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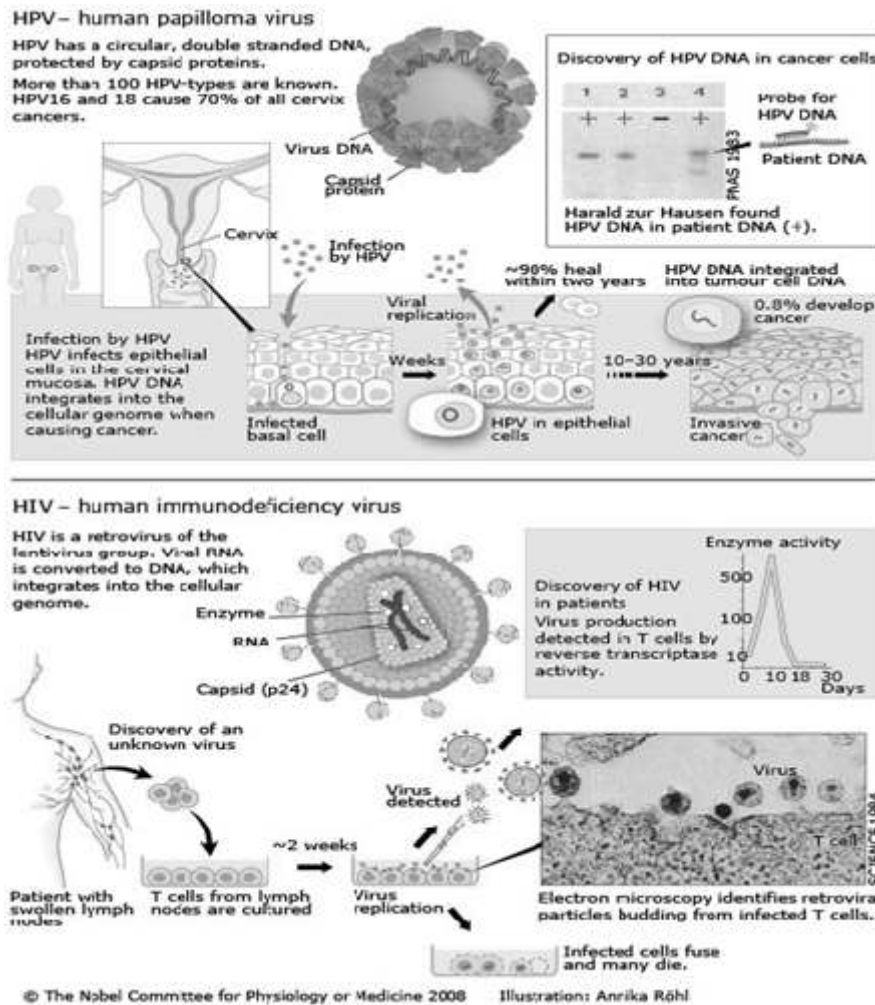
As per decision of Council meeting held on May 03, 2014, Presidential Address will not be printed henceforth in Everyman's Science as they are already printed in the above mentioned book.

EDITORIAL

An Introduction To Human Pappillomavirus

Human Pappillomavirus (HPV), is virus which infect the genital warts of human body and causes tumour. This virus cause as “high risk” as it infect the cervix which then leads to the cervical cancer. Many HPV virus genomes have been sequenced. As a result over 120 HPV types genome sequence have been identified.

Cervical cancer is the second worldwide disease commonly seen in women. There is many type of HPV Viruses. The most prevalent HPV virus found is HPV type 16 whose proteins are e6 and e7, where e7 is much more effective than the e6 protein. In around 55% of cervical cancer cases, HPV 16 is responsible.



(Courtesy by:- The Nobel Committee for Physiology or medicine 2008 Illustration: Annika Röhl)

A cervical screening test (Papanicolaou smear test) commonly known as "PAP" test is done to reduce the cases of cervical cancer. Girls are asked to have this test at the age of 15 years till the age of 45 years once a year. Gardasil is the vaccine which should be taken by the female at the age of 15 years to avoid the infection of HPV. No proper medicines have come in the market which is completely curable. The HPV viruses are double stranded DNA virus and are double enveloped. Their genomes are circular in size. There are 8 major proteins encoded in HPV, where 6 proteins are responsible for the regulatory function like transcription, cell cycle, cell signalling. The rest two proteins are for the late region at the infection. Apitoxin known as the honey bee venom is used as a natural compound for the treatment of cervical cancer. Honey bee is made of peptide (melittin) and amino acids (C1q - Vp.c1q). Many other natural compounds like Gene Eden-VIR is also a antiviral compound used in curing disease spread viruses, it has five natural ingredients. Novirin is a antiviral natural compound used as a antiagent for viruses. It has five natural ingredients i.e. *Camellia sinensis* extract, Quercetin, *Licorice* Extract, *Cinnamomum* extract and Selenium. The viral E6 and E7 Oncoprotein are the necessary malignant conversion.

These proteins have the ability of suppressing p53 tumor suppressor and pRb. Some symptoms which are seen in the genital warts of women such as small bumps or group of bumps, it may be small or large.

In the cervical cancer it usually does not show any symptoms and are not noticeable soon. It is very important for women to go for yearly regular screening per year. HPV 6 and 11 is the most common virus in the case of genital warts responsible for low type risk.

These viruses are also responsible for skin warts such as they affect arms, face, feet, hand, and legs. HPV is not only responsible for causing cervical cancer but also a great risk for oral cancer. HPV infections are also transmitted by skin to skin contact also if a person is infected by skin warts virus, it may include the kissing and touching the infected area. If a mother is infected with this virus it is transmitted to the infant during the labour time. According to a research the genital infection are generally seen in teenagers and young adults. This infection may also occur due to the number of sex partners. Person already with less immune system or a comprised immune system or is medicated which is suppressing the immunity gives a great chance of increase in infection of HPV virus.

This is the second mortality disease after HIV which is not curable, yet the scientist and researchers are trying their best to make medicine for this disease. Natural compounds always play a best role in curing disease. Honey bee venom is used as a natural product to inhibit the action of this infection.

*Dr.(Mrs.) Vijay Laxmi Saxena
Kanpur*

Science is vastly more stimulating to the imagination than the classics.

-J.B.S. Haldane

LIPASE ENZYME AND ITS DIVERSE ROLE IN FOOD PROCESSING INDUSTRY

Shweta Sachan and Aditi Singh

Lipases enzymes catalyze the hydrolysis and synthesis of esters formed from long-chain fatty acids and glycerol. They are widely distributed in the plant world, bacteria, molds as well as in milk products and in animal tissues, especially in the pancreas. They have applications mainly in dairy, oleochemical, pharmaceuticals, paper & pulp, cosmetics, textile, detergents and leather industries. It is one of the most reported groups of enzymes for the production of biofuels.

INTRODUCTION

Lipases (triacylglycerol acylhydrolases, E.C. 3.1.1.3) are found in wide diversity of sources such as blood, gastric juices, adipose tissues, intestinal juices and pancreatic secretion. Lipases are subclass of esterases that catalyzes the formation, cleavage (hydrolysis), digestion and transport of fats (lipids). If lipase is produced in sufficient quantity it can use fat stores to be burned as fuel. In eukaryotes, lipases are involved in various stages of lipid metabolism including absorption, lipoprotein metabolism, fat digestion and reconstitution. In plants, lipases are present in energy reserve tissues.

Lipases are produced by higher eukaryotes as well as many microorganisms. Microbial lipases are most useful for industries. Some lipase-producing microorganisms are bacteria, yeast, fungi and actinomycetes. Some of the lipolytic bacterial species are *Bacillus subtilis*, *Pseudomonas fragi*, *Bacillus megaterium*, *Staphylococcus aureus*, *Burkholderia cepacia*, *Pseudomonas aeruginosa*, and *pseudomonas pseudoalcaligenes*. Some common lipase producing fungal species are *Helvina lanuginosa*, *Rhizopus delemar*, *Eurotrium herbanorium*, *Aspergillus niger*, *Mucor circinelloi* and *Penicillium citrinum* etc¹.

PHYSICAL AND CHEMICAL PROPERTIES OF LIPASES

Structurally Lipase enzyme is a monomeric

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protein and has a molecular weight of 19-60 kDa. It's activity generally depends on the availability of large surface area, requires extremely mild conditions and is pH dependent. Lipases are generally stable at or near a neutral pH, but some may be stable up to pH 4.0 and 8.0. For the expression of its activity cofactors are not essential but divalent cations stimulate the activity. Though the maximum activity of lipase is found in the range of 30-35°C, but it can be stable at lower temperature also.

Lipases are divided into two groups according to the region-specificity exhibited with acyl glycerol substrate. The first group lipases show no regiospecificity and release fatty acids from all three positions of glycerols. The lipases of second group release fatty acids regio-specifically from the outer 1 and 3 positions of acylglycerols. It hydrolyse triacylglycerol to give free fatty acids, 2-monoacylglycerol and 1,2-(2,3)-diacylglycerols.

FUNCTIONS & BIOLOGICAL ROLE OF LIPASE ENZYME

Lipase enzyme has so many biological actions in our body:

- I. Digestion of Nutrients:** One of the most important functions of lipase is digestion of fat. When we consume food, the fats from food pass through the stomach undigested into the small intestine. Pancreas releases the enzyme lipase, which hydrolyzes fats into

smaller particles that can pass through the wall of the intestine and into the lymphatic ducts, after that they eventually pass into our bloodstream.

- ii. Cholesterol Transport:** Lipase helps our body to package cholesterol to transport in the blood. A specific lipase cholesterol acyltransferase (LCAT), combines fatty acids with cholesterol then the molecules are packaged by the body into transporter particles like LDL and HDL, respectively and moves them to or away from the cells.

INDUSTRIAL USES OF LIPASE ENZYME

Lipases form an integral part of the industries ranging from dairy, food, cosmetics, leather, textile, pharmaceuticals, detergents, tea industries and bioremediation processes. They are also being exploited as versatile and cheap catalysts

to degrade lipids in more modern applications. Lipase enzymes are available in market for baking, to be used in detergents and also as biocatalysts in alternative energy production to convert vegetable oil into fuel.

Lipases shows promising applications in detergent formulations, organic chemical processing, synthesis of biosurfactants, dairy industry, paper manufacture, the oleochemical industry, the agrochemical industry, cosmetics, pharmaceutical and nutrition processing². The main use of hydrolytic lipases is their use in detergents. About 1000 tons of lipases have been added to 13 billion tons of detergents produced every year.

Lipases and Food Industry

Lipase enzyme has a diverse role in almost every field of food processing industry (Table – 1), some examples are as follows:

Table 1: Uses of Lipase Enzyme in Food Processing Industries⁶

Industry	Action	Product of application
Dairy	Hydrolysis of fat, modification of butter fat, cheese ripening	Development of flavouring agent in milk cheese and butter
Bakery	Flavour enhancement	Shelf life prolongation
Beverages	Improved aroma	Alcoholic beverages
Food dressing	Quality improvement	Mayonnaise and dressings
Health food	Transesterification	Health foods
Meat and fish	Flavor development	Removal of fat from meat and fish
Fats and oils	Transesterification, hydrolysis	Cocoa butter, margarine, fatty acids, glycerol, mono -, and diglycerides
Tea processing	Breakdown of lipid, Flavour enhancement	Black tea

Dairy Industry

In dairy industries lipases are extensively used for the hydrolysis of milk fat. It is used to enhance the flavour of cheeses, in acceleration of cheese ripening, manufacturing of cheese products and lipolysis of cream. Lipases when act on milk fat, generate free fatty acids, which leads to production of many dairy products, particularly cheeses with specific flavour characteristic³.

Bakery Food

In baking industry, there is an increasing focus on lipolytic enzymes. Recent findings suggest that lipases can be used to substitute traditional emulsifiers since the enzymes degrade wheat lipids to produce emulsifying lipids *in situ*. It was primarily used to improve the flavour content of bakery products by liberating short-chain fatty acids through esterification along with flavour enhancement. It also modifies the natural lipids in flour to strengthen the dough.

Beverages

Barley is the most important grain in use for making beer all over the world. Total lipid content in barley ranges from 3 to 5 % of grains dry matter. Lipase is used to hydrolyse the lipid of barley and also improved aroma in alcoholic beverages like sake wine.

Meat and Fish Processing and Food Dressing

In processing of meat and fish products, lipases are used for fat removal and flavour development. Lipase is found in fats and oils which can break a fat down into free fatty acids and glycerol. Lipases are found also in the fat of meat, fish, eggs, milk and cereals. Lipases are being used extensively in the mayonnaise, dressing and whipping to improve its quality and texture.

Lipases in Tea Processing

The quality of black tea is dependent largely on the dehydration, enzymatic fermentation and mechanical breaking. While processing black tea, enzymatic breakdown of membrane lipids initiate the formation of volatile products with characteristic flavour properties⁴.

Lipases in Fat and Oil Processing

Modification of fats and oil is one of the prime areas in food processing industry that demand novel economic and green technologies. Lipases allow us to modify the properties of lipids by altering the location of fatty acid chains in the glyceride and replacing them with other ones. Esterification and interesterification are used to obtain value added products among the lipolytic conversion of oils and fats. Such as specialty fats and partial glycerides by using positional and fatty acid specific lipases have greater industrial potential than fatty acid production in bulk through hydrolysis⁵. The removal of phospholipids in vegetable oils is also a recently developed environmental friendly process.

USE OF LIPASE IN OTHER INDUSTRIES

Detergents

Enzymes are used in the laundry detergents for the removal of oil stains from fabrics. It allows detergents to work in lower temperatures and also shorter periods of agitation are needed, often after a preliminary period of soaking. Nowadays, so many detergents contain cocktails of enzymes like amylases, proteases, lipases and cellulases. In general, it removes protein from clothes soiled with blood, grass, sweat, milk etc. far more effectively than non-enzyme detergents. However, use of modern bleaching and brightening agents, the difference between looking clean and being clean may be difficult to discern.

Pulp and Paper Industry

The enzymatic pitch control method using lipases have been used since early 1090s in a large-scale paper-making process as a routine operation since early 1990s. Severe problems in pulp and paper manufacturing are caused by pitch or the hydrophobic components of wood. Lipases are used to separate the pitch from the pulp for paper manufacturing⁴.

Oleochemical Industry

The current trend in the oleochemical industry involves the use of immobilized lipases to save

energy, minimize thermal degradation during hydrolysis, glycerolysis and alcoholysis by using mixed substrates. Thus it ensures high productivity as well as continuous running of the processes. Enzymatic hydrolysis offers the successful fat splitting without substantial investment in expensive equipment and in expenditure of large amounts of thermal energy.

Cosmetic Industry

Lipases have potential application in cosmetics and perfume industries because of its use in surfactants and in aroma production. Although the cost of esterification by lipase remains too high for the manufacturing of bulk products yet esters synthesis has found its way in the market place.

Lipases as Diagnostic Tools

Lipases are also important drug targets or marker enzymes in the medical sector. They are used in the enzymatic determination of serum triglycerides to generate glycerol which is determined by enzyme linked colorimetric reactions⁴. Its level in blood serum may be used as a diagnostic tool for detecting acute pancreatitis and pancreatic injury.

Lipases in Environmental Management and Bioremediation

Employment of lipases in bioremediation processes is a new aspect in biotechnology. The wastes of lipids in restaurants and processing factories can be cleaned by its help. The strains which produce lipases played a key role in the enzymological remediation of polluted soils⁷.

In bioremediation field Cold-adapted lipases shows great potential in fat contaminated cold environment, water waste treatment and active compounds synthesis in cold condition. By the use of lipase oil spills in refinery, shore sand and processing factories can be handled. The enzymes that can active at low and moderate temperature are also ideal for bioremediation process⁸.

Biodiesel Production

Biodiesel is a liquid biofuels; they are esters of

long chain fatty acids and short chain alcohols. Transesterification is the central reaction in the biodiesel production which could be catalyzed either enzymatically or chemically. Enzymatic transesterification has advantages over chemical transesterification, as it is less energy intensive, allows easy recovery of glycerol and the transesterification of glycerides with free fatty acid contents⁹. Lipases represent most reported groups of enzymes for production of biofuels.

CONCLUSION

The potential of lipases in food and other industries shows the need to develop novel cost-effective technologies for increased production, scaling up and purification of this versatile enzyme. The large number of hydrolytic applications, like flavour enhancement in dairy products, beverages, milk chocolate etc. is a promising field of lipase enzyme. Other than the food industry, lipases have been applied in the synthesis of fine chemicals, the production of biopolymeric materials, biodiesel production, detergent industry, organic synthesis, textile industry, paper and pulp industry, the synthesis of ingredients for personal care products, the synthesis of surfactants and of structural triglycerides, agrochemical production, the oleochemical business, the pesticide industry and in environmental management. The application and characterization of lipases to catalyze reactions with commercial potential will significantly broaden the spectrum of industrial biotechnology. Novel lipase genes have to be isolated to fulfil the needs of the enzymes in industries and the existing lipases are to be engineered for desired properties. A rapid boom in the future of lipase technology is evident from the large number of research, patents and publications reports in the recent years and indications are that this growth will be sustained for many years.

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BASICS OF MATERIAL DETECTION AND ITS APPLICATION IN DEFENCE

Vijay Kumar

Material detector uses a non-destructive inspection process to determine whether a person/container have explosive material. Material detection is commonly used at sensitive area like airports, ports and for border control. Depending upon the characterization process of material detector, broadly it can be photon detector, thermal detector and coherent receiver.

INTRODUCTION

A detector is a device that recovers information of interest contained in a modulated wave. Nearly all detectors made up of special materials act as transducers that receive photons and produce an electrical response that can be amplified and converted into a form intelligible to suitably conditioned human beings.

TYPES OF MATERIAL DETECTOR

There are three basic ways that detectors carry out this function:

1. Photon detectors respond directly to individual photons. An absorbed photon releases one or more bound charge carriers in the detector that may (1) modulate the electric current in the material (2) move directly to an output amplifier or (3) lead to a chemical change. Photon detectors are used throughout the X-ray, ultraviolet, visible, and infrared spectral regions. Photoconductors, photodiodes, photoemissive detectors, and photographic plates.
2. Thermal detectors absorb photons and thermalize their energy. In most cases, this energy changes the electrical properties of the detector material, resulting in a modulation of

the electrical current passing through it. Thermal detectors have a very broad and nonspecific spectral response, but they are particularly important at infrared and submillimeter wavelengths, and as X-ray detectors. Example: Bolometers etc.

3. Coherent receivers respond to the electric field strength of the signal and can preserve phase information about the incoming photons. They operate by interference of the electric field of the incident photon with the electric field from a coherent local oscillator. These devices are primarily used in the radio and submillimeter regions and are sometimes useful in the infrared.

CHARACTERIZATION OF MATERIAL DETECTOR

Usually a material detector is characterized by Spectral response, Spectral bandwidth, Linearity, Dynamic range, Quantum efficiency, Noise, Imaging properties, Time response of the material.

APPLICATIONS OF MATERIAL DETECTION IN DEFENCE/MILITARY

1. Infrared Detection Devices

IR detectors are mainly used in Night vision devices and Infrared seekers use different detectors to observe the IR signature of aircraft.

Methods/Materials used for detection: Several

Quasi-phase-matching (QPM) techniques have been proposed, including stacking crystals of alternating orientations, periodic poling of polymers or fused silica, ferroelectrics, asymmetric quantum wells, and epitaxial growth of semiconductor materials on template substrates.

2. **Chemical/Biological Sensing**

Photonics will continue to be a primary approach to sensing chemical and biological agents in the form of gases, vapours, aerosols, or surface-bound media. In defence material detectors are also used to detect the underground mines laid by enemies.

Methods/Materials used for detection: For chemical sensing there are several different techniques. The main material challenges are for new IR laser media. Compact semiconductor quantum cascade lasers (QCLs) are a recent breakthrough that extends the wavelength range of semiconductor lasers well into the mid-IR. The lasing wavelength of the QCL can be tailored by bandgap engineering, but operation is currently limited to cryogenic temperatures. For bio sensing, UV fluorescence will likely remain a predominant detection technique because of its sensitivity and ubiquity among biological species. The lack of efficient UV laser and detector media are barriers to progress. Wide-bandgap semiconductors made from GaN are receiving the greatest attention in the engineering research community, but fundamental studies are lacking.

