Monthly Newsletter of Vigyan Prasar

# DREAM 2047

October 2002 Vol. 5 No. 1

## VP News

### SAARC Book Fair In Dhaka

Vigyan Prasar participated in the first SAARC Book Fair 2002 held at Dhaka, Bangladesh, during 26-29 September 2002 under the aegis of SAARC Book Development Council, representing National Publishers' Associations of the SAARC countries. The venue of the Book Fair was Shilpakala Academy in Dhaka and it was organized by Bangladesh Publishers' Council. The Fair was inaugurated by Begum Selima Rahman. Hon'ble Minister of State of Cultural Affairs, Govt of the People's Republic of Bangladesh. Publishers from, Bangladesh, India, Nepal, Pakistan and Sri Lanka participated in the Fair. Seventeen Publishers from India Including Vigyan Prasar and Publications Division, Govt. of India took part in the fair. The closing ceremony was graced by Hon'ble Foreign Minister of Bangladesh Mr. M. Morshed Khan. Vigyan Prasar's books were well appreciated by the visitors at the Fair. Publishers from other foreign countries showed keen interest in Vigyan Prasar's books. It appears that there is lot of scope for promoting Vigyan Prasar's books in SAARC countries.

*Shri V.K. Joshi and Dr. Subodh Mahanti presenting some Vigyan Prasar publications to Begum Selima Rahman, Hon'ble Minister of State of Cultural Affairs, Govt of the People's Republic of Bangladesh.*

### Popular Science Writing in 19th Century Bengal

As part of its effort to document popular science writings in different Indian languages, Vigyan Prasar had commissioned a project to Science Communicator's Forum, Kolkata for popular science writings in Bengali. Earlier, a similar project for Hindi was completed by Vigyan Parishad Prayag. The period covered in Bengali was 1818 to 1860. The final project report in the form of compilation of selected articles/writings and with a detailed introduction was handed over to Vigyan Prasar by Professor Sushil K. Mukherjee, former Vice Chancellor of Calcutta University, Jadavpur University and Kalyani University, at Kolkata on August 24, 2002. The function was held at Loreto Day School, Sealdah, Kolkata.

*Prof. S.K. Mukherjee handing over the manuscript to Dr. S. Mahanti of Vigyan Prasar on Aug. 24, 2002 at Kolkata. Also seen Dr. Amit Chakrabarty and Prof. S.S. Ray (Sitting)*

*Contd. on page .....24*

## Inside



**...think scientifically, act scientifically ... think scientifically, act scientifically ... think scientifically, act...**

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# Surviving New Drugs

According to a recent newspaper report, the drug nimesulide commonly prescribed for fever is found to have serious side-effects, and may cause complications in the liver, especially in children. Earlier this year, it was withdrawn by its innovator, Boehringer, from Spain and Finland. It is interesting that the drug was never licenced for use in Canada, the United States, Britain and Australia. However, it has been aggressively promoted in India for fever and pain relief. The report further states that while most doctors here insist that there is no need to press the panic button yet , they also admit that they know little about it. This is due to the fact that most studies on the drug are sponsored by the pharmaceutical companies themselves! A child specialist believes that one child that came to his clinic with acute liver toxicity and subsequently died could have suffered a reaction from the drug. However, this could not be established as a scientific fact as liver biopsy could not be done. He insists that the drug should be put through intensive scrutiny. Following a European Union warning, now a review has been ordered by the Drug Controller of India to ascertain its side-effects and risks.

Indeed, this is not the first time that an obsolete or a potentially harmful drug has been dumped on us. Yet another prominent example is analgin which could adversely affect blood pressure, kidneys and the liver, or cause allergic reactions. Then, how is it that these, drugs continue to be prescribed and freely available in the market? Indeed, this is a result of the aggressive promotion and marketing strategies of the pharmaceutical companies. Invariably, each company would quote a study to support its claim to prove superiority of the drug manufactured or promoted by it over its rivals. In the process quite a bit of disinformation is spread, doctors begin to prescribe the drug, and gradually it may even become available over the counter at any pharmacy though it is not allowed.

Quite often we are led to believe that it is quite safe to take a certain drug in case of specific symptoms. We insist on such a drug at a pharmacy. It could be nimesulide, analgin or even an antibiotic. Despite the fact that none of these drugs is allowed to be sold over the counter, that is, without the prescription of a medical practitioner we still insist on having it. Many a time, the pharmacist also happily obliges without bothering to tell us about its side-effects, if any. By resorting to self-medication, and with the help of the willing pharmacist, are we not compounding the problem further benefiting the pharmaceutical companies pushing obsolete or harmful drugs on us?

Let us not be taken in by the advertisements of medical or cosmetic quick fixes in the newspapers or other media. No one knows about the origin or efficacy of these quick fixes. There are hair raising advertisements to cure baldness, to remove dark circles under the eyes, for immediate relief from cold and headache. There are even drugs sold over the counter which ostensibly protect the user from a number of life risk conditions like stress, diabetes, cholesterols and hypertension! Let alone drugs, even medical procedures which could be potentially harmful are pushed through advertisements. A case in point is the beauty technologies so vigorously marketed in our country. Slimming technology is yet another example.

Indeed, it is vital that patients receive adequate information to enable them to use medicines safely and responsibly and to prevent and reduce the unnecessary use of medicines and the associated risks. No doubt, this is the joint responsibility of manufacturers, general practitioners and pharmacists. Information on correct dosage, contra-indications and side-effects should be displayed on the packaging and on the legally required patient information leaflet, in a language that is understood easily by the patient. Consumer organizations, general practitioners, pharmacists, Government and the non-government organizations need to work together and co-ordinate the flow of information from various sources in order to improve the public information. The World Health Organization publishes fairly accurate data on drug safety. It should be made easily accessible for the purpose. This would go a long way in strict enforcement of the law against the erring pharmaceutical companies.

There is no gainsaying the fact that we need to work out a strategy to protect ourselves from the hazards of obsolete and potentially harmful drugs being dumped on us. In addition, the public needs to be informed and educated about the risks associated with self-medication and falling prey to the misleading advertisements that seek to push drugs and questionable medical procedures. Educating the public on these issues will also help curb mushrooming of spurious drug industry to a great extent. Surely, this forms an integral part of what we call scientific literacy. The onus is on science communicators to take the initiative. Where do we begin? Please do write to us.

❒ V. B. Kamble

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# Acharya Jagadis Chandra Bose

## A Pioneer of Modern Indian Science

**Subodh Mahanti**

"In a large forest the trees shed their dry leaves one by one in profusion thus making the soil underneath fertile. In a country where there is continuous research in science, knowledge of it in fragmentary bits is being spread constantly. This is how one's heart's soil is quickened, becoming fertile with an alive feeling in science. It is the loss of it that has left our mind unscientific. We feel the impoverishment not only in our education, but also in the field of our occupation where we are bowed with frustration."

Rabindranath Tagore in '*Bishwa-Parichaya'* quoted from its English version titled "Our Universe" translated by Indu Dutt.

"If there was been any success in my life that was built on the unshakable foundation of failure…"

Jagadis Chandra Bose

"Bose was a physicist and a physicist he remained in his outlook to the very end."

Meghanad Saha

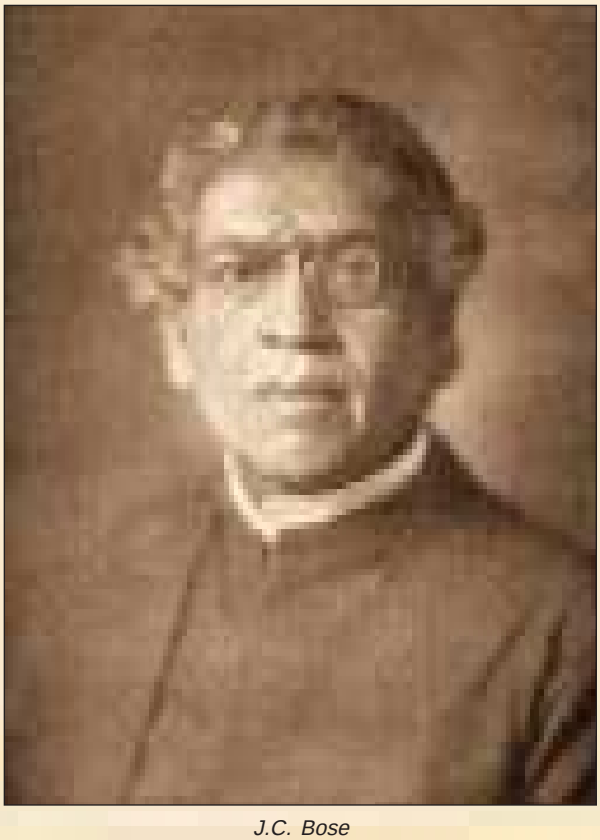
"The generally accepted interpretation of Jagadis Chandra's scientific activities is that he had essentially the biologist's conception of Nature; lack of opportunities for biological studies while as a student in Calcutta and later lack of any teaching post in biology, induced Jagadis Chandra to take up the post of teacher in physics…."

D.M. Bose

He (Bose) was modern India's first physicist after all, one of her very first scientists. He was his motherland's first active participant in the Galilean - Newtonian tradition. He had confounded the British disbeliever. He had shown that the Eastern mind was indeed capable of the exact and exacting thinking demanded by western science. He had broken the mould.

*S. Dasgupta in "Jagadis Chandra Bose and the Indian Response to Western Science".*

Jagadis Chandra Bose, popularly known as J.C. Bose, occupies a unique position in history of modern Indian science. He is regarded as India's first modern scientist. But then it is also true that Bose was not the only pioneer of modern Indian science. Prafulla Chandra Ray (1861-1944), who established an Indian school of chemistry and a chemical industry, and Srinivasa Ramanujan (1887-1920), the great mathematician, are equally familiar names in the annals of modern history of Indian science and who were Bose's contemporaries. It was Ramanujan, who was first elected as Fellow of the Royal Society, the ultimate recognition given by the British Scientific establishment. But then as one of Bose's biographers, Subrata Dasgupta, writes : "Bose was the first Indian to be admitted in person to the *sanctum sanctorum* of English, thus western science". In January 1897 Bose delivered a lecture at the Royal Institution, London, a Friday Evening Discourse, then most prestigious and visible platform for announcing new discoveries. It was Michael Faraday (1791-1867) who started the Friday Evening Discourse in 1826. Some of the most prominent British scientists worked in the Royal Institution and participated in these discourses. In this lecture Bose demonstrated his devices for the generation and detection of radio waves.



