89	896,974.68	(2,760.63)	13,967,309.94
Refrigerators	689,495.80	260,418.46	-	949,914.26
Air Conditioners	2,406,133.85	570,247.98	-	2,976,381.83
Communication Equipment	365,296.93	85,138.29	-	450,435.22
Computers / Printers	18,315,914.37	2,616,660.08	-	20,932,574.45
Computer Software	151,522.41	102,040.00	-	253,562.41
Furniture & fittings	1,474,555.08	555,596.86	(83,125.31)	1,947,026.63
Sport Items	13,480.00	-	-	13,480.00
Office & Miscellaneous Equipment }	12,468,267.79	4,250,830.80	(20,329.56)	16,698,769.03
	171,689,707.15	47,559,559.48	1,210,824.98	220,460,091.61

Written down value

261,035,316.49303,903,902.00

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31.12.2016

(RESTATED)

	SLRs 2016	SLRs 2015
NOTE 9		
ACCOUNTS PAYABLE		
Creditors - Suppliers & Services (Note 9A)	724,748.50	4,658,976
Other Creditors and Payable (Note 9B)	297,879.83	900
	1,022,628.33	4,659,876

NOTE 9A**CREDITORS-SUPPLIERS & SERVICES**

General Upkeep - Janitorial	148,000.00	74,725
General Upkeep - Garden Maintenance	-	45,854
General Upkeep - Catering	25,000.00	-
Department of Inland Revenue (stamp)	16,160.00	16,730
Department of Inland Revenue (PAYE tax)	17,947.97	38,202
LHC Associates Pvt Ltd	-	200,820
Kandy Tyre Rebuilding Co. Ltd	-	66,215
Mr.P.G.Chamila Sanka Wickrama	130,300.00	174,850
Mr.T. Gamini Silva	47,500.00	48,300
Security Services	189,920.43	179,884
Microref Airconditioning Engineers	-	2,250
Hemsons International (Pte) Ltd	-	1,616,860
EWIS Peripheral (Pvt) Ltd	-	26,000
ACE International Express (Pvt) Ltd	-	5,852
A.P Enterprises	-	91,204
Microtech Biological Pvt Ltd	-	94,350
S. A. D. Associates	-	25,118
Dr. P.S.B. Wanduragala	-	500
Sri Ramya	-	93,783
C. Illangakoon	1,400.00	2,000
Gatambe Motors	-	4,800
Prof. A. Nanayakkara	-	84
D.B. Dissanayake	-	160
G.R.N. Rathnayake	-	1,880
Dr. D. Maganarachchi	4,250.00	-
Saman Priyadeva	1,600.00	1,600
Ms. R.K.C. Karunarathne	3,632.50	-
Metropolitant Office Pvt Ltd	4,216.65	-
Regal Hardware	5,325.00	-
Mahanuwara Agencies	8,500.00	-
PRESS	1,700.00	-
Mrs. Chandrakanthi	2,400.00	-
Mrs. Jeewa Kasthuri	2,000.00	-
Mr. M.A.P. Perera	350.00	-
Avanhala	-	106,170
M.M.Quader	-	1,000

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31.12.2016

	SLRs	(RESTATED) SLRs
	2016	2015
The International Hardware Stores	-	3,620
Atlas Electricals	-	1,860
United Professional Agencies Pvt Ltd	-	22,500
Avon Phamo Chem Pvt Ltd	-	69,113
P & T Trading Pvt Ltd	-	403,320
Analytical Instruments (Pvt) Ltd	104,710.95	1,038,353
Mohan Perera	-	4,000
Danushka Malwewa	-	200
B.J. Weerasooriya	635.00	475
Sandamali Motors	-	100,947
United Motor Lanka Plc	-	45,972
Ms. I.M.Priyani Gunathilake	-	13,500
Sri Lanka Insurance Corporation	-	625
Mr. K.T.D.K. Kariyawasam	9,200.00	-
Hansana Construction	-	35,300
	724,748.50	4,658,976

NOTE 9B

OTHER CREDITORS & PAYABLE

Disposable Item (Refundable Deposit)	900.00	900
Research Allowances - PGIS	34,000.00	-
Retention Money Payable-CECB	39,039.06	-
Retention Money Payable - Jayantha Furniture	36,950.00	-
Retention Money Payable- Computerage (Pvt) Ltd	51,644.00	-
Retention Money Payable - D.S. Construction and Movers	135,346.77	-
	297,879.83	900

NOTE 10

ACCRUED EXPENSES

Postage	7,525.00	-
Overtime	145,279.08	-
Telephone - Dr. Wanduragala	2,891.63	-
Telephone - Ms. Jeewa Kasthuri	5,000.00	-
Salary - Chariman	83,725.00	26,129
Traveling & Subsistence	5,325.00	7,853
Government Audit Fees	400,000.00	621,578
Temporary Staff Allowance - NIFS	61,075.00	98,287
Temporary Staff Allowance -Grant	155,690.00	341,943
Temporary Staff Allowance - Rizobium	109,101.29	-
Communication	129,677.51	148,690
Overtime - NIFS	-	114,533
Overtime - Grant	9,086.05	1,089
Water Charges	82,764.22	112,585

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31.12.2016

	(RESTATED)	
	SLRs	SLRs
	2016	2015
Internet	274,139.71	233,875
Visiting Salary - NIFS	165,660.53	117,305
Electricity	288,121.85	242,362
Postage	-	7,000
Transport	4,064.76	138
Travelling - Grant	1,350.00	-
Visiting Research Allowance - Grant	-	89,143
	1,930,476.63	2,162,510

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31.12.2016

(RESTATED)

	SLRs 2016	SLRs 2015
NOTE 11		
SPECIFIED FUNDS & GRANTS		
N.I.F.S Provident Fund	85,806,896.30	70,836,667
Retired Members Fund	3,949,781.93	1,704,529
Festival Advance Fund	300,000.00	300,000
Consumption Loan Fund	381,234.88	225,398
Specified Grants (NOTE-11A)	8,049,433.49	13,571,508
Research Grants Fund	2,495,837.49	2,210,377
	100,983,184.09	88,848,479

NOTE 11A**SPECIFIED GRANT BALANCES**

School Science Programme - Engineering	2,410.00	2,410
School Science Programme	204,799.98	59,463
BES Grant	29,539.72	57,312
RG/2015/EB/04 - Dr. Benjamin	462,411.49	1,942,000
Scientia Magazine	-	174,706
Dayata kirula	-	13,825
Sample Analysis - Outside Funds	431,600.58	422,601
Bioassaya	-	43,443
Vidu Kirana	182,561.03	973,135
Annual Review	471,255.60	360,976
Sola- Asia	164,346.95	178,443
International Symposium - Natural Product	247,514.20	277,240
University Of Sydney	-	2,398
HETC Project	113,048.48	118,298
IFS Sweeden Grant	466,739.58	1,052,576
Rhizobium Grant	240,643.90	308,995
PV Workshop - Prof. L. Dissanayake	-	9,832
RG/2012/NRB/03 - Dr. N.D. Subasinghe	-	24,147
RG/2012/BS/04 - Prof. L.Dissanayake	-	519,990
Water Quality - Mr. Padmasiri	-	31,543
Tokyo Cement - Dr. Iqbal	-	92,400
NSF - RG/2012/AG/01 - Dr. Jayasinghe	-	144,462
NSF-RG/2012/ESA/01	105,181.80	309,066
Spectra Industries	-	290,000
MTR Indian Grant	779,373.43	2,686,354
NSF-Vidu Nena Dasuna	-	204,392
President Sri Lanka Society	-	22,000
NSF-RG/2014/EB/03	840,317.13	1,834,406
BIO Film	8,521.83	67,934
N.W.I.B.M.N.S(Enzyme Inhibitory Studies)	175,363.26	177,618
Plant Nursery in Dambulla ARB	10,564.13	22,597
NSF-RG/2014/BS/02	668,683.56	563,648
South East University - Oluvil	300,839.38	572,188
Clusea Rosea	131,311.07	-
Panicum Trochocladum	83,766.72	-

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31.12.2016

	SLRs 2016	(RESTATED) SLRs 2015
National Workshop on Separation Techniques	242,778.71	-
Technical Training Programme	299,127.07	-
Phobam Arboretum - Prof. Siril	65,477.80	-
Devid Piries Motor Company - Dr. Deepal	61,718.72	-
Faculty of Natural Science - OUSL	68,094.80	-
NSF/SCH/2016/03	1,191,442.57	-
Young Scientists Symposium	-	11,110
	8,049,433.49	13,571,508