3. **Transduction and Measurement of Small Forces and Masses**

The converse effect to the actuation of motion and mass transport is the detection of motion, small forces, and mass.

Methods/Materials used for detection: The forces on micro and nanostructured materials can be detected by a variety of physical processes, such as the creation of a voltage on a

piezoelectric material. Small changes in mass can be sensed by observing the resonant frequency shift of micro-oscillators. Modulated electron tunnelling and deflection of a laser beam by a moving structure have also been used to detect small motions. Such approaches are used in commercial scanning probe microscopes, often using micro fabricated cantilevers as the force or motion transduction elements. The optical, electrical, and piezoelectric in addition to the mechanical properties can be important for microstructures used in force transduction. Materials that can perform these functions must be integrated with other materials of different functionality.

4. **Transmitters, Receivers, and Detectors for High-Frequency Broadband Systems**

The military needs materials for transmitters, receivers, and detectors that can operate at frequencies from MHz to over 100 GHz frequencies.

Methods/Materials used for detection: SiGe is seen as the next-generation material for high-speed, high-frequency applications, but it is not suitable at the highest frequencies; these require different materials, most likely the group III-nitride crystals and their derivatives. Materials research should concern itself with developing appropriate substrates, optimizing epitaxial growth (which will require better understanding of fundamental aspects of the growth of these polar materials), and improving the junctions and contact layers (which will entail identifying important defects and ways to eliminate or control them).

Apart from all these to create economically developed and deployed sensors that enable warning of transit of special materials. One of the proposed concepts in this regard is:

5. **Self-Powered architecture for subcutaneous detector devices**

This architecture is designed to work as an event

detector or threshold level alarm of some substances, ions etc. that are detected through three-electrode amperometric Biosensor approach. The ?nal device is envisaged as a Low-Power subcutaneous implantable application powered by an inductive link, one emitter antenna at the external side of the skin and the receiver antenna under the skin.

VARIOUS CHALLENGES FACED BY MILITARY AND THE PROPOSED SOLUTIONS

Even though there are numerous material detectors are available, but still there is probability of not detecting a material, which many times lead to misshapen. These non-detection problems in the present material detector are because of false detection and failed threat ID's. The proposed solutions for these problems are:

1. False Detection and Failed threat ID's: We can overcome this fault by using multi-mode detection techniques which uses different properties of material like its chemical and physical properties. It is always better to check the main property of the explosive using single mode detector. In case material used is very complex we should go for multimode detection.
2. To make the multimode detection techniques more efficient we should first prioritize the degree of threat depending upon that we should increase the degree (degree here means we should check more properties i.e. chemical, physical etc. of the explosive) of multimode detection technique. It is always better to check the

main property of the explosive using single mode detector. In case material used is very complex we should go for multimode detection.

CONCLUSION

Efficient material detection technique radically improves security concern of a country. The wide variety of techniques we have covered will give the insight of material detection and its importance. However, this list is by no means limiting. It is hoped that this article will also give broad overview into promising areas of research and it may further stimulate investigations in material detection.

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AUTISM : A GLOBAL PROBLEM

Aditi Bandyopadhyay, Julie Bhattacharya and Salil Kumar Mandal

Autism is a very familiar word to most of the world population over the last decade. Autism, at present also known as 'Autism Spectrum Disorder', according to *Diagnostic and Statistical Manual-IV* is a wide spectrum disorder that involves individuals from those who have super intelligence to those needing sheltered atmosphere for daily living. But still people are wondering, as of how to know that the person sitting next to him is by any means an Autistic individual, since it is an invisible disability. Surprisingly, recent statistics of Center for Disease Control and Prevention (2014) says 1% of world population has Autism Spectrum Disorder. Prevalence being 1 in 68 births. This article speaks about the problems manifested in Autism, an insight into them, and how they can be managed with early interventions. So it is a matter of concern to the whole world and is becoming a global problem.

INTRODUCTION

International Classification of Diseases (WHO, 1992) classified Autism Spectrum Disorder under the general heading of Pervasive Developmental Disorder (PDD). According to Center for Disease Control and Prevention, this group of disorders are characterised by qualitative abnormalities in reciprocal social interactions and in patterns of communication, and characterised by a restricted, stereotyped, repetitive repertoire of interests and activities. Autism is a developmental disorder where individuals have difficulty in mainly the following areas:

Impairment in communication:

The entire range of communicative skills are impaired. A major proportion of them never speak at all but can listen, understand and obey instructions¹. Even if they start developing speech and can talk, many among them with classical Autism fail to develop purposeful speech, eg may keep on repeating the same word or phrase or may develop echolalia (repeating what is heard). Some develop a kind of abnormal intonation of speech and may use stereotyped phrases which are conditioned with a situation.

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They also have tremendous difficulty in understanding language of other individuals in their surrounding and sometimes feel very much challenged to survive in regular academic or social settings.

Difficulty in social understanding:

People with Autism have tremendous difficulty in making friends and understanding relationships. The usual methods of social communication such as eye-to-eye gaze, use of gesture and facial expressions are generally affected.³ Their body language and eye contact sometimes appear to be inappropriate and for that they are easily misunderstood by others, and at times avoided, ridiculed or even punished. Hence from a very young age they are unable to participate in play, social events, education and employment.

Impaired thinking and social imagination:

Abstract thinking is a big problem encountered by individuals with Autism. Children with ASD usually lack the ability of pretend play. In a company of regular non Autistic children they are mostly non-interactive and at a level of parallel play.

Mostly people with Autism have rigid and repetitive behaviours¹. On the contrary, people with Autism are strong visual and experiential learners. Standard teaching methods which are mostly lecture based henceforth fail to teach them.

Sensory problems:

Children and also adults with Autism usually have different sensory issues. They may be affected by certain noises, colours, lights, tastes or smell. They may be easily distressed by a certain stimuli which may not make any difference to any regular individual. The range in this situation can also vary from being hyposensitive to hypersensitive. A very common behaviour seen in Autistic individuals is to seek visual stimulation by staring at objects from unusual angles, spinning and flickering objects under a light. They may also seek tactile stimulation by spinning, flapping hands or rocking and may be very uncomfortable in certain fabrics or items of clothing to an extent that can evoke a socially unacceptable behaviour³ for example- rocking, head banging, unusual restlessness etc.

SPECTRUM OF AUTISM

The spectrum of Autism is huge and varied. It can manifest as:

Severe:

Marked speech impairment, unregulated behaviours, associated with mental retardation.

Moderate:

Mostly uneven skills, speech difficulties, training required in a structured sheltered facility to develop self help skills.

High functioning/Asperger's syndrome:

Commonly known as Borderline Autism. They are capable of studying or working in a regular environment. They will need a support structure throughout life². Some of them may have very high intelligence who are known as Autistic savants.

EARLY SIGNS OF AUTISM

Signs of Autism appear as early as 18 months and the regression period is usually within this period of 18 months to three years. However, researchers are of the opinion that nowadays screening can be done as early as six months².

Flag signs to look for in a child to suspect Autism Spectrum Disorder³:-

1. Difficulty in interacting and playing with other children
2. Indicates needs by gestures, or by leading adults by the hand
3. Echoes words and phrases spoken to the child
4. Enjoys spinning or rotating objects
5. Inappropriate laughing or giggling
6. Likes sameness in everyday routine, does not enjoy change
7. Lack of pretend play or unusual and repetitive pretend play
8. Does not respond when called, sometimes appears to be deaf
9. Not responsive to normal teaching methods
10. No understanding or fear of real dangers
11. Carrying tantrums, extreme distress for no apparent reason
12. Extreme restlessness, hyperactivity or extreme passivity
13. Unusual behaviours or body movements such as flapping hands or rocking and jumping.

In case of any of these signs or any other doubts regarding any developmental delay or significant speech delay, the child should be taken immediately to a paediatrician or psychiatrist from where the child will be referred for screening of Autism to an early intervention clinic, or developmental clinic of any hospital or else to a professional special

educator who has qualifications related to this field.

If a child suffers from any aforesaid flag sign, the screening needs to be done to ensure proper timely intervention.

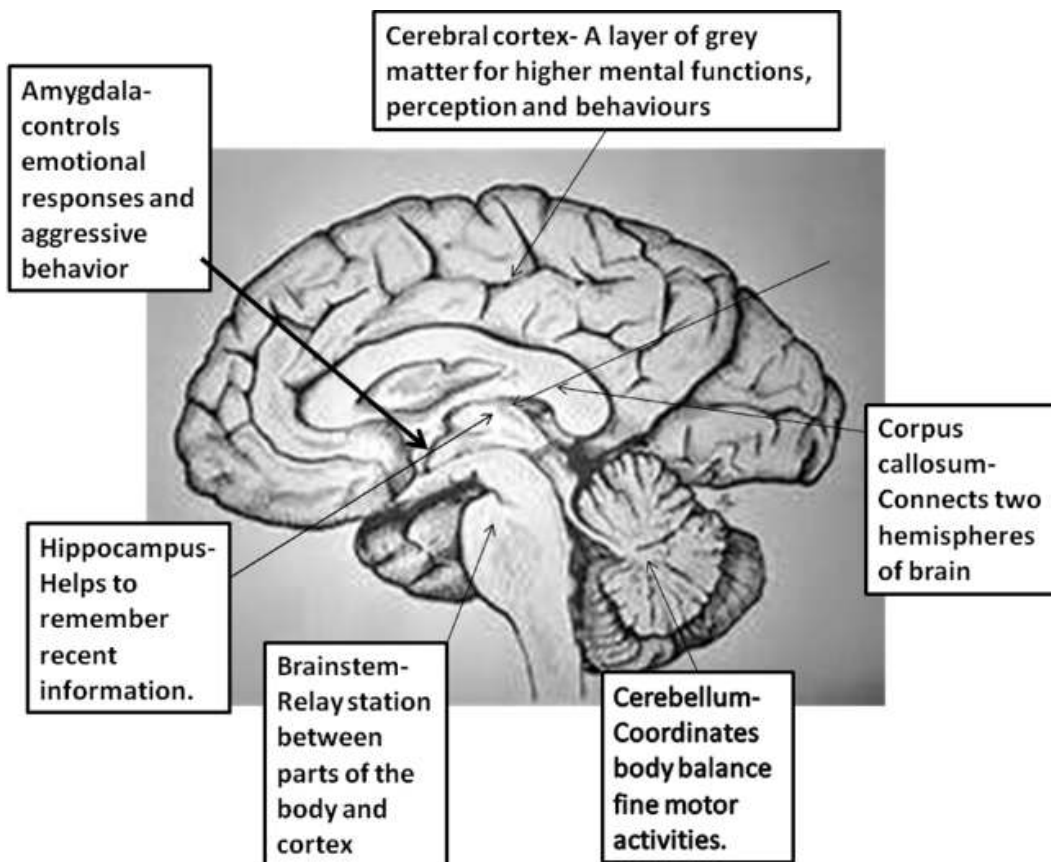
There is also an online questionnaire MCHAT⁴ (Modified checklist for Autism) which can be completed by parents who have doubts about their child's possibility of being Autistic.

CAUSE

The cause of Autism is still not clear. Research is going on all across the world to find the

answer to this question. Genes and environment both may play strong roles in the process. Family studies of two consecutive siblings affected with ASD is 2%-18%. In identical twins the risk is 36%-95%. However, reasons have not yet been established^{5,7}. It has been established that Autism affects higher centers of Cerebral cortex, Amygdala, Basal ganglia, Hippocampus, Corpus callosum, Brainstem and Cerebellum (diagram below). It has been proposed that there is a surplus of neurons due to lack of cerebral pruning. Less involvement of mirror neurons is another proposed theory⁹ but no concrete reason has till now been given as the cause of Autism. The entire world is looking for an answer.

Parts of Brain affected by Autism



MAGNITUDE OF THE PROBLEM

- 1 According to the most recent statistical data obtained from Center of Disease Control and Prevention, 1 in 68 children are identified with Autism⁶.
- 1 Autism occurs in all population irrespective of race, religion, culture and ethnicity and 8 out of 10 children are boys, the occurrence being much lower in girls⁶.
- 1 Autism can co exist with other conditions like cerebral palsy, Down's syndrome, hearing impairment, visual impairment and mental retardation⁸.
- 1 In India the problem is soaring high but not catered to properly. In most of the cases children with Autism at a young age, get ignored and are not given proper interventions due to lack of awareness of parents and the society around.

INTERVENTIONS

It is a huge disappointment and a big mental set back when parents get to know that their child has Autism. The mind stays in denial for a long time. Fear of social stigma and uncertainty of the future of the child looms large. Many parents get into depression and start feeling helpless!¹⁰

However, the good news is they are not alone. This journey of life has been destined for many parents across the globe and they have been successful in making their children with Autism capable enough to develop self help skills. Prognosis of the child will depend on the severity of Autism.

Parents should immediately take their children for early intervention which involves a series of therapies for behavioral modification and special education. Applied Behavioral Analysis (ABA), Verbal Behavior Analysis (VBA), TEACCH method, Speech Therapy, Rapid Prompt Method are

a few of them which have shown immense improvement in children with Autism who have started them as early as possible. It should be remembered that every moment is precious. So, keeping the development of the child as a first priority parents should start the interventions as early as possible¹¹. The best therapy required by the child will be decided by a qualified and professional special educator which will be the Individualised Education Program (IEP) for the child.

AWARENESS

Autism is a condition with which people are born with. The society has to come forward in understanding the issues of an Autistic individual. Awareness in the society has to develop among all sections, all professions like Teachers, Students, Health Professionals, Executives, Office personnel, Shop keepers etc to understand the quirky individual whose speech or body language might seem to be a little awkward but has the need and necessity of merging with the mainstream society. Acceptance has to come from the outer world.

High Functioning Autistic individuals have not only achieved success in their lives but also advocated needs of their own. Dr. Temple Grandin , Professor of Animal Sciences and Psychology at University of Northern Colorado is a pioneer in the field¹². Dr. Vernon L. Smith, Professor in Economics, Nobel Laureate, 2002, Dr. Stephen Shore, Professor at Adelphi University, and many more scientists, singers, mathematicians making the list very long. But, even those who have not been into the limelight have also been achievers in their own ways. A person with severe Autism who can perform his own self help skills and control behavioural issues even is an achiever in his own stride. The secret to these success stories started with the immense dedication and perseverance on the part of their parents and caregivers and of course by these Autistic individuals.¹⁰

CONCLUSION

As mentioned earlier, time is precious. Early intervention can sometimes bring about a magical transformation in lives of Autistic individuals who can live purposeful lives in future. According to their abilities, some might be able to do a job independently while some may work at a sheltered workshop. But, all of them deserve a quality life which needs to be ensured by the society.

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E-agriculture: A New Instrument for Indian Farmers

L. Pradhan¹, B. B. Mohapatro², S. Dehuri³, and A. K. Panda⁴

Agriculture is an information intensive industry that is spatiotemporal in nature. To be successful, farmers must be generalists who are not only well versed in the advancement of farming technologies but also astute businessman who are technology savvy. Furthermore, the globalization has very adverse effects on Indian farmers, as they have to vie with the farmers of developed countries. Hence to cope with challenges posed by the globalization of agriculture, the farmers have to produce quality product at par with world market at economic prices. Thus, the farmers need to be well informed and well trained in the management of natural resources and production of agricultural commodities. E-agriculture plays an important role in addressing these challenges and uplifting the livelihood of Indian farmers. This paper explores the potential contribution so far been attempted under the aegis of e-agriculture or Information and Communication Technology (ICT) to the livelihoods of farming community in India. Moreover, a general framework of the current state-of-the art wireless sensors network is presented as a challenging technology for Indian farming community to monitor actively their crops from a remote place.

INTRODUCTION

In a country like India, where large numbers of people earn a living as farmers or landless labourers, broad-based agricultural development on small farms has been a powerful driving force for promoting growth and reducing poverty^{1, 2, 3}. Once the agricultural sector is developed it paves the way for the development of the rural areas and agricultural development becomes the foundation for the development of the rural areas. Agricultural development depends to a great extent on how successfully knowledge is generated and applied³. For millennia, people have used knowledge from family and friends to grow crops or raise livestock. Investments in knowledge especially in the form of science and technology have been featured

prominently and consistently in most strategies to promote sustainable and equitable agricultural development at the national level. Although many of this investment have been quite successful, the context for agriculture is changing rapidly-sometimes radically and the process of knowledge generation and use has been transformed as well. It is increasingly recognized that in traditional agricultural investment in science and technology such as research and extension are necessary although not sufficient to enable agricultural innovation. Globally, new digital systems now exist for sharing information on agricultural innovations and markets⁴. Today, Information and Communication Technology can and should be a key agent for changing people's lives by improving access to information and sharing of knowledge. As this paper will demonstrate, new perspective on the nature of the agricultural innovation process can yield practical approaches to agricultural development that may be suited to this changing context. Figure 1 shows a temporal development of

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agricultural technologies with an initial configuration of human labor and followed by tractors to wireless sensors and robotics under the umbrella of ICT⁵.

49% Indians derive their livelihood from the agricultural sector (c.f., Economic Survey 2013-2014). Thus, agriculture plays a vital role in India's economy from the perspective of poverty alleviation



Fig. 1: Evolution of Agricultural Technologies.

As far as agricultural development is concerned India is a unique country in the world. The country has diverse geographical settings such as hilly areas, wetlands, deserts, and coastal areas. Diversity of soil and climatic conditions are existing in the country. A variety of crops can thus be grown and various agricultural technologies can be adopted and adapted to the specific needs. Both the advanced and primitive kind of agricultural technologies are practiced in the country. On the one hand there are most modern agricultural implements such as tractors and harvesting combines, on the other hand there are millions of farmers using bullock carts and ploughs. There are farmers who have developed hundreds of web pages of agricultural information and communicate through email and there are also the farmers who still dispatch their messages through conventional means of communication. There are several languages spoken and several ethnic groups of farmers living in various states and having different cultural belief and ethical systems.

India is a vast country with 127 different agro climatic zones classified by National Commission on Agriculture [6]. Agriculture is the largest livelihood provider in rural India. It contributes 13.9% of its gross domestic product (GDP) and approximately

and employment generation. However, Indian farming community is facing a multitude of problems to maximize productivity. Due to several reasons, the majority of the farming community is not getting the potential yield, despite successful research on new agricultural practices by inventing new crop varieties, crop cultivation, and pest control techniques. The per capita income of the farmers is one-fifth of that of an average Indian. An Indian farmer faces several impediments. These are related to issues such as fragmented land holdings, monsoon dependent water supply for crop growth, disrupted power supply, increasing cost of farm inputs, non availability of international quality seeds, exploitation by intermediaries and lending institutions, price realization, lack of adequate information on the kinds of crops grow, how should grow, what planning need to do with respect to area and soil conditions and what are the market dynamics.

With continuing population growth and a fixed land base, small farms are getting smaller. Small farm holdings are one of the barriers to modernization and automation of agricultural farms. Much of the small farms are perhaps too small to be productive and supportive of sufficient livelihood for the families

that they support. According to the study conducted by the International Development Enterprises India (IDEI)⁷, in India 70% of farmers are cultivators of small plots from which they can hardly get food security let alone sustainable incomes. Most of them are small and marginal farmers cultivating land less than one hectare in size, average size of which decreases by half in every 15 years due to rapid population growth. In India, nearly 60 percent of farmers belong to marginal category with an average of 0.4 ha land²². There is the problem of price realization. There is heavy fluctuation in the prices of agricultural commodities. The prices of potato or onion may be less than rupees five when the farmer sell it in the local market but may increase ten times when sold in the retail market at a different time and such price hikes not only affect the farmers but also severely affect the common people.

The increasing cost of agricultural inputs and comparatively low cost of agricultural products in the international market is creating a crisis situation for Indian agriculture. The constantly growing cost of agricultural inputs is affecting the small farmers and their families and they have started thinking that agriculture is not a viable occupation. The small farmers are increasingly under debt and stress. Small land holdings, growing cost of production, increasing debt, low prices of some agricultural commodities in the international market is aggravating the problems of small farmers and leading to some suicides. Hundreds of farmers in the Vidharbha region have committed suicides and such incidences have also been reported from other parts of India. As pointed out by the National Knowledge Commission (NKC) set up by the Government of India in its 2006 report "low and volatile growth rates and the recent escalation of an agrarian crisis in several parts of the Indian country side are a threat not only to national food security, but also to the economic well being of the nation as a whole".

