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news and views of
Kerala Academy of Sciences
www.keralaacademyofsciences.net

Upcoming Events
- Infosys Science Lectures
- KAS - Silver Jubilee Lectures
- FAS Conferring Ceremony

Kerala Academy of Sciences
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Kerala Academy of Sciences is a premier professional body of scientists and academicians, instituted in 1989, primarily for the promotion of teaching and research in various branches of science, for conducting seminars and workshops and creating multidisciplinary integrated approach towards popularization of science in the state of Kerala. The Academy derives its memberships from the cream of science professionals, technologists, physicians and academicians in the State. At present the Academy has six honorary Fellows-Dr.P.K Iyengar,Dr.K.Kasturirangan,Dr.M.S.Swaminathan, Dr. M.S Valiathan, Dr. Varghese Kurien and Dr. G. Madhavan Nair, thirty one Fellows and around three hundred and fifty life members.

Executive Council members

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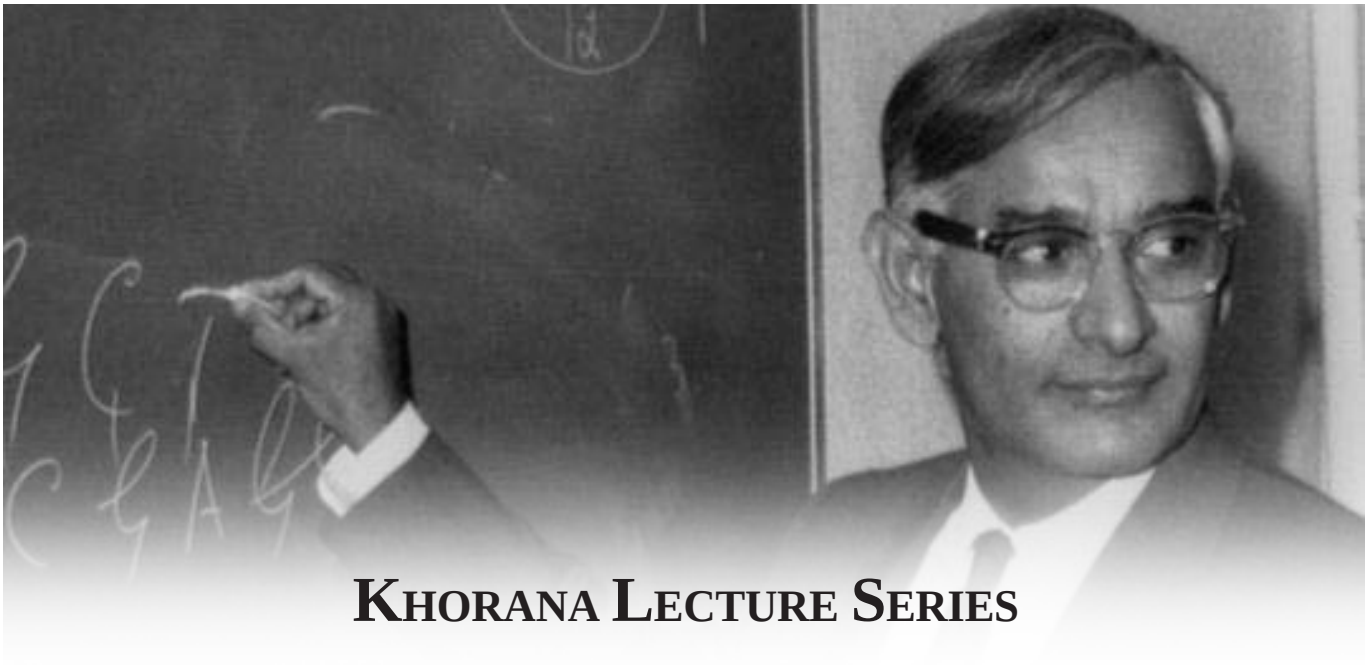


KHORANA LECTURE SERIES

EXECUTIVE SUMMARY

As part of the science popularization initiatives of the Kerala Academy of Sciences, the Academy has sought financial assistance from the Kerala State Council for Science, Technology and Environment KSCSTE to implement a programme designed to enthuse higher secondary school students to consider science as a career path by submitting a project proposal. This proposal was accepted, with modifications, by the KSCSTE and was designated as "Khorana Lecture Series".

KSCSTE approved a grant of Rs. 20,00,000.00 for its implementation during a period of one year. The Academy inaugurated the programme on 30 Dec 2011 and the KSCSTE released an amount of Rs. 1,00,000.00 as the first installment of the grant on Jan 04, 2012.

Subsequent to a review of the programme held on 17 Aug 2012, the KSCSTE released an amount of Rs. 1,00,000.00 as the second installment on Dec 17, 2012. Meantime, upon a request from the Academy, the KSCSTE has also sanctioned the extension of the programme to 31 Jun 2013.

The format of the Khorana Lecture Series (KLS) consisted of delivering lectures to higher secondary school students at various districts of Kerala. The focus of the programme was focused on XIth grade school students, with the aim of projecting science as a career path for the students. The lectures were delivered by experts drawn from state and central Universities, VSSC, NIIST, IISER, JNTBGRI, MSSRF, KFRI, MBG, KSBB, KSBC, govt. engineering and post graduate science colleges and NGOs that are active in dissemination of scientific knowledge and temper.

In addition to the lectures by practitioners of science and technology, the KLS programme included an interactive session of the students with the resource persons subsequent to the lectures. The prograame was conducted in selected centres of Kerala, with special attention to the northern districts.

As part of the KLS programme, nine lecture sessions were conducted, including the inaugural and valedictory sessions both of which were organized at the Conference Hall of the KSCSTE. The out-station sessions were conducted at two venues in Kozhikode, Kattapana, Thalasery, Kasargod, Peechi and Manarkad. There were multiple lectures per session, generally lasting 3-4 hrs. A local organizing group was identified and entrusted with the task of publicity, sending invitations to schools, local press release and organization. The resource persons included those from the locality as well as members of the Academy. The theme of the lectures also touched upon the avenues, opportunities and scope of science as a career, with the resource persons serving as role models at several instances.

Enthusiastic participation of the students in the interactive session was the event at each venue. Subsequent feedback was satisfying, with several students expressing a strong desire to possibly opt science as a career choice. On several occasions, the guardians or parents present also voiced their support for the desire expressed by their wards to look up to science as a career.

B. Future Plan of Action and Recommendations

On the basis of the experience garnered during the conduct of the KLS science popularization programme, the Academy puts forward the following action plan for future and suggests the following recommendations:

i Since it became quite evident that there is much innate enthusiasm among XIth grade students to consider a career in science, they should:

a. be provided with guidance on how to achieve their desire

b. be allowed to experience the work environment and daily routine of a scientist / technologist at first hand and

c. have an access to information pertaining to the opportunities in and the rewards of a science-based career.

ii. Based on the on-site verbal and email feedback, response and enthusiasm, the interactive sessions with practicing scientists appear as the high-point in each session. Consequently, a team of scientists/technologists willing to contribute their time and effort to popularize the message of science as an attractive career option should be identified and provided with support to meet with higher secondary school students in XIth grade all across Kerala. The presence of person-of-the soil resource persons was seen to enthrall the student audience and hence such personalities should be identified to interact with the students at each local venue.

iii. The Academy recommends that the venue of similar programmes in future preferentially be at locations away from the major city areas. Students from such locations appeared more in need of science-related information avenues, exposure to the world of science and opportunities, including financial support, for further education in science.

The Audience at the inauguration of Khorana Lecture Series, Sasthra Bhavan.