NOTE 12

DIFFERED LIABILITIES

Provision for Retirement Gratuity	20,844,045.00	19,910,287
	20,844,045.00	19,910,287

NOTE 13

CAPITAL FUND SPEND AND UNSPENT

Capital Fund Spent

Capital Fund Spent	483,834,835.10	394,540,173
Government Grant Capital Spent(Current Year)	59,023,860.69	23,211,969
	542,858,695.79	417,752,142

Capital Fund Unspent

Capital Fund Unspent	46,620,746.90	1,281,244
Government Grant Capital Unspent(Current Year)	85,975,718.31	112,789,031
	132,596,465.21	114,070,275

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31.12.2016

	SLRs 2016	(RESTATED) SLRs 2015
NOTE 14		
OTHER INCOME		
Foreign & Local Grants (NOTE 14A)	12,090,329.10	9,570,596
Donation	-	4,163
Sale of Books	1,111.60	840
Sundry Income	319,062.14	209,354
Interest Received	362,951.53	327,758
Foreign Currency Exchange Gaining	320,319.29	548,209
Surcharge for Damages	15,102.00	-
Income - Accommodation	700,005.14	649,897
Sale of Disposable Items	3,160.63	-
Gratuity - Mrs. M.C. Rajapaksha	72,427.50	-
	13,884,468.93	11,310,817

NOTE 14A

FOREIGN & LOCAL GRANTS INCOME

School Science Programme	524,638.38	268,287
School Science Programme - Engineering	-	70,590
BES	27,772.00	5,100
NSF- RG/SCH/2012/02	-	416,773
RG/2012/NRB/03	-	558,185
Bioassays	20,503.70	-
RG/2015/EB/04	1,058,442.59	35,000
Vidukirana	790,573.55	-
Annual Review	282,220.40	50,694
Sola - Asia	14,096.00	128,120
Symposium	22,665.00	5,500
University of Sydney	447,086.10	-
HETC Project	5,250.00	134,672
Rhizobium - Prof. Kulasoorya	1,268,546.11	2,376,967
RG/2012/BS/06 NSF - Prof. Kumar	-	9,361
NSF- RG/2012/AG/01 - Dr. Jayasinghe	-	465,000
RG/2011/BS/04	-	400,000
NSF/ESA/01	513,884.46	925,452
MTR Indian Grant	867,474.22	338,309
Specified Research Grant Fund	598,028.00	5,554
RG/2012/BS/04	309,989.65	-
Sample Analysis -Outside Funds	6,000.00	104,619
Vidu Nena Dasuna	9,250.00	210,948
UNESCO	-	367,771
RG/2014/EB/03	1,558,789.10	1,435,594
BIO Film	59,412.20	-
N.W.I.B.M.N.S	2,255.00	-
Plant Nursery in Dambulla ARB	12,032.63	332,668
Tissue Culture - Kantale	-	127,414
RG/2014/BS/02	614,964.35	727,108
South East University - Oluvil	271,348.94	70,910

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31.12.2016

	SLRs	(RESTATED) SLRs
	2016	2015
Clusea Rosea	113,688.93	-
Panicum Trochocladum	224,233.28	-
National Workshop on Seperation Techniques	1,476,550.75	-
CKDu Mini Symposium	30,000.00	-
Technical Training Programme	681,752.93	-
Phobam Arboretum - Prof. Siril	6,522.20	-
Devid Piries Motor Compan - Dr. Deepal	4,935.00	-
Faculty of Natural Science - OUSL	31,795.20	-
NSF/SCH/2016/03	235,628.43	-
	12,090,329.10	9,570,596

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31.12.2016

NOTE 15

EXPENDITURE FOR PERSONAL EMOLUMENTS

		(RESTATED)	
		SLRs	SLRs
		2016	2015
Salaries	(Appendix 01)	102,280,765.34	96,177,553
EPF	(Appendix 01)	13,696,674.88	12,557,192
ETF	(Appendix 01)	2,739,334.98	2,511,438
Temporary Staff Allowances		2,823,951.35	985,017
Overtime		1,171,171.79	1,260,169
		122,711,898.34	113,491,369

NOTE 16

TRAVELLING

Local	(Appendix 01)	289,054.25	294,735
Foreign	(Appendix 01)	966,620.75	864,788
		1,255,675.00	1,159,523

NOTE 17

EXPENDITURE FOR SUPPLIERS & CONSUMABLES

Stationery & Office Requisites	(Appendix 01)	445,436.27	510,138
Fuel and Lubricants		2,461,155.85	1,947,910
Chemical & Glassware	(Appendix 01)	5,299,883.76	5,964,450
Consumable	(Appendix 01)	7,327,461.96	8,194,411
		15,533,937.84	16,616,909

NOTE 18

EXPENDITURE FOR MAINTENANCE

Building	(Appendix 01)	826,559.03	936,260
Equipment	(Appendix 01)	5,306,723.71	4,267,225
Vehicle		2,481,583.58	2,172,720
		8,614,866.32	7,376,205

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31.12.2016

	SLRs 2016	(RESTATED) SLRs 2015
NOTE 19		
EXPENDITURE FOR CONTRACTUAL SERVICES		
Transport	1,239,759.92	522,484
Telecommunication	1,332,301.57	763,329
Postage	132,930.00	146,326
Electricity	6,878,876.60	6,836,871
Water	2,423,537.15	2,194,349
Janitorial Services & Garden Maintenance	1,773,720.00	1,446,951
Security Services	2,212,985.86	2,158,607
Catering Services	300,000.00	300,000
Internet Service	3,054,759.65	2,899,210
	19,348,870.75	17,268,127

NOTE 20**OTHER EXPENDITURE**

Advertisement	1,848,848.50	430,514
Arboretum Expenses	180,000.00	180,000
Audit Fees	200,000.00	200,000
Auditorium And Room Maintenance	84,160.37	215,498
Bank Charges	52,638.07	32,490
Entertainment	6,000.00	6,000
Grant Expenses (Note 20A)	12,090,329.10	9,570,596
Gratuity	1,897,957.50	1,839,790
Staff Insurance	691,286.31	600,387
Insurance - Building	386,707.08	386,707
Insurance Motor Vehicle	568,305.42	763,916
Journal Periodicals & Subscription	357,643.21	507,246
Membership Fees	814,805.47	734,277
Miscellaneous	1,069,549.65	583,221
Printing / Photocopy	159,233.50	529,229
Publication - Donation	116,955.00	-
Research Council Meeting Expenses	49,174.96	48,290
Welfare	2,118,390.46	1,909,744
Legal Expenses	168,000.00	66,000
Annual Review - NIFS	385,821.00	367,395
Room Expenditure	370,940.00	-
Workshop - Role of Microbial Biofertilizer	15,606.00	-
Local Registration Fees	116,000.00	81,000
	23,748,351.60	19,052,300

NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31.12.2016

	(RESTATED)	
	SLRs	SLRs
	2016	2015
NOTE 20A		
GRANT EXPENSES		
School Science Programme	524,638.38	268,287
School Science Programme - Engineering	-	70,590
BES	27,772.00	5,100
NSF- RG/SCH/2012/02	-	416,773
RG/2012/NRB/03	-	558,185
Vidu Kirana	790,573.55	-
Annual Review	282,220.40	50,694
Sola - Asia	14,096.00	128,120
Symposium	22,665.00	5,500
University of Sydney	447,086.10	-
HETC Project	5,250.00	134,672
Rhizobium - Prof. Kulasoorya	1,268,546.11	2,376,967
RG/2012/BS/06 NSF - Prof. Kumar	-	9,361
NSF- RG/2012/AG/01 - Dr. Jayasinghe	-	465,000
RG/2011/BS/04	-	400,000
NSF/ESA/01	513,884.46	925,452
MTR Indian Grant	867,474.22	338,309
Specified Research Grant Fund	598,028.00	5,554
Bioassays	20,503.70	-
RG/2012/BS/04	309,989.65	35,000
Sample Analysis - Prof. Gamini	6,000.00	104,619
Vidu Nana Dasuna	9,250.00	210,948
UNESCO	-	367,771
RG/2014/EB/03	1,558,789.10	1,435,594
BIO Film	59,412.20	-
N.W.I.B.M.N.S	2,255.00	-
Plant Nursery in Dambulla ARB	12,032.63	332,668
Tissue Cultrue - Kantale	-	127,414
NSF - RG/2014/BS/02	614,964.35	727,108
South East University - Oluvil	271,348.94	70,910
NSF/2015/EB/04	1,058,442.59	-
Clusea Rosea	113,688.93	-
Panicum Trochocladum	224,233.28	-
National Workshop on Seperation Techniques	1,476,550.75	-
CKDu Mini Symposium	30,000.00	-
Technical Training Programme	681,752.93	-
Phobam Arboretum - Prof. Siril	6,522.20	-
Devid Piries Motor Compan - Dr. Deepal	4,935.00	-
Faculty of Natural Science - OUSL	31,795.20	-
NSF/SCH/2016/03	235,628.43	-
	12,090,329.10	9,570,596