Agriculture involves risks and uncertainties, with farmers facing many threats from poor soil, drought, erosion, and pests. Further, rural population in our country have difficulties in accessing crucial

information in the forms they can understand in order to make timely decisions for better farming. Thus, Indian farmers need timely expert advice to make them more productive and competitive. It is true that India possesses a valuable agricultural knowledge and expertise. However, a wide information gap exists between the research level and practice. The appropriate and timely scientific advice about farming is not reaching to farmers.

Information and Communication Technology (ICT) is generating possibilities to solve the problems of different categories of Indian farmers. ICT in agricultural sector is of special significance and plays a vital role due to the transformations relating to the delivery of services as well as agricultural products. Accordingly, various high tech information and communication technologies ranging from the agricultural product development, marketing, distribution to training of agricultural sector personnel etc is in use in the agricultural sector around the world. The demand for agricultural information is now stronger than ever before.

E-AGRICULTURE

E-agriculture⁸ is a new term to study the role of Information and Communication Technology in agricultural development. Simply speaking, it is a way of harnessing the power of ICT in agricultural domain. It is an emerging field for enhancing sustainable agriculture and food security and rural development through improved processes for knowledge access and exchange using ICT's. More specifically, e-agriculture involves the conceptualization, design, development, evaluation, and application of innovative ways to use ICTs in the rural domain, with a primary focus on agriculture. Figure 2 illustrated various steps involved in e-agriculture. E-agriculture goes beyond technology to promote the integration of technology with multimedia, knowledge and culture, with the aim of improving communication and learning processes between various actors in agriculture locally,

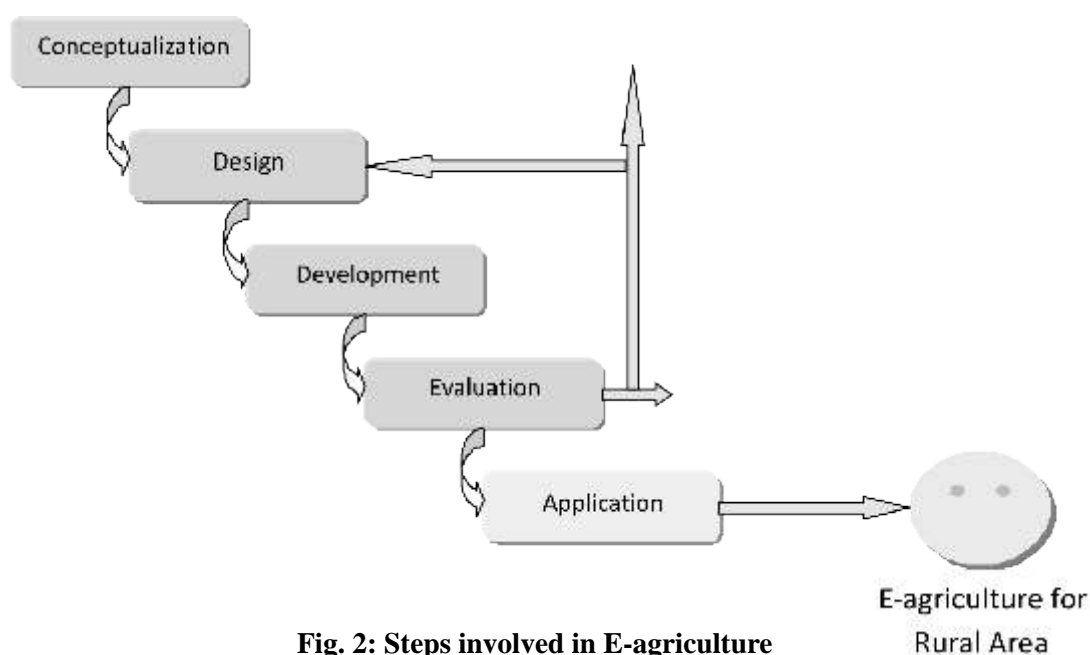


Fig. 2: Steps involved in E-agriculture

regionally and worldwide. E-agriculture is one of the action lines identified in the declaration and plan of action of the World Summit on the Information Society (WSIS)⁹. The Food and Agriculture Organization of the United Nations (FAO)¹⁰ has been assigned the responsibility of organizing activities related to the action line under C.7 ICT Applications on E-agriculture.

OVERVIEW AND ROLE OF ICTs IN AGRICULTURE

Information and Communication Technology (ICTs) denote a wide range of services, applications and technologies, using various types of hardware and software, often running over telecom networks. ICTs facilitate improvement in information management and dialogue between individuals, groups, communities etc. It consists of mainly three technologies such as Computer, Communication, and Information Management Technology. These technologies are applied for acquiring, storing, processing, exchanging and managing data and then

disseminating information and knowledge. The tools provided by ICTs include computer hardware, operating systems, application software, as well as networks and intranets, telephone and electricity lines, radio and satellite systems by which they operate.

The main focus of this subsection is to elaborate how the achievements of ICT can be applied in Agriculture sector and its development. The application of ICT in agriculture is increasingly important. The biggest advantage of ICT is that it is far more interactive and personalized that can render services, particularly the information as per the needs and requirements of end users. Such a facility makes a favorable impact on adoption and utilization of the improved and innovative techniques in agriculture. The information technologies which are increasingly used in agriculture are Satellite Communication, Geographic Information System (GIS), and computer network. Some other latest technologies such as wireless sensor network, robotics, cloud computing, and big data analytics can be used in agriculture to strengthen the infrastructure. On the

other hand for effective transfer and dissemination of agricultural information to the farmers the technologies like teleconferencing, fax, and mobile phones could be replaced by videoconferencing, social network, smart phones, and emails.

Awareness of up-to date information on prices for commodities, inputs and consumer trends can improve farmer's livelihoods substantially and have a dramatic impact on their negotiating position. Such information is instrumental in making decisions about future crops and commodities and about the best time and place to sell and purchase goods. ICT plays an important role in agricultural marketing. With improved record-keeping, more detailed cost analysis and more sophisticated marketing strategies, it can help farmers to make better decisions and earn higher profits. ICT can help to provide the information on the price distribution of key commodities over the years. Such information helps farmers and traders to make decisions on when and in what ways to market their agricultural outputs. When combined with enterprise budget data, the information can also be used in deciding which crops to produce in the next season. Information on the status of price of various agricultural output markets is also provided to facilitate farmer to move his produce to the market where he can expect better price. Farmers, cooperatives, suppliers and buyers use the Internet to exchange ideas and information, as well as to conduct business with each other. Machinery, seed, chemicals and other types of agricultural products can be purchased and sold online.

In order to solve the problems of agricultural marketing, initiatives have taken in various countries. Simple websites to match offer and demand of agricultural produce are a start of agricultural trade systems. These sites tend to evolve from local selling/ buying websites and price information systems to systems offering marketing and trading functions. For this, price information is collected at the main regional markets and stored in a central database. The information is published on a

website, accessible to farmers through information centers. To reach a wider audience, information is broadcast through radio and TV and thereby creating a link between producers and traders in a region. In recent years, short message and text services have taken up and effectively deliver prices and trading information via mobile and smart phones to farmers. In India the private sector-led Agriwatch and e-Choupal programme support several million farmers with price information, trade and transaction facilities. In the fertilizer marketing context, ICT can play a major role in efficient sales, operations, checking the marketing costs, safeguarding market share and providing efficient customer services. A well conceived IT set up can endow decision makers at all levels with better reflexes to effectively respond to market conditions.

ICTs also play an important role in making processes more efficient and transparent. It helps in making laws and land titles more accessible. Global Positioning Systems (GPS) linked to Geographical Information Systems (GIS), digital cameras and internet help rural communities to document and communicate their situation¹¹. ICT enables rural communities to interact with other stakeholders, thus reducing social isolation. It widens the perspective of farming communities in terms of national or global developments and opens up new business opportunities.

ICTs can provide a comprehensive solution to the farmer's financial needs. It can be used to manage financial services, savings, credit, investment opportunity, hedging negotiation, etc for the farmers. For transforming the economy, there is a need to develop a comprehensive rural information system to identify credible borrowers. Each farmer should be given a unique identity card or e-passbook which has to be machine readable and must provide electronic and biometric access. Using ICTs in the rural banking, the processes should be automated and the applications should be customized and made more flexible. There are already several connectivity options and many access devices present, but we also need to consider unconventional delivery

technologies like ATM, digital cash, mobile banking etc to make rural finance reach till the last mile. The energy-electricity network can be used to connect villages with the mainstream. Another possibility is that of Wi-Max, for the financial inclusion of rural areas. Mobiles and smart devices using GSM could be another possibility in this regard.

ICTs in universal access to financial services should not merely be limited to the access but take into account the process and the end usage. For successful rural e-banking every village should be benefited beyond the services like knowledge centre to fill in the grand gap, which existed between village Panchayats and farmers, on one hand and the financial institutions based at national and district levels on the other.

ICTs used in agriculture production cover three aspects: data collection or information input, analysis or processing of the precise information, and recommendations or application of the information. Data collection occurs both before and during crop production and is enhanced by collecting precise location coordinates using the GPS (Global Positioning System). GPS determines precise location based on radio signals from 4 or more of the 24 satellites in the GPS launched and maintained by the US Department of Defence (DoD).

Data collection technologies operating in advance of crop production include grid soil sampling, yield monitoring, remote sensing and crop scouting. In the grid soil sampling technique soil samples based on a systematic grid laid out across a farmed field are collected. Soil samples are then analyzed in a laboratory to determine soil characteristics such as texture, organic matter, pH and concentration of nitrogen, phosphorous and other nutrients. Yield monitoring is an automated measurement of the amount of production taken at intervals as the combine or harvester passes over a field. Data from the yield monitor must be integrated with data on vehicle speed, head position, and crop moisture level derived from separate sensors. These data are combined in onboard computers to produce an estimate of harvested yield for each area of the

field that can be incorporated into a GIS database for the field. In the remote sensing technique data on light reflectance are collected by instruments carried in airplanes or orbiting satellites that can be used to estimate the spatial pattern and vigor of vegetation at small areas within the field. Crop scouting often involves use of pheromone or other insect traps to estimate pest levels as part of integrated pest management approaches.

Other data collection takes place during production through "local" sensing instruments¹² mounted directly on farm machinery or equipment to detect soil conditions, nutrient concentrations, weed density and location, soil moisture, livestock identity and other conditions for real time input to variable rate applications.

Precise data are useless unless they can be analyzed to enable management adjustments. Geographic Information Systems (GIS) are the principal technology used to integrate spatial data coming from various sources in a computer. It is a computerized map and database program that contains spatial (map) and attribute (characteristic) data linked by a common geographic identifier. GIS software provides for overlays and geographic analyses of multiple mapped layers, representing the spatial patterns of soil, crop yields, input applications, drainage patterns, and other variables of interest in a Personal Assistant system.

Data collected at different times on the basis of different sampling regimes and different scales must be combined for use with subsequent decision technologies, such as process models, artificial intelligence systems, and expert systems. Computer process models use frequent time-steps to stimulate the processes of crop growth and movement of nutrients and pesticides through the environment. Artificial intelligence systems use heuristic or empirical decision rules in most process models to recommend appropriate management choices. Expert systems incorporate the "rules of thumb" used by human experts that match the conditions reflected in the input data in order to reach recommendations.

Communications links cut across all three stages of the e-farming process, contributing to data collection, analysis, and application. Fiber optic and satellite communication links, local area networks and the like link producers, cooperatives, extension experts, processors, input dealers, consultants and others involved in the production process. These communications links enable a nearly continuous electronic conversation or virtual community that puts many heads to work on interpreting precision information for better production decision making.

ICT FOR IMPROVED RESOURCE USE

A farmer walks through his rice field in Odisha (a state of India having 80% of people are mainly dependent on rice agriculture, shown in Figure 3)¹³, heading for a spot pinpointed by a remote sensing image the farmer downloaded in that morning's e-mail. Pest infestation in this small spot, indicated by a change in the vegetative index would not be detected this quickly. Untreated, it could spread rapidly and destroy the entire crop. The farmer opens his computer, brings up information on the pest, completes an economic threshold analysis, and determines what control measures he will use. He records the exact location of the infestation using the integral GPS receiver and alerts his pest control advisor and custom pesticide applicator through cellular phone link.

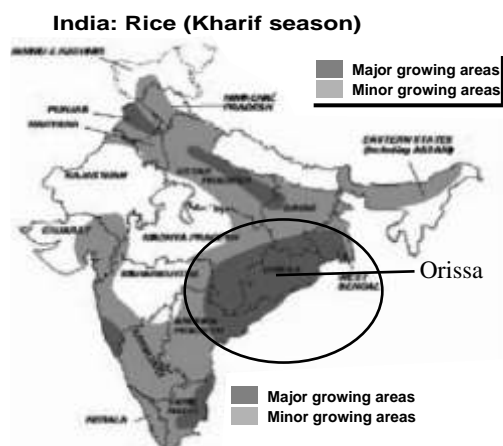


Fig. 3 Illustration of Rice Dominated Area in INDIA : A Speecial Focus on Orissa¹⁴

Wireless sensor technology (discussed detail in Subsection 3.1) may be an alternative attractive technology to the above framework.

E-AGRICULTURE PRACTICES IN INDIA

Although accounting for just about 13.9% of the country's GDP, the role of agriculture in the Indian economy cannot be undermined even today because; nearly 50% of the country's population still depends on agriculture to earn their livelihood (c.f., Economic Survey 2013-2014). Thus, in order to revive the agriculture sector and usher in the era of e-agriculture India needs to effectively harness the power of ICT¹⁵. Experts opine that introduction of IT in agriculture could be one of the potent tools to brings the second Green Revolution in India with easy and cost effective information to the farmers at the right time. Enormous efforts are thus made in India for adoption and absorption of information technologies for agriculture information communication^{16,17}. The National Agricultural Policy lays emphasis on the use of Information Technology for achieving a more rapid development in India. Accordingly, the Department of Agriculture and Cooperation (DAC) has formulated information technology vision 2020¹⁵. This vision states that:

1. Information relating to agriculture sector would be available to the ultimate users—the farmers for optimizing their productivity and income.
2. Extension and advisory services making use of information technology would be available to the farmers on round the clock basis.
3. The tools for information technology will provide networking of agriculture sector not only in the country but also globally and the Union and State Government Departments will have reservoirs of data base and
4. The long term vision on 'Information Technology in Agriculture Sector' is to bring farmers, researchers, scientists and administrators together by establishing 'Agriculture on-line' through exchange of ideas/information

Numerous initiatives have been taken throughout the length and breadth of the country, aiming at extending the benefits of the information revolution to rural and remote areas. These includes the establishments of Kisan call centers⁶, Gyandoot project¹⁸, Village knowledge centers⁶, AGMARKNET⁶, eSagu system¹⁹, etc.

Kisan call centers (KCCs)⁶ were launched on 21st

information production and access supportive of the right to information. It is primarily a state based project, which involves the digitalization of all land records in Karnataka and the provision of access to these records through information kiosks and fingerprint authentication systems. This computerized land record facilitates the farmers in obtaining, so called technically, the Rights, Tenancy and Cultivation certificates (RTCs). Moreover, the

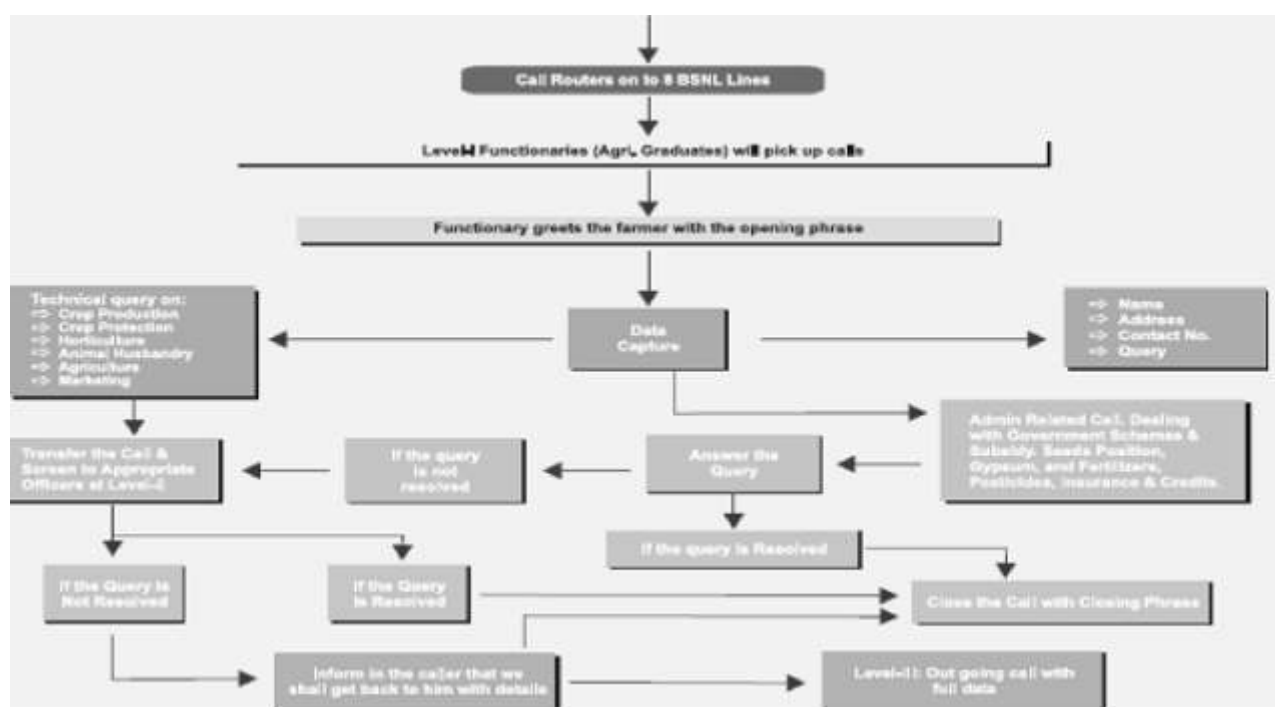


Fig. 4: Flow Diagram of Kisan Call Center A Gateway for Farmers
(Sources:<http://www.kisancallcenter.net/schematic.htm>)

January, 2004 by the Department of Agricultural and Cooperation with the aim to deliver the extension services to the farming community in the local languages. The farmer dials a toll free number 1551, and the agricultural scientists provide the initial enquiry. The cost to the farmers is almost zero and they get the response in their local languages. If the farmers want more information, the call is forwarded to level II and level III executives. (See Figure 4)

The Bhoomi project¹⁸ is a significant achievement on its own right and is an example of how an ICT project can be used for data processing,

Bhoomi project also provides online connectivity to various courts to make use of the land records database to settle civil disputes on land ownership and cultivation.

The Gyan Ganga project¹⁸ is what one would call a premium telecentre project that is committed to providing a range of ICTs services from telephony to e-governance. It is a joint state private sector initiative aimed at the use of ICTs in development, in Gujarat. It is an ambitious project aimed at the provision of information, connectivity, education, e-health and e-governance broadly within the

parameters of the right to information. It currently operates 212 ICT kiosks in Gujarat. In this project the villagers pay for the services. The project is based on a business model in which the key players- the private firm N-Logue, the Local Service Providers and operators of the local kiosks are involved in selling their services. Another feature of this project is the role of N-logue which is committed to providing low-cost voice and internet services to rural India.

The Gyandoot Project¹⁸ was started in the Dhar district of Madhya Pradesh, which covers 600 villages and 26 Soochanalay. Soochanalay is nothing but information centers at the village level. The service covers to provide information about the agricultural produce, auction center rates, copies of land records, on-line registration of applications, village auction sites, and more. The village Auction Site Project allows farmers and villagers to advertise and sell land, agricultural machinery, equipment and other durable commodities. In order to provide information minimum user fees are charged by the information centers.