EVP. Prof. Dr. V.N. Rajasekharan Pillai, Dr. A. D. Damodaran and Prof. Dr. A. Jayakrishnan

Khorana Lecture Series KLS III at Regional Science Centre

Mr Shanneth, VSSC, delivering the lecture at MSSRF, Kalpatta

KERALA ACADEMY OF SCIENCES- KHORANA LECTURE SERIES

Future of Chemistry - Green Chemistry

K. N. Rajasekharan, UGC-BSR Faculty Professor at the Dept. of Chemistry,
University of Kerala. Email: rajkn_1951@yahoo.com

INTRODUCTION

As a science, chemistry has made significant contributions to the welfare of the mankind. These contributions have been accompanied, unfortunately, by several instances of undesirable consequences as well. Among these, the pollution caused by the chemical industry, the human tragedies that arose from disasters connected with chemical industry, the misuse of drugs, pesticides, insecticides and fertilizers and the environmental degradation caused by the release of toxic chemicals are prominent in establishing a mental picture in public mind that connects chemistry with hazard. Thus, chemistry seems to have attained an overall hue of "red" in public mind. Though the fault lies more with the practitioners of chemistry and chemical technology, than that of chemistry per se, a remedy to this rather serious issue, connected with the human existence as a whole, has come up in the last few decades. This approach, fashioned by chemists themselves, who have been concerned with undesirable consequences of the practice of chemistry in the past, is based on a line of thinking that it is possible to counter, as well as to reverse, all, or most of, the undesirable consequences mentioned above by a conscious effort by chemists and chemical technologists themselves. This thought process has now been condensed into a concept of "greening" chemistry by making it inherently environment-friendly, and hazard free, in its practice. The efforts in this direction has now spawned a new area in chemistry that is focused on reducing chemical pollution, minimizing the generation of chemical waste, adopting safer processes in chemical manufacture and developing safer chemicals for use in all spheres of human activity. This fast developing area in chemistry and chemical technology has now been referred to "Green Chemistry".

THE DAWN OF GREEN CHEMISTRY AND ITS PRINCIPLES

Green chemistry has many aliases; it has been called environment-friendly chemistry, benign chemistry, sustainable chemistry and so forth. It did not arrive all of a sudden in the realm of chemistry; rather, its birth may be compared to an agglomeration process in which ideas that were discussed in a disconnected manner coalesced into a theme. The theme was that chemists can proactively take steps to remedy the current pitfalls in the art, science and practice of chemistry and thus to salvage the reputation of chemistry. This can be achieved by a conscious effort to reduce the chemical pollution, to design molecules that are inherently less toxic, to lessen the hazards associated with the practice of chemistry at all levels and to use renewable materials so as to incorporate sustainability in chemical manufacture.

In the early 1990s, scientists in the USA became aware that new approaches were needed for the reduction and prevention of pollution since legislations such as Pollution Prevention Act of 1990 of the USA had not produced the desired results. This led to the scientists at the Industrial Chemistry Branch of the EPA, headed by Paul T. Anastas, to evolve concepts that later paved the way for green chemistry. It was felt that the EPA regulations, mostly concerned with end of the chemical manufacture pipeline, and the subsequent pollution clean-up, were not effective enough. Rather, preventing pollution could better be achieved if this issue could be tackled at the beginning and not at the process end. The advent of green chemistry can thus be traced to the 1990s and often the credit has been attributed to Paul T. Anastas and Jack C. Warner who pioneered the thinking in this area which later appeared in their land mark book entitled "Green Chemistry: Theory and Practice" published in 1998. According to these path breaking scientists, green chemistry can simply be termed as the safe practice of chemistry with attention to the reduction of chemical waste by proper process design, the lowering of the hazards associated with the use and manufacture and the use of renewable resources.

THE NEED FOR GREEN CHEMISTRY

The galloping rise in world population is projected to hit 10 billion in another forty years and the ensuing higher demands for products of all sorts would multiple the global chemical manufacture requirement; the current annual world-wide prouction being over 4000 million tons. The current chemical manufacture is highly dependent on nonrenewable natural resources that are fast dwindling. The global environment has already been severely damaged, instances of chemical industry disasters have been many and overall chemical pollution of the globe has reached alarming levels. Unless attempts to remedy the situation are initiated at a war footing, the future of earth will be even more jeopardized as it is now.

THE PRINCIPLES OF GREEN CHEMISTRY

The concepts of green chemistry have been enshrined into a set of principles. This set of twelve principles was enunciated by Anastas and Warner and are discussed in detail in their book. [Anastas , P.T. , and Warner , J.C., Green Chemistry: Theory and Practice , 1998, OUP]. These twelve principles can be succinctly stated as: 1. pollution prevention at source and not at the end; 2. less wastage by better atom economy; 3. reduction of chemical hazard; 4. design of safer chemical entities; 5. use of safer solvents and reagents; 6. design for and practice of energy efficiency; 7. switch over to renewable feed stocks; 8. reduction of derivatization and other avoidable chemical steps 9. preference to the use of catalysis 10. molecular design that incorporate safe degradation after use; 11. real-time monitoring to avoid unexpected disasters and 12. adoption of safer processes for accident prevention.

According to Anastas and Warner, green chemistry is "the utilization of a set of principles that reduces or eliminates the use or generation of hazardous substances in the design, manufacture and application of chemical products." In simple terms, these guiding principles may be described a set of directives to be followed in the practice of chemistry by which (i) chemical waste generation is to be prevented at source and not to be attempted as a post-process clean-up exercise, (ii) the efficient use of chemicals and reagents is to be promoted with an eye to atom economy so that most of the atoms in the starting material(s) gets

Future of Chemistry - Green Chemistry

incorporated in to the final product, (iii) hazard-free, enviro-friendly chemical processes are to be designed or existing chemical reactions to be so modified by "greening" these, (iv) the development of safer alternatives to useful molecules, but having some toxicity, is to be promoted, (v) the diversification of the feedstocks to renewables is to be preferred, (vi) the more efficient use and conservation of energy are to be implemented, (vii) the minimization and optimization of chemical steps in a process, the introduction of better catalysts and catalyzed reactions and the option of safer self-destruction at the end of use in chemicals are to be considered at the initial planning stage and (viii) the real-time monitoring of processes to prevent chemical accidents and spillage.

THE ROLE OF GREEN CHEMISTS AND TECHNOLOGISTS

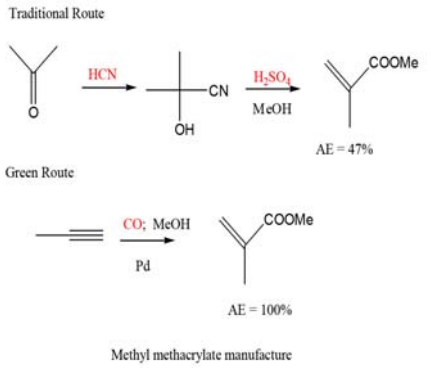
A perusal of the twelve principles of green chemistry shows that there is ample scope for green chemists and technologists for greening of the existing reactions and processes. The scope for improvement is not confined to a manufacture scenario. Instead, one can think of adopting green chemistry principles in a research and development laboratory, in a school or college teaching laboratory, in a commercial clinical or industrial laboratory and thus the possibilities are numerous. Realizing the vastness of its scope, it may be pointed out that the concept of green chemistry is in fact a new mind set which marks a paradigm shift from the well-entrenched practices of chemistry in a traditional setting. Newer concepts such as green auditing and green accounting, at every step of a process, are being developed.

EXAMPLES OF GREEN CHEMISTS IN ACTION

Several industrial processes have now been redesigned or developed to suit the green outlook and a few typical example are presented below.

1. Example of improved atom economy

Methyl methacrylate manufacture by traditional and green routes are shown below along with the respective atom economy AE of these two routes [Cann, M. C. & Connelly, M. E., Real World Cases in Green Chemistry, ACS, 2000, pp. 11–49]



Methyl methacrylate manufacture

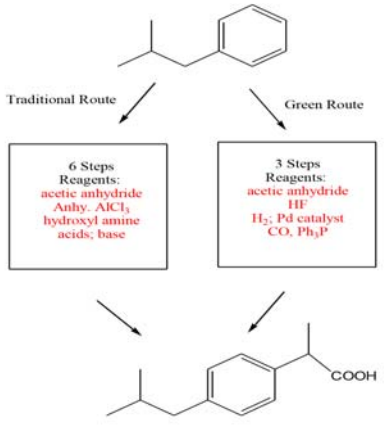
2. Example in day-to-day life

Use of supercritical carbon dioxide SCF-CO2 for dry cleaning in place of traditional chlorinated organic solvents.