APPENDIX 01

PROJECT RECURRENT EXPENDITURE

PROJECT	CHEMICAL & GLASSWARE, CONSUMABLE	EQUIPMENT MAINTANANCE	BUILDING MAINTANANCE	FOREIGN TRAVELLING	LOCAL TRAVELLING	STATIONARY	TRANSPORT	COMMUNICATION	PRINTING	SALARIES, EPF,ETF
PLANT BIOTECHNOLOGY	153,720	33,425	35,949	80,000	38,612	7,517	10,243	-	1,690	6,530,246
THEORETICAL & COMPUTATIONAL SCIENCE	1,255,409	10,620	3,493	-	-	3,549	-	4,469	-	5,575,699
NATURAL PRODUCT CHEMISTRY	557,066	54,440	20,034	72,814	10,350	19,386	-	-	-	7,848,028
CELL BIOLOGY	2,558,160	43,897	9,240	80,000	5,400	6,395	12,000	1,500	5,633	4,112,256
SOLIDE STATE CHEMISTRY	586,806	39,913	18,800	80,000	4,625	8,916	-	-	2,718	3,305,651
CONDENSE MATTER PHYSICS										2,304,528
PHOTOCHEMISTRY	1,080,366	336,680	70,369	-	1,600	20,854	-	-	-	6,365,868
ECOLOGY & ENVIRONMENTAL BIOLOGY	1,752,095	88,174	8,296	-	34,162	8,611	3,200	5,295	-	4,972,499
MICROBIAL BIOTECHNOLOGY UNIT										
BIO FILMED BIO FERTILIZER	1,032,516	36,194	3,474	-	40,165	12,459	1,200	-	13,175	5,380,273
BIOFUELL	1,319,263	56,230	20,456	17,688	18,245	7,449		-	-	5,380,273
GEO THERMAL RESOURCE MAPPING	7,888	7,225	-	90,280	42,675	6,396	-	-	-	5,605,153
CHEMICAL & ENVIRONMENTAL MODELLING	421,915	45,125	5,607	-	4,450	6,869	-	44,997	-	4,034,142
ELECTRO CHEMICAL MATERIALS	728,353	304,552	8,818	-	1,175	14,697	-	-	-	5,228,748
FOOD SCIENCE NATURAL - I	461,768	67,752	-	80,000	2,100	4,422	-	-	4,060	4,054,403
FOOD SCIENCE NATURAL - II	346,470	32,541	2,653	-	1,600	5,302	-	-	2,188	2,300,082
PLANT TAXONOMY	1,088	12,150	10,800	-	3,625	4,238	-	-	-	2,817,085
MEDICAL ENTOMOLOGY	343,956	-	-	-	-	-	-	-	-	728,667
ADMINISTRATION	20,506	4,137,806	608,570	465,839	80,270	308,376	1,213,117	1,276,040	129,770	42,173,173
TOTAL	12,627,345	5,306,724	826,559	966,621	289,054	445,436	1,239,759	1,332,301	159,234	118,716,775

AGE ANALYSIS AS AT 31.12.2016

AGE ANALYSIS OF ADVANCES AND OTHER RECEIVABLES Rs.778,191.22 :

	0 - 12 MONTHS Rs	1 - 2 YEARS Rs	2 - 3 YEARS Rs	3-4 YEARS Rs	4 - 5 YEARS Rs	OVER 5 YEARS Rs
Telephone Charges - Aroma Security Service	1,887.00	-	-	-	-	-
Transport - National Science Foundation	12,782.36	-	-	-	-	-
Travelling - National Science Foundation	750.00	-	-	-	-	-
Over Time - National Science Foundation	1,002.08	-	-	-	-	-
Stamp Imprest	8,500.00	-	-	-	-	-
N.I.F.S. E.P.F.1%	54,562.14	-	-	-	-	-
Transport - Mrs. I. S. Illeperumarachchi	6,600.00	-	-	-	-	-
Transport - Mr.E.M.G.S. Ekanayake	3,780.00	-	-	-	-	-
Accomadation - Mr. G. Naveendra	2,500.00	-	-	-	-	-
Accomadation - Prof. R. Weerasooriya	2,700.00	-	-	-	-	-
Accomadation - Mr. Sunil Panimulla	1,200.00	-	-	-	-	-
Accomadation - Prof. R.M.G. Rajapaksha	1,200.00	-	-	-	-	-
Accomadation - Miss. Y.H.H.W. Kumari	2,500.00	-	-	-	-	-
Accomadation - Miss. W.M.E.H.Wijesinghe	2,500.00	-	-	-	-	-
Uwa Wellassa University	9,955.68	-	-	-	-	-
Ministry of science & Technology	-	7,027.96	-	-	-	-
D.S. Construction and Earth Movers	658,744.00	-	-	-	-	-
	771,163.26	7,027.96	-	-	-	-

AGE ANALYSIS OF REFUNDABLE DEPOSIT AS AT 31.12.2016 : Rs. 518,600.00

	0 - 12 MONTHS Rs	1 - 2 YEARS Rs	2 - 3 YEARS Rs	3-4 YEARS Rs	4 - 5 YEARS Rs	OVER 5 YEARS Rs
Ceylon Electricity Board	-	-	-	-	-	275,000.00
Sri Lanka Telecom	-	-	-	-	-	5,000.00
Kandy Municipal Council	-	-	-	-	-	20,000.00
Ceylon Oxygen Ltd.	-	24,000.00	-	-	-	32,100.00
Colombo Gas Company	-	-	-	-	-	2,000.00
Lanka Internet Service	-	-	-	-	-	1,000.00
Kandy Tyre Rebuilding Co.	-	-	-	-	-	50,000.00
D.A. Epa & Sons (Pvt) Ltd	-	-	-	-	-	3,750.00
C.I.S.I.L.	-	-	-	-	-	15,000.00
Shell Gas Lanka Limited	-	-	-	-	-	3,750.00
MTN Network Pvt. Ltd.	-	-	-	-	-	2,500.00
Dialog Telecom Package	-	-	-	-	4,000.00	-
America Preime Water Systems	-	-	-	3,000.00	-	-
Priya Agencies	77,500.00	-	-	-	-	-
	77,500.00	24,000.00	-	3,000.00	4,000.00	410,100.00

AGE ANALYSIS OF PREPAYMENTS AS AT 31.12.2016 : Rs. 3,289,008.91

	0 - 12 MONTHS Rs	1 - 2 YEARS Rs	2 - 3 YEARS Rs	3-4 YEARS Rs	4 - 5 YEARS Rs	OVER 5 YEARS Rs
American Chemical Society	117,467.00	-	-	-	-	-
American Physical Society	30,330.00	-	-	-	-	-
American Society For Microbiology	79,820.30	-	-	-	-	-
The American Archeological Society	8,996.25	-	-	-	-	-
Chief Post Master Kandy	5,000.00	-	-	-	-	-
Metropolitan Office Pvt Ltd	712.25	-	-	-	-	-
Macmillan Subscriptions Ltd	10,131.51	-	-	-	-	-
National Geographic Society	9,343.65	-	-	-	-	-
New Scientist	46,630.25	-	-	-	-	-
Scientific America	9,603.25	-	-	-	-	-
JohnKeells Office Automation (Pvt.) Ltd.	26,749.94	-	-	-	-	-
Oxford Journal	8,729.59	-	-	-	-	-
Sri Lanka insurance	542,700.00	-	-	-	-	-
Hostmonster	2,471.72	-	-	-	-	-
Soil Science Society of America	34,681.25	-	-	-	-	-
American Association for Advance of Science	18,842.02	-	-	-	-	-
World Health Organization	233,921.89	-	-	-	-	-
Elsevier Ltd Journal	77,283.75	-	-	-	-	-
John Wiley & Sons Ltd	8,481.81	-	-	-	-	-
New York Acedemy of Science	24,093.75	-	-	-	-	-
The Union	19,594.41	-	-	-	-	-
S.B. Freigh Services - Clearance	85,196.32	-	-	-	-	-
Director General Custom - Defence Levy	1,888,228.00	-	-	-	-	-
	3,289,008.91	-	-	-	-	-

