SLAAS

Newsletter of the Sri Lanka Association for the Advancement of Science

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Biotechnology in the 21st Century

Biotechnology in simple terms is a technology based on biology which uses living organisms to make products that are of benefit to humans. The use of biological systems by man has existed since ancient times dating back to as far as 6000 BC. The Organization for Economic Co-operation and Development (OECD) has defined biotechnology as "The application of science and technology to living organisms as well as parts, products and models thereof to alter living or non-living materials for the production of knowledge, goods and services". The advent of recombinant DNA technology (Genetic engineering) in the 1970s completely revolutionized biotechnology and led to the creation of a new field known as Molecular Biotechnology. It has been suggested that it would be the driving force for modern civilization. Biotechnology today is considered a frontier technology and is the world's fastest growing and most rapidly changing. Since biotechnology has a tremendous potential to contribute substantially to economic growth, many governments around the globe have actively supported the development of this knowledge based industry. This has fueled the rapid proliferation of biotechnology business around the world. The global market for biotechnology currently is around US$ 300 billion. Biotechnology in general and molecular biotechnology in particular has had a tremendous impact in two major areas, which are of significant relevance to humans, i.e. food production (Agriculture) and healthcare (Medicine). It has also had an impact in other areas such as waste disposal, bioremediation, mining etc. Biotechnology today has become an integral part of our lives, from the food we consume, to the medicines we use, to the fuel that provides us with energy. It plays a vital role in meeting many of our needs and also in helping us face and respond to major challenges in healthcare, food security, climate change etc.

Healthcare Biotechnology (Red Biotechnology)

Biotechnology has had an enormous impact on Medicine (Healthcare) from prevention to diagnosis and treatment of diseases. Over 350 million patients today benefit from biotech based medicines (vaccines and medications) which constitutes around 20% of all drugs. It is projected that 50% of the top 100 drugs will be biotech based. Several antibiotics are now made through microbial fermentation and many vaccines used today are produced through recombinant DNA technology. The use of Biotech based diagnostic tools have helped detect and diagnose diseases more rapidly and with a higher degree of accuracy leading to improved patient prognosis. Currently there are more than 2000 biotech based diagnostic tests available. Furthermore the availability of portable biotech based diagnostic tools allows physicians to carry out tests in a non-laboratory setting allowing rapid treatment of the patients. The complete sequencing of the human genome together with a deeper knowledge of human sequence variation laid the ground work for "Personalized Medicine", an emerging practice in medicine where treatment is tailored to an individual patient. It uses an individual's genetic profile to guide decisions made in regard to prevention, diagnosis, and treatment of disease. The "One Size fits all" approach is now replaced by more customized strategies. Patients are provided with individualized information which includes the risk of developing a disease in later life (e.g. Cancer, Diabetes, Asthma etc.). This makes it possible to tailor prevention programs. It has also made it possible to select treatment that is effective and has the least adverse reactions. Biotech based diagnostic tools have helped personalize medicine by helping detect genetic variations in people which predispose them to various diseases and also to help determine the safest and most effective dosage of a drug for treatment.

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Biotechnology has likewise played an important role in the drug discovery process and also helped us understand diseases better allowing the development of new therapeutics. Several advances in genetic engineering have made possible 'genome editing' where genomic elements (DNA) can be inserted, replaced or removed. This technique has several applications in animals and plants and holds much promise for gene therapy.

Agricultural Biotechnology (Green Biotechnology)

Feeding a global population of 7 billion through sustainable agriculture is a major challenge. These challenges include increasing crop productivity to feed an increasing population, production of more healthy foods and improving the nutritional value of foods, efficient control of diseases, pests and weeds, decreasing post-harvest losses and produce more food from less land. Agricultural applications of modern biotechnology have the potential to address these needs and challenges. Through genetic engineering genes from one species can be transferred to another allowing desirable traits to be introduced into plants. These plants are referred to as transgenic plants and several genetically engineered plants resistant to herbicides, insects and diseases have been developed. This reduces the need to use synthetic agricultural pesticides, makes weed control easier and more efficient and reduces the risk of pollution through contamination of ground water and the environment. Plants have also been engineered to be drought, cold and salt tolerant and to have enhanced ability to fix nitrogen. As at 2010, a total of 148 million hectares in 29 countries have been cultivated with transgenic crops by 15.4 million farmers. A few controversies surround the use of genetically modified organisms in relation to their safety and other issues. However to date no scientifically proven negative impact has been reported either in humans or animals. Around 40% of agricultural output is from the livestock sector. Biotechnology has contributed to this sector in many areas including reproduction, selection and breeding, animal nutrition and livestock health products. Alternative use of plants include the production of recombinant pharmaceuticals which help reduce production costs, phytoremediation where plants are used to detoxify or absorb pollutants in the soil, and as a renewable feedstock for the production of biofuels and other biobased materials.