3. Example from research laboratory

The use of anhy. $AlCl_3$ can be supplanted by switching over to solid acids such as clays and zeolites. Several such examples have been reported by researchers, including those from NIIST, Thiruvananthapuram. In another typical example, developed in the author's research laboratory, it has been shown that an α, α unsaturated methyl ketones such as a methyl oxystyryl ketones, can be safely and chemoselectively brominated by supported copper bromide, thus avoiding the use of anhy. aluminium chloride, flammable solvent diethyl ether and the hazardous liquid bromine.

4. Example from drug manufacture



Ibuprofen manufacture

The widely used analgesic ibuprofen has been manufactured by the traditional six step process developed by Boots Pure Drug Company. This route uses stoichiometric reagents, and has a low overall AE. It results in much chemical waste formation due to the use of $AlCl_3$; acids and bases. In stark contrast, the green Boots-Hoechst-Celanese process, has three catalytic steps, the HF is fully reused and the last two steps are 100% AE.

5. Examples of the use of renewable feed stocks

Renewable resources for chemical manufacture include biomass from which biodiesel consisting of methyl esters of fatty acids, ethanol for supplementing petrol, , lactic acid to produce biodegradable polymers, succinic acid and levulinic acid to make complex organics can be sourced.

6. Example of the use of safe solvents or alternative energy sources.

Organic synthesis has traditionally been carried out in organic solvents; however, water has now emerged as an alternative; water being the greenest of all solvents. In addition to this safety aspect, speeding up of reactions has also been observed in this most benign of all solvents. Supercritical water has also been emerged as a very useful solvent. Attempts to develop solvent-less synthetic routes also receive much attention currently. Regarding energy input for driving a chemical reaction, newer approaches include the use of microwave and ultra sound, in addition to the well established use of light.

THE FUTURE

Green chemistry has definitively arrived in the world chemical research and manufacture scenario, its impact has already been widely accepted and has even started to extend into related areas such as food sciences and technology, materials sciences and technology and in short, wherever chemicals and solvents are used. In addition to industries governments are also taking up a 'green' approach to move over to a sustainable economy.

Water for Life, Life for Water

Preetha N & *K.P Laladhas, *Member Secretary, Kerala State Biodiversity board, Pallimukku,Thiruvananthapuram.

All life forms depend on Water- the unique resource of planet Earth for food security, health, sanitation and for fostering both urban and rural livelihood. United Nations General Assembly in 2010 recognized safe and clean drinking water and sanitation as a human right which was reconfirmed at the Rio + 20 Summit held in 2012. In accordance with this theme, 2005-2015 was declared as the UN decade of Water for Life, 2013 as International Year of Water Cooperation and the theme for International Day of Biodiversity 2013 as 'Water & Biodiversity'. Globally we are facing a water crisis even though 70% of the Earth surface is covered by water. Of the world's total water resources, less than 3% is represented by freshwater and less than 1% of that occurs in the Earth's liquid surface as fresh water (the remainder is below the planet's surface, or locked in the ice-caps). The overall water demand is projected to increase by 55% by 2050, due to growing demand from industries and service sector, energy generation and domestic use.

Out of the 783 million people worldwide without improved drinking water, India has the dubious distinction of having 97 million. It is a matter of shame to us that in this era of technological advancement globally, an estimated 2,000 children under the age of five die every day from diarrhoeal diseases and of these some 1,800 deaths are linked to water. Diseases transmitted through water or human excrement are the second-leading cause of childhood mortality worldwide, after respiratory diseases. Our water management strategies has lost sight of the fact that the loss and degradation of biodiversity compromised ecosystems and all the services they deliver, especially the supply of clean drinking water.

Forests, grasslands, wetlands, rivers, lakes, swamps, floodplains and aquifers are all interlinked in the hydrological cycle. Biodiversity is critical to sustain the water cycle as wetlands replenish ground water, rivers transport it, forests sustain quality of water, mangroves and coral reefs provide coastal protection.

A new global Strategic Plan for Biodiversity now recognizes water as an important ecosystem service and water is widely regarded to be the primary global natural resource challenge and a key link between the Millennium Development Goals (MDGs) and Biodiversity.

Biodiversity and water resources management

Biodiversity augments the ability of nature to supply drinking water by sustaining the continuous recycling of water, and by purifying water. Sustainable water management promotes an integrated management of land, water, and living resources for conservation and sustainable use in an equitable way. Rain Water Harvesting, Sustainable Ground Water Recharge, Maintenance of Water Balance, Preventing Water Pollution and Economic use of water are all integral parts of this.

At least one-third of the world's largest cities obtain a significant portion of their drinking water directly from forested protected areas. The water-related ecosystem services provided by forests, include water provisioning, regulation of water flows, water purification and erosion prevention. Forests directly control hydrological cycles by its influence on rates of transpiration and evaporation and by influencing how water is stored in a watershed. The terrestrial ecosystems on the upstream of a river basin are important in the context of rainwater harvesting, groundwater recharge and for maintaining the stream flows.

The National Forest Commission report 2006 indicated that around 41 per cent of total forest in the country is already degraded, 70 per cent of the forests have no natural regeneration capacity. The forest cover under natural vegetation has decreased with adverse consequences on Biodiversity and the ecosystem services it provides. Deforestation, changes in land use, degradation of catchment areas of rivers and unplanned development are major causes of imbalance affecting the natural flow of rivers,

Wetlands help regulate the water cycle, providing a natural water source for direct human use and as wastewater treatment systems for many towns and cities. They act as carbon sinks, provide protection from floods, regulate sediment transport, and contribute to groundwater replenishment and nutrient retention. They help in retaining water during dry period, maintaining the water table stable and reduce flood levels. Wetlands are important feeding, breeding, and drinking areas for wildlife. Wetland plants remove toxic substances, such as heavy metals, from water. But deplorably India has lost more than 38% of its wetlands in just the last decade. Minor irrigation systems – tanks, ponds and other community-based water harvesting systems also play a critical role in the recharge of groundwater. Sadly these traditional aquifers are neglected and serve as just dumping grounds for waste.

It is high time that Water resources management of the country take into consideration Nature based sustainable solutions. Physical infrastructure (dams, water-treatment facilities) has contributed to improving drinking water supply needs but it has to be integrated with an ecosystem approach for sustainable growth. Ecosystem based water filtration and provision of water, including aquifer recharge, should be made a part of integrated management planning.

Activities of the Academy

Dr K.G.Ajit Kumar, General Secretary, KAS.

PRESENTED AT THE GENERAL BODY MEETING ON JUNE 22.6.2013
FOR THE PERIOD 1ST OCT 2010 TO 31ST MAY 2013

Respected President,Distinguished Fellows and Esteemed members of the Academy:

On behalf of the Executive Council of the Academy, may I present the report of the activities of the Academy for the period of 1/10/2010 to 31/5/2013 for discussion and approval:

The General Body of the Academy in its meeting held on 25 Sept 2010 approved the Annual Report and the audited accounts for the period 01/03/2008 to 31/07/2010 and elected the six office bearers and the members of the executive council. The Elected General Secretary resigned and informed the President his inability to continue in the post due to personal reasons and subsequently the Executive Council held on 4th November 2011 decided to give the charge to Dr.K.G. Ajit kumar Joint Secretary as the General Secretary.

Condolences

During the period under consideration, the Academy had to bear the irreplaceable loss two of its Honorary Members, Dr. P. K. Iyengar and Dr. Varghese Kurien. The Academy has expressed its deep condolences at these losses and also at the demise of the Nobel Laureate Prof. Dr. Hargobind Khorana.

Membership and Chapter Formation

The Academy has added 73 new life members to its rolls since Sep 2010 and at present, the Life Member Roll of the Academy stands now at 299.

A new regional chapter was inaugurated at Kozhikode during a function held at Malabar Botanical Gardens by the Vice Chancellor, University of Calicut. Efforts were made to activate the existing regional Chapter at CUSAT.

Activities

I. Executive Council meetings

The Executive Council held 6 meetings for discussion and planning of the activities of the Academy.