*J.C. Bose*

Bose did pioneering research, first in physics and then in physiology. In 1888 Heinrich Rudolf Hertz (1857-94) produced and detected electromagnetic waves in the 60 cm wavelength range and in doing so he verified James Clerk Maxwell's (1831-79) electromagnetic theory. However, Bose was the first to produce millimeter-length radio waves and study their properties. Bose also perfected the method of

transmission and of reception of electromagnetic waves. In recent years there has been welcome news of proper credit being given to Bose for his pioneering work in the area of wireless telegraphy. The Institute of Electrical and Electronics Engineers (IEEE) in one of their publications wrote : " Our investigative research into the origin and first major use of solid state diode detector devices led to the discovery that the first transatlantic wireless signal in Marconi's world-famous experiment was received by Marconi using the iron-mercury-iron-coherer with a telephone detector invented by Sir J.C. Bose in 1898." Bose was a pioneer in microwave optics technology. He was the first to show that semiconductor rectifiers could detect radio waves. Bose's galena receiver was amongst the earliest examples of a lead sulphide photo conducting device.

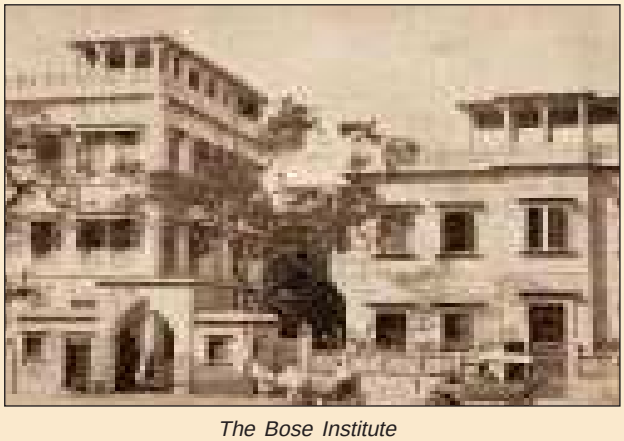
*Michael Faraday*

Bose's his theories about the relationship between living and non-living and plant's response to stimuli were not taken seriously in his time and even today some of his ideas have remained esoteric. However, as D.M. Bose, who succeeded Bose as Director of the Bose Institute, has pointed out "his model of an electric eye which records with electric signals message received from outside world, his physical model of memory as a mechanism for storing information justified his being considered a precursor of the modern discipline of cybernetics." It is now recognised that Bose had made very significant contributions to the field of chronobiology and circadian rhythms even before these two technical terms were coined.

*James Clerk Maxwell*

Bose was the pioneer of experimental science in India. He was an inventor of the first order. He devised many sensitive instruments for his research both in physics and physiology.

Bose was a close friend of Rabindranath Tagore (1861-1941) and received much emotional support from him at difficult times. Before seriously taking up scientific investigation (1894), Bose spent many of his vacations visiting and photographing historic places of scenic beauty, armed with a full sized camera. Some of his experiences he wrote down in vivid Bengali prose. These, together with some of his other literary addresses and writings, were published in a volume called 'Abyakta'.



*The Bose Institute*

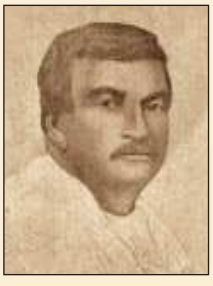
Jagadis Chandra Bose was born in Mymensingh, in his mother's parental house, now in Bangladesh on 30th November 1858, the same year in which India, which was being administered by the East India Company since 1757, came directly under crown rule. Lord Canning, Governor General, as the East India Company's Chief Administrator of India used to be called since 1772 when Warren Hastings assumed the office, was proclaimed Viceroy. Bose's ancestral home was at the village named Rarikhal in Vikrampur, not far from Dhaka (then Dacca), the capital of present-day Bangladesh. His father Bhagaban (also spelt as Bhagwan) Chandra Bose served the British India Government in various executive and magisterial positions. At the time when Bose was born, Bhagaban Chandra was Deputy Magistrate of Faridpur and it is here Bose's early childhood was mainly spent. Bhagaban Chandra was no ordinary government servant. To quote Patrick Geddes, who was Professor of Botany at St. Andrews University, and the author of one of the most authentic biographies of Bose : "Bose's father – Bhagaban Chunder Bose, Deputy Magistrate of Faridpur – was the active defender, not only of the townlet but of the scores of villages around as well. The modern magistrate is mainly settled between his courthouse and his home; but here in those days a man was needed, picked not only for judicial capacity, intelligence and local knowledge, but for active initiative and courage and thus prepared at any moment to assume command of his own police and his people as well, and be ready even to raid the raiders. Of this readiness various stories might be told. As a single example, hearing of a gang of dacoits in his neighourhood, Mr. Bose mounted an elephant and with the very few police available, rode straight into the very heart of the dacoits' camp. Taken by surprise, they broke and scattered; the ready magistrate dropped down, captured the leader with his own hands, and took him back for trial." Bhagaban Chandra had kept in his household a dreaded ex-dacoit, whom he had earlier sentenced to imprisonment, to look after young Jagadis Chandra. Though Bhagwan Chandra served the British Government he was a staunch nationalist and also a dreamer. He undertook, not always with success, many educational, agricultural and technical projects aiming to provide employment and promote opportunities to his less fortunate countrymen. In 1869 Bose's father went to Burdwan as Assistant Commissioner. Here he opened workshops in carpentry, in metal turning in general metalwork and even a foundry. Bose was very much influenced by his father's ideals. While speaking at the fiftieth anniversary of the Exhibition and Mela founded by his father at Faridpur Bose said : "A failure ! Yes, but not ignoble nor altogether futile. And through

*Heinrich Rudolf Hertz*

witnessing this struggle, the son learned to look on success or failure as one, and to realize that some defeat may be greater than victory. To me his life has been one of blessing, and daily thanksgiving. Nevertheless everyone had said that he had wrecked his life, which was meant for greater things. Few realize that out of the skeletons of myriad lives have been built vast continents. And it is on the wreck of a life like his, and of many such lives, that will be built the the greater India yet to be. We do not know why it should be so; but we do know that the Earth-Mother is always calling for sacrifice."

*Rabindranath Tagore*

Bose started his education in a vernacular or Bengali School, a *pathsala*, which was founded by his father in Faridpur. It may be noted that Bhagaban Chandra could have easily sent his son to the local English School. However, he wanted his son to learn his mother tongue and know his own culture before he learned English and knew the foreign culture. In this *Pathasala* Bose studied with the children of peasants, fishermen and workers. In their company Bose imbibed a love of nature. Bose often attended *Jatras* (folk plays) in village fairs and which inspired him to read the great epics, *Mahabharata* and *Ramayana*. The character of Karna in *Mahabharata* influenced him deeply. To quote Bose: "From his (Karna's) low caste came rejection, came every disadvantage; but he always played and fought fair! So his life, though a series of disappointments and defeats to the very end – his slaying by Arjuna– appealed to me as a boy as the greatest of triumphs. I still think of the tournament where Arjuna had been victor, and then of Karna coming as a stranger to challenge him. Questioned of name and birth, he replies, "I am my own ancestor! You do not ask the might Ganges from which of its many springs it comes: its own flow justifies itself, so shall my deeds me!' Further he wrote : "Like that of my boyhood's hero Karna, my life has been ever one of combat and must be to the last. It is not for man to complain of circumstances, but bravely to accept, to confront, and to dominate them."



*Bhagaban Chandra Bose, J.C. Bose's Father*

In 1869 Bose was sent to Kolkata (then Calcutta), where after spending three months at the Hare School he was admitted in St. Xavier's College, which was both a secondary school and a college. This institute was founded by Belgian Jesuits in 1860. Here Bose came in contact with Father Eugene Lafont (1837-1908), who played an important role in developing a tradition of modern science in Kolkata. With Lafont's initiative St. Xavier's College put a special emphasis on science teaching. In 1875 he established a small astronomical observatory in the College. He was one of those principals who persuaded the Calcutta University to offer an undergraduate course in science. Lafont also gave popular science lectures at the Indian Association for the Cultivation of Science, which was established by Mahendra Lal Sircar (1833-1904) in 1876.

*Father Eugene Lafont*

In fact, he was the first lecturer of the Association. Bose was very much influenced by Lafont. To quote Patrick Geddes: "All the pupils of Father Lafont, so long Professor of Physics in that College (St. Xavier's College), recall his teaching and influence as truly educative. His wealth of experiments and vivid clearness of exposition of them, made is class most interesting in the hole college; and his patient skill, his subtlety, as well as brilliance of experimentation, were appreciated by this young student above all. Here was Bose's first discipline towards that combination of intellectual lucidity with wealth of experimental devise and recourse by which he has all the more fully represented and honoured his old master by surpassing him."