Industrial Biotechnology (White Biotechnology)

Modern Biotechnology has also contributed to sustainable industrial manufacturing. Industrial Biotechnology (IB) also known as White Biotechnology is the application of biotechnology-based tools to traditional industrial processes ("bioprocessing") and the manufacture of bio-based products (such as fuels, chemicals and plastics) from renewable feedstocks. It uses microorganisms and enzymes for this purpose. Considerable interest has been generated in IB as it is associated with less energy usage, reduced greenhouse gas emissions and waste production. In IB, agricultural products (biomass), a renewable source is converted to biobased products such as biopolymers, pharmaceuticals, biofuels, fibers, chemicals etc. It is similar to using crude oil as a feedstock for the production of fuels and chemicals. However, renewable raw materials are used, which are less expensive than fossil counterparts. Furthermore there is a reduced greenhouse gas emission leading to decreased global warming. It is more environmentally friendly since byproducts do not harm aquatic life or pollute soil or air. It uses an alternate and safer energy source (Biofuels) which avoids use of limited fossil fuel resources and decreases reliance on petroleum. There is energy saving in the production process and less waste is produced and it is biodegradable. Hence some of the major challenges of today such as climate change and scarcity of resources are being addressed by IB and is helping us to move away from a petroleum based economy to a biobased economy.

Biotechnology today is touching almost every aspect of our lives and has immensely benefitted society. It continues to meet many of our needs and is providing solutions to some of the pressing challenges faced today and in the future.

Dr N V Chandrasekharan, Department of Chemistry, University of Colombo

Sectional Activities

Section A

The following workshops were conducted:

i) **'Ethics in Research'** on 24 March 2015 at the University of Wayamba. The topics addressed were **'Introduction to Ethics'** (Prof Sagarika Ekanayake, University of Sri Jayewardenepura), **'Establishment of ethics committees and related ethical issues'** (Dr Geethani Galagoda, Secretary, Ethics Review Committee, MRI) and **'Ethics related to animals in research'** (Dr Mayuri Thammitiyagodage, Veterinary surgeon, MRI).

ii) **'Dairy based food development'** by Dr H A A S Piyasiri (Veterinary surgeon, Homagama) and Mrs Tharangamala Caldera, on 26 March 2015 at the Agrarian Services Centre, Homagama. Different dairy based food developments were introduced to middle income house wives in Homagama. The programme was conducted in collaboration with the Homagama Veterinary division.

iii) **'Healthy in old age'** on 1 April 2015 in collaboration with the Battaramulla Udumulla, Poorvarama temple elderly society. Topics discussed were: **'Growing old with dignity', 'Correct postures in old age'** and **'Healthy eating in old age'**. Resource persons were Dr Sameera A Gunawardena (Department of Forensic Medicine, Faculty of Medicine, University of Colombo), Dr Romain Perera (Allied Health Unit, University of Colombo) and Dr Shreenika Walianga (Department of Community Medicine, University of Colombo).

iv) **'Rational use of antibiotics'** by Dr Enoka Corea (Department of Microbiology, Faculty of Medicine, University of Colombo) on 7 April 2015 at the SLAAS auditorium for medical, dental and veterinary professionals.

v) **'Basic statistics'** on 3 and 5 June 2015 at the IT resource centre, University of Sri Jayewardenepura. Resource persons were: Drs. Sharmini Prathapan and Dr W A A Wijayasiri from the Department of Community Medicine, University of Sri Jayewardenepura.

vi) **'Scientific writing'** on 8 July 2015, at the IIM, in collaboration with the Postgraduate Section of Indigenous Medicine, University of Colombo. Prof Nalika Gunawardena, Dr Carukshi Arambepola, (Department of Community Medicine, University of Colombo) and Dr R D H Kulathunga (Acting Additional Director, PG Section) were the resource persons.

vii) **'Preparation of dairy food and recipes towards income generation'** by Dr H A A S Piyasiri (Veterinary surgeon, Homagama) and Dr Carukshi Arambepola, for residents of the Women's Society of Mihindusenpura, on 9 July 2015, in collaboration with the NIROGI LANKA project (SLMA).