AGMARKNET, (Agricultural Marketing Information Network)⁶ is a joint venture of the Directorate of Marketing and Inspection (DMI) and the National Informatics Center (NIC). Currently, it covers 2800 market nodes and 300 commodities and provides information in ten languages. It has increased the efficiency in marketing activities by establishing a nation-wide information network, which provides information on prices, arrivals, availability, trends, analysis, laws etc. These timely information data are helpful to producers, traders and consumers. It has been connected to 670 agricultural produce markets and 40 State Agricultural Marketing Boards And Directorates. Each AGMARK portal of wholesale market provides daily information to AGMARK portals of its respective states, and then each state's AGMARK portal sends the information to the AGMARKNET portal. The National Information System maintains all of these portals. The food processing units, traders and different village kiosks, to help the farmers in taking the right decisions mainly use these portals. The e-Choupal project⁶ is

very popular in the country. The project now covers nine states and around 36,000 villages, empowering around 3.5 million people. These e-Choupal centers deliver real-time information and customized knowledge to improve the farmer's decision making ability, thereby better aligning farm output to market demands, securing better quality, productivity and improved price discovery. It also helps farmers to access higher quality farm inputs at lower cost.

The eSagu project¹⁹, an initiative of the Indian Institute of Information Technology, Hyderabad, provides crop related advice from the experts in cities to the rural areas of Andhra Pradesh, using digital technology. In this system, a coordinator collects all the information regarding the crop in the local area and sends it to the team of experts in Hyderabad by using a storage device. The experts then evaluate the crop system and suggest solutions, which can be downloaded in the village information centers.

In India the use of the Internet in the farm decision making is very less. Hardly 12 percent of farmers are applying this technology and majority of them are using traditional technologies like radio, television and newspaper. Thus a central scheme involving mass media support to agriculture extension has also been launched. The existing infrastructure of Doordarshan and All India Radio (AIR) is being utilized for production and telecast of 30 minutes agricultural programmes five or six days a week. Farmer's feedback is being collected regularly through the Audience Research Units and AIR state/district level monitoring committees are mandated to guide and monitor implementation of scheme at the respective levels.

SENSOR TECHNOLOGY FOR INDIAN FARMERS

A wireless sensor network^{12,16,20} is a system comprised of radio frequency (RF) transceivers, sensors, microcontrollers and power sources. Wireless sensor networks with self-organizing, self-configuring, self-diagnosing and self-healing capabilities have been developed to solve problems

or to enable applications that traditional technologies could not address. Once available, these technologies would allow us to find many new applications that could not have been considered possible before. Wireless sensor technology is still at its early development stage. Applications of wireless sensors in agriculture and food industry of India are still rare. This Section intends to give an overview of available wireless sensor technologies that can enhance the productivity obtained from agriculture Sector of India¹². An example is given below.

In a nutshell, PhyTalk is designed as a modular and distributed system. New sensors can be added as and when needed. The architecture supports cost effective deployment of sensors over large geographical area. The system consists of four modules.

Sensors: Measure a variety of parameters, providing relevant and precise information about plant and environmental conditions. Example of such type of sensors is illustrated in Figure 6.

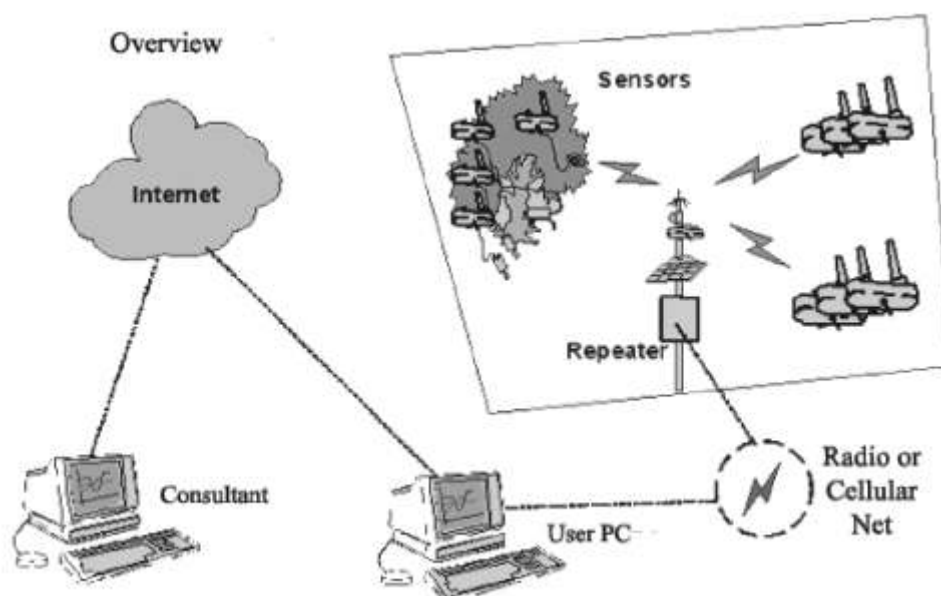


Fig. 5: The PhyTalk System

PhyTech is a pioneer and a leader in Phytomonitoring: the practice of remote sensing and monitoring of plants. The advanced solutions use innovative software for collecting and analyzing data, state-of-the-art sensors, and wireless communication. The system improve crop production and reduce cultivation costs by providing timely and accurate information regarding the physiological status of the plants and identifying stress conditions before they impact the plant or the fruit. Figure 5 describes the system.

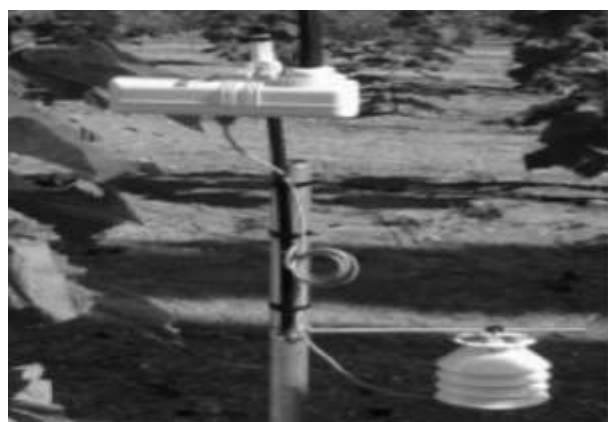


Fig. 6: A Sensor in Field

Communications: Supports cordless deployment of sensors in the field and wireless communication to remote computer anywhere in the world.

Software: Developed by experts in the field of phytomonitoring^{20,21}, the software supports the analysis and interpretation of data in real time by displaying it in easy to read formats such as graphs and tables and supporting disorder prevention.

Application Technique: Recommended measurement protocols and decision support procedure for major horticulture crops.

Applications of wireless sensor network can be classified into five categories: (1) environmental monitoring, (2) precision agriculture, (3) machine and process control, (4) building and facility automation and (5) traceability systems. The recent progress obtained from our team is as follows: 1) deploying the sensors for plant monitoring; and 2) concentrated on developing sophisticated software for analysis and decision making.

Disease encountered in crop fields dramatically affects productivity of a crop. Manual analysis of the causes of diseases in a large crop field is difficult and very time consuming method. Hence, we need a generic and rapid method for the analysis of the causes and timely prevention of those diseases. The timely prevention and monitoring not only enhances the productivity but also aids developing new crops varieties by observing the adaptation of new breed with different climate conditions. Therefore, deploying sensors for monitoring plants and developing methods/techniques for analysis of huge amount of data collected from the field sensors is a promising task. Instrumented with wireless sensors it will become available to monitor plants in real time for air temperature, soil water content, and nutrition stress. The real time information from the fields will provide a solid base for farmers to adjust strategies at any time. As a part of ongoing research starting from installation of wireless sensor network to monitoring plants, we primarily focus on the following points while placing the sensors in the field.

- i) Each plant is in the coverage region of at least one sensor.
- ii) The overlap between the sensing regions has to be minimized (thus minimizing the number of regions).
- iii) Multiple communication paths exist between the sensors and the base station. this provides reliability in case of temporary failure of the sensors.

Furthermore, we assume that sensors have circular sensing region and likewise we recorded the reading for different plants. Sensors collectively transfer the data like temperature, humidity, and light intensity (considered as important factors of the growth of the plant) to forwarding sensors which finally reach to the sink. Then the sink node is communicating to the remote users through the internet.

CONCLUDING REMARKS

There is abundant prospective for effective use of ICT in agriculture and initiatives are promising. However, much still remains to be done. The implementation of these following recommendations can help to realize the full potential of ICT in agriculture and improve rural livelihoods.

Research and Innovation

- ? 1 Technical information systems in agriculture need to use of local knowledge for software development, be integrated into regional and international systems and maintain links to policy makers. More investment in infrastructure and skilled human resources is needed for such systems.
- 1 Researchers and extensionists require continued training in how to interact and share knowledge more effectively using the new digital technologies.
- 1 Academic and research data in agriculture, available in the form of journals and research

paper needs to be digitalized to facilitate cross flow of information.

- | At local and sub-national level, there should be institutional mechanism, mainly multi-stakeholder, to link rural communities with universities, research agencies through intermediary organizations.

Enhancing Rural Access

- ? | While investing in communication infrastructure the Government must focus on financially viable and socially acceptable approaches that are accessible to the rural poor. In order to enhance rural access, the Government should, ensure low prices for broadband Internet in rural areas.
- | Foster combined public private efforts and cost sharing arrangements to ensure sustainability of rural information centers.
- | Foster awareness raising and capacity building of rural communities to use and maintain ICT.
- | Support technical innovations for rural connectivity such as wireless broadband connections or solar powered systems.
- | Foster the adoption of information into formats and languages relevant for rural areas. Investment is needed to repackage technical information for farmers and make it available in local languages.
- | Existing channels for technical information (e.g., extension services, radio stations) should be integrated with new communication technologies, which are accessible to farmers.

Education

Another major challenge for putting agriculture knowledge to work in agricultural fields is farmers' information literacy level, urge to learn and learning facilities available to them. The farmers do not adopt the solution due to low literacy. Thus, the farmers education from lower level will be required and the sooner it commences the better. Information literacy

will help the farmers to even independently access information of their interest and profitably use it for better functioning and performance.

?

- | Agriculture should be introduced as a subject in school curriculum and computer education should be an important part of Agriculture Education System.

?

- | Development of digital libraries in rural areas can play an immense role in providing adequate learning environment, imparting literacy to rural communities and even in transfer of agricultural technologies to farmers

?

- | In India, agriculture is close to tradition. Farmers sometimes become averse, as they think that they might lose their traditional methods of cropping practices. They do not want to utilize the system, even if the cost incurred by them is very low. Thus, it is necessary to change the attitude and mindset of the farmers. There is the need to win the confidence of the poor farmers and make them aware of the benefits of ICT in agriculture.

Market chains

The growth of communication networks needs to be supported amongst actors in the chain (farmers, transporters, buyers, traders, etc) in order to ensure more equitable, timely and collaborative access to markets for small holders.

Government policy

The social and political environment within which ICT projects operate is crucial and supportive Government policies and measures are required.

- | The government should appoint a commission to study the deployment of IT for the benefit of farmers and recommend ways to expand the role of IT in agriculture.
- | Agriculture should be on the Concurrent List to have better results out of the efforts being made.

- 1. Government should put policies into place that systematically capture local knowledge, ensure appropriate research agenda setting and support the functioning of intermediary organizations.
- 1. Government should aid the process of identification and vertical integration of diverse ICT tools that are employed in present day agricultural practices.

The need of the hour is to make IT usable for the farmers, i.e., making IT farmer friendly, rather than making farmers IT friendly. There is the need to tailor rural ICT policies, aiming to deliver information to solve the problems that rural people perceive important for their well being. The process has to be a step-by-step approach, not neglecting the process of rural readiness within the broad context. Since the use of ICT in agriculture is still a new and rapidly changing area, there is a need to raise awareness among government and other national stakeholders.

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BIOREMEDIATION FOR A CLEANER ENVIRONMENT

K. Brindha and L. Elango

Pollution of air, water and soil has become inevitable in the rapidly growing world. It is important to remediate the polluted environment in a sustainable way which is a challenge to scientists and researchers. In this process, bioremediation has proved to help in amending water and soil pollution successfully. The various methods of bioremediation provide wide options to be chosen for any particular type of contaminant and medium. This is an environmental friendly process that would help to safeguard our natural resources in a sustainable way without causing any secondary harm to the surroundings.

INTRODUCTION

Life on earth from the single celled microbes to human beings depends upon air, water and soil. Introduction of any foreign substance into these or any change in their physical, chemical or biological characteristics that affects its original nature may result in pollution. As it is widely acceptable that 'prevention is better than cure' it is the responsibility of every individual to contribute their part in safeguarding the planet we live in and pave way for a sustainable future. But, in the rapidly growing 21st century, pollution is a major environmental issue that the world faces. This may not only be of air, water and soil, but also include light, noise, thermal, radioactive and solid waste pollution. Of all these types of pollution, air, water and soil pollution are important to be addressed because it supports all forms of life. Cleaning up of the pollution is highly important in order to avoid further or any irreversible damage caused to the environment. Sustainable methods of pollution remediation are the need of the hour. The methods of cleaning vary from physical, chemical and biological processes to a combination of these processes. In this situation, bioremediation has proved to be one of the safe methods for removal of pollutants without much adverse effects. Bioremediation can be defined as the use of microorganisms to ward of contaminants from

the environment. Mainly bacteria serve this purpose but fungi, algae and plants have also been used. These bacteria are omnipresent i.e. they are present everywhere naturally in the environment. This article briefly explains the process and various methods of bioremediation also discussing the advantages and disadvantages.

WHY BIOREMEDIATION?

Microorganisms help to remove the waste that we create by consuming them. For example, the organic waste that is disposed into the environment i.e. from household waste to dead organisms is acted upon by microorganisms which use them as food thereby degrading them. Similarly, there are microorganisms that can be targeted to ward off the hazardous pollutants in the environment, thus serving to restore the quality of the environment. This method requires knowledge on the type of microorganisms that should be directed in the polluted sites. The use of microorganisms has been studied by researchers and has been found suitable for the treatment of wastes in controlled conditions. Either bacteria that exist in the place of pollution or new strains of bacteria that have proved effective in removing the pollutant are used for this purpose¹. It should be noted that the bacterial strains used for this purpose may not be harmful to human or other living organisms. The medium of remediation has ranged from soil, groundwater, surface water, sludge,

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wastewater, oil spills in marine environment etc. The degradation by microbes can happen in the presence of oxygen (aerobic) or without the presence of oxygen (anaerobic). So it is possible to remediate the groundwater and subsurface soil also, where enough oxygen may not be present. It is however comparatively easier to remove pollutants with the help of microbes from the earth surface than in the subsurface environment. The process of degradation of pollutants by the microbes is given in Figure 1.

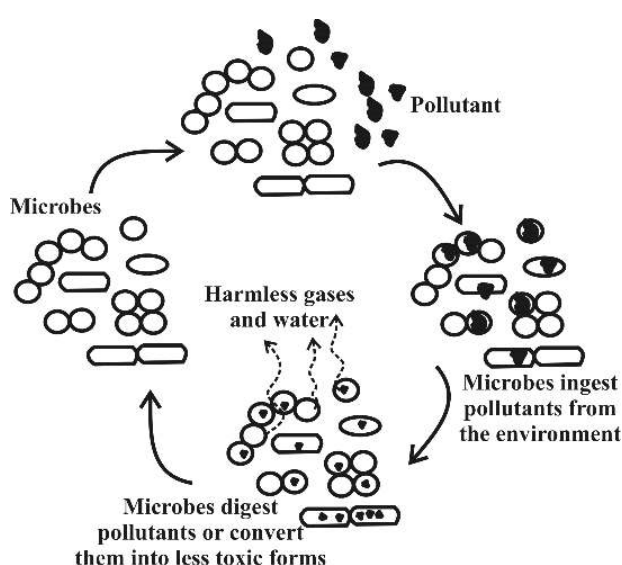


Fig. 1 : General process of degradation of pollutants by microbes

SOIL AND WATER POLLUTION

Pollution of soil and water is generally caused by natural and anthropogenic sources. Anthropogenic sources like industrial effluents, oil spills, agrochemicals etc are the major cause for soil pollution. Whereas, the surface water and groundwater may be polluted both by natural and anthropogenic sources. Example for natural water pollution is Dead Sea, which has high salinity by nature and thereby does not provide a suitable condition for any flora and fauna to flourish. Another natural source is the inherent toxicity in geological formation i.e. rocks present in an area might contain certain minerals with high concentration of some elements like fluoride², iron, arsenic³ etc which may

eventually contaminate the groundwater. The major cause for anthropogenic pollution of water is industrialization⁴, leakage from chemical and oil storage tanks⁵ etc. Developed countries have already faced the problems due to contamination and have started to take measures in remediating the pollution caused to water and soil. But developing countries like India still have a long way to go in the remediation of regions that are contaminated. Bioremediation, one of the environmental friendly methods with several advantages can be adopted to remediate the contaminated sites.

ADVANTAGES

The various advantages of bioremediation are listed below:

- 1. In *in-situ* treatment, the pollutants are removed on the site itself by the microbes thereby reducing the need for excavation and transportation of the contaminated medium.
- 1. In case of physical and chemical processes, the disposal of the removed pollutants is a problem as there is a chance that they might again cause pollution. Whereas in the case of bioremediation, the pollutants are consumed and broken down into harmless gases and water. Hence there is no release of harmful secondary by-products in the environment.
- 1. After the pollutants are cleaned up by the microbes, they die due to the lack of the pollutant which has been serving as their food. Thus any harmful effects of the microbes are also ruled out.
- 1. Aesthetically acceptable.

METHODS OF BIOREMEDIATION

For the bioremediation process to take place effectively, the environmental conditions should be favorable. The main factors that have to be considered during bioremediation are the pH, temperature, moisture content, availability of oxygen, availability of nutrients, properties of the soil medium, type of bacteria and the composition of the pollutant. This method can be carried out either

in-situ or *ex-situ*. In-situ bioremediation as the name indicates is the treatment of contaminant medium at the site while in *ex-situ* bioremediation the contaminated medium is removed from the site, treated elsewhere and usually is restored back in its original place. *In-situ* bioremediation is suitable especially for treating pollutants below the sub surface such as groundwater while *ex-situ* methods are usually adopted for solid and slurry medium. Depending upon the suitability and feasibility in the polluted site, one of the types is adopted. Bioaugmentation, bioleaching, biosparging, biostimulation and bioventing are some of the in-situ remediation methods while *ex-situ* bioremediation methods include biopiling, bioreactor, composting and land farming which are explained briefly.

IN-SITU REMEDIATION

Bioaugmentation

In some case the indigenous microbes (i.e. the microbes that are present in the environment naturally) will not be capable of consuming the pollutants in the contaminated soil or water. Then the microbes that have proven to be successful in carrying out the remediation and that which has been tested on a laboratory scale are induced exogenously into the natural environment to facilitate the process. This may include genetically engineered microbes also. It is a widely used method to enhance nutrient removal from municipal wastewater⁶. This method was also applied to remove petroleum hydrocarbons and heavy metals from the sediments of a harbour⁷.

Bioleaching

This is a safe method to recover metals from the polluted media using microorganisms. The enzymes secreted by the microbes help to leach out the metals from the contaminated sites in the form of salts. These salts are removed, purified and refined to obtain the metal. This is also an economical process as the leached out metals can be sorbed by the use of microbes and utilized. This process is called

biosorption. The terms “biomining”, “bioextraction”, or “biorecovery” are also applied to describe the mobilization of elements from solid materials mediated by bacteria and fungi⁸. Ferric iron and sulfuric acid are the main leaching agents⁸ produced by bacteria which facilitate the leaching of metals such as copper, arsenic, lead, nickel, gold, silver etc.

Biosparging

This method is used in remediating the saturated zone where pollution due to leakage from underground storage tanks has occurred. It involves injection of air especially oxygen (Figure 2) through pipes below the groundwater table in order to facilitate increase in microbes and biological degradation in-situ. This method increases the mixing in the saturated zone and thereby increases the contact between soil and groundwater¹.