In 1879 Bose passed the BA examination in Physical Science Group of the Clacutta University. At the time of his graduation Bose did not have clear plan for his future career except that he wanted to go to England for higher training. However, his father's economic situation was far from satisfactory for this venture. His father's innovative schemes and investment had mostly failed and as a result he was burdened with debts. There were some projects which were successful but then Bose's father did not make profit out of them. For example the People's Bank, the forerunner of the later co-operative societies, started by his father was highly successful. Had Bose's father kept the shares that he had bought as its founder there would have been no financial difficulty. But he had given away his shares to his poorer friends. Bose decided that his first duty was to earn money and help his father in paying off the debts. Following his father's example the natural choice was to join the coveted Indian Civil Service. However, his father did not want his son to become a civil servant, which he thought would take his son away from the common people. In fact, his father wanted that his son should be helpful to the common man and which could not be done by becoming a civil servant in British India. Finally it was decided that Bose would study medicine in some English University. In realizing this goal Bose faced two difficulties. First as stated above his father's financial condition was totally inadequate to support such expensive educational stay in England. What is more at that time Bhagaban Chandra was on two years' medical leave on reduced pay and he was not sure when his health would permit him to resume his duties with its full pay. His second difficulty was his mother's worry in sending him to unknown western world. In those days the sea-voyage was considered

*Banasunndari Devi, J.C. Bose's Mother*

extremely dangerous. And she had lost her second son, aged ten and so she had become highly possessive of her only remaining son. But when considering these factors Bose had decided to settle down in India, and see what he could do best, his mother Banasundari Davi, suddenly decided that his son should go to England as he had originally planned. She said: "My son, I cannot understand much of this going to Europe, but I see your heart's desire is to educate yourself to the utmost; and so I have made up my mind. You shall have your heart's desire. Though nothing is left of your father's fortune, I have my jewels; I have even some money of my own. Between these I can manage it. Go you shall". For a mother it was a courageous decision and India and Indians should be thankful to her. After his mother's consent his father also readily agreed. His objection was to becoming a civil servant and studying law. So selling her mother's jewels Bose sailed for England.

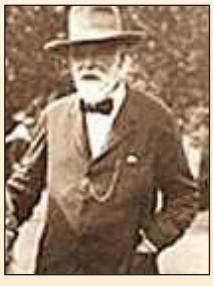
*Lord Rayleigh*

However, after a year's study he had to abandon his plan to study medicine because of the recurrence of a fever he had contracted earlier, and which exacerbated, by the odours of the dissecting rooms. In January 1882 Bose left London for Cambridge where he took admission in Christ's College to study natural sciences. His decision to join the Christ's College was influenced by the fact that his brother-in-law, Ananda Mohan Bose (1847-1906), had earlier studied there. Ananda Mohan, who took the Mathematics Tripos in 1874, was Cambridge's first Indian wrangler. Among Bose's teachers at Cambridge were: Lord Rayleigh (1842-1919), Michael Foster (1836-1907), Sidney Vines (1849-1934) and Francis Darwin (1848-1925).

*Michael Foster*

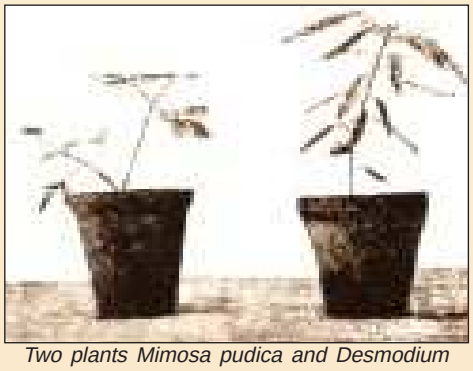
In 1884 Bose obtained a Bachelor of Arts with a second class in natural sciences tripos and in the same year he also obtained a Bachelor of Science from the University of London. After coming back to India he joined the Presidency College at Kolkata in 1885. He was the first Indian to be appointed Professor of Physics in the Presidency College. His appointment was strongly opposed by Sir Alfred Croft, then Director of Public Instruction of Bengal and Mr. Charles R. Tawney, Principal of the Presidency College. But Bose finally managed to get the appointment because of the intervention of Lord Ripon, then Viceroy of India. In getting his appointment Bose was helped by Professor Fawcett, the economist and then Postmaster-General of Britain. Fawcett was a friend of Bose's brother-in-law Ananda Mohan Bose. With Fawcett's letter of introduction Bose met Lord Ripon at Shimla. In those days, Simla used to be the summer capital of India. Ripon was very nice to Bose and he promised to nominate him for the Imperial Educational Service. But after coming to Kolkata when Bose met Croft he was not at all welcomed. Croft said : "I am usually approached from below, not from above. There is no higher-class appointment at present available in the Imperial Educational Service, I can only offer you a place in the Provincial Service, from which you may be promoted." Bose did not accept the offer. The Viceroy again wrote to the Government of Bengal asking explanation for the delay in appointing Bose. Finally Croft was forced to appoint Bose.

In those days the Britishers thought that Indians were not capable of holding high post in educational service and thus Imperial Educational Service was out of their bound, howsoever qualified might they be. For example P.C. Ray, who returned from England with a PhD degree, could not make it to the Imperial Educational Service. He had to be content with the Provincial Service. Unlike in case of Indian Civil Service, which an Indian could join by passing the prescribed examination, the Imperial Educational Service was accessible only through nomination.



*Oliver Lodge*

Though Bose, because of Lord Ripon's personal intervention, was given an appointment in the higher service he was taken on temporary basis with one-half of the pay attached to such an appointment. Bose protested and he asked for the same salary as an European was entitled to get. When his protest was not entertained he refused to accept his salary. He continued his teaching assignment for three years without any salary. Finally both the Director of Public Instruction and the Principal of the Presidency College fully realised the value of Bose's skill in teaching and also his lofty character. As a result his appointment was made permanent with retrospective effect. He was given the full salary for the last three years in lumpsum, which he used for paying off his father's debt.



*Two plants Mimosa pudica and Desmodium gyrans that accompanied Bose round the world*

In 1894 on his thirty-fifth birthday Bose decided to pursue scientific research and not to be confined with teaching assignment alone. There was no laboratory or apparatus or peers. He conducted his researches in a small 24 square foot room, which he was given in the Presidency College. With the help of an untrained tinsmith he devised and constructed new apparatus for his first research on electric radiation. Bose was inspired to study the properties of electric waves after reading Oliver Lodge's book *Heinrich Hertz and His Successors*. Bose devised and fabricated a new type of radiator for generating radio waves. He also built a unique and highly sensitive 'Coherer' or radio receiver for receiving radio waves. Bose's coherer was far more compact, efficient

and effective than the ones used in Europe. It was Oliver Lodge who had devised an improved version of coherer inveted in 1890 by Eduard Branly (1846-1940) of France. Though Branly invented the coherer but he did not conceive it as a detector, it was Lodge's contribution. Even the term 'coherer' was coined by Lodge. Branly had shown that metal fillings enclosed in glass tubes with loose contacts form an insulator. Though the fillings themselves were good conductors, they would be highly resistant to small voltages. However, in the presence of Hertzian waves their resistance was enormously reduced or in other words they switched to a conducting state and they would remain in that state until shaken or tapped slightly. In the coherer developed by Lodge wires in contact with the fillings placed in a glass tube led out from the end of the tube and were connected in a series with a galvanometer. When there is a radiation, the fillings would switch to a conducting state and a current would be obtained and which will be detected by the galvanometer. Bose's receiver was a great advance on that of Branly and Lodge. In earlier versions the sensitivity varied and at times they behaved in an erratic manner. Bose replaced the irregular fillings by fine wire spiral springs. They were fixed in ebonite and under control of a spring. Using his improved equipment Bose demonstrated various properties of radio waves like reflection, absorption, interference, double reflection and polarisaton. He also demonstrated a new type of radio waves as small as 1 centimeter to 5 millimeters. Such waves are now called microwaves, and are used in radars, ground telecommunication, satellite communication, remote sensing and microwave ovens. In May 1895, he read his first research paper before the Asiatic Society of Bengal 'On the polarisation of Electric Rays by Double Reflecting Crystals". In the same year one of his papers titled "On the Determination of the Indices of Refraction of Sulphur for the Electric Ray" was communicated to the Royal Society of London by Lord Rayleigh. The paper was read before the Royal Society in December 1895 and it was accepted for publication in the Society's proceedings in January 1896. Bose's three articles were published in *The Electrician* of Friaday 27 December. These were probably the first papers to be published by an Indian in a western scientific periodical. It may be noted that in those days, *The Electrician* was amongst the most prominent periodicals devoted to electrical matters. In spite of the most adverse circumstances Bose succeeded just by his seer dedication and ingenuity. The Royal Society of London not only accepted his paper for publication, also offered him financial help from their Parliamentary grant so that Bose could continue his researches. The University of London awarded him Doctor of Science ( DSc) without any examination. Lord Kelvin congraturalted Bose by stating that he was "literally filled with wonder and admiration…for his success in the difficult and novel experimental problem".

*Lord Kelvin*

*Marie Alfred Cornu*

Marie Alfred Cornu (1841-1902), the former President of the French Academy of Sciences, wrote : "the very first results of your researches testify to your power of furthering the progress of science. For my own part, I hope to take full advantage of the perfection to which you have brought your apparatus, for the benefit of the Ecole Polytechnique and for the sake of further researches I wish to complete."

Bose's sudden success in his research and its appreciation by leading scientists in England and other western countries had their impact in India. The attention of the Lieutenant-Governor of Bengal, Sir William Mackenzie, was drawn to Bose's work and he tried to improve the conditions under which Bose was working. A new post with higher emoluments, with more initiative and with reasonable leisure for research' was created for Bose. However, this appointment was cancelled because of Bose's refusal to support the official line in a meeting of the Calcutta University, of which he was a Fellow. After failing to overcome the opposition of the Education Department in giving sanction to the new appointment the Lieutenant Governor decided to reimburse the expenditure incurred by Bose in carrying out his researches. However, Bose refused to accept the grant for his past work. But he accepted the Government's annual grant of Rs. 2500/ - (£166) for his future research work at the Presidency College.