II. Khorana Lecture Series.

The Academy with its stated objective of "creating an integrated approach towards popularization of science in the state of Kerala" has organized a series of lectures during Dec 2011-mar 2013 at different districts of Kerala with the generous financial support of Kerala State Council for Science, Technology and Environment, KSCSTE. This series of lectures and scientist-interactive sessions were conducted with the intention of enthusing higher secondary school students to take up science as a career. The KLS were held at Sasthra Bhavan Thiruvananthapuram (30/12/2011; KLS1), Malabar Botanical Gardens, (KLS2; 27/6/2012), Regional Science Centre, Kozhikode (27/6/2012; KLS3), M. S. Swaminathan Research Foundation, Kalpata, Wayanad (9/11/12; KLS4), St. Joseph H. S. School Thalasery (15/2/13; KLS.5), Govt. College Kasargod, (16/2/13; KLS.6), KFRI, Peechi (1/3/13; KLS.7) and H. S. School, Kottayam (9/3/13; KLS.8).

The Lectures were delivered by Dr. A. D. Damodaran, Prof. Dr. V.N.Rajasekhara Pillai Executive VicePresident, KSCSTE, Prof. Dr. Jayakrishnan, Vice Chancellor, Kerala University, Prof(Dr.)Abdul Salam, Vice chancellor University of Calicut Dr. A. Ajaya Ghosh (NIIST), Prof.Oommen V Oommen,Chairman KSBB, Prof. K.N.Rajasekharan, Dr.. Gauri VSSC, Shaneeth (VSSC), Dr. N. Anil Kumar, (MSSRF), Dr. Pradeep, (TBGRI), Dr. Sabu (Kannur Univ), and V S Ramachandran, Dir., RegionalScience Centre Calicut, Prof. Dr. M. Haridas (Kannur Univ), Dr.L.Divya (CUK, Kasargod), Prof.(Dr).P.V.Madhusudanan (Malabar Botanic Garden) ,Dr.R.Prakashkumar (Malabar Botanic Garden),Dr.James Jacob, Director, (Rubber Research Institute of India Kottayam).

The speakers were successful in conveying to the students that a career in science offers much personal satisfaction and an opportunity for a life long voyage of innovation, discovery, learning and hands-on experimentation.

As part of the series, an interactive session with the +1 students and the scientists was arranged which evoked much enthusiasm by the student participants and media attention. In addition, an essay

Water for Life, Life for Water

Conclusions

The root cause of deteriorating water quality and decreased water availability is a degraded ecosystem; thus ecosystem should be viewed as a "natural infrastructure", an asset to be managed wisely for sustainable development. The inter-connected web of terrestrial and aquatic ecosystems has to be conserved properly to serve as an 'environmental reserve' for water security. Conservation of Traditional aquifers, river basins, water sheds and implementation of an ecosystem based water management system is necessary for ensuring water security in the coming decades. Water management should be based on a participatory approach, involving users, planners and policymakers at all levels and it is high time that we prioritize our water management strategies. Where ecosystems degrade, biodiversity is lost and so is the precious natural resource "Water" that sustains life.

competition was held at each of the venues for the participating 11th grade students and two of the best performers were selected from each venue based on the essays by an evaluating team which consisted of Dr P. R. Sudhakaran and Dr.K. N. Rajasekharan. These students, designated as Khorana Young Scientists, have been invited, with guardian, for a visit to JNTBGRI, VSSC,RGCB and other research institutions and to attend the valedictory KLS function held on 22nd June 2013 forenoon.

These well attended successful events highlights the enthusiastic acceptance of the Programme by the target student group. The Academy could also, in the course of KLS programme, add several Life Members and could carry the banner of KAS to several places in North Kerala.

III.Workshops, Symposia, Seminars and Lectures

Foundation Day Celebration 2011.

KAS organised Founders day in Hotel Pankaj. The day is celebrated with an event "Frontiers in Science". The eminent speakers to address the KAS members are:Prof.C.G.Ramachandran Nair

1. Prof.A.Jayakrishnan, Vice Chancellor, University of Kerala.

2. Prof. M.Radhakrishna Pillai, Director, RGCB.

3. Mr. Shaneeth, Scientist, VSSC.

IV. Discussion with State Planning Board

KAS participated in the interaction meeting on the approach paper on 12th Five year Plan by Kerala State Planning Board with professional bodies. This was facilitated by Trivandrum Management Association and was held on 29th November 2011 in Mascot Hotel, Thiruvananthapuram. Dr. K.G.Ajitkumar , General Secretary, Dr. Rajasekharan K. N and Shri Shaneeth M, EC member participated in the event and made a presentation on the status and plans for science education and career in the state. Later, on invitation from the board, a detailed document on the subject was prepared and submitted to Planning board, in a one-to-one meeting.

Senior scientist of KAS and former presidents and secretaries were present along with the present Office bears.

V . Foundation Day Celebration 2012

KAS organised a seminar on "Traditional Knowledge , biodiversity and human welfare "as part of Founders day,held on 14th November 2012. Prof. Augusti, Dr. C. S. P.Iyer, Prof. K.T Pillai, Prof.V. N. R,Mrs.(Dr.) RadhaDas, Prof.P.R.Sudhakaran, Dr.Anilkumar,Prof.OommenV.Oommen, President,Dr.K.N.Rajasekharan, Dr.K.K.Ramachandran, Dr.K.G.AjitKumar, Dr.Sudha and Dr.Gouri were present. Research scholars, post graduate students from Kerala University departments and different colleges attended the programme. Dr.K.K.Ramachandran member secretary KSCSTE offered a special section in the 24th Kerala Science congress at RRII, Kottayam during the occasion. The meeting commerate contributions of the Scientist Hargobind Khorana to science.

VI. Session at 24th Kerala Science Congress

The Academy organized a special session in the 24th Kerala Science Congress held at Kottayam. The News letter Scientia was released during the occasion.

VII. Organized a Workshop on Project Formulation and Grant Utilization

Academy organized in association with KSCSTE on 15.02.2012 attended by over 100 PG students, researchers and research supervisors. Dr.Martha Kimball Cathcart, Dept of Cell Biology, Lerner Research,Institute, Cleveland Clinic Foundation, USA served as one of the resource persons.

VIII. Interactive session with Maharaja

KAS in association with British Council, orgasnised an interactive session with Marthanda Varma Maharajha ,Representative from British council, Vice chancellor of University of Kerala Prof. (Dr.) Oommen V.Oommen,President KAS, Dr. K. N. Rajasekharan and Dr.K.G.Ajit Kumar were present.

IX. International Seminar on climate change and sustainable development

In association with the British council, TKM management association and the Kerala Agricultural University, the Academy organized an "International Seminar on climate change and sustainable development" at Kanakakuunnu Palace on 27 Feb 2012.

X. Technical talk on Ribosomes and their functions

KAS in association with University of Kerala, KSCSTE and Dept. of Computational Biology & Bioinformatics, KAS organized an interactive session with Prof. Ada E Yonath,Nobel Laureate in Chemistry were arranged on 7th February 2013

XI. Technical talk on carbon nano tubes by Dr Ijima

A technical talk by Dr Ijima, Japan, Carbon Nano tube fame, was held on March 2nd, 2013. KAS was one of the co-organizers for the event.

Dr. L.Divya of Central Univ. Kerala at KLS VI at Kasaragod

Students listening to Dr.Jayaraj at KFRI

Print Media coverage of Khorana Lecture Series

Number of academy members participated in the event and Prof.Oomman V Oomman ,President KAS felicitated the speaker from academy's side and Dr.K.N.Rajasekharan, Dr.K.G.Ajit Kumar and Sri.Raveendran Pillai, Dr.Hari Narayanan were attended.

XII. Workshop on Apprentice scientist programme

A nationwide programme for school children, Apprentice Scientist was conducted by French School, Pondicherry. KAS was one of the co-organizers for the zonal event held in Hassan Marikkar Hall, along with Rotary Club. Teams from different schools in and around the city participated in the event and they were made to exhibit their skills in conducting scientific experiments and analyzing the observations. Shri Shaneeth M,EC member worked with representatives from French School in conducting the session.Prof.(Dr.) Oommen .V .Oommen, President, KAS presided over the valedictory function where Dr Madhavan Nair ,former chairman ISRO was the chief guest. Dr.K.G Ajit Kumar, Secretary, KAS also participated in the function. The programme was coordinated by Mr. Balagangadharan, KAS

XIII. Discussion with Diplomats from UK

Dr.Oommen .V. Oommen, Dr. Fazil Marickar and Dr. K.G.Ajit Kumar participated in a discussion with the diplomats of UK Foreign and Commonwealth Office, Mr. Greg Shapland, Ms. Heidi Minshall and Ms. Sarah Harper about Kerala's long-standing historical, social, cultural and wider relationship with the Middle East at Hotel Taj Vivanta on Mar 18, 2013. The meeting was organized in association with the Association of British Scholars.