A lecture on **'Awareness on rabies control'** was conducted by Dr Deepani Jayantha (Dog Star Foundation) on 13 May 2015, at Pitipana Maha Vidyalaya, Negombo for 300 participants. The programme was conducted in collaboration with Dog Star Foundation, Negombo and the Negombo Municipality MOH office. Leaflets with information on **'How to prevent dog bites'** were distributed among children.

Two public lectures on **'How to read food labels'** and **'Healthy meals from your own herbal garden'** were conducted on 26 and 27 June 2015 in collaboration with the Institute of Incorporated Engineers in Sri Lanka, at the INCO trade fair.

The resource persons were: Dr Ishanka Thalagala (Department of Community Medicine, University of Colombo) and Dr Sahani Weerasekera (Bandaranayake Memorial Ayurvedic Research Institute - BMARI).

At an activity organized on 28 June 2015, in collaboration with the Sri Lanka Dental Association, Dr Shreenika Walianga (Department of Community Medicine, University of Colombo) delivered a lecture on **'Healthy life style'**.

A newspaper article on **'Health benefits of coconut water'** written in Sinhala by Dr Sureka Chackrewarthy (Department of Biochemistry, University of Kelaniya) was submitted to Divayina/Maubima newspapers.

An article entitled **'Brighter smile'** written by Dr Vasantha Sivaguru (Consultant in restorative dentistry, Dental Institute of Colombo) was published in the Sunday Times of 21 June 2015.

A radio programme on **'Measles'** by Dr Geethani Galagoda (Consultant Virologist, MRI) will be recorded by the Sri Lanka Broadcasting Corporation.

Section B

Dr Sanjeewa Jayaweera, Ms H G P Herath (Lecturer, Dept. of Livestock Production, University of Sabaragamuwa), Mr T D Dissanayake (TO), and Ms G D Yasawathi (TO) conducted programmes related to **'Biosystem technology', 'Postharvest technology', 'Yoghurt production', 'Sausage production'** and **'Milk quality testing and tissue culture',** at the University of Sabaragamuwa on:

- 18 March 2015 for 61 students of R/ Seeavali Central College
- 25 March 2015 for 72 students of Ananda Maithree Madya Maha Vidyalaya, Balangoda and Jeilani Muslim Vidyalaya
- 2 April 2015 for 80 students of Kalawana National school and Karawita Central College

Section D

Dr Dinithi Peiris published an article on **'Effects of pesticides on human fertility'** in the weekly science paper Vidusara on 18 March 2015.

Dr Mangala Ganehiararchchi conducted a seminar on **'Environmental biology'** for 300 A/L students at Pinnawala Maha Vidayalaya, Pinnawala on 22 April 2015. The activity was organized by the Provincial Education Ministry, Sabaragamuwa Province.

A seminar on **'Ornamental fish disease - a practical view'** was conducted on 28 March 2015 at the Auditorium of the Department of Physics, University of Ruhuna with the participation of 130 undergraduates. Mr Palitha Chandrarathna (OIC, Fish Breeding and Training Centre, NAQDA, Rambodagalle) served as the resource person.

A **tree planting programme** was conducted on 5 June 2015 at the University of Kelaniya to commemorate the World Environment day. Nature's Secrets Pvt. Ltd. provided rare and medicinally important plants for the programme.

Dr Dinithi Peiris conducted a lecture on **'Aging'** at the monthly gathering of the Colombo Chapter of the Alumni of the University of Peradeniya on 29 June 2015.

Section E1

A workshop on **'Nanotechnology & Nano Science'** was conducted by Dr Sasini Jayewardene (Department of Physics, University of Sri Jayewardenepura) on 4 March 2015 at Vidyakara Balika Navodya Vidyalaya, Maharagama for over 200 students and several teachers. An interesting discussion followed the presentation, demonstrating the interest and enthusiasm created among the children.

Dr Jayantha Lanel (Department of Mathematics, University of Sri Jayewardenepura) served as the resource person at a workshop on **'Scientific writing using Latex'** conducted on 21 March 2015 at the Mathematics Laboratory, University of Sri Jayewardenepura with the participation of 40 final year undergraduate students. The aim of the workshop was to improve skills related to writing of scientific reports, theses, etc. using the Latex software package.

Mrs Dinushiya S Rodrigo (Department of Mathematics, University of Sri Jayewardenepura) conducted a seminar on **'Combined Mathematics for Advanced Level students'** on 6 June 2015, for 50 students, at Mahinda Rajapaksha Vidyalaya, Homagama, The seminar covered the topic **'Simple harmonic motion'** which is considered by students, to be a difficult area in the A/L Mathematics curriculum.