*J.J. Thomson*

At the initiation taken by William Macknzie, the Education Department agreed to send Bose on deputation to England for six months. And he sailed for England on 24th July 1896. He gave a lecture-cum-demonstation on his new findings on radio waves at the meeting of the British Association for Advancement of Science at Liverpool. Among those present were Sir James Johnson Thomson (1856-1940), Oliver Lodge and Lord Kelvin. It was Bose's first interaction with the English scientists after his success in research. The assembled scientists were highly impressed by Bose's presentation. Lord Kelvin climbed upto the ladies' gallery to congratulate Mrs. Abala Bose on her husband's brilliant work. He was also invited by the Royal Institution to deliver a Friday Evening Discourse. It was a great honour. The Government of India extended his deputation for another three months for the preparation of the lecture. He delivered his Friday Evening Discourse on 19th July 1897. The title of the lecture was 'On the polarization of Electric Rays". More than five hundred people including Oliver Lodge, James John Thomson and Lord Kelvin had assembled to hear Bose. The lecture was not only praised but it was considered valuable enough for publication in the Transactions of the Royal Society. Bose's fame spread quickly to the neighbouring countries, France and Germany. He was invited by Physical Society of Paris and leading physicists of Berlin to explain his results.

Bose's peers in England were highly impressed by his achievements and they wanted to help improve the conditions under which Bose was working. He had no proper laboratory for carrying out his research work. Lord Kelvin wrote to Lord George Hamilton, then Secretary of State: "It would be conducive to the credit of India and the scientific education in Calcutta, if a well-eqipped Physical Laboratory is added to the resources of the University of Calcutta in connection with the Professorship held by Dr. Bose." Lord Kelvin's letter was followed by a letter jointly signed by a number of eminent scientists including Lord Joseph Lister (1827-1912), then President of the Royal Society, Professor Fitzerland, Sir William Ramsay, Sir George Gabriel Stokes (1819-1902) and many others. This communiqué stated: "to the great importance which we attach to the establishment in the Indian Empire of a Central Laboratory for advanced teaching and research in connection with the Presidency College, Calcutta. We believe that it would be not only beneficial in respect of higher education, but also that it would largely promote the material interest of the country; and we venture to urge on you the desirability of establishing in India a Physical Laboratory worthy of that great Empire." The Secretary of State not only sent the letter to the Government of India but he also endorsed the proposal by stating that `being of opinion that the question of establishing an institution of the kind mentioned is deserving of consideration by Your Excellency in Council.' Though the then Viceroy Lord Elgin informed Bose that the government would be interested in his project but the concerned government department finally decided that though the project was important but it might be postponed for future. The foundation of such a laboratory was laid in 1914, just one year before Bose's retirement

*Swami Vivekananda*

*Abala Bose Bose's wife*

Bose was very much against in patenting his invention. He had resolved not to seek any personal advantage from his invention. He pursued science to only for itself but for its application to the benefit of mankind. In his Friday Evening Discourse at the Royal Institution, London, he made public his construction of the coherer. Thus *The Electric Engineer* expressed 'surprise that no secret was at any time made as to its construction, so that it has been open to all the world to adopt it for practical and possibly moneymaking purposes." In 1901, one of the great manufacturers of wireless apparatus, approached Bose for signing a remunerative agreement as to his new type of receiver. However, Bose declined the offer. One of his American friends, Sara Bull (also known as Mrs. Ole Bull), was able to persuade Bose to file a patent application for his galena receiver. The application was filed on 30 September 1901 and it was granted on 29 March 1904 (US patent No. 755,840). However, Bose refused to accept his rights and allowed to lapse the patent.

*Bose delivering his Friday Evening Discourse before the Royal Institution*

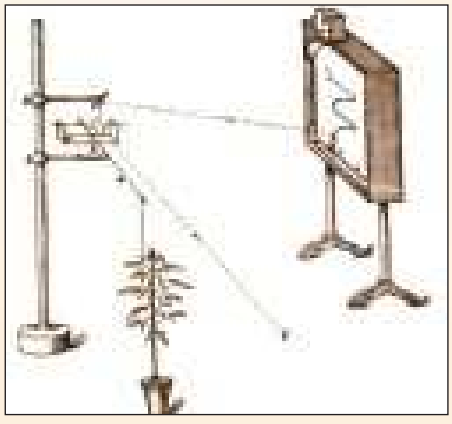
Fascinated by the peculiar behavior of his electric-wave receiver, which seemed to show signs of "fatigue" after prolonged use but could be `revived' to its original sensitivity after some rest, Bose took up a systematic study to understand this phenomenon. He started believing that metals too had "feelings". From metals he turned his attention to plants and he found the latter responding more favorably to his experiment than the former. Bose thought that he had hit upon the underlying unity in the natural world between living and non-living. And he fully devoted to this line of investigation.

In 1900 Bose read his paper "On the Similarity Responses of Inorganic and Living Matter' before the Paris International Congress of Physicists. It was for the first time in science one compared and parallelised the responses to the excitation of living tissues with those of inorganic matter. Bose's paper was considered as one of the most important ones received by the Congress. The paper was published in the Proceedings of the Congress. Many in India thought that Bose had given a fresh scientific impetuous to the age-old wisdom of the East which believed in the basic unity of all life. Swami Vivekanada (1863-1902), who was then in Paris, went to hear Bose at the Congress. While describing his impression of the Congress Swami Vivekanand wrote : "Here in Paris have assembled the great of every land, each to proclaim the glory of his country. Savants will be acclaimed here; and its reverberation will glorify their countries. Among these peerless men gathered from all parts of the world, where is thy representative, O thou the country of my birth ? Out of this vast assembly a young man stood for thee, one of thy heroic sons; whose words here electrified the audience, and will thrill all his countrymen." Tagore sent his appreciation in the form of a poem.

At the Physical Section of the British Association's meting at Bradford, England in September 1900 Bose read a similar paper. Here also his ideas were widely appreciated by the physicists. After the Bradford meeting Bose fell ill and he was confined for two months. On recovery, he was invited by his old friends and teachers. Lord Rayleigh and Sir James, Dewar (1842-1923) to work at the Davy-Faraday Laboratory of the Royal Institution. Bose delivered his second Friday Evening Discourse at the Royal Institution on May 10, 1901. This time on his research on the responses to living and non-living. The lecture was highly appreciated. Bose's ideas were first opposed by John Burdon Sanderson and Augustus Waller, the two eminent plant physiologists on June 6, 1901 when Bose read his paper at the Royal Society. Following their criticism the Royal Society did not

publish this paper. Bose decided to prolong his stay at London to conduct experiments to prove his theory. Somehow he managed to get his deputation extended. After his two year stay Bose decided to come back India though he was offered a job at a British University.

After coming back to Kolkata Bose continued his work on the responses living and non-living and the physiological properties of plant tissues and the similarity of their behaviour with that of animal tissues. He presented the results of his investigation in the form of monographs.



*The Optical Pulse-Recorder*

Bose demonstrated that plant tissues under different kinds of stimuli like mechanical, application of heat, electric shock, chemicals and drugs, produce electric response similar to that produced by animal tissues. He also tried to demonstrate that similar electric response to stimulation could be noticed in certain inorganic systems. For his investigations Bose invented several novel and highly sensitive instruments. Among these the most important one was the Crescograph – an instrument for measuring the growth of a plant. It could record a growth as small as 1/100,000 inch per second. Bose's experiments on plants were mostly performed on *Minosa pudica* and *Desmondium gyrans* (Indian Telegraph plant). In all his investigations Bose attempted to offer original interpretations. He attempted to devise models which were illustrative of physical basis of memory. His findings subsequently influenced subjects like physiology, chronobiology, cybernetics, medicine and agriculture.

Bose retired from educational service as Senior Professor of Physics in 1915. In fact he was to retire in 1913, on the completion of his fifty-fifth year, as per Government rules of those days. However, the Government of Bengal, in recognition of his service to the Presidency College and of his scientific achievements, extended his period of service for two years. After his retirement the Government also made him Professor Emeritus on full pay instead of pension. And this way he remained permanently connected to the Presidency College. Even after his retirement his researches were not interrupted. He continued his plant physiological investigation in a small laboratory set up in his own house. In the meantime he was also working towards the establishment of a research institute. The foundation ceremony of this institute took place on 23rd November 1917. Bose was able to collect about Rs. 11 lakhs for its endowment, in this effort he was greatly helped by his friend Rabindranath Tagore. Bose became its life-time director. His inagural speech summerising the ideals that led him to establish the institute was really inspiring. Here we quote a part of it:

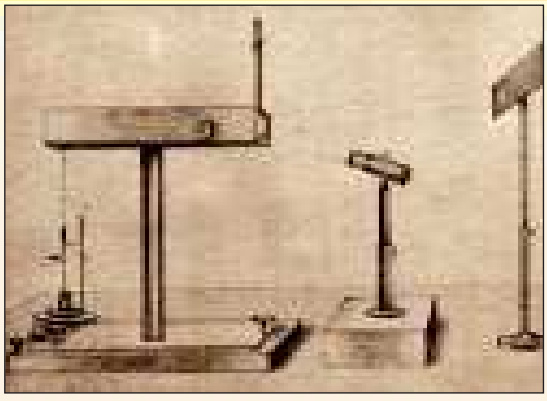
*General view of the Resonant Recorder*

I dedicate to-day this Institute – not merely a Laboratory but a Temple…The advance of science is the principal object of this Institute and also diffusion of knowledge. We are here in the largest of all the many chambers of this House of Knowledge – its Lecture Room. In adding this feature, and on a scale hitherto unusual in a Research Institute, I have sought permanently to associate the advancement of knowledge with the widest possible civic and public diffusion of it; and this without any academic limitations, henceforth to all races and languages, to both men and women alike, and for all time coming.

The lectures given here will not be mere repetitions of second-hand knowledge. They will announce, to an audience of some fifteen hundred people, the discoveries made here, which will be demonstrated for the first time before the public. We shall thus maintain continuously the highest aim of a great seat of learning by taking active part in the advancement and diffusion of knowledge. Through the regular publication of the *Transactions of the Institute*, these Indian contributions will reach the whole world. **The discoveries made will thus become public property**. Besides the regular staff there will be selected number of scholars, who by their work have shown special aptitude, and who would devote their whole life to the pursuit of research. They will require personal training and their number must necessarily be limited. But it is not the quantity but quality that is of essential importance.