XIV. Major Achievements:

* The banner of the Academy could be taken to places such as Wayanad, Kasargod etc.

* The Khorana Lecture Series programme was well attended and the response from the students was remarkable.

* The membership enrollment has reached nearly 300 due to the exposure received during the KLS programme.

* The website is actively being maintained and all members are requested to update their email IDs by visiting the web site.

* On this occasion, I wish to place on record with sincere gratitude the support given by KSCSTE very generously for the activities of the Academy including financial support, use of the premises of KSCSTE including this auditorium.

The above achievements are due to the untiring efforts of the President of the Academy working with his sincere involvement despite his other activities such as the Chairman of the Kerala State Biodiversity Board in addition to those of the other office bearers and the members of the Executive Council. In his capacity as the Chairman of the KSBB, he was gracious enough to permit his office to serve as the venue of EC meetings.

I also thank all our esteemed fellows, life members and others at various locations in Kerala who have been of great help in the activities reported above. I use this occasion to welcome new members to our midst. I acknowledge that all shortcomings in my functioning as the general secretary are my responsibility and I am very thankful to all those who have pointed out these.I now humbly place this report for discussion and the approval of the AGM.

Benefits & Hazards of Nanotechnology

Dr. Rajeev R. S., Vikram Sarabhai Space Centre

"COAL AND DIAMONDS, sand and computer chips, cancer and healthy tissue: throughout history, variations in the arrangement of atoms have distinguished the cheap from the cherished, the diseased from the healthy. Arranged one way, atoms make up soil, air, and water; arranged another, they make up ripe strawberries. Arranged one way, they make up homes and fresh air; arranged another they make up ash and smoke." – this is what told by K. Eric Drexler in his all time favorite book, Engines of Creation-the Coming Era of Nanotechnology-one of the five most influential books on nanotechnology. When one is capable of arranging atoms and molecules the way he wants, then we can say that the concept of nanotechnology is fully realized

Dr.Kim Eric Drexler (born April 25, 1955 in Alameda, California) is an American engineer best known for popularizing the potential of molecular nanotechnology (image courtesy, Wikipedia)

Nanotechnology and nature

Nature always amazes us. Even the smallest of living creatures or plants have the highly complex mechanisms yet to be fully understood by mankind. Many of these mechanisms, in fact, are driven by the sophisticated concepts of nanotechnology. Compared to all other modern technologies, nanotechnology is the one which is inspired by the nature the most. Lotus leaves are an amazing example of nature's nanotechnology. The miniscule crystals, which are just one nanometre across, arranged on the surface of the lotus leaves, act as integrated vacuum cleaners- helping the leaves to acquire its own self-cleaning mechanism so that no dirt or bacteria can stay on these leaves-keeping the leaf clean at all times. Scientists have proved, with the help of powerful microscopes such as atomic force microscope that the lotus leaf has two levels of structure giving its self-cleaning behavior – micro-scale bumps and nano-scale hair-like structures – coupled with the leaf's waxy chemical composition. The different varieties of self-cleaning paints, self-cleaning roofs and self-cleaning textiles available in the market are inspired from the self-cleaning mechanism of lotus leaves. The same technology is also used to increase the efficiency

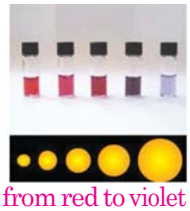
of solar cells by preventing the dirt, which will reduce the efficiency, from accumulating the photovoltaic arrays in solar cell. However, despite these practical applications of nanotechnology, we are yet to learn a lot about the "Lotus Effect". Other examples are the tiny hair-like projections on the feet of the Gecko lizard, which contain nano-sized structures that act as a dry adhesive and give the lizard the ability to walk on walls and ceilings and the pearly internal layer of many mollusk shells, which have evolved through millions of years to a level of optimization which no man-made composites could achieve so far.

Importance of the dimension, "nano"

Self-cleaning nanotechnology on lotus leaves. Nanometer size bumps on a lotus leaf makes its waxy surface extremely water repellent so that raindrops roll easily across the surface, preventing the dirt from sticking on it (image courtesy, www.ecofriend.com)

What is the importance of the length scale "nano"? Many physical and chemical properties of the materials change in the nano regime which can be controlled and tuned to make many useful products and devices. When the size is reduced to nanometer range, there is more number of atoms on the surface than in the bulk. For example, a particle of size 30 nm has 5% of its atoms on its surface, at 10 nm 20% of its atoms, and at 3 nm 50% of its atoms. Thus nanoparticles have a much greater surface area per unit mass compared with larger particles. Atoms in the material surface are highly unstable and very active in a chemical reaction so that increase in the surface area will result in enhanced chemical reaction. That is why gold, an inert material in the bulk form, become highly reactive and acts as catalyst when its size is reduced to nanometers. The colour of the gold nanoparticles changes with their size. Thus, by controlling the size and shape of materials in the nanometer range, revolutionary products, useful for the mankind, can be designed and fabricated, which is the reason for the attraction and fascination of nanotechnology in the scientific and technological world.

The mechanical, thermal, optical, electrical and electronic properties of materials change at the nanoscale. For metals with grain size less than 100 nm, mechanical properties change significantly because of the contribution of grain boundaries. Therefore, novel materials with superior strength and ductility can be developed. Copper, which is a ductile metal, become super-strong when the size of copper nanoparticles is reduced below 50 nm because of the restrictions introduced for free molecular movement. High surface surface-to-volume ratio and the enhanced reactivity thereof can help in the development of superior catalysts (gold, for example), solar cells, batteries and gas sensors. Lower percolation. threshold will increase the conductivity of materials so that efficient thermal and electrical management are possible.Increased hardness as well as wear resistance with decreasing grain size will result in hard coatings and protective layers because of the tribological properties of materials in the nano dimension. Opto-electronics will be immensely benefited due to the narrower band gap with decreasing grain size of nanomaterials.



Size dependent optical properties of gold nanoparticles. Smaller sized particles reflect red light. As the size increases, the colour also changes from red to violet (image courtesy, www.webexhibits.org)

Impact of nanomaterials and nanotechnology

Both the science of nanomaterials and its application- that is nanotechnology- are highly interdisciplinary. Chemists, physicists, and medical doctors are working together with engineers, biologists, and computer scientists to determine the applications and development of nanotechnology where industries such as materials manufacturing, computer manufacturing, and healthcare also contribute. Nanomaterials can be prepared by 'top down' approach where nanoscale structures are produced from larger materials- for example, production of silicon microchips by etching, They may also be constructed by 'bottom up' approach by assembling atom by atom or molecule by molecule- for example, self-assembly, in which the atoms or molecules arrange themselves into a structure due to their natural properties- a phenomenon abundant in Mother Nature.

Growth of crystals for the preparation of semiconductor is an example of self-assembly in laboratory. By using tools such as scanning tunneling microscope or electron beam lithography, self-assembly is possible though currently it is a laborious process. The concepts of nanotechnology promise us improved living standards and more secured life. With superior, lightweight materials realized through nanotechnology, which are ten times stronger than steel at a fraction of its weight, the efficiency, reliability and performance of tanks, air-frames, spacecrafts, skyscrapers, bridges etc can be increased multi-fold. performance of tanks, air-frames, spacecrafts, skyscrapers, bridges etc can be increased multi-fold. Even materials, which can automatically deform the wings to minimize drag can be developed by the combination of different areas of nanotechnology which will improve the fuel efficiency and reliability of aircrafts. Nanocomposites will replace many of the metallic structures currently being used in automobiles, aircrafts and rockets. Materials that not only provide protection, but also store energy and monitor health status of soldiers or astronauts will replace currently used material such as Kevlar. More powerful and smaller computers will encrypt data and provide round-the-clock security. Quantum computers provide better simulations to predict natural disasters and pattern recognition to make biometrics —identification based on personal features such as face recognition — possible. Chemical sensors based on nanotechnology will be so sensitive to sense even a single molecule out of billions which will warn us in advance of airport security breaches or anthrax-laced letters. They can sense different types of gases and molecules in space to make them useful in our interplanetary missions.