AGE ANALYSIS OF ADVANCES (FOREIGN PURCHASE) AS AT 31.12.2016 : Rs. 4,354,596.98

	0 - 12 MONTHS Rs	1 - 2 YEARS Rs	2 - 3 YEARS Rs	3-4 YEARS Rs	4 - 5 YEARS Rs	OVER 5 YEARS Rs
Springer Customer Service Center	130,190.00	-	-	-	-	-
Amersham Life Science Ltd	-	-	-	-	-	-
Bacheman California	-	-	-	-	-	-
CEM Innovators in Microwave Technology	900,375.82	-	-	-	-	-
Fluka Chemical	-	-	-	-	-	-
Phatpocket Ltd	16,409.11	-	-	-	-	-
Shiramadzo (Asia Racific) Pte Ltd	716,411.50	-	-	-	-	-
Ven India Imports & Export	-	-	-	-	-	1,167.50
VWR International Ltd	215,711.48	44,728.07	-	55,862.98	-	-
Wageningen Agricultural University Netherlands	-	-	-	-	-	-
Macrogen Inc	195,658.37	-	-	-	-	-
Thorlabs Inc	1,297,725.33	-	-	-	-	-
Defence levy & Clearance - FP/15/26	401,887.96	-	-	-	-	-
Defence levy & Clearance - FP/10/74	378,468.86	-	-	-	-	-
	4,252,838.43	44,728.07	-	55,862.98	-	1,167.50

AGE ANALYSIS OF PREPAYMENTS & ADVANCES (LETTER OF CREDIT) AS AT 31.12.2016 : Rs. 44,772,771.60

	0 - 12	1 - 2	2 - 3	3-4	4 - 5	OVER 5
	MONTHS	YEARS	YEARS	YEARS	YEARS	YEARS
	Rs	Rs	Rs	Rs	Rs	Rs
Rigaku Corporation - KN/SIL/2016/40	17,369,001.17	-	-	-	-	-
Korvus Technology Ltd - KN/SIL/2016/46	9,526,047.10	-	-	-	-	-
Thermo Fisher Scientific OY - KN/SIL/2016/59	7,884,271.83	-	-	-	-	-
Thermo Fisher Scientific Wissenschaftliche Geräte GmbH- KN/SIL/2016/58	9,993,451.50	-	-	-	-	-
	44,772,771.60	-	-	-	-	-

ACCRUED EXPENSES Rs.1,930,476.63 :

	0 - 12	1 - 2	2 - 3	3-4	4 - 5	OVER 5
	MONTHS	YEARS	YEARS	YEARS	YEARS	YEARS
	Rs	Rs	Rs	Rs	Rs	Rs
Postage	7,525.00	-	-	-	-	-
Overtime	145,279.08	-	-	-	-	-
Telephone - Dr. Wanduragala	2,891.63	-	-	-	-	-
Telephone - Ms. Jeewa Kasthuri	5,000.00	-	-	-	-	-
Salary - Chariman	83,725.00	-	-	-	-	-
Traveling & Subsistence	5,325.00	-	-	-	-	-
Government Audit Fees	200,000.00	200,000.00	-	-	-	-
Temporary Staff Allowance - NIFS	61,075.00	-	-	-	-	-
Temporary Staff Allowance -Grant	155,690.00	-	-	-	-	-
Temporary Staff Allowance - Rizobium	109,101.29	-	-	-	-	-
Communication	129,677.51	-	-	-	-	-
Overtime - Grant	9,086.05	-	-	-	-	-
Water Charges	82,764.22	-	-	-	-	-
Internet	274,139.71	-	-	-	-	-
Visiting Salary - NIFS	165,660.53	-	-	-	-	-
Electricity	288,121.85	-	-	-	-	-
Transport	4,064.76	-	-	-	-	-
Travelling - Grant	1,350.00	-	-	-	-	-
	1,730,476.63	200,000.00	-	-	-	-

OTHER CREDITORS AND PAYABLE BALANCE Rs. 297,879.83 :

	0 - 12	1 - 2	2 - 3	3-4	4 - 5	OVER 5
	MONTHS	YEARS	YEARS	YEARS	YEARS	YEARS
	Rs	Rs	Rs	Rs	Rs	Rs
Disposable Item (Refundable Deposit)	-	-	-	900.00	-	-
Refundable Benchfees	34,000.00	-	-	-	-	-
Retention Money Payable-CECB	39,039.06	-	-	-	-	-
Retention Money Payable - Jayantha Furniture	36,950.00	-	-	-	-	-
Retention Money Payable- Computerae (Pvt) Ltd	51,644.00	-	-	-	-	-
Retention Money Payable - D.S. Construction and Movers	135,346.77	-	-	-	-	-
	296,979.83	-	-	900.00	-	-

CREDITORS-SUPPLIERS AND SERVICES Rs.594,145.90 :

	0 - 12 MONTHS Rs	1 - 2 YEARS Rs	2 - 3 YEARS Rs	3-4 YEARS Rs	4 - 5 YEARS Rs	OVER 5 YEARS Rs
General Upkeep - Janitorial	148,000.00	-	-	-	-	-
General Upkeep - Catering	25,000.00	-	-	-	-	-
Department of Inland Revenue (stamp)	16,160.00	-	-	-	-	-
Department of Inland Revenue (PAYE tax)	17,947.97	-	-	-	-	-
Mr.P.G.Chamila Sanka Wickrama	130,300.00	-	-	-	-	-
Mr.T. Gamini Silva	47,500.00	-	-	-	-	-
Security Services	189,920.43	-	-	-	-	-
C. Illangakoon	1,400.00	-	-	-	-	-
Dr. D. Maganarachchi	4,250.00	-	-	-	-	-
Saman Priyadeva	1,600.00	-	-	-	-	-
Ms. R.K.C. Karunaratne	3,632.50	-	-	-	-	-
Metropolitant Office Pvt Ltd	4,216.65	-	-	-	-	-
Regal Hardware	5,325.00	-	-	-	-	-
Mahanuwara Agencies	8,500.00	-	-	-	-	-
PRESS	1,700.00	-	-	-	-	-
Mrs. Chandrakanthi	2,400.00	-	-	-	-	-
Mrs. Jeewa Kasthuri	2,000.00	-	-	-	-	-
Mr. M.A.P. Perera	350.00	-	-	-	-	-
Analytical Instruments (Pvt) Ltd	104,710.95	-	-	-	-	-
B.J.Weerasooriya	635.00	-	-	-	-	-
Mr. K.T.D.K. Kariyawasam	9,200.00	-	-	-	-	-
	724,748.50	-	-	-	-	-