It is my further wish that, as far as the limited accommodation would permit, the facilities of this Institute should be available to workers from all countries. In this I am attempting to carry out the tradition of my country, which, so far back as twenty-five centuries ago welcomed all scholars from different parts of the world within the precincts of its ancient seats of learning at Nalanda and at Taxila…

Not in matter but in thought, not in possessions nor even in attainments but in ideals, is to be found the seed of immortality. Not through material acquisition but in generous diffusion of ideas and ideals can the true empire of humanity be established. Thus to Asoka, to whom belonged this vast empire, bound by the inviolate seas, after he had tried to ransom the world by giving away to the utmost, there came a time when he had nothing more to give, except one half of an Amlaki fruit. This was his last possession, and his



*The Magnetic Crescograph for magnifying imperceptible growth of plants ten million times*

anguished cry was that since he had nothing more to give, let the half of the *Amlaki* be accepted as his final gift.

Asoka's emblem of the *Amlaki* will be seen on the cornices of the Institute, and towering above all is the symbol of thunderbolt. It was the Rishi Dadhichi, the pure and blameless, who offered his life that the divine weapon, the thunderbolt, might be fashioned out of his bones to smite evil and exalt righteousness. It is but half of the *Amlaki* that we can offer now. But the past shall be reborn in a yet nobler future. We stand here today and resume work tomorrow, so that by the efforts of our lives and our unshaken faith in the future we may all help to build the greater India yet to be."

Bose's inaugural speech produced a profound impression both in India and abroad. One of London's leading newspapers, *The Times* wrote : "To bringing about the scientific renaissance (In India) Sir Jagadis had influentially contributed. Indians are justly proud of the possession of a few men who have gained world-wide reputation in their particular fields of activity, and this pride reacts strongly on public opinion. At the Research Institute a group Indian post-graduate students devote their lives to research. The published Transactions of the Institute show that under the leadership of this eminent Bengali, Indian research is making substantial contribution to scientific knowledge, that in this field there is no fundamental difference between the Western and the Eastern mind, as was assumed when Sir Jagadis began his work". *The Athenaeum* wrote : "The foundation of an Institute for research in pure science is an event in the history of India. The publication of the Transactions, the first fruits of its activity, shows that it is an event also in the history of science."

In 1903 Bose was honoured with Commander of the Order of the Indian Empire (CIE) at Delhi by the British Government. He received in 1912 the Commander of the Star of India (CSI) at the Coronation of the British Emperor. He was knighted by the British Government in 1916. Bose was elected a fellow of the Royal Society (FRS) of London in 1928. Bose died on 23 November 1937 at Giridih in Bihar.

We would like to end this article by quoting Geddes : "The life-story of Jagadis Bose is worthy of close and ardent consideration by all young Indians whose purpose is shaping itself towards the service of science or other high cause of the intelligence or social spirit. It is possible that looking upon the triumph of the end and knowing nothing of the long uphill road, the slow costly attainment of ends, they may think that a fine laboratory or other material endowment the antecedent condition of successful achievement in intellectual creation. The truth indeed, is far otherwise. The countless obstacles which had to be surmounted only called forth in Bose all the endurance and all the effort which are latent in manly natures, welding them to the fullest strength of character and intensity of thought by which alone a great life-task can be accomplished. In contemplating the great career of his fellow countrymen, the young India will be stimulated to put brain and hand to fine tasks, nothing fearing. Thus will he be inspired not only to recover the noble intellectual tradition of the Indian past, but to restate these traditions in modern times and find the greatest challenge for mind and soul in achieving their vital relation with the coming age."

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8. *Physiology of Ascent of Sap*, Longmans, Green & Co. London 1923
9. *Letters to Rabindranath Tagore* (in Bengali Patrabali), (edited & annotated by D.Sen). The Bose Institute, Calcutta, 1994.

## For Further Reading


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# Ginger-Really a *Zing* Thing

T.V. Venkateswaran

> An I had but one penny in the world, thou shouldest have it to buy gingerbread – Shakespeare in *Love's Labour Lost.*

Yes ! Grandma was indeed right. When we were kids suffering with an upset stomach or the flu and she gave us flat ginger, or ginger tea, instead of medicine, she knew what she was doing. Maybe she did not know why ginger settled our stomach, but she knew it would do the trick—and it did.

Actually, for thousands of years ginger has been used medicinally as well as in cooking in India and China. It's said to aid in the remedies of ailments from motion sickness to athletes foot. Its anti-inflammatory properties is said to mitigate the pain of rheumatoid arthritis and many women claim ginger tea helps rid them of menstrual cramps.

Ginger, the plant is native to India and China and as a matter of fact, the very names of ginger in most languages derive (via Prakrit *singabera*) ultimately from Sanskrit *shringavera* "shaped like a deer's antlers (horn)", from shringan "horn" an obvious reference to the 'hand' and 'finger' like look of the Ginger bulbs. Thence Greek ziggiberis and Latin zingiber (vulgar Latin gingiber), whence the forms in the modern European tongues are formed. The Old and Middle English forms *gingifer* and *gingivere* relate to Old French *gingivie*. It is one of the oldest spices used that it finds mention in the writings of Confucius, Holy Koran, and ancient Sanskrit texts on medicine.

Ginger, scientifically called as *Zingiber officinale Rosc*, belongs to the family of *Zingiberaceae* is native to South Asia, is widely used for cooking, candies, beverages (such as ginger beer), as preserves and in Asian culinary. The English botanist William Roscoe (1753-1831) gave the plant the name *Zingiber officinale* in an 1807 publication. The ginger family is a tropical group consisting of more than 1200 plant species in 53 genera and the genus *Zingiber* includes about 85 species of aromatic herbs .

There is archeological evidence for use of Ginger even as early as 2500 BC, that we have evidence of baking of gingerbread in Greece. It was the second most favorite spice of Greeks and Romans, first being the pepper. It reached Romans and Greeks through the great travelers of the ancient world, Phoenicians, and is recorded as a subject of a Roman tax in the second century after being imported via the Red Sea to Alexandria. It was ancient Romans who spread this spices to other parts in the course of their march over Europe, that by ninth century Ginger was part of every respectable dinner table in Europe.

Since ginger rhizome can be in a state of living for a considerable time without perishing, it can easily be transported over distances, and thus it is one of the widely introduced spices and hence is found in tropical and sub-tropical countries, far and wide as Jamaica in Americas, Sierra Leone in Africa, Japan in pacific and even Australia.

**Ginger as folk medicine**

Pure ginger juice seems to be helpful for stomach upsets, nausea, heartburn, abdominal cramps, and motion sickness. Morning tea with ginger seems to sooth over morning sickness. Ginger is said to be useful in keeping cholesterol levels under control. Ginger helps in the digestion since it contains a compound similar to the digestive enzymes found in our digestive tract, which may help to digest a heavy, protein-rich meal more easily. Ginger can be chewed to relieve toothache. Hot ginger drink is effective for cold and flu. It helps to clear the blocked nose and it is claimed that it stimulates the liver to remove toxins from the blood stream. Ginger juice, made with a teaspoon of freshly squeezed juice of ginger and lime and a teaspoon of honey in hot water, is not only an enticing drink, but can also aid in digestion. Its use in hot tea to relieve nighttime cold symptoms is well known and most of the *Dhabas* of north India, serves tea in the morning with a dash of salt and a squeeze of ginger, in particular during the winter.

For motion sickness, upset stomachs, colds or headaches, steep about a teaspoon of chopped fresh ginger in a cup of boiling water to make a tea. Sip this tea before taking a trip to avoid motion sickness or during or after the journey to calm a queasy stomach. In one study published in *The Lancet* researchers D.B. Mourey and D.E. Clayson found that capsules containing 940 mg. of dried ginger powder when given to persons who suffer from motion sickness, actually produced better results than dimenhydrinate, an antihistamine used in an over-the-counter motion sickness product. If you have athlete's foot, cool this tea and soak your feet in it. It's anti-fungal property will ease the burn and itch. Ginger tea is also said to reduce excessive perspiration, act as an aphrodisiac, and freshen one's breath. Indeed, not bad at all for the stem of a plant that grows underground!

As a mood enhancer, ginger's cineole content may help contribute to stress relief. So sipping a cold glass of ginger-lime after a hard day at the work may be welcome. Just make sure that the ginger-drink that we consume is made with real ginger. Some of today's sodas are artificially flavored and is no substitute for real ginger. Ginger root is also taken to loosen phlegm, relieve gas, and tighten the tissues. Asian medicine employs it as a treatment for asthma, shortness of breath, water retention, earache, diarrhea, nausea, and vomiting; and lo behold, homeopathic practitioners are said to recommend it for sexual disorders as well.

**Root of Ginger**

The ginger plant is an erect perennial growing from one to three feet in height. The stem is surrounded by the sheathing bases of the two-ranked leaves. A club-like spike of yellowish, purple-lipped flowers have showy greenish yellow bracts beneath. Unfortunately, ginger rarely flowers in cultivation.

Actually, ginger root is not really a root at all, but a rhizome or underground stem. In the fresh state, it has a characteristic staghorn-like appearance; dried ginger is usually sold in form of a off-white to very light brown powder. Ginger leaves are occasionally used for flavouring in ginger producing countries. The rhizome of Ginger, called as 'hand' appearing to be gnarly fist-like bulb is best if the brown skin on it is smooth, the surface

hard, and the weight heavy. Interestingly, while the Ginger bulb is called as 'hand', each protrusions are called 'fingers'. It is harvested nearly year-round. Early harvest of ginger, about five to six months old, is used mostly in processed preparation such as ginger syrup or candy. Later harvests are what are usually sold as fresh ginger. The longer the ginger remains underground before harvest, the hotter and spicier it gets—and the better it is for use as home remedies.