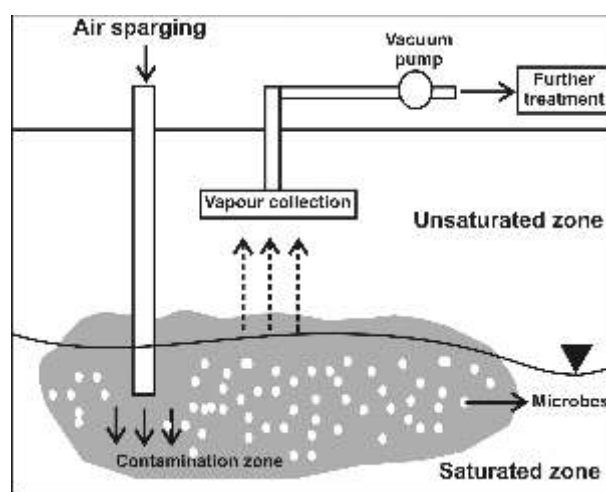


Fig. 2 : Bioremediation of the saturated zone by air injection

Bioventing

This method is similar to biosparging, but takes place in the unsaturated zone (Figure 3). The requisite air is supplied through wells at low pressure so as to increase remediation but to minimize volatilization and release of contaminants into the atmosphere¹.

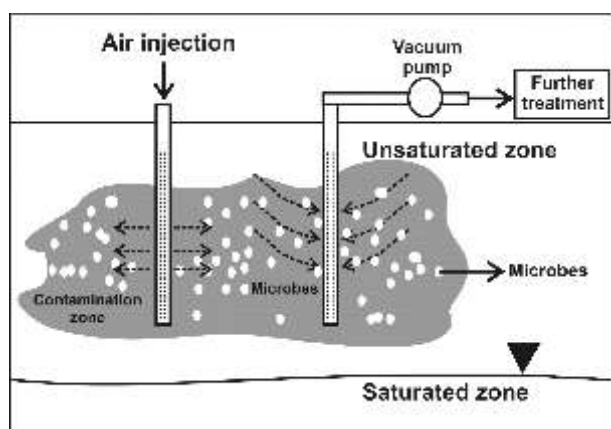


Fig. 3 : Bioremediation of the unsaturated zone by air injection

Biostimulation

The microbes existing in the contaminated site that are capable of remediation are stimulated by providing them better environmental conditions which may include addition of nutrients in order to ease the remediation process. The difference between biosparging and biostimulation is that, in biosparging oxygen is supplied externally while in biostimulation nutrients are provided. But both these methods are aimed at increasing the microbial population to enhance the remediation process.

EX-SITU REMEDIATION

Bioreactor

Polluted water and soil are removed from the contaminated site and remediated in reactors which are structures designed to provide adequate environmental conditions for bioremediation. The temperature and pH are maintained and requisite microbes with nutrients for their growth are added at regular intervals into the reactor. After remediation they are restored in their original place. PAHs contaminated groundwater has been remediated effectively by the use of bioreactors⁹.

Composting

Compost is usually rich in microbes and contains decayed organic matter. The contaminated soil is remediated with the help of microorganisms present in the compost by mixing the compost with the contaminated soil or sludge. The microbes in the compost consume the contaminant and this method is used to degrade wide range of contaminants including explosive wastes, diesel and petroleum hydrocarbons from contaminated soil. This method was applied in ammunition plants to degrade TNT, RDX and other explosives¹⁰.

Biopiling

This is an ex-situ method suitable for solid medium where the contaminated soil is stacked into piles. The growth and reproduction of aerobic indigenous microbes are stimulated by providing adequate oxygen, moisture and nutrients through injection into the piles. This is done by perforated pipes over which the piles are created.

Land farming

Bioremediation of top soil or sludge over a prepared bed is called land farming. This requires removal of the soil and then it is treated. The contaminated soil or sludge is turned periodically to supply oxygen and facilitate remediation by indigenous microbes. This is similar to biopiling except that the aeration is provided by perforated pipes in biopiles and by tilling and plowing in land farming.

LIMITATIONS

Though the bioremediation process had wide applications and advantages, there are certain limitations in this method which are discussed below.

- | The biodegradation process is site specific. The same process which had proved effective in one place cannot be adopted in another location.
- | It also depends on the composition of pollutant present and the type of microbe used.

- | This process may consume longer time when compared to physical and chemical treatment processes.
- | Biodegradable substances only can be treated by this process and there are also certain pollutants that cannot be degraded.

CONCLUSION

It is essential to address the pollution issues that have been caused in the past as soon as possible to safeguard the natural resources. One solution for remediation is the use of microorganisms which is an environmental friendly process and is well suited to remediate pollutants without causing secondary pollution. This method known as bioremediation is aesthetically acceptable and has proven to be successful in remediating heavy metals, petroleum hydrocarbons and other hazardous wastes. Pilot scale studies followed by application in the field with regular monitoring will yield recognizable results. This article serves the purpose of explaining one of the safe and widely adopted technique of bioremediation and the various methods that are included in it. Extended research is still required in this field in order to cope with the increasing number of newer pollutants and in bringing about a remediated environment as early as possible.

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NUTRACEUTICALS IN LIVESTOCK FEEDS

B. Deva Sena

The use of many nutraceutical ingredients for animals in supplements or feeds initially stemmed from human use and is now being applied for animal use. Nutraceuticals whether from plant or animal origin are nothing but organic compounds that are biodegradable. Their entry into the animal or human body brings about beneficial effects and do not leave the residual effects. A few of them leaves may leave residues in animal products but these are not harmful. Currently nutraceuticals are used more in humans. Some pet practitioners use them. Usage in other animal species is gaining importance, and research results so far obtained indicated the beneficial effect of their inclusion interms of improved immunity, and production efficiency. However there is a need for further more detailed research on the use of these nutraceuticals in livestock feeds.

INTRODUCTION

Nutrition plays an important role in animal health and it's productivity, contributing to 70% of the total rearing cost of livestock. The health and production are directly proportional to the quality and the efficiency of utilization of feed by the animals. Keeping this in view, many substances are being used as feed additives/ supplements to increase the utilization of the nutrients in the feed by the animals. The use of nutritional supplements that offer physiological and microbiological benefits in the digestive system of livestock and companion animals is becoming much more prevalent to the modern feed and pet care industry. One of these feed additives which gained importance in the recent times is the nutraceuticals.

The term nutraceuticals was coined by amalgamation of nutrition and pharmaceuticals in 1989 by Stephen Defelice, Founder and Chairman of the Foundation for Innovation in Medicine (FIM). Defelice (1995) defined nutraceutical as a food or a part of a food that provides medical or health benefits, including prevention and treatment of diseases. While Klark (2003) differentiated between dietary supplements and functional foods.

Dietary supplements are the products which are intended to be supplemented in the diet that contains one or more dietary ingredients namely vitamins, minerals and amino acids.

Functional foods provide the body with the required amount of vitamins, fats, proteins and carbohydrates needed for healthy survival. When the functional foods aids in the prevention and treatment of diseases and disorders other than anaemia, then they are termed as nutraceuticals. Anti anaemic character makes the difference between functional foods and nutraceuticals.

When the functional food aids in the prevention or treatment of diseases or disorders, they are called as Nutraceuticals. Thus a functional food for one consumer can act as a nutraceutical for another consumer.

They are defined as substances which are produced in a purified or extracted form which on administration provide or stimulate production of raw materials required for normal bodily functions. These include safe feeds (protein hydrolysates, hydrolysed carbohydrates and fats), enzymes, prebiotics (oligosaccharides), probiotics, yeasts and fungal extracts, acids, phytogetic additives, immuno stimulants and the like substances.

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(Or) nutraceuticals may be otherwise defined as a food or a part of food that provides medical or health benefits, including the prevention and treatment of a disease.

Nutraceuticals or functional foods are natural, bioactive chemical compounds that have health promoting, disease preventing or medicinal properties. Food may not only be used to sustain life but also to enhance it. Various nutraceuticals are in

Classification of Nutraceuticals

Nutraceuticals are broadly classified into two categories

1. Nutrient nutraceuticals: These are the substances which have established nutritional functions eg.; vitamins, minerals, amino acids, fatty acids.

2. Non-nutrient nutraceuticals: These are the substances which are added to the diets as feed

Nutraceuticals	Function
Organic acid mold and bacterial inhibitors, anti oxidants	Maintain feed quality and hygiene
Flavours, antioxidants, enzymes	Voluntary feed intake
Enzymes and phospholipids	Digestion and absorption of nutrients
Organic acids, oligosaccharides, probiotics	Modulation of the gastro intestinal tracts
Carotenoids, -glucans and herbal extracts	Modulation of immune system
Antioxidants	Oxidative stress and non-infectious diseases

vogue which include- phytochemicals, carotenoids, lycopenes, astaxanthin, non-carotenoids, terpenoids, polyphenolics, phytoestrogens, tannins, isoflavones, catechins etc. The different nutraceuticals have a wide spectrum of activities ranging from effects upon feed quality and hygiene, to disease avoidance as shown in the table.

In continuation of the statement let your food be your medicine by "Hippocrates", modern medicine has developed nutraceuticals which become indispensable nutrients to improve the overall performance of the animals. Ban on certain antibiotic growth promoters encouraged the importance of nutraceuticals.

Merits of feeding the nutraceuticals

- | Feed quality and the palatability are increased
- | Feed conversion ability and the animal growth are improved
- | Environmental stress is decreased
- | Immunity against diseases is increased
- | Quality of final animal products is improved

additives to enhance the feed conversion efficiency by the animal and thus promoting the growth. eg. antibiotics, enzymes, probiotics, prebiotics, organic acids, Herbal nutraceuticals / Phyto-genetic products: Plant extracts have been used for centuries for their anti-microbial properties in substitution of antibiotics. eg garlic oil (anti-bacterial and anti-oxidant), green tea leaves (enhances humoral and cell mediated immunity), ginger(carminative and anti-emetic), soybean extract (polycystic kidney prevention), citrus (vitamin C source), turmeric (osteoarthritis).

These products are available in the market as feed additives to enhance the performance of the birds, improve the feed utilization, maintain health, alleviate the effects of environment stress and prevent the respiratory infection in poultry.

Nutrient nutraceuticals

Amino acids: Lysine and methionine are considered as the two limiting amino acids in monogastric nutrition. By feeding the commercial preparations of

these amino acids in swine, the cost of the ration goes down in addition to a reduction of environmental pollution with nitrogen.

Carnitine: Lysine and methionine are the carnitine precursors. L-carnitine helps in oxidation of fatty acids and enhancing the oxidative phosphorylation. In birds it increases the hatchability upto 3-4 %. It improves the growth rate and feed conversion efficiency ability in swine when fed up to 0.1% in the diet.

Fatty acids: α -Linoleic acid, Eicosapentaenoic acid (EPA) and Docosahexaenoic acid (DHA) are considered as Omega fatty acids. These are synthesised from the α -Linoleic acid. Both EPA and DHA have potent anti-thrombotic and anti-carcinogenic effect. Linseed is a rich source of α -Linoleic acid, while fish meal is rich in EPA and DHA. By feeding these feed stuffs to the animals, n-3-PUFA content is increased in animal products. By feeding this α -Linoleic acid to swine at 1% level prevented the skin lesions and dermatitis. Fat free diets fed to the growing chicks died on the 4th week of age. α -Linoleic acid deficient diets in laying hens resulted in decreased egg production and reduced fertility.

Conjugated Linoleic Acid (CLA): Conjugated Linoleic acid (CLA) is an unsaturated fatty acid refers to a group of chemicals found in the fatty acid linoleic acid. It is the collective name for a group of geometric and positional isomers of Linoleic acid in which the double bonds are separated by a single carbon atom instead of a methyl group (Conjugated means, compound containing two or more double bonds each separated from the other by a single bond). It has anti-carcinogenic, hypocholesterolemic and anti-atherogenic properties. Dietary CLA enhanced immune responses, improved feed efficiency and improved leanness in pigs⁶. It is more potent anti-oxidant than α -tocopherol.

Heteropolysaccharides: Glucosamine sulphate and chondroitin sulphate are considered as chondroprotective nutraceutical agents and protects the animals against osteoarthritis and also helps in the cartilage healing and maintenance.

Minerals: These are the nutrient nutraceuticals which make the animal body to carry out its normal metabolic activities

Name of the mineral	Nutraceutical role
Calcium	Building block of bones and teeth; helps in nerve impulses transmission
Phosphorus	Building block of bones and teeth; helps in the formation of genetic material; helps in the formation of high energy phosphates
Magnesium	Nerve and muscle functions
Sodium and chlorine	Acid-base maintenance; hydrochloric acid production
Sulphur	Helps in the formation of niacin and thiamine
Iron	Electron carrier in oxidative phosphorylation
Cobalt	Essential component in Vitamin B ₁₂
Copper	Helps in formation of haemoglobin and pigmentation
Iodine	Component of thyroxine
Selenium	Anti-oxidant
Zinc	Essential in DNA transcription

Vitamins

Name of the vitamin	Nutraceutical role
Vitamin A	Anti-xerophthalmic and anti-sterility factor
Vitamin D	Helps in the synthesis of 1,25-dihydroxycholecalciferol
Vitamin E	Anti-oxidant
Vitamin K	Helps in blood clotting
Vitamin C	Anti-oxidant
Vitamin B-complex	Major role as co-enzymes in metabolism

Vitamin like substances

Name of the compound	Nutraceutical role
Choline	Lipotropic agent
Inositol	Lipotropic agent
Taurine	Retinal photoreceptor activity

Carotenoids: More than 600 carotenoids have been found in plants. Orange carotenoids are alpha, beta and gamma carotenes. Red carotenoids include lycopene and astaxanthin. Yellow carotenoids are leutin and zeaxanthin. Both alpha and beta carotenoids are protective against liver cancer in cell culture and animal studies. Heating, chopping or crushing of vegetables releases carotenoids, especially β -carotene and lycopene. Carotenoids are nearly insoluble in water and are best absorbed in the presence of fats. In the blood stream carotenoids are transported in the most lipid rich (LDL) particles. Tissues containing more LDL receive more carotenoids.

Non-nutrient Nutraceuticals

Antibiotics: The use of antibiotics has been banned by the European community since January 2006 vide regulation 1831/2003 and so the use of antibiotics as growth promoters is replaced many times with other substances.

Probiotics : are defined as live microbial feed supplements which beneficially affect the host animals by improving its intestinal microbial balances². Nearly all the probiotics available in the market contain lactobacilli and or streptococci and a few contain bifidobacteria, yeast and fungi also.

Some of the proposed mode of action of probiotics in poultry include-maintaining beneficial microbial population in the alimentary tract, improving feed intake and digestion⁷, altering bacterial metabolism and stimulation of immune system⁵. The competitive exclusion approach of inoculating day old chicks with an adult microflora successfully demonstrated the impact of the intestinal microbiota on intestinal function and disease resistance⁸. The effect of probiotics has been shown to be influenced by various factors like level of incorporation, product composition, location, stress conditions and health of the birds. The intensive system of poultry rearing causes more stress on the birds. The dietary use of probiotics is gaining momentum to counteract the stress because of their beneficial effects on live weight gain, feed conversion efficiency and reduced mortality in chickens⁹. It has been reported that probiotics not only act as growth promoters and feed savers, but also as nutritional bioregulators, improving animal performance and health. The majority of probiotic products are based on *Lactobacillus acidophilus* (because of the properties like they are able to survive gastro intestinal transit, being resistant to bile, low pH, and digestive enzymes. They may then be able to adhere to human epithelial cell lines and human intestinal mucus membrane, although other organisms such

as *Streptococcus faecium*, *Bacillus subtilis* and yeasts are also used. The ideal properties of probiotics are-

- ? | Viable and capable of growing in the intestinal tract
- | Resistant to pH and bile acids
- | Must be able to get attached to the gut epithelium
- | Non-pathogenic and non-toxic
- | Stable on storage
- | Beneficial to the host
- | Should be host specific
- | Capable of producing the desirable effect in the host animal, such as inhibiting the growth of pathogens, providing digestive enzymes
- | Easy to prepare on industrial scale

Mode of action of probiotics

- ? | By maintaining the beneficial flora in the gut
- | Change the gut microflora and reduction in *E.Coli*
- | Synthesis of lactic acid with a reduction in pH.
- | Adhesion to or colonization of the intestinal mucosa
- | Prevention of toxic amine synthesis in the gut
- | By stimulating the immune responses in the gut

Prebiotics

Prebiotics are non-digestible food ingredients that affect the host by selectively stimulating the growth or the activity of bacteria in the colon and thus improve the host health³. Among the food ingredients, it includes non-digestible carbohydrates (oligo and polysaccharides). Because of their chemical nature these compounds are not absorbed in the upper GI tract. When they enter the caecum /colon, it serves as a substrate for the endogenous bacteria, thus indirectly provide the hoist with energy. Oligosaccharides such as galacto-oligosaccharides, mannan-oligosaccharides,

fructo-oligosaccharides have been tried in poultry and other non-ruminants^{1,4,10}. The mechanism of action includes lowering of pH through lactic acid production, by inhibiting the colonization of pathogen and producing systemic effect on utilization of feed ingredient, stimulation of immunity and neutralizing the toxin.

Oligosaccharides are used as feed additives for the modification of gut microbes and stimulation of the intestinal immune system. The intestinal mucosa contains carbohydrate residues that serve as binding sites for pathogenic bacteria that have the *receptor sites* for oligosaccharides on their cell walls. The proposed mode of action of dietary Oligosaccharides is that they bind to the receptor sites on the bacteria, thus preventing them from binding to the intestinal mucosa. Pathogenic bacteria must bind to and colonize the gut lining to cause enteric disease. The binding sites on bacteria are called lectins.

Another possible mechanism of action of Oligosaccharides is that they may stimulate the growth of beneficial bacteria in the gut such as lactobacillus and *Bifido bacterium*. These bacteria use the oligosaccharides as substrates, so that their growth is encouraged by the use of oligosaccharides in the diet. By the process of competitive exclusion, stimulation of beneficial should reduce the number of detrimental organisms. Beneficial microbes such as *Bifidobacteria* have greater binding affinity for mucosal attachment than enteric pathogens. Thus stimulation of *Bifidobacteria* by feeding the oligosaccharides may aid in preventing the attachment and colonization of the gut epithelium by pathogenic bacteria.

Synbiotics

A synbiotic is a combination of probiotics and prebiotics. This combination could improve the survival of probiotic organism, because it's specific substrate is available for fermentation. Typical examples of synbiotics include Fructo oligosaccharides (FOS) and *Bifido* bacteria.

Enzymes

These include enzymes which are produced in adequate quantities by the animals for the digestion of various nutrients, The importance of adding these enzymes as feed additives can be felt during the addition of cellulose to the feeds of non-ruminants and addition of α -glucanase to swine and poultry to increase the digestion of α -glucans.

Organic acids (Acidifiers)

Organic acids have shown favourable effects when used as additives in the diets for weanling piglets. In most animals, the stomach doesn't become highly acidic until after weaning. During suckling period, fatty acids in the milk have anti-microbial activity. After weaning, development of highly acidic stomach aids in killing ingested microbes. During a brief period between weaning and the development of low acid stomach, young piglets are susceptible to the invasion of pathogenic bacteria into the gut causing post-weaning diarrhoea. Feeding of organic acids during this period may aid in lowering the stomach pH and preventing the digestive upset. Examples include citric acid and fumaric acid which are added at 1-2 percent.

Uses of Acidifiers

- 1 The anions of these organic acids complex with calcium, phosphorus, magnesium and zinc resulting in improved absorption of these minerals
- 1 Due to lack of acidic pH in the stomach, there is a reduced activity of Pepsinogen conversion and there by decreased enzymatic digestion leading to lowered protein digestion and lowered amino acid availability
- 1 Organic acids reduces the toxic metabolites of bacteria

Antioxidants

These are the substances which prevent the auto oxidation of fats (rancidity).These can be classified

under nutrient and non-nutrient nutraceuticals. Unsaturated fatty acids react with oxygen to produce undesirable products with offensive odours and toxic properties and destruction of nutrients especially fat soluble vitamins. Two types of antioxidants are in vogue-natural (Vitamin E and Vitamin C) and synthetic (Ethoxyquin, Butylated Hydroxy toluene BHT and Butylated Hydroxy Anisole BHA).These synthetic anti oxidants are very effective in preventing the rancidity and these not only reduce this but also has a sparing effect on vitamin E.

Botanicals and Herbs

Extracts of cinnamon, cloves and pepper have been standardized for use in dairy rations. These compounds have demonstrated the ability to change rumen fermentation patterns to favor more efficient feed utilization. The use of botanical extracts and herbs is an exciting future area that will continue to see new uses of these well-known human herbs and ingredients for dairy applications.