TRIAL BALANCE AS AT 31.12.2016

NO		DEBIT	CREDIT
F/A/1	AIR CONDITIONER	6,098,919.45	-
F/A/2	BUILDING	34,782,089.90	-
F/A/3	COMPUTER & PRINTERS	27,739,099.15	-
F/A/4	COMMUNICATION EQUIPMENT	913,280.42	-
F/A/5	FURNITURE & FITTINGS	7,706,163.80	-
F/A/6	IMPROVEMENTS TO BUILDING	-	-
F/A/7	LAND	28,622,151.00	-
F/A/8	LABORATORY EQUIPMENT	345,600,110.96	-
F/A/9	LIBRARY BOOKS	16,657,074.21	-
F/A/10	MOTOR VEHICLE	29,623,000.00	-
F/A/11	MACHINERY TOOLS & IMPLEMENTS	1,118,061.64	-
F/A/12	OFFICE & MISCELLANEOUS EQUIPMENT	22,360,777.05	-
F/A/13	REFRIGERATORS	2,721,626.03	-
F/A/14	SPORT ITEMS	13,480.00	-
F/A/15	MOTOR VEHICLE OVERHALL	-	-
F/A/16	KITCHEN EQUIPMENT	-	-
F/A/17	TRAINING CAPACITY	949,197.40	-
F/A/18	COMPUTER SOFTWARE	408,160.00	-
O/F/A/1	EMPLOYEE PROVIDENT FUND INVESTMENT	76,925,668.67	-
O/F/A/2	DISPOSABLE OF FIXED ASSETS	24,915,351.37	-
O/F/A/3	MODEL OF LAND	37,500.00	-
O/F/A/4	INVESTMENT OF CONSUMPTION LOAN	381,234.88	-
O/F/A/5	GEOTHERMAL MAPPING REPORT	-	-
O/F/A/6	NEW BUILDING - WORKING PROGRES	156,054,032.38	-
O/F/A/7	WORKING PROGRESS - LAND & LAND IMPROVEMENT	4,420,627.65	-
O/F/A/8	WORKING PROGRESS - INTEGRATED SOFTWARE - SARASA	660,000.00	-
O/F/A/9	WORKING PROGRESS - INSTALLATION OF LAB FURNITURE	9,300,912.00	-
O/F/A/10	WORKING PROGRESS - STEEL BOOK SHELVES	154,200.00	-
O/F/A/11	WORKING PROGRESS - BUILDING IMPROVEMENT	1,582,112.57	-
C/A/1	BUILDING MAINTENANCE STOCK	327,005.67	-
C/A/2	CHEMICAL GLASSWARE AND LAB WARE STOCK	1,129,628.93	-
C/A/3	CONSIGNED STOCK	17,405.84	-
C/A/4	STATIONERY STOCK	330,993.82	-
C/A/5	SUNDRY STOCK	408,941.07	-
C/A/6	PUBLICATION STOCK	32,176.64	-
C/A/10	INSURANCE CLAIM RECEIVABLE(JANASHAKTHI)	-	-
C/A/11	ADVANCE TO SUPPLIES & OTHERS	94,837.49	-
C/A/12	FOREIGN PAYMENTS ON ADVANCE	3,574,240.16	-
C/A/13	LETTER OF CREDIT MARGIN	44,772,771.60	-
C/A/14	FESTIVAL ADVANCE	-	-
C/A/15	SPECIAL ADVANCE	-	-
C/A/18	REFUNDABLE DEPOSIT	518,600.00	-
C/A/19	PREPAYMENT	1,315,584.59	-
C/A/20	OTHER RECEIVABLE ACCOUNT	110,947.22	-
C/A/21	INTEREST RECEIVABLE FOR FIXED DEPOSIT	4,521,732.52	-
C/A/23	REFUNDABLE DEPOSIT FOR DISPOSABLE ITEMS	-	900.00
C/A/24	RESEARCH ALLOWANCE - PGIS	-	34,000.00
C/A/26	SOONER SCIENTIFIC	-	-
C/A/27	PRELIMINARY EXPENSES FOR CONTRUCTION	-	-
C/A/36	HYDRAULIC JACK	-	-
C/A/38	ADVANCE FOR RACK - EEB	57,231.25	-
C/A/39	STAND ST, GEOLOGY	-	-
C/A/40	FESTIVAL ADVANCE INVESTMENT ACCOUNT	300,000.00	-
C/A/41	DIRECTOR BUILDING DEPARTMENT - ADVANCE	123,914.09	-

C/A/42	YOUNG SCIENTISTS SYMPOSIUM	-	-
C/A/43	NEW RACK STORES	-	-
C/A/45	D.S. CONSTRUCTIONS AND EARTH MOVERS	658,744.00	-
L/1	ACCRUED EXPENSES	-	1,930,476.63
L/2	CREDITORS	-	724,748.50
L/3	CAPITAL FUND SPENT	-	483,834,835.10
L/4	CAPITAL FUND UNSPENT	-	46,620,746.90
L/5	E.P.F. PAYABLE	-	-
L/6	E.T.F. PAYABLE	-	-
L/8	I.F.S.PROVIDENT FUND	-	85,806,896.30
L/10	INSTITUTE FUND	90,128,571.64	-
L/12	PROVISION FOR GRATUITY	-	20,844,045.00
L/13	PROVISION FOR DEPRECIATION	-	220,460,091.61
L/14	PRESIDENT FUND CAPITAL SPENT-SUPPLEMENTARY	-	7,078,501.15
L15	RENT PAYBLE	-	-
L16	LABORATORY EQUIPMENT - REFUND 2016- FP//15/26	401,887.96	-
L17	LABORATORY EQUIPMENT - REFUND 2016-FP/10/74	378,468.86	-
L/19	OTHER PAYABLE ACCOUNTS	-	-
L/20	RETENTION MONEY PAYABLE	-	262,979.83
L/21	RETIRED MEMBERS FUND ACCOUNT	-	3,949,781.93
L/22	CAPITAL EXPENDITURE SPECIFIED FUNDS & DONATION	-	6,242,702.66
L/23	SCHOOL SCIENCE PROGRAMME	-	204,799.98
L/24	SCHOOL SCIENCE PROGRAMME - ENGINEERING	-	2,410.00
L/25	BUILDING CONTRACTORS	-	-
L/26	FESTIVAL ADVANCE - FUND ACCOUNT	-	300,000.00
L/28	CONSUMPTION FUND	-	381,234.88
L/36	SPECIFIED RESEARCH GRAND FUND	-	2,495,837.49
L/42	BES GRANT	-	29,539.72
L/45	DEP OF INLAND REVENUE	-	-
L/55	BIOASSAYS	-	-
L/56	SCIENCE MAGAZINE	-	-
L/65	VIDU KIRANA	-	182,561.03
L/66	ANNUAL REVIEW	-	471,255.60
L/70	SOLA ASIA	-	164,346.95
L/72	INTERNATIONAL SYMPOSIUM - NATURAL PRODUCT	-	247,514.20
L/73	UNIVERSITY OF SYDNEY	-	-
L/78	HETC PROJECT	-	113,048.48
L/82	IFS SWEEDEN	-	466,739.58
L/83	RHIZOBIUM	-	240,643.90
L/84	RG/2012/AG/01	-	-
L/86	PV WORK SHOP	-	-
L/92	RG/2012/NRB/03	-	-
L/93	RG/2012/BS/04	-	-
L/94	WATER QUALITY	-	-
L/95	TOKYO CEMENT COMPANY	-	-
L/96	REVALUVATION RESERVE	-	131,630,743.37
L/97	MTR DAYATA KIRULA	-	-
L/99	SAMPLE ANALIZED - OUTSIDE FUNDS	-	431,600.58
L/100	NSF/ESA/01/2012	-	105,181.80
L/102	SPECTRA INDUSTRIES	-	-
I/104	MTR (INDIAN)	-	779,373.43
L/107	NSF - VIDU NANA DASUNA(VND)	-	-
L/110	PRESIDENT SRI LANKA SOCITY	-	-
L/111	SAMPLE ANALIZED PROF: BANDARA	-	-
L/115	RG/2014/EB/03	-	840,317.13
L/116	BIO FILM	-	8,521.83
L/117	N.W.I.B.M.N.S	-	175,363.26
L/118	PLANT NURSERY IN DAMBULLA ARB.	-	10,564.13

L/120	NSF RG/2014/BS/02	-	668,683.56
L/122	SOUTH EASTERN UNIVERSITY	-	300,839.38
L/124	RG/2015/EB/04 DR.BENJAMIN	-	462,411.49
L/125	CLUSEA ROSEA	-	131,311.07
L/126	RG/2015/EQ/04	-	-
L/127	PANICUM	-	83,766.72
L/128	NATIONAL WORKSHOP ON SEPERATION TECHNIQUES	-	242,778.71
L/129	CKDU MINI SYMPOSIUM	-	-
L/130	TECHNICAL PROGRAMME 2016	-	299,127.07
L/131	PHOBAM ARBORETUM PROJECT	-	65,477.80
L/132	GEO PHYSICAL SERVICES FOR DEVID PERIS MOTOR COMPANY	-	61,718.72
L/133	OPEN UNIVERSITY OF SRI LANKA	-	68,094.80
L/134	RG/SCH/2016/03	-	1,191,442.57
I/1	FOREIGN CURRENCY EXCHANGE GAINING	-	320,319.29
I/2	GOVERNMENT GRANT RECURRENT	-	181,000,000.00
I/3	GOVERNMENT GRANT CAPITAL -SPENT - RS. 59,023,860.69	-	144,999,579.00
	-UNSPENT - RS. 85,975,718.31	-	-
I/4	ACCOMADATION INCOME	-	700,005.14
I/5	HIRING AUDITORIUM	-	-
I/6	INTEREST RECEIVED	-	362,951.53
I/7	SALE OF BOOKS	-	1,111.60
I/8	SUNDRY INCOME	-	319,062.14
I/9	DISPOSAL ITEM	-	-
I/10	DONATION	-	-
I/11	SURCHARGE FOR DAMAGES	-	15,102.00
I/13	DISPOSAL OF FIXED ASSETS	-	3,160.63
I/16	FOREIGN & LOCAL GRAND FUND INCOME	-	12,090,329.10
I/17	NRC - GRATUITY - MRS. M.C.RAJAPAKSHA	-	72,427.50
E/1	ADVERTISEMENT	1,848,848.50	-
E/2	AUDIT FEES	200,000.00	-
E/3	AUDITORIUM AND ROOMS MAINTENANCE EXPENSES	84,160.37	-
E/4	BUILDING INSURANCE	386,707.08	-
E/5	BANK CHARGES	52,638.07	-
E/6	COMMUNICATION	1,332,301.57	-
E/7	CLEARANCE	85,196.32	-
E/8	DEFENSE LEVY AND GST	1,888,228.00	-
E/9	DAMBULLA ARBORETUM	180,000.00	-
E/10	ELECTRICITY	6,878,876.60	-
E/11	FUEL	2,461,155.85	-
E/12	GENERAL UP KEEP-JANITORIAL SERVICE & GARDEN MAINTENAN	1,773,720.00	-
E/14	GENERAL UPKEEP-CATERING SERVICE	300,000.00	-
E/15	GRATUITY	1,897,957.50	-
E/16	MAINTENANCE OF MOTOR VEHICLES	2,403,688.58	-
E/17	MOTOR VEHICLE INSURANCE	568,305.42	-
E/18	MOTOR VEHICLE LICENSE	77,895.00	-
E/19	MAINTENANCE OF BUILDING	826,559.03	-
E/20	MAINTENANCE OF EQUIPMENT	5,306,723.71	-
E/21	OVERTIME	1,171,171.79	-
E/22	POSTAGE	132,930.00	-
E/23	PRIOR YEAR ADJUSTMENT	588,758.34	-
E/24	RESEARCH COUNCIL MEETING EXPENSES	49,174.96	-
E/25	SECURITY	2,212,985.86	-
E/26	STAFF TRANSPORT	1,239,759.92	-
E/27	ANNUAL REVIEW IFS	385,821.00	-
E/28	SUBSCRIPTION PERIODICALS & JOURNALS	357,643.21	-
E/29	MEMBERSHIP FEES	814,805.47	-
E/30	STAFF INSURANCE	691,286.31	-
E/31	TRAVELLING & SUBSISTENCE	289,054.25	-