Ginger is not only associated with digestive health, but its nutritional benefits are also widely known. In root form it has a strong, sweet scent. Dry ginger contains protein (8.6%), fat (6.4%), carbohydrates (66.5%), ash (5.7%) , calcium (0.1%), phosphorus (0.15%), iron, sodium, potassium, vitamin A, thiamine, riboflavin, niacin and ascorbic acid. It has a calorific value of 380 calories per 100 gms.

**Chemistry**

The sensory perception of ginger arises from two distinct groups of chemicals; while in the mouth it is largely due to the non-volatile pungent principles, such as the gingerols and zingerone, the perception of nose is stimulated by the volatile oils, a mixture of terpenoids which imparts the characteristic aroma and modifies the taste.

The pungency of ginger is largely due to gingerols, what are susceptible to transformation to less-pungent compounds such as shogaols, gingeroles and zingerone. The pungent gingeroles degrade to the milder shoagoles during storage; high gingerole content and good pungency thus indicate freshness and quality. High Performance Liquid Chromatography (HPLC) has been used to measure the ratio of [6]-gingerol to [6]-shogaol which gives an indication of the extent of pungency degradation. The lower the value the higher the pungency loss. About 2-3% of ginger oil is obtained from the dried rhizomes on steam distillation.

However, it is the chemical called, zingerone that puts the zing in ginger and is also a flavor ingredient in mustard oil. The structure of this chemical is quite near to that of vanillin. The structure of zingerone is nothing but a hydrocorbon tail attached to the vanillin foundation ring. Nonetheless, it doesn't lower the solubility of zingerone much because it contains a carbonyl group (C=O) that can form strong hydrogen bonds with water molecules. Zingerone is sparingly soluble in water, but also freely soluble in fats and oils.

The higher molecular weight of zingerone in combination with the polar side-chain carbonyl group makes zingerone molecules attract each other more strongly than eugenol and vanillin molzecules do. As a result, zingerone is less volatile than either eugenol or vanillin. The odour of ginger isn't strong, but the hydrocarbon tail gives it a more intense flavor when it does come into contact with its receptor.

It is safe to claim that the Ginger root as a popular folk medicine appears to have a scientific basis. Some of the beneficial medicinal qualities claimed for ginger may stem from zingerone's effectiveness as an antioxidant. Zingerone reacts with free radicals that can cause tissue damage and inflammation. Studies by researchers at Case Western University show that a topically applied extract containing zingerone may help prevent some skin cancers.

India is the worlds largest producer of Ginger, in fact 50% of worlds total production is made in India. Besides, Kochi

**Gingerbread**

It is for sure that we would have heared the song about 'gingerbread man' or the house made of gingerbread in the nursery fairy tales. In fact, Gingerbread has been baked in Europe for centuries. In some places, it was a soft, delicately spiced cake; in others, a crisp, flat cookie, and in others, warm, thick, steamy-dark squares of "bread," sometimes served with a pitcher of lemon sauce or whipped cream. It was sometimes light, sometimes dark, sometimes sweet, sometimes spicy, but it was almost always cut into shapes such as men, women, stars or animals, and colorfully decorated or stamped with a mold and dusted with white sugar to make the impression visible.

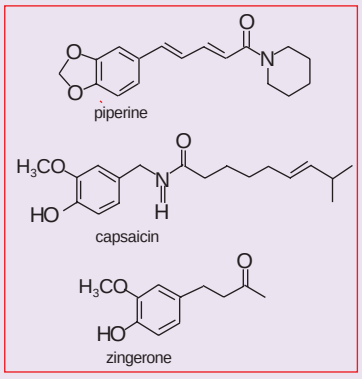
The manufacture of gingerbread appears to have spread throughout Western Europe at the end of the eleventh century, possibly introduced by crusaders returning from wars in the Eastern Mediterranean. From its very beginning gingerbread has been a fairground delicacy. Many fairs during the medieval Europe was even called as "gingerbread fairs" and so much so that gingerbread items took on the alternative name in England of "fairings" which had the generic meaning of a gift given at, or brought from, a fair. Certain shapes were associated with different seasons: buttons and flowers were found at Easter fairs, and animals and birds were a feature in Autumn. There is also more than one village tradition in England requiring unmarried women to eat gingerbread "husbands" at the fair if they are to stand a good chance of meeting a real husband.

During the nineteenth century, gingerbread was both modernized and romanticized. When the Grimm brothers collected volumes of German fairy tales they found one about Hansel and Gretel, two children who, abandoned in the woods by destitute parents, discovered a house made of ginger bread, cake and candies.

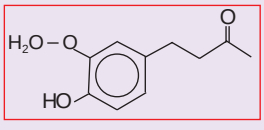
**Crown of Ginger: Jamican Ginger**

Though Ginger is native to South Asia, the worlds best ginger is grown in Jamica. Ginger (*Zingiber officinale* Rosc.) is thought to have been introduced into Jamaica about 1525. By 1547 though, it is reported that the export of ginger amounted to over 22,000 quintals (2.2 million Kg).In 1980, a survey by the International Trade Centre reported that 1,100 acres of ginger were planted in Jamaica in the central range areas of Clarendon, Manchester and Trelawny.

*Jamaica Ginger*




The structures of these three essential substances of spices are remarkably similar. Piperine is active substance of black pepper, Capsaicne of Chilli and Zingerone of Ginger. Each contains an aromatic ring with two ortho oxygen atoms (similar to vanillin), either in an ether-phenol combination, as in the case of capsaicin and zingerone, or as an acetal, as found in piperine.



Bonded to the ring at position 4 is a long chain bearing a carbonyl group. The carbonyl group is located in the same position for capsaicin and zingerone- although the latter is a ketone, whereas capsaicin is an amide. The carbonyl is located further down the chain in piperine, which, like capsaicin, is an amide.

**Chemical composition of essential oil of Ginger**

| | Chemical Components | |
|---|---|---|
| 1 | Zingiberne | 35% |
| 2 | AR-curcumene | 10 % |
| 3 | beta-sesquiphellandrene - | 10% |
| 4 | Bisabolene | 8% |
| 5 | Dextro-camphene | 6% |
| 6 | beta-phellandrene | 3% |
| 7 | 1,8-cineole | 2% |
| 8 | citral-a (geranial), citral-b (neral) , alpha-pinene , myrcene | trace |

Ginger is considered to be one of the finest varieties of the Ginger, next only to the Jamaican variety. Ginger is the fourth largest spice export product of India. Of the total production in India, 70% are produced in the southern state of Kerala. Chinese Ginger usually is not exported as fresh stock or dried spice as it has only a low pungency and aroma. The Japanese ginger has high pungency, but lacks the typical zing associated with ginger. Ginger from other south Asian countries usually lack adequate quality, Indian ginger has a predominant position in the global market. Ginger is as popular a home remedy in India today, as it was 2,000 years ago.

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*VP News Contd. from page .....36*

A large number of scholars, science writers and poupular science activists attended the function. Other eminent personalities attended the function included, Prof. Moloy

*A Section of the Audience*

Kumar Banerjee, Secretary, Science & Technology Department, Govt. of West Bengal, Prof. Ananda Dev Mukherjee, Vice Chancellor, Vidyasagar University, Midnapur, Prof. Dilip Sinha, Ex. Vice Chancellor, Viswa Bharati and Prof. Anjali Mukherjee, former Dean, School of Life Sciences, J.N. U.

Dr. Subodh Mahanti and Dr. Amit Chakraborty of Vigyan Prasar also attended the function. The compilation has been edited by Professor Sardindu Sekher Roy. Vigyan Prasar intends to get it printed at Kolkata.

## Online Chat Session

Vigyan Prasar is continuing its live chat sessions on its website (www.vigyanprasar.com). The chat on 27th September 2002 was on the topic 'Bones, Weak Bones and Fractures'. Dr. R.K. Chopra, Associate Professor of Orthopaedic Surgery at Safdarjung Hospital and Vardhman Mahavir Medical College, New Delhi, answered the questions on the topic. About thirty participants from all over the country asked questions on various aspects related to orthopaedics. Those who could not participate for the lack of time were requested to send their questions through e-mail (Vigyan@hub.nic.in). Those who are interested to participate in our future chat sessions, may inform us through e-mail.

*Dr. R.K. Chopra*

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# Digital Television

Kinkini Dasgupta Misra

The Digital television (DTV) is a revolutionary new form of television that delivers top quality all digital audio & video programming to viewers over the air, and via cable and satellite.

Digital TV is the next significant improvement since the introduction of colour TV. It would bring together TV, computer, and communication technology, and with its near that total penetration in homes it would even rival the impact PC has made on the life of common man.

Digital TV simply means the information that you are supposed to be seeing and hearing is digitally encoded. This means that when the data gets to your TV, the picture is constructed in exactly the manner the programmer intended. Your TV today receives an analog signal, with the picture and sound directly riding on it. If the signal weakens or deteriorates, so do picture and sound quality. Such analog signals are prone to electrical interference, can be deflected by physical structures in their path, and may even be affected by solar activity. This results in 'ghost' images, 'snow' and other interference on the screen. On the other hand, digital signals are transmitted as a stream of 0s and 1s. Even if the signal deteriorates during transmission, the 0s and 1s stay intact, giving you perfect picture and sound at the receiving end. And also more channels can be transmitted in the same space using digital technology than by using analog.

In the 1990s, digital technology has crept into various stages of the TV program production process, but completely digital content creation, transmission and reception is just beginning to see the light of day. Star TV channels are transmitted digitally, but they are decoded at your cable provider and the analog signal sent down the cable to your TV. Ideally, this would be digital all the way to your TV set, giving you a spectacular picture matching video CD quality. But your TV tuner is not digital, hence the analog conversion. Future TV sets will be digital.