Safety of Nutraceuticals

Nutraceuticals can be harmful to the animal due to adverse effects. It is therefore prudent to evaluate both the efficacy and safety of any nutraceutical. Companies that add nutraceuticals-type ingredients must make sure that these ingredients are not inactivated during the processing and storage and are present quantitatively in the product at the time of consumption, not as qualitatively as ingredients on the label.

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Effective Renewable Energy in Rural and Urban Areas

Sumita Singh¹ and Sneha Kumari²

We need to focus on the optimization of efficiency from renewable energy resources. To achieve this, along with new technology, new initiatives should be introduced into research and its implementation. Cooperative societies can be formed where new technology should be used to bring more efficiency even from small quantity of biomass. Intensive theoretical hydro research project can be started at universities/research centre as to induce it into main stream research. Efficiency can also be achieved by using the next generation (costly but efficient) turbines, in cascade manner in dam's projects final stage to maximise hydropower to produce electricity. Natural waterfalls can be used extensively. Instead of big power stations, substations can be built in smaller area reducing the burden of land acquisition. We can minimise the loss by cleaning the verbs/creeper which act as an earthed point and hence electric loss occurs. Another method can be the use of underground transmission wiring for electric distribution at larger scale.

INTRODUCTION

Renewable energy is derived from natural processes that are replenished constantly on a human time scale such as wind and solar energy and will always be available.

Renewable energy sources either directly or indirectly are expected to be capable of supplying humanity energy for almost another 1 billion years as we have viable technology which can convert all form of renewable energy to produce electricity. While many renewable energy projects are large-scale, biomass based renewable technologies are best suited to rural and remote areas, where energy is often crucial in human development.

Globally there is strong support for promoting renewable sources and many countries are providing tax incentives to encourage the development and use of such technologies. A positive temperament should be inculcated that renewable energy investments will be economically in the long term.

Benefits associated with use of Renewable energy

Renewable energy is an important source of energy because of the environmental benefits it provides.

Renewable energy is considered to be a clean source of energy, like biomass which is used extensively as it is environment friendly. For example all the leftover and unnecessary wood waste can be used so to reduce the risk of a forest fire which would cause chaos and economic loss if occurred¹.

Renewable energy will not perish as compared to non – renewable energy resource hence will result in enhanced job opportunities in the long run. Thus we feel that a thrust should be on making available substantial amount of energy through hydro - power and wind energy with focus on bio mass and solar panel parks. In this paper we focus on biomass and hydro energy.

Globally there is strong support for promoting renewable sources such as solar power and wind power, requiring utilities to use more renewable energy (even if this increases the cost), and providing tax incentives to encourage the development and use of such technologies. There is substantial optimism that renewable energy investments will pay off economically in the long term.

At the national level, at least 30 nations around the world already have renewable energy contributing more than 20% of energy supply and many countries

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now have various policy related to longer-term shares of renewable energy.

Biomass - one of the primary renewable energy for rural areas:

Biomass is biological material derived from living or recently living organisms⁵. It is most often referred to plants or plant derived materials, which through the process of photosynthesis, capture the sun's energy. And due to breaking of chemical bonds, they release the sun's energy; hence can be described as a sort of natural battery stored with solar energy².

Biomass is generally suited to rural areas where energy often plays crucial role in development. And importantly biomass is always available and can be used as a renewable resource anytime.

In our country, spreading of large-scale biogas plants has begun in the mid-seventies and the for spreading it to larger section, National Project on Biogas Development (NPBD) was established in 1981. This helped in a saving of 3 million tonnes of fuel-wood per year².

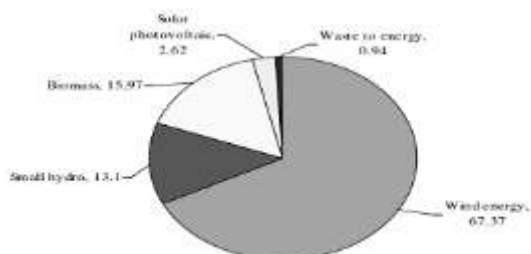


Fig. 1: Use of renewable energy source in India²

In our country, the spreading of large-scale biogas plants has begun in the mid-seventies and the process has amalgamate with the establishment of the National Project on Biogas Development (NPBD) in 1981. This helped in a saving of 3 million tonnes of fuel wood per year and manure containing nitrogen equivalent to 0.7 million tonnes of urea².

In biogas plants methane gas is produced by degradation of biological matter by the bacterial action in the absence of oxygen. And the methane gas produced is used for lightning and other electrical

household works. With an overall efficiency of 35%, 7 billion tons of globally available biomass, with an energy content of 124 EJ, could produce 44 EJ of electricity.

We can get biomass by growing plants specifically for energy use like petro plants (known as first and third generation biomass), and also by using the residues, non – food based biomass source, (known as second-generation biomass) such as agriculture waste⁵.

In liquid form, available biomass are liquid biofuels include bio alcohols, such as bioethanol, and oil, biodiesel. Gaseous biofuels include biogas, landfill gas (methane gas) and synthetic gas⁶.

Biomass utilization plays a crucial role in policy making in countries like Bangladesh (according to data gathered for FY 1986) where 61 per cent of biomass energy used for fuel use comes from crop residues, 24 percent from animal dung, and rest from firewood, twigs, and leaves. So biomass plays effective role is energy production thus is dependable on agricultural practices and also agricultural policies.³

Transesterification¹ method is used for production of biofuel “Biodiesel” which is made from vegetable oils, animal fats or recycled greases. Biodiesel can be used as a fuel for vehicles in its pure form also but generally used as a diesel additive to reduce levels of carbon monoxide.

With advanced technology being developed, cellulosic biomass, such as trees and grasses, are also used as feed-stocks for Bioethanol production, which is made by fermenting the sugar components of plant materials. Ethanol is usually used as a gasoline additive nowadays to increase octane and improve vehicle emissions but not as pure form.

Hydropower Energy

Hydroelectric energy is a term usually reserved for large-scale hydroelectric dams. The energy in moving waters is one of the most widely used renewable energy source.

Energy in water can be harnessed and used. Since water is about 800 times denser than air, even a slow flowing stream of water, or moderate sea swell, can yield considerable amounts of energy. It is cheaper than thermal or nuclear power. Dams are built to store water at a higher level; which is made to fall to rotate turbines that generate electricity. Hydroelectricity or hydropower is the fourth largest source of commercial energy production and consumption globally.

The basic principle behind hydropower energy is the damming of rivers to create artificial in waterfalls; sometimes natural waterfalls are also used. The falling water is used to turn the turbines that drive electrical generators. One of the greatest advantages of hydropower is that once the dam is built and turbines become operative, it is relatively cheap and clean source of energy. As our power demand would be 4,000,00 MW by 2022 and the hydropower has maximum potential to generate electricity almost about 1,50,000 MW, but as we are exploiting just a little over 39,000 MW⁸.

CONCLUSION

Today the need is to focus on the uses of renewable energy resources so as to gain maximum efficiency. To achieve this, along with new technology new initiatives should be introduced into its research and development.

Biogas plant cannot be used by poor or needy because domestic cattle in large numbers are required, eventually for maintenance manpower is mandatory. Therefore new technology should be used to bring more efficiency even from small quantity of biomass. Cooperative societies formed at gram/village level will ensure sufficient resource of raw material for biomass facility and lead to a "green energy revolution" similar to "white revolution" in milk production.

Intensive theoretical hydropower research projects using computer based software can be started at universities/research centre so as to bring biomass technology into the main stream research.

We can emphasise on transmission so to

minimize the loss and yield maximum efficiency. This can be done also by using the next generation (costly but efficient) turbines, in cascade manner in the final stage, thus we can utilize the maximum hydropower to produce electricity. Likewise we can use valuable hydro power resource at its maximum efficiency.

Biogas plant facility can build in smaller areas which will lead to maximum utility of an expensive resource like land. Natural water fall can be used extensively in hilly areas reducing the concern over environmental pollution arising from the construction of dams. We can derive benefits in dividing the bigger power stations into numerous substation so to build them in smaller area with wider connectivity and reducing the burden of land acquisition.

We can minimise the loss by cleaning the verbs/creeper that roll upon the electric wire and act as an earthed point and hence electric loss occurs. Another method can be use of the underground transmission wiring for electric distribution at larger scale.

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MELANOIDIN: A MAJOR POLLUTANT FROM DISTILLERY EFFLUENT

Ishwar Chandra¹, Abha Saxena², Garima Sharma³, Shruti Singh⁴ and S.N. Pruthvi⁵

This review article focus mainly on the melanoidin, one of the major environmental hazard that causes serious damage to land as well as water bodies. It includes a survey on distillery effluent containing Melanoidin, its chemical nature, different technology such chemical and biological approach that can be used to degrade melanoidin, pros and cons of using chemical and biological agents for melanoidin containing effluent decolorization.

INTRODUCTION

India is one of the largest producers of sugar cane and its product sugar. In sugar industry many by-products are accumulated at various stages of its unit process, some of the products are molasses, bagasse and fiber cake, among which molasses is the most important one. This molasses is used in distillery as a substrate for ethanol production. Molasses contains about 48 to 50% sugar and has a high commercial value due to its use as a carbon source in various fermentation processes especially in ethanol production, and also as cattle feed and biofertilizer¹. In India, distilleries are one of the largest pollution causing industry because 88% of the raw materials are left as waste and discharged into the nearby water bodies and barren land, causing water and land pollution. In the distillery industry, for 1 litre of alcohol produced, about 15 liters of spentwash is effluent which is released as wastewater. At present there are about 315 major distilleries in India producing 50 to 60 billion liters of effluent annually, which are used for various purposes such as fuel ethanol, ethanol for pharmaceuticals, perfume industry and various other purposes².

MELANOIDIN

Melanoidins are acidic compounds with a

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charged nature and its composition depends on the reaction conditions, mainly temperature, pH, water content, heating time, and the nature of reactants. Caramels are also thermal degradation products of sugars which forms a colour. They are formed by heating concentrated sucrose syrups at temperatures above 210°C and pH from 3 to 9. Caramelization occurs in ethanol production when beer is heated strongly during distillation at high temperature.

Melanoidin is known as a natural browning polymer which is produced by the Maillard reaction between amino- and carbonyl groups of organic matters and is closely related to humic substances in the natural environment. In Maillard reaction, the end product melanoidin, whose 3-stage pathway includes cyclisations, dehydrations, retroaldolisations, rearrangements, isomerisations and further condensations.

Like other products of Maillard reaction, melanoidins have antioxidant properties that makes them highly toxic to aquatic micro- and macro-organisms³. The disposal of distillery wastewater into the water bodies or land is hazardous. Its highly dark red-Brown colored components also lead to a decrease in sunlight penetration in water bodies like lakes or lagoons, which in turn, decreases both photosynthetic activity and dissolved oxygen concentrations causing harm to aquatic flora and fauna. Disposal on land is equally hazardous, causing

a decrease in soil alkalinity and also in soil manganese availability⁴ inhibition of seed germination and the retardation of vegetation growth¹.

REMOVAL OF MELANOIDIN

Due to the hard nature of melanoidins, conventional waste water treatment process are unable to remove colour from the molasses spent wash¹⁰. To tackle these harsh effects on environment, various treatment techniques are studied in the past and current research is also going on to find out most economical and less time consuming process for treatment with maximum colour removal target, the study has shown varying degree of success¹¹. By different methods of treatment we can achieve different levels of melanoidin removal ranging from 50-100% and each technique has its own advantage and disadvantage.⁵

Microbial and physiochemical methods are two different major approach for de-colorization, where Processes ranging from chemical precipitation, ozonization⁶, flocculation which uses several decolorizing agent, such as chemical coagulation and flocculants to agricultural residues such as wheat straw, corn cob shred and wood chips, seeds as *Moringa oleifera*. Studies have shown that low cost absorption material which includes peat, benomite, steel plant slag, fly ash, china clay, maize cob, wood shavings silica and chemical adsorption by activated carbon are also used for the removal of the melanoidin.⁷

However, colour removal by these processes still has disadvantages because of economical as well as technical reasons such as high operation cost, chemicals consumption of demand, low colour removal efficiency, high volume of solid waste produced and secondary pollutant generation.⁸

Various microbes are involved in decolorization process such as fungus whole cell which can degrade synthetic melanoidin and in immobilized form also³. There are number of biological methods reported

which includes Biosorption⁹, Bioremediation, Anaerobic and Aerobic treatment processes, use of microorganisms based systems such as Fungi (*Penicillium decumbens*, *Aspergillus* sp., *Coriolus* sp.)¹⁰ Bacteria (*Bacillus* sp., *Pseudomonas* sp.), yeast (*Citeromyces* sp.), mixed consortium treatment and use of microbial oxidative enzymes (laccase, manganese peroxidase, lignin peroxidase).⁸

Treatment processes, hence treatment by microbes is also very limited to few species, which are not enough efficient in colorant degradation. In conventional anaerobic-aerobic processes colorants are removed with an efficiency of approximately 7%. In the activated sludge process, high molecular-weight coloured substances are degraded only to low-molecular-weight compounds.

CONCLUSION

Different studies have shown that this melanoidin is highly dangerous for the aquatic life. Therefore the need of the hour is to save the aquatic flora and fauna. The task can be achieved by selecting an optimum technology for melanoidin removal. Microbial approach is one of the recent advancement in this field as it leads to maximum melanoidin removal with high efficiency in lesser time and minimum side effects.

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Cutting Edge Alloys

Partho Pratim Chatterjee

In the recent past, new alloys have been developed. In this back drop, the paper dwells upon few newly developed important alloys such as super stainless steels, bulk metallic glasses (BMG), metallic super alloys made from nano particles, etc. The paper attempts to establish that there could be amazing applications of these alloys in the near future if harnessed techno- economically. The article is followed by possible future applications in real life situations and conclusion.

INTRODUCTION

Metal alloys, by virtue of composition or principal constituent or base metal can be grouped into two categories: ferrous alloys and non-ferrous alloys. Ferrous alloys have iron as their principal constituent, whereas non-ferrous alloys are non iron based. Ferrous alloys include steels and cast iron, whereas non-ferrous alloys include alloys of aluminium, copper, nickel, titanium, etc.

Among the ferrous alloys, steel ferrous alloys, are by far the most important metallic alloys, mainly because of cost economy and wide range of mechanical properties. Alloying elements such as nickel, chromium, and molybdenum are added to plain carbon steels to produce low alloy steels. Addition of these alloying elements results in a fine distribution of alloy precipitates which effectively hinder dislocation movement and hence enhance strength. They also improve the hardenability. Low alloy steels have a good combination of high strength and toughness. Stainless steels are important ferrous alloys because of their high corrosion resistance in oxidizing environments. Among the non-ferrous alloys, aluminium alloys are important mainly because of their lightness, workability, corrosion resistance, and economic viability.

There have been great advancements in the field of high-strength alloys that are lighter and stronger. The need for additional enhancements continues to

augment. To this end, in addition to the conventional alloys, recently developed special purpose alloys are growing in importance and application in various industries as they are superior to the conventional alloys in several respects. Among them, alloys such as super stainless steels, bulk metallic glasses (alloys which are as mouldable as plastic but yet much stronger than steel), metallic super alloys made from nano particles, etc. are noteworthy to mention as they have cutting edge over conventional alloys. These alloys owe their special characteristics and predominant role to the presence of alloying element(s). Depending on the nature and the amount of the alloying element(s), these special purpose alloys possess (i) superior strength, hardness and ductility, (ii) superior fatigue and impact strengths, (iii) superior resistance to grain growth and softening during tempering, (iv) excellent high and low temperature properties at extremes, (v) enhanced corrosion resistance and wear resistance, (vi) better electrical and magnetic properties.

SUPER STAINLESS STEEL

As we know, the predominant alloying element in conventional stainless steels is chromium. The high corrosion resistance of stainless steels might be attributed because of the formation of chromium oxide scales (Cr_2O_3) due to oxidation. These chromium oxide scales thus formed, act as

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deoxidizing agent and impede oxidation of the stainless steel by preventing it in coming with contact with the atmosphere thereby impeding corrosion. The high oxidation resistance property in air at ambient temperature is normally achieved with additions of a minimum of 13% (by weight) chromium and up to 26% for harsh environments, creating a thin layer, too thin to be visible.

Among the stainless steels group, the austenitic stainless steels offer superior corrosion resistance because of their high chromium and nickel contents. Stainless steels, such as ultrahigh stainless steels (17-7 pH), are extremely strong and offer very high corrosion resistance. The addition of alloying elements like aluminium, chromium, nickel, etc. in austenitic stainless steel is easily possible than other stainless steels (ferrite or martensite). This is because the austenitic phase possessing face centred cubic (FCC) crystal structure, (as compared to body centred cubic (BCC) ferrite or body centred tetragonal (BCT) martensite crystal structure) has larger interstitial voids which makes possible the inclusion of alloying elements in it without imposing much strain on rest of the iron atoms. This ensures that Gibbs free energy of the system is lower and hence the system is thermodynamically more stable. Oak Ridge National Laboratory, USA has developed a new type of stainless steel. It is the "Superman" of its class, austenitic grade, offering superior oxidation resistance properties compared to conventional stainless steels at relatively the same cost of production. Because of aluminium addition, aluminium oxide scales (Al_2O_3) are formed. This ensures that it exhibits greater ability to withstand corrosion and creep. This unique combination of corrosion and creep has only been found in nickel base alloys earlier, which are almost five times more expensive than the new super stainless steel. This new super stainless steel may prove to be useful for high temperature corrosive applications with respect to conventional stainless steels because it maintains its mechanical integrity and very high corrosion resisting properties at high temperatures and extreme environmental conditions. Such steels also help to

overcome the problem of sagging commonly found in conventional stainless steels at high temperature!¹

BULK METALLIC GLASSES (BMG)

The Bulk Metallic Glasses (BMGs) are alloys which are as mouldable as plastic but yet much stronger than carbon steel. Recently, material scientists team of Yale University led by Jan Schroers have developed these metal alloys². These new metal alloys cost around the same as high-end steel, but can be processed as economically as plastic. The team believes that BMG's could enable a whole new paradigm for shaping metals.

The BMGs are made up of a range of materials including copper, nickel, titanium and zirconium. The BMGs have a random atomic structure, as opposed to the orderly, crystalline structures found in conventional metals. Due to random atomic structure, the strong metallic bonds are not present. Because of the absence of strong metallic bonds and the presence of a disordered structure, the BMG's can be re-arranged into different geometrical shapes without undergoing fracture to suit particular purposes. These materials behave as good conductors of heat and electricity. They also do not display metallic lustre as found in conventional metals. Lack of metallic lustre could be attributed to the diffuse reflection of incident light due to random atomic structure. These materials have a greater area under the plastic region between the elastic limit and the fracture point and a small area under the elastic zone in the stress strain curve. They undergo large amounts of plastic deformation before fracture, thereby enhancing design safety.

This implies that they can be "blow moulded" (in the same way that plastics are) into very complex and intricate shapes that is difficult to be achieved using regular metals, without degrading any of their mechanical properties like strength, durability, etc. The material scientist team demonstrated the mouldability of the bulk metallic glasses by creating complex shapes that can be moulded in less than a minute and are twice as strong as typical steel. They

can also be used as smart materials because of their ability to change shape without loss in ductility. The specific heat capacity of these materials are expected to be high. Hence, it might be concluded that the properties of the BMG's are quite different from those of the parent metals of which they are composed of.

The material scientists team is already using the materials to create tiny resonators for micro electro-mechanical systems. It might be used to create precise clocks which lose very little time over a significant period. The superior properties of BMGs relative to plastics and typical metals, combined with the ease, economy and precision of blow moulding, have the potential to impact the human life just like the development of synthetic plastics in the last century.²

BMGs can be strong or even stronger than steel, as malleable as plastics, conduct electricity and resist corrosion. However, BMGs have few demerits also. They are brittle, have poor and uneven resistance to fatigue that makes their reliability questionable. The creation of multi-component BMG composites and noble BMGs addresses the issues and liquidates the demerits. For example, palladium based BMGs have good fatigue strength, as good as the best composite BMGs. The fatigue strength are comparable to regular polycrystalline structural alloys, such as steel, aluminium and titanium.³ Noble metal based BMGs composed of Pd-Cu-Ni-P are viewed as potential materials for use in thermoplastic nano fabrication and electrocatalytic applications. The stability, formability and physical properties of these glasses are related to the kinetic pathways taken towards their decomposition and crystallization.⁴

METALLIC SUPER ALLOYS MADE FROM NANOPARTICLES

Nano particles or nano crystals consist of metals, semiconductors, or oxides. They are of particular importance because of their excellent properties. They have also been utilized as quantum dots and as chemical catalysts. Nano particles of a material

exhibit contrasting properties in comparison to the bulk of that material. For eg, copper nano particles about 50 nm in size exhibit super hardness, and they are neither malleable nor ductile. Because of ease of diffusion, agglomeration is possible at much lower temperatures. Another interesting facet is that the size of these nanoparticles can be suitably modified to create different properties for specific purposes. Similarly, gold nanoparticles exhibit a large number of colours from red to black whereas bulk gold is golden in colour.