Healthcare is one of the areas where nanotechnology has direct impact on mankind. Faster, cheaper and portable diagnostic equipment will be

realized; for example, the concept of lab-on-a-chip is approaching reality to analyze a patient's ailments in an instant, providing testing as well as drug application. Newborn children will have their DNA quickly mapped, pointing out future potential problems, allowing us to curtail disease before it takes hold. Controlled drug delivery has already utilized the concept of nanotechnology where the right amount of medicine will be delivered to the exact spots of the body where it requires. Nanoshells, approximately 100 nm in diameter, will float through the body, attaching only to cancer cells. When excited by a laser beam, these nanoshells will give off heat destroying the tumor cells. Nanotechnology will create biocompatible joint replacements and artery stents having improved toughness and wear resistance that will last the life of the patient instead of having to be replaced every few years.

Two important nanomaterials which revolutionized nanotechnology are carbon nanotube and graphene; both find immense applications in all fields of science and technology. Graphene is considered as the mother of all graphitic forms and the finding that single layer graphene can exist in that form and can have exceptional properties resulted in the Nobel Prize in Physics in 2010. When rolled into tubular form, graphene becomes carbon nanotube, another wonder material which revolutionized the carbon chemistry; when made into the form of a ball, it becomes one of the most stable carbon structures – that is fullerenes, the discovery of which bagged yet another Nobel Prize; when stacked together, they become the conventional, well known, graphite. Initially scientists thought that free-standing form of planar graphene is impossible as it always shows a tendency to roll-up. However, it is now proven that monolayer graphene can exist in the free-standing form even by careful peeling of layers of graphite using a scotch tape. These nanomaterials have exceptional electrical, electronic, thermal and mechanical properties more than that of any known conventional materials like copper, steel, or silicon for the respective areas. Similarly carbon nanotube, which was discovered in 1950s-though not fully understood its real potential at that time- already find applications in many areas including that in electronics and space.

Nanomaterials – current applications

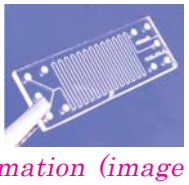
Sunscreens use nanosized TiO_2 and ZnO due to their ability to absorb and reflect ultraviolet rays. It is reported that some companies use nanosized iron oxide in cosmetics such as lipsticks as a pigment though safety concerns are already raised on the use of nanomaterials in cosmetics. An important use of nanoparticles and nanotubes is in composites. Carbon nanotube incorporated polymer composites have increased electrical conductivity so that they can be used in antistatic packaging. Nanoclays, one of the cheapest nanomaterials available, have been used to develop the first commercial polymer nanocomposites based on Nylon-6 in automotives. Coatings with thickness in the nanoscale are used in self-cleaning windows which contain nanometer size TiO_2. Functionally graded nanomaterials are used in scratch-resistant coatings. A range of enhanced textiles, such as breathable, waterproof and stain resistant fabrics, have been enabled by the improved control of porosity at the nanoscale and surface roughness in a variety of polymers and inorganics. Nanosilver is used in such fabrics for anti-microbial activities. Nanosilver is also commercialized in water purification. Silicon and germanium are widely used in semiconductor manufacturing. Calcium oxide based nanomaterials are used in bone replacement and reconstruction.

Hazards of nanomaterials

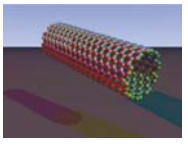
Thus, it can be seen that nanomaterials are now an indispensable part of our daily life. Therefore, awareness about its hazards at various levels -right from production to the final use is of utmost importance. Potential health and environmental impacts of nanomaterials have been discussed by various agencies and appropriate steps are being taken from time to time as more and more information about these materials are evolved. Preliminary animal studies and studies in vitro have shown that some nanomaterials have potential health and environmental hazards, especially in their free standing form. Once they are embedded in a matrix such as in nanocomposites, they are risk-free. However, more studies are required to ascertain the health, safety and environmental effects of nanomaterials. Different agencies are conducting such studies. There are ongoing researches on the hazards of nanoscale metal oxides, carbon nanotubes, fullerenes and quantum dots. The very properties, which make nanoparticles different from other materials, are the reason for their potential health hazards. The high surface area makes them highly reactive. The very reactivity can impart greater toxicity for cells and living organisms. Limited data from preliminary studies in animals have shown that some nanomaterials can accumulate in the lungs and translocate to the blood, to produce inflammatory responses.

Though there are no confirmed reports available on the health, environment and safety hazards of nanomaterials, its use in laboratories and industries should be strictly controlled. Proper protection mechanisms need to be adopted to prevent potential hazards due to these materials. Mother Nature is the beautiful example of co-existence of nanotechnology and living organisms. If we carefully study Mother Nature, we can learn a lot to suitably adapt nanotechnology for the benefit of mankind. Parallely, all safety concerns associated with this technology need to be addressed by carrying out in-depth and systematic studies. Needless to say, nanotechnology is God's own technology, which can revolutionize mankind if it is properly understood and implemented.

Lab-on-a-chip is a device that integrates several laboratory functions on a single chip of only millimeters in size. It requires only very small fluid volume to generate the required information (image courtesy, Wikipedia)



Schematic representation of a single walled carbon nanotube (image courtesy, Wikipedia)



Therapeutic Significance of Minor Fruits

G.S. Unnikrishnan Nair,
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Minor fruits are nature's blessing to mankind. But we hardly realize the value of these fruits. Due to this, these fruit trees and shrubs has been neglected by us. Many of these plants are facing extinction. Ancient systems like Ayurveda has recognized the qualities of these fruits and included them in many medicines. Modern studies are also revealing the properties of these miracle foods. One another important aspect is that these fruit plants mostly grow naturally and fruits are fully organic. Let us go through the benefits that these wonder fruits bestow us.

Common name: West Indian Cherry
Botanical name: *Malpighia punicifolia,* **Family:** Malpighiaceae

One of the richest known sources of vitamin C is the West Indian cherry fruit. It is grown mostly as an ornamental shrub and people are rarely aware of the nutritional qualities. West Indian cherry is a medium-sized tropical evergreen fruit-bearing shrub belonging to the family Malpighiaceae. It is native to the West Indies and North and South America. West Indian cherry grows up to 3 meters, with dense crowns of leaves that are ovate.

The flowers are formed in umbels (a cluster of flowers with stalks of nearly equal length, which spring from about the same point, like the ribs of an umbrella). Each flower is small having diameter 1-1.5 cm with five pink petals. The ripe fruit is bright, containing seeds. It has a sweet and sour taste. West Indian cherry can be propagated using seedlings and by air layering. Pruning once a year prior to monsoon and application of organic manure is recommended. Layers bear fruit in 6 months, while seedlings bear fruit after 2 years of planting. Fruiting is noticed from August to November and April to May.

The juice of the fruit is used as a nutritional supplement in baby foods and in canning and processing industries. With added pectin, excellent jelly, jam and other preserves can also be prepared.

The vitamin C in the fruit acts as an antioxidant. According to the study conducted at Michigan State University, West Indian cherry contains powerful anthocyanins and flavanoids, which can inhibit colon cancer and heart diseases.

Common name: Star Gooseberry
Botanical name: *Phyllanthus acidus,* **Family:** *Euphorbiaceae*

Star gooseberry (Otaheite gooseberry or Tahitian gooseberry) is a curious deciduous fruit tree that was once frequently found in households of South India. It belongs to the family *Euphorbiaceae* and is locally known by the names arinelli, seemanelli and pulinelli. Native to Madagascar, it was spread long ago to India, Southeast Asia and Pacific islands.