E/32	WELFARE	2,118,390.46	-
E/33	WATER	2,423,537.15	-
E/34	SALARY	102,280,765.34	-
E/35	E.P.F. 15%	13,696,674.88	-
E/36	E.T.F. 3%	2,739,334.98	-
E/37	STATIONARY USED	445,436.27	-
E/38	CHEMICAL GLASSWARE AND LABWARE USED	5,299,883.76	-
E/39	CONSUMABLE	7,327,461.96	-
E/40	PRINTING	159,233.50	-
E/41	LEGAL EXPENSES	168,000.00	-
E/43	ENTERTAINMENT ALLOWANCE	6,000.00	-
E/45	DEPRECIATION	47,559,559.48	-
E/47	TEMPORARY STAFF ALLOWANCE	2,823,951.35	-
E/49	MISCELLANEOUS	1,069,549.65	-
E/50	INTERNET	3,054,759.65	-
E/53	FOREIGN & LOCAL GRAND EXPENDITURE	12,090,329.10	-
E/54	PUBLICATION DONATION	116,955.00	-
E/55	WORKSHOP- ROLE OF BIO MICROBIAL FERTILIZER	15,606.00	-
E/56	TRAVELLING FOREIGN	966,620.75	-
E/57	ROOM EXPENDITURE	370,940.00	-
E/58	DESPOSAL YEAR 2013	-	-
E/59	IFS SCIENCE WEEK	-	-
E/60	LOCAL REGISTRATION FEES	116,000.00	-
E/61	LOSS ON TRANSFER OF MOTOR VEHICLE	928,438.36	-
O/C/B/1	NATIONAL SAVINGS BANK. A/C NO1-0015-01-02989	4,449,216.44	-
O/C/B/2	RESEARCH FUND N.S.B.1-0015-01-03152	70,106.00	-
O/C/B/3	PETTY CASH CONTROL ACCOUNT	-	-
O/C/B/4	STAMP IMPREST - DIRECTORS' OFFICE	8,500.00	-
O/C/B/5	STAMP IMPREST - ACCOUNTS	-	-
O/C/B/6	PROVIDENT FUND CURRENT ACCOUNT B.O.C.32794	3,850,669.91	-
O/C/B/8	COLOMBO OFFICE	-	-
	N.S.B A/C NO.100151091808	381,234.88	-
O/C/B/11	STAFF CONSUMPTION LOAN RECEIVABLE A/C	4,317,002.00	-
	BANK OF CEYLON 32779	134,492,248.44	-
	BANK OF CEYLON 32795	13,356,179.97	-
	CASH	-	-
	SFCA/KN/USD/01	8,394,550.90	-
		<u>1,360,532,002.77</u>	<u>1,360,532,002.77</u>
		0.00	



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கணக்காய்வாளர் தலைமை அபிபதி திணைக்களம்
AUDITOR GENERAL'S DEPARTMENT



මගේ අංකය
எனது இல.
My No.

} CLP/KD/J/NIFS/2017/07

ඔබේ අංකය
உமது இல.
Your No.

}

දිනය
திகதி
Date

} 30 September 2017

The Director,
National Institute of Fundamental Studies

Report of the Auditor General on the Financial Statements of the National Institute of Fundamental Studies for the year ended 31 December 2016 in terms of the Section 14 (2)(c) of the Financial Act No.38 of 1971.

The audit of Financial Statements of the National Institute of Fundamental Studies for the year ended 31 December 2016 comprising the statement of financial position as at 31 December 2016 and the statement of financial performance, statement of changes in equity and cash flow statement for the year then ended and a summary of significant accounting policies and other explanatory information, was carried out under my direction in pursuance of provisions in Article 154(1) of the Constitution of the Democratic Socialist Republic of Sri Lanka read in conjunction with the Section 13(1) of the Finance Act, No.38 of 1971 and Section 36(4) of the National Institute of Fundamental Studies Act, No.55 of 1981. My comments and observations which I consider should be published with the Annual Report of the Institute in terms of Section 14(2)(c) of the Finance Act appear in this report. A detailed report in terms of Section 13(7)(a) of the Finance Act was issued to the Director of the Institute on 16 June 2017.

1.2 Management's Responsibility for the Financial Statements

Management is responsible for the preparation and fair presentation of these Financial Statements in accordance with Sri Lanka Public Sector Accounting Standards and for such internal control as the management determines is necessary to enable the preparation of financial statements that are free from material misstatements whether due to fraud or error.



1.3 Auditor's Responsibility

My responsibility is to express an opinion on these financial statements based on my audit. I conducted my audit in accordance with Sri Lanka Auditing Standards consistent with International Standards of Supreme Audit Institutions (ISSAI 1000 -1810). Those Standards require that I comply with ethical requirements and plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatements.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the Institute's, preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Institute's internal control. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of accounting estimates made by management, as well as evaluating the overall presentation of financial statements.

Sub-sections (3) and (4) of Section 13 of the Finance Act, No. 38 of 1971 give discretionary powers to the Auditor General to determine the scope and extent of the audit.

I believe that the audit evidence I have obtained is sufficient and appropriate to provide a basis for my audit opinion.

1.4 Basis for Qualified Opinion

My opinion is qualified based on the matters described in paragraph 2.2 of this report



2. Financial Statements

2.1 Qualified Opinion

In my opinion, except for the effects of the matters described in paragraph 2.2 of this report the financial statements give a true and fair view of the financial position of the National Institute of Fundamental Studies as at 31 December 2016 and its financial performance and cash flows for the year then ended in accordance with Sri Lanka Public Sector Accounting Standards.

2.2 Comments on Financial Statements

2.2.1 Sri Lanka Public Sector Accounting Standards

As the useful life of non-current assets had not been reviewed annually in terms of Sri Lanka Public Sector Accounting Standard 07, 15 items of fixed assets costing Rs.79,737,220 had been further utilized though they were fully depreciated. Accordingly, action had not been taken to revise the estimated error in terms of Standard 03.

2.2.2 Accounting Deficiencies

The following observations are made.

- (a) Interest on fixed deposits receivable as at 31 December of the year under review amounting to Rs.4,148,299 had been shown as Rs.4,521,733 in the statement of financial position.
- (b) Accessories for the use of a laboratory equipment purchased on 05 May of the year under review by incurring a sum of Rs. 1,200,000 should have been capitalized under plant and equipment but it had been accounted as revenue expenditure in the year under review.



2.2.3 Lack of Evidence for Audit

Evidence in respect of 2 items of accounts totalling Rs.549,279,345 in the year under review indicated against each item was not made available for audit.

Item	Value	Evidence not made available
	Rs.	
(a) Fixed Assets	524,363,994	Register of fixed assets.
(b) Laboratory equipment, tools and furniture show under current assets	24,915,351	Evidence to establish the existence.
	549,279,345	

2.4 Non-compliance with Laws, Rules, Regulations and Management Decisions

The following non-compliance were observed.