Digital TV would not be possible without the ability to squeeze out some unneeded parts of TV pictures and sound. This is known as "compression." Compression simply reduces the amount of a digital picture's tiniest details by removing anything that is not critical for us to see. This shortcut does not affect the way we see moving pictures on the screen, but it does mean they take up less signal space ("spectrum") and are easier to broadcast with other services. Because of this digital ability to manipulate what a digital station's signal can do - it is also possible to divide a station's signal into multiple parts. This allows each digital station to separate its one big over-the-air signal into several TV signals or "channels." Therefore, a single station may broadcast 2, 3, 4 or more different channels at one time. This is called "multicasting" - which is the ability to broadcast multiple channels at once - which can be dedicated for children's program, distance learning, the culture and arts, etc. viewers would be able to select the multicast channel of their choice.

Digital technology also provides the ability of broadcasters to send ancillary material with certain programs - and permit viewers to interact on-screen with that supplementary material. By sending this supplemental material (not immediately visible on-screen) within a show's digital broadcast signal, digital broadcasters provide viewers with the option to place that extra material on-screen. It happens when a viewer sees a small icon pop up in the corner of the TV set. Using a special TV remote, for example, viewers may automatically "pause" the actual TV show and address new information on-screen, such as answers to questions, related maps, or even watching related video in a small on-screen window from someone who isn't in the main program. And much of this "enhanced" material can be recorded for later use - and used over and over again. This is called datacasting.

The digital channel carries a 19.39 megabit-per-second stream of digital data that your digital TV receives and decodes. Each broadcaster has one digital TV channel, but one channel can carry multiple sub-channels if the broadcaster chooses that option. On its digital channel, each broadcaster sends a 19.39 megabit-per-second (Mbps) stream of digital data. Broadcasters have the ability to use this stream in several different ways. For examples:

- A broadcaster can send a single program at 19.39 Mbps.
- A broadcaster can divide the channel into several different streams. These streams are called sub-channels. For example, if the digital TV channel is channel 53, then 53.1, 53.2 and 53.3 could be three sub channels on that channel. Each sub-channel can carry a different program.

The reason that broadcasters can create sub-channels is because digital TV standards allow several different formats. Like broadcasters can choose between three formats:

- 480p- the picture is 704x44480 pixels, sent at 60 complete frames per second (480i is also possible).
- 720p- The picture is 1280x720 pixels, sent at 60 complete frames per second.
- 1080i- The picture is 1920x1080 pixels, sent at 60 interlaced.

A digital TV decodes the MPEG-2 signal and displays it just like a computer monitor does, giving it incredible resolution and stability. MPEG-2 (Motion Picture Expression Group Standard-2) is the default standard for transmission of multiple video and audio channels.

Digital television is set to provide a completely new television experience with high definition television (HDTV), interactive TV, Web TV and data broadcasting. DTV encompasses Surround Sound audio, high definition pictures, standard definition pictures, multicasting pictures

of several programs simultaneously, and data broadcasting. Many digital TV programs also will incorporate a wider-screen viewing area (known as the aspect ratio). The current analog aspect ratio is 4:3. The new aspect ratio for many (but not all) DTV programs will be 16:9, which approximates the more natural viewing experience of most motion pictures in theaters. HDTV (High Definition TV) is a DTV format that offers the highest-quality images and CD-quality Surround Sound audio, and the 16:9 aspect ratio, with resolution that equals or surpasses 35mm film commonly viewed in theaters. Therefore, HDTV programming is noticeably superior to the audio and video currently seen on today's analog sets. It is believed that HDTV standard for commercial broadcast television will provide outstanding features including noise free, high definition, wide screen, progressive scan video displays with low frequency enhanced audio.

Digital TV can be received in four ways, each one having its own features and suppliers:

- **Digital Cable TV** - Digital cable TV can be provided through a set-top box. Most coaxial cable systems currently have the capability to distribute 40 to 60 analog channels. By converting to compressed digital video, cable systems have the potential to deliver additional services by initially expanding to more than 500 channels.
- **Digital Satellite TV** - By combining digital-video compression technology with high-power KU-band satellites, Digital Broadcasting System have the potential to broadcast over 150 channels directly to an 18-inch dish antenna. The increased channel capacity could be used for new services such as near-video-on-demand, movie delivery, pay-per-view, and programming directed to specific segments of the viewing population.
- **Digital TV through your aerial (TERRESTRIAL BROADCAST):** Terrestrial broadcast is the oldest and the most successful way to transmit analog video and audio. Digital terrestrial TV is provided through a set-top box.
- **Digital ADSL TV** - Digital ADSL TV can be received via high speed digital internet connection through a standard telephone line

Digital TV is possibly one of the biggest markets opening up in this millennium. By the year 2006, Federation Communications Committee (FCC) in the US has mandated to complete transition to the digital format. Similarly, test runs of digital transmission are reported to have begun in Europe, Australia, and China. In the cable TV domain, conversion to digital has happened in 1998. Thomson, a member of the Grand Alliance has successfully teamed up with Hughes, a subsidiary of General Motors, to launch 'Direct TV' through the Direct Broadcast Satellite using a proprietary digital format. Set-top-boxes are being used to convert these digital signals for viewing on the present NTSC/PAL screens.

In India, government is pushing for the implementation of an open architecture in the delivery of Direct-to-Home (DTH) Services. The government has decided to permit DTH TV service in Ku Band in India. The advantage of DTH is the availability of satellite broadcast in rural areas where cable is difficult to install. DTH also offers digital quality signals which do not degrade the picture or sound quality.

## Forms of Digital TV Receivers

To address the different consumer segments, Digital TV receivers will come in various forms. Most common of these would be an inexpensive set-top-box converter that would receive all the 18 ATSC video formats and convert them to a format suitable for the front-end TV display including the existing NTSC/PAL receivers.

The display units could be of any size or aspect ratio. Second form would be a wide-screen digital receiver with aspect ratio of 16:9 used for the HDTV. It would integrate the tuner functionality within the display unit. PC/TV would be another form that would receive all the digital video formats and display it on the PC monitor with the display resolution remaining limited to standard definition.

## Advantages

The key advantages to digital television are many. Consumers would find Digital TV appealing in several ways. It has approximately twice the vertical and horizontal resolution compared to existing TVs. The combination of wide screen, sharp resolution, and clear transmission will make natural viewing experience a reality. On the audio front, besides the theater quality 3D sound, it will also offer freedom to mix and match one of the several audio channels, may be in different languages, for the same picture.

Most significantly, digital technology will upgrade TV from a receiver of signals to a more sophisticated two-way interactive device. This would give the viewers capability for online programming of schedules/customized programming and interactive download of movies, games, data, and programs of their choice. Electronic shopping would be another offshoot of this interactive capability. With the mixing of video with data, Digital TV would also be a powerful communication device offering Internet access, email, and other online services.

The TV should impress broadcasters too. As it will take smaller frequency spectrum for broadcasts, resulting in cost optimization and new channels. Digital TV will also open opportunities for additional revenues for broadcasters by making subscription and pay-per-use revenue possible. They can also be a part of the distribution channel in electronic shopping and thereby possibly add up further revenues.

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# Recent Developments in Science and Technology

## Research Reveals Role of Breast Cancer Gene in Repairing Damaged DNA

It is estimated that 200,000 new incidences of breast cancer will be diagnosed in the U.S. in 2002. For women with a family history of the disease, about half of the cases will be caused by mutations in one of two genes: *BRCA1* and *BRCA2.* Now findings published online by the journal *Science* reveal the crystal structure of the BRCA2 protein and demonstrate how mutations in the gene could contribute to tumor growth.

Previous research had suggested that BRCA2 was involved in DNA repair, but its mechanism remained unclear. "By studying the normal function of BRCA2, we can understand how changes in the protein contribute to the development of cancer," explains Nikola P. Pavletich of the Memorial Sloan-Kettering Cancer Center, a co-author of the study. Using a process known as x-ray crystallography, Haijuan Yang of Cornell University and colleagues assembled a three-dimensional picture of BRCA2 (*see image*). The team determined that the protein can bind to broken DNA and—through a process known as homologous recombination—fix "double-strand" breaks in which both parts of the DNA double helix incur damage at the same time. When this first-aid kit fails, the researchers posit, the faulty DNA can lead to tumor growth in the breast, ovaries, prostate and pancreas.

*Source: Scientific American Sept 2002*

## Nobel Prizes of the year 2002

This year the Nobel Prizes in Physics, Chemistry, Physiology or Medicine have been given to the following :

### Physics:

**Riccardo Giacconi, Masatoshi Koshiba and Raymond Davis Jr.**

"For pioneering contributions to Astrophysics in particular for the detection of cosmic neutrinos"

### Chemistry:

**Kurt Wuthrich, Koichi Tanaka and John B.Fenn**

"For the development of method for identification and structural analysis of biological macromolecules."

### Physiology or Medicine:

**Britons Sydney Brenner, John E. Sulston and H. Robert Horvitz**

"For demonstrating how gene regulate organ growth and a process of programmed cell suicide"

(Detailed write-ups on this year's Noble Prizes will appear in the next issue of Dream-2047)

## CSIR Celebrates Diamond jubilee

The Council of Scientific and Industrial research (CSIR) India's largest research and development Organisation celebrated its Diamond jubilee celebration on 26 Sept.2002. The CSIR was established in the year 1942 and has 40 laboratories spred over the length and breadth of the country.

## Scientists Sequence Genomes of Malaria Parasite and Mosquito

Malaria continues to plague the world's population, particularly inhabitants of sub-Saharan Africa, where it kills at least one person every 30 seconds. Efforts to eradicate the disease in the 1950s and 1960s met with failure, and current control measures such as anti-malarial drugs are swiftly losing their potency. Now researchers have sequenced the genetic codes of the most deadly malarial parasite and a mosquito that carries it. Scientists hope the findings, published in the journals *Science* and *Nature,* will aid in the development of novel approaches to combating the disease. A team of more than 150 scientists describes the genome of *Plasmodium falciparum,* a parasite that causes malaria. The analysis, which took six years to complete, identified 14 chromosomes containing almost 5,300 genes, including nearly 200 that produce proteins to help *P. falciparum* evade the body's defense mechanisms. A better understanding of their functions may point to potential new targets for anti-malarial drugs. Because transmission of malaria requires a mosquito vector, controlling or killing the insects is another route to disease control. To that end, the work published in *Science* could help. A consortium of researchers led by Celera Genomics has sequenced the DNA of *Anopheles gambiae,* the primary species of mosquito that transmits malaria to humans. According to the report, the genome is 278 million bases long and contains almost 14,000 genes. The scientists have started the daunting task of identifying their functions. In particular, they investigated which genes were turned on or off when female mosquitoes feed on blood. Those are the pathways that are likely to be useful in finding points of intervention for developing new insecticides or transmission-blocking vaccines.