Section E2

The following workshops were conducted:

(i) '**Freeware for higher education and research**' on 10 April 2015 at the Department of Chemistry, University of Kelaniya for undergraduate and postgraduate students. Resource persons were: Drs. Sashi Vithanarachchi, Samantha Weerasinghe and Aashani Tillekaratne (Department of Chemistry, University of Colombo).

(ii) For G C E A/L students of Kelaniya, undergraduates and staff of the Faculty of Science, University of Kelaniya on 5 May 2015 at the Chemistry lecture theatre of the Faculty. Resource persons: Mr Rohan Pallewatte and Dr Himesh Fernando. The goal was to inspire school children and undergraduates to engage in science and be entrepreneurs.

(iii) G C E A/L Chemistry teacher training workshop for the teachers in the Ratnapura District on 7 and 8 May 2015 at Eheliyagoda Central College, Ratnapura. Resource persons were Drs. Jeewantha Premaratne, Sri Skandaraja, Aashani Tillekaratne, Dinesh Pandithavidana and Sashi Vithanarachchi.

(iv) '**Value addition and commercialization of natural resources for economic development in Sri Lanka**' on 4 June 2015 at the SLAAS Headquarters. The Chief Guest, Mr Rizvi Zaheed (Managing Director, Hayleys Agriculture Holdings Ltd., Executive Director, Hayleys PLC) and the Keynote speaker Prof Veranja Karunaratne (Senior Professor in Chemistry, University of Peradeniya; Associate Director, Science and Strategic Relations, SLINTEC) highlighted the key aspects that need to be addressed to improve the revenue generated for our natural resources and gave examples where value addition to natural resources have been successful. The distinguished panel of resource persons, namely, Mr Udena Wickremesooriya (Director, Brandix Lanka Limited), Prof Vijaya Kumar (President, NASSL; President, Science Council of Asia), Dr Uthuman Farook, (Chief Operating Officer, Dankotuwa Porcelain PLC, Royal Fernwood Porcelain Ltd.), Dr Upul Ratnayake (Head, Raw Rubber Process Development & Chemical Engineering, Rubber Research Institute, Sri Lanka), Prof Ajith de Alwis (Professor of Chemical and Process Engineering, University of Moratuwa), Dr Anushka Wijesinha

(Special Advisor on Industrial Policy and Youth Entrepreneurship to the Minister of Industry and Commerce) and Prof Namal Priyantha (Senior Professor in Chemistry, University of Peradeniya) gave insights about various natural resources of Sri Lanka, the current status and on how to improve them in a technologically and economically viable manner. About 75 participants attended the workshop from various industries and institutions.

A seminar for G C E A/L students of Pinnawala Central College was conducted by Dr Sri Skandaraja on 6 April 2015.

Dr Nilwala Kottegoda was the Chief Guest at the Science Day Programme of Gankanda Central College, Gangkanda on 31 April 2015 and she delivered a lecture on **'Nanotechnology'** on this occasion.

Section E2 donated chemicals to the Science Section of Gurukanda Maha Vidyalaya, Iduruwa on 7 July 2015. At this event, Dr Theshini Perera gave a talk on **'The importance of engaging in science'** and Dr M N Kaumal organized an activity to encourage innovative thinking in young minds.




Section F

A panel discussion on the **'19th Amendment'** was held on 9 April 2015 at the SLAAS Auditorium. The panelists, Prof Sumanasiri Liyanage and Mr Manohara de Silva (President's Counsel), made brief presentations on the shortcomings of the then proposed 19th Amendment, which were followed by a discussion with audience participation.

Prof K Karunathilake (Professor in Sociology, University of Kelaniya), delivered a lecture on **'Political culture of Sri Lanka: An analysis of citizens' role in politics'** on 29 April 2015. The lecture was based on a pioneering study in this context conducted with the support of People's Action for Free and Fair Elections.

A **'Members meeting'** of Section F, was called based on a proposal by Dr S Weligamage on 8 May 2015. The objectives were to discuss current activities of Section F, and to obtain the opinion of its members to plan future programmes. The possibility of increasing the subjects covered by Section F under Social Sciences, involvement of more people in the activities by selecting topics of interest, the importance of discussions, the improved Google group of the section and conducting a workshop with members were discussed. Many recent past Presidents of the Section participated in the discussion.

Environment Committee

A Panel discussion on **'Ex-situ conservation'** was held on 1 April 2015 at the SLAAS Headquarters. The resource persons were Dr Siril Wijesundara (Former Director General, National Botanic Gardens), Dr D H P Peramunegama (Director General, National Botanic Gardens), Prof. Devaka Weerakoon (Department of Zoology, University of Colombo), Mr A S U Liyanage (Plant Genetic Resource Centre), Dr U K L Pieris (Deputy Director, Department of Wildlife Conservation) and Mr Leel Randeni

(Environment Management Officer, Biodiversity Secretariat, Ministry of Mahaweli Development & Environment).