Reference to Laws, Rules, Regulations, etc.	Non-compliance
(a) Financial Regulations of the Democratic Socialist Republic of Sri Lanka	
(i) Financial Regulation 103 (1)	(i) Action in terms of financial regulations had not been taken in respect of 143 items valued at Rs.4,772,606, identified as untraceable by the Board of Survey.



(ii) Action in terms of financial regulations in respect of 809 books identified as shortages at the Board of Survey for the year 2016.

(ii) Financial Regulation 135

Even though the National Institute of Fundamental studies had incurred an expenditure of Rs.358,285,716 during the year under review, financial authorities had not been delegated in terms of Financial Regulations.

(iii) Financial Regulation 137

Two vouchers valued at Rs.12,881,992 had been paid without being approved.

(iv) Financial Regulation 139

Payment of Rs.429,652 had been made to 5 payment vouchers in the year under review without the certificate of the Deputy Accountant.

(v) Financial Regulation 225

All payments must be supported by vouchers, prepared accurately and completely in the Form General 35 and for general payments, recommendation and approval should be ensured by placing signature and rubber stamp of the relevant officers. Action had not been taken accordingly in respect of 2,715 payment vouchers paid in the year under review.



- (vi) Financial Regulation 371 (2) Although a maximum of Rs.5,000 can be paid at a time from the petty cash imprest, payments ranging from Rs.7,500 to Rs.12,000 had been made in 4 instances to the contrary.
- (b) Employees Provident Fund Act No.15 of 1958 and letter No.ප්‍ර/ආයතන/11 dated 24 August 2001 of the Commissioner of Labour. Even though the academic allowance should not be taken into account in the calculation of contributions to the Employees Provident Fund and the Employees Trust Fund, contrary to that, an overpayment of Rs.3,011,258 had been made as the employers contributions based on the academic allowance.
- (c) Public Finance Circular No.438 of 13 November 2009. Goods valued at Rs.7,977,978 had been informally removed from use and stacked un-protectively in the office premises.

3. Financial Review

3.1 Financial Results

According to the financial statements presented, the financial results of the year ended 31 December 2016 had been a deficit of Rs.44,817,129 as compared with the deficit of Rs.50,269,507 for the preceding year. An improvement of Rs.5,452,378 had indicated under review as compared with the preceding year. Accordingly, though employees remuneration had increased by Rs.9,220,529 as compared with previous year, increase of recurrent grants by Rs.27,000,000 had mainly attributed to this improvement.

In analyzing the financial results for the year under review and the preceding 4 years, deficits were indicated from the year 2012 to 2016, but after considering the employees remuneration and depreciation on non-current assets, the contribution of Rs.72,927,520 in the year 2012 of the University had increased to Rs. 125,454,329 in the year 2016.



4. **Operating Review**

4.1 **Performance**

According to the National Institute of Fundamental Studies Act No.55 of 1981, the objectives of the Institute are as follows.

- (a) To create an interest in and to provide facilities for fundamental and advanced studies and in particular to initiate, promote and conduct research and original investigations in fundamental studies in general with particular emphasis on mathematics, physics, chemistry, life science, social sciences and philosophy.
- (b) Arrange lectures, meetings, seminars and symposia in pursuance of its academic work and for the diffusion of scientific knowledge.
- (c) Invite scientists in Sri Lanka and from abroad, actively engaged in creative work to deliver lectures and participate in its academic activities.
- (d) Establish and maintain liaison with scientific workers and scientific institutions in other countries and promote international Co-operation in matters relating to the aims and objects of Institute.
- (e) Do such other acts and things as may be necessary to promote the aims and objects of the Institute.

The following observations are made in this connection.

- (a) About 30 year had lapsed after the establishment of the National Institute of Fundamental Studies, number of patents rights obtained by the Institute was only 11. However, only one patent certificate had been used within Sri Lanka for Economic and Commercial activities.



- (b) Even though patent rights bearing No.9772 and 9873 had been obtained in the years 1987 and 1988 respectively for the manufacture of super phosphate and Ammonium phosphate fertilizer, they had not been practically implemented even by the year 2017. It was observed that Sri Lanka spends a lot of foreign exchange to import such fertilizer.

4.2 Operating Activities

Even though more than 01 year had elapsed after paying advances totalling Rs.100,591 in 2 instances to purchase library books, chemicals and other equipment from a foreign institution in the years 2013 and 2015, action had not been taken to get these books and equipment.

4.3 Transactions of contentious Nature

The following observations are made.

- (a) Even though the house rent of Rs.160,570 payable for official quarters used by the officers of the Institute belonging to the Mahaweli Authority which had not been formally acquired, should have been recovered from the occupants and remitted to the relevant institution, a sum of Rs.101,000 had been paid in the year under review from the Fund of the Institute.
- (b) As a damage caused to a cable of the Sri Lanka Telecom in the preparation of lands for the construction of access road by a Private Company, the loss estimated by the Telecom amounting to Rs.658,744 had been paid by the Institute of Fundamental Studies even though it had to be recovered from the contractor.

4.4 Under utilization of Funds

Out of the government capital grants of Rs. 144,999,579 received during the year under review, a balance of Rs.85,975,718 and a balance of Rs.45,253,912 received during the previous years had been shown under unspent government grants without being utilized for the relevant purposes.



4.5 **Idle and Under utilized Assets**

A motor cab which had been revalued at Rs. 1,200,000 on 16 February 2015 had been removed from running and parked in the premises of the Institute since 21 January 2016 to the date of audit.

4.6 **Procurement and Contract Process**

The following observations are made.

- (a) In terms of Paragraph 55 (f) of part XI of the Construction Industries Development Act No.33 of 2014, specimen forms specifically introduced should be used for construction activities of all government and semi government institutions. Nevertheless, the National Institute of Fundamental Studies had not used specific agreement forms in respect of construction works totalling Rs.43,985,981 and entered in to informal agreements. As a result, legal action in respect of abandoned projects and delayed construction works could not be taken or to recover fines.
- (b) Mobilization advances of Rs. 13,855,793 had been paid for 6 contracts, the works of which should have been commenced during the year under review and to be completed within a period of 4 months. Works of these constructions had not been completed even though more than one year had elapsed and action had not been taken to get the period of contract extended as well. The periods of advance bonds presented for mobilization advances had expired and action had not been taken to recover the mobilization advances of Rs.13,855,793 further existed.
- (c) In terms of Section 7.9.2 (j) of the Procurement Guidelines manual, when bids with large price gaps are presented, bid evaluation should be carried out by comparing the prices of other bidders for each item of work with the prices stated in the Engineering estimate. However, in the bid evaluation of the construction contracts, the cost of Engineering estimate of which amounted to Rs.5,472,685, each item had not been evaluated and as such the contract had been awarded for Rs.5,481,618 to the qualified bidder who had quoted less



than 6700 per cent of the other bidder and less than 90 per cent of the price stated in the Engineering estimate for item 24 of the Bill of Quantity.

- (d) Although a sum of Rs.4,620,420 had been paid for 420 square feet to build concrete tables for the research Laboratory in the construction of the new building of the National Institute of Fundamental Studies as originally planned, subsequently those concrete tables had been broken and removed, stating that they were not in compliance with standards for research activities. Instead, wooden tables had been made and as such the Institute had incurred a financial loss of Rs.4,620,420 which had been spent for making concrete tables.
- (e) A sum of Rs.814,925 had been spent in the year under review to spread concrete blocks on the front premises of the National Institute of Fundamental Studies in the area of 675 square meters (675 m²). Nevertheless, by the time of audit examination, lots of places where cement blocks were spread had been subjected to sink and water was remained therein. Furthermore, action had also not been taken to make the premises properly in a manner to flow the accumulated water in that area.

4.7 Personnel Administration

In view of the existence of 20 vacancies of officers in the Research Staff by 09 March 2017, it had hindrance to reach the objectives of the Institute at an optimum level.

5. Accountability and Good Governance

5.1 Budgetary Control

Variances ranging from 6 per cent to 1684 per cent in 14 items were observed between the budgeted income and expenditure and the actual income and expenditure of the year under review, thus the budget had not been made use of as an effective instrument of management control.



6. Systems and Controls

Weaknesses in System and Control observed in audit had been brought to the attention of Director of the Institute from time to time. Special attention is needed in respect of the following areas of Systems and Controls.