A group of scientists at the Sandia National Laboratories have performed a random series of experiments to study the science of creating metal and super alloy nanoparticles in the recent past. They created lightweight, corrosion-resistant materials with startling properties. The new technology for metallic super alloys made from nanoparticles focuses on the use of radiation in breaking down the molecular structure of metals and form nanoparticles. It is an approach that is flexible and versatile for large scale creation of metallic super alloys nanoparticle compositions. The methodology used is radiolysis and it brings to the fore a universal method of nanoparticle formation. These materials offer multi-faceted advantages as they are exceptionally strong, have very high strengths, are light weight, and they possess the unique ability of not undergoing fracture even under high stresses which would otherwise destroy materials like steel, aluminium, copper etc.⁵

Over the years researchers have mastered the synthesis required for size and shape control of many nanostructures, and today focus is shifting towards being able to process the internal structure of these materials with great precision. To accomplish this goal, new nano alloy interfaces are being prepared with stainless steel like compositions that will be used as a chemical tool to control interfacial oxidation rates. This will allow for the preparation of nano particles with morphologically defined void spaces, including asymmetric ones, which can be controlled with 15 nm fidelity.⁶

Comparison of mechanical properties of super stainless steel, BMGs and metallic super alloys made from nano particles are depicted in Table 1.

longer lasting biomedical implants are possible with BMGs. (iv) Super Stainless steels may find usage in turbines as they exhibit the property of extremely

Table 1 : Mechanical properties of cutting edge alloys

Cutting Edge Alloy	Mechanical Property
Super Stainless Steel	High creep resistance, high strength, low sagging tendency
Bulk Metallic Glasses (BMGs)	High strength, high mouldability, high fatigue strength, high toughness, high durability, undergo large plastic deformation before fracture
Metallic Super alloys made from nano particles	High strength, ability to resist fracture at high stress, high strength to weight ratio, ability to withstand high impulsive stresses

POSSIBLE FUTURE APPLICATIONS AND CO-RELATION OF PROPERTIES

There could be wide spread applications of these alloys in real life situations. Few such possible applications could be the following : (i) The super stainless steel can be rolled conveniently into sheets, plates, bars, wires, pipes, etc. The possible application could be in automotive and aerospace assembly, industrial equipment, pipelines carrying fluids at high temperature; say steam in nuclear power plants, surgical instruments, building material in skyscrapers and other industrial buildings in saline coastal areas, due to high corrosion resistance and ability to withstand creep at high temperature. (ii) For BMG's, complex shapes like seamless bottles, wrist watch casings, biomedical implants can be moulded conveniently in a time saving and a cost economic manner and can be used to create systems which are twice as strong as typical steel. As BMG's can be of different shapes, they can be used to reach internally damaged parts of the human body and repair them without tedious surgeries. (iii) Production of tougher, more durable smart phones and other electronic devices and a wide variety of

strong corrosion resistance even at elevated temperatures. (v) Metallic super alloys made from nano particles may find use in equipments exposed to heavy centrifugal stresses by virtue of their reduced densities. (vi) Metallic super alloys made from nano particles may be used in turbines, aircrafts, guns and tank barrels, weapon casings, bullet proof jackets, nuclear reactors, nuclear flasks for safe storage and transportation of nuclear wastes etc. by virtue of their high strength and ability to withstand high impact stresses. (vii) Aluminium nano particles may help in surface plasmon resonance and enhance efficiency of solar cells. (viii) The agglutinating properties of metallic super alloys made from nano particles may be utilized to create materials of high refractive index, and hence may prove useful in optical communication systems. (ix) The confinement of electrons in metallic super alloys made from nano particles may help to produce a wide range of wavelengths from a single incident beam. Thus, appropriate signals may be created without use of electricity. (x) Nano alloy interfaces including titanium and aluminium based super alloys have applications in energy sector, biotechnology sector, gas storage, medical appliances.

CONCLUSION

These cutting edge alloys are poised to be mainstay materials for next generation science and technology if harnessed in techno-economic manner.

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NATIONAL INSTITUTE OF IMMUNOHAEMATOLOGY, MUMBAI

Situated at Mumbai in Maharashtra, the National Institute of Immunohaematology (NIIH) conducts research on various haematological disorders.

THRUST AREAS

The following are the thrust areas of NIIH

- | Study from population to molecular levels of Haemoglobinopathies, Thalassemia, Red Cell
- | Enzymopathies and Membrane disorders.
- | Pilot projects to assess the control and smoother management of these disorders in our country.
- | Prenatal diagnosis of all inherited severe haematological disorders, for which no effective treatment/cure is available, including in addition, haemophilia, other congenital coagulation disorders, severe immunodeficiencies etc.
- | Cytogenetics, immunophenotypic studies of acute leukaemia, haemopoietic stem cell expansion and differentiation programmes.

- | Cost effective treatment modalities for various haematological disorders.
- | Molecular studies of major blood group antigens, HLA and immunogenetics.
- | Developing Centres of Excellence for congenital immunodeficiency.
- | Developing collaborative centre for research in haemato-virology.

INTERNATIONAL RECOGNITION

- | NIIH is recognized as World Federation of Hemophilia (WFH) training centre in genetic diagnosis of hemophilia for South East Asia.
- | WHO has recognized NIIH as a Training centre listed under its Regional Directory of Training Institutes.
- | Training centre in "Transfusion Medicine" and "Advanced Haematology and Immunohaematology" for its in Country Fellowship Training Programme.
- | Recognition by INSERM (Paris) as international associate laboratory.

Human Resource Development

- | NIIH has been training Blood Bank Medical Officers and Technicians from all over India, with special emphasis on backward areas of the country, for the past 35 years.
- | The International Centre for Scientific Research (ICSR) has included the Institute's name in its list of research institutes in the world.
- | The Institute has conducted several hands on training workshops sponsored by DBT, WHO, Red Cross, State Blood Transfusion Council, etc where advanced training in specific subjects is given to the trainees.
- | The Institute has been conducting NACO and MDACS sponsored special adhoc training programmes for doctors and technicians for HIV testing since 1985.
- | The Institute undertakes M.Sc dissertation projects of Mumbai and other universities for 6 months.

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- | NIIH is recognised by the University of Mumbai for M.Sc and Ph.D in Applied Biology and Biochemistry.
- | The Institute is also involved in training DM (Clinical Haematology) and MD (Transfusion Medicine) students at KEM Hospital under Maharashtra University of Health Sciences.
- | The Institute has 8 guides for Ph.D in Applied Biology and 3 guides for Ph.D in Biochemistry of Mumbai University.

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Significant achievements of NIIH are the following

- | Discovery of "Bombay Blood, Ina blood group, Hb Ratnagiri, Fibrinogen Mumbai as well as demonstration of several mutations

in Hemoglobin, Pyruvate Kinase, Factor VII, Factor X, Factor VIII, Factor IX, Protein C molecules, and Gp Iib, IIIa molecules in Glanzmanns Thrombasthenia.

- | Development of Prenatal diagnosis for various inherited haematological disorders like haemoglobinopathies, thalassemia, and hemophiliac, methodology for non-invasive prenatal diagnosis for α -thalassemia.
- | Identification of some rare as well as novel G6PD variants (G6PD Coimbra, G6PD Namoru, G6PD Niligiri) among primitive tribes of India.
- | Studies on Effect of Hydroxyurea on patients suffering from various hemoglobinopathies
 - | Sickle cell anemia
 - | α -thalassemia intermedia
 - | α -thalassemia major.
- | Tracing of mechanism of thrombocytopenia following dengue virus infection to infection of CFU – Meg colonies.
- | Development of preliminary data on molecular analysis of ABO alleles and D variants in Indian population.
- | Production of Monoclonal antibodies against B antigen, H antigen, Fetal hemoglobin, Factor VIII using hybridoma technology.
- | Development of a diagnostic algorithm for detection of congenital immunodeficiency syndromes.
- | Development of FISH and comparative genomic hybridization techniques for study of MDS, Fanconi's anemia, Down syndrome etc.
- | Development of a TEG based classification of haemophilia for rational management of these patients.
- | Development of several techniques on mutation detection, VWF binding assay, semiquantitative factor XIII assay, ELISA

assay for Factor VIII inhibitors, Spot test for severe Glanzmann's thrombasthenia (GT), simple flowcytometry based red cell osmotic fragility assay, ELISA based detection of GT carriers. Some of the tests have been patented.

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- | Big Data Quality and Provenance Control
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- | Data security, licensing and privacy
- | Metadata and Ontology for Big Data
- | Standards and Protocols for Big Data
- | Role of Librarians in Data Publishing, Data curation and services
- | Building Data Repositories
- | Data Citation Practices
- | Altmetrics and Big Data
- | Big Data in Social Networks
- | Capturing, Analysing and Visualising streaming Data
- | Big Data Search and Retrieval
- | Linked Open Data
- | Big Data in Semantic Web
- | Mobile Data Management

Social Sciences data

- | Census data analysis
- | Econometric data, forecasting systems
- | Budgeting and Data based policies
- | Agriculture data production and management
- | Open Government Data
- | Big Data in E-Governance
- | Role of Big Data in building Smart Cities
- | Big Data in Business Analytics
- | Big Data for Rural Development

Domain Specific Data in Science & Technology:

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- | IoT-cloud Integration
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- | Bioinformatics Data applications
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Special Sessions

- | Social Science data analysis and applications
- | Open Knowledge and Data in Agriculture and Nutrition
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International Conference on Engineering Physics, Materials and Technology,
3rd to 4th June 2016 , Gurgaon, Haryana.

Topics :

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| Photonics | Ultrasonic transducers & devices |
| Dielectric, ferroelectric, piezoelectric materials & characterization | Ultrasonic materials- Characterization & Nondestructive evaluation |

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Bio Asia-Pacific 2016, July 25-27, 2016, Avani Atrium, Bangkok, Thailand.

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5TH International Conference on Earth Science & Climate Change , July 25-27, 2016 Bangkok, Thailand.

Theme “Stimulating and Analyzing the changes of Earth & Climate-ICESCC”.

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S & T ACROSS THE WORLD

NOBEL PRIZE 2015

PHYSICS

The Nobel Prize in Physics 2015 recognises Takaaki Kajita, University of Tokyo, Kashiwa, Japan and Arthur B. McDonald, Queen's University, Kingston, Canada for their key contributions to the experiments which demonstrated that neutrinos change identities. This metamorphosis requires that neutrinos have mass. The discovery has changed our understanding of the innermost workings of matter and can prove crucial to our view of the universe.

Around the turn of the millennium, Takaaki Kajita presented the discovery that neutrinos from the atmosphere switch between two identities on their way to the Super-Kamiokande detector in Japan.

Meanwhile, the research group in Canada led by Arthur B. McDonald could demonstrate that the neutrinos from the Sun were not disappearing on their way to Earth. Instead they were captured with a different identity when arriving to the Sudbury Neutrino Observatory.

A neutrino puzzle that physicists had wrestled with for decades had been resolved. Compared to theoretical calculations of the number of neutrinos, up to two thirds of the neutrinos were missing in measurements performed on Earth. Now, the two experiments discovered that the neutrinos had changed identities.

The discovery led to the far-reaching conclusion that neutrinos, which for a long time were considered massless, must have some mass, however small.

For particle physics this was a historic discovery. Its Standard Model of the innermost workings of matter had been incredibly successful, having resisted all experimental challenges for more than twenty years. However, as it requires neutrinos to be massless, the new observations had clearly

showed that the Standard Model cannot be the complete theory of the fundamental constituents of the universe.

The discovery rewarded with this year's Nobel Prize in Physics have yielded crucial insights into the all but hidden world of neutrinos. After photons, the particles of light, neutrinos are the most numerous in the entire cosmos. The Earth is constantly bombarded by them. Many neutrinos are created in reactions between cosmic radiation and the Earth's atmosphere. Others are produced in nuclear reactions inside the Sun. Thousands of billions of neutrinos are streaming through our bodies each second. Hardly anything can stop them passing; neutrinos are nature's most elusive elementary particles.

Now the experiments continue and intense activity is underway worldwide in order to capture neutrinos and examine their properties. New discoveries about their deepest secrets are expected to change our current understanding of the history, structure and future fate of the neutrinos.

CHEMISTRY

The Nobel Prize in Chemistry 2015 is awarded to Tomas Lindahl, Francis Crick Institute and Clare Hall Laboratory, Hertfordshire, UK, Paul Modrich, Howard Hughes Medical Institute and Duke University School of Medicine, Durham, NC, USA and Aziz Sanjar, University of North Carolina, Chapel Hill, NC, USA for having mapped, at a molecular level, how cells repair damaged DNA and safeguard the genetic information. Their work has provided fundamental knowledge of how a living cell functions and is, for instance, used for the development of new cancer treatments.

Each day our DNA is damaged by UV radiation, free radicals and other carcinogenic substances, but even without such external attacks, a DNA molecule is inherently unstable. Thousands of spontaneous changes to a cell's genome occur on a daily basis. Furthermore, defects can also arise when DNA is copied during cell division, a process that

occurs several million times every day in the human body.

The reason our genetic material does not disintegrate into complete chemical chaos is that a host of molecular systems continuously monitor and repair DNA. The Nobel Prize in Chemistry 2015 awards three pioneering scientists who have mapped how several of these repair systems function at a detailed molecular level.

In the early 1970s, scientists believed that DNA was an extremely stable molecule, but Tomas Lindahl demonstrated that DNA decays at a rate that ought to have made the development of life on Earth impossible. This insight led him to discover a molecular machinery, *base excision repair*, which constantly counteracts the collapse of our DNA.

Aziz Sancar has mapped *nucleotide excision repair*, the mechanism that cells use to repair UV damage to DNA. People born with defects in this repair system will develop skin cancer if they are exposed to sunlight. The cell also utilises nucleotide excision repair to correct defects caused by mutagenic substances, among other things.

Paul Modrich has demonstrated how the cell corrects errors that occur when DNA is replicated during cell division. This mechanism, *mismatch repair*, reduces the error frequency during DNA replication by about a thousandfold. Congenital defects in mismatch repair are known, for example, to cause a hereditary variant of colon cancer.

The Nobel Laureates in Chemistry 2015 have provided fundamental insights into how cells function, knowledge that can be used, for instance, in the development of new cancer treatments.

PHYSIOLOGY OR MEDICINE

The 2015 Nobel Prize in Physiology or Medicine with one half jointly to William C. Campbell and Satoshi mura, for their discoveries concerning a novel therapy against infections caused by roundworm parasites and the other half to Youyou Tu

for her discoveries concerning a novel therapy against Malaria.

Diseases caused by parasites have plagued humankind for millennia and constitute a major global health problem. In particular, parasitic diseases affect the world's poorest populations and represent a huge barrier to improving human health and wellbeing. This year's Nobel Laureates have developed therapies that have revolutionized the treatment of some of the most devastating parasitic diseases.

William C. Campbell and Satoshi mura discovered a new drug, Avermectin, the derivatives of which have radically lowered the incidence of River Blindness and Lymphatic Filariasis, as well as showing efficacy against an expanding number of other parasitic diseases. Youyou Tu discovered Artemisinin, a drug that has significantly reduced the mortality rates for patients suffering from Malaria.

These two discoveries have provided humankind with powerful new means to combat these debilitating diseases that affect hundreds of millions of people annually. The consequences in terms of improved human health and reduced suffering are immeasurable.

ECONOMICS

The Royal Swedish Academy of Sciences has decided to award The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel for 2015 to Angus Deaton, Princeton university, NJ, USA "*for his analysis of consumption, poverty, and welfare*".

To design economic policy that promotes welfare and reduces poverty, we must first understand individual consumption choices. More than anyone else, Angus Deaton has enhanced this understanding. By linking detailed individual choices and aggregate outcomes, his research has helped transform the fields of microeconomics, macroeconomics, and development economics.

The work for which Deaton is now being honored revolves around three central questions: *How do consumers distribute their spending among different goods?* Answering this question is not only necessary for explaining and forecasting actual consumption patterns, but also crucial in evaluating how policy reforms, like changes in consumption taxes, affect the welfare of different groups. In his early work around 1980, Deaton developed the Almost Ideal Demand System – a flexible, yet simple, way of estimating how the demand for each good depends on the prices of all goods and on individual incomes. His approach and its later modifications are now standard tools, both in academia and in practical policy evaluation.

How much of society's income is spent and how much is saved? To explain capital formation and the magnitudes of business cycles, it is necessary to understand the interplay between income and consumption over time. In a few papers around 1990, Deaton showed that the prevailing consumption theory could not explain the actual relationships if the starting point was aggregate income and consumption. Instead, one should sum up how individuals adapt their own consumption to their

individual income, which fluctuates in a very different way to aggregate income. This research clearly demonstrated why the analysis of individual data is key to untangling the patterns we see in aggregate data, an approach that has since become widely adopted in modern macroeconomics.

How do we best measure and analyze welfare and poverty? In his more recent research, Deaton highlights how reliable measures of individual household consumption levels can be used to discern mechanisms behind economic development. His research has uncovered important pitfalls when comparing the extent of poverty across time and place. It has also exemplified how the clever use of household data may shed light on such issues as the relationships between income and calorie intake, and the extent of gender discrimination within the family. Deaton's focus on household surveys has helped transform development economics from a theoretical field based on aggregate data to an empirical field based on detailed individual data.

(Source: http://www.nobelprize.org/nobel_prizes/laureates/2015/press.html)



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संस्था की सदस्यता उन सभी लोगों के लिए खुली हैं, जो स्नातक या उसके समान स्तर पर शैक्षणिक योग्यता अर्जन कर चुके हैं, और जिन्हें भारत में विज्ञान की तरक्की में रुचि हैं।

Membership of the Association is open to person with Graduate or equivalent Academic Qualifications and interested in the advancement of Science in India.

1. **वार्षिक सदस्य** : जो व्यक्ति नये रूप से वार्षिक सदस्यता ग्रहण करना चाहता है उसे वार्षिक सदस्यता शुल्क ₹ 200/- के साथ भर्ती शुल्क ₹ 50/-* (विदेशियों के लिए** U.S. \$ 70) मात्र देने पड़ेंगे। वार्षिक सदस्यता शुल्क प्रत्येक वर्ष के 01 अप्रैल को देय हो जाएगा। जो भी 15 जुलाई के भीतर अपनी सदस्यता शुल्क नहीं अदा कर पाएगा वह उस साल के लिए अपनी वोट देने की क्षमता से वंचित हो जाएगा और/या वह उस वर्ष के लिए संस्था के कार्यालय को भी नियंत्रण नहीं कर पाएगा। वार्षिक सदस्य अपनी सदस्यता दोबारा अगले साल 15 जुलाई के भीतर बिना शुल्क दिए पुनः अपनी सदस्यता प्राप्त कर सकता है।

सदस्यगण अपना पेपर कांग्रेस सत्र के समय पेश कर सकते हैं। उन्हें वार्षिक विज्ञान कांग्रेस सत्र की कार्यविवरण की एक प्रति बिना मूल्य में प्राप्त हो सकती है। इसके साथ वे संस्था के रोजनामचा "एवरीमैन्स साइंस" की प्रति भी बिना मूल्य उस साल के लिए प्राप्त कर सकते हैं। सदस्यता के नवीकरण के लिए कृपया ISCA वेबसाइट से फार्म डाउनलोड करें।

1. **Annual Member** : A person willing to be enrolled as new Annual Member has to pay an annual subscription of ₹ 200/- along with an admission fee of ₹ 50/-* (for foreign ** U.S.\$ 70) only. The annual subscription of a Member shall become due on the 1st April of each year. Anyone who fails to pay the subscription on or before the 15th July in any year shall lose the right of voting and/or holding any office of the Association for that year. A member failing to pay the annual subscription by the end of March of the following year shall cease to be a Member. Annual members can renew their Membership without paying the admission fee in the next year by remitting subscriptions in time i.e. within 15th July. Members may contribute papers for presentation at the Science Congress. They will receive, free of cost, reprints of the Proceedings of the Session of any one section of their interest and also the bi-monthly journal of the Association Everymans Science for that year only. For Renewal of Membership please download the form from ISCA website.