The Star gooseberry prefers tropical climate and is grown from seeds and by air layering. It grows 6-9 m in height with spreading branches. The branchlets bear alternate leaves that are ovate or lanceolate in form with short petioles and pointed ends. Leaves are 2-5 cm long, green and smooth on the upper surface, and blue-green on the underside. There are two tiny pointed stipules at base of the each leaf.

Small rosy flowers are male, female and some hermaphrodite. They are borne collectively at leafless parts of the main branches in little clusters. The tree often bears twice a year in South India, first during April-May and second during August- September. The fruits are numerous and oblate with 6 to 8 ribs. They develop very densely to form spectacular masses giving the tree an ornamental appearance. Fruits are pale yellow, waxy, crisp, juicy and sour. There is only one seed in each fruit.

The fruit is eaten raw and pickled in Kerala. In Indonesia, Philippines, Surinam and Bahamas, the fruit flesh is used for flavoring dishes and for making cold drinks, syrup and vinegar. The fruit pulp cooked in sugar yields ruby-red coloured jelly. The young leaves are cooked and eaten in Indonesia. The wood is lightly brown, fine-grained, attractive, moderately hard, strong, tough and long lasting if seasoned.

According to the report published in *Molecular Pharmacology*, a combined study conducted by University of Lisboa, University of Regensburg and Prince of Songkla University proved that an extract from the *Phyllanthus acidus* and its isolated compounds induce airway chloride secretion. A potential treatment for cystic fibrosis (hereditary disorder causes the body to secrete abnormally thick and sticky mucus that clogs the pancreas and the lungs, leading to the problems with breathing and digestion.

In India, Star gooseberry fruits are taken to enrich the blood and as liver tonic. Fruit syrup is prescribed as a stomachic and the seeds promote bowel movement. Because of the mucilaginous nature of leaves, they are taken as a demulcent (having soothing effect on the skin) in cases of gonorrhea. Root poultice is applied to cure psoriasis on the soles of feet.

Common name: Sour sop
Botanical name: *Annona muricata,*
Family: Annonaceae

The Sour sop is usually processed into ice creams, sherbets and drinks but fibers-free varieties are often eaten raw. According to latest research conducted at Catholic University of South Korea, Sour sop also called Graviola fruit is a miraculous natural cancer cell killer. Sour sop was shown to target the cancer cells selectively, leaving healthy cells untouched. Sour sop is a broad-spectrum antimicrobial agent for both bacterial and fungal infections, is effective against internal parasites and worms, lowers high blood pressure and is used for depression, stress and nervous disorders.

A study at Purdue University recently found that leaves of Sour sop tree killed cancer cells among six human cell lines and were especially effective against prostate, pancreatic and lung cancers. Much of the cancer research on graviola focuses on a novel set of phytochemicals called *Annonaceous acetogenins*. Graviola produces these natural compounds in its leaf and stem, bark and fruit seeds. Three separate research groups have isolated these acetogenin compounds in graviola, which have demonstrated significant antitumor and anticancer properties and selective toxicity against various types of cancer cells, without harming healthy cells. Purdue University has filed nine United States and international patents on their work around the antitumor and insecticidal properties and uses of these acetogenins.

All parts of the graviola tree are used in natural medicine in the tropics. Fruit and fruit juice are taken for worms and parasites to cool fevers and as a lactagogue. The crushed seeds are used as a vermifuge and anthelmintic against internal and external parasites, head lice and worms. Bark, leaves and roots are considered sedative, antispasmodic, hypotensive and nervine. Graviola has a long, rich history of indigenous medicinal use. Leaf tea is used for catarrh (inflammation of mucous membranes) and the crushed seed is used to kill parasites. Bark, roots and leaves are also used for diabetes and as a sedative and antispasmodic. Leaf and bark tea is used as a sedative and heart tonic. In the Brazilian Amazon, a leaf tea is used for liver problems. In Jamaica, the fruit and fruit juice is used for fevers, parasites and diarrhea and as a lactagogue.

Common name: Passion Fruit
Botanical name: *Passiflora edulis*
Family: Passifloraceae

Passion fruit is a vigorous vine, found especially in the tropics. The Catholic Bishops who believed that the peculiar shape of its flower is synonymous to the crucifixion of Christ named it.

The corona threads of the passion flower is seen as a symbol of the crown of thorns, the five stamens for wounds, the five petals and five sepals as the 10 apostles (excluding Judas and Peter) and the three stigmas for the nails on the cross. The Hindus of South India consider the stamens of the Passionflower as a symbol of the *pancha pandavas*.

Propagated using vine cuttings, it can grow over 15 feet in a year. The tendrils need support for climbing. There are two types of passion vines, i.e., yellow-fruited and purple-fruited. While both passion fruits possess an oval shape and contain a yellowish flesh, the yellow passion fruit is larger and contains more fruit juice. However, the purple passion fruit is sweeter in taste than the yellow fruit and has a sweet odour. Profuse fruiting is seen during the months of September to November and May to June.

The fruit can be eaten and is often placed as a topping for ice cream, custards and fruit salads. The undiluted juice is an excellent additive to other fruit juices, or it may be drunk as such with water and sugar added to it. Passion fruit can also be used to make jellies and jams. Passion fruit is also used as an ingredient in ice creams, candies, fruit juice concentrates and alcoholic beverages, such as cordials.

Passion fruits provide a good source of fibers, are low in sodium and contain no cholesterol. They also provide a high amount of the vitamins A and C and offer an excellent source of potassium, calcium and iron.

The fruit juice and the leaves of passion fruit contain alkaloids, including Harmine, Harmalol and Harmol, which has blood pressure lowering, sedative and antispasmodic action. It is used in the treatment of insomnia and depression. Passion fruit juice is used for urinary infections and as a mild diuretic.

Common name: Bilimbi
Botanical name: *Averrhoa bilimbi*,
Family: Oxalidaceae

Native to Indonesia, Bilimbi is a tree, which grows about 5-10 m height and is propagated using seeds. The bilimbi prefers a tropical environment and grows well in backyards of South India. The most common use for the fruits is as flavouring for fish and meat dishes. Fruits are also used for beverages and preserves. Half-ripe fruits are salted, set out in the sun and kept for longer use. Squash, wine and pickle are made using bilimbi fruit.The fruit is a rich source of vitamin C. It fights cholesterol and is used as a tonic and laxative. Syrup made from the fruit is used to cure illness arising from jaundice. The fruit is also known to stop internal bleeding in the stomach. In the Philippines, the leaf paste is applied on itches, swellings, rheumatism and on skin eruptions. Leaf infusion is a remedy for coughs

and is taken after childbirth as a tonic. The fruit is given to children as a protection against coughs. Flower infusion is said to be effective against coughs. In Java, the fruits combined with pepper are eaten to cause sweating during fever. The fruit conserve is administered as a treatment for coughs, beriberi and biliousness. Syrup prepared from the fruit is taken as a cure for fever and inflammation, to stop rectal bleeding and alleviate internal hemorrhoids. The fruits and leaves are applied on bites of poisonous insect. The juice is useful for bleaching stains from white clothe and also tarnish from brass.

Common name: Cashew Apple
Botanical name: *Anacardium occidentale,* **Family:** Anacardiaceae

Cashew apple (Cashew Tree-*entalis*) after separating cashew nut is usually wasted but the fact is that it contains 5 times vitamin C as compared to a lemon fruit. Cashew juice, syrup, candy, jam, vinegar, etc. are made using this. Cashew apple is a digestive and aids in control of intestinal worms, diarrhea, body pain and scanty urination.

Cashew apple juice without removal of tannin is prescribed as a remedy for sore throat and chronic dysentery in Cuba and Brazil. In 16th century Brazil, cashew fruits and their juice were taken by Europeans to treat fever, sweeten breath and for stomach. The Tikuna tribe in northwest Amazonia considers the fruit juice medicinal against influenza. A wine made from the fruit is used for dysentery in other parts of the Amazon rainforest. In 1999, researchers reported that cashew fruit exhibited antibacterial activity against the Gram-negative bacterium *Helicobacter pylori*, which is now considered to cause acute gastritis and stomach ulcers. Its effectiveness against ulcers also was documented in two clinical studies. Because of its high amount of vitamin C and mineral salts, cashew fruit is used to remineralize the skin and as a catalyst in the treatment of premature ageing of skin. It is also an effective scalp conditioner and tonic and is often used in shampoos, lotions and scalp creams for conditioning activity of its proteins and mucilage.