*Source: Nature, Oct:2002*

## METSAT Put in Orbit

India has proved its capability in space technology programme once again by successfully placing the 1060 kg first exclusive meteorological satellite (METSAT), into Geosynchronous Transfer Orbit from Sriharikota on September 12, 2002. METSAT will give scientists better capabilities to predict phenomena like monsoon and cyclones. India did not have an exclusive meteorological satellite so far. The 44.4 meter tall, four-stage Popular Satellite Launch Vehicle, PSLV-C4, weighing 295 tones, an improving version of this rocket series, injected the all-weather satellite METSAT into orbit, after traveling in an oval path, which would be about 36,000 km from the earth and also come close to 250 kms.

*Source : PTI News, September 2002*

**Compiled by Kapil Tripathi**

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# Interview With Prof. Asis Datta

Prof. Asis Datta, former Vice Chancellor of the Jawaharlal Nehru University, New Delhi, and presently the Director of National Centre for Plant Genomic Research (NCPGR), New Delhi, was till date the youngest biological scientist to get the S. S. Bhatnagar Prize, which he received in 1980. A molecular biologist par excellence, Prof. Datta is currently engaged in the research to improve the protein content of otherwise low-protein cereals and food crops. In a freewheeling interview to "Dream-2047", Prof. Datta talks about his current research interests and expresses his views on genetically modified organisms. Excerpts:

**Prof. Asis Datta on his research work in the past**

My Ph. D. work led, for the first time, to the discovery of the role of allosteric enzymes in the amino sugar metabolism in animal issues. As recognition of this work, I was invited to contribute two articles in Methods of Enzymology. After doing Ph.D. from Bose Institute of Calcutta, I left for the U.S. in 1968 to take up the position of Research Associate at the Public Health Research Institute in New York under the leading virologist Richard Franklin. There I worked on lipid containing viruses. It was my entry into the field of molecular biology. Subsequently in 1971, I moved to the University of California Los Angeles and worked there as an Assistant Virologist (equivalent to Assistant Professor) for two years.

While in the U.S., I worked on the central issues of molecular biology at that time. That is, elucidation of macromolecules using lipid enveloped doubled-stranded DNA bacterial virus PM2 as a model system. Our extensive investigations on this bacteriophage and its host cell led to some important conclusions concerning the alteration in the host cell membrane leading to synthesis of the viral envelope and on the structure of the viron with particular reference to the membrane. The discovery of a novel RNA polymerase as one of the structural proteins of the bacteriophage was the first-ever report of the presence of an enzyme inside the bacterial virus.

In 1973, I had decided to come back to India. There were plenty of options before me — Bhabha Atomic Research Centre, Mumbai, University of Calcutta, and my alma mater the Bose Institute. But I opted for Jawaharlal Nehru University, New Delhi, which was coming up at that time. Its Biological Sciences Department was set up in July 1972. And I joined in March 1973. Here, I decided to work on gene expression in eukaryotic cells. Eukaryote is an organism consisting of a cell or cells in which the genetic material is DNA in the form of chromosome. The obvious choice was yeast. It not only multiplies fast, but also is a preferred medium for culturing bacteria. There too, instead of working on the more commonly used *saccharomyces* yeast, we picked up Candida albicans, human pathogenic yeast which could be life threatening when the immunity of the affected is weak. Our work on C. albicans led to the understanding of molecular basis of its pathogenicity. **In addition to discovering an inducible N-acetylglucosamine catabolic pathway,** we could unravel that all genes of this pathway in C. albicans are present in a cluster. Catabolism is nothing but the breakdown of complex organic compounds in living organisms into simpler ones. N-acetylglucosamine is an aminosugar involved in this catabolic process.

*Prof. Asis Datta*

In 1975, I started thinking of getting basic mechanism of plant protein synthesis worked out. I have always felt that one should try to know the area well before launching any major programme. Subsequently in 1976, I went to the U.S. to work in Nobel laureate Dr. Severo Ochoa's lab for 15 months. Our work there clearly demonstrated that initiation of protein synthesis in eukaryotic cells is controlled by phosphorylation of the initiation factor. Phosphorylation is a process by which a phosphate group is introduced into an organic compound or a molecule. This, for the first time, established the role of a new initiation factor. Another important work we carried out was related to development of plant embryo. We found that certain messenger RNAs are produced during formation of an embryo, but stored for use during germination. My attempt to understand the regulation of translation of these stored mRNAs into messages led to the discovery of two compounds that inhibit the translation process. They were a protein kinase and a small molecular weight RNA.

By the mid-eighties, we decided to look at application potential of our scientific work. My grounding in biochemistry and understanding of molecular biology attained through years of scientific research came in handy when we decided to take up the cloning of plant gene in a major way. Plant is an accomplished system. But the major challenge was lying in improving the protein content of low-protein crop plants. For instance, crops such as rice and maize, which are quite popular in our country, have very low protein content. Moreover, the nutritive value of the protein is very low. We were then looking for a gene that can code for a protein with useful amino acids in high quantities. Amino acids are organic compounds found in plant and animal tissues and form the basic constituents of proteins. That is how we hit upon *amaranthus* seeds, which are rich in amino acids. That was just a beginning. Subsequently we isolated a gene, AmA1, from *amaranthus* seed and tried to introduce

them in many edible crops. Another problem that attracted our attention at that time was presence of oxalic acid in many vegetables and crops which combines with calcium, iron and zinc in our bloodstream to spawn kidney stones. Oxalic acid is present in as many as 40 crops, including tomato and spinach. We felt that if we can get this oxalic acid rid of these crops we have a viable solution for renal failures which otherwise require life-long use of dialysis or kidney transplantation, both beyond the means of most Indians. Our investigations led to an isolation of oxalate decarboxylase (OXDC) gene from an edible fungus.

### On his current research interests

Our work on C albicans and on genes isolated from *Amaranthus* and an edible mushroom called *Collybia velutipes* are continuing. I already have four U.S. patents on these two genes — AmA1 and OXDC. We have almost completed field trials for transgenic potato and tomato. While protein-enriched transgenic potato variety developed with AmA1 gene is on the verge of completion of field trials, an oxalic acid-free tomato crop is also getting readied for release. The field trials for the genetically modified potato is being conducted jointly with Central Potato Research Institute, Shimla.

Similarly we are working on introduction of the AmA1 gene in rice, cassava and sweet potato. A marginal increase of even 1 per cent in the protein content of these crops will be a significant achievement. We have networked with Haryana Agricultural University, Punjab Agricultural University and University of Agricultural Sciences, Bangalore, for the work in rice, while we work with Central Tuber Research Institute, Thiruvananthapuram, for testing protein-rich transgenic varieties of sweet potato and cassava. We have recently identified and isolated a gene that can increase the shelf life of vegetables by delaying the ripening process and a patent on the same is expected to be filed very soon.

We are also continuing with our work on *C albicans* yeast. This pathogenic fungi which invade and colonise human mucosal surfaces rich in amino sugars, are a cause of secondary infection. Secondary infections have assumed much more notoriety since the advent of AIDS, caused by Human Immunodeficiency Virus (HIV). We could not only work out a catabolic pathway of *C albicans*, but also disrupt this catabolic process in order to render the fungus avirulent. This work has been going for the last 28 years. We expect this to have significant medical importance.

### On introduction of transgenic crops

Transgenic crops can be developed in many ways. One is to use genes from edible sources and another to use genes from non-edible plants and microorganisms. In our lab, the emphasis has been on developing genetically modified (GM) crops using genes from edible sources. They are believed to be quite safe. Whereas transgenic varieties developed with the genes from other sources should be handled with caution. That does not mean that India should not go for GM crops. In fact India should take up GM crops as they are important for the country's food and nutrition security. We have already permitted limited Bt cotton trials. In fact India has very clear-cut policy regarding monitoring of monitoring and evaluating bio-safety of such crops. I myself have been the chairman of the Review Committee on Genetic manipulation (RCGM) of the Department of Biotechnology for several years.

### On biotechnology education in the country

Department of Biotechnology (DBT), Department of Science and Technology (DST) and Council for Scientific and Industrial Research (CSIR) have been contributing enormously to manpower development in biotechnology in the country. But if you ask me whether biotechnology education should be further spread to a large number of universities of undergraduate level, my answer will be a "No". Firstly, biotechnology education and research require infusion of huge amounts of funds, which I feel the University Grants Commission (UGC) is not in a position to do. As a result, the infrastructure available in most universities for biotechnology studies is poor. Moreover, my personal feeling is that what is more important is imparting of quality education in subjects such as modern biology, biochemistry and molecular biology at undergraduate and postgraduate levels. In-depth knowledge of these subjects comes handy when one goes for research in biotechnology.

**T.V. Jayan**

## Letters to the Editor

*I find Dream 2047 extremely interesting, rich in its contents and helpful as teaching material. I distribute interesting articles/news items on recent developments in science from the newsletter to our students and also to the teacher participants of the Refresher Course (conducted by us) as reading material.*

*Dr. Uma Tiwari Palni*
*Reader, Dept. of Botany,*
*D.S.B. Campus, Kumaon University, Nainital*

*I have read with great pleasure "Dream 2047" issues of 2002. The production in all respects is of very high quality and you can legitimately be proud of it. The contents and the presentation of the scientific / historical articles is exceptionally good. I specially enjoyed the brief article on Pascal's Triangle.*

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