2. **सत्र सदस्य** : यदि कुछ कारणों से वार्षिक सदस्य अपनी सदस्यता उस वर्ष के 15 जुलाई के अंदर दोहराना भूल जाएँ, तो उनकी सदस्यता, सत्र सदस्यता के रूप में बिना वोट डालने की क्षमता में सीमित कर दिया जाएगा। सत्र सदस्यको ₹ 200/- (विदेशियों के लिए \$ 50) अदा करना पड़ेगा। एक सत्र सदस्य को लेख/पोस्टर प्रस्तुतीकरण का अधिकार प्राप्त होगा जिस कांग्रेस सत्र का वह सदस्य है। एक सत्र सदस्य वोट प्रक्रिया में भाग लेने के योग्य नहीं हैं। सत्र सदस्य को विभागों के व्यवसाय बैठकों और साधारण बैठकों में भाग लेने की योग्यता प्राप्त नहीं है।
2. **Sessional Member** : If for some reasons, Annual Members fail to renew their Membership by remitting subscription prior to 15th July each year, their Membership for the year would be restricted to Sessional Membership without voting right. Sessional Member has to pay ₹ 200/- (for foreign \$50). A Sessional Member shall have the right to present paper / poster at the session of the congress of which he/she is a member. A Sessional Member shall not be eligible to participate in the voting process. A Sessional member shall not be eligible to participate in the Business meetings of the Sections and the General Body.
3. **छात्र सदस्य** : जो व्यक्ति स्नातक स्तर से नीचे पढ़ाई कर रहा है, उसे वार्षिक सदस्यता शुल्क ₹ 100/- मात्र देने पड़ेंगे अपना नाम छात्र सदस्य के रूप में लिखवाने के लिए, बशर्ते उसके आवेदन पत्र पर उसके प्राचार्य/विभागाध्यक्ष/संस्थान के प्रधान के हस्ताक्षर हों। एक छात्र सदस्य को यह अधिकार दिया जाएगा, कि वह अपना पेपर कांग्रेस सत्र के समय पेश कर सकें, बशर्ते वह पेपर वह किसी वार्षिक सदस्य या संस्था के कोई अवैतनिक सदस्य के साथ पेश करें। उसे वोट करने का या कार्यालय को नियंत्रण करने का अधिकार प्राप्त नहीं होगा। छात्र सदस्य को विभागों के व्यवसायबैठकों में भाग लेने की योग्यता प्राप्त नहीं है।
3. **Student Member** : A person studying at the under - graduate level may be enrolled as a Student Member by paying an annual subscription of ₹ 100/- **only provided his/her application is duly certified by the Principal/Head of the Institution/Department.** A student member shall have the right to submit papers for presentation at the Session of the Congress of which he / she is a member, provided such papers be communicated through a Member, or an Honorary Member of the Association. He/She shall not have the right to vote or to hold any office. A student member shall not be eligible to participate in the Business Meetings of the Sections and the General Body.
4. **आजीवन सदस्य** : एक सदस्य अपने भविष्य की सारी वार्षिक सदस्यता शुल्क एक बार में ₹ 2,000/- (विदेशियों के लिए U.S.\$ 500) मात्र अदा करके पा सकता है। एक व्यक्ति जो 10 साल या उससे अधिक नियमित रूप से सदस्यता प्राप्त कर चुका है, उसे उसकी संयुक्त सदस्यता शुल्क के ऊपर प्रतिवर्ष ₹ 50/- की छूट दी जाएगी, बशर्ते कि उसकी संयुक्त शुल्क ₹ 1,200/- से नीचे न हों (विदेशियों के लिए U.S.\$ 12.50 और U.S.\$ 300 क्रमशः)। एक आजीवन सदस्य को उसके पूरे जीवन काल में सदस्यता की सारे विशेषाधिकार प्राप्त होंगे।
4. **Life Member** : A Member may compound all future annual subscriptions by paying a single sum of ₹ 2,000/- (for foreign** U.S.\$ 500) only. Any person who has been continuously a member for 10 years or more, shall be allowed a reduction in the compounding fee of ₹ 50/- for every year of such membership, provided that the compounding fee shall not be less than ₹ 1,200/- (for foreign** U.S.\$ 12.50 and U.S.\$ 300 respectively). A life Member shall have all the privileges of a member during his/her lifetime.
5. **संस्थान सदस्य** : एक संस्थान जो ₹ 5,000/- सदस्यता शुल्क के रूप में दे वही संस्था के संस्थान सदस्य उस वित्तीय वर्ष के लिए बन सकता है, (विदेशियों के लिए U.S.\$ 2,500)। इसमें वह विज्ञान कांग्रेस के वार्षिक सत्र में अपने एक व्यक्ति का नाम नामांकित कर सकता है, जो उनका प्रतिनिधि हों। एक संस्थान सदस्य को वार्षिक विज्ञान कांग्रेस

सत्र की कार्यविवरण की एक पूर्ण प्रति बिना मूल्य में प्राप्त हो सकती है। इसके साथ वे संस्था के रोज़नामचा "एवरीमैन्स साइंस" की प्रति भी बिना मूल्य प्राप्त कर सकते हैं।

5. **Institutional Member** : An Institution paying a subscription of ₹ 5,000/- (for foreign** U.S.\$ 2,500) only, can become an Institutional Member of the Association for that financial year. It shall be eligible to nominate one person as its representative to attend Annual Session of the Science Congress. An Institutional Member shall be eligible to receive, free of cost, a copy of the complete set of Proceedings of the Annual Science Congress Session as also a copy each of the Associations journal Everymans Science.
6. दाता : कोई भी व्यक्ति जो एक साथ ₹ 10,000/- (विदेशियों के लिए U.S. \$ 5,000) मात्र दें, वह संस्था के दाता बन सकते हैं। एक व्यक्तिगत दाता को वह सारे अधिकार और विशेषाधिकार मिलेंगे जो एक सदस्य को उसके पूर्ण जीवन काल में प्राप्त होते हैं।

एक संस्थान जो एक साथ ₹ 50,000/- (विदेशियों के लिए U.S. \$ 25,000) मात्र दें, सदा के लिए इस संस्था के संस्थान दाता बन सकते हैं, जिसे वह एक व्यक्ति को नामांकित करके उसे अपने संस्थान के प्रतिनिधि के रूप में विज्ञान कांग्रेस के वार्षिक सत्र में भेज सकते हैं। एक संस्थान/व्यक्तिगत दाता वार्षिक विज्ञान कांग्रेस के कार्यविवरण और संस्था के रोज़नामचा "एवरीमैन्स साइंस" की प्रति भी बिना मूल्य प्राप्त कर सकते हैं।

6. **Donor** : Any person paying a lump sum of ₹ 10,000/- (for foreign ** U.S.\$ 5,000) only, can become an Individual Donor of the Association. An **INDIVIDUAL DONOR** shall have all the rights and privileges of a member during his/her lifetime.

An Institution paying a lump of ₹ 50,000/- (for foreign ** U.S.\$ 25,000) only, can become an **INSTITUTIONAL DONOR** of the Association forever, which shall have the right to nominate one person as its representative to attend Annual Session of the Science Congress. An Institutional/ Individual Donor shall be eligible to receive, free of cost, a copy of the complete set of Proceedings of the Annual Science Congress Session as also the Associations journal Everymans Science.

* भर्ती शुल्क ₹ 50/- सिर्फ एक नये वार्षिक सदस्य के लिए ज़रूरी है। यह सत्र सदस्य/आजीवन सदस्य/ संस्थान सदस्य/छात्र सदस्य/दाता के लिए ज़रूरी नहीं है।

* Admission fee of ₹ 50/- is needed only for becoming a new Annual Member and not for Sessional Member/Life Member/Institutional Member/Student Member/Donor.

** (एक विदेशी सदस्य का अर्थ है, जो भारतवर्ष के बाहर का नागरिक हों।)

** (A Foreign Member means one who is normally Resident outside India).

(अ) **पेपर पेश करना** : एक पूर्ण पेपर की प्रति उसके साथ तीन सारांश की प्रति जो 100 शब्दों से ज्यादा न हों और जिसमें कोई आरेख या फार्मूला न हों, वह प्रत्येक वर्ष 15 सितम्बर के अंदर अनुभागीय अध्यक्ष तक पहुँच जाना चाहिए।

(A) **Presentation of Papers** : A copy of complete paper accompanied by an abstract in triplicate not exceeding one hundred words and not containing any diagram or formula, must reach the Sectional President latest by September 15, each year.

(ब) सभी वर्गों के सदस्य जो विज्ञान कांग्रेस सत्र में भाग लेने के पश्चात लौटते समय के टिकट में रियायत प्राप्त कर सकता है, बशर्ते कि उनकी यात्रा के खर्च का थोड़ा भी भाग सरकार (केन्द्रीय या राज्य),

कोई कानूनी सत्ता या कोई विश्वविद्यालय या कोई नगरपालिका न उठाएँ और उनकी कुल कमाई या परिलब्धियां ₹ 5,000/- (प्रति माह पाँच हजार रुपए) से अधिक नहीं हैं। कृपया ISCA वेबसाइट से रेलवे रियायत फार्म डाउनलोड करें।

- (B) Members of all categories are entitled to **Railway Concession** of return ticket by the same route with such conditions as may be laid down by the Railway Board for travel to attend the Science Congress Session provided that their travelling expenses are not borne, even partly, by the Government (Central or State), Statutory Authority or an University or a City Corporation and their total earning of or emoluments drawn do not exceed ₹ 5,000/- (Rupees Five Thousand per month). Please download the Railway Concession form from ISCA Website.
- (स) संस्था के पुस्तकालय में सभी वर्गों के सदस्य को पढ़ने की सुविधा सुबह 10.00 बजे से शाम को 5.30 बजे तक सभी काम के दिनों में (शनिवार और रविवार) को छोड़कर प्राप्त होगी।
- (C) Members of all categories are entitled to reading facilities between 10.00 a.m. to 5.30 p.m. on all weekdays (except Saturdays & Sundays) in the library of the Association.
- (ड) समय समय पर संस्था द्वारा तय की गई मूल्य दरों पर विश्रामगृह, सभागार आदि सुविधाओं की प्राप्ति भी सभी वर्गों के सदस्य कर सकते हैं।
- (D) Members of all categories may avail Guest House facilities, Lecture Hall hiring at the rates fixed by the Association from time to time.
- (ई) भविष्य में भारतीय विज्ञान कांग्रेस संस्था द्वारा आयोजित परिसंवाद, सम्मेलन और वार्षिक कांग्रेस में सभी वर्गों के सदस्यों द्वारा भाग लेने के लिए अपनी—अपनी सदस्यता पत्र को लाना जरूरी होगा।
- (E) Members of all categories should bring the Membership Card always for attending any Seminar, Conference and Annual Congress organized by ISCA in future.

ध्यान दें : (1) सभी बैंक ड्राफ्ट The Indian Science Congress Association के नाम से ही लिखा जाएँ, और जो कोलकाता के किसी भी शाखा में देय हों। सदस्यों से यह निवेदन किया जा रहा है, कि वे अपनी सदस्यता संख्या का उल्लेख भारतीय विज्ञान कांग्रेस संस्था के कार्यालय के साथ पत्राचार के वक्त अवश्य करें।

(2) भारतीय विज्ञान कांग्रेस संस्था द्वारा मनीऑर्डर, आई. पी. ओ., ई. सी. एस. या चेक से भुगतान ग्रहण नहीं किया जाएगा। कोई भी सदस्यता निर्धारित सदस्यता फार्म (आवेदन-पत्र नई सदस्यता/सदस्यता की नवीकरण के लिए) में विधिवत बिना भरने से नहीं लिया जाएगा।

(3) नकदी केवल ISCA मुख्यालय में हाथ से लिया जाएगा। कृपया डाक द्वारा लिफाफे के भीतर नकदी नहीं भेजें।

Note : (1) All Bank Drafts should be drawn in favour of *The Indian Science Congress Association* Payable at any branch in Kolkata. Members are requested to mention their Membership No. while making any correspondence to ISCA office.

(2) No money order, I.P.O., ECS or cheque will be accepted by ISCA. No Membership will be taken without duly filled in prescribed Membership Form (Application Form for New Membership/ Application for Renewal of Membership).

(3) Cash will only be taken by hand at ISCA Hqrs. Pl. do not send the Cash by Post within the envelope.



भारतीय विज्ञान कांग्रेस संस्था

14, डॉ० बिरेश गुहा स्ट्रीट, कोलकाता - 700 017, भारत

THE INDIAN SCIENCE CONGRESS ASSOCIATION

14, Dr. Biresh Guha Street, Kolkata-700 017, INDIA

दूरभाष/Telephone : (033) 2287-4530, 2281-5323

फैक्स/Fax : 91-33-2287-2551

वेबसाइट/Website : <http://sciencecongress.nic.in>

ई-मेल/E-mail : iscacal@vsnl.net

es.sciencecongress@nic.in

सदस्यता के लिए नया आवेदन पत्र / Application Form For New Membership

सेवा में/To

महासचिव (सदस्यता कार्य)/ The General Secretary (Membership Affairs)

भारतीय विज्ञान कांग्रेस संस्था/The Indian Science Congress Association

14, डॉ० बिरेश गुहा स्ट्रीट/14, Dr. Biresh Guha Street,

कोलकाता - 700 017/Kolkata - 700 017

महोदय/Dear Sir,

मैं भारतीय विज्ञान कांग्रेस संस्था का आजीवन सदस्य/वार्षिक सदस्य/सत्र सदस्य/छात्र सदस्य/संस्थान सदस्य/व्यक्तिगत दाता/संस्थागत दाता अपना नाम लिखवाना चाहता/चाहती हूँ।

I like to be enrolled as a Life Member/Annual Member/Sessional Member/Student Member/Institutional Member/Individual Donor/Institutional Donor of The Indian Science Congress Association. (Pl. Tick)

मैं इसके साथ ----- सदस्यता शुल्क के रूप में नक़द ₹ -----/बैंक ड्राफ्ट संख्या ----- दिनांकित ----- प्रचालक बैंक ----- 01 अप्रैल 20--- से 31 मार्च 20--- तक भेज रहा/रही हूँ।

I am sending herewith an amount of ₹ in payment of my subscription by Cash/Bank Draft No. dated issuing bank from the year 1st April 20 to 31st March 20.

मैं निम्नलिखित विभाग में रुचि रखता/रखती हूँ (कृपया किसी एक में निशान लगाएँ)/ I am interested in the following section (Please tick any one).

विभाग/Sections

1. कृषि और वानिकी विज्ञान/Agriculture and Forestry Sciences
2. पशु, पशुचिकित्सा और मत्स्य विज्ञान/Animal, Veterinary and Fishery Sciences
3. मानवशास्त्रीय और व्यवहारपरक विज्ञान (जिसमें सम्मिलित हैं, पुरातत्व-विज्ञान, मनोविज्ञान, शैक्षिक विज्ञान और सेना विज्ञान)/Anthropological and Behavioural Sciences (including Archaeology, Psychology, Education and Military Sciences)
4. रसायन विज्ञान/Chemical Sciences

5. भू-पद्धति विज्ञान/Earth System Sciences
6. अभियन्ता विज्ञान/Engineering Sciences
7. पर्यावरण विज्ञान/Environmental Sciences
8. सूचना और संचारण विज्ञान और प्रौद्योगिकी (जिसमें कंप्यूटर विज्ञान भी सम्मिलित है)/Information and Communication Science & Technology (including Computer Sciences)
9. भौतिक विज्ञान/Materials Science
10. गणित विज्ञान (जिसमें सांख्यिकीय सम्मिलित है)/Mathematical Sciences (including Statistics)
11. चिकित्सा शास्त्र (जिसमें शरीर विज्ञान भी सम्मिलित है)/Medical Sciences (including Physiology)
12. नया जीवविज्ञान (जिसमें जीव रसायन, जीव भौतिकी और आणविक जीवविज्ञान और जीव-प्रौद्योगिकी भी सम्मिलित है)/New Biology (including Bio-Chemistry, Biophysics & Molecular Biology and Biotechnology)
13. भौतिकीय विज्ञान/Physical Sciences
14. वनस्पति विज्ञान/Plant Sciences

(कृपया टंकित करें या ब्लॉक अक्षरों में भरें/Please type or fill up in Block Letters)

नाम/Name (ब्लॉक अक्षरों में/in Block Letters) :

श्री/सुश्री/श्री/श्रीमती/डॉ॰/प्रो॰/Mr./Ms./Shri/Shrimati/Dr./Prof (कृपया टिक करें)/(Please tick)

कुलनाम/Surname

प्रथम नाम/First Name

मध्य नाम/Middle Name

शैक्षणिक योग्यता/Academic Qualifications :

(अंतिम शैक्षणिक योग्यता प्रमाण-पत्र अंक-सूची का स्वतः सत्यापित जिराक्स प्रति संलग्न करना है / Self attested xerox copy of last educational certificate/marksheet must be attached)

पदनाम/Designation

सम्पर्क का पता/Address of communication :

(राज्य, शहर/नगर और पिन कोड सहित/including state, city/town and pin code)

दूरभाष संख्या/मोबाईल संख्या और ई-मेल/Phone No./Mobile Number & E-mail :

स्थायी पता/Permanent Address :

टिप्पणी (अगर कोई)/Comments (if any)

दिनांक/Date :

भवदीय/Yours Faithfully

हस्ताक्षर/Signature

ध्यान दें : (i) सभी बैंक ड्राफ्ट The Indian Science Congress Association के नाम से ही लिखा जाएँ और जो कोलकाता के किसी भी शाखा में देय हों।

- Note :**
- (i) All Bank Drafts should be drawn in favour of *The Indian Science Congress Association* Payable at any branch in Kolkata.
 - (ii) सभी सदस्यता और सदस्यता के नवीकरण के लिए आवेदन-पत्र आवेदकों को अपने खुद के पते उपलब्ध कराके करने चाहिए न कि देखभाल के पते प्रस्तुत करने चाहिए।
 - (ii) All Application Forms for Membership and the renewal of Membership must be submitted by providing the address of the applicants themselves only and not any care of address.
 - (iii) भर्ती शुल्क ₹ 50/- सिर्फ एक नये वार्षिक सदस्य के लिए ज़रूरी है। यह सदस्य/आजीवन सदस्य/संस्थान सदस्य/छात्र सदस्य/दाता के लिए ज़रूरी नहीं है।
 - (iii) Admission fee of ₹ 50/- is needed only for becoming a new Annual Member and not for Sessional Member/Life Member/Institutional Member/Student Member/Donor.
 - (iv) सदस्यों से यह निवेदन किया जा रहा है कि वे अपनी सदस्यता संख्या का उल्लेख भारतीय विज्ञान कांग्रेस संस्था के कार्यालय के साथ पत्राचार के समय अवश्य करें।
 - (iv) Members are requested to mention their Membership No. while making any correspondence to ISCA office.
 - (v) भारतीय विज्ञान कांग्रेस संस्था द्वारा मनीऑर्डर, आई. पी. ओ., ई. सी. एस. या चेक से भुगतान ग्रहण नहीं किया जाएगा।
 - (v) No Money order, I.P.O., ECS or Cheque will be accepted by ISCA.
 - (vi) कोई भी सदस्यता निर्धारित सदस्यता फार्म (आवेदन-पत्र नई सदस्यता/सदस्यता की नवीकरण के लिए) में विधिवत बिना भरने से नहीं लिया जाएगा।
 - (vi) No Membership will be taken without duly filled in prescribed Membership Form (Application Form for New Membership/Application For Renewal of Membership)
 - (vii) नकदी केवल ISCA मुख्यालय में हाथ से लिया जाएगा। कृपया डाक द्वारा लिफाफे के भीतर नकदी नहीं भेजें।
 - (vii) Cash will only be taken by hand at ISCA Hqrs. Pl. do not send the cash by Post within the envelope.