Common name: Durian
Botanical name: *Durio zibethinus,* **Family:** Malvaceae

Durian is considered as the King of Tropical Fruits in countries like Malaysia and Singapore. According to them, durian fruit warms up the body. The Japanese believe durian to have aphrodisiac qualities.

Durian means thorny in Indonesian dialect. Thailand and South Vietnam are chief producers. Durian fruits are ovoid-oblong, brownish green, covered with sharp spines and weighs 2.5 to 4 kg. Handling the fruits without gloves can be painful. Inside the fruit, there are five compartments containing the creamy-white flesh and 1 to 7 chestnut-like seeds. The flesh is mostly eaten fresh but is best chilled. The taste is comparable to French custard but flesh of durian has a very nasty odour as that of dirty socks. In Singapore, it is forbidden to carry durian in public transport. Durian fruit is used to flavour a wide variety of dishes like traditional Malay candy- dodol, milk shakes, ice cream, custard, moon cakes and cappuccino. In Java, the sliced seeds are cooked with sugar as a confectionery. In Indonesia, fermented durian is covered in palm leaves and served. The fruit is mixed with rice and sugar to make a dessert called *lempog*. Durian flesh is canned in syrup for export.

Durian fruit contains a high amount of sugar, vitamin C, potassium and the amino acid tryptophan. It is a good source of carbohydrates, proteins and fats and has no cholesterol. The odour of the flesh is believed to be due to indole compounds, which are antibacterial. Eating durian is believed to clear the lungs and breathe pathways. In Malaya, decoctions of leaves and fruits are applied to swellings and skin diseases. Eating durian is assumed to restore the health of sick persons.

Durian is an evergreen tree and grows 80-100 feet in height. There are over 300 named varieties of durian in Thailand, most valued one being *Monthong Durian*. Seedling trees generally come into bearing 7 to 12 years after planting, while grafted trees bear in 4 years. Durian generally blooms in March and April. The fruits mature in July and August. A tree yields about 100 fruits in a year. Malaysia is the largest exporter of fresh durian. Fresh durians are usually shipped to nearby countries such as Singapore, Hong Kong and Taiwan where it is in high demand. Frozen durian from Thailand is shipped to the United States, Australia and Canada.

The latest news is that DKT Indonesia, an anti-AIDS organization sold 150,000 durian-flavoured condoms as part of a campaign to fight AIDS. The group is targeting sales of 600,000 durian-flavoured condoms in a year. Though it has a pungent smell, it remains the king of fruits for people in some parts of the world.

Common name: Java Apple
Botanical name: *Syzygium javanica,* **Family:** Myrtaceae

The tree, 5-15 m tall, has a short trunk 25-30 cm thick and open wide spreading crown, and pinkish-gray flaking bark. The wood is red, coarse, hard and used for constructing huts in the Andaman and Nicobar Islands.

The flowers are astringent and used in Taiwan to treat fever and halt diarrhea. Investigators have found their principal constituent to be tannin. They also contain desmethoxymatteucinol, 5-*O*-methyl-4'-desmethoxymatteucinol, oleanic acid and B-sitosterol. They show weak antibiotic action against *Staphylococcus aureus*, *Mycobacterium smegmati,* and *Candida albicans*

(Continued in the next issue).

Meeting of State Science Councils and State Science Academies

28 June 2013, INSA, New Delhi

S No.	State Councils / Academies	Address	Contact
1.	Andhra Pradesh State Council of Science and Technology (APCOST)	Dr.Y.Nagesh Kumar, Member Secretary, AP State Council of Science & Technology,12th Floor, Eastern Wing, GaganVihar, MJ Road Nampally, Hyderabad. PIN-500001	Ph: 040-24619675 Fax: 040-24600590 Mob: 08008888564 Email: secy_apcost@ap.gov.in
2.	Andhra Pradesh Academy of Sciences	Dr. C H. Mohan Rao, FNA President, Andhra Pradesh Akademi of Sciences & Director, CSIR-Centre for Cellular & Molecular Biology (CCMB), Uppal Road, Hyderabad 500007	Ph: 040-27160789 (O) 040-27203931 (Res) Fax: 27160252 Email: director@ccmb.res.in
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5.	Chhattisgarh Council of Science and Technology (CCOST)	Shri.Mukund Hambarde, Director General Chhattisgarh Council of Science & Technology, MIG 25, Indravati Colony, Raipur , Chhattisgarh	Ph: 0771-2434569, Fax: 0771-2434093. Mob. 09300028876, 07389487146. Email: mukund.hambarde@gmail.com dgccost@gmail.com
6.	Gujarat Council on Science & Technology (GUJCOST)	Dr.Narottam Sahoo, Advisor & Member Secretary,Gujarat Council on Science & Technology, Dept. of Science & Technology, Govt of Gujarat, Blcok B, 7th Floor, M. S Building, Sector 11, Gandhinagar 382011, Gujarat	Tel: 079-23259362-68 Fax: 079-23259363 Mob: 09879553960 Email: narottam.sahoo@gmail.com
7.	Gujarat Science Academy	Prof. Shobhana K. Menon, Secretary, Gujarat Science Academy, Ex. Director, School of Sciences Coordinator, Department of Forensic Sciences, Gujarat University, Ahmedabad 380009	Mobile: 09327015426 Email: shobhanamenon07@gmail.com
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KAS MALABAR CHAPTER INAUGURATION & KHORANA LECTURE SERIES -2 IN MALABAR BOTANICAL GARDEN, KOZHIKODE

INFOSYS SCIENCE FOUNDATION & KERALA ACADEMY OF SCIENCES

Nalanda Auditorium, Kozhikode

5 October 2013, 10:00 AM

Infosys Science Foundation Lecture

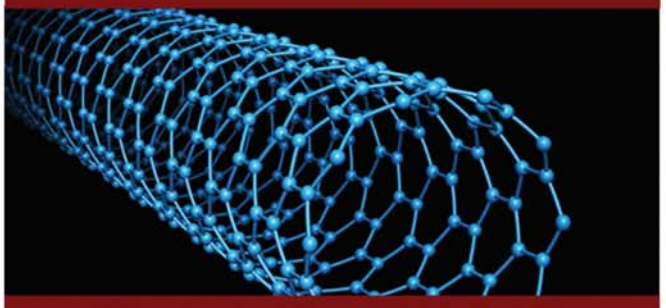
Chemistry: The Fascinating World of Molecules

by

Dr. A. Ajayaghosh

(Outstanding Scientist, NIIST, CSIR, Thiruvananthapuram)

INFOSYS SCIENCE FOUNDATION



KERALA ACADEMY OF SCIENCES

PROGRAMME

Welcome	:Dr. K.G. Ajit Kumar *(Secretary, KAS)*
Presidential Address	:Dr.Oommen V.Oommen *(President, KAS)*
Infosys Science Foundation Lecture	:Dr.A.Ajayaghosh *(Outstanding Scientist, NIIST, CSIR)*
Interaction with students	
Vote of Thanks	:Dr. K.N. Rajasekharan *(Treasurer, KAS)*
Video Documentary	:Kerala State Biodiversity Board
Refreshment	

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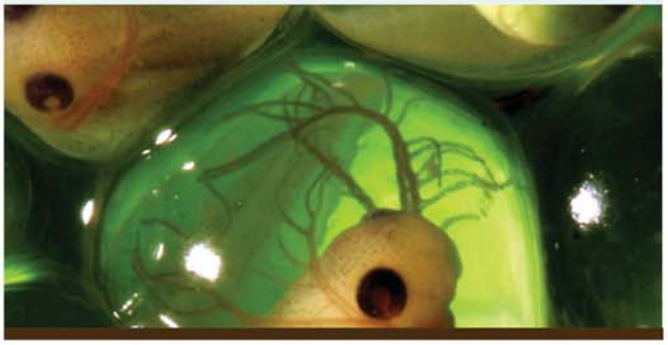

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