A school programme on '**Water and waste management methods**' was held at Sri Sadhdharmodaya Maha Vidyalaya, Colombo on 28 July 2015. Resource persons: Mr R M S Ratnayake (Water Resources Board), Dr Budhdhika Arukgoda and Dr Janaki Saparamadu (The Open University of Sri Lanka) and Dr Deepa Gunasekara (Faculty of Medicine, University of Kelaniya). The topics covered were, **'Water conservation', 'Water and waste utilization', 'Vermicompost preparation'** and **'Importance of clean water consumption'**. On this occasion several composting bins were donated to the school.

Science Education Committee

A workshop on **'Science projects for G.C.E A/L students'** was conducted to improve the quality of science projects carried out by G C E A/L student, on 26 June 2015 at the SLAAS Headquarters. 103 students and 22 teachers from 12 schools in the Colombo and Gampaha districts participated. Profs. Ruchira Cumaranatunga, W Abeyewickreme, D Tantrigoda, Janitha Liyanage, Chandrani Wijeyaratne and Hema Pathiana served as resource persons.

General Research Committee

A seminar entitled, **'Scientific Research: Planning, Implementation and Dissemination'** was held on 4 April 2015, at the auditorium of the Staff Development Centre, University of Jaffna, for 35 participants. Presentations were made by Prof Kamal Gunaherath (**Research proposal writing**), Dr M C M Iqbal (**Methodology in scientific research**), Prof Chandrani Wijeyarathna (**Ethics in scientific research**), Dr Asoka Ramanayake (**Role of statistics in research**) and Prof Sumedha Jayanetti (**Effective ways of writing research publications**). Prof J C N Rajendra made arrangements to conduct the seminar by coordinating with Prof P Ravirajan, Director, Staff Development Centre, University of Jaffna.

Committee for the Popularization of Science

The first of the **medicinal plant garden (MPG) programmes** for 2015 was conducted at Andarewewa Vidyalaya, Hambantota on 15 May 2015 by Dr R M Dharmadasa.

Science Day Programmes (SDP): The second in the series was conducted on 11 May 2015 at Walisinghe Harishchandra Maha Vidyalaya, Anuradhapura for approximately 300 students from 17 schools. As before, lectures, interactive sessions, science quizzes and poster competitions on current issues were held. Resource persons: Drs. J M J K Jayasinghe, A K Chandana, Mudith D Senarath-Yapa (JKF), Charitha Goonasekera, Prasanna Galhena, Chamari Hettiarachchi, Bandunee C L Athapattu and Ms Nadee Jayaweera (JKF).

The third SDP was conducted on 22 June 2015 at Mahanama Central College, Monaragala with the participation of approximately 200 students from 14 schools in the district. Resource persons: Drs. J M J K Jayasinghe, A K Chandana, Mudith D Senarath-Yapa (JKF), Charitha Goonasekera, Chamari Hettiarachchi, Thusitha Wikramasinghe, Prof E Wikramanayaka, Mr Gamunu Gunatilake, and Ms Nadee Jayaweera (JKF). Financial support to conduct these SDPs was provided by John Keells Foundation, and the refreshments were provided by Fonterra Lanka (Pvt) Ltd & Ceylon Biscuits Ltd.

Prof Chandana Jayaratne in collaboration with the National Institute of Education (NIE) and Astronomical Association of the University of Colombo conducted an **Astronomy programme** at the NIE for approximately 150 teachers, on 15 May 2015.

Two workshops on **nature diaries programmes** were held for the school teachers in Matale and Polonnaruwa districts. These training sessions were organized and conducted by Prof Deepal Mathew and Prof Jayantha Wijeyaratne.

Annual Sessions 2015

Date : 30 November - 04 December 2015

Venue : Faculty of Applied Sciences,
University of Sri Jayewardenepura

Annual Dinner : On Golden Pond, Taj Samudra Hotel

Membership News

- Prof Lal Jayakody was appointed as Chairman, National Medicines Regulatory Authority
- Prof M M M Najim was appointed as Vice Chancellor, South Eastern University of Sri Lanka

Hon. Bernard Soysa Memorial Oration - 2015 will be delivered by Prof Narada Warnasuriya, on Tuesday 25 August at 5 p m at the SLAAS Auditorium, on the topic **'Bernard Soysa: Case study of a professional politician'**.