Area of Systems and Control	Observations
(a) Accounting	Non-compliance with Sri Lanka Public Sector Accounting Standards.
(b) Stock Control	(i) Action not taken in terms of financial regulations in respect of slow moving and obsolete stock. (ii) Segregation of duties in respect of purchase of Chemical and Laboratory equipment, having an internal check.
(c) Constructions Activities	Non-compliance with Laws, Rules and Regulations, deviation from proper supervision.
(d) Motor vehicles control	As one officer had been doing all the activities in respect of vehicles control and repairs, a proper internal check was not in operation.
(e) Personnel Administration	Segregation of duties not subjected to an internal check.

H.M.Gamini Wijesinghe
Auditor General
Sgd./ H.M. GAMINI WIJESINGHE
Auditor General

Observations of the Members of the Board of Governors with regard to the Report of the Auditor General on the Financial Statements of the National Institute of Fundamental Studies for the year ended 31st December 2016 in terms of Section 14(2)(C) of the Finance Act, No. 38 of 1971.

2.2. Comments on Financial Statements

2.2.1 Sri Lanka Public Sector Accounting Standards

As per the instructions of the Board of Governors written requests have been made to the Department of Valuation in order to revalue the respective 15 items of fixed assets. The final request was made on 20.07.2016. As there was no reply, the Board decided to revalue these assets by appointing an officer from the Ministry of Science, Technology and Research. A written request was made to the Ministry on 06.02.2017 highlighting these facts.

Since there was no reply from the Ministry, it was decided by the Audit and Management Committee held on 03.06.2017 to appoint a five-member committee comprising two members with technical knowledge from the University to carry out the revaluation work. The respective work is now underway.

2.2.2 Accounting Deficiencies

- (a) It was noted to show the withholding tax provision of Rs.373,434 separately in the accounts.
- (b) Since these items were required during the course of maintenance as replacements, they were treated as revenue expenditure.

2.2.3 Lack of Evidence for Audit

- (a) Supervision arrangements have been made.
- (b) Assets amounting to Rs. 24,915,351 have been identified as unusable assets. A committee has been nominated to dispose of these assets. These assets are still in the premises of the Institution. Committees have already been appointed to dispose of the said assets and the assets which were subsequently identified as unusable.

2.3 Non-compliance with Laws, Rules, Regulations and Management Decisions

(a) Financial Regulations of the Democratic Socialist Republic of Sri Lanka

(i) Financial Regulation 103 (1)

- ❖ A committee has been appointed to investigate on the untraceable items and to confirm that they are actually misplaced. Upon the submission of the committee report, corrections will be made.

- ❖ The board of survey was done in 2016. Out of the 809 books which were identified as shortages, 793 books have already been found and the necessary steps have been taken to identify the remaining 16 books.

(ii) Financial Regulation 135

Delegation of financial authorities has been properly implemented in 2017.

(iii) Financial Regulation 137

Instructions have been given to act according to the Financial Regulation 137.

(iv) Financial Regulation 139

Instructions have been given to act according to the Financial Regulation 139.

(v) Financial Regulation 225

Accurate completion of Form General 35 is already practiced and the certification with the rubber stamp according to Financial Regulation 225 has been fulfilled from 2017.

(v) Financial Regulation 371(2)

Instructions have been given to act according to Financial Regulation 371(2)

- (b)** The education allowance of concern has been paid to the research staff based on the Circular 1000 on 08.01.2013 of the Commission and according to the instructions given by the Management Services Department of the Ministry of Finance and Planning to the Ministry of Science, Technology and Research through the letter DMS/B1/62/03/VOII dated 27.03.2014.
- (c)** Disposal committee has been appointed and necessary steps have been taken to dispose of these assets. Once the work is completed, corrections will be made in accounts.

4 Operating Review

4.1 Performance

- (a)** When considering countries with greater scientifically and technological advancements, only 2% - 5% of research work has been extended to obtaining patent rights. Therefore, obtaining 11 patents is a greater achievement for our Institution which is engaged in fundamental science studies. Necessary support from other parties was not experienced to commercialize the patents obtained by scientists.

- (b) Commercializing a patent is a task which cannot be achieved by NIFS alone as it requires a considerable involvement of both public and private entities such as different ministries and institutions. The Minister is well aware of this problem and planning to establish a division at the Ministry to facilitate similar situations.

4.2 **Operating Activities**

Due to lack of supporting evidence related to the following foreign currency payments made to overseas suppliers, the Board of Governors has decided to write off the advances paid to them from the books on 05.02.2017.

Description	Year
Amersham life Science Ltd	1997
Bacheman California	1995
Fluka Chemical	1998
Wageningen Agriculture University of Netherlands	1998

VWR International Ltd

Reminders have been sent on the following days to get the goods delivered.

2017.01.09, 2017.02.01, 2017.02.25, 2017.03.25

4.3 **Transactions of Contentious Nature**

- (a) No payment was received during transition of tenants where the property was not occupied. With the approval of the Board on 10.12.2016, the Institution had to bear such amounts in total.
- (b) When making the final payment to D.S. Construction & Erath Movers, it is scheduled to deduct the payment made to Telecom PLC from them.

4.4 **Underutilization of Funds**

The Institution started to receive capital transfers (non-refundable) properly from the treasury from August onwards. On account of this, much of the construction work was carried out during the latter part of the year.

Further, many of the lab furniture and equipment were purchased from the local market and the items were received during 2017. As the payments also were made in 2017, higher capital balance remained unspent as at 31.12.2016.

4.5 **Idle and Underutilized Assets**

On account of the constant mechanical failures of the 54-1066 Cab, it was examined by the Department of Motor Traffic and was condemned. During the Board meeting held on 01.04.2017,

it was decided by the Board to give this vehicle to a school to perform practical training of G.C.E. A/L Engineering Technology subject as per the Public Finance Circular 438 of 13.11.2009. With the letter TRA/NIFS/DIS/1066/MOSTR/2017 dated 19.04.2017 sent to the Ministry, initial steps have been taken to expedite the matter of transferring this vehicle to a school.

4.6 Procurement and Contract Process

- (a) It has been scheduled to enter into agreements as per the set guidelines
- (b) Since the contractor failed to complete the work on agreed time frame, 2 constructions have shortcomings. Only one construction whose work is completed has been paid for. Final payment has not been paid for the incomplete work as yet and the advance payment shall be deducted when making the final payment.
- (c) The engineer who was appointed on work basis to administer and consult on this contract has instructed to award the contract to D.S. Construction & Earth movers. Further, he was involved in the appraisal of bids and technical appraisal committee. Based on that, response was obtained from him on price appraisal.
- (d) It was observed that standard lab furniture could not be fixed in a setup of concrete tables. Therefore, old concrete tables were removed and wooden tables were fixed according to the modern lab technology. The removal of old tables and fixing of new tables were done by the supplier with no extra charges.
- (e) No payment has been made to the contractor for the item no. 17 in the Bill of Quantity (BOQ) and the respective balance is to be deducted when making the final payment. Further, the contractor has already repaired the places which sank. Accordingly, the engineer has been consulted and a reply has been obtained.

4.8 Personnel Administration

Research assistants are recruited on contract basis and they leave the organization once they obtain their postgraduate degrees. Their positions would stay vacant till notices are published and interviews are conducted. With the Board approval, assistance of 4 visiting lecturers has been obtained on daily payment basis.

Action is underway to call applications to fill the vacancies of scientists.

5 **Accountability and Good Governance**

5.1 **Budgetary Control**

In 2016, the Institute has fully spent the estimated recurring budget of Rs.176 Mn. Although the National Budget Department as per the Financial Regulation 66 has authorized to spend a further Rs.10.9 Mn., Rs.5 Mn. was released only on 30.12.2016. As a result, there was a shortage of Rs.5.9 Mn. and also there was no enough time to make the expenses. Therefore, these variances are observed amongst expense subjects.

6 **Systems and Controls**

(a) **Accounting**

Noted to follow Sri Lanka Public Sector Accounting Standards.

(b) **Stock Control**

- (i) Steps have been taken to act according to Financial Regulations on slow moving and obsolete stocks.
- (ii) This will be corrected with the detailed job allocation.

(c) **Construction Activities**

All the effort shall be taken to follow the rules and regulations.

(This error had taken place since the appointed civil engineer had not given proper instructions)

During the Board meeting held on 03.06.2017 it was decided that a new civil engineer shall be appointed on work basis for the upcoming construction work.

(d) **Motor Vehicle Control**

Instructions have been given to the Secretary and the Administrative Officer to supervise the vehicle maintenance and repair functions in addition to the work performed by the Management assistant / transport officer.

(e) **Personnel Administration**

Duty allocation based on detailed job descriptions has already been carried out for many employees. Action is underway to provide detailed job description for the rest of the employees.

Chairman
Board of Governors

Director
